The Effects of Internal Migration and Related Factors on Nutrient Intake and Anthropometric Status of Children Aged 1-9 Years in South Africa, 1999

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EXAMINATION COPY

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The effects of internal migration and related factors on nutrient intake and anthropometric status of children aged 1-9 years in South Africa, 1999.

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Keywords

Migration

Residential mobility

Height

Weight

Nutritional status

Children

Dietary intake

Women

Growth

South Africa

Abstract

Migration both as a process and as an outcome of multiple factors contributes to social, economic, environmental and behavioural changes, which, in turn, affect the health and nutritional status of individuals. To best understand the association between migration, dietary intake, nutritional status and socio-economic conditions, all factors should be considered as a continuum. The differences in outcomes would depend on where the individual started off. In turn, the starting point not only influences the outcomes, but also the propensity to migrate. Children are often most susceptible to changes, but, as they are often not regarded as migrants, little is known about the impact of internal migration on the nutritional status of children in South Africa.

Therefore, for the first time in South Africa, the purpose of this study is to provide a national overview on internal migration of children and to relate these migration patterns to the nutritional status of children. This study specifically investigates the internal migration that took place during the life span of the National Food Consumption Survey (NFCS) study population and relates that to their dietary intake and anthropometric status. The 1999 NFCS was a cross-sectional nationally representative sample of children aged 1-9 years in South Africa (n = 2 892; 2 505 with migration information).

For 83% of the children no migration was reported and 15% moved only once. The children who moved mostly experienced intra-provincial migration within urban areas or within rural areas. Rural-to-urban migration was reported for only 1.5% of children. The highest volume of migration (both inter- and intra-provincially) was reported for children living in Gauteng and the Western Cape. For two-thirds of the children the same migration pattern was reported for their mothers. Migration was found to be an independent predictor of a higher energy and vitamin C intake as well as a lower prevalence of overweight in children who migrated.

Children aged 1-9 years, who migrated in South Africa in the period 1990 –1999, are not the most vulnerable rural children, and migration most likely contributed to their improved dietary intake.

Declaration

I declare that The effects of internal migration and related factors on nutrient intake and anthropometric status of children aged 1-9 years in South Africa, 1999 is my own work; that it has not been submitted previously for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete reference.

ELIZABETH CATHERINA SWART OCTOBER 2004

SIGNED: ....

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Statistics South Africa and Prof Louis van Tonder made access to and comparison with the 1996 Census and the University of Pretoria/Brown University Migration Study 1999 datasets possible. Dr Pieter Kok provided valuable guidance on migration and Dr Stefan Maritz provided guidance on regression analyses.

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Abbreviations

24-HRQ	24-hour recall questionnaire
BMI	Body mass index (kg/m^2)
CSS	Central Statistical Services
CI	Confidence Interval
DHS	Demographic and Health Survey
EA	Enumerator area
EC	Eastern Cape
FS	Free State
GP	Gauteng
HAZ	Height-for-age z-score
HH	Household
HSQ	Hunger scale questionnaire
kJ	Kilojoule
KZN	KwaZulu-Natal
LBW	Low birth weight (<2500g)
LP	Limpopo (former Northern Province)
MP	Mpumalanga
NC	Northern Cape
NFCS	National Food Consumption Survey
NW	North West
QFFQ	Quantified food frequency questionnaire
RDA	Recommended dietary allowance
SD	Standard deviations
SDQ	Socio-demographic questionnaire
UNICEF	United Nations Children's Fund
U.S.	United States
WAZ	Weight-for-age z-score
WC	Western Cape
WHO	World Health Organization
WHZ	Weight-for-height z-score

Definition of concepts

Acculturation	Refers to the acquisition of cultural norms by members of another group (usually a non-dominant group acquiring cultural norms of a dominant group) (Gordon-Larsen *et al*., 2003:2023).
Amenity migrants	Those who migrate to obtain specific facilities and services such as housing, school, or recreational activities.
Chain migration	The process of migration facilitated through social networks is called chain migration (Gelderblom & Kok, 1994:63).
Circular migration	Circular migration includes "return migration" and "circulation" as subsets. It refers to all cases where migration takes on a circular form, thus ending up from where it started (Gelderblom & Kok, 1994:254). It includes all cases of mobility where more than one migration cycle are completed and, typically, does not include permanent settlement away from the place of origin. It is also called circulatory migration.
Cultural marginality	Is defined as "situations and feelings of passive between-ness when people exist between different cultures and do not yet perceive themselves as centrally belonging to either one" (Choi, 2001:193).
Demographic transition	Refers to changes in the size of population through reductions in deaths followed by births (Pressat & Wilson, 1985:62).
Ethnic origin based on language groups	Nguni (Swazi, Zulu, Ndebele, Xhosa) Sotho (South, West & North Sotho, Tswana, Pedi) Tsonga (Venda, Tsonga, Shangaan) (Coetzee, 1982:8)

Globalisation	Globalisation is defined as a process whereby increasing economic, political and social interdependence and global integration take place as capital, traded goods, persons, concepts, images and ideas. Values diffuse across State borders (Yach *et al.*, 2001:234).
Gravity flow migration	Refers to a relative permanent move from one area to another, usually rural-to-urban. People move to town/city to stay as shown by the notion of water running downhill, but not uphill." These moves are based on the relative attractiveness of different areas.
International migration	This consists of immigration, which involves a move from another country, and emigration that indicates migratory moves out of one country to another (Kpedekpo, 1982:146).
Internal migration	This entails both in-migration movement into an area, and out-migration movement from a particular area within the same country (National Population Unit, 2001:15). For the purposes of this study, it includes change of residence that involves crossing of magisterial boundaries and duration of stay at residence of at least one year. It is described as urban-to-urban, rural-to-urban, urban-to-rural, and rural-to-rural movement.
Migration	Migration is defined as the change of residence, i.e. movement of person(s) who change their usual place of residence from one country to another, i.e. international migration, or from one magisterial district to another, i.e. internal migration (Kpedekpo, 1982:146). In this study a person was regarded as a migrant if they had stayed at a place for one year. In this study, the term mobility or residential mobility is sometimes used as synonymous to migration.

Migration efficiency	Net migration (in-migration – out-migration) divided by the total number of moves whose origin or destination is that area (in-migrants + out-migrants) multiplied by 100 (Galle & Williams, 1972:655).
Migration rates	Expressions used to describe the extent of the movement (Kpedekpo, 1982:146). In-migration rate = in/population x 100 Out-migration = out/population x 100 Gross migration rate = (in + out)/population x 100 Net migration = (in – out)/population x 100
Migration transition	Refers to how migrations change as development sets in. Transition process is from a low migration state through a high migration period to a lower migration period, but different to the previous low migration state.
Modernisation	The process by which individuals change from a traditional way of life to a more complex, technologically advanced, and rapidly changing style of life (Kosinski & Prothero, 1975:24). Modernisation is typically seen as spreading through a society by way of spatial diffusion. It originates in the towns and then slowly percolates through to the surrounding countryside. This is the basis of the often-made assertion that one can distinguish between a traditional, rural culture and a modern, urban culture (Gelderblom & Kok, 1994:6).
Nutrition transition	Refers to a sequence of characteristic changes in dietary patterns and nutrient intakes associated with social, cultural, and economic changes during the demographic transition. Dietary patterns usually change from high-fibre low fat diets to diets rich in animal fats and low in fibre (Popkin 1994:285).

Oscillatory migration	This is often also termed labour migration meaning that a worker moves to wherever he/she finds a job, and returns home for a while. This could be for periods of a year, six months or three months at a time (Bekker & Swart 2002:3).
Poverty	Refers to the denial of opportunities and choices most basic to human development to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-esteem and respect from others. In terms of income, <R800/month/household is usually defined as poor, while extreme poverty is defined as monthly household income of <R250 (Hirschowitz *et al*., 2000:54).
Psychology of place	Explores the connection between individuals and their intimate environments. Individuals require a “good enough” space to live in and the environment interacts through three key processes, i.e. attachment, familiarity, and identity (Fullilove, 1996:1516).
Recommended Dietary Allowance (RDA)	RDA is the goal for dietary intake by individuals. In South Africa the levels set by the Food and Nutrition Board of the National Research Council of the National Academy of Science (US) are used as reference. This level of nutrient intake will meet the needs of almost all (97-98%) individuals in a particular gender group at a given life-stage (Earl & Borra, 2000:332; Institute of Medicine, 2000:30). Reference to the RDA in the text will always imply these sources for the definition, and the sources as mentioned on page 156 as the reference to the specific values used for each nutrient.
Residential mobility	*[See migration]*. Residential mobility is sometimes reserved in the literature for the description of short-tem short distance movements where no district or provincial

	boundaries are crossed (Kok *et al*. 2003:9).
Social networks	Social networks in relation to migration are understood as links between residents in a community of origin and individuals who are living in another place or who previously migrated, regardless of current residence (Curren & Rivero-Fuentes, 2003:290). Also see *Chain migration*.
Urbanicity	Refers to the extent to which the place of residence is urban or rural.
Urbanisation or urban transition	The process through which a population becomes urbanised. This happens as a result of economic and developmental forces impacting on people. It is a collective term for a set of large-scale co-ordinated activities in society such as the operation of centralised governance, control of water for irrigation, production of goods in a factory system and the channelling of exchange through a pervasive market (De Woude *et al.,* 1990:44). Urbanisation does not only refer to physical presence in an urban area, but also requires participation/contribution to the economy of that urban area/city. Informal settlements are sometimes seen as part of the rural sector as their socio-economic system is still very rural (rely on each other, have not yet accepted township lifestyle). In South Africa, on the other hand, peri-urban areas with high population density might also exist in rural areas mainly as a result of apartheid laws. References to urbanisation in the literature often equate it to rural-to-urban migration (Gelderblom & Kok, 1994:260).

Chapter 1

Introduction

Introduction and Rationale

Migration as a process, and as an outcome of multiple factors, is an important contributor to change in the lives of individuals, families, and the population at large. This change includes economic conditions, relationships and social support systems, environmental conditions, food availability and eating patterns. In turn, all these changes affect the health and nutritional status of adults and children.

At the time that the National Food Consumption Survey was planned in 1998, there was no detailed information available on the migration/residential mobility patterns of children in South Africa. The South African 1996 Census included questions aimed at estimating how long people have lived in a particular area, and what their place of birth was (Census questionnaire, questions 12.1 and 12.2). The results of these questions were not tabulated in the Census 1996 report (Statistics South Africa, 1998). Limited information related to adults, income and employment was reported in the State of the Population 2000 (National Population Unit, 2000:17-24). "Post-apartheid Patterns of Internal Migration" by Kok *et al.* (2003:1-82), which reports on migration data collected by the 1996 Census team, was published towards the end of the finalising of this dissertation. The University of Pretoria and Brown University in America (UP/BU), conducted a national survey on migration patterns of Africans in 1999. However, the findings of this study are not yet available, although the data is available to interested researchers (Roux, 2000:4; Van Tonder, 2003, personal communication). Neither the 1996 Census nor the UP/BU study included detailed migration information on children younger than 12 years. As this study took place five years post-apartheid and more than ten years after the abolition of influx control measures in 1987, it was expected that a reasonable amount of unrestricted migration would have taken place during the lifetime of the children included in this study i.e. between 1989-1999.

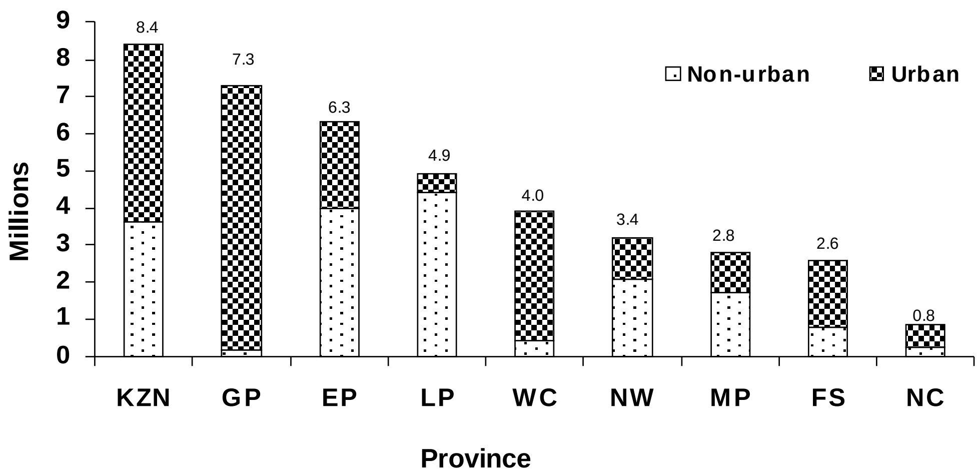
Although nutritional surveys usually include information on urbanicity, i.e. the extent to which the area of residence is urban or rural, this is usually observed as a static variable. In South Africa only one study in a specific geographical area investigated the relationship between migration and nutritional status – and in that case the children were not the migrants, but their household experienced labour migration.

The purpose of this study is, therefore, to provide a national overview on internal migration of children and to relate these internal migration patterns to the nutritional status and dietary intake of these children.

The Problem: Setting and background

South Africa is a diverse country internally, and is very different from other countries on the African continent. Internally, the population of just over 44 million people resides in nine provinces of varying densities where the largest geographical province, Northern Cape, has the lowest population, while the smallest geographical province, Gauteng, has the second highest population (Statistics South Africa, 2003:3f.). The urban and rural (non-urban) distribution of provinces is diverse with five provinces having an almost equal population distribution between rural and urban areas, one province that is almost only rural and two provinces with an almost exclusively urban population (Statistics South Africa, 1998:6) (Figure 1.1).

Figure 1.1: Number of people in each province by urban and non-urban place of enumeration Census 1996.



The population of South Africa consists of a number of ethnic groups as illustrated by the nine official languages spoken in the country.

The nutritional status and health of children (and adults, for that matter) is as diverse as the population distribution and is related to urbanicity and racial groups, both of which are linked to socio-economic conditions. There are high rates of undernutrition and infectious diseases on one end of the scale, while there is overnutrition and diseases of lifestyle in adults on the other end of the scale. Consistent with nutrition transition theories (Drewnowski & Popkin, 1997:40; Vorster *et al.*, 1999:342; Popkin, 2001:S873), both these conditions increasingly exist in the same communities and even in the same household. Diseases of lifestyle, which have traditionally been associated with affluence, now occur at lower socio-economic strata.

A comparison of the nutritional status of children in South Africa with that of children in other countries (Table 1.1) highlights another diversity, namely, that the proportionate distribution of types of undernutrition i.e. stunting, wasting and being underweight, is different among these countries, even when compared to a country with a similar economic status such as Botswana (Figure 1.2). This would imply that there are different causal factors involved and that these factors impact at different levels on the nutritional status of children.

Within this context, it is postulated that investigation into alternate mechanisms and factors in the causation of malnutrition might be useful. International literature and anecdotal reports on children who reside outside of urban centers, but who occasionally use health services in urban centers, seem to suggest that migrant children might be at risk of adverse conditions, and, therefore, also at risk of undernutrition (Van der Spuy, 1999, personal communication). The questions that arose in the planning of this study were:

1. What is the nature of internal migration of children and their primary caretakers in South Africa?
    - Frequency of movement during lifespan;
    - Direction/description of movement during lifespan of child (birth and current province and type of area of residence);

- Duration of stay in current area of residence;
- Similarity of the internal migration patterns of children and those of their mothers and/or grandmothers?

2. Are the socio-demographic characteristics of children who moved different from those who did not move?
3. Is the nutrient intake of children who moved different from those who stayed in one place?
4. Is the anthropometric status (as indicated by weight-for-age, height-for-age and weight-for-height) of children who moved different to those who did not move?

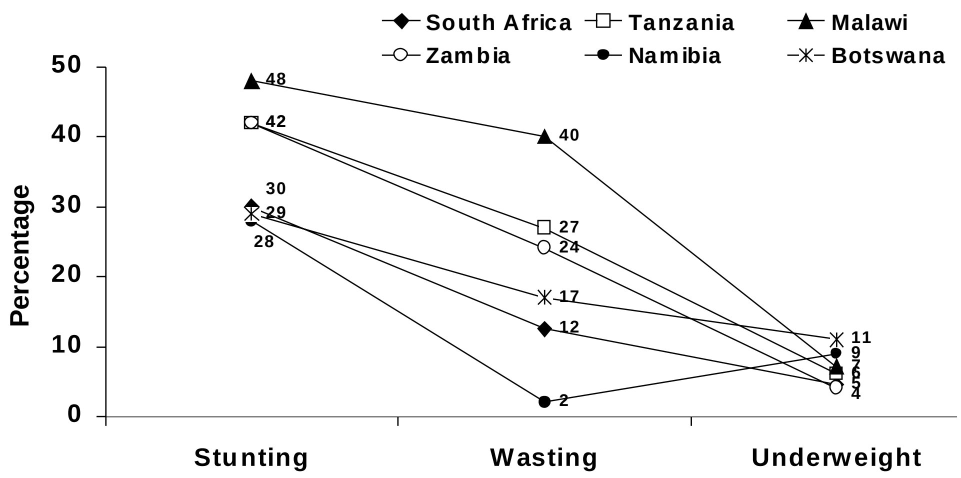
Table 1.1: Comparison of the anthropometric status of children in South Africa with that of children in some other countries in Africa, South America and Asia

Country	GNP/Capita (US$ 1997)	Anthropometric status		
		Stunting♦	Underweight♦	Wasting♦
South Africa 1999*	3 210	30	12	5
Ethiopia	110	64	48	8
Burundi	140	43	37	9
Tanzania	210	42	27	6
Malawi	210	48	40	7
Uganda	330	38	26	5
Bhutan	430	56	38	4
Nigeria	280	43	36	9
Bangladesh	360	55	56	18
India	370	52	53	18
Zambia	370	42	24	4
Ghana	390	26	27	11
Nicaragua	410	25	12	2
Pakistan	500	38	N/A§	N/A§
Lesotho	680	44	16	5
Zimbabwe	720	32	15	6
Bolivia	970	26	10	2
Egypt	1 200	25	12	6
Guatemala	1 580	50	27	3
El Salvador	1 810	23	11	1
Namibia	2 110	28	26	9
Botswana	3 310	29	17	11
Brazil	4 790	11	6	2

(Source: Belammy, 2000:71; Labadarios (ed.), 2000:217)

* NFCS, children aged 1–6 years only
♦ Data from other countries refer to under-five year old children; combined moderate and severe
§ N/A = Not available

Figure 1.2: Comparison of anthropometric status of children aged 1-6 years in South Africa with that of children in selected countries in Africa.



Value of the study

The source study, i.e. the National Food Consumption Survey of children aged 1-9 years, undertaken between February to June 1999, was the first national representative study of the dietary intake of children in South Africa. The anthropometric information extended the database on children 0-6 years of age as collected by the South African Vitamin A Consultative Group in 1994. Information on internal migration could highlight a possible impact on nutrient intake and explain possible differences in growth patterns.

The following new information on a national, representative scale will be provided by this study:

- Information on the internal migration patterns of children, and their mothers and grandmothers during the lifespan of each child, i.e. between 1989 and 1999.
- Information on possible associations between internal migration patterns and nutrient intake and anthropometric status of South African children.

Aim of the study

The aim of this study is to investigate internal migration that has taken place during the lifespan of children aged 1-9 years in South Africa, and to measure the effects of this migration, and other related factors on nutrient intake and anthropometric status.

Objectives of the study

- To describe the internal migration of South African children aged 1-9 years;
- To relate the internal migration patterns of children aged 1-9 years to their nutrient intake;
- To relate the internal migration patterns of children aged 1-9 years to their anthropometric status.

Scope and limitations

This thesis reports on the internal migration reported for children who were the study sample of a nationally representative National Food Consumption Survey (NFCS) of children aged 1-9 years in South Africa 1999 (n=2 892; n=2 505 with migration data). This study further reports on the association between the migration differentials of these children and the intake of 12 nutrients (energy, protein, fat, fibre, vitamin A, vitamin C, thiamine, niacin, riboflavin, calcium, iron and zinc) by these children as well as their anthropometric status.

As this study is the first national report on the internal migration of children in South Africa, a considerable portion of the report has been dedicated to the description of their migration patterns and socio-economic characteristics. Standard demographic procedures were employed in this description. Although migration is the smallest field of the four pillars of demography (which include mortality, fertility, morbidity and migration), it can have far-reaching implications in the field of public health — including public health nutrition. The one migration differential employed in the data analyses that is not according to standard demographic procedures was that of 'similarity of migration patterns', i.e. whether the child was accompanied by his mother and/or grandmother during his/her lifetime, was investigated as a possible proxy for the ‘quality of caring’ that children might have received.

The main emphasis of this thesis was not to provide a similarly detailed description of the nutrient intake or the anthropometric status of the study population — as that was dealt with by the report on the source study, the NFCS — but rather to focus on the association between migration as an exposure and the two outcomes i.e. nutrient intake and anthropometric status. This forms the analytical component of this study.

The emphasis mentioned above was also the justification for the limitation of the literature review on the nutritional status of children in South Africa to the two national studies, and the omission of a review of the research methodology employed to obtain information on these outcomes.

Literature on the impact of humanitarian emergencies and its related population displacements on nutritional status has also been excluded for the purposes of this review.

Research hypotheses

The following research hypotheses will be tested:

1) Migration is associated with a difference in the nutrient intake of children. The null hypothesis states that there is no difference in the nutrient intake of children who migrated and those who did not.
2) Migration is associated with a difference in the anthropometric status of children. The null hypothesis states that there is no difference in the anthropometric status of children who migrated and those who did not.

Organisation of the remainder of the report

Chapter Two provides an overview of the literature on migration organized around definitions, reasons for migration, direction of migration, and the consequences of migration. As limited literature is available on internal migration, this review has generalised some aspects as often described for international migration. Specific attention is also paid to a review of the literature on international migration and internal migration and nutritional status of children. Furthermore, the literature review provides an overview of the nutritional status of children in the country (limited to the two national surveys) to serve as a comparison for the findings of this study. Chapter Two also provides an overview of migration in South Africa.

The methodology applied in this particular study is described in Chapter Three. It is important to note that the study population, sampling and description of instruments provided in Chapter Three are a description of the NFCS methodology as it appears in Labadarios (2000:1-1259) with specific additions related to the migration component, which were the sole responsibility and original contribution of this researcher.

The results of this study are reported in Chapter Four. As this is the first national report on internal migration of children, various attempts have been made to ensure external validity and reliability of the data. To that effect comparisons have been drawn between this study, the 1996 Census and data from a 1999 study on internal migration by the University of Pretoria and Brown University (UP/BU).

The results are organised by firstly describing the volume of migration, the direction of migration, similarity between the migration/non-migration patterns of children, their mothers and grandmothers during the lifetime of the child, and lastly the duration of stay at the current place of residence. Further analyses of migrant children by socio-economic status, dietary intake and anthropometric status are made according to the same categories as described above, i.e. volume of migrants, direction, similarity and duration of stay.

The discussion, in Chapter Five, firstly tries to compare the main findings of this study with the available body of knowledge; secondly it attempts to identify the groups most and least vulnerable to the impact of migration based on dietary intake and anthropometric status reported for children aged 1-9 years old. Finally, an amendment to the conceptual framework— proposed at the end of the literature review in Chapter 2—to illustrate the role and importance of migration in nutritional status is suggested based on the findings of this study. Although specific recommendations are not made as part of the discussion, the researcher raises specific issues for consideration and implementation.

Chapter Six, the conclusions and recommendations of this thesis, uses the main findings of this study to create a context within which future work on migration and nutritional outcomes such as anthropometric status and dietary intake could be investigated.

The “List of References” provides an alphabetical list of all references cited in this thesis.

Appendices A-D include the study variables and values, the original research proposal; consent form as well as the questionnaires used to collect data. Appendix E contains additional data such as the stratified cross-tabulations on the socio-economic context of migration, nutrient intake and anthropometric status, not otherwise included in the body of the report, as additional reference for the reader and in support of the summary tables (Table 4.37; Table 4.38) used in Chapter 5 to identify the groups most and least vulnerable to the impact of migration.

Chapter 2

Literature review

Introduction

The purpose of this section of the report is to review and highlight possible mechanisms through which migration could impact on the nutritional status of children. This will be achieved by a review of current literature on the following aspects:

a) Migration as a construct and the motivational factors involved in migration;
b) The impact of migration on aspects related to public health nutrition with attention to research on migration and nutritional status of children.

Furthermore, this review will attempt to set the scene for this particular research report by providing a review of the following aspects:

c) The South African migration situation as well as
d) The nutrition situation of children in South Africa.

For the purpose of this review the following electronic databases were searched: pubmed, ebscohost (academic, medline, agriculture, business), popline, nexus, ovid, sosig, and sabinet, using the keywords migration, internal migration, residential mobility, nutrition, nutritional status, health, dietary intake, height, weight, auxology, urbanisation, modernisation and children.

Literature on the impact of humanitarian emergencies and its related population displacements on nutritional status has been excluded for the purposes of this review. The libraries of the three universities in the Western Cape were also searched for relevant books, monographs and anthologies.

Secondary sources were identified from the references cited by authors in the primary sources. The Internet was also searched, but it mostly rendered resources on residential mobility within a housing and regional planning context. In cases where it was not possible to access copies of full articles, either because the journals are not held in the country (either hard copy or via electronic resources) or the articles are in foreign languages, the abstract has been consulted and cited in the text. In these cases the reference in the bibliography will indicate “(abstract only)”. The resources that were consulted are regarded as representative of the body of knowledge available on the topic.

In this review migration is viewed as a generic concept so that sources of information include publications on internal and international migration.

Although it is acknowledged that the decision to leave one's country is more momentous than internal migration, it is assumed that the same general principles would apply to the decision to change place of residence as were, for example, documented for China by Martin & Widgren (2002:24). Depending on the nature of the origin and destination, there might actually be a great similarity between the changes experienced as part of internal migration and international migration, for example a person moving from deep rural Eastern Cape in South Africa to Cape Town, and a person moving across the border from Mexico to a metropolitan area in the United States. On the other hand, it is possible that internal migration might entail greater changes and challenges than international migration. The same migrant from deep rural Eastern Cape in South Africa to Cape Town might experience greater changes than a person (especially someone from a high socio-economic class) moving from Cape Town to another Anglophone international city.

The surprising finding of this literature survey is that empirical information specifically on the impact of internal migration on the nutritional status of children is limited. Based on the number of references identified through Pubmed with a publication date of 2003 or later, it would appear that there has been a relative upsurge in publications in this field after the relatively quiet period of post-1997/8. Literature, that links to specific aspects in the causation of nutritional outcomes, and that could possibly be prevalent in migrants such as urbanisation, socio-economic status, ethnicity, gender of care-givers and educational levels, was also reviewed to draw parallels or provide comparisons in the discussion section of this report. A review of this body of knowledge is, however, not necessarily systematically represented in this section.

Migration

Definition of migration

Migration is defined as the movement of persons – either individual, collective or mixed in character (Brown & Neuberger, 1977:14) – from one distinct place to another (Cross, 2000:12), i.e. either within the same city or town, or between cities, states/countries or communities. Some authors add qualifiers such as frequent change of residence (Kpedekpo, 1982:146), permanency of the move (Kosinski & Prothero, 1975:1; Simon, 2002:1), and that the move must be out of free will (Cross, 2000:12). Children younger than 12 years of age are usually not counted as migrants (Roux, 2000:6-7). Although parents may make decisions to leave their homes or send children away, either willingly in the hope of improving their lives or involuntarily to escape danger and seek safety for themselves and their families, it is never a voluntary decision for a child (Guarnaccia & Lopez, 1998:537)

Migration information is generally biased towards long-term movements and often eliminates temporary movements and movements within the same magisterial district, which might all have important social and economic implications. An alternative term that is used by the Medical Bibliographic Index is that of residential mobility. Although the definition provided for residential mobility by the Medical Bibliographic Index is the same as for migration, i.e. movement of person(s) from one place to another, researchers usually define residential mobility as moves within the same district (Kosinski & Prothero, 1975:1; Cross, 2000:16; Kok *et al*., 2003:10).

Migration consists of a variety of movements depending on the purpose, direction and permanence of migration and include circulatory migration, oscillating migration and gravity flow migration. Kok *et al*., (2003:9) provide a typology of migration based on time and space (Table 2.1). In reality, the differentiation between different types of mobility might not be that clear as it focuses on the intention of the migrant. For example, a young adult might move from a rural area to a city for employment purposes, but maintain strong links with his/her birthplace, make financial contributions to his/her family at home, and return once a year for a long visit/holiday. This would be classified as long-term circulatory labour migration. However, that same person might also start a home with an independent family in the city and eventually never return permanently to his/her birthplace, i.e. he/she becomes a permanent migrant. So, although it is sometimes useful to classify migrants according to the typology of migration, people might actually be at different stages of their migration trajectory at different stages of their life. This review will include all long-term migration with no differentiation on the basis of the purpose of migration.

Table 2.1: Kok's suggested typology of spatial mobility encompassing both circulation and more permanent moves, and incorporating the more flexible approaches to defining migration

Broad category	Example	Temporal dimension		Spatial dimension		Classification
		Description	Change in place of residence?	Description	Migration-defining boundary crossing	
Circulation	Nomads, gatherers and wanderers	People with no 'fixed' place of residence	No	Short or long distance moves	Yes / No	Transilient mobility
	Shopping trips and tourist trips	Short-term circular moves involving no change of residence	No	Short or long distance moves	Yes / No	Short-term mobility
	Daily work trips					Daily commuting
	Trips home to visit, or to return to place of employment after a period of stay at the origin of the move	Short-term circular moves that do not necessarily involve a change in usual place or residence but do involve a change in residence	Yes	Short or long distance moves	No	Local weekly commuting
					Yes	Short-term labour migration
	Long-term migrant labour absence (usually longer than a week at a time) from home	A move taking place at the beginning or end of an extended migrant-labour period	Yes	Short or long distance moves	No	Local long-term labour mobility
					Yes	Long-term labour migration
More 'permanent' moves	Change of permanent residence ('moving home')	Short or long-term residence at place of destination	Yes	Short or long distance moves	Yes	Permanent migration
					No	Residential mobility

Source: Kok *et al*., (2003:9)

Migration is most often equated to and recorded in official Government documentation as immigration or emigration, i.e. international migration (Kpedekpo, 1982:146; National Population Unit, 2000:14; Cross, 2000:16) and yet international migrants are less than 3% of the world's population compared to much higher proportions of internal migrants (Martin & Widgren, 2002:5). Although statistics on internal migration are not regularly available, it is estimated that in the United States 20% of the population migrate per annum (US Census Bureau, 2000:23-200) and in West Africa migration is regarded as a way of life (Adepoju, 2003:37). The reasons for the paucity of internal migration statistics and literature might be that they are no longer monitored by governmental organisations (as with international migration). Records on internal migration are not readily available in most countries, except in the Soviet Union before liberation and in China where restrictions and economic penalties are associated with internal migration (Gang & Stuart, 1999:117; Martin & Widgren, 2002:24). Attempts to describe internal or national migration, i.e. the movement within a country, are usually included in Census data, or in specialised surveys, such as Demographic Health Surveys. In Canada, the United Kingdom and the United States, their National Health Surveys or National Health System records serve as a source of information on migration. Due to the nature of these instruments and surveys it is understandable that they can only provide a crude measure of movement and are biased towards long distance migration (Kok, 2002:3).

Reasons for migration

Various authors describe mobility strategies as organised responses to the structural properties of the natural and social environment (Bilsborrow, 1993:2; Kalipeni, 1996:285; Hitchcock, 2002:1). Migration behaviour, i.e. the when, where to, and why of movement, is influenced by numerous factors at different levels, such as economic, political, social, cultural, spiritual, institutional, demographic, information, and service factors (Krige, 1962:53; Greenwood & Sweetland, 1972:665; Kok, 1986:11; Cross, 2000:23; Gooszen, 2000:57; Adepoju, 2002:4; Kok *et al.*, 2003:27).

Migration can either be for economic or non-economic reasons (Table 2.2). Within these two groups there are three further categories of factors, i.e. (i) demand-pull factors – such as labour recruitment and better wages or better medical care and infrastructure or family unification; (ii) supply-push factors – such as unemployment and low wages or humanitarian or environmental emergencies, and (iii) network factors – either social networks or information, family unification or desire for new adventures (Kosinski & Prothero, 1975:8; Bustamante *et al.*, 1998:175; Martin & Widgren, 2002:8). These factors do not have equal weight in different situations, and the weight of each factor can change over time. This complexity and fluidity have been well described for one of the best-documented migration phenomena, i.e. that between Mexico and the United States (Mexican Ministry of Foreign Affairs & U.S. Commission on Immigration Reform, 1998:1ff.).

Often, it is also the perception of opportunities that act as a pull factor and not necessarily the reality of a job or a better life (Findlay & Findlay, 1995:56). A study from France reports that migration does not necessarily help in finding a job if one is unemployed. Yet, if one is young with good initial training (Detang-Dessendre, 1999:1417) or is aspiring to occupations in specific higher social classes (Gibson *et al.*, 1984:278), then one leaves to obtain a job, and does not usually return.

Table 2.2: Factors influencing the decision to migrate

Type of Migrant	Demand-pull	Supply-push	Network/ Other
Economic	Labour recruitment e.g. seasonal workers	Un- or under-employment; low wages; farmers whose crops fail	Job and wage information; sons following fathers; family reunification
Non-economic	Family unification; family join spouse established in destination; medical care	Flee war and persecution; refugees/ asylum seekers	Communication; transportation; assistance organisations; desire for new experiences

Source: Bustamante *et al.,* (1998:175)

Traditionally, the view of a migrant was that of a man looking for a job (Bean *et al.*, 1998:69; Kok *et al.*, 2003:55). This image is slowly changing, as half of all internal migrants in developing countries are women (Bilsborrow, 1993:3). Women, generally, have greater proportionate long-term migration than temporary migration; their movement is often categorised as “associational”, i.e. to join or accompany husbands/families, to marry, or to leave husbands (Katzenellenbogen *et al.*, 1988:329; United Nations, 1993:29; Nanthamongkolchai, 2000:91). Women also migrate more often for reasons other than employment or survival. These reasons could include so-called pull factors at the destination such as better housing, schools or health services for the children, especially if a woman is the head of the household (United Nations, 1993:29).

Not all migration processes are random. Migration selection appears to be closely related to individual characteristics of family members such as the younger, more adventurous or modern members, or related to group characteristics and links such as clan structures, social networks or specific disease conditions (Schnaiberg, 1970:82; Kok, 1986:12; Williams-Blangero & Blangero, 1989:2; Morrison, 1990:399; Solomon & Gross, 1995:90; Guilmoto, 1998:85; Ntozi, 1997:S125; Curran & Rivero-Fuentes, 2003:289) and also reflects differences in costs and benefits from migration (Bustamante *et al.*, 1998:100). In the case of international migration legal aspects could also play an important role. The degree of positive selection, i.e. migrants being of a better "quality", increases with the difficulty of the intervening obstacles. According to Kosinski & Prothero (1975:10) selection tends to be negative when people are mainly responding to push factors at the origin or when they choose to relocate to receive better care or support when they have serious illnesses such as HIV (Berk *et al.*, 2003:1091).

Social networks are not only important in the migration decision, but also in the assimilation process. Social networks facilitate migration in several ways:

1) Show individuals that they may be better off in a place other than their current residence;
2) Reduce travel costs by providing information on safe and cheap routes and reduces emotional costs;
3) Lessen assimilation shock if immigrants arrive in an environment where others speak their language;
4) Increase the expected benefit of migration when contact with previous migrants helps individuals find jobs; and
5) Help to reduce living expenses and provide financial assistance on arrival (Curran & Rivero-Fuentes, 2003:290).

The effect of social networks on the probability of migration may be different for men and women because the costs, risks, and benefits of migration differ whether one is male or female.

Distance – not only in linear terms, but also as a measure of difference in economic, demographic, and cultural terms (Kosinski & Prothero, 1975:13) – is a serious deterrent to migration for people across the economic spectrum. (Galle & Williams, 1972: 662; Greenwood & Sweetland, 1972:674), but it is much less of a deterrent to high-income people (Greenwood & Sweetland, 1972:675). The greater the distance travelled by in-migrants, the more likely that they would not return to their origin (Galle & Williams, 1972:662). The higher the level of income in an area, the greater is the expected rate of in-migration and the smaller the expected rate of out-migration (Greenwood & Sweetland, 1972:675; Ezra, 2002:22). Temperate climates are also pull factors for migration (Greenwood & Sweetland, 1972:678; Rogers *et al*., 1990:253), especially amenity migrants, i.e. those who migrate to obtain specific facilities and services (Walters, 2002:243). Persons at the age of retirement are good examples, as they tend to seek retirement options in areas with a temperate climate, which offer access to good medical care and leisure activities.

Strong family ties could either restrain migration or facilitate the process. In some countries family ties are the reason for migration specifically for elderly persons, who move to live with children (Rogers *et al*., 1990:291). Another factor that could influence the decision to migrate is quality of life. On the one hand quality of life has been found to be a deterrent to migration. On the other hand, people often move to obtain social and public services, which are key factors in the perception of quality of life (Liao, 2001:436).

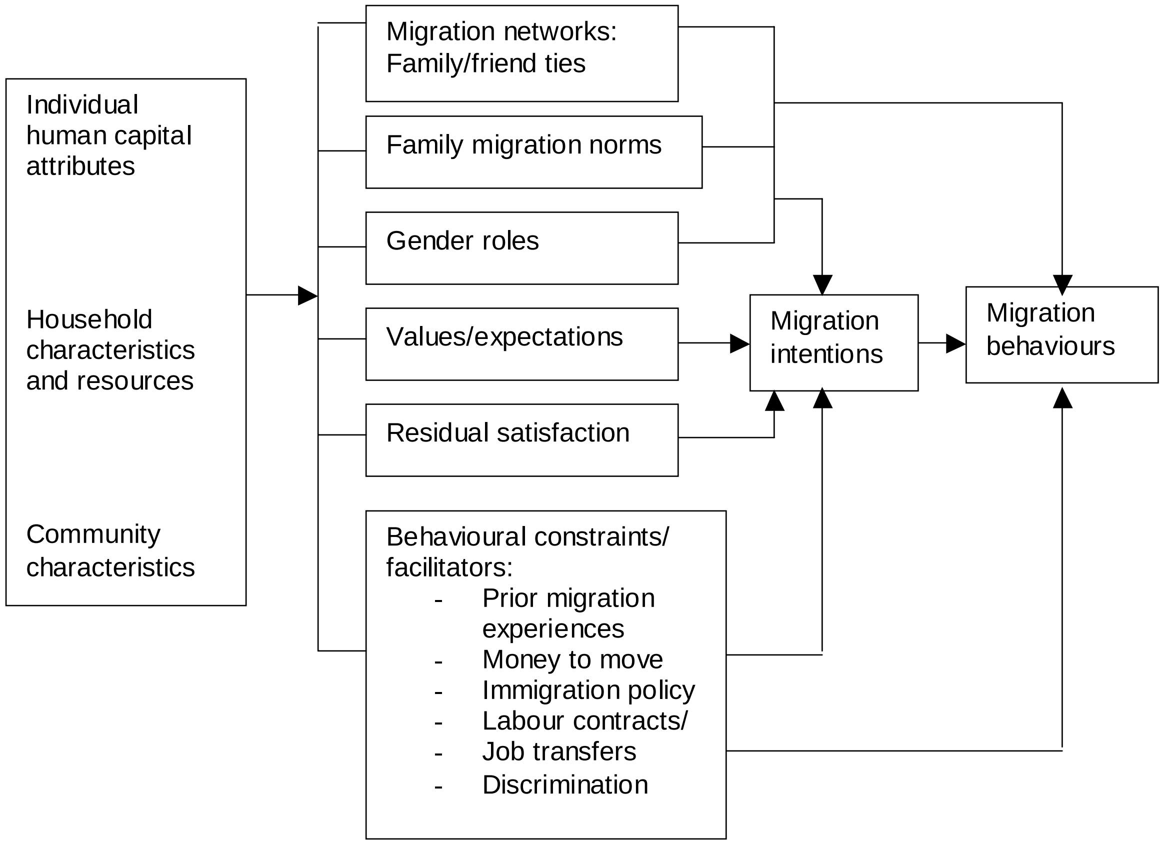
Some researchers have found persons with a high income and longer duration of residence to be less likely to migrate (Liao, 2001:452), while others have found the high-income group, especially, to be most mobile (Bekker (ed.), 2002:21). Kok *et al.* (2003:29) conclude that the effects of distance (whether real geographical distance or as a proxy for the cost of moving, opportunity cost, psychological cost, or as an indication of the 'stream of migration' that current migrants tend to follow) as well as distance elasticity, i.e. the response of migration to the change in distance, decline over time. Therefore, they suggest that distance does not need to be considered as an independent variable in the study of migration.

In conclusion, migration should be viewed as a function of multiple motives (Kok *et al.*, 2003:31). Although economic causes are often regarded as the root cause of migration (Skeldon, 1990:150), they are unable to explain migration decision-making as a whole (Kok *et al.,* 2003:20). De Jong (2000:310) has developed a conceptual framework on migration decision-making that reflects the non-economic factors such as people's values and expectations, household demographic characteristics, societal and cultural norms, and information. In this model economic factors may be intimately linked to family, household or community expectations or, alternatively, they could exert a minimal effect on some migration decisions when seen against other goals (Figure 2.1).

Once initiated, migration flows easily become self-perpetuating through the strengthening of social networks (also called chain migration) and the social and economic disequilibria created. Spengler and Myers (1977:11), Bilsborrow (1993:1) and Scott *et al.* (1998:15) support the contribution of migration towards the maintenance of homeostasis in population dynamics. Once social networks are in place, people may start to move for quite different reasons from those that initiated the flow.

Figure 2.1: De Jong's general model of migration decision-making

Adapted from: De Jong, (2000:310)



Direction of migration

Similar to factors influencing migration, the migration destination is a complicated choice, which depends on various factors, either social or special, that helps individuals/groups gain access to an area. People go where they have connections of some kind, although this is generally less important in more advantaged groups (Cross, 2000:20).

The popular journalistic view of migration is a mass exodus from deprivation and want in search of opportunity. This has been demonstrated by Chang (1996:197) who found that economic betterment was the sole motivation of rural population migration in China. Another popular belief is that internal migration concerns mostly rural-to-urban movements. As poverty appears to be more severe in non-urban areas (Alderman *et al*., 2000:25), there is much truth in this view. However, not all migration is city bound (Portes, 2000:5; Anonymous, 2002:5) or heads for the richest countries. Despite the attraction to economically developed countries with an active labour market (del Rey Calero, 2002:123) half of the world's migrants move from one less developed country to another (Martin & Widgren, 2002:35). There is also a growing trend to move to smaller cities and towns instead of mega-cities (Corona-Vasquez, 1999:15). Gender differences in the destination have been observed with regard to the labour market, with men being international and women being national (Bocquier, 1997:23).

Portes (2000:15) and Findlay and Findlay (1995:56) suggest that there is a link between migration and colonising expeditions. Similar to colonisation, migration tends to be directed towards port cities, which used to be the main centres of colonial structures. Gooszen (2000:57) corroborates the view that migration patterns can be linked to colonial economic activities and policy, but finds no connection to colonial rule. However, urbanisation is not the result of colonisation only, as pre-colonial urbanisation extended across the savannahs of West, Central and East Africa (Montgomery & Brown, 1990:75), although the majority of African people do not live in urban centres. As of 2000, 42% of the population of Africa was estimated as living in urban areas (Findlay & Findlay, 1995:55).

Migration has been activated by deliberate labour recruitment, which has always been linked to mineral revolution or commercial cash crop agriculture. Various authors have reported a reduction in circulatory migration over the last thirty years (Bean *et al.,* 1998:69; Gilbert & Crankshaw, 1999:2375; Gagahe, 2000:53), i.e. people do not necessarily return to their place of origin once they have migrated. It is believed that circulatory migration, which is believed to be a transitional stage towards urbanisation, will eventually be replaced by permanent migration and chain migration as modernisation spreads (Brown & Sanders, 1981:167; Gelderblom & Kok, 1994:7).

According to Morrison (1990:399) people migrate from a spectrum of origins, but flow selectively to a narrow spectrum of destinations. In Sub-Saharan Africa the trend seems to be for urban populations to gravitate towards a few large cities (Montgomery & Brown, 1990:75). Goldstein and Goldstein (1978:257) working from their findings in Thailand where the level of migration rose consistently from the most rural to the most urban areas of residence have suggested that the use of an rural-urban continuum might be more useful than an rural-urban dichotomy in any evaluation of the relationship between demographic, development factors, urbanisation and/or modernisation.

In some countries an urban-to-rural migration turnabout is taking place. Affluence, improved communication networks, the Internet, and a retired elderly population play a significant role in this turnabout (Rogers *et al.,* 1990:253; Mears, 1997:605). This has led to the transformation of adjacent towns and agricultural villages into commuter settlements. Although some call this counter-urbanisation, it could also be described as urbanisation of former agricultural and rural areas, or “rurbanisation” (Toubon, 2002:4).

Consequences of migration

Migration is inevitably associated with a period of significant adjustment and stress (Perez Cuadrado *et al.,* 2004:3). The economic, political, social, environmental and other contextual issues associated with migration are as significant in predicting a person’s adjustment to his or her new circumstances as his or her physical and psychological endowment (Guarnaccia & Lopez, 1998:537). The consequences of migration are the result of the characteristics of the migrants themselves (which might reflect characteristics of the origin), or the characteristics of the destination (Lebowitz & Burrows, 1975:153; Bilsborrow, 1993:4; Reed *et al.*, 1995:673; Toole, 1995:353; Belhedi, 2001:233), or the adaptation of migrants to changes in the culture, social environment or interpersonal relations (Moilanen *et al.*, 1998:180) as a result of migration, or a combination of these factors. As migration is naturally selective and attracts, under specific conditions, certain sections of the population more than others, it has specific impacts on both the area of destination and the area of origin (Findlay & Findlay, 1995:61; Solomon & Gross, 1995:90). Individuals might have vulnerability factors that increase susceptibility, and/or buffering influences that serve as protecting factors under the same circumstances (Moilanen *et al.*, 1998:180).

While there is a range of possible consequences on social, physical, and mental health due to migration, this study focuses primarily on the nutritional consequences. Therefore, nutritional consequences, with a particular focus on children, will be covered in the next section. This section will review the non-nutritional consequences of migration to provide a basis for understanding the general phenomenon and its *sequelae*. It should be noted that even though these consequences might be labelled non-nutritional, e.g. poverty, they would also impact on the nutritional consequences of migration. Alternatively, nutrition might be linked to these consequences as a mediating factor, e.g. diseases of lifestyle.

Urbanisation

Urbanisation is defined as the process through which the population becomes urbanised or though which the proportion of the population living in urban areas increases (Kok, 2003:33). Urbanisation is a complex phenomena. Firstly, the urban/ rural divide is arbitrary; it has become blurred and its definition often differs between countries (Cohen, 2004:25). Secondly, there is a major difference between the model of earlier European and American urbanisation and that of Africa and Asia (Premi, 1981:291; Ankerl, 1983:277; Badibanga, 1985: 849; Diwakar & Qureshi, 1992:27; Lin, 1994:1; Cohen, 2004:27). Thirdly, the outcome of urbanisation is demonstrated through different formats, i.e. mega-cities, towns and smaller cities, urban metropolitan regions typical of Asia (Lin, 1994:1; Pechoux, 1995:63; Cohen, 2004:27) or squatter areas surrounding cities that are typical of Africa (Badibanga, 1985:849; Singh, 1992:15).

Although many low- and middle-income countries exhibit a high degree of urban primacy with a large proportion of population residing in a single large city, which is in many cases the capital city, it is estimated that only 15% and 19% of the population in Africa and Asia respectively is expected to be living in million-plus cities by 2015. The majority of the population will continue to live in towns and cities with fewer than a million inhabitants (Cohen, 2004:31). A major difference between Africa and the rest of the world is that its cities are not serving as engines of growth and structural transformation. Instead they are part of the economic and social crises that have enveloped the continent (Cohen, 2004:34).

The causes of, or factors contributing to, urbanisation have been identified as migration, natural increase and annexation. In countries where there is a high level of modernisation, which limits natural increase (Gibson, 1973:79; Portes, 2000:1), migration is often identified as the major source of urbanisation and the growth of mega-cities (Cohen, 2004:29). In situations of high fertility rates, i.e. high levels of natural increase, un- and/or under-employment in cities reach alarming proportions especially when coupled with migration from the countryside (Population Crises Committee, 1988:35). The latter scenario is often associated with poor sanitary conditions and related diseases (Vega-Franco, 1985:407). In Pakistan rapid population growth combined with rural-to-urban migration has led to the creation of urban slums in which morbidity levels are usually higher than in rural populations of origin (D'souza & Bryant, 1999:33). Various authors conclude that in developing countries, especially, the intensification of rural-to-urban migration is the main cause of urbanisation (Forde, 1976:56; Gupta, 1984:67; Rietveld, 1988:73; Gupta & Sharma, 1994:147; Yaakoubd, 1997:243; Cohen, 2004:29). However, although Bocquier (1997:23) concurs with this view, he concludes that in the landlocked countries of West Africa, the rural exodus is mainly directed towards urban areas in <u>other</u> countries. Urbanisation as a construct has also been found to be a significant contributor (pull-factor) to migration (Gupta & Sharma 1994:147). In these cases the natural selectivity of migration is demonstrated in the characteristics of migrants being young and, twice as often, single females (Benyoussef *et al.*, 1973:536).

The consequences of urbanization and migration in cases where migration is the main contributor to urbanisation, which includes the demographic, economic and social transitions as part of the process, are closely linked to the ability of the urban areas to cope with population numbers as well as the characteristics of the migrants and the urban host population. This, in turn, is linked to (urban) planning (Huth, 1984:1) and policy (Sjoberg, 1992:3), and economic investments (Rietveld 1988:73; Qutub, 1993:648) and development (Singh, 1992:15).

Several components of urbanization influence health status, but it is difficult to attribute changes in health status to any particular component (Williams, 1990:145). Some of the changes may be related to particular aspects of urbanisation such as changes in sanitation levels. In general, the perception is that the changes experienced as a result of urbanisation are positive, but as illustrated in many African and Asian countries, where the urban areas cannot keep up with the population growth, people may be living in under-serviced areas. However, in some cases even under-serviced urban areas might still be better off than rural areas of origin. Migration to the urban environment imparts the tendency to acquire the health characteristics of the host population (Williams, 1990:145). In general it is believed that urbanisation is linked to a loss of prudent dietary practices and physical activity levels. This will be discussed in more detail in the section on the health consequences of migration. Various authors are of the opinion that in developing countries migration merely shifts underemployment from the rural to the urban sector of the economy (Mears, 1997:600; Vorster *et al.*, 1999:342). In the United States with a small rural population, concentrated poverty is, almost exclusively, an urban phenomenon (US Department of Housing and Urban Development, No date: 1).

This brief review of migration and urbanisation does not do justice to the complexity of the urbanisation phenomena, but is included as a general overview to illustrate that, in general, migration is currently regarded as one of the main contributors to growth of urban population and specifically mega-cities, and that rural-to-urban migration could have many possible important consequences for public health nutrition. Many of these consequences will be discussed in more detail under the health consequences of migration.

Poverty

As mentioned in the section on “reasons for migration”, migration is often the result of economic reasons either as a push or a pull factor (Kosinski & Prothero, 1975:8; Martin & Widgren, 2002:8). For many people in countries faced with famine, mass out-migration is a means of survival (Lindtjorn, 1990:1123; Carnell & Guyon, 1990:109). For others, like the Amazon Indian group Xavante of Pimentel Barbosa, the semi-nomadic nature of the group saved them from extinction (Flowers, 1994:18). In countries with high levels of poverty family members sometimes resort to migration (either permanently or temporarily) in order to diversify and improve their livelihood (Garnier, Ndiaye, & Benefice, 2003:223), i.e. the lure of economic betterment motivates them to migrate (Chang, 1996:197). Goduka *et al.*, (1992:523) propose that residential mobility can be used as a practical measure of economic stress on families and that it is particularly useful in environments where development and personal achievement is so limited that common socio-economic indicators, such as education may not be reliable indices of opportunities.

The economic consequences of migration are relative and depend on the situation in the host area/country, the area/country of origin, and other “costs” involved in migration. Survival migration, for example, takes place at the risk of uprooting and separating families (Robinson *et al.*, 2001:286) and at possible increased risk of death due, especially, to preventable infectious diseases as part of the journey or due to circumstances in the host area/country (Toole, 1995:353). In many countries migration of the poor has also resulted in shifting poverty and underemployment from one area, usually rural, to another, usually urban (US Department of Housing and Urban Development, No date:1; Mears, 1997:600; Vorster *et al.*, 1999:342; National Population Unit, 2000:15).

Literature on the impact of migration on the economic situation of the population/area and/or country of origin describes a range of situations. Most of the changes are related either to the changed composition or responsibilities of the household structures, or to the "feedback" from migrants to the origin.

The changed household structures often result in an increase in female-headed households due to male out-migration or male labour migration. In some cases, such as India, this is associated with the impoverishment of women (Mukherjee *et al.*, 1994:223), while in other cases female-headed households receive sufficient remittances from those who have migrated (Onyanga *et al.*, 1994:1633). Migration often results in a reduced ability to produce own food as labour or time is not available. If the male partner migrates, a woman's time is often reallocated from childcare to income generation – even if by means of involvement in small scale or commercial agriculture. This may actually increase children's morbidity (De Walt, 1993:1414), as increased income may not translate directly to increased food consumption at the household or individual level. In Kenya (Onyanga *et al.*, 1994:1633) and in Mexico (Kaiser & Dewey, 1991:1113) it appears as if households cope using trade-offs, which appear to balance the negative effects of migration, such as loss of the household head, or reduced income and the positive effects of the migration situation, such as remittances, not having to provide sustenance for the ones who have left, and reduced burdens of welfare (Demeny & McNicoll, 1998:317).

Migrants are also responsible for bringing about economic change in rural environments as a result of migrants marketing agricultural produce — especially during the initial time of their stay in the city — as a survival strategy, resulting in a changed character of rural economies of communities, from which they came, by encouraging production of crops for sale in the city rather than the production of food needed in the villages (Findlay & Findlay, 1995:62). Other changes are the result of communication and feedback from migrants to their origin, either directly or indirectly, which could influence their lifestyle and practices, and which might have economic implications.

Migrants themselves also experience the economic consequences of migration differently:

1) A longitudinal study of adolescent health indicates that foreign-born immigrants are more likely to have a lower family income, and maternal education, and to live in areas of higher immigrant density and greater linguistic isolation (Gordon-Larsen *et al.*, 2003:2023). Similarly Spanish-speaking, limited English-proficient children have become increasingly more likely to attend schools with low-income, minority and limited English-proficiency students (Van Hook & Balistreri, 2002:639).
2) The prevalence of hunger amongst low-income legal Latino and Asian immigrants to the United States is unacceptably high at 40% (Kasper *et al.*, 2000:1629). One could, however, only speculate what the situation would have been for these particular migrants if they had remained in their country of origin.
3) Poverty, unemployment, and low level of education have been found to account for adverse health in the Latino population in the U.S. Lack of health insurance and access to quality health care typically plague an adult immigrant. For many the nearest emergency department is their only source of medical care (Diaz, 2002:503). Anti-immigrant sentiment and discrimination in health care and education contribute to the adversity of an immigrant's experience.
4) Irish migrants to Scotland in the Twenty-07 study were poorer than the host population, and their different religious background gave rise to prolonged discrimination. Differences were largely associated with social class and mediated not only by low income, but also by educational disadvantage (Mullen *et al.*, 2000: 47).
5) In some cases migrants experienced initial economic benefits from their move, but this was not sustained. The large number of Turkish and Moroccon workers to the Netherlands in 1960-1970 are now mostly unemployed (Verhoeven, 1993:191). Their financial situation makes it difficult for them to return to their countries of origin.
6) A positive economic outcome has been documented for migrants from Puerto Rico to the U.S. This group have experienced reduced risk of child

poverty (in comparison with the origin rather than the destination), partly because of better jobs available in the U.S. However, employment, human capital, family structure and public assistance cannot completely explain the observed difference. The economic benefits of migration continued for the native-born on the mainland and return migration to Puerto Rico was associated with impoverishment (Oropesa & Landale, 2000:323).

7) Children of tenants who migrated to work the land in a welfare scheme in the Coast Province of Kenya, 1963, were better off five years later than the rural population in all aspects studied including living conditions, household resources and income, food self-sufficiency, food consumption, and nutritional status (Hoorweg *et al.*, 1996:161). The relatively better nutritional status was only partly due to increased food production and agricultural income. Income from employment was also higher than that of the rural comparison population.

The International Institute for Environment and Development (IIED) (2003:1) is of the opinion that rural-to-urban migration reduces poverty for both the rural and urban areas. Although rural specialists often see rural-to-urban migration as taking the brightest, youngest and best-educated rural dwellers, which helps impoverish rural communities, most urban professionals see rural-to-urban migration as a problem because of migrants' needs for new housing, basic infrastructure and services. However, the IIED argues that nations with the best economic performance over the last forty years are those with the largest rural-to-urban migration. For rural-to-urban migrants, income or educational possibilities are generally improved (or they escape discrimination and exploitation). With regard to the rural areas from where they have moved, the number of people dependent on a limited local resource base is reduced and the migration of one or more family members to an urban area often means urban-to-rural remittances (International Institute for Environment and Development, 2003:1). Increased access to information on different and often distant places influences people's desire to experience the wider world, and to move out of farming to more modern types of employment in services and, where available, manufacturing.

In conclusion, the economic consequences of migration are relative to the characteristics of the origin, the characteristics of the destination, and the selectivity of the migration process, i.e. the characteristics of the migrant. Furthermore, the economic consequences do not operate in isolation, but are influenced by social and cultural perceptions and norms.

Health and disease

The act of moving has a notable effect on patients' health (Bain, 1981:891). It is frequently assumed that migrant status constitutes a health risk because migration is inevitably associated with a period of significant adjustment and stress (Hyman & Dussault, 2000:357). Results of national and international studies on the health of immigrants are inconsistent in showing either increased or decreased morbidity in relation to native inhabitants (Zeeb *et al*., 2004:76). Literature available on the health and disease consequences of migration will be summarized below according to the type of disease or health outcome. Nutritional status and dietary intake are also regarded as health outcomes, but will be discussed later in this chapter in a separate section, as that is the main interest of this study.

Infectious diseases

Migrants may be more susceptible to preventable illnesses such as HIV/AIDS than non-migrants because of the social, economic and political conditions to which migration exposes them. Similarly, migration also plays a decisive role in shaping the pattern of disease especially as oscillating migration facilitates the geographic spread of diseases such as tuberculosis, HIV/AIDS and sexually transmitted diseases (Plorde, 1981:357; Colvin *et al*., 1995:1303; Lurie *et al*., 1997:S17; Hope, 2000:6; Beesey, 2000:38; Horwitz, 2001:119; Dollar, 2001:827; Oppong & Ghosh, 2004:324; Booysen, 2004:6). In turn, these diseases can also affect the nutritional status of infected persons (Piwoz & Preble, 2000:6) and, in the case of HIV/AIDS, it has been suggested that health shocks associated independently with the disease explain part of the observed differences in out-migration (Booysen, 2004:33). Migration is, therefore, an important coping strategy for poorer households especially, as it acts as an economic survival and social strategy to access support from the extended family (Booysen, 2004:30). In the case of tuberculosis (TB) it was found that foreign-born

TB patients in the U.S. were reported to reside in more affluent, more educated, and less crowded areas than U.S.-born patients. They were also more likely to have been employed in the two years before diagnosis (Davidow *et al.*, 2003:1007).

For other infectious diseases, studies have also found higher levels of infection in immigrants than in resident persons, an example being the higher prevalence of anti-hepatitis amongst immigrant children in primary schools in Denmark (Gjorup *et al.*, 2003: 231). In the latter study information on the prevalence of anti-HBc in the countries of origin is not provided. Diseases in immigrant children in the city of Bologna (based on health records and school admission reports) were more often infectious and allergic than in the resident Italian population, while parasitic infections occurred more frequently in Italian children. Sixty-nine percent of immigrant children in Bologna were born in EU countries. Of these children, those who had most often undergone diagnostic investigations requiring hospitalisation were from Asia and Africa (Stampi *et al.*, 2003:261).

Infant mortality

Migration is a cumulative process with varying health effects at different stages of its progression (Kanaiaupuni & Donato, 1999:339). Brockerhoff has reported on the impact of internal migration on infant and child mortality based on:

1. An analysis of the 1986 Senegal Demographic and Health Survey (DHS) (Brockerhoff, 1990:601-615);
2. An analysis of the DHS data for 17 countries (Brockerhoff, 1994:127-149) and
3. An analysis of the DHS data for fifteen developing countries (Brockerhoff, 1995:1371-1383).

All three of these reports illustrate the discrepancy in infant and child mortality between rural and urban areas even after controlling for education, fertility, previous exposure to urban life and access to amenities such as piped water and flush toilets.

However, the survival chances of children of females who migrated from rural areas to urban areas were better relative to those of children of females who remained in their respective rural origins (Brockerhoff, 1994:127; Brockerhoff, 1995:1371). The differences in the survival chances of children of these female migrants were greater for big cities than smaller towns. The child mortality that did occur amongst migrant women within big cities was clearly related to their concentration in low-quality houses (Brockerhoff, 1994:127). Poor living conditions were also found to be one of the reasons for the statistically significant higher infant mortality of migrants compared to citizens of Sabah in Malaysia (Zukifli *et al.*, 1994:151).

Migration in the opposite direction, i.e. urban-to-rural migration has been reported to result in incomplete immunisation (26%), as services are not available in the rural areas. This has been linked to increased child mortality in India (Mathew *et al.*, 2002:135). These findings suggest that the higher infant mortality found for migrants with a rural destination is the result of poor services and other conditions in the rural areas. The infant mortality for rural-to-urban migrants is lower than that of their origin mainly as a result of the better health and environmental conditions in urban areas, although these migrants still experience a higher infant mortality compared to their destination as they usually occupy areas with the poorest environmental conditions, such as housing, at their destination.

Even in the United States rural areas have the highest levels of infant-child mortality based on the U.S. National Family Health Survey (Stephenson *et al.*, 2003:15). Migration status was not a significant determinant of mortality in any of the three age groups in this study and could be explained by differences in socio-economic status and use of health services between rural-to-urban migrant and non-migrant groups. The selectivity of rural-to-urban migrants on socio-economic characteristics creates mortality differentials between rural-to-urban migrants and rural non-migrants. Problems faced by migrants in assimilating into urban societies create mortality differentials between rural-to-urban migrants and urban non-migrants (Stephenson *et al.*, 2003:15).

For a select group of U.S. citizens, i.e. infants of native-born black women, the infant mortality is greater than that of infants of foreign-born black women even after controlling for potential confounders (Rosenberg *et al.*, 2002:770). Maternal nutrition and stress were indicated as possible causes of this excess in black, non-migrant infant mortality. The mortality rates of infants of U.S.-born and foreign-born Japanese

American women are similar, but exceeded Japan's 1990 rates (Alexander *et al.*, 1996:820). Indo-Chinese refugees to the United States had an infant mortality rate similar to Asian groups in the U.S., but lower than non-Hispanic Whites and substantially below that for Blacks. These findings held even after controlling for birth weight and the onset of prenatal care (Weeks & Rumbaut, 1991:327).

In Greenland, the risk of infant death was significantly lower when the mother was born outside of Greenland (Friborg *et al.*, 2004:452). The findings of this study support the healthy immigrant theory.

All the studies mentioned above focussed on the infant mortality of the migrants and their destination. However, two studies also reported the mortality rates of countries of origin, i.e. Mexico and Bangladesh.

Kanaiaupuni and Donato (1999:339) describe higher rates of infant mortality in Mexican communities experiencing intense U.S. migration. Two factors diminish the disruptive effects of migration, *viz.* migrant remittances to villages, and the institutionalisation of migration over time. Mortality risks are low when remittances are high, and decrease as migration becomes increasingly salient to livelihoods of communities. Together these findings suggest an eventual benefit to all infants, irrespective of household migration experience, as a result of the development of social and economic processes related to U.S. migration (Kanaiaupuni & Donato 1999:339).

In Bangladesh neonatal mortality rates in families with migrant fathers were found to be double those of families with non-migrant fathers, specifically in families where mothers have no education or a low body weight (Chowdhury, 1986:449). The same benefits to infants as mentioned for the Mexican communities to the U.S. were not found in Bangladesh, as the households who experienced migration were more vulnerable and also did not receive economic benefits from the male out-migration.

Reproductive outcomes

One of the best-documented health-related outcomes of migration is that of reproductive outcomes of female Mexican immigrants to the United States. This situation has been termed 'the epidemiological paradox' as foreign-born Mexican mothers do not have lower levels of low birth weight (<2 500g), neonatal mortality or infant mortality when compared to U.S.-born whites and blacks (Smith, 1986:346; Guendelman & English, 1995:S30; English *et al.*, 1997:229; Fuentes-Afflick *et al.*, 1998:1105; Cervantes *et al.*, 1999:99; Guendelman *et al.*, 2001:1805; Kelaher & Jessop, 2002:2171; Buescher, 2003:97; Gould *et al.*, 2003:e676). This is the case despite their increased risk of adverse perinatal outcomes based on higher levels of inadequate prenatal care, teen births, and lower levels of maternal and prenatal education (Gould *et al.*, 2003:e676). Furthermore, for Mexican American migrants, higher maternal education levels and earlier prenatal care did not protect against low birth weight infants. These two factors had a protective effect on U.S. whites and blacks. Asian Indian migrants to the United States had similar levels of risk factors for adverse birth outcomes to the Mexican American group, and, indeed, had high levels of low birth weight, growth retardation and fetal mortality (Gould *et al.*, 2003:e676).

Possible reasons for the existence of the Mexican American (epidemiological) paradox include:

- Lower rates of smoking (Buescher, 2003:97) amongst Mexican Americans
- The "healthy migrant effect" caused by immigration of the fittest or by deliberate selection of healthy people in the immigration process. The study by Kelaher & Jessop (2002:2171) demonstrating a trend of increased LBW from documented to undocumented Mexican migrants to U.S.-born supports this argument.
- Protective socio-cultural orientation, attitudes and values. These could include fertility control, the amount and type of partner support, and stress during pregnancy (Guendelman *et al.*, 2001:1805), the valued status of pregnant women by Hispanics, and related steps to ensure adequate food intake during pregnancy (Smith, 1986:346; Jones & Bond, 1999:56).

When only low birth weight (LBW) is considered as an outcome, it is true that foreign-born women generally have fewer low birth weight infants than do U.S.-born women, despite the fact that immigrants to the U.S. are usually ethnic minorities and socio-economically disadvantaged, (Fuentes-Afflick *et al.*, 1998:1105; Forna *et al.*, 2003:257). However, the relationship between maternal birthplace and low birth weight varies by ethnicity (Fuentes-Afflick *et al.*, 1998:1105; Reichman & Kenney, 1998:182):

- Foreign-born Latino women have less favourable characteristics than U.S.-born Latino women, yet they are less likely to have low birth weight infants (Alexander *et al.*, 1996:820; Fuentes-Afflick *et al.*, 1998:1105; Gould *et al.*, 2003:e676).
- Foreign-born Asian women have a less favourable profile than US-born Asian women, yet there is no difference in LBW prevalence (Alexander *et al.*, 1996:820; Fuentes-Afflick *et al.*, 1998:1105; Gould *et al.*, 2003:e676).
- Foreign-born black women have more favourable maternal characteristics than U.S.-born black women, but there is no significant difference between their risks of low birth weight infants (Fuentes-Afflick *et al.*, 1998:1105; Palotto *et al.*, 2000:1080).
- Foreign-born white women have a higher risk of low birth weight than U.S.-born white women (Reichman & Kenney, 1998:182).

Korenbrot *et al.* (2000:241) point out that U.S.-born women experienced improvements in birth outcomes between 1994-97 that did not occur for foreign-born women. Foreign-born women also remained more likely to have inadequate prenatal care than U.S.-born women.

A positive reproductive outcome (as indicated by higher mean birth weight, less low birth weight and fewer pre-term births), similar to that documented for Mexican immigrants to the U.S., has been found for immigrants from North Africa to France (Guendelman *et al.*, 1999:177; Roville-Sausse *et al.*, 2001:439) and immigrants from North Africa to Belgium (Beukens *et al.*, 1998:808; Guendelman *et al.*, 1999:177; Delveaux *et al.*, 2003:779). These differences cannot be explained by traditional risk factors such as differences in socio-economic status, marital status and parity.

Protective factors and selective migration have been offered as possible explanations of these findings (Guendelman *et al.*, 1999:177) as immigrants also had a lower prevalence of LBW and pre-term births and higher mean birth weights than their countries of origin.

Negative reproductive outcomes such as low birth weight and pre-term delivery were of similar prevalence for native-born women for Finns in Sweden (Gissler *et al.* 2003:1443); all immigrants to Sweden (Rasmussen *et al.*, 1995:441); immigrants to Spain (Perez Cuadrado *et al.* 2004:3); non-European Union immigrants to Italy (Diani, 2003:615); Chinese immigrants to Hong Kong (Cheung & Yip, 2001:1135) and to Australia (Westerway *et al.*, 2003:46); Ethiopian immigrants to Israel (Press *et al.*, 1993:403); and immigrants to Canada (Doucet *et al.*, 1992:192).

Some studies report poorer reproductive outcomes for immigrants compared to counterparts at their destination. Multiple regression analysis showed that babies born to women from Vietnam and Korea were significantly lighter than babies born to Anglo-Australian controls (Rundle *et al.*, 1996:430), while they were significantly heavier than full-term infants in their country of origin. Infants of immigrant parents who were born in Italy during 1996/7 showed higher incidences of prematurity, low birth weight, asphyxia and neonatal mortality rates than newborns with Italian parents (Bona *et al.*, 2001:155). These authors (*ibid.*) conclude that the health problems of infants with immigrant parents are mainly related to social disadvantage and can be overcome by improving the social state, the lifestyle and the obstetric care of the immigrant women

Highly acculturated Southeast Asian immigrant women (Hyman & Dussault, 1996:158; Hyman & Dussault, 2000:357) and long-term Mexican immigrants (>5 years) (Guendelman & English, 1995:S30) in Canada also experienced a higher rate of term low birth weight than Canadian natives and new Mexican immigrants respectively. Acculturation with its corresponding stressful life experiences, dieting during pregnancy and inadequate social support has been identified as possible contributing factors to these findings.

Nomadic Turkana women in Kenya experienced lower intra-uterine mortality compared to settled counterparts (Leslie *et al.*, 1993:237) and Efe foragers in North-east Zaire experienced lower fluctuations in ovarian function than Lese subsistence farmers (Bailey *et al.*, 1992:393). In both these cases nutritional stress of the non-mobile women, who found it hard to maintain their dietary intake during periods of hardship such as drought, may have contributed to the relevant reproductive outcomes.

In summary, it would appear as if there are three possible pathways by means of which reproductive outcomes are affected:

- Firstly, the lifestyle of nomadic groups appears to allow them to optimise environmental resources and to respond better to hardship than non-mobile groups.
- Secondly, migrants having better reproductive outcomes than their countries of origin illustrate positive selection for migration, either on the basis of socio-economic characteristics or on health status or a combination of factors.
- Thirdly, healthy values and practices related to pregnancy might ensure good reproductive outcomes as illustrated by the Mexican epidemiological paradox.

However, all of these could be influenced by time resulting from the assimilation process into the new area/country and its ways. The degree of change and the direction of change (positive or negative) of the reproductive outcomes of the migrants would depend on the situation at the destination (Guendelman & English, 1995:S30; Landale & Hauan, 1996:429-442; English *et al.*, 1997:229; Hyman & Dussault, 2000:357).

Reproductive outcomes are associated with the health and nutritional status of children either directly, especially for children younger than two years of age, or indirectly. The factors identified as relating to migration and reproductive outcomes i.e. migration as a coping strategy during hardship, positive selection for migration, and healthy values and practices, could also be active in the relationship between migration and nutritional status of children.

Diseases of lifestyle

The socio-cultural context of migrants alters the risk of diseases of lifestyle associated with individual-level variables. In many cases migrants initially demonstrate a lower risk of and mortality from diseases of lifestyle. As lifestyle (smoking, obesity, physical activity, stress, dietary intake) and the environment (environmental contamination) of immigrants often change dramatically, so does their risk of chronic diseases (Pawson & Janes, 1981:509; Ruel *et al.*, 1999:1926; Singh & Siahpush, 2002:83).

Depending on the initial level of chronic diseases of lifestyle and the degree of change experienced (also called acculturation), the risk of chronic diseases and related mortality may increase, but remains lower than the host population or, in some cases, may exceed that of the host population. Findings from the U.S. National Longitudinal Mortality Study found that, compared to U.S.-whites of equivalent socio-economic status and demographic background, foreign-born blacks, Hispanics, and Asian/Pacific Islanders, U.S.-born Asian/Pacific Islanders, U.S.-born Hispanics and foreign-born whites had respectively lower mortality risks (in the order of mentioning). Black and Hispanic immigrants experienced respectively 52% and 26% lower mortality risks than their U.S.-born counterpart. Consistent with the acculturation theory, an immigrant's risk of smoking, obesity, hypertension and chronic conditions, although substantially lower than those for the U.S.-born, increased with increasing length of U.S. residence (Singh & Siahpush, 2002:83). These findings where immigrants have the lowest risk of mortality and other associated risk factors are consistent with two other studies that focus on Mexican-born women and men and their U.S.-born counterparts (Sundquist & Winkleby, 1999:723; Sundquist & Winkleby, 2000:470), but the mortality risk of U.S.-born Spanish-speaking men and women is higher than that of U.S.-born English speaking men and women in the study by Sundquist & Winkleby (1999:723).

In a different population of migrants, i.e. that of Greeks to Australia, acculturation has also taken place to such an extent that first generation Greek Australians, who have a high prevalence of cardiovascular disease risk factors such as obesity, diabetes, hyperlipidaemia, smoking, hypertension, and sedentary lifestyles, continue to display a 35% lower mortality from CVD and overall mortality compared with the Australian-born, even after 30 years in Australia. This has been called the morbidity mortality paradox or Greek migrant paradox (Kouris-Blazos, 2002:S569).

In contrast to these studies where migrants were "better off", researchers from developing countries such as Peru, Samoa and South Africa have concluded that immigration is a significant independent predictor of cardio-vascular disease risk factors such as total cholesterol, hypertension, obesity and alcohol consumption (Pawson & Janes, 1981:508; Steyn *et al.*, 1991:480; Vorster *et al.*, 1999:344; Lizarzaburu & Palinkas, 2002:342).

An analysis by Elford *et al.* (1990:291) of the British Regional Heart Study in Great Britain has revealed that the place of examination, i.e. place of living, was a more important determinant of the risk of a major ischaemic heart disease than the place of birth. These authors conclude that time would probably reduce the impact of genetic differences and increase the importance of environmental factors.

The key factors related to the development of diseases of lifestyle may change dramatically as a result of migration and the process of acculturation (which will be discussed later in this chapter). As all these factors and processes are time-bound, it is probable that the younger the age of the child at migration, the greater the similarity between the risk of diseases of lifestyle of migrants and the host population.

Cancer

Differences in the occurrence of three common types of cancer viz. breast, colon and lung cancer among Hispanic women compared to English-speaking white women are present in two different geographic locations, i.e. Texas, New Mexico and Los Angeles. Migration status, dietary intake, socio-economic status and fertility patterns were some of the indicators of the differences (Newell & Mills, 1986:23).

All seven European source countries of migrants to Australia (1970) had higher rates of stomach cancer than native-born Australians. The migrant groups that initially reflected those higher rates experienced an approximate 25% risk reduction with increased duration of residence. For cancer of the pancreas, migrants initially had rates above those of their origin, but by staying longer the rates converged to those of the Australian-born population. Continental European migrant groups initially had a colon cancer risk half of that of the Australian population, and experienced an increased risk with increasing duration of stay. It has been proposed that dietary differences are related to changes in gastro-intestinal cancer risks (McMichael *et al.*, 1980:431), either facilitating or inhibiting, and have to be linked to the rate of adaptation.

Health care access and utilization

Assuming equality of health status between immigrants and non-immigrants, or between immigrant groups is likely an unrealistic and simplistic assumption, given unseen barriers affecting accessibility, the structure of the health care system, and problems with the provision of health care resources to the immigrant population (Newbold & Danforth, 2003:1981). Firstly, rendering of health services is more difficult in a mobile community and secondly, intercultural differences can have serious consequences for health care in terms of risk of incorrect diagnoses, poor communication between health care practitioners and immigrants, and non-compliance (Harmsen *et al.*, 2003:99).

More than half of the foreign-born children in the U.S. are uninsured and only two-thirds have a regular care source compared to 20% and 92%, respectively, of native-born children (Guendelman *et al.*, 2001:257). Studies have found lower health care access and utilization amongst Asian/Pacific Islander children than in non-Hispanic white American children (Yu *et al.*, 2004:101). On the other hand, these children (Asian Indian, Chinese, Filipino and other Asian/Pacific Islanders) are less likely to miss school because of illness or injury and have fewer learning disabilities compared with non-Hispanic whites (Yu *et al.*, 2004: 101).

A study by Bain (1981:891) has found that the consulting behaviour of patients in the United Kingdom is similar to that in the United States. During the first year in a new community, adults will consult twice as often as established patients with emotional illness; during the same period children will be seen twice as often with respiratory problems. The settling-in period is a time of stress, and such times of stress will be reflected by higher consulting rates and greater demands on physicians' services (Bain, 1981: 891). However, it has been reported that immigrants to Germany utilize health care facilities and preventive programmes less frequently than Germans. They also express a lower level of satisfaction with the health care (Zeeb *et al.*, 2004:76). Similarly, Hispanics in the U.S. (Ramirez *et al.*, 1995:1) and immigrants to Canada (Newbold & Danforth, 2003:1981) also face barriers to health care access. These barriers have a direct impact on the risk of disease and on the development of prevention and control strategies.

Not all migrants face cultural differences and health care access problems. Forty percent of persons of the national probability sample of the HIV Cost of Services and Utilization Survey in the United States (HCSUS) indicated that they had moved to be closer to quality care services. The vast majority of this group did not move "to return home", but rather to be close to caregivers and to be in a community with shared needs and interests and to be away from discrimination (Berk *et al.*, 2003:1091). The characteristics of persons with HIV who migrated in the HCSUS were similar to those who did not move based on age, region of the country and income. Similarly, Booysen (2004:32) found that in the Free State Province, South Africa, individual attributes such as age and gender were not significant determinants of out-migration in households affected by HIV/AIDS. Household variables such as gender of the household head, household size, dependency ratio, family structure, human capital and place of residence were, however, independently associated with out-migration (Booysen, 2004:33).

The impact of migration on health care access depends, therefore, on the characteristics of the migrant. New migrants might not have a regular health care provider and will therefore use emergency services more often (Fowler *et al.*, 1993:934; Simpson & Fowler, 1994:303). In cases where there are major language and cultural differences between the caregiver and the migrant, the difficulties with regard to health care access and utilization might be more than only temporary.

Acculturation

Acculturation is defined as the acquisition of dominant cultural norms by members of a non-dominant group (Gordon-Larsen *et al.*, 2003:2023). The process of acculturation — sometimes also called deculturation or transculturation — is measured along two dimensions, i.e. psychological and behavioural (Marino *et al.*, 2001:107) and is seen to lead to a transition in practices, values and norms (Cheetham *et al.*, 1983:942).

Interaction of technologically advanced societies in the western world with underdeveloped societies has produced a process of acculturation or transculturation (Vega-Franco, 1985:407). Mexican migrants to the United States have been cited as a classic example (Smith 1986:346; Guendelman & English 1995: S30; Jones *et al.*, 2001:83; Callister & Birkhead, 2002:22). However, migrants to Australia from developed societies, such as Greece, also experience acculturation. Acculturation is related to many aspects of migrants' lives, such as:

- The displacement of breastfeeding (Vega-Franco, 1985:407; Romero-Gwynn, 1989:804; Naggan *et al.*, 1991:428);
- The replacement of traditional remedies or medicine with Western medicine (Park & Petersen, 1991:261; Golomb *et al.*, 2003:714; Papadopoulos *et al.*, 2003:210). It should be noted that supply might play a role in this situation. Researchers have also found that although migrants might resort to modern medicine with regard to sickness, their interpretation of sickness might not change (Rabain-Jamin & Wornham, 1990:287).
- Dietary intake of migrants (Wandel, 1993:117; Hsu-Hage *et al.*, 1995:623; Kouris-Blazos *et al.*, 1996:177; Popkin, 1999:1905; Hyman *et al.*, 2002:125; Kouris-Blazos, 2002:S569; Varghese & Moore-Orr, 2002:72; Kim & Chan, 2004:469; Wahlqvist, 2002:S562) including child-feeding practices (Mandrup, 1992:8);
- Childcare practices (Mandrup, 1992:8; Liamputtong & Naksook, 2003:605) although it has been stated that childcare practices do not change as rapidly as child-feeding practices (Mandrup, 1992:8);

- Lifestyle: smoking (Cobas *et al.*, 1996:303) and physical activity (Popkin, 1999:1905; Yach *et al.,* 2001:236; Singh & Siahpush 2002:83). Based on the HHANES data from the United States, Cobas *et al.* (1996:303) conclude that acculturation affects low birth weight status indirectly through smoking and dietary intake rather than through parity.
- Perceptions about the value of pregnant women, and related food and work distributions (Smith, 1986:346).
- Fertility related behaviour and outcomes (Doucet *et al.*, 1992:192; Guendelman & English, 1995:S30; Hyman & Dussault, 1996:158; Guendelman *et al.*, 2001:1805; Jones *et al.*, 2001:83). For example, migrants to the United States were found to face higher risks of conceiving and bearing a child before marriage compared to their countries of origin (Fennelly *et al.*, 1992:107; Landale & Hauan, 1996:429).

Socio-cultural factors together with genetics play an important role in the lives of people. Although both these factors also affect the impact of migration, it appears as if the socio-cultural factors and, specifically, acculturation is emerging as an important variable that should be considered when assessing the impact of migration on the lives of migrants and in the planning of (health) care for migrants (Callister & Birkhead, 2002:22).

Behavioural problems / social adaptation

Migration is inevitably associated with a period of significant adjustment and stress (Perez Cuadrado *et al.*, 2004: 3) and may impact on mental health through the following factors:

- Displacement (Fullilove, 1996:1516);
- Cultural marginality (Choi, 2001:193);
- Adjustment to and assimilation into a new society (Williams, 1990:145; Park & Petersen, 1991:261; McGuinness, 2000:59; Liamputtong & Naksook, 2003:605) and,
- Acculturation stress (Cheetham *et al.*, 1983:942; Mandrup, 1992:8; Skreblin & Sujoldzic, 2003:469).

The following problems have been documented for different groups of immigrants:

- Mental health related problems associated with migration have been documented as one of the precipitating factors in parasuicidal acts in more than 50% of Asian immigrants to South Africa (Cheetham *et al.*, 1983:942);
- Emotional stress and fatigue experienced by Korean women in the United States (Park & Peterson, 1991:261);
- Depression among young women in Taiwan (Cheng, 1989:309);
- Social isolation of new Thai mothers in Australia complicating motherhood (Liamputtong & Naksook, 2003:605);
- Psychological distress of adolescents in the Croatian region of Dalmatia (Williams, 1990:145; Skreblin & Sujoldzic, 2003:469);
- Early drug use initiation and progression amongst young adults aged 18-35 in Ontario (DeWit, 1998:623);
- Child dysfunction such as behavioural problems, delayed development and learning disabilities of children in the United States (Wood *et al.*, 1993:1334; Simpson & Fowler, 1994:303; Leventhal & Brooks-Gunn, 2003:1576);
- A negative perception of welfare and quality of life (WHO, 1995:1403) of the elderly in Tanzania (Nyaruhucha, 2001:489) and in China (Yeh, 2003:729).

Factors that appear to have a protective effect against the mental health impact of migration – especially for children – include family cohesiveness (Nyaruhucha 2001:489; Kelley *et al.* 2003:1019) and parental warmth ((Costello *et al.*, 2001:1494), the relationship of children with their mothers (Kelly *et al.*, 2003:1019), length of time of stay which affects attachment, familiarity and identity, i.e. psychology of place (Fullilove, 1996:1516), and neighbourhood quality and stability (Fullilove, 1996:516; Bures 2003:1144).

Possible aggravating factors include multiple moves (Simpson & Fowler, 1994:303), destinations being high-poverty neighbourhoods (Leventhal & Brooks-Gunn, 2003:1576), the absence of traditional rituals (Becker, 2002:S79; Liamputtong & Naksook, 2003:605), anti-migration sentiments (McGuinness, 2000:59) and structural discrimination (Tsai, 2003:76).

Protecting, restoring and maintaining mental health for migrants are essential for the well-being of both the individual and the community at large. This not only requires assistance to migrants and communities, but also planning and policy on a micro- and macro-economic and political scale.

Summary

In summary, the consequences of migration are of diverse nature. Migration contributes to the growth of cities and has a definite impact on the economic situation of migrants themselves, their origin, as well as their destination. It has been reported that migrants experience economic benefits (compared to their origin), even though they are often economically marginalized compared to their host area. The area of origin could either benefit from migration or be disadvantaged depending on the availability and significance of remittances from migrants.

The health situation of migrants varies greatly. On the one hand, migrants have been reported to be at risk of infectious diseases as well as diseases of lifestyle. On the other hand, two paradoxes have been documented, i.e. the Mexican-American paradox related to reproductive outcomes and infant mortality and the Greek-Australian paradox related to cardio-vascular diseases where migrants had better health outcomes. This confirms that the impact of migration is dependent on the characteristics of the migrants themselves, their origin and their destination as well as the process. Changes in health status as a result of migration or subsequent to migration have been ascribed to the process of acculturation. Health care of migrants may be compromised due to access, anti-migrant sentiments or communication. A simplistic view of migrant status and related life experiences, health and other outcomes is, therefore, insufficient for understanding fully the complexity of the process and its impact. Migrants' lives are inseparable from the larger societal contexts. Together with other evolutionary forces such as selection and genetics, migration contributes to regions becoming more genetically homogeneous, but at the same time, through social, cultural and economic factors, the social, health and economic differences between regions are maintained or even accentuated (Williams-Blangero & Blangero 1989:1; Gibson *et al*., 1994:275; Mascie-Taylor & Lasker, 1995:629). Research on and descriptions of the impact of migration should take cognisance of these complexities (Marino *et al.*, 2001:107).

Impact of migration on nutritional status of children

As the nutritional status of children is the particular interest of this study, the literature on dietary intake and anthropometric status of children will be discussed in this section even though it is recognized that nutritional status is closely linked to the other consequences of migration. As with the consequences of migration, the review will start with a general overview, which will include adults and international migration, and then focus on internal migration and children. The purpose of this review is to highlight factors that might contribute towards the development of a conceptual framework of migration and nutritional status and to highlight specific variables that need to be investigated as part of this research.

Dietary intake

Dietary intake contributes not only to the growth of children (UNICEF, 1990:3), but also to the health of the population (Popkin, 1999:1905). The impact of migration on dietary intake is bi-directional (Wahlqvist, 2002:S562). Migrants have to adapt to an environment where their traditional foods might not be available and where practices related to food, its preparation and consumption might differ. Immigration, therefore, almost always involves major cultural changes in dietary (and health) related beliefs and behaviour (Vega-Franco, 1985: 407; Kouris-Blazos *et al.*, 1996:177; Trostler, 1997:352). Greek migrants to Australia (Kouris-Blazos *et al.*, 1996:177; Kouris-Blazos, 2002:S569), North African immigrants to Norway (Wandel, 1993:117), Chinese migrants to Australia (Hsu-Hage *et al.*, 1995:623), Indians to Canada (Varghese & Moore-Orr, 2002:72), and Koreans to America (Kim & Chan, 2004:469) are cases illustrating this point. A change from a healthy to a less-healthy diet in their traditional dietary patterns has been reported for all these groups, especially migrants from non-Western countries (Hyman *et al.*, 2002:125). These changes may often include increased protein – specifically animal protein, fat and sweetened foods, while traditional “protective foods” such as cruciferous vegetables by the Chinese, grains, fruit and vegetables by the Indians, cereals and olive oil by the Greeks, leafy vegetables by the North Africans and fibre by Koreans, may be reduced.

Within migrant groups, persons who migrated at an older age would more often try to maintain traditional practices. This group might be unable to make appropriate food choices to maintain health as the food choices are too limited (Hsu-Hage *et al.*, 1995:623). Those migrants (educated professionals and administrative professionals) who replace or supplement traditional foods with foods of the host country might benefit from the diversity, but be at risk of the diseases prevalent in the host country, usually an industrialised society. The interesting phenomena where migrants seem to return to traditional practices with advancing years have been documented for Greek migrants to Australia (Kouris-Blazos, 2002:S569).

Although children are not explicitly indicated in the abovementioned reports, it could be assumed that the changes in traditional dietary practices reported would hold true for children who might have experienced migration with their families (Wandel, 1993:117; Hsu-Hage *et al.*, 1995:623; Kouris-Blazos *et al.*, 1996:177; Kouris-Blazos 2002:S569; Varghese & Moore-Orr, 2002:72; Kim & Chan, 2004:469). In children the acceptance of the new dietary patterns as their own might be easier and more permanent. Therefore, a return to traditional dietary practices with advancing years would not be likely, as children might not have been able to internalise traditional dietary patterns sufficiently to enable them to return to these with advancing age.

The other side of the coin is the impact of migrants on the eating practices of the host area/country. In Australia, immigrants, especially from Asia, have injected cultural food elements and caused a measure of change. The advantage for Australia has been the diversification of its food supply with associated health protections (Wahlqvist, 2002:S562).

Historically, one of the most effective and far-reaching dietary changes, which have taken place on the African continent as a result of colonialisation and migration, is that of maize. Maize (mielies), also called Indian or Turkish corn, was introduced to Africa by the Portuguese navigators around 1492 and reached Southern Africa in the

18th century (Coetzee, 1982:66). Since then it has replaced the indigenous/ autochthonous sorghum as a staple. Unfortunately, maize is deficient in protein (especially tryptophan) and niacin (nicotinic acid), and vulnerable to drought. The dietary intake of children in Africa is often insufficient in these nutrients, regardless of migration status.

Migrant health is further threatened if the changes in dietary intake are accompanied by a decrease in energy expenditure. This poses a particular problem for population groups who are genetically programmed towards abdominal obesity, diabetes and cardiovascular disease, such as Asians in Australia (Wahlqvist, 2002:S562). However, not all migrant dietary habits are adequate and some migrants might actually be at risk of micronutrient deficiencies as a result of their traditional dietary practices (Wandel, 1993:117; Pomerleau *et al.*, 1998:41). Although the study sample of the 1996 Ontario Health Survey only reports on persons 18 years and older, it could be assumed that some of the findings of this study would also apply to children (Pomerleau *et al.*, 1998:41). This study indicated that some adult immigrant groups (particularly from Asian countries) displayed higher risks of inadequate protein and micronutrient intakes (calcium, iron, thiamine, riboflavin and niacin) compared with non-immigrants.

Another health problem associated not only with migration, but also with globalisation in general, relates to rapid nutrition transition (Yach *et al.*, 2001:236). The problem of unhealthy and over-nutrition now compounds longstanding problems of under-nutrition in developing countries. Various authors have documented especially the increase in energy density and fat density as a result of migration and urbanicity (Popkin, 1999:1908). In higher income countries this difference is not as marked, as rural people are also changing their eating patterns due to national integrated food distribution systems and improved communication. These changes apply to adults and children, including infant feeding practices (Dagan *et al.*, 1984:1029).

Urbanisation is also accompanied by trends towards less physically demanding occupations worldwide (Ruel *et al*., 1999:1925). The decline in activity levels in urban areas is accompanied by an increase in body mass index (BMI) and obesity. Data from China, Brazil, Malaysia, India, and South Africa show that the combination of increased fat and sugar combined with reduced physical activity, and the resultant increase in chronic diseases, is most pronounced where the rate of urbanisation has occurred rapidly (Popkin, 1999:1905; Yach *et al*., 2001:236).

Only two studies have been found which explicitly refer to dietary-related changes for children post-migration:

- Kockturck-Runefors in Wandel (1993:24) theorised in 1990 that the dietary intake of migrants changes even though many migrants might not think that they had changed their dietary practices. This theory was based on their findings that migrants from developing countries in North Africa to Northern Europe changed their dietary patterns after migration so that they would be similar in nutrient content to that of the North European inhabitants. In some cases the dietary changes exceeded that of the North European inhabitants. These dietary changes were mainly the result of changes in the amount of accessory food items such as sweets, fat and sugar used in the preparation of traditional dishes, and the type of snacks consumed by migrants and their children.
- Meulmeester & Hulshof (1993:320) report that eight-year-old Turkish and Moroccan children in the Netherlands consumed a diet that was more compatible with the Dutch recommendations for a prudent diet than Dutch children of a similar socio-economic background The vitamin D status of these children (as measured by plasma 25-OHD concentrations) was, however, significantly lower than that of the Caucasian reference group (Meulmeester *et al*., 1990:461). It was concluded that the secondary hyperparathyroidism observed in some of these children confirms that migrant Mediterranean children have a higher risk of developing nutritional rickets when living in areas with a moderate climate.

In summary, changed dietary intake is to be expected in children who migrate, as dietary practices are easily influenced as part of acculturation (Mandrup, 1992:8). The advantage of this change could be greater dietary diversity, which might have a positive impact on the micronutrient status and malnutrition of adults and children (Vorster *et al.*, 1999:342). However, the disadvantages of the changed dietary intake would be observed only much later when diet-related diseases manifest, and would depend on factors such as a genetic endowment for low-energy output, thrifty genotype, and maternal under-nutrition. No studies have been identified that have reported on the nutrient intake of internal migrant children.

Anthropometry

Migration has been identified as being related to child growth. The reasons for this finding are mostly environmental, *i.e.* related changes in poverty levels, food availability, transportation, sanitation, educational levels of mothers, and/or access to health services.

Some studies have described the following anthropometric observations:

- An increase in the adult height of children who have migrated and a diminishing of the differences between ethnic groups (Laor *et al.*, 1991:169; Shell-Duncan & Obiero, 2000:183; Fredricks *et al.*, 2003:788),
- Lower levels of stunting in immigrants (Bertrand *et al.*, 1988:566; Baba *et al.*, 1994:247; Forman *et al.*, 1995:495), but others have found higher levels of wasting (thinness) and stunting (Bogin & Mac Vean, 1981:1373; Malina *et al.*, 1981:277; Carnell & Guyon, 1990:111; Pelto, 1991:55; Goduka *et al.*, 1992:523; Núñez-Rocha, 1998:248; Hulanicka *et al.*, 1999:556; Gonzalvo 2000:17);
- Growth faltering (Cameron 1999:211);
- Being overweight relative to height, as a result of children being shorter than their counterparts (Schroeder *et al.*, 1999:177; Fredricks *et al.*, 2003:788).

These differences were often more significant in cases where migration had occurred in the recent past (Pelto, 1991:52). New arrivals usually occupy the least desirable areas of the urban or metropolitan zones (Solomon & Gross, 1995:92), and do not enjoy a standard of living similar to the one they enjoyed prior to migration (Findlay & Findlay, 1995:61). These effects might be less marked in groups of higher economic status or groups who might have economic means or accumulated capital stock (Whiteford, 1993:1399; Bekker, 1999:222).

A general increase in childhood obesity has been observed worldwide regardless of migration status. Shifts in transportation, technology, and leisure — especially television-viewing patterns — also affect children and may be responsible, to some extent, for this increase in childhood obesity (Johnson-Down *et al.*, 1997:2315; Ruel *et al.*, 1999:1926).

Obesity rates in the United States were lowest in Asian-Americans (20%) followed by white non-Hispanics (24%), Hispanics (30%) and black non-Hispanics (31%) (Popkin & Udry, 1998:701). The adult waist circumference and abdominal obesity of the U.S. population also varies by country of birth and acculturation status (identified by primary language spoken) with Mexican-born women and men having the smallest waist circumference, U.S.-born, English-speaking women and men have intermediate waist circumference and U.S.-born, Spanish-speaking women and men have the largest waist circumference after accounting for age, education, percent energy from dietary fat, leisure time physical activity and smoking (Sundquist & Winkleby, 2000:470). Asian-American and Hispanic adolescents born in the U.S. are also more than twice as likely to be obese as first generation residents of the fifty states (Popkin & Udry, 1998:701).

Physical appearances might also differ between different areas. A study of traditional rural and traditional urban families in a few Polish regions found specific differences in the physical development of persons living in rural or urban regions. Rural people have greater muscle development and shorter reaction time. Differences in the majority of somatic features, which are positive indices of health, were, however, insignificant (Wolanski, 1992:323).

Only a few studies reported on the anthropometric status of children as international migrants. These include:

- A semi-longitudinal study on growth and development of immigrant and refugee children in San Francisco found that although these children demonstrated significant lower anthropometric indices, their median growth velocity was close to or exceeded the median for U.S. white children (Schumacher *et al.*, 1987:861). This finding confirms the importance of the situation prior to migration and also confirms that children experience a period of catch-up growth in an optimum nutritional environment.
- Young Turkish adults residing in the Netherlands were 10cm shorter than their Dutch contemporaries; the differentiation in height started at three years of age. The height of these Turkish children in the Netherlands was similar to Turkish children in Germany and to children from high socio-economic classes in Istanbul. The shorter stature of children contributed to their being more overweight as the BMI of Turkish children was higher than that of Dutch children of all ages. Maturation stages of Turkish children were also delayed by 0.5-0.7 years for both sexes (Fredriks *et al.*, 2003:788). These findings support the mediation of height attainment by socio-economic and genetic factors. They may also highlight possible health implications, if these migrant children were to be exposed to other risk factors for diseases of lifestyle.
- Although Ethiopian immigrants to Israel had a BMI below Western values (20-22 for adults), teenage Ethiopian immigrants had the same BMI as the Israeli comparatives five years after migration (Trostler, 1997:352). This confirms the conversion to the destination, especially if similar environmental factors such as socio-economic status apply.
- Illegal immigrant children from Maghreb to Zaragoz in Spain were not chronically malnourished, but showed signs of acute malnutrition probably due to food deprivation and poor dietary habits experienced as part of the immigration process (Gonzalvo, 2000:17).

The majority of the body of literature available on the differences between children who migrated within one country, i.e. internal migration and those who did not, and who did so under relatively normal circumstances, i.e. not related to humanitarian crises or famine, centres around three areas or countries: (i) Bedouin infants in Lebanon and Syria, (ii) children in Mexico, and (iii) in Senegal. Some single publications have been generated from localised projects in Zaire, South Africa, Poland and Guatemala.

The Bedouin Infant Feeding Study followed a group of 680 children from a birth cohort (1981-1982) after ten years of urban settlement. Although none of these children had migrated themselves, it was clear that they and their later siblings benefited from the resettlement.

In the 1981-1982 birth cohort of the Bedouin Infant Feeding Study, the more traditional Bedouin Arabs were more likely to breastfeed exclusively than established women, i.e. those who lived in houses rather than the traditional huts and tents and who had access to modern appliances. The type of housing emerged as the environmental factor which best correlated with breastfeeding practices at six months of age. Those living in a tent had the highest prevalence of exclusive breastfeeding (13.9%) followed by those living in a hut (9.1%), and those living a in a house having the lowest prevalence of exclusive breastfeeding (6.4%). The type of housing also contributed strongly to increased duration of breastfeeding. Nutritional status at six months was independently associated with breastfeeding at 18 months (Naggan *et al.*, 1991:428).

Stunting dropped 25 percentage points from 32.7% at 18 months to 7.7% at 10 years of age in the 1981 birth cohort and 11 percentage points from 17.5% at 9 months to 6.5% at 9 years of age in the 1982 birth cohort (Forman *et al.*, 1995:495). Stunting amongst the siblings of the birth cohort was much less than stunting in the index children. These findings indicate that factors present in early childhood have the greatest impact on current height-for-age. There is no comparison with children at the origin or the destination for this group of children. It merely illustrates that nutritional status of migrants is time-bound and can be influenced by changes in the situation at the destination. Temporality is, therefore, important. Researchers and health workers should also investigate the underlying causes of malnutrition and not only be concerned with the estimation of the prevalence of malnutrition, as migration, and especially distress migration, often results in a degraded health environment (Young & Jaspars, 1995:26).

In 1993, anthropometric measurements of 296 children aged 6-10 years from four different Bedouin groups in Lebanon and Syria were assessed. These groups represented semi-settled Bedouins in the Beqa valley, transhumant Bedouins who follow traditional migration routes between winter and summer grazing areas in Akkar, true nomadic groups in Syria, and settled Bedouins in Syria's Aleppo desert. The children from the semi-settled group in Beqa had the lowest rates of severe and mild underweight and stunting, followed by the transhumant group, the true nomadic group and the settled group. The dietary intake and food availability range was similar to the malnutrition rates between these groups. For Bedouin children, access to food, as well as access to possible extra income sources afforded as part of their living conditions (partly or fully nomadic) contributed to their improved nutritional status (Baba *et al.* 1994: 247).

More than three out of four children living in rural indigenous communities in the Oaxaca Mountains of Mexico and on the sugar cane fields of Jalisco are malnourished (Malina *et al.*, 1981:334; Ysunza-Ogazon *et al.*, 1993:569; Salcedo-Rocha & Prado-Aguilar, 1992:518). According to Ysunga-Ogazon *et al.* (1993:569) under-nutrition is negligible in the migrant families in Mexico City, which is different from the finding ten years earlier by Malina *et al.* (1981:334) that rural-to-urban migration did not result in improved growth status. For chronically malnourished children living in Jalisco, Salcedo-Rocha & Prado-Aguilar (1992:518) conclude that coming from a poverty-stricken population and being a permanent migrant, i.e. having changed address permanently, were significant risk factors for malnutrition. More detailed analyses of the differences and similarities between these studies have not been possible as two of them were based on abstracts only, as the articles are in Spanish.

A longitudinal study from Senegal investigated growth during puberty. Various authors have reported on different aspects of this study, but all conclude that migrants (based on the nutritional status of girls who had just returned from seasonal migration to work as maids in Dakar) enjoyed better living conditions than rural non-migrants. This was partly due to the better socio-economic environment of the employer, and was associated with earlier puberty and better nutritional status (higher BMI, MUAC), but not a catch-up in growth, i.e. the migrant girls were not taller than rural non-migrants (Garnier, Simondon *et al*., 2003:535; Garnier, Ndiaye & Benefice, 2003: 232; Simondon *et al*., 1997:521). The significantly higher levels of physical activity reported by the migrant girls, after a possible gradual introduction to the work load, and/or the adjustment of dietary intake after a possible initial increased intake as a result of the availability of food — over consumption as part of the adjustment period — might explain why migrant girls with the longest duration of migration were worse off in terms of stunting and underweight than migrants with medium and short-term migration.

Different complexes of variables have been found to predict malnutrition as measured by separate anthropometric measures of under-five-year-old children in the capital of Zaire (Bertrand *et al*., 1988: 556). For acute malnutrition, migration (the father was used as reference for categorisation as a migrant) was a significant predictor, but not for chronic malnutrition.

A study on the influence of urban or rural origin of parents on the attained height of 19-year old adult males resident in urban centres in Poland revealed that conscripts whose parents were both of rural origin were on average taller than conscripts whose parents were both of urban origin. Results were similar when both origin and education level of mother or father, and family size were considered (Kolodziej *et al*., 2001:30).

Severely stunted Guatemalan children had a significantly greater adult abdominal fatness after controlling for overall fatness and confounders. Migration to urban centers was significantly associated with an even greater waist: hip ratio in severely stunted females (Schroeder *et al*., 1999:177).

In summary, these findings on the impact of internal migration on the nutritional status of children are ambiguous. This confirms the statement by Renzaho (2004:105) that the nutritional risks, to which migrants are exposed prior to migration, together with changes associated with migration (including acculturation) and the conditions at the destination, have a post-migration impact on the health and nutritional status of individuals including children.

The South African situation

The South African migration situation

Migration is not a concept foreign to the South African population. Historically, many of the people living in this country today are the descendents of migrants; either those who migrated from the vicinity of the lakes in central and south-eastern Africa between the 14th and the 18th century (Coetzee, 1982:8; Pereira *et al.*, 2002:369), those who have arrived from European countries since 1652, and the slaves from India, Indonesia and Madagascar. Although the majority of these people have settled over the last 300 years, some of the indigenous Khoi Khoi and Bushman inhabitants are still nomadic, albeit on a limited scale (Nurse & Jenkins, 1975:71; Nurse *et al.*, 1982:157; Hitchcock, 2002:1). Two other major events, i.e. the formation of the modern African state system and the discovery of mineral wealth shaped the population movement in South Africa (Kotze & Hill, 1997:5; Mears, 1997:606) and led to the emergence and strengthening of an urban core. In addition, up until 1985, the apartheid regime controlled the movement of blacks in particular in South Africa by means of the pass laws (Kok, 1986:17; Graaff, 1987:46; Ellison *et al.*, 1996:1257; Fontana, 1996:3; Mears, 1997:608; Pick & Cooper, 1997: 45; Martin & Widgren, 2002:1).

Discussion of the South African situation will attempt to follow the same logical order of the literature review on migration and its impact, i.e. summarize information on the reasons for migration, direction of migration and the consequences of migration.

Observers generally accept that migration has not had an equilibrating effect as far as the geographical distribution of the South African population is concerned (Mears, 1997:602). Most of the literature on internal migration, is concerned with rural-to-urban movements, i.e. urbanisation (Fontana, 1997:3, Mears, 1997:596). By 1991, the Asian, white and coloured populations had virtually completed their rural-to-urban migration phase with 96,2% of Asians, 91.1% of whites and 83.2 % of coloureds urbanised, while only 35.4% of the black population was urbanised in 1991 (CSS, 1995:3). According to the 1996 census, the situation remained similar for all population groups except for the African population group where 43.3% were urbanised by 1996 (Statistics SA, 2000:1.5). Kok *et al.* (1985:56) concluded that for the majority of migrants the Pretoria-Witwatersrand-Vanderbijlpark (PWV) area is their ultimate destination. Most migrants to the PWV area, especially those from rural areas, move directly there and do not follow a step-wise migration pattern.

The Western Cape also became a destination of choice after the abolition of influx control policies in 1985. In 1987 it accommodated only 3.8% of the black population. In April 1988 an estimated 72% of the black population stated that they were born outside the area and had migrated to the Cape Flats – mostly from Transkei (52.1%) and Ciskei (7.8%) (Kok, 1990:1-3; Mears, 1997:608). In 1999 less than a quarter of the adult black Cape Metropole (CMA) population was born in the CMA (Cross *et al.*, 1999:23). The same study found that less than half of the white adult population was born in the CMA compared to more than 80% of the coloured population that was born in the Cape Metropolitan area. An additional destination in the Western Cape appears to be the Garden Route area (George, Knysna and Mossel Bay), which was previously used as a stop-over in gravity flow migration towards Cape Town (Bekker, 2002:vi). The reasons for this are not quite clear, as, in reality, no better employment or economic conditions exist there to motivate this destination. The perception of employment as a result of the tourism industry might be a possible pull factor. Better health services such as anti-retrovirals for prevention of mother-to-child-transmission (MTCT) of HIV/AIDS, or other services and amenities might also be a possible motivation for the selection of this specific destination.

In South Africa, the 1996 Census included, for the first time, questions on migration, which were expanded and adjusted for the 2001 Census (Cronje, 2002:1; Kok, 2002:3). Kok *et al*. published the first report on migration in South Africa at the end of 2003. According to this report the proportion of migrants amongst African, Coloured and Indian South African residents with a permanent address was similar at 10%, while it was 22% in the White population (Kok *et al*., 2003:55).

Migration in South Africa has some economic links as migration differentials were associated with employment, housing and specific provinces (Cross, 2000:23; Kok *et al*., 2003:52-74). The official unemployment rate increased from 16.9% in 1995 to 20.1% in 1996 and again to 22.9% in 1997. Currently it is estimated to be 37% (CIA, 2003:7). Gender and race are important factors that determine the level of formal employment (Statistics SA, 2000:10).

A detailed nationally representative survey on migration of the African population was undertaken by the University of Pretoria and Brown University (USA) at the end of 1999. The data from this study is available to interested researchers (Van Tonder, 2003, personal communication). The Provincial Government also commissioned a survey on migration in the Western Cape in 2000/1, and this report was officially released in April 2003 (Bekker, 2002:1).

Data on inter-provincial migration in South Africa between 1992 and 1996 indicate that the Eastern Cape, Gauteng and the Northern Province lost a large number of people through out-migration. At the same time, however, Gauteng was by far the most popular migration destination in the country followed distantly by the Western Cape. The effect of these exchanges of people between provinces is that Gauteng experienced a net gain of more than a quarter of a million people between 1992 and 1996, while the Eastern Cape had a net loss of more than 206 000 people during the same period (Statistics SA, 2000:18).

The age gender profile of migrants shows that South African men were consistently more migratory than women in almost all age categories. Another important feature of the age-gender profile of migrants is that people aged between 15-44 years, in particular, are inclined to migrate, with a peak around the age group 25-29 years. Combined with the historically male dominated migrant labour system, this means that rural areas are left with high proportions of *de facto* female-headed households (Statistics SA, 2000:20). Yet, according to Pick & Obermeyer (1996:1431), female migration to urban areas has increased since 1994 based on the increased number of independent female-headed households between 1994 and 1996 in Khayelithsa, Western Cape. These black female migrants to urban areas have been described as "quadruply oppressed" – as women in a patriarchal society, as members of the disenfranchised majority, as low-status workers, and as incongruent aliens in an urban environment (Cooper *et al*., 1991:423).

The rural population is especially mobile. In 1997 over 50% of the rural population said that they had moved away from their community of origin. However, the direction of migration is increasingly within rural areas as people realize that employment opportunities in the cities are not that abundant (Bekker, 1999:214; Cross, 1999: 9). The rural population is, therefore, becoming more concentrated into dense clusters, especially along infrastructures such as railway lines or in peri-urban settlements in rural districts. The majority (75-85%) of these people do not consider moving to urban areas (Cross, 2000:46). People want to be close to the cities, but prefer to remain in an area with modified traditional institutions where some environmental resources are still free of charge (water from the spring, wood, medicinal plants, etc.). In urban areas everything they need to live has to be paid for. As a result of this rural densification – sometimes also called displaced urbanisation – household subsistence activities such as planting and livestock rearing seem to be declining. A survey in KwaZulu-Natal reported that only 22% of the total flow recorded was rural-to-urban (Bekker, 1999:216; Cross, 1999:9). Hardly anybody from a farm managed to move directly to a major city. Migrating farm workers first stop in a small town (usually the town where they usually shop) where they gather contacts and the information they need to move on to a major town (Ward, 1992:94; Ross, 1995:96). However, in many cases that next step does not happen. These rural people who do manage to move to bigger urban areas usually have "social capital" in these areas (Bekker, 1999:223).

The unequal population and income distribution in South Africa makes spatial mobility inevitable as people move to find a job, better housing, medical and educational services. However, Mears (1997:611) is of the opinion that migration has failed to close the gap in income and employment, which triggered the move in the first place.

The health consequences of migration for South Africans

The South African population is not immune to health and disease consequences of migration. Both historically and recently, migrants have introduced a number of diseases previously unknown to the indigenous African population of South Africa. These include:

- The 2299delG mutation (causing retinitis pigmentosa). This is common in northern and southern Europe and North America, and individual patients in South America, South Africa and China are the result of an ancestral mutation that was spread throughout Europe and into the New World (Dreyer *et al.*, 2001:228) though migration.
- Multiple sclerosis (Dean & Kurtzke, 1971:725).
- Familial hypercholesterolemia was introduced by Dutch settlers (Defesche *et al.*, 1996:1) and migrants from India (Seedat, 1990:421). Currently, coronary heart disease is 'epidemic' in the white and Indian population, but still relatively uncommon in the black population (Seedat, 1996:349).
- Hereditary hemochromatosis (inappropriate dietary iron absorption) has been introduced as a result of emigration from Europe (Merryweather-Clarke, 2000:183).
- Tuberculosis (TB) did not occur to any great extent amongst South Africa's indigenous people prior to European colonization, which introduced sources of infection and caused rapid urbanization for purposes of commerce and trade. By the start of the 20th century TB was recognised as a common health problem amongst the black and coloured people of SA (Donald, 1998:35). Currently, South Africa has one of the highest rates of TB in the world.
- The major incursion of human immunodeficiency virus type I infection into the SA heterosexual population has been by southerly migration of the heterosexual HIV-1 epidemic, especially HIV-1c, from Central Africa (Prior & Buckle, 1990:623).

These diseases have been spread within South Africa through reproduction and migration, while infectious diseases have also been exacerbated by socio-economic conditions – especially for new migrants (Cooper *et al.*, 1991:423). Diseases whose spread has been facilitated by internal migration include:

- Infectious diseases such as Tuberculosis and Measles. The prevention and treatment of infectious diseases are more difficult in mobile communities who miss out on immunisation (Ramphele *et al.*, 1991:710) or do not complete treatment (Conolly *et al.,* 1999:801).
- Sexually transmitted diseases and HIV infection. Migration is associated with the risk of these diseases (Karim *et al.*, 1992:1535; Esterhuyse & Doyle, 1993:14; Wilkinson *et al.*, 2000:405; Lurie *et al.*, 2003:2245; Zuma *et al.*, 2003:814). The migrant labour system breaks down families and communities of departure (Evian, 1993:45) placing the migrant and his/her family at risk through prostitution (Jochelson *et al.*, 1991:157) and the goods transportation network. The incidence of TB has also increased dramatically as a result of the HIV epidemic (Williams & Gouws, 2001:1077).
- Urbanisation and acculturation of different groups within South Africa have also been linked to various diseases such as hypertension (Seedat *et al.*, 1982:999; Seedat, 1996 (a):S35), gout (Beighton *et al.*, 1977:969), and colorectal carcinoma (Anderson *et al.*, 2003:67).

Loss of medical doctors and nurses due to migration impacts negatively on human resources and health services (Blacket, 1990:125; Bateman, 2002:107; Kruger, 2002:100). The impact of Cuban doctors (Bateman, 2003:640) on the South African health care system or Cuba is yet unknown.

The differences in the psychological status of migrant and non-migrant children, as well as between the groups of migrant children (Magwaza, 1994:283), need to be explored further to establish the relative weighting of premigration socializing experiences as well as educational and socio-economic differentials (Magwaza, 1992:707).

Anecdotal reports often indicate that children are sent “home” to grandparents when they reach school-going age (Cooper *et al.*, 1991:426). Sometimes grandparents raise children from an early age when the single mother has to return to her workplace soon after giving birth or, according to traditional cultural practices, as a “future caretaker” of her ageing grandparents (Broster, 1967:118; Adepoju & Oppong, 1994:218). According to anecdotal reports the migration rate in the Western Cape is lower for children than for their parents (Bekker, 2002, personal communication). This practice has not been documented for other countries and the impact on the health and nutritional status of children is unknown.

Only one small study reported on the impact of migration on the nutritional status of children in a rural community in South Africa (Goduka *et al.*, 1992:523). In this study it was clear that those children whose household was exposed to migration – although they might not have migrated themselves – were at risk of malnutrition to such an extent that migration was an indicator of nutritional stress.

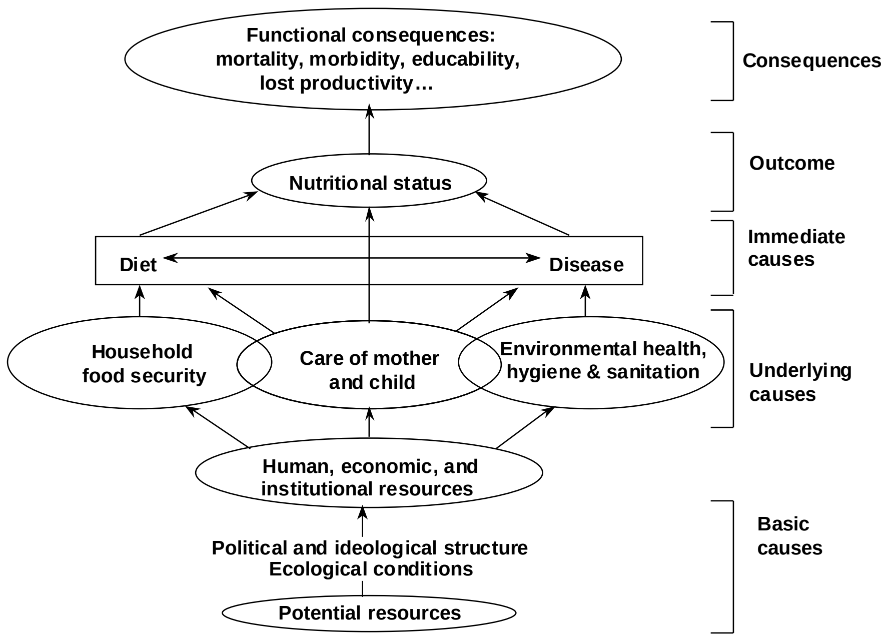
Although research on migration in South Africa, and, especially, the consequences thereof for the health of the people is limited to localized studies, it is clear that the disease patterns and access to medical resources are as stratified as any other index of social class and that migration plays a role either directly or indirectly (Unterhalter, 1982:617).

The nutritional status of children in South Africa

Malnutrition is the outcome of a complex combination of interrelated causes, which was conceptualized by UNICEF in 1990 (Figure 2.2). Although this conceptual framework is well understood and generally accepted in South Africa, no studies have attempted to identify the relative weight of factors within different settings. The relative importance of the different contributing factors varies between different countries and even within a country between different areas and groups.
The consequences of mild to moderate malnutrition, specifically chronic under-nutrition such as stunting (i.e. children being too short for their age) and micro-nutrient malnutrition (such as sub-clinical deficiencies in vitamins and minerals such

as vitamin A or iron) are not always visible, but have significant effects on mortality, morbidity, educability and future productivity of children. Evidence of the consequences of under-nutrition has been provided by a number of meta-analyses (Beaton, 1983:77; Pelletier, 1994:S2106; Rivera *et al*., 1995:S1068; Haas *et al*., 1995:S1078; Martorell, 1996:66; Aguayo, 1999:1). Alternately, children being overweight can contribute to the risk of adult overweight and obesity. Adult obesity is associated with an increased risk of developing hypertension, coronary heart disease, diabetes, stroke and some forms of cancer (WHO, 2003:61, 73).

Figure 2.2: Conceptual framework on nutrition
(*Adapted from*: UNICEF, 1990:22)



Over the past two decades, a number of localized studies on preschool children have established the relatively high prevalence of malnutrition in preschool children in South Africa. However, this review will focus on the findings of only two nationally represented studies on children aged 6-72 months completed in 1994 by the South African Vitamin A Consultative Group (SAVACG, 1995:1-18) and in 1999 on children aged 1-9 years by the National Food Consumption Survey (NFCS) Consortium (Labadarios (ed.), 2000:1-1259). These studies have generally been well accepted in the country – possibly because of the similarity of the findings, which are believed to indicate limited change over the period between the two surveys – and relatively few other studies on nutritional status of children have been published subsequently. Furthermore, a review focusing on these two studies will set the scene for comparison with findings of this research project. This literature review will not attempt to provide a comprehensive review on causation of malnutrition in children as that has been included as part of the NFCS 1999 (Labadarios (ed.), 2000:1-1259), which was the source study for this research.

Anthropometry

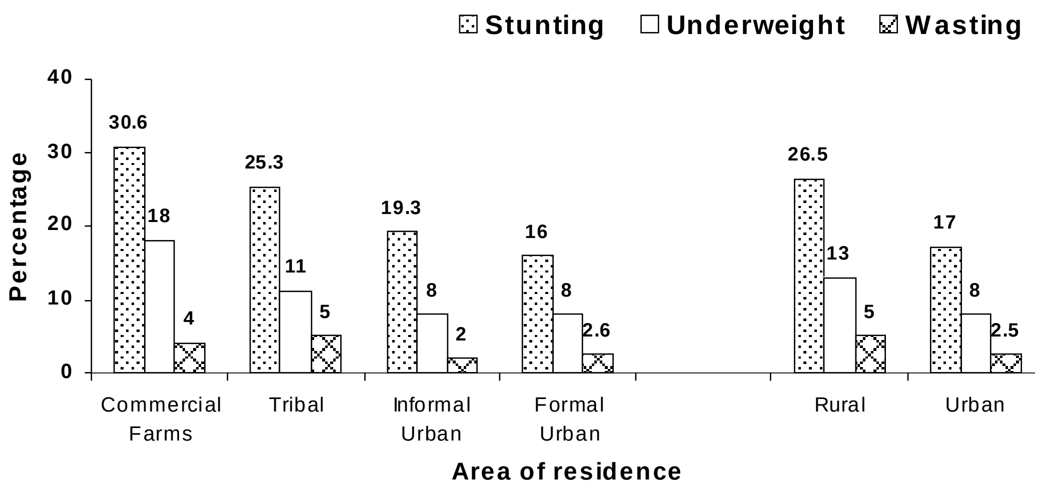
Compared to international ranges chronic under-nutrition as measured by stunting levels (height-for-age below –2 years standard deviations of the NCHS reference values), is a moderate public health problem in South Africa (WHO, 2004:n.p.). Acute protein energy malnutrition as measured by underweight levels (weight-for-age below –2SD of the NFCS reference values) as well as acute-on-chronic malnutrition as measured by wasting (weight-for-height below –2SD of the NFCS reference values) are both regarded as mild public health problems.

National stunting, underweight and wasting levels are around 23%, 10% and 5% respectively (SAVACG, 1995:1-18; Labadarios (ed.) 2000:181). As mentioned earlier, it is important to note that the prevalence of under-nutrition in South Africa did not change over the five-year period between the SAVACG and the NFCS studies. Based on the population estimates of the 1996 Census, this prevalence translates to about 1.9 million children in South Africa being stunted, 800 000 being underweight, and 500 000 being wasted. Severe protein energy malnutrition as measured by stunting, underweight and wasting levels below –3SD of the NCHS reference values is relatively low (Labadarios (ed.), 2003:167).

The national averages mask considerable variation between rural and urban areas, provinces, age groups and, most importantly, household income categories. The children least affected were those living in urban areas (16.7% stunting, 7.7% underweight, 2.4%wasting). However, children living in informal urban areas were more stunted (20%) as compared with those living in formal urban areas (16%).

Within rural areas, those children living in commercial farming areas had the highest rates of stunting (30.6%) (Figure 2.3).

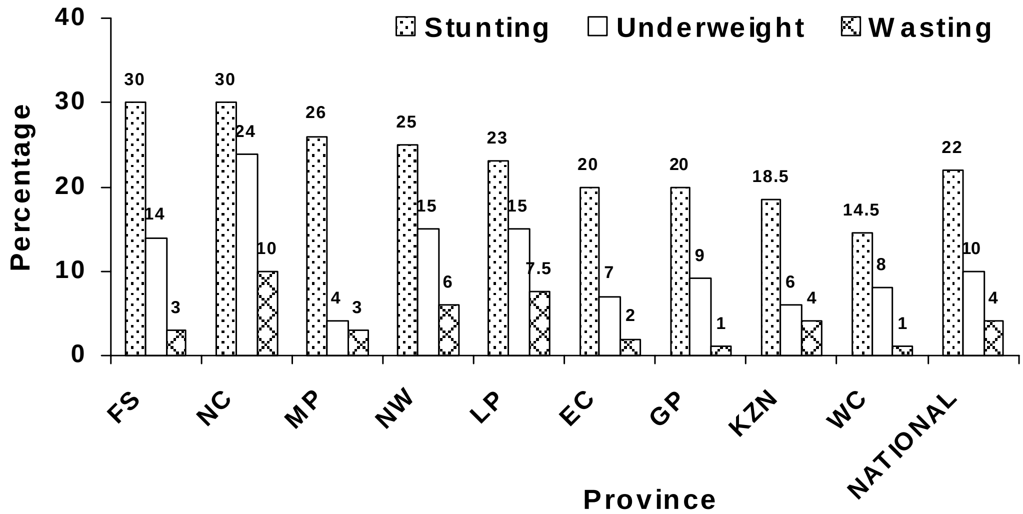
Figure 2.3: The anthropometric status of children 1-9 years nationally and by area of residence: NFCS 1999



The highest rates of stunting (a measure of chronic under-nutrition) occurred in the Free State and the Northern Cape (30% each), while the lowest rates of stunting occurred in the Western Cape (14.5%) and KwaZulu Natal (18.5%). Although acute food shortage as reflected by underweight is nationally a low public health priority (WHO, 2004:n.p.), it is a high priority public health problem in the Northern Cape (24%), and a moderate public health concern in the North West (15%), Limpopo Province (15%), and the Free State (14%) (Figure 2.4).

In the 1999 NFCS the strongest risk factors associated with stunting and underweight were the lack of cold storage facilities, using paraffin or fire to cook, no radio or TV in the house, mothers with primary level schooling or lower, residing in a mud or tin house, income less than R 1000.00 and using a communal tap or river water (Labadarios (ed.) 2000: 246). The risk factors for wasting were lack of cold storage facilities, mothers with a level of primary school education or less, caregiver with a level of primary school education or less, cooking with fire or paraffin, no radio or television in the home, and more than four people sharing a room.

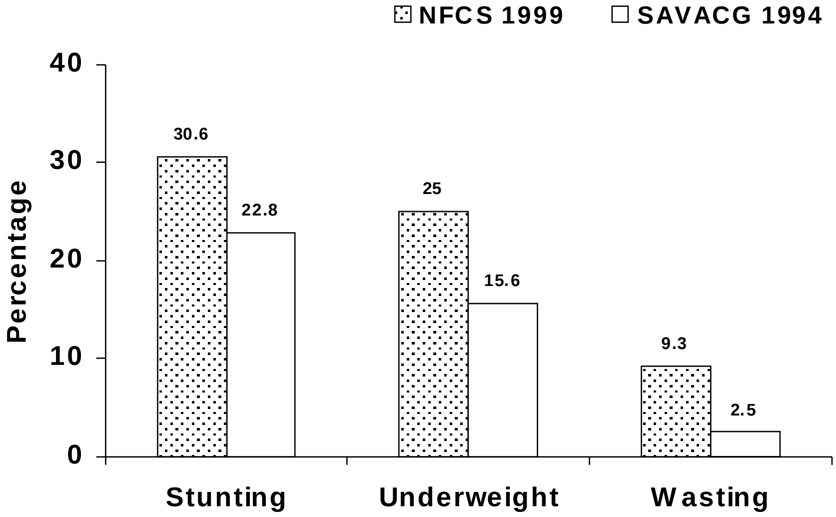
Figure 2.4: The anthropometric status of children 1-9 years by province: NFCS 1999



Despite the generalization that at a national level the nutritional status of children did not deteriorate between 1994 and 1999, there are specific provinces that require closer investigation based on the differences in under-nutrition rates between the two surveys. Furthermore, this comparison needs to be considered within the necessary cautions of comparing two surveys that employed different methodology.

The provinces that exceeded more than 5 percentage points (worse off in the 1999 survey) are the Northern Cape, KwaZulu Natal, Gauteng and Free State. The Northern Cape is the only province where stunting, wasting and underweight was more than 5 percentage points higher than in the 1994 survey (Figure 2.5).

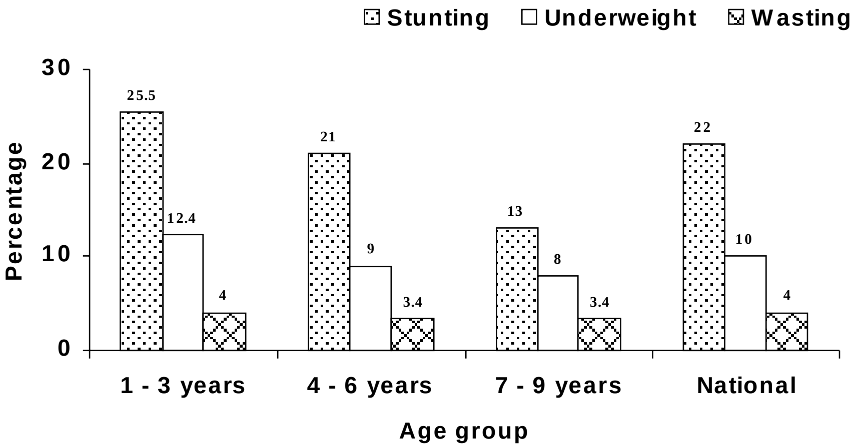
Figure 2.5: Comparison of anthropometric status of children aged 12 – 71 months from the NFCS 1999 with that of children of the same age from the SAVACG 1994: Northern Cape



Underweight and wasting remain roughly at similar levels between the different age categories in years completed of the NFCS study population. However, the stunting levels are lower in older children than in younger children (Figure 2.6). This is in contrast to the findings of the SAVACG in 1994 where stunting levels were similar for all children between 12-72 months (SAVACG, 1995:1-18). It should be noted that the 7-9 year old group was not included in the SAVACG 1994 survey, and in the NFCS 1999 survey this group was statistically under-represented.

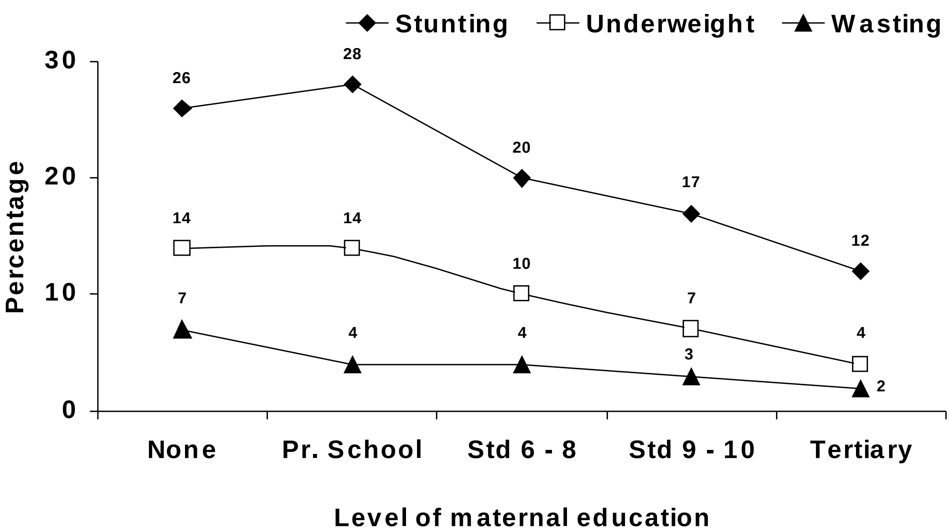
Forty percent of children included in the NFCS study lived in households with a monthly household income less than R500.00 and only 4% lived in households with an income of more than R5 000.00 per month. Amongst the poorest households the stunting rate is 26.5%, underweight is 12.2% and wasting is 3.2%, while it is only 5%, 1% and 1% respectively among the richest households (NFCS, 1999 unpublished data set).

Figure 2.6: Anthropometric status of children aged 1-9 years by age category: NFCS 1999



In the NFCS study sample a significant correlation was found between the level of maternal education and stunting and underweight (Figure 2.7). This was not the case for wasting. A tendency was also found in four of the nine provinces for children to be overweight with higher levels of maternal education (Labadarios (ed.), 2000:167-183).

Figure 2.7: The anthropometric status of children 1-9 years of age by level of maternal education: NFCS 1999



According to the NFCS, the prevalence of overweight children (weight-for-height >+2SD of NCHS reference population) was 6%, with the highest prevalence in urban areas (7.5%) and the lowest prevalence in commercial farming areas (2.5%). Mpumalanga was the only province where the prevalence of overweight exceeds 8%, being 18%. Cut-off points for interpreting the prevalence of overweight and obesity in children, similar to those developed by the WHO for the interpretation of under-nutrition, have not yet been developed.

If the general principle of a statistical normal distribution would apply, then it is assumed that based on weight-for-height in children a prevalence of <5% would be regarded as a low prevalence, 5-10% moderate, 10-15% being a high prevalence and >15% being a very high prevalence and public health importance. This would imply that for South African children aged 1-9 years overweight is a moderate problem compared to other countries such as the United States with 30% overweight children. However, of greater concern than the actual proportion of children being overweight is the increase in overweight reported over time, combined with reported changes in dietary composition and a general perception that physical activity is lower. Another development in the area of childhood obesity is the possible utilization of BMI in children and the development of cut-points that correspond to those in adults (i.e. >25 kg/m^2 as overweight and >30kg/m^2 as obese) (Cole *et al.,* 2000:1240).

Micronutrient malnutrition

As the National Food Consumption Survey did not include any biochemical analysis of micronutrient status, information on the micronutrient status of children is, therefore, based on the SAVACG study of 1994.

Micronutrient malnutrition is a public health problem of considerable significance in South Africa. One in three children have serum retinal levels below 20mg/dl, which indicates marginal vitamin A status. Children in rural areas and those of mothers with limited education are worst off as a result of limited resources as well as insufficient knowledge to optimize resources. Forty percent of stunted children have marginal or deficient vitamin A status. The problem is most severe in the Northern Province.

Anaemia is a significant problem among young children in South Africa. Twenty percent of children were found to be anaemic and 10% to be iron deficient. Iron deficiency anaemia was diagnosed in 5% of young children. Anaemic children were at greater risk of having low serum retinol levels as well.

Iodine deficiency in South Africa is limited to specific geographic areas where goitre rates of schoolgoing children range from 14.3-30.2%. Urinary iodine levels of schoolgoing children indicated that within one year of the introduction of mandatory iodization of salt, iodine deficiency was virtually eradicated in schoolchildren (Jooste *et al.*, 2000:75).

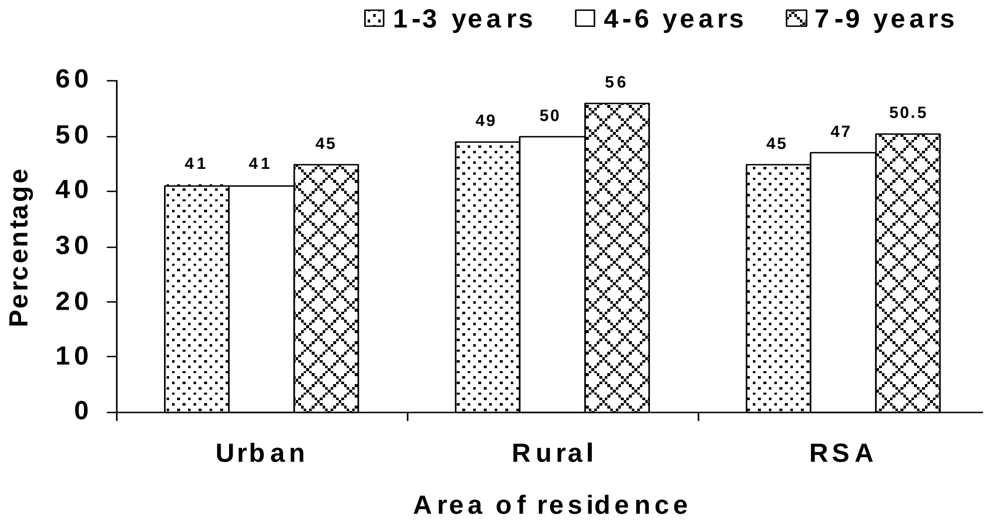
Nutrient intake

The nutrient intake of children living in rural areas was overall considerably poorer than that of children living in urban areas according to the NFCS (Labadarios (ed.), 2000:167). Additionally, all variables associated with household food security were associated with a poorer dietary intake and a poor anthropometric status, particularly stunting and being underweight.

Macronutrient intake

***Energy**:* On the basis of the 24-hour recall questionnaire applied in the NFCS 1999, the mean energy intake of children in all provinces was below that recommended for their age. Energy intake was the lowest (3 278 kJ) in the Northern Cape for the 1–3 year olds and the Free State for the 4–6 (4 267 kJ) and 7–9 (4 552 kJ) year olds. The two provinces with the highest energy intake for all age groups were the Western Cape and KwaZulu/Natal. At the national level, one out of two children had an energy intake less than two-thirds of their daily energy needs. Indeed, in the Northern Cape, Mpumalanga, Northern Province and the Free State one out of three children of all age groups had less than half of their daily energy needs. As such, these provinces can be considered as being the worst affected. Children of all age groups living in rural areas had a consistently and significantly lower energy intake than children living in urban areas (Figure 2.8). There was an overall tendency, which reached levels of statistical significance in the 1–3 year old age group ($p < 0.05$), for boys to have a higher energy intake than girls (Labadarios (ed.), 2000:327).

Figure 2.8: The percentage of children by age category with energy intakes less than two-thirds of the RDA: NFCS 1999



Protein: For all age groups and provinces the mean intakes were greater than the RDA. The highest mean intakes were found in the Western Cape and KwaZulu/Natal and the lowest in Free State, Eastern Cape, Mpumalanga and Gauteng. Urban children had significantly greater mean intakes than rural ones (Labadarios (ed.), 2000:328). The Northern Cape and the Free State had the greatest percentage of children with protein intakes less than half of the RDA. No gender differences were noted.

Micronutrient intake

Vitamin A: Only children living in urban areas and the Western Cape in the age groups 1-3 and 4–6 years had the recommended intake for vitamin A (Labadarios (ed.), 2000:332). At the national level 60-85% of children had a vitamin A intake that was less than 67% of the recommended level. The vitamin A intake of children living in urban and rural areas is poor (Figure 2.9).

Figure 2.9: The percentage of children by age category with vitamin A intakes less than two-thirds of the RDA: NFCS 1999

Iron: The mean intake of iron was consistently low in all age groups and all provinces. The lowest iron intake in all age groups was reported in the Free State, Northern Cape, Eastern Cape and the Free State (Labadarios (ed.), 2000:339). At the national level, 53-80% of children have an intake less than 67% of the recommended level. The gender and urban rural differences in intake were unremarkable (Figure 2.10).

Iodine: There is no national dataset on iodine deficiency in South Africa. Localized studies up to 1995 indicated a prevalence of 14-30% goitre, and mild to severe iodine deficiency. A follow-up study in Langkloof and other areas (post legislated salt fortification with iodine) in 2000 indicated a remarkable improvement (+/- 10% goiter), but that specific vulnerable groups identifiable by geographic area, socio-economic group and salt use practices, are still at risk of iodine deficiency (Jooste, 2003, personal communication).

Figure 2.10: The percentage of children by age category with iron intakes less than two-thirds of the RDA: NFCS 1999

Summary

The unequal geographic distribution of the South African population, combined with the unequal distribution of services, infrastructure, employment, and income, makes migration inevitable. For many people, especially those in rural areas, migration is not a matter of choice, but is regarded as essential for survival. The ultimate destination internationally and nationally has generally been to urban areas, although this situation might be changing.

Migration and/or urbanisation processes in South Africa are regarded as being disequilibrating with regard to the different race, gender and age groups. Historically, migration in most of Africa has tended to be male-dominated, since it has been linked to paid employment, and in South Africa this pattern prevailed as a direct consequence of the migrant labour system and influx control legislation during apartheid. In recent years, following the easing of influx control legislation, migration has increasingly involved females, who, increasingly, migrate independently with or without their children. These female-headed households are doubly disadvantaged and usually hold the majority share in the lowest income categories. This situation puts their children at an increased risk of malnutrition.

The NFCS reported moderate levels of stunting and unacceptably high levels of micronutrient malnutrition for children aged 1-9 years (Labadarios (ed.), 2000:6,10). As the only South African study on the impact of migration on the nutritional status of children indicated the possibility of increased risk to children of migrants (Goduka *et al.*, 1992:523), it is within this context that this study examines the hypotheses that children who migrated in South Africa have a poorer nutritional status and dietary intake compared to those children who did not move.

Conceptual framework for the effect of migration on the nutritional status of children in South Africa

The nature of a conceptual framework is determined by its function, which includes typologies (provides classification), models (classification plus suggesting new links), or theories (provides classification, suggest new links and specify specific relations among variables) (Mouton & Marais, 1988:137-145). The conceptual framework that will be proposed below falls into the category of models and attempts to systematise the relationship between variables contributing to nutritional status as well as indicating directionality. It is therefore meant to guide the assessment and analysis of the context-specific basis of a situation rather than predict the causes of malnutrition or migration. The relative contribution of specific causation factors might therefore vary between different situations.

The literature reviewed in this chapter clearly indicates that migration as well as the nutritional status of children, is the outcome of many processes not only in the household, but also in society at large. Although the conceptual framework on migration decision- making (De Jong, 2000:310) as depicted in Figure 2.1 (see p.21) has not been organised to indicate the relative "distance" of factors to the outcome, it can be assumed that similar to the UNICEF conceptual framework (UNICEF, 1990:22) on the causation of malnutrition in children (depicted in Figure 2.2, see p. 64), the factors will function hierarchically as immediate, underlying and basic causes.

The major similarity between the UNICEF conceptual framework on the causation of malnutrition in children and De Jong's conceptual framework on migration decision-making appears to be economic resources, which have been identified as the basic causes of both migration and nutritional status and are reflected as diagonally striped ovals in Figure 2.11. In addition, economic factors such as available money and labour contracts or employment, together with political factors such as (im)migration policies and discrimination act as either strong constraints or facilitators of migration behaviour. The availability and control of resources (i.e. entitlements) are determined by previous and current technical and social conditions of production and political, economic and ideological/cultural factors. The choice and use of resources in efforts to achieve the necessary conditions for nutrition security (with nutritional status as the outcome) and residual satisfaction with quality of life (with migration as the outcome) are also influenced by education, which is both a human and an economic resource.

A difference between these two models is the mediating role of factors such as expectations and lifestyle satisfaction in migration, which are not reflected in Figure 2.11. Psychosocial factors could also affect nutritional outcomes and are sometimes inserted between the immediate and underlying causes in the UNICEF conceptual framework. This, too, is not reflected in Figure 2.11.

Although the process would most probably be different, common factors in the two models will include norms, networks and services. These factors are represented by the dotted ovals in Figure 2.11. To mention a few examples, norms refer specifically:

- to perceptions on migration (migration model);
- to perceptions of what a child should look like (as manifested as part of "Care" in the UNICEF conceptual framework);
- to the importance of gender in decision-making (related to migration as well as child feeding and resource allocation).

Networks facilitate access and assimilation for migrants, and also play an important role in how households ensure food security and care. Services (such as environmental services, housing, etc.) are closely related to malnutrition mainly through the malnutrition-infection cycle, which is part of the immediate causes in the

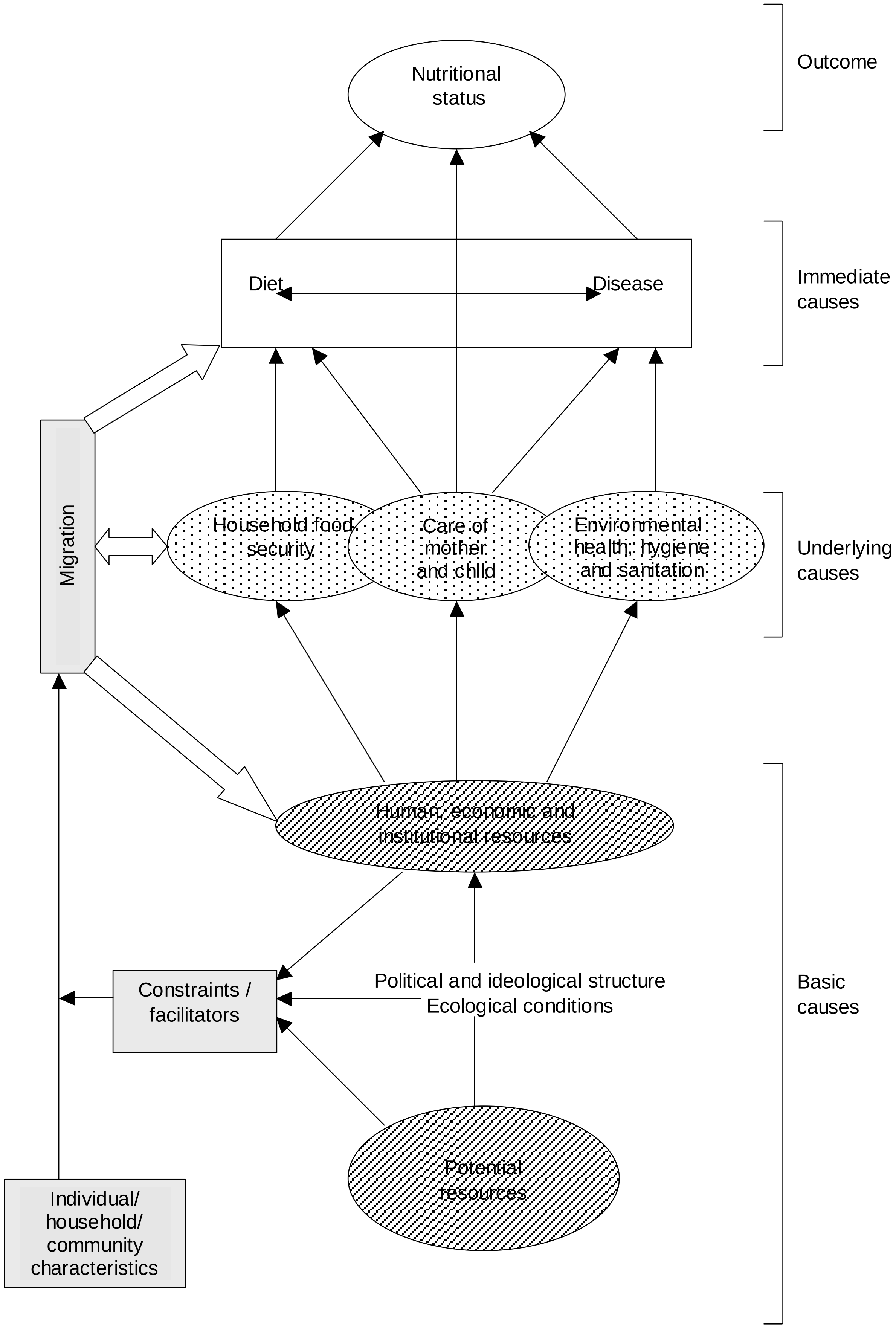
UNICEF conceptual framework. In the migration model, services are part of the basic resource issues.

The literature reviewed suggests that migration *per se* could impact on nutritional status in three different ways as indicated by the use of boxed arrows in Figure 2.11. These links are the focus of this research. Firstly, migration could result in changed economic strata for migrants (relative to their origin rather than their host area), which in turn could facilitate improved household food security, access to improved housing, health care, etc. Secondly, migration could also impact directly on the underlying causes of malnutrition. Without a change in economic situation, access to care for children might be changed as a result of the living and work arrangements; water supply and sanitation might be different or access to health care might be compromised as has been documented for migrants due to communication barriers. Thirdly, migration could impact directly on the dietary intake of children as a result of the amount and type of food available and acculturation-related changes in diet and to the disease burden by increasing or decreasing exposure of children to for example infectious diseases.

Based on the understanding of these conceptual frameworks which clearly indicate that both migration and nutritional status are outcomes of complex processes and that each of them can indeed contribute to one another, and in view of the literature on the impact of migration (internal and international) on the nutritional status of adults and children, it is suggested that, for this particular study within the South African context, migration could be a causal factor in the nutritional well-being of children. The effect of migration on the nutritional status of children could be direct through changed dietary intake, or indirect through affecting the underlying causes such as food security, care, and the environments that children live in. In turn, the economic resources available to individuals and the household affect all these factors mentioned above (Figure 2.11).

This proposed conceptual framework on the role and importance of migration in the nutritional status of children, will be reconsidered following the analyses of data from this study and will be discussed again in Chapter Five of this dissertation.

Figure 2.11: Conceptual framework to illustrate the role and importance of migration in the nutritional status of children
(*Adapted from*: Figure 2.1 and Figure 2.2**)**



Chapter 3

Methodology

Research methodology

Study design

This study will be based on data collected as part of the National Food Consumption Survey (NFCS) 1999. The NFCS collected quantitative data in a cross-sectional survey of a national probability sample with proportional provincial representation of children aged 1-9 years in South Africa and their mothers and grandmothers.

Study population

The study population, sampling and description of instruments as described in this chapter are a description of the NFCS methodology as it appears in Labadarios (2000:42-73) with specific additions related to the migration component.

The NFCS target population consisted of all the children aged 1-9 years in South Africa. For this purpose a nationally representative sample with provincial representation was selected by Statistics South Africa using the 1996 Census. The initial sample was adapted by means of 50% over-sampling to accommodate for children that would not be at home at the time of the survey and allowing an over-representation of children living in high-risk areas, i.e. low socio-economic status (a requirement of the Department of Health who commissioned the survey) as well as meeting the requirements of the 24-hour recall methodology in terms of the minimum recommended number of subjects (Labadarios (ed.), 2000:43). The migration study used the same study population and included the mothers and grandmothers of the children, if they were at home at the time of the survey.

Sample size

The NFCS collected data from 2 982 children, which amounts to a 93% response rate of the target sample. The sample was selected using a multi-staged selection process from 156 Enumerated Areas (EAs) as defined by the 1996 Census in the categories urban (82) and non-urban (74). The total number of EAs in the country for the 1996 Census was 86 200. Selection criteria for EAs were as follows:

- At least 16 qualifying households per EA, except on commercial farms where only six qualifying households were accepted for inclusion. A qualifying household was defined as any household with at least one child aged between 1-9 years.

- EAs with hostels and special institutions as well as EAs classified as "other rural" were excluded from the sample.

All EAs were randomly selected from the list of EAs that met these criteria. The distribution of EAs per province was determined proportionate to the distribution of the total population and the urban/non-urban distribution in each province (Table 3.1).

Table 3.1: Number of random EAs selected per province for the NFCS

Province	Number of EAs for urban areas	Number of EAs for rural areas	Total
KwaZulu Natal	13	16	29
Gauteng	25	4	29
Eastern Province	8	14	22
Limpopo (Northern Province)	4	14	18
Western Cape	14	4	18
North West Province	4	8	12
Mpumalanga	4	6	10
Free State	6	4	10
Northern Cape	4	4	8
Total	82	74	156

Selection of households in each selected EA was made after the maps of the relevant EAs were obtained. The total number of households in each EA was estimated to determine the approximate number of qualifying households. The snowball sampling method was used to set up the sampling frame in each EA. A household was selected randomly as a starting point in each EA. Each household was asked whether there were other households in the vicinity with children in the prescribed age range. This process was repeated at each of the mentioned households and then recorded on the EA map. Eventually a list of qualifying households was created for each EA. Fieldworkers made sure that the list of households created was evenly spread throughout the EA and that a minimum of 30 households were listed. From this list, 20 households in each EA were randomly selected using computer-generated random numbers. In each selected household all the occupants were listed. If there were more than one child in the age range 1-9 years, a random number table was used to select one child in a given household to be included in the survey.

In the case of commercial farms and sparsely populated rural areas, a small number of farms were selected using a random number table. On these farms all households were listed, and from the list a simple random sample was drawn.

Exclusion criteria were:

- Death in the family in the past 3 weeks;
- Acute illness of child within the last 48 hours;
- Caregiver not available;
- Caregiver incapable;
- Child away from home for the past 24 hours;
- Caregiver younger than 12 years;
- For children older than 2 years, the caregiver must have looked after the child for more than 3 months.

The whole sample selected for the NFCS was available for inclusion in the migration study. Of the 2892 participants in the NFCS survey 2505 were included in this study. This excludes those children for whom no migration information was available (n=387). The extent of data used for this study is outlined below.

Number of households:	2 505	No. of variables:	10
Number of children:	2 505	No. of variables:	34
Number of mothers:	2 028	No. of variables:	12
Number of grandmothers:	942	No. of variables:	10

Study variables

Exposure variables

Respondents were categorized according to their place of birth to create two exposure variables. Migration dichotomised respondents into those who had never migrated (no movement/stayed) and those who had migrated during their lifetime (moved/migrated). Direction of migration categorized children by the type of area of birth compared to their current area of living according to Statistics South Africa’s definition (1998) of urban and rural (non-urban) areas. Children who had never migrated in urban and rural areas were used as the reference categories in the analyses. Migration information was also used to construct a variable on the direction of migration.

Outcome variables

Nutrient intake as analysed from the 24-hour recall questionnaires using the South African Food Composition Tables (Kruger *et al*., 1998:1-60; Langenhoven *et al*., 1991:1-227; Sayed *et al*., 1999:1-97) for total intake of energy, protein, vitamin A, vitamin C, thiamine, niacin, riboflavin, calcium, iron, and zinc were expressed as proportion of the Recommended Dietary Allowances (RDA) consumed for each child's particular age group (Earl & Borra, 2000:334-335). For each nutrient, intake was also dichotomised as (1) having an insufficient intake (<67% of the RDA) of a particular nutrient for that age and (2) having a sufficient intake (>=67% of the RDA).

Fat intake was expressed as proportion of energy consumed (Institute of Medicine 2002: 661) and fibre was expressed as proportion of the adequate intake (AI) (Institute of Medicine, 2002:12). More than thirty percent of energy from fat was used as the cut-point for excessive fat intake and <67% of the AI was used as the cut-point for insufficient fibre intake.

From a Public Health Nutrition viewpoint this approach in assessment can assist in identifying groups at higher risk, which is of public health significance (Pomerleau *et al*., 1998:47). Comparison of mean intakes of two groups might be statistically different while both groups are in the same range of intake (either high or low) and not necessarily of public health significance.

Anthropometric status of children was analysed by comparison to the National Centre for Health Statistics (NCHS) reference population using EpiInfo 6 (Centre for Disease Control and Prevention 1994: *n.p.*) and expressed as a z-score for each child's weight-for-age, height-for-age, and weight-for-height. Indicators of anthropometric status were also dichotomised as (1) being underweight, stunted, or wasted respectively or (2) being normal. This was done to identify groups at high risk, which is of public health importance.

Potential confounding variables

Demographic and socio-economic variables [gender, age, language, ethnic origin, caretaker, household headship, gender of household head, marital status of mother, employment status of mother and of the father, type of house, number of people sleeping in the house, household income, money spent on food, source of drinking water, type of toilet, fuel used for cooking, availability of cold storage, stove, primus, and microwave, mother's education, availability of radio/television, area of residence (urban/rural), duration of stay at current residence, and similarity of migration patterns with that of the mother or grandmother], were used in the regression analyses because of their potential confounding effect on the relationships studied.

The variables explored in this study and their values are summarized in Appendix A.

Data collection

The NFCS was conducted during the period February to June 1999. Fieldworkers visited the selected households, and used the following procedure:

- The fieldworker introduced him/herself and explained the purpose of the survey.
- The interviewee was assured of the confidentiality of the information and was asked to answer questions truthfully.
- Informed consent was obtained.
- The socio-demographic questionnaire was completed.
- Anthropometric assessments of children were completed.
- Anthropometry of the mother and grandmother was completed, if they were present in the household.
- The migration questionnaire was completed.
- The 24-hour recall questionnaire was completed.
- The food frequency questionnaire was completed (not used by this migration study).
- The food procurement and household inventory was completed in all households in high risk EAs as well as in one randomly selected household in other EAs (not used by this migration study).

- The hunger scale was completed (not used by this migration study).

The fieldworkers completed all questionnaires except the hunger scale, which was filled in by the mother/caregiver. Fieldworkers had master copies of all questionnaires in the local languages.

For the purpose of this study, data from the socio-demographic questionnaire, the migration questionnaire, the 24-hour recall, and the anthropometric measurements will be analysed.

Questionnaires and measurements

The socio-demographic questionnaire (Appendix D) was used to obtain information on the household composition and general information on the socio-economic conditions of the household such as employment status and income of the household. Other general socio-economic information that can be related to the nutritional status of children such as education level of mother/caretaker, household cooking equipment, water and sanitation was also collected.

The questions that will be analysed in relation to migration patterns and -direction in this study pertain primarily to:

- Demographic characteristics:
    - The child's gender and age;
    - The language of the child (mother tongue);
    - The ethnic origin of the child (based on language).
- Childcare variables:
    - The relation of the caregiver to the child;
    - The household head (including gender of the household head);
    - The marital status of the mother.
- Economic variables:
    - The employment status of the mother and father;
    - The type of dwelling;
    - The number of people sleeping in the house;
    - The household income;

- The amount of money spent on food.

- Environmental variables:
    - The availability of water and sanitation facilities.
- Food preparation variables:
    - The fuel used for food preparation;
    - The functional household food preparation and food storage equipment.
- Educational variables:
    - The type of available communication, e.g. functional TV and radio;
    - The mother's formal education level.

The migration questionnaire (Appendix D) was developed by the researcher and was used to obtain information related to the movement of children aged 1-9 years, and for mothers and grandmothers during the lifespan of these children. This was done to determine the volume of migration and to establish whether similar patterns exist for the different generations during the lifetime of the children. Additional information was also obtained on the birthplace and early life of the mother and grandmother to be able to calculate net migration rates for the different generations.

The migration questionnaire was developed based on suggestions from the literature (Kpedekpo, 1982:145-158; UNICEF, 1970:1-2). The questionnaire was reviewed by a number of colleagues, and by two demographers (one international and one South African) to assess the relevance and appropriateness of the questions (face validity). It was not validated in the field, but was piloted with the NFCS questionnaires, which took place in one urban and one rural EA (at least 100 km apart) at the start of the survey. Retrospectively, the suggested migration questions by Kok *et al*. (2003:81-82) to be used in future Census questionnaires provide a validation of the questions that were used to obtain the migration data.

As time was a factor in the data collection process and the battery of questions was quite substantial, the questionnaire on migration had to be limited. This influenced the decision to use one year as the critical duration of stay in a particular place. The literature on migration requires a degree of permanency to qualify as migration, but often a three- to six-month period might be deemed sufficient (Cross, 2000:12). Retrospectively Simon (2002:1) validated the decision to use one year of residence at a particular place as an indication of migration when he stated "a migrant is taken to mean a person who resides outside of his or her country of birth for one year or more". This criterion is supported by Morrison *et al*. (2004:495).

The questions asked of children, mothers and grandmothers pertained primarily to:

- The duration of stay in the current place of residence.
- The place (defined by type of area such as urban/rural, the province and whether it was a town, village or farm) where the first year of life was spent. The question was specifically phrased in this way and not as the place where they were born, as people often would travel to towns/cities with better medical facilities for the birth and return immediately after birth. This move was not regarded as migration for the purposes of this study.
- The place (defined as above) where the next four years of life were spent. This specification of a time period was selected specifically to summarise (together with information from the first question) the pre-school years. It could, however, have introduced some degree of inaccuracy for mothers and grandmothers, if they had spent these four years in more than one place. Attempts were made to limit the inaccuracy by requesting fieldworkers, during training, to add the relevant information, if it was indicated during the interview.
- The last question tried to capture a list of places where children, mothers and grandmothers had lived during the last 10 years i.e. the lifespan of the children included in this survey. This question provided the opportunity to capture migration of children from birth to date. Names of places, and not only in how many places people had lived, were purposefully requested, as it is usually easier for respondents to remember the places where they have lived. During data entering the names of these places were captured, but for analysis these are translated into frequency. For children frequency of movement reflects the total number of movements during their lifespan. For grandmothers and

mothers the frequency of movement reflects only the number of moves during the last 10 years.

- Based on the information provided by these questions the researcher compared the places mentioned, the duration of stay in the particular place and the age of the child to decide whether the movement pattern was similar for the child, mother and grandmother.

The 24-hour recall questionnaire used (Appendix D) was pre-coded to limit errors by interviewers and was used to obtain information on all food and drink consumed by children during the day preceding the interview. Special procedures were put in place to ensure that the 24-hour recall questionnaires completed in each EA covered all days of the week including weekends. Dietary intake was calculated from the 24-hour recall questionnaire by using the food composition database provided by the Medical Research Council. Dietary intake was calculated for energy, protein, fat, fibre, vitamin A, vitamin C, thiamine, niacin, riboflavin, calcium, iron and zinc. The nutrient intake of each child was expressed as a proportion of the Recommended Dietary Allowance (RDA), or as a proportion of the Adequate Intake (AI) for fibre, or as a proportion of energy consumption for fat. Two-thirds of the RDA (Earl & Borra, 2000:332-335) and the AI (Institute of Medicine, 2002:12) will be used to identify children with insufficient dietary intake. More than 30% of energy consumed as fat will be used as an indication of excessive fat intake.

The main reason for using data from the 24-hour recall in this study was the finding by the National Food Consumption Survey (Labadarios (ed.), 2000:356) that the Quantified Food Frequency Questionnaire provided an over-estimation of dietary intake in comparison to the 24-hour recall.

Measurement of body weight and height of children was used to assess the anthropometric status of children. Body weight was measured with an electronic platform scale to the nearest 0.1 kg. Height was recorded to the nearest 0.1 cm by using a stadiometer for adults and children older than 2 years. For children younger than 2 years of age, supine length was determined by means of a measuring board. All measurements were repeated twice. Measurements were repeated, if these two measurements differed by more than 0.1 kg or 0.5 cm. Children were measured wearing light clothing, but without shoes. For the purpose of this study the age of the child and the mother and grandmother was based on the date of birth, and calculated as completed years of life.

Weights and heights of children were compared with those of the National Centre of Health Statistics of the USA (1977: 78-1650) using Epi Info version 6.02. For each child a z-score (i.e. the number of standard deviations from the reference population median) was calculated for weight-for-height (WHZ), weight-for-age (WAZ), and height-for-age (HAZ). For children a z-score of <-2 Standard Deviations (SD) and <-3 SD will be used to classify moderate and severe under-nutrition respectively, i.e. for underweight, stunting and wasting. A z-score of >+2 SD weight-for-height will be used to classify overweight in children.

Pilot study

Testing and validation of the 24-hr recall questionnaire against a weighed 3-day dietary record was carried out in 50 households each in a rural area in the Northern Province and an urban urea in the Western Cape. A pilot was carried out in one urban and one non-urban EA in each province. The migration questionnaire was included in the pilot study as it was part of the socio-demographic questionnaire. This pilot also included a validation of the dietary recall questionnaires. Once the pilot was completed and problems addressed, the formal survey started.

Training of fieldworkers

A set of questionnaires, a training manual and a video were specifically developed for the NFCS. These instruments covered all aspects of the survey methodology and were used for this purpose. Training happened in a stratified manner, i.e. the directors trained co-ordinators for each province. The co-ordinators then trained the fieldworkers using the training tools and with some standardisation activities from the directors. The researcher developed guidelines on the migration questionnaire which was included in the training package and process as part of the NFCS.

Quality control

Relative validation for the NFCS was determined by repeating the Quantified Food Frequency Questionnaire (QFFQ) and anthropometric measurements in two randomly selected HHs for each EA by the co-ordinator and combined with two additional repeats of the 24-hour recall in these HHs on two randomly selected days, one week apart each. The three 24-hour recalls were used to determine the relative validity of the QFFQ.

Repeatability was determined by the repeat of the QFFQ and the anthropometric measurements in one randomly selected HH per EA by the same interviewer. All fieldworkers were tested for repeatability during the course of the survey. The co-ordinator, without the prior knowledge of the fieldworkers, implemented the repeats.

Data management and data analysis

The co-ordinator as well as the director for each province checked each questionnaire. A template was created for each questionnaire using D-base IV, a database programme. Once data was entered for each EA by a data typist, it was checked and corrected by a second data typist and cleaned by the statistician. The researcher was responsible for the checking and cleaning of all migration specific data. Data relevant to this study was exported into a spreadsheet, Excel, and a statistical package, Statistical Package for the Social Scientist (SPSS) (version 11.0), was used by the researcher for data analysis.

The NFCS reported descriptive information on the study sample such as socio-demographic characteristics, anthropometric status, dietary intake, food procurement practices and perceived hunger. See Labadarios (2000:1-1259) for the full report. The report is also available on www.sahealthinfo.org.

This study used descriptive statistics and standard demographic procedures to present the migration patterns of children, mothers and grandmothers (Kpedekpo 1982: 145-158; Siegal & Swanson eds. 2004: 455-522). Data analysis was done on SPSS (version 11.0). The socio-demographic characteristics, anthropometric status and dietary intake of the study sample were analysed according to the migration patterns of children, mothers and grandmothers. Cross-tabulations and the Chi-square statistic were used to assess possible associations between categorical variables. In cases where the cell count is less than five, Fisher's exact test was used, but in all other cross-tabulations Pearson Chi-square was used. Where appropriate, odds ratios and 95% confidence intervals were calculated to measure the strength of the associations. Regression models such as analyses of variance (ANOVA) and co-variance, and general linear regression were used to estimate the differences in dietary intake and anthropometric indicators (outcomes) for different migration patterns after adjusting for potential confounding factors. The R^2 as well as the coefficient were used to determine the strength of the associations. Logistic regression were used to estimate the differences between categorical variables for different migration patterns, e.g. proportion of the children categorised as underweight, wasted, stunted, or with insufficient dietary intake by province and different migration patterns. A p-value of ≤ 0.05 was considered statistically significant.

The normality of the distribution of continuous variables was assessed using the Kolmogorov-Smirnov test. All continuous variables, except weight-for-age and height-for-age for the group of children who migrated, were statistically significantly different from a normal distribution in this data set (Table 3.2). This is the result of a number of high extremes i.e. outside the range of (Q3 + 1.5*IQR). Exclusion of these extremes would have reduced the number of cases severely with a concomitant loss of information. The nature of the dietary methodology employed i.e. the 24-hour recall method lends itself to the possibility of high extremes should a child consume a very good source of a specific nutrient on the day of recall. However, visual inspection of histograms representing the continuous variables (Figure 3.1-Figure 3.6; Figure 3.15) supported the decision to use parametric tests for regression analysis of anthropometric indices and macronutrient intakes (including fibre). Kleinbaum *et al.* (1987:48, 108) have stated that normality is a robust statistical procedure and that assumptions will remain valid except in cases of extreme violation, which do not appear to be the case for the anthropometric indices and macronutrient intakes in this study.

Table 3.2: Tests of Normality for selected continuous variables

Migration differential			WAZ	HAZ	WHZ	Energy (%RDA)	Protein (%RDA)	Fat (%Energy)	Fibre (g)
Stay	Mean		-0.6	-0.9	0.1	74.0	173.6	21.2	11.4
	95% CI for Mean	Lower	-0.6	-1.0	0.0	72.5	169.3	20.7	11.0
		Upper	-0.5	-0.9	0.1	75.5	177.8	21.7	11.7
	5% Trimmed Mean		-0.6	-0.6	-0.9	0.0	72.1	167.4	20.9
	Median		-0.6	-1.0	0.0	69.3	155.0	20.4	9.7
	Std. Deviation		1.3	1.3	1.5	1.3	32.6	94.4	10.6
	Skewness		0.6	0.3	0.7	0.9	1.1	0.5	3.3
	Kurtosis		1.3	1.2	2.0	1.4	2.0	0.0	33.1
	Kolmogorov-Smirnov sig.		0.000	0.000	0.000	0.000	0.000	0.000	0.000
move	Mean		-0.5	-0.8	0.1	78.0	180.0	22.9	12.0
	95% CI for Mean	Lower	-0.6	-1.0	0.0	74.5	170.8	21.8	11.2
		Upper	-0.3	-0.7	0.2	81.5	189.3	23.9	12.8
	5% Trimmed Mean		-0.5	-0.5	-0.8	0.1	76.2	175.0	22.7
	Median		-0.5	-0.8	0.1	74.4	164.6	22.9	10.3
	Std. Deviation		1.2	1.2	1.4	1.1	34.3	91.4	10.3
	Skewness		0.4	-0.1	0.5	1.3	0.9	0.1	1.8
	Kurtosis		1.3	0.8	2.3	4.8	0.9	-0.6	5.1
	Kolmogorov-Smirnov sig.		0.200	0.200	0.001	0.000	0.000	0.073	0.000

Table 3.2: Tests of Normality for selected continuous variables (continued)

Migration differential			Vit. A (%RDA)	Thiamin (%RDA)	Niacin (%RDA)	Riboflavin (%RDA)	Calcium (%RDA)	Iron (%RDA)	Zinc (%RDA)
Stay	Mean		82.8	118.6	93.4	113.0	51.9	54.3	47.2
	95% CI for Mean	Lower	74.2	115.7	90.3	107.4	49.5	52.5	45.9
		Upper	91.4	121.5	96.5	118.6	54.4	56.2	48.5
	95% Trimmed Mean		54.1	54.1	113.6	87.2	96.2	45.4	50.4
	Median		36.0	105.9	75.2	69.6	36.6	43.6	40.7
	Std. Deviation		190.5	190.5	64.2	68.9	123.9	53.8	40.1
	Skewness		8.2	1.3	1.4	2.7	2.9	2.4	1.7
	Kurtosis		94.3	2.8	2.6	9.9	14.0	11.0	6.6
	Kolmogorov-Smirnov sig.		0.000	0.000	0.000	0.000	0.000	0.000	0.000
move	Mean		95.8	120.1	103.5	117.6	51.7	59.1	52.3
	95% CI for Mean	Lower	67.6	113.8	96.3	104.5	46.9	54.9	49.1
		Upper	123.9	126.3	110.8	130.6	56.5	63.4	55.6
	5% Trimmed Mean		57.4	57.4	116.4	98.0	100.4	46.8	55.4
	Median		39.2	108.3	86.0	78.3	37.5	50.2	44.6
	Std. Deviation		278.6	278.6	61.9	72.0	129.1	47.1	42.0
	Skewness		10.9	1.2	1.2	3.4	2.0	3.0	1.5
	Kurtosis		149.2	3.0	1.6	17.8	6.4	20.0	2.7
	Kolmogorov-Smirnov sig.		0.000	0.000	0.000	0.000	0.000	0.000	0.000

The same visual inspection suggested substantially skewed distributions for most of the micronutrients (Figure 3.7-Figure 3.14). Therefore testing of the hypothesis for these variables was based on either logistic regression of dichotomised variables(rather than continuous format) or non-parametric methods using the Mann-Whitney test, which is the same as the Wilcoxon rank sum test (Colton, 1974:222) for variables expressed in continuous format.

Figure 3.1: Distribution (with a normal curve fitted) of weight-for-age of children aged 1-9 years according to migration status: South Africa 1999

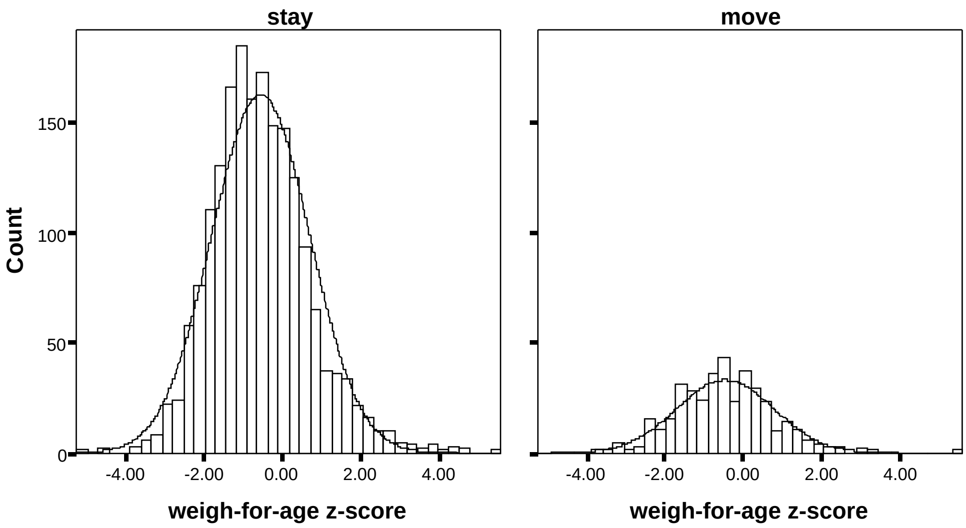


Figure 3.2: Distribution (with a normal curve fitted) of height-for-age of children aged 1-9 years according to migration status: South Africa 1999

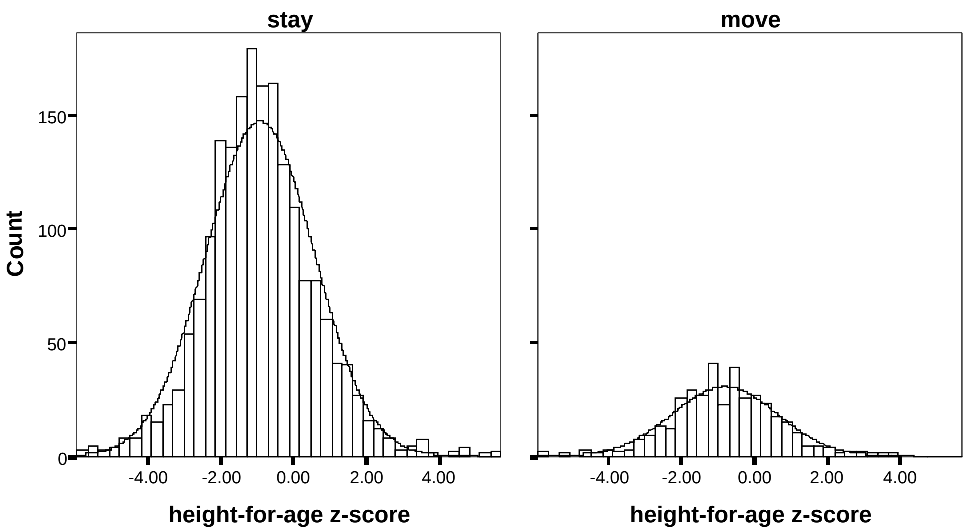


Figure 3.3: Distribution (with a normal curve fitted) of weight-for-height of children aged 1-9 years according to migration status: South Africa 1999

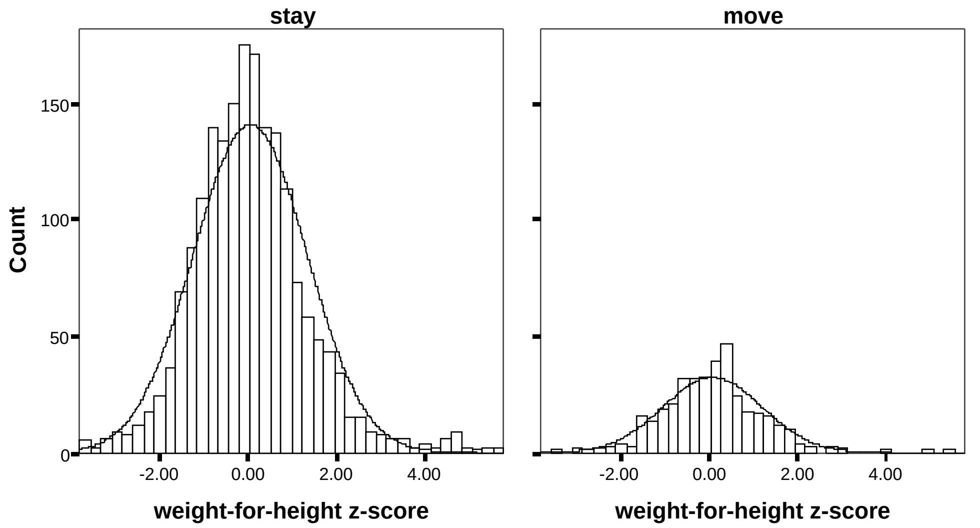
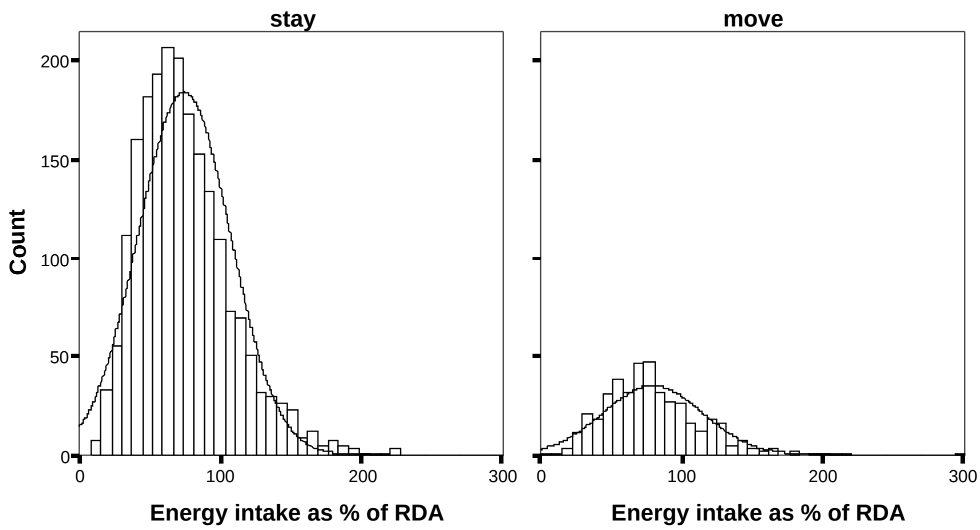


Figure 3.4: Distribution (with a normal curve fitted) of proportion of the RDA* for energy consumed by children aged 1-9 years according to migration status: South Africa 1999



* (Earl & Borra, 2000:334)

Figure 3.5: Distribution (with a normal curve fitted) of proportion of the RDA* for protein consumed by children aged 1-9 years according to migration status: South Africa 1999

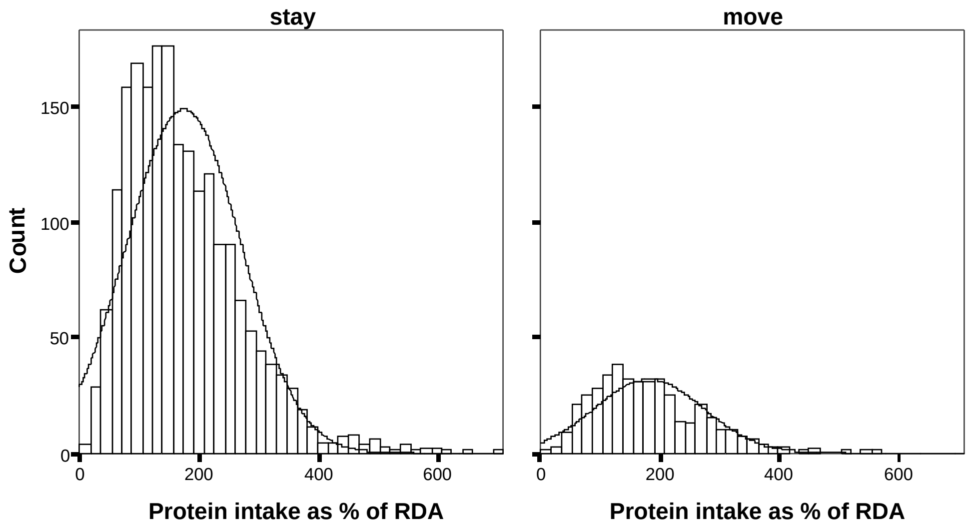
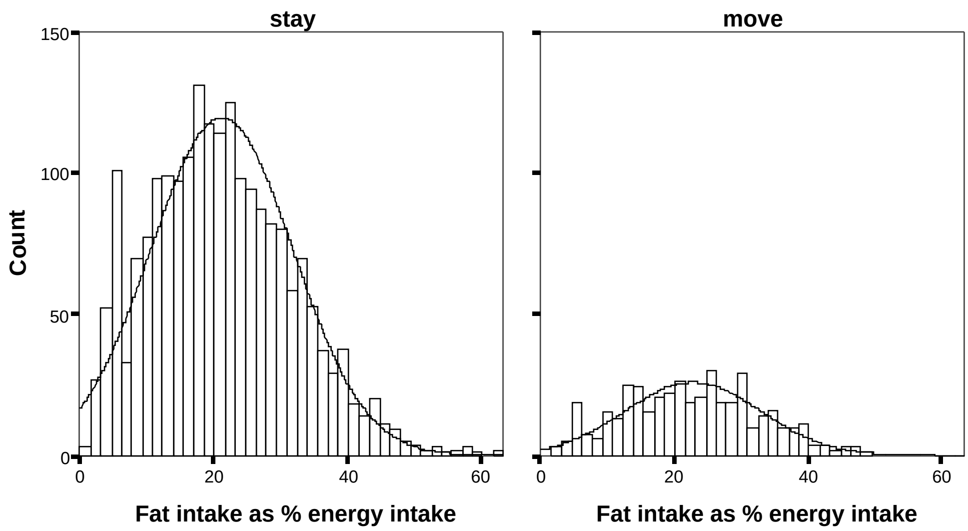


Figure 3.6: Distribution (with a normal curve fitted) of fat intake as proportion of energy consumed by children aged 1-9 years according to migration status: South Africa 1999



***** (Earl & Borra, 2000:334)

Figure 3.7: Distribution (with a normal curve fitted) of proportion of the RDA* for vitamin A consumed by children aged 1-9 years according to migration status: South Africa 1999

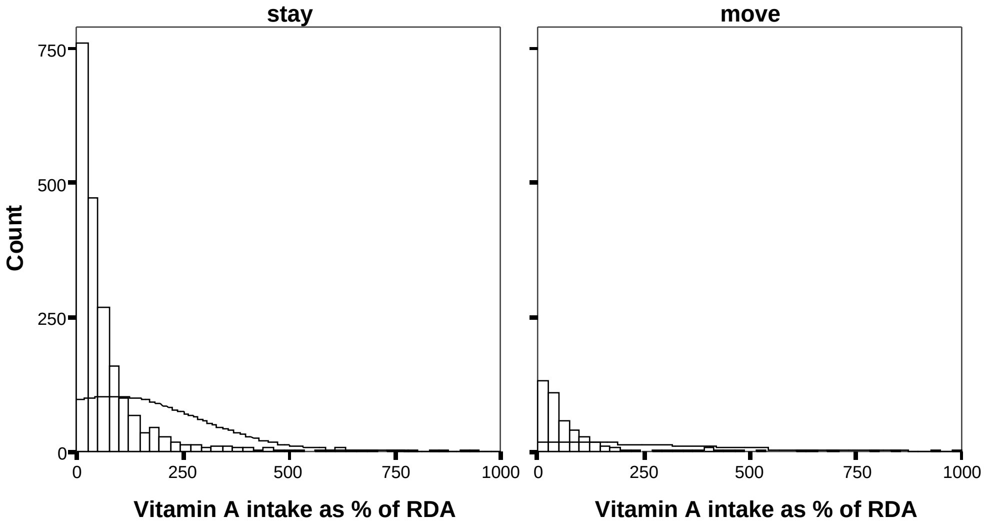
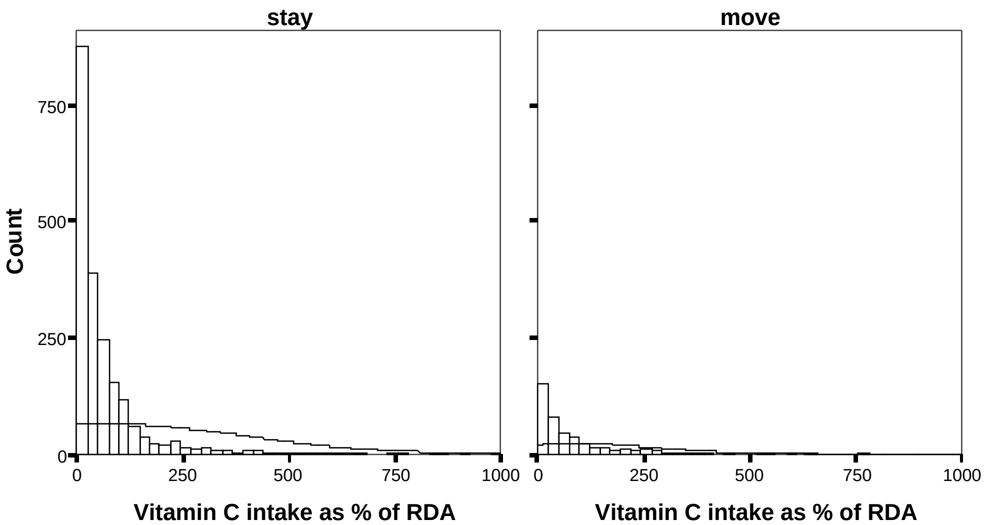


Figure 3.8: Distribution (with a normal curve fitted) of proportion of the RDA* for vitamin C consumed by children aged 1-9 years according to migration status: South Africa 1999



***** (Earl & Borra, 2000:334)

Figure 3.9: Distribution (with a normal curve fitted) of proportion of the RDA* for thiamin consumed by children aged 1-9 years according to migration status: South Africa 1999

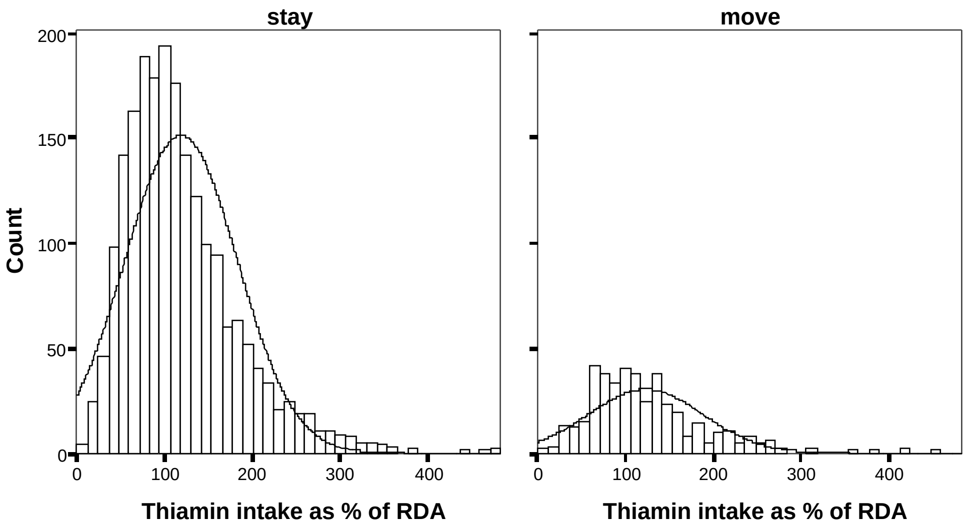
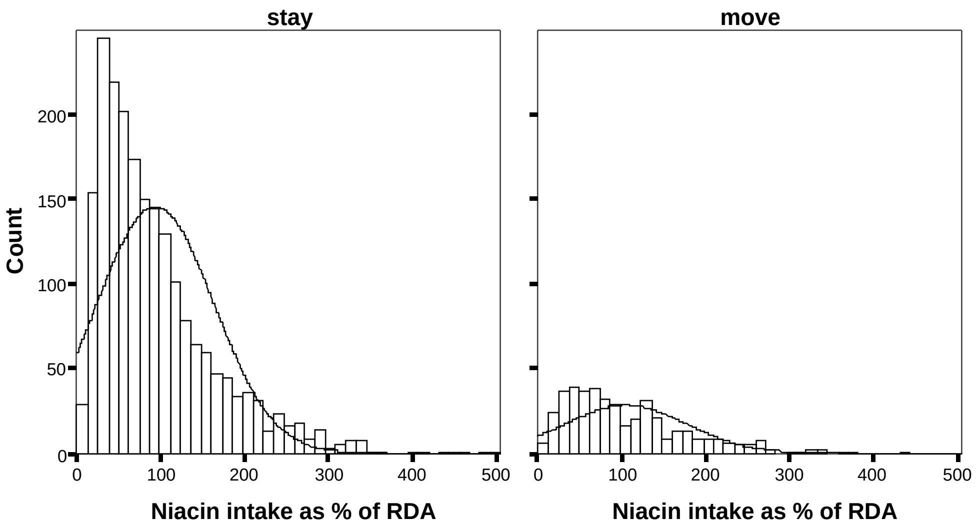


Figure 3.10: Distribution (with a normal curve fitted) of proportion of the RDA* for niacin consumed by children aged 1-9 years according to migration status: South Africa 1999



***** (Institute of Medicine, 1998:556, 557; Earl & Borra, 2000:335)

Figure 3.11: Distribution (with a normal curve fitted) of proportion of the RDA* for riboflavin consumed by children aged 1-9 years according to migration status: South Africa 1999

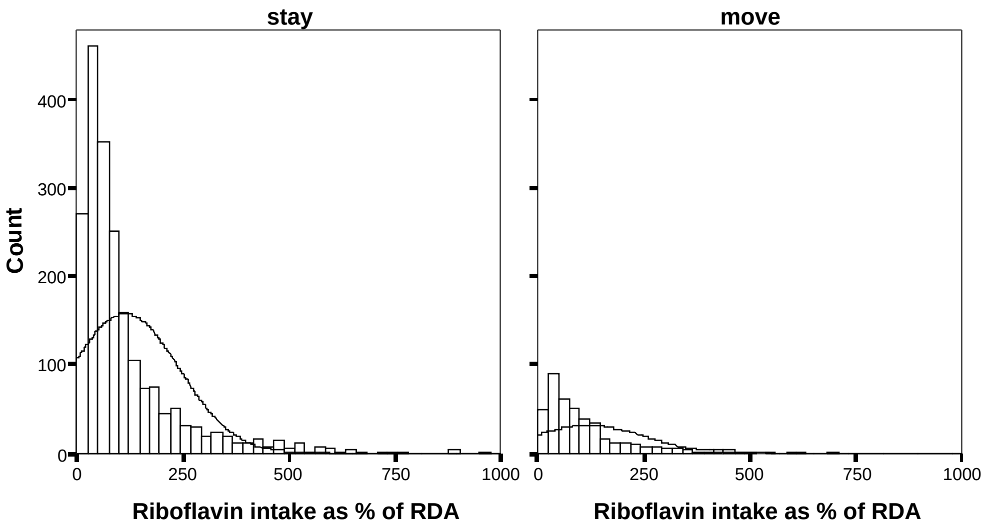
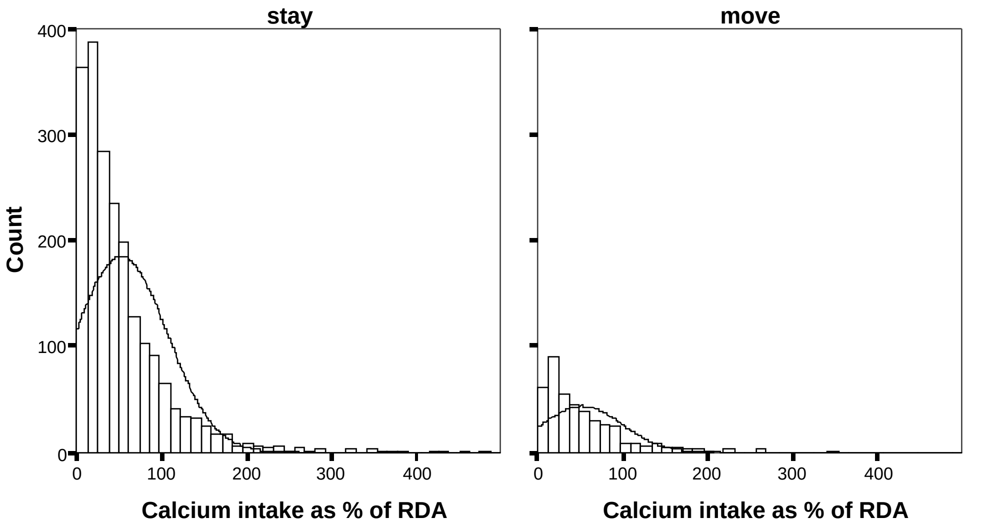


Figure 3.12: Distribution (with a normal curve fitted) of proportion of the RDA* for calcium consumed by children aged 1-9 years according to migration status: South Africa 1999



***** (Institute of Medicine, 1998:567; Earl & Borra, 2000:335; Institute of Medicine, 2000:772)

Figure 3.13: Distribution (with a normal curve fitted) of proportion of the RDA* for iron consumed by children aged 1-9 years according to migration status: South Africa 1999

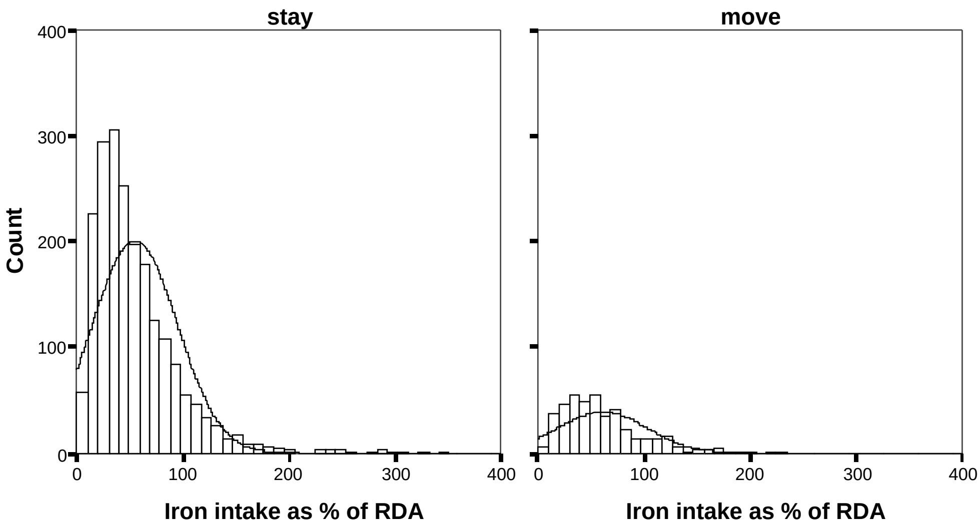
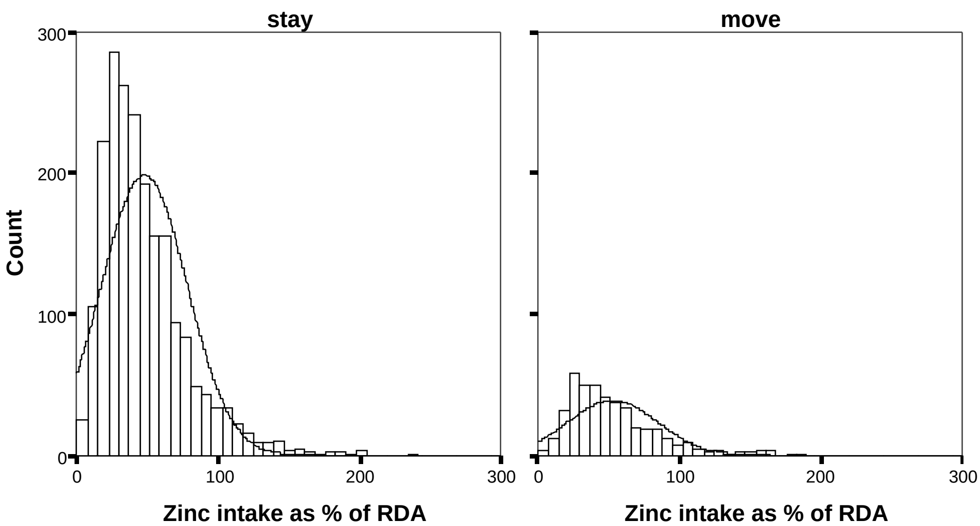
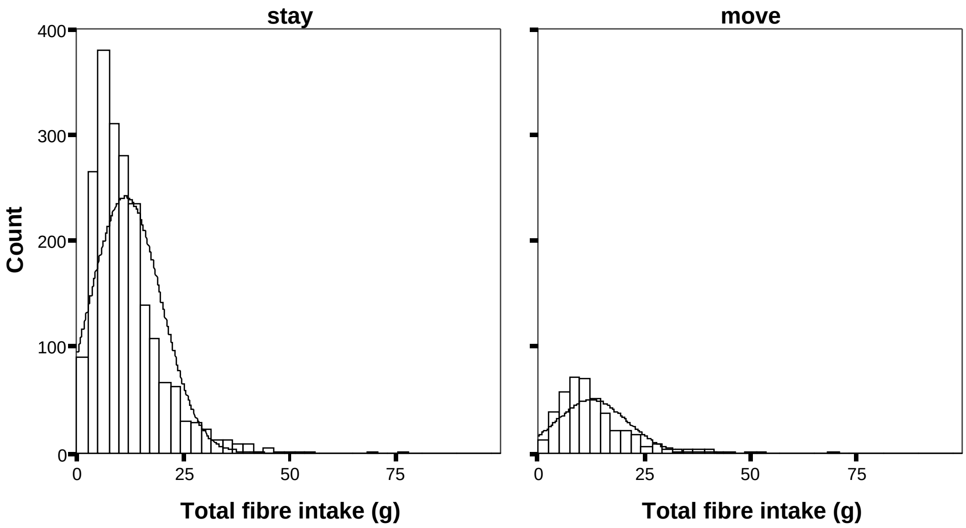


Figure 3.14: Distribution (with a normal curve fitted) of proportion of the RDA* for zinc consumed by children aged 1-9 years according to migration status: South Africa 1999



***** (Earl & Borra, 2000:335)

Figure 3.15: Distribution (with a normal curve fitted) of total fibre (g) consumed by children aged 1-9 years according to migration status: South Africa 1999



Assumptions

This study assumes that the person indicated as the mother of the child would be its biological mother. In addition to this, and in line with the instructions provided as part of the migration questionnaire, the assumption is that information was obtained for the maternal grandmother unless otherwise specified. This is only relevant to the discussion on the possible relationship between anthropometric indicators of the child, mother and grandmother where genetics may have played a role. Measures were implemented to ensure the validity and reliability of anthropometric and dietary measurements as part of the NFCS. It is assumed that the information provided on internal migration was accurate. The validation of the Quantified Food Frequency Questionnaire as part of the NFCS suggests that the 24-hour recall methodology provided an accurate indication of the dietary intake of the children. However, it needs to be accepted that there would be some degree of inaccuracy as the mother is the respondent on behalf of the child. Other studies have found that children younger than 9 years of age cannot give a reliable report of their own dietary intake (Bingham *et al*. 1988: 84). As the HIV/AIDS infection rate in children was still thought to be relatively low in children at the date of data collection (1999), and sick children were excluded from the study, it is assumed that the impact on the nutritional status might not be extreme, although it cannot be ruled out in the light of the HSRC report (2003:1) on HIV which reported a prevalence of 5.6% among children aged 2-14 years. However, it is possible that many of the adults included in this study — especially mothers in age groups 25-49 for whom the highest HIV prevalence of 28% has been reported by the HSRC (2002:1) — might be infected with HIV/AIDS which might influence their nutritional status (Piwoz & Preble, 2000:8).

Validity and reliability

Every attempt was made to ensure validity and reliability of data and to avoid possible biases. It should be noted that the methodology employed, i.e. random selection of EAs and the use of the snowball technique to create a sampling frame within each EA, might possibly have introduced some selection bias (Margetts *et al*., 2003:80) as the social networks that have been described to facilitate migration, might have resulted in migrants living in close proximity of each other – possibly within the same EA. However, randomisation — of household selection from the sampling frame as well as selection of the EAs — assists against selection bias. The snowball technique was also used in a study on migration in Kathmandu Valley (Hamal, 26/02/2004 online). Missing value analyses were employed to ensure that information bias (Margetts *et al*., 2002:85), which is possible as the information is based on recall, is limited. Although there is no perceived motivation for deliberate misinformation by respondents as migration is not restricted in any way, the results of the missing value analyses do suggest possible information bias as will be discussed in the Chapter Four. Interviewer bias was limited by standardized training of fieldworkers as well the various quality assurance measures build into the study design.

Contribution by the researcher

The source survey, i.e. the NFCS, was planned and executed by a consortium of the heads of the nine dietetics departments at universities, of which the researcher was an active member. Each director of this consortium was assigned a province for co-ordination of the fieldwork. The researcher, as one of the directors of the consortium, was responsible for the Eastern Cape. The consortium approved the draft proposal on migration as prepared by this researcher and agreed that the researcher could use the information from the NFCS for a doctoral thesis on the basis of the involvement of and contributions by the researcher in the conceptualisation, planning, implementation, analyses and reporting of the NFCS. The researcher developed the migration questionnaire independently. The researcher was also responsible for the checking and cleaning of the migration data and the anthropometry of the mothers and grandmothers. This data was not analysed as part of the NFCS report, but will be written up by the researcher as an addendum to the NFCS.

Ethical considerations

The Ethics Committee of the University of Stellenbosch approved the protocol of the source study (reference number US 98/140). Written informed consent was obtained from the mother/caregiver of each child who was included in the survey. The Senate Higher Degrees Committee of the University of the Western Cape approved the specific protocol for this study.

Chapter 4

Results

Introduction

The fieldwork for the survey was completed between February and July 1999. Of the 3120 children who were originally designed to have been included in the survey, data was obtained for a total of 2892 of children, which amounts to a 93% response. The purpose of this study is not to provide a description of the anthropometric status, dietary intake and socio-demographic characteristics of the study population as this information has been described in detail in the NFCS report (Labadarios (ed.), 2000: 1-1259). This study will use the 2505 children from the NFCS for whom migration information was available to describe the migration patterns and analyse the anthropometric, dietary and socio-demographic information based on these internal migration patterns.

Missing value analyses

In view of the pivotal role of the migration variable in the interpretation of data for this study, missing value analyses were performed on this variable. Information on migration was available for 86.6% of children (n=2505), 2028 mothers (80% of the children), and 942 grandmothers (37% of the children). It appears as if the mothers and grandmothers for whom information was available have the same distribution as the children based on selected demographic indicators such as province and area of residence (Figure 4.1; Figure 4.2). The differences between the children for whom migration information was not available and the rest of the children were not statistically significant for gender, age, educational level of mothers, employment of mothers, the number of people contributing to the household income, weight-for-age z-score, height-for-age z-score, weight-for-height z-score, or the proportionate intake of energy, protein and vitamin A as compared to the Recommended Dietary Allowance (RDA). The differences between the two groups were statistically significant for the current province, the urban rural classification of the area of residence, the income categories, and the caretaker of the child (Table 4.1). Given the proportions of children with missing migration information and the circumstances related to handling of questionnaires, which contributed to specific rural provinces to be underrepresented in the migration data set, it was decided to assume that the children for whom information on migration is missing (Figure 4.3) are reasonably

Figure 4.1: Proportionate provincial distribution of children, mothers and grandmothers for whom information is available: South Africa 1999

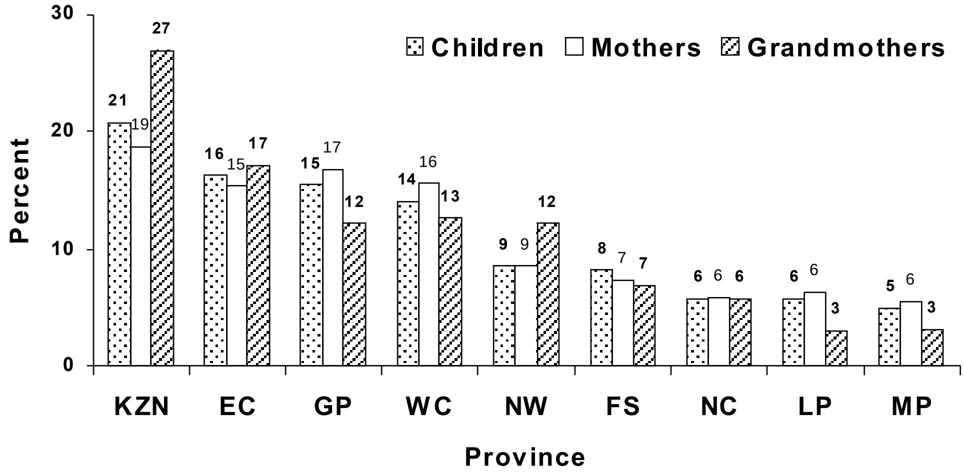


Figure 4.2: Proportionate distribution of children, mothers and grandmothers for whom information is available by area of residence: South Africa 1999

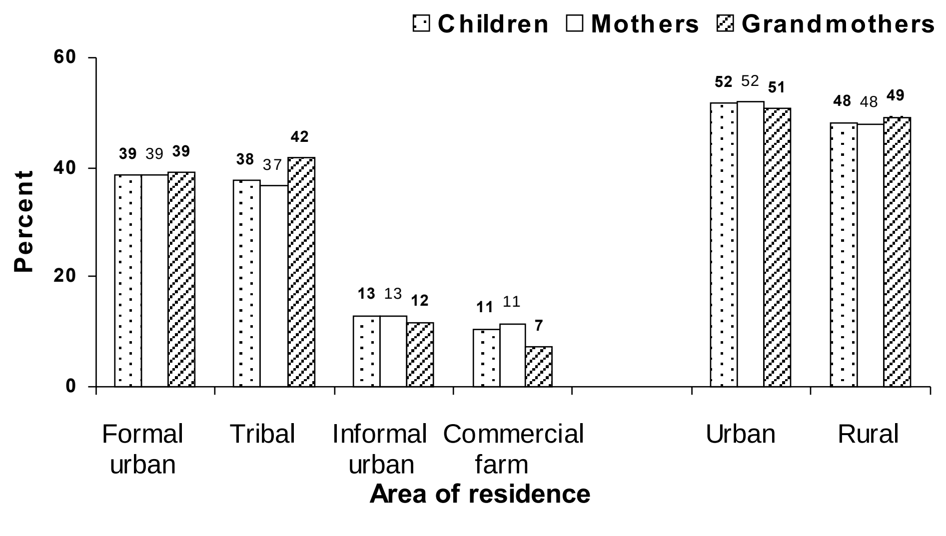


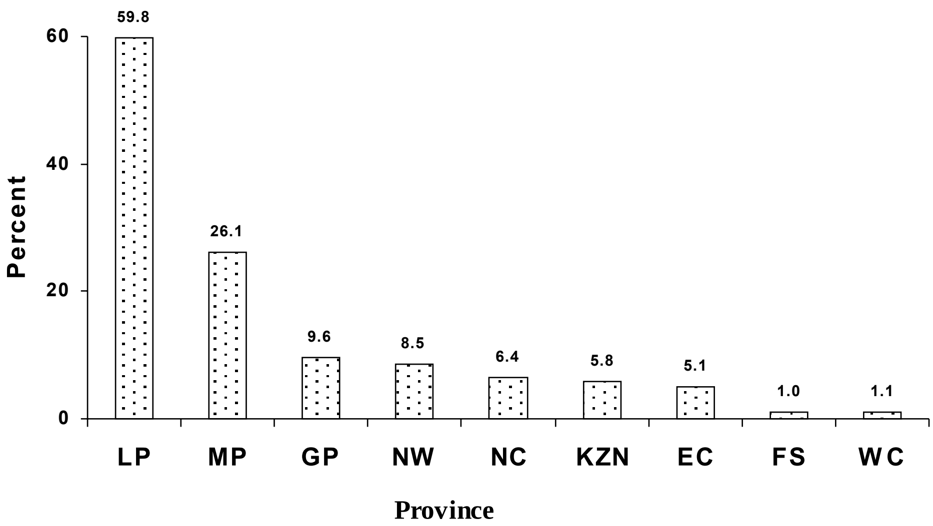
Table 4.1: Missing value analyses on internal migration and selected categorical variables of child

Variable	Categories	NFCS study sample	Proportion migration information missing	Statistics
Number (n)		2 892 (100%)	13.4%	Chi-square
Area of residence	**Urban**	51.7%	9.3%	p=<0.001
	Rural	48.3%	17.4%	
Province	**Eastern Cape**	14.9%	5.1%	p=<0.001
	Free State	7.2%	1.0%	
	Gauteng	14.8%	9.6%	
	KwaZulu Natal	19.2%	5.8%	
	Limpopo	12.3%	59.8%	
	Mpumalanga	5.7%	26.1%	
	Northern Cape	5.3%	6.4%	
	North West	8.1%	8.5%	
	Western Cape	12.3%	1.1%	
Caretaker	**Mother**	65.6%	11.2%	p=<0.001
	Father	2.4%	19.4%	
	Grandparents	21.1%	9.0%	
	Sibling	3.6%	39.4%	
	Aunt/Uncle	7.3%	12.8%	
Household income	**≤R1 000/month**	71.1%	10.7%	p=0.002
	>R1 000/month	29.9%	12.0%	

representative of the total study population. However, it is acknowledged that a possible information bias could have been introduced by the missing information on migration. The two main reasons for this are:

- Handling of questionnaires and quality of data collection, specifically from children living in rural Limpopo and Mpumalanga was a problem so that these children are underrepresented in the study sample. In cases where no migration took place fieldworkers wrote on the questionnaire "Born here" for all categories (child, mother and grandmother). The migration questionnaire was then separated from the socio-demographic questionnaire (during data entry) without checking that information on EA and subject number has been transferred to the migration questionnaire.
- Migration information was most often missing when a sibling was the caretaker.

Figure 4.3: Proportionate provincial missing information on migration for children aged 1-9 years: South Africa 1999



A further missing value analysis was performed on values missing within the migration dataset using the standard SPSS command. No significant differences were found during this process (Table 4.2).

Table 4.2: Summary of analyses of missing information on internal migration and selected continuous variables

Group Statistics	Internal migration	n	Mean	SD	Standard error of the mean
WAZ	Move info available	2 201	-0.546	1.251	0.027
	Move info missing	313	-0.674	1.162	0.066
HAZ	Move info available	2 201	-0.919	1.483	0.032
	Move info missing	313	-0.973	1.487	0.084
WHZ	Move info available	2 201	0.060	1.259	0.027
	Move info missing	313	-0.021	1.337	0.076
Energy %RDA	Move info available	2 415	132.818	59.449	1.210
	Move info missing	344	122.153	59.349	3.200
Protein %RDA	Move info available	2 415	174.278	95.610	1.946
	Move info missing	344	169.318	107.481	5.795

Independent sample Test		Levene's Test for Equality of Variance	
		F	Sig.
WAZ	Equal variances assumed	1.726	0.189
	Equal variances not assumed		
HAZ	Equal variances assumed	0.318	0.573
	Equal variances not assumed		
WHZ	Equal variances assumed	1.846	0.174
	Equal variances not assumed		
Energy %RDA	Equal variances assumed	0.197	0.657
	Equal variances not assumed		
Protein %RDA	Equal variances assumed	0.997	0.318
	Equal variances not assumed		

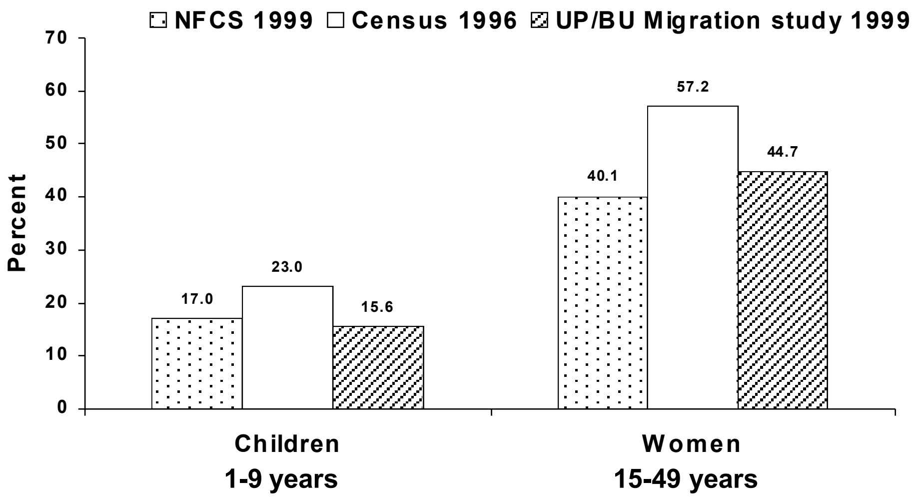
Independent sample Test		t-test for Equality of Means					
		t	Sig. (2-tailed)	Mean difference	Std. Error difference	95% CI of difference	
						Lower	Upper
WAZ	Equal variances assumed	1.719	0.086	0.129	0.075	-0.018	0.276
	Equal variances not assumed	1.816	0.070	0.129	0.078	-0.011	0.268
HAZ	Equal variances assumed	0.606	0.544	0.054	0.089	-0.121	0.229
	Equal variances not assumed	0.604	0.546	0.054	0.089	-0.122	0.230
WHZ	Equal variances assumed	1.056	0.291	0.081	0.076	-0.069	0.231
	Equal variances not assumed	1.009	0.313	0.081	0.080	-0.077	0.238
Energy %RDA	Equal variances assumed	3.114	0.001	10.666	3.421	3.949	17.382
	Equal variances not assumed	3.118	0.001	10.666	3.421	3.943	17.388
Protein %RDA	Equal variances assumed	0.886	0.375	4.960	5.599	-6.020	15.939
	Equal variances not assumed	0.811	0.417	4.960	6.112	-7.056	16.974

Representativeness of the data

To be able to say, with a relative degree of certainty, that the migration data collected for the study sample is nationally representative, comparisons of specific socio-demographic variables such as residential province, urban/rural classification of area of residence, age, gender, language, and migration, were made with the Census 1996 population metadata (Statistics SA: unpublished data) and the dataset of the University of Pretoria/Brown University (UP/BU) Migration Survey 1999 (Van Tonder, 2003:unpublished data).

The frequency of migration reported for children in this study (17%) is lower than the Census 1996 (23%) and higher than the UP/BU Mellon Migration Survey 1999 (15.6%) (Figure 4.4). The migration reported for adult women in the UP/BU Migration Survey 1999 is slightly higher than this study, but both are lower than the migration reported by the Census 1996.

Figure 4.4: Comparison of migration reported for children and mothers included in the study sample (South Africa 1999) with children aged 1-9 years and women aged 15-49 years in Census 1996 and UP/BU Migration study 1999



The provincial distribution of the study population is not exactly comparable to Census 1996 (Table 4.3) as the sample size for the Northern Province, Free State and the rural areas of Gauteng and the Western Cape had to be increased to meet the requirements of the 24-hour dietary recall methodology. The proportionate increases are summarised in the NFCS Protocol, which is part of the final NFCS report (Labadarios (ed.), 2000:952-955). As a result of the oversampling as well as missing migration information as described in the previous section, the urban/rural distribution and certain language groups are affected in this study sample. The final sample by province is within 5% of the Census suggesting reasonable provincial representation in this study sample. As the UP/BU Migration Survey 1999 study sample was limited to Africans, comparison of the results of this study will be limited to the Census 1996.

Although the study sample of the NFCS was not selected to ensure representativeness of mothers, a comparison with women aged 15-49 years from the Census 1996 and the UP/BU Migration Survey is made to gauge representativeness. It is acknowledged that not all women in the latter groups would be mothers (Table 4.4).

Table 4.3: Representativeness of study sample: Comparison of current residential province of study sample with Census 1996 and UP/BU Migration survey 1999 (children aged 1-9 years)

Province		Census 1996*	Study sample 1999	UP/BU 1999
Number (n)		731 678	2 505	1 691
EC	Count (n)	130 435	409	304
	Expected count	130 353	444	301
	Proportion	17.8%	16.3%	18.0%
FS	Count (n)	43 799	207	78
	Expected count	43 811	137	101
	Proportion	6.0%	8.3%	4.6%
GP	Count (n)	99 709	388	94
	Expected count	99 608	319	230
	Proportion	13.6%	15.5%	5.6%
KZN	Count (n)	155 371	522	484
	Expected count	155 435	582	359
	Proportion	21.2%	20.9%	28.6%
LP	Count (n)	111 952	142	310
	Expected count	111 918	401	258
	Proportion	15.3%	5.7%	18.3%
MP	Count (n)	54 395	138	183
	Expected count	54 402	174	125
	Proportion	7.4%	5.5%	10.8%
NC	Count (n)	13 478	131	0
	Expected count	13 549	48	31
	Proportion	1.8%	5.2%	0.0%
NW	Count (n)	61 026	214	102
	Expected count	60 980	223	140
	Proportion	8.3%	8.5%	6.0%
WC	Count (n)	61 513	353	136
	Expected count	61 620	174	142
	Proportion	8.4%	14.1%	8.0%
Rural	Count (n)		1 463	762
	Expected count	***	1 392	831
	Proportion	55.9%**	50.6%	44.2%
Urban	Count (n)		1 429	963
	Expected count	***	1 498	893
	Proportion	44.1%**	49.4%	55.8%

* Source 10% metadata
** Urban/rural classification as available on SuperSTAR
*** Statistical comparison not executed by SPSS as urban/rural classification not available as part of metadata

The count refers to the actual number of participants within each province for each study population, expected count was calculated by SPSS in the statistical procedure and proportion reflect the proportion that the number within each province contributes to the total number within that particular study population.

Table 4.4: Representativeness of study sample: Comparison of current residential province of study sample with Census 1996 and UP/BU Migration survey 1999 (women aged 15-49 years)

Province		**Census 1996***	**Study sample 1999**	UP/BU 1999
Number (n)		991 712	1 797	2 811
EC	Count (n)	145 172	236	427
	Expected count	145 160	263	411
	Proportion	14.6%	13.1%	15.2%
FS	Count (n)	66 724	144	136
	Expected count	66 694	120	189
	Proportion	6.7%	8.0%	4.8%
GP	Count (n)	193 941	316	218
	Expected count	193 575	350	548
	Proportion	19.6%	17.6%	7.8%
KZN	Count (n)	203 031	328	1 008
	Expected count	203 421	368	576
	Proportion	20.5%	18.3%	35.9%
LP	Count (n)	111 131	104	335
	Expected count	111 054	201	314
	Proportion	11.2%	5.8%	11.9%
MP	Count (n)	66 733	101	261
	Expected count	66 784	121	189
	Proportion	6.7%	5.6%	9.3%
NC	Count (n)	19 091	111	0
	Expected count	19 113	34	.
	Proportion	1.9%	6.2%	0.0%
NW	Count (n)	82 052	152	185
	Expected count	82 007	148	232
	Proportion	8.3%	8.5%	6.6%
WC	Count (n)	103 837	305	241
	Expected count	103 900	190	294
	Proportion	10.5%	17.0%	8.6%
Rural	Count (n)		1 463	762
	Expected count	***	1 392	831
	Proportion	55.9%**	50.6%	44.2%
Urban	Count (n)		1 429	963
	Expected count	***	1 498	893
	Proportion	44.1%**	49.4%	55.8%

* Source 10% metadata
** Urban/rural classification as available on SuperSTAR
*** Statistical comparison not executed by SPSS as urban/rural classification not available as part of metadata

The count refers to the actual number of participants within each province for each study population, expected count was calculated by SPSS in the statistical procedure and proportion reflect the proportion that the number within each province contributes to the total number within that particular study population.

Migration

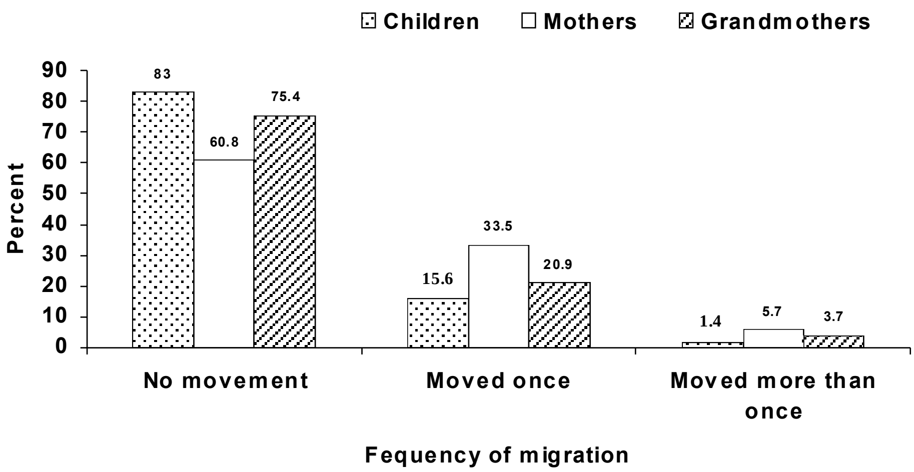
Migration of children, their mothers and grandmothers

Frequency of migration

The majority of children (83%) did not move during the monitored period, i.e. from their birth to 1999 (Table 4.5). For the purpose of this study, this period will be referred to as the lifetime of the child. Fifteen per cent of children moved once and only five children moved three times and more. For the purposes of this discussion, all children who moved are grouped together and their characteristics analysed accordingly.

The frequency of migration of mothers and grandmothers was based on the number of places where they lived between 1989 and 1999. If they reported duration of stay at the current residence that exceeded the age of the child, the frequency of migration was adjusted to none. This was based on the assumption that migration took place before the birth of the child. Sixty per cent of mothers and 75% of grandmothers did not report any migration during the lifetime of the child at the time of the study (Figure 4.5).

Figure 4.5: Frequency of migration reported for children, mothers and grandmothers during the lifespan (birth – 1999) of children aged aged 1-9 years: South Africa 1999

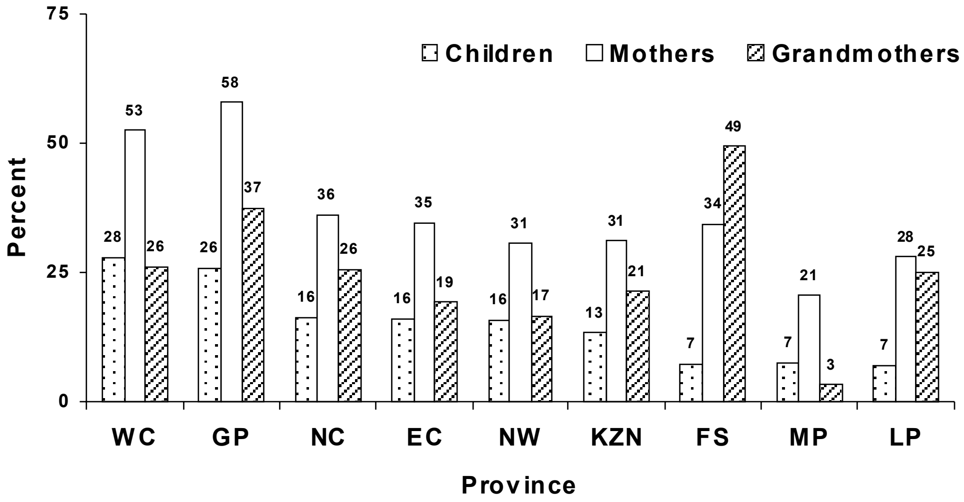


Twenty-eight mothers reported two moves during the lifetime of the child and two mother each reported six and seven moves. Twenty-five grandmothers reported two moves and two grandmothers reported up to six moves during the lifetime of the child. Similar to the children, mothers and grandmothers who moved more than once will be grouped together as having moved (regardless of the number of moves) and analysed accordingly.

Information on migration for 11 children (0.5%), 43 mothers (2.1%), and 13 grandmothers (1.4%), involved international migration (immigration) between place of birth and current area of residence. These individuals were included in the analyses as children/mothers/ grandmothers who migrated. They were, however, excluded from the calculation of net internal migration and provincial net migration streams. No separate analyses were done on immigrants.

Children and mothers currently living in Gauteng (26% and 58%) and the Western Cape (28% and 53%) reported the highest migration with the lowest migration reported for children in the Free State, Limpopo and Mpumalanga (7% each). The lowest migration for mothers was also reported for Mpumalanga (21%). Grandmothers currently living in the Free State and Gauteng reported the highest migration (49% and 37% respectively) with the lowest migration in Mpumalanga (3%) (Figure 4.6; Table 4.5)

Figure 4.6: Internal migration reported for children, mothers and grandmothers by province: South Africa 1999



Province

The lowest migration was reported for children, mothers and grandmothers currently living in tribal areas at 11%, 28% and 17% respectively (Figure 4.7; Table 4.5). The migration rates reported by children, mothers and grandmothers living in commercial farming areas were the highest, and these groups also reported the highest occurrences of more than one move. The reasons for migration were not investigated as part of this study. It can therefore only be speculated as to the reasons for the high migration in commercial farming areas. The migration rates in commercial farming areas were almost equalled by those in informal urban areas. In total, children, their mothers and grandmothers currently living in urban areas of residence reported higher migration than those living in rural areas. The migration rates reported by the Census 1996 for children aged 1-9 years and for women 15-49 years were higher than those reported in this study. Similar to the findings in this study, the Census 1996 also reported higher migration rates in urban areas than in rural areas (Table 4.5)

Figure 4.7: Internal migration reported for children, mothers and grandmothers by area of residence: South Africa 1999

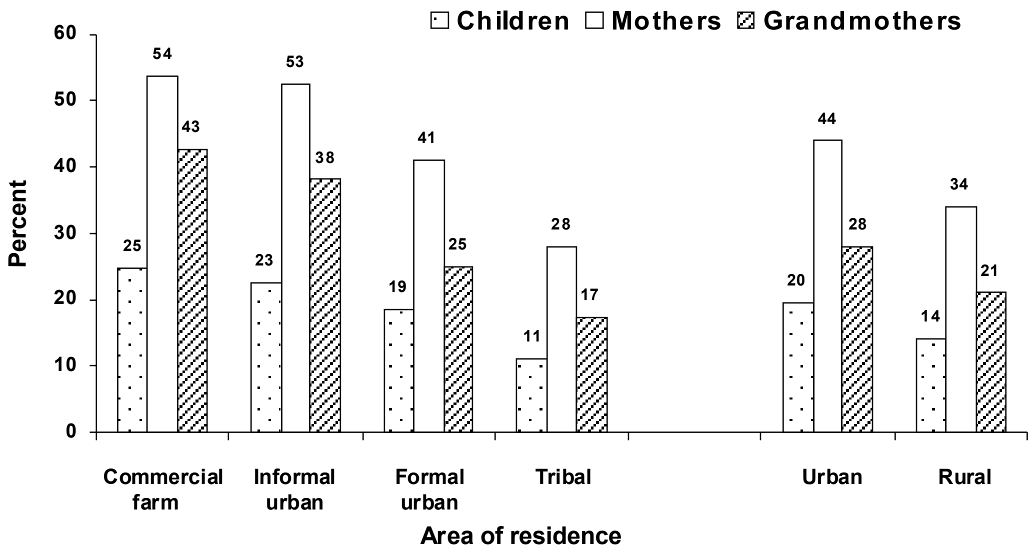


Table 4.5: Migration reported for study sample and Census 1996 by area of residence

	Area	n	% migrated	
Children	Formal urban	971	18.6	Census 1996 children 1-9 years
	Informal urban	325	22.4	
	Commercial farm	266	24.8	
	Tribal	943	11.1	
	Urban	1 296	19.6	40.0
	Rural	1 209	14.2	9.5
	TOTAL	2 505	17.0	23.0
Mothers	Formal urban	787	41.0	Census 1996 women 15-49 years
	Informal urban	265	52.6	
	Commercial farm	231	53.7	
	Tribal	745	27.9	
	Urban	1 052	43.9	76.2
	Rural	976	34.0	30.6
	TOTAL	2 028	39.2	57.2
Grandmothers	Formal urban	368	25.0	
	Informal urban	110	38.2	
	Commercial farm	70	42.8	
	Tribal	394	17.3	
	Urban	478	28.0	
	Rural	464	21.1	
	TOTAL	942	24.6	

Direction of migration

The direction of migration will be represented using graphs and maps as suggested by Kpedekpo (1982:145-158).

The majority of migration (ranging between 57% and 91%) of children, mothers and grandmothers were reported to be intra-provincial (Table 4.6; Table 4.8; Table 4.10). These findings are similar yet not as consistent and at a slightly lower level than the findings from Census 1996 where about 80% of all migration reported was intra-provincial. As a result of the high intra-provincial migration, the provincial net migration is relatively low for most provinces (Figure 4.8) except for mothers in the Eastern Cape, Gauteng, Limpopo Province and Western Cape. A positive net migration was reported for children, mothers and grandmothers in Gauteng and the Northern Cape. In the Western Cape only the children experienced a small negative net migration. Negative net migration was reported by all three groups for Free State, Northern Province and the North West, with only the children in the Eastern Cape and in KwaZulu-Natal reporting a small positive net migration.

Census 1996 recorded positive net migration for children aged 1-9 years and women aged 15-49 years in Gauteng, Western Cape, Free State, and Mpumalanga. Both groups reported a negative migration in KwaZulu-Natal, the Eastern Cape and Limpopo Province (Figure 4.9; Table 4.7; Table 4.9). There seems to be agreement in the Census data set between the direction of migration for children and mothers for all the provinces except the North West (only women positive) and the Northern Cape (only children positive).

Despite the differences in volume of migrants, there seems to be agreement between this study and the Census 1996 for the direction of net migration of children and mothers/women in Gauteng, the Western Cape, Mpumalanga, Limpopo and Eastern Cape provinces. In the Free State and the Northern Cape this study found the direction of migration for mothers/women and children to be the opposite of the Census 1996. In KwaZulu Natal this study found the direction of migration to be positive for children but negative for mothers whilst the Census 1996 reported negative net migration for both groups. In the North West Province the opposite was the case with this study reporting negative net migration for both groups and the Census 1996 reporting negative net migration for children only.

For children and their mothers it is clear that there are specific provincial migration streams (Figure 4.10 a-j; Figure 4.11 a-j). For all three groups Gauteng is both a major destination and origin, although provincially it is a net destination. The Western Cape is a net destination from all provinces except for mothers to the Northern Cape. Although the volumes of flow are much smaller, the Northern Cape is a net destination for children and mothers and mostly so from provinces in the north. The Limpopo province is a net origin although flow is limited to the “northern” provinces. KwaZulu-Natal is also a net origin to neighbouring provinces for mothers.

Figure 4.8: Net migration for children, mothers and grandmothers by province: South Africa 1999

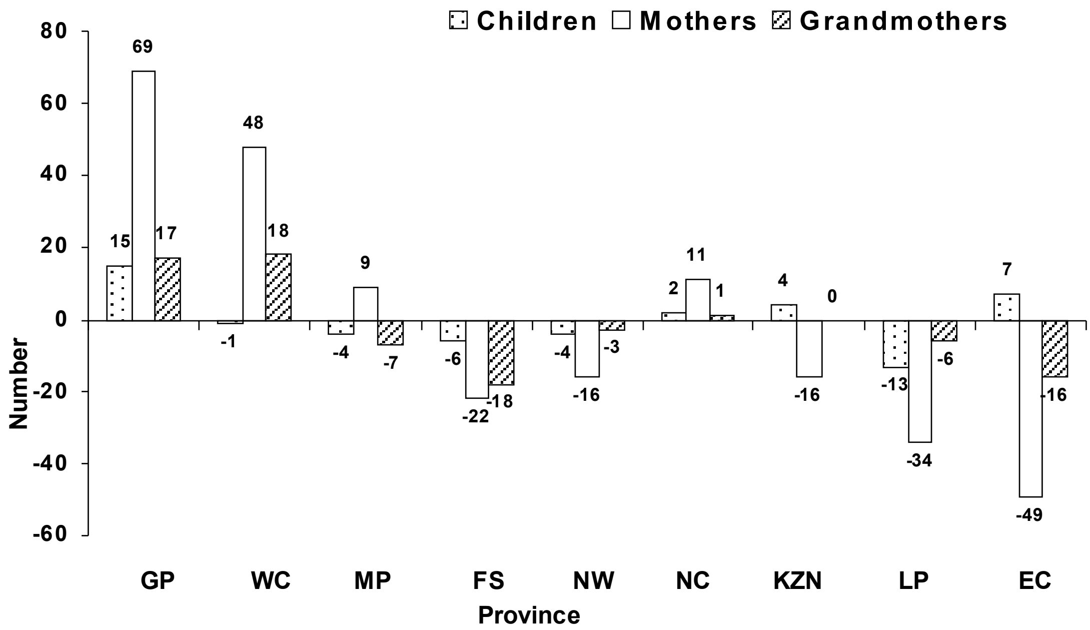


Figure 4.9: Net migration for children and mothers by province: Census 1996

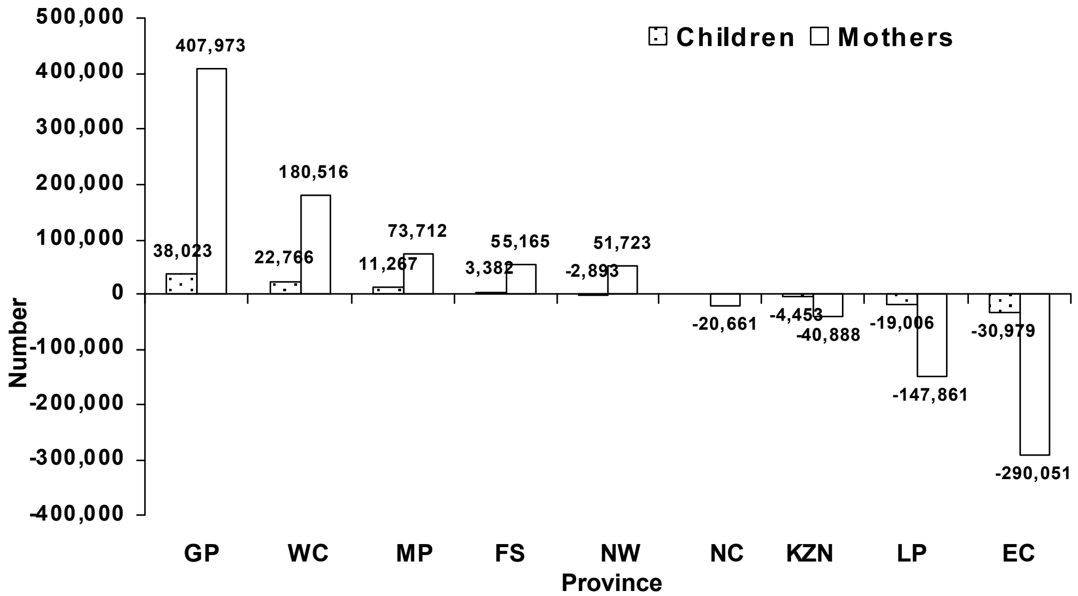


Table 4.6: Summary of migration of children between birth- and current residential province and area of residence: South Africa 1999

Birth (from) / Current (to)		EC		FS		GP		KZN		MP		NC		LP		NW		WC		Immigrant
		U	r	U	r	U	r	U	r	U	r	U	r	U	r	U	r	U	r	
No movement		121	223	116	76	251	34	184	269	37	76	60	61	16	117	48	132	207	48	
EC	U	22				1												5	1	
	r		25			1												11		
FS	U			3	2	2										1				
	r			1	6															
GP	U		1	3	2	42	8	4	1	1	2			3	3	3	1			6
	r					5	4								7	2	3			
KZN	U			1		2	1	29	2											
	r				1	3	1	1	27											1
MP	U									4										
	r					2				1	2									
NC	U						1					9	4	1			2			
	r												4				1	1		2
LP	U										1			2						
	r					1									7					
NW	U									1						9	2			
	r		3			4									1	2	11			1
WC	U	5	3	2		2				1		4						51		1
	r																	6	23	

	EC	FS	GP	KZN	MP	NC	LP	NW	WC
In-migration*	19	3	36	9	2	6	2	9	17
Out-migration*	12	9	21	5	6	4	15	13	18
Net migration*	7	-6	15	4	-4	2	-13	-4	-1

Shaded area indicates intra-provincial movement

* Excludes immigrants

Table 4.7: Proportionate migration of children (aged 1-9) between previous and current residential province: Census 1996

Previous / Current	EC	FS	GP	KZN	MP	NC	LP	NW	WC
EC	80.2	0.5	0.7	0.6	0.1	0.6		0.1	1.0
FS	1.4	92.0	1.4	0.6	0.5	1.8	0.3	1.0	0.2
GP	4.7	3.3	89.1	4.7	7.9	1.8	13.6	14.3	0.9
KZN	2.5	0.4	1.1	92.0	1.0	0.4	0.2	0.3	0.3
MP	0.7	0.9	2.9	1.1	86.8	0.4	5.3	0.8	0.2
NC	0.2	0.6	0.3	0.1	0.2	88.5	0.1	1.2	0.6
LP	0.1		0.9	0.1	2.0		77.4	0.5	0.1
NW	1.0	1.9	2.4	0.2	1.1	2.1	2.9	81.6	0.2
WC	9.3	0.5	1.3	0.7	0.4	4.4	0.2	0.3	96.5

	EC	FS	GP	KZN	MP	NC	LP	NW	WC
In-migrants	7 593	13 154	73 888	12 295	24 723	5 680	7 006	20 989	28 774
Out-migrants	38 884	12 663	42 002	17 795	15 540	5 419	27 674	26 166	7 959
Net-migrants	-30 979	3 382	38 023	-4 453	11 267	642	-19 006	-2 893	22 766

Table 4.8: Summary of migration of mothers of children (aged 1-9) between birth- and current residential province and area of residence: South Africa 1999

Current (to) \ Birth (from)		EC		FS		GP		KZN		MP		NC		LP		NW		WC		Immigrant
		U	r	U	r	U	r	U	r	U	r	U	r	U	r	U	r	U	r	
No movement		72	131	64	30	109	9	96	159	12	55	41	28	9	81	27	87	101	27	
EC	U	32	3	1		1										1		5	1	
	r	1	58			1		2	1											
FS	U			5	12	2										1				
	r			10	23			1	1											1
GP	U	9	3	8	6	74	11	13	4	10	7			10	5	7	5	1		5
	r			1	1	5	9		1	2				1	9	3	7			3
KZN	U			1		4	2	57	2									1		2
	r					1		3	51											
MP	U	1		1		12				3				1	1					1
	r		2			6			1	1	7			1	4					2
NC	U			1	1	1						11	3	2			1		1	
	r					1							10				2		1	15
LP	U													5						
	r					1	2			1				1	27					1
NW	U													1		9	6			1
	r	1	4	2	2	2								1	1	4	23			3
WC	U	25	14	2		8		1		1				1		3		63	6	9
	r	1	2															6	34	

	EC	FS	GP	KZN	MP	NC	LP	NW	WC
In-migration*	13	5	113	9	30	11	4	14	58
Out-migration*	62	27	44	25	21	0	38	30	10
Net migration*	-49	-22	69	-16	9	11	-34	-16	48

Shaded area indicates intra-provincial movement

* Excludes immigrants

Table 4.9: Proportionate migration of women aged 15-49 years between previous and current residential province: Census 1996

Current \ Previous	EC	FS	GP	KZN	MP	NC	LP	NW	WC
EC	76.2	0.5	0.5	0.4	0.1	1.0	0.1	0.1	0.9
FS	2.1	89.8	1.1	0.6	0.6	2.2	0.4	1.3	0.3
GP	5.8	4.9	88.8	6.5	10.0	3.3	21.9	15.2	1.1
KZN	3.5	0.5	1.1	90.6	1.1	0.5	0.3	0.2	0.3
MP	0.5	0.8	3.2	0.9	83.5	0.5	6.1	0.9	0.2
NC	0.1	0.5	0.1		0.1	80.7		1.1	0.4
LP	0.1	0.1	0.9	0.1	2.8	0.1	67.0	0.8	0.1
NW	1.3	2.2	3.0	0.3	1.5	4.7	4.0	80.2	0.1
WC	10.3	0.6	1.3	0.7	0.3	7.0	0.2	0.2	96.5

	EC	FS	GP	KZN	MP	NC	LP	NW	WC
In-migrants	42 688	149 375	693 940	107 942	190 210	28 575	77 568	206 447	230 755
Out-migrants	332 739	94 210	285 967	148 830	116 498	49 236	225 429	154 724	50 239
Net-migrants	-290 051	55 165	407 973	-40 888	73 712	-20 661	-147 861	51 723	180 516

Table 4.10: Summary of migration of grandmothers of children (aged 1-9) between birth- and current residential province and area of residence: South Africa 1999

Current (to) \ Birth (from)		EC		FS		GP		KZN		MP		NC		LP		NW		WC		Immigrant
		U	r	U	r	U	r	U	r	U	r	U	r	U	r	U	r	U	r	
No movement		42	82	14	7	43	4	62	122	4	16	20	13		19	13	67	56	5	
EC	U	13	3															1	1	
	r		10			1			2											
FS	U			4	24	1														
	r			3	11															
GP	U	2	1	6	2	11	9	3	3	2	1	3		2		4	3			7
	r		1			1								1	1	1	2			1
KZN	U		2	2	1	1	1	17	8											2
	r				1	2		1	26											
MP	U					4								2						
	r					3		1												
NC	U											3	5			1	1			
	r					1							5				3		1	1
LP	U													2			1			
	r														6					
NW	U															1	9			1
	r		1	4	2	5									1		6			1
WC	U	8	6	1		2		1				3						15	9	
	r																	7	6	

	EC	FS	GP	KZN	MP	NC	LP	NW	WC
In-migration*	5	1	38	10	10	7	1	13	21
Out-migration*	21	19	21	10	3	6	7	16	3
Net migration*	-16	-18	17	0	-7	1	-6	-3	18

U Urban
r Rural
Shaded area indicates intra-provincial movement
* Excludes immigrants

Net migration (Table 4.6-Table 4.10) for each province is calculated as the difference between in-migrants (total in the rows across each current province—both urban and rural) minus the out-migrants (total in the columns down each birth province—both urban and rural). Inter-provincial migrants (grey shaded) are excluded from these calculations. Net provincial migration flow (Figure 4.10-Figure 4.11) indicates the net volume of migrants between specific provinces (birth and current). For example between the Eastern Cape (EC) and Gauteng (GP) 2 children moved from GP (birth) to the EC (current) whilst only 1 child moved from the EC (birth) to GP (current). The net provincial flow between these two provinces will therefore be 1 child in the direction of the Eastern Cape. However, only 2 mothers moved from GP (birth) to EC (current) whilst 12 moved from EC (birth) to GP (current) resulting in a net migration flow of 10 mothers in the direction of Gauteng.

Figure 4.10: Net provincial migration flow of children aged 1-9 years: South Africa 1999

The arrows indicate the direction of net flow to and from each province. The thickness of the arrow lines represents the volume of migrants. For ease of reference the number of migrants are indicated on each Figure.

Legend
1 person
2 persons
3 persons
5 persons
9 persons
12 persons

Figure 4.10a: Net provincial migration flow of children aged 1-9 years Eastern Cape 1999

EC to NW 3

WC to EC 9
GP to EC 1

Figure 4.10b: Net provincial migration flow of children aged 1-9 years: Free State 1999

FS to GP 3
FS to KZN 2
FS to WC 2

NW to FS 1

Figure 4.10c: Net provincial migration flow of children aged 1-9 years: Gauteng 1999

GP to NC 1
GP to EC 1
GP to KZN 2

LP to GP 12
NW to GP 5
FS to GP 3
MP to GP 1

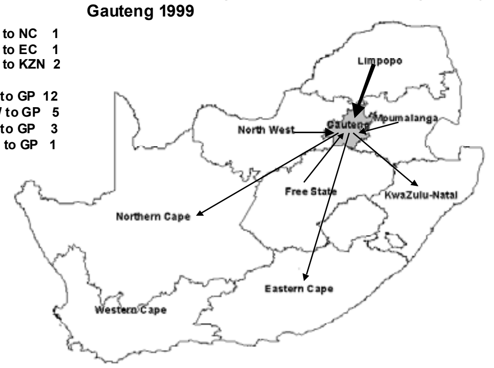


Figure 4.10d: Net provincial migration flow of children aged 1-9 year KwaZulu-Natal 1999

FS to KZN 2
GP to KZN 2

Figure 4.10e: Net provincial migration flow of children aged 1-9 year Mpumalanga 1999

MP to LP 1
MP to GP 1
MP to WC 1

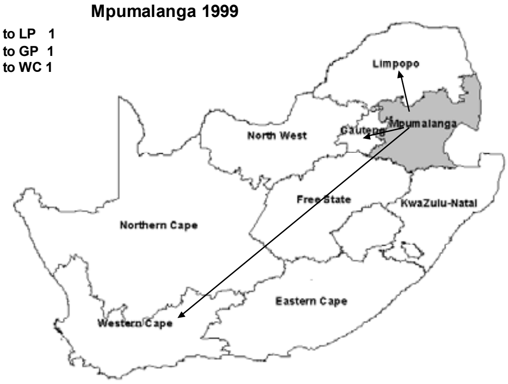


Figure 4.10f: Net provincial migration flow of children aged 1-9 years: Northern Cape 1999

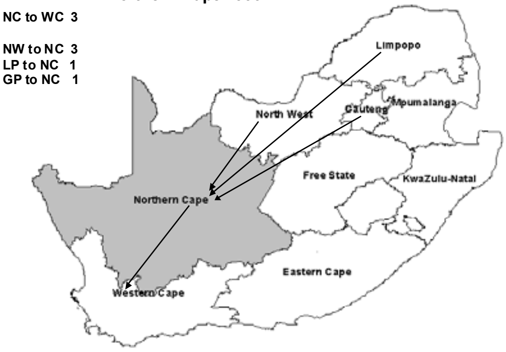


Figure 4.10g: Net provincial migration flow of children aged 1-9 years: Limpopo 1999

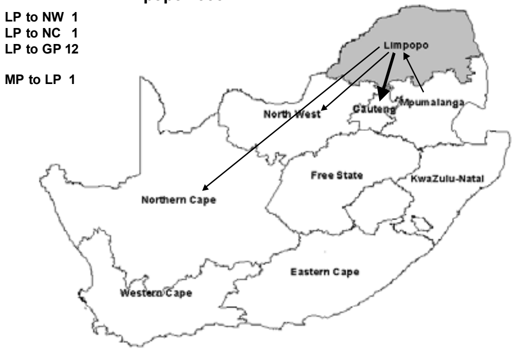


Figure 4.10h: Net provincial migration flow of children aged 1-9 years: North West 1999

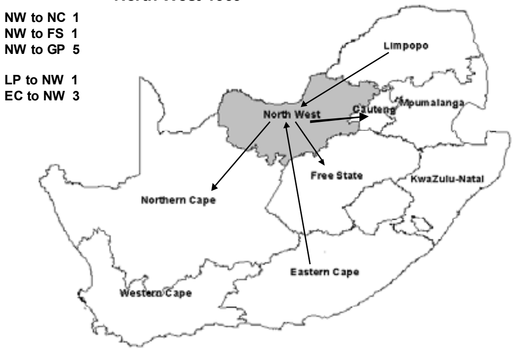


Figure 2.10i: Net provincial migration flow of children aged 1-9 years: Western Cape 1999

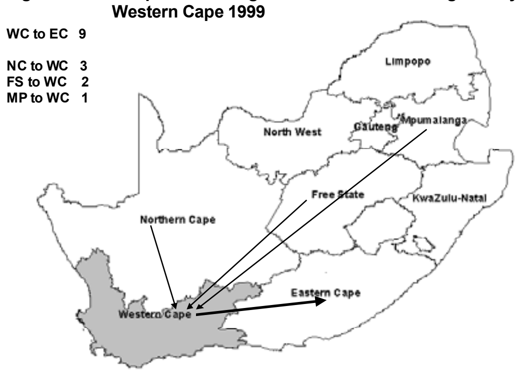


Figure 4.11: Net migration flow of mothers of children aged 1-9 years: South Africa 1999

The arrows indicate the direction of net flow to and from each province. The thickness of the arrow lines represents the number of migrants.

Legend
1 person
2 persons
3 persons
4 persons
5 persons
6 persons
7 persons
9 persons
10 persons
12 persons
14 persons
20 persons
22 persons
36 persons

Figure 2.11a: Net provincial migration flow of mothers of children aged 1-9 years: Eastern Cape 1999

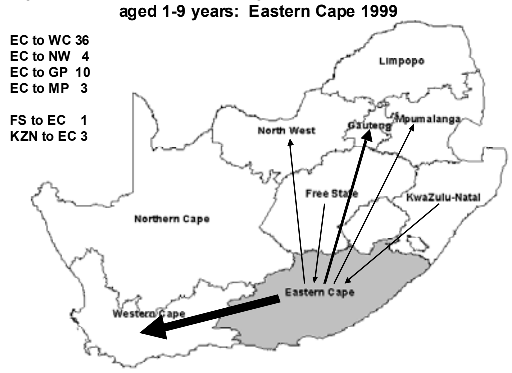


Figure 4.11b: Net provincial migration flow of mothers of children aged 1-9 years: Free State 1999

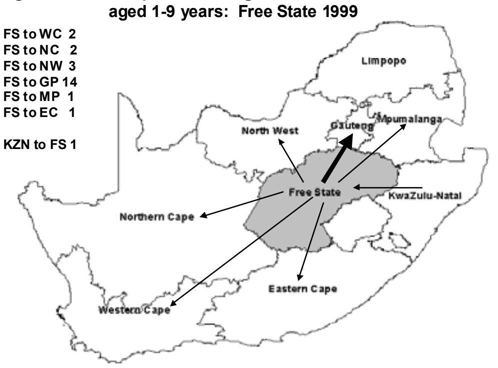


Figure 4.11c: Net provincial migration flow of mothers of children aged 1-9 years: Gauteng 1999

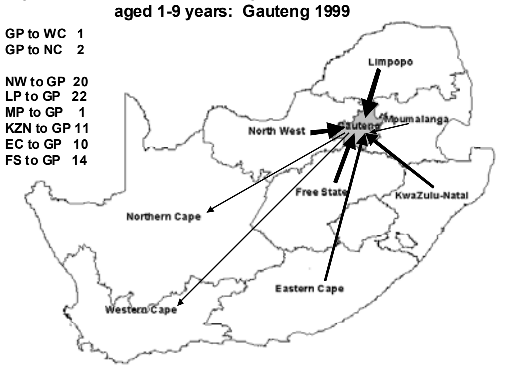


Figure 4.11d: Net provincial migration flow of mothers of children aged 1-9 years: KwaZulu-Natal 1999

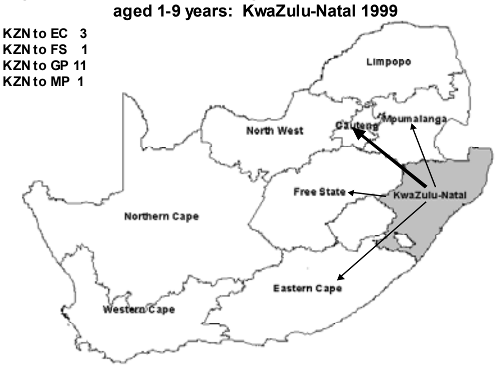


Figure 4.11e: Net provincial migration flow of mothers of children aged 1-9 years: Mpumalanga 1999

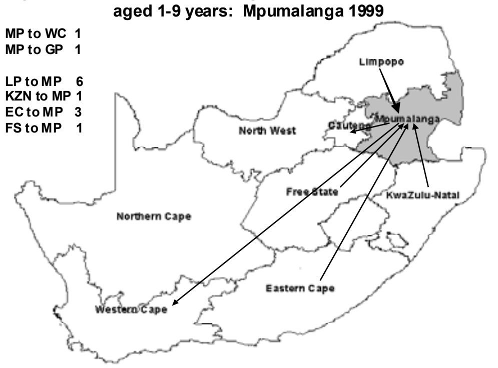


Figure 4.11f: Net provincial migration flow of mothers of children aged 1-9 years: Northern Cape 1999

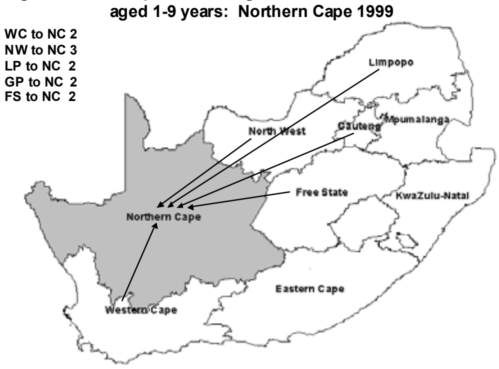


Figure 4.11g: Net provincial migration flow of mothers of children aged 1-9 years: Limpopo 1999

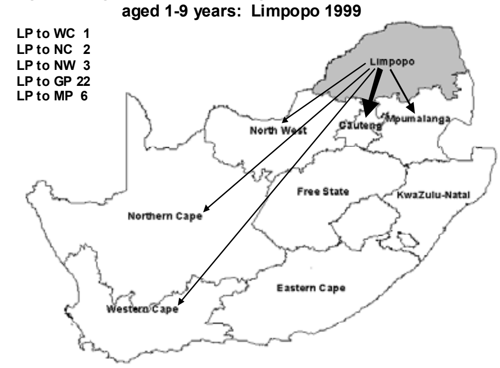


Figure 4.11h: Net provincial migration flow of mothers of children aged 1-9 years: North West 1999

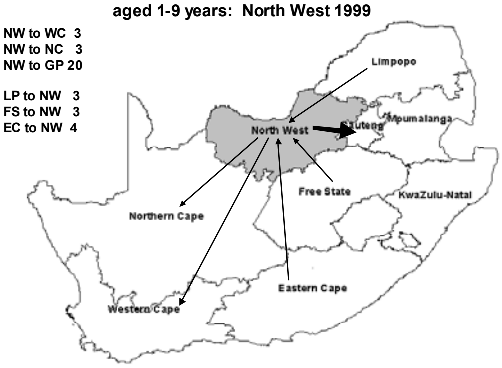
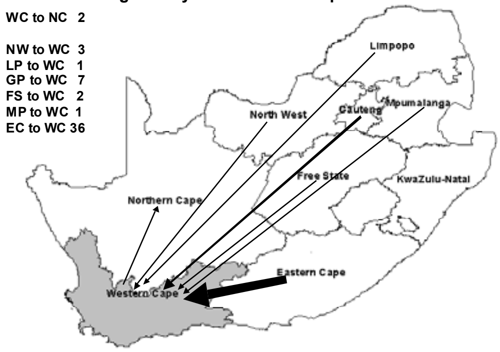
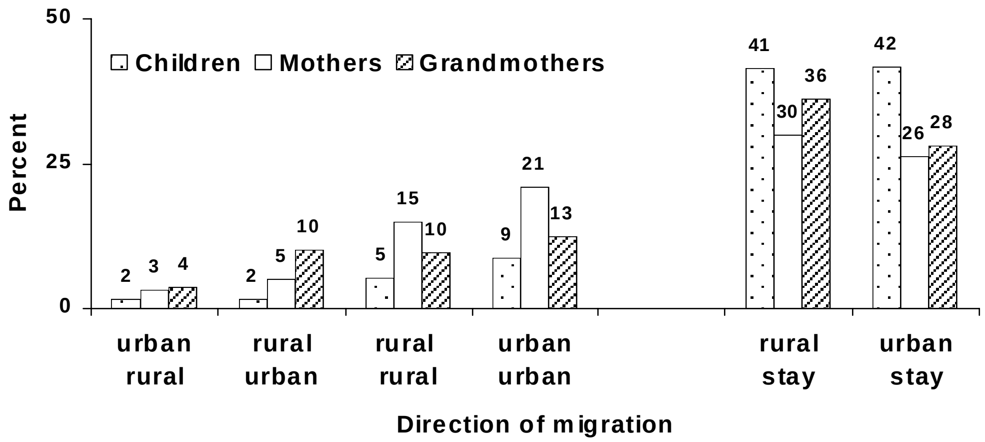


Figure 4.11i: Net provincial migration flow of mothers of children aged 1-9 years: Western Cape 1999



When classifying migration across urban and rural areas, the majority of migration reported for all groups is urban-to-urban with rural-to-rural migration the second highest (Figure 4.12; Table 4.11).

Figure 4.12: Movement of children, mothers and grandmothers between birth- and current area of residence: South Africa 1999



Within the urban-to-urban migration group the highest migration was reported for those living in informal urban areas. Within the rural-to-rural migration group, the highest migration was reported for commercial farm areas (data not shown).

Table 4.11: Summary of frequency of direction of migration for children, mothers and grandmothers during the lifespan of children aged 1-9 years: South Africa 1999

Proportion %	Direction of migration						RSA
	rural rural	rural urban	urban rural	urban urban	rural stay	urban stay	Total (n)
Children	4.8	1.5	1.5	9.0	40.4	42.8	2 179
Mothers	14.3	5.1	3.2	21.6	29.2	26.5	1 808
Grandmothers	9.3	10.4	3.5	13.8	43.1	28.9	797
Number (n)	105	32	33	197	880	932	Total %
All similar	6.7	12.5	12.1	6.1	13.6	14.5	12.9
Mother similar to child	58.1	59.4	51.5	65.5	62.4	62.8	62.4
Grandmother similar	12.4	12.5	9.1	7.6	17.3	15.2	15.1
None similar	22.9	15.6	27.3	20.8	6.7	7.5	9.5
Mother same	63.6	71.9	60.0	71.6	76.8	80.4	76.8
Mother not the same	36.4	28.1	40.0	28.4	23.2	19.6	23.2
<3 years stay	61.6	57.1	64.1	58.5			9.8
3-5 years stay	28.0	42.9	25.6	33.8			5.2
6-9 years stay	10.4	0	10.3	7.7			1.3

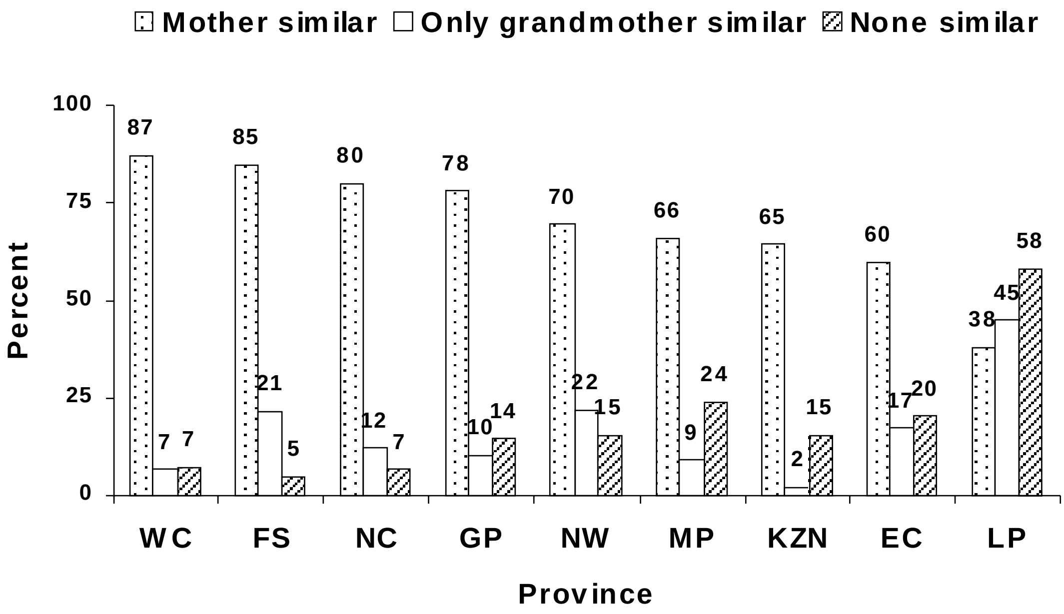
Similarity of migration patterns

'Similarity of migration patterns' is used as a term to describe whether the migration (including no migration) reported during the lifetime of the child, i.e. from birth to 1999, was the same for the child and mother pair and for the child and grandmother pair.

The migration patterns for 76% of mothers and 27% of grandmothers are the same as those of their children/grandchildren. These are similar for children who moved and those who did not move. Only 12.9% of children had the same migration pattern as both their mothers and grandmothers, while no children who moved more than once had a similar migration pattern to both mother and grandmother. Children who moved more than once had the highest occurrence of a similar migration pattern for mother and child, while children who did not move had the highest occurrence of having a migration pattern similar to that of their grandmothers. The highest occurrence of similar migration patterns for mother and grandmother together with the child was reported for the Northern Cape (23%) and the North West (17%). The Western Cape (87%) and the Free State (85%) had the highest occurrence of mothers and children with the same migration patterns, followed by the Northern Cape and Gauteng, while the greatest proportion of grandmothers (only) with similar migration patterns as their grandchildren were reported in the North West and Free State (22% each) (Figure 4.13). The highest occurrence of all three generations with the same migration pattern was found for children in the Northern Cape (23%) and the North West (17%). The lowest occurrence of similar migration patterns between children and their mothers and/or grandmothers was found in Limpopo, where no similarity was reported for 58% of children. This again needs to be considered in the light of the quality of migration data collected from the Limpopo.

Tribal areas had the highest occurrence of no similar migration patterns for mother, grandmother and child. The highest occurrence of similarity between migration patterns between mother and child was reported for commercial farm areas (84%), but in total, urban areas reported the highest similarity with mothers (73%). Children who stayed rural or urban had similar though slightly higher occurrence of mothers and grandmothers with similar migration patterns than children who moved urban-to-urban or rural-to-rural. Children for whom urban-to-rural and rural-to-rural migration was reported had the highest occurrence of no similarity between migration patterns for child and mother and/or grandmother (40% and 36% mother not similar respectively).

Figure 4.13: Similarity of migration pattern (including no migration) reported for children, their mothers and grandmothers by province: South Africa 1999



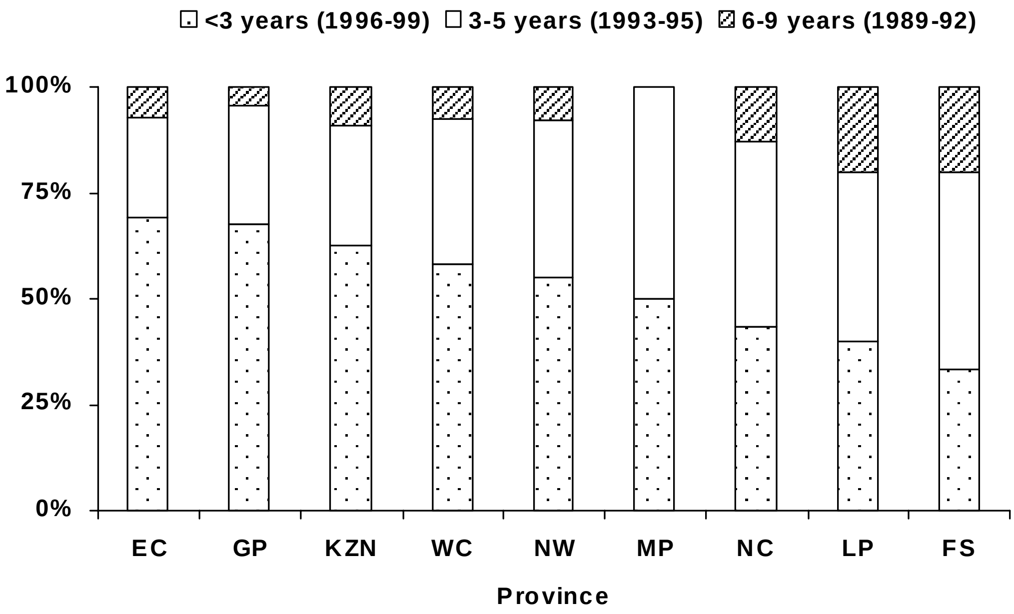
Duration of stay at current residence

The duration of stay at the current residence was assessed to provide an indication of the periods of highest mobility, especially in view of the various political and governmental changes that took place during the period recorded for this study. The findings of this study suggest differences interesting for future investigation.

Sixty per cent of the children who moved did so less than three years previously (i.e. between 1996 and the date of data collection in 1999), with 92% having moved <6 years prior to 1999 i.e. since 1993 (Table 4.11). One-third of mothers reported having stayed at their current area of residence for 3-5 years and 6-9 years with only 11% having stayed longer than 9 years. Thirty-five percent of grandmothers had been staying at their current area of residence for longer than 9 years and only fifteen percent moved in the last 3 years. The highest recent migration was reported for the Eastern Cape, Gauteng, and KwaZulu-Natal with the lowest recent migration in the

Free State. All provinces showed a similar pattern of occurrence of migration, except in the Free State the highest migration was reported in the period between 1993 and 1995 (Figure 4.14).

Figure 4.14: Duration of stay at current residence for children who migrated, by province: South Africa 1999



The occurrence of migration was similar over the most recent two periods i.e. 1996-1999 and 1993-1995, in Mpumalanga, the Northern Cape and Limpopo. No migration was reported for children in Mpumalanga for the period 1989-1992. The proportionate inverse increase in migration over the three time periods as reported for the provinces, with the highest proportion of migration having taken place in the period 1996-1999, holds true for all the areas of residence with commercial farm areas reporting the highest recent migration (68%) following a relatively low intermediate migration (20%). There is no difference in the proportionate distribution of categories of duration of stay on the basis of having the same migration pattern as the mother or not. Those children who have similar migration patterns to their grandmothers have the lowest proportionate recent migration (41%) and the highest past migration (44% and 14%). Children with no similarity to their mothers or grandmothers have the highest proportionate recent migration (72%).

The opportunity for migration is a function of age, as a three-year-old child could not have migrated nine years prior to 1999. Calculation of the proportion of time spent in the current place of residence, expressed as a component of age, was considered. However, subsequently the mean age at which children migrated was calculated (current age – number of years at current residence = age at migration). This will be discussed in more detail under the socio-demographic characteristics of migrants. It is worth noting here that the mean age at which children migrated was similar for all categories of the various variables. The findings on how recently children migrated need to be considered in that context. How recently children migrated will also be discussed in the section on anthropometry, as other studies suggest a link between these two indicators.

Internal migration and socio-economic characteristics

The socio-demographic characteristics of the NFCS source study population are described in detail in the NFCS report (Labadarios (ed.), 2000:74). This chapter will summarise the socio-economic characteristics of the study population for this study according to their migration patterns and specifically frequency of migration, direction of migration, similarity of migration patterns and how recently migration occurred.

The prevalence of migration reported for children aged 1-9 years in South Africa 1999, is summarized below in Table 4.12. The Chi-square statistic (p-value) is only indicated if it is statistically significant i.e. <0.05. The rest of the data on which this discussion is based, is not shown in the text, but is available as a separately binded section to this thesis, Appendix F.

Table 4.12: Proportionate distribution of sample and probability for migration of children aged 1-9 years within each socio-demographic variable: South Africa 1999

Variable	Categories	Study sample	Probability of migration	Chi-square
		n=2 505 (100%)	n=426 (0.170)	
Gender	**Male**	50.6%	0.165	
	Female	49.4%	0.175	
Age	**1-3 years**	46.50%	0.123	p=<0.001
	4-6 years	37.30%	0.200	
	7-9 years	16.10%	0.215	
Area of residence	**Urban**	51.7%	0.196	p=<0.001
	Rural	48.3%	0.142	
Province	**Eastern Cape**	16.4%	0.161	p=<0.001
	Free State	8.3%	0.072	
	Gauteng	15.5%	0.258	
	KwaZulu Natal	20.8%	0.132	
	Mpumalanga	4.9%	0.072	
	Northern Cape	5.8%	0.165	
	Limpopo	5.7%	0.070	
	North West	8.5%	0.159	
	Western Cape	14.1%	0.277	
Language	**Afrikaans**	12.1%	0.216	
	English	4.4%	0.321	
	IsiNdebele	1.7%	0.075	
	IsiXhosa	22.4%	0.154	
	IsiZulu	25.4%	0.156	
	Sepedi	1.1%	0.308	
	Sesotho	16.0%	0.129	
	SiSwati	1.1%	0.074	
	Setswana	12.5%	0.166	
	Tsivenda	0.5%	0.182	
	Xitsonga	2.7%	0.123	
Ethnic origin	**Nguni**	13.1%	0.150	
	Sotho	50.4%	0.151	
	Tsonga	25.0%	0.132	

Table 4.12: Proportionate distribution of sample and probability for migration of children aged 1-9 years within each socio-demographic variable: South Africa 1999 (continued)

Variable	Categories	Study sample	Probability of migration	Statistics Chi-square
		n=2505 (100%)	n=426 (0.170)	
Caretaker	**Mother**	66.9%	0.166	p=<0.05
	Father	2.2%	0.204	
	Grandparents	22.1%	0.148	
	Sibling	2.5%	0.233	
	Aunt/Uncle	6.4%	0.245	
Household head	**Father**	42.8%	0.199	p=<0.001
	Grandfather	19.3%	0.158	
	Grandmother	26.5%	0.111	
	Mother	11.4%	0.200	
Gender of household head	**Male**	68.9%	0.186	p=<0.01
	Female	31.1%	0.138	
Marital status of mother	**Not married**	44.1%	0.157	p=<0.05
	Married	40.5%	0.179	
	Divorced	1.7%	0.190	
	Separated	0.8%	0.250	
	Widowed	3.1%	0.107	
	Living together	4.7%	0.278	
	Traditional marriage	5.0%	0.132	
Employment of mother	**Housewife by choice**	15.6%	0.175	p=<0.01
	Unemployed	56.2%	0.149	
	Self-employed	5.2%	0.168	
	Wage earner	23.0%	0.216	
Employment of father	**Unemployed**	18.2%	0.179	
	Self-employed	5.8%	0.197	
	Wage earner	47.7%	0.195	
	Retired by choice	0.8%	0.590	
	Not applicable	27.6%	0.145	
Type of dwelling	**Brick**	67.3%	0.162	p=<0.001
	Traditional/Mud	17.6%	0.119	
	Tin/Plank	15.2%	0.274	
No of people sleeping at house	**1-3 persons**	13.1%	0.226	p=<0.001
	4-6 persons	50.4%	0.194	
	7-9 persons	25.0%	0.121	
	>9 persons	11.5%	0.112	

Table 4.12: Proportionate distribution of sample and probability for migration of children aged 1-9 years within each socio-demographic variable: South Africa 1999 (continued)

Variable	Categories	Study sample	Probability of migration	Statistics Chi-square
		n=2505 (100%)	n=426 (0.170)	
Household income (monthly)	**None**	4.6%	0.158	p=<0.001
	R100-R500	38.4%	0.149	
	R501-R1 000	28.1%	0.144	
	R1 001-R3 000	19.8%	0.167	
	>R3 000	9.1%	0.312	
Weekly food expenditure	**R0-R50**	27.6%	0.139	
	R51-R100	22.4%	0.180	
	R101-R150	14.3%	0.180	
	R151-R200	11.7%	0.168	
	R201-R250	6.7%	0.207	
	R251-R300	5.9%	0.168	
	R301-R350	2.7%	0.167	
	R351-R400	3.2%	0.172	
	>R400	5.6%	0.254	
Source of drinking water	**Borehole**	3.7%	0.198	
	Communal tap	27.0%	0.151	
	Own tap	57.4%	0.184	
	River/dam	11.9%	0.144	
Type of toilet	**Bucket**	7.4%	0.200	p=<0.01
	Flush	46.4%	0.191	
	Pit	44.9%	0.139	
	VIP	1.2%	0.259	
Fuel used	**Electricity**	45.5%	0.187	
	Gas	4.6%	0.207	
	Open fire	10.7%	0.124	
	Paraffin	32.1%	0.160	
	Wood/Coal	7.0%	0.165	
Cold storage	**Fridge**	22.0%	0.143	p=<0.01
	Freezer	6.0%	0.161	
	Both	24.2%	0.207	
	None	47.8%	0.164	
Stove	**Yes**	53.9%	0.176	
	No	46.1%	0.163	
Primus	**Yes**	54.5%	0.161	
	No	45.5%	0.182	
Microwave	**Yes**	10.4%	0.248	p=<0.01
	No	89.6%	0.163	

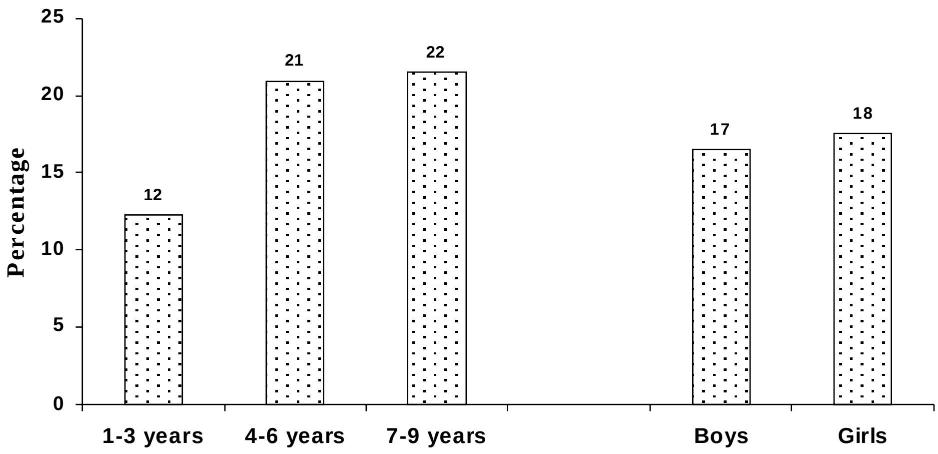
Table 4.12: Proportionate distribution of sample and probability for migration of children aged 1-9 years within each socio-demographic variable: South Africa 1999 (continued)

Variable	Categories	Study sample	Probability of migration	Statistics Chi-square
		n=2505 (100%)	n=426 (0.170)	
Mother's education	**None**	10.1%	0.200	p=<0.01
	Primary	27.0%	0.138	
	Std 6-8	29.3%	0.165	
	Std 9-10	25.9%	0.168	
	Tertiary	7.7%	0.269	
Radio/TV	**Radio**	28.0%	0.172	
	Television	7.5%	0.150	
	Both	50.6%	0.173	
	None	13.9%	0.171	
Similarity of lifetime pattern	**All same**	12.9%	0.096	p=<0.001
	Only mother similar	62.4%	0.166	
	Only grandmother similar	15.1%	0.095	
	None similar	9.5%	0.380	

Gender

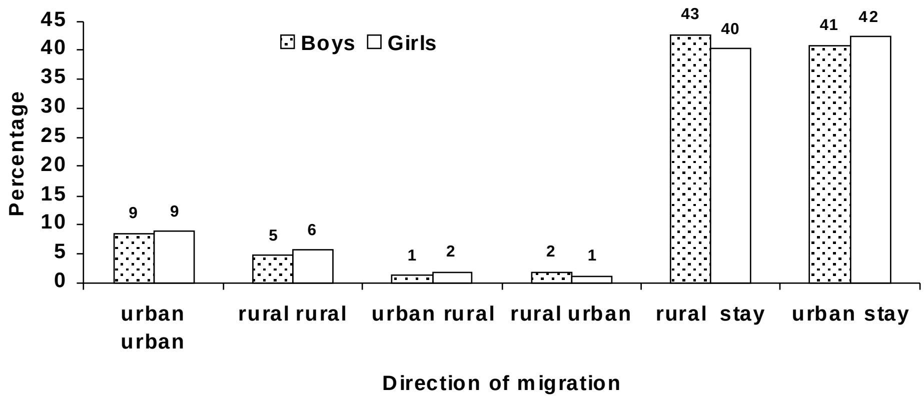
Almost the same number of boys and girls were included in the study. The total occurrence of migration reported was similarly for boys and girls (Figure 4.15; Table 4.12) although there were small differences based on the direction of migration (Figure 4.16). There was no difference in whether boys or girls had lifetime patterns similar to their mother and grandmother.

Figure 4.15: The age and gender of children who migrated: South Africa 1999



Boys and girls were proportionately equally distributed on the basis of how recently migration occurred. All of these findings confirm that there is no gender preference in the decision to migrate, with regard to children aged 1-9 years.

Figure 4.16 Gender of children by direction of migration: South Africa 1999

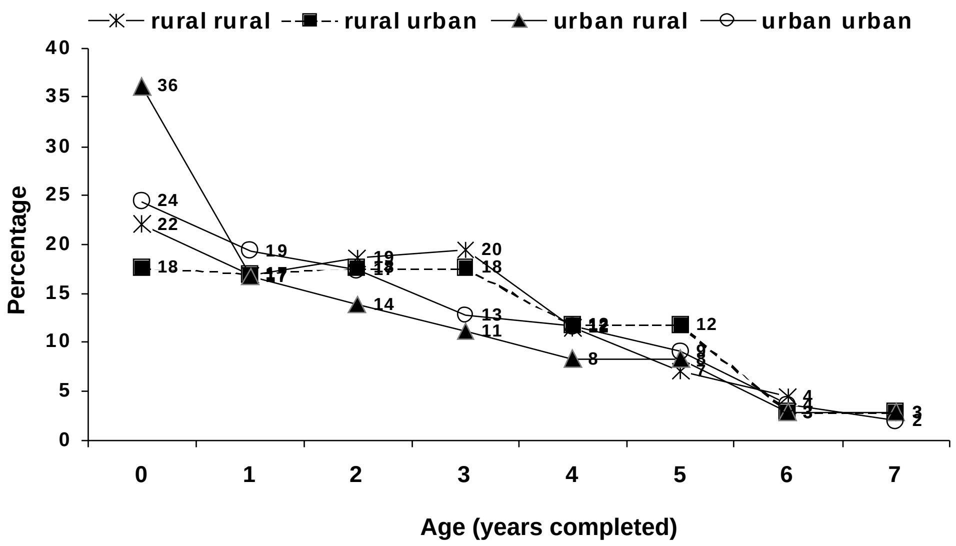


Age

Although fewer children in the age group 7-9 years were included in the study, there was a statistically significant difference between the occurrence of migration and the age group of the child (Figure 4.15; Table 4.12) with older children reporting the highest migration, as is to be expected. There was not much difference between the age groups according to the direction of migration. Younger children more frequently had the same migration pattern as their mothers, while children older than 3 years reported proportionately more often no similarity of migration pattern with mother or grandmother. Older children, as one would expect, had the greatest share in past migration, but most frequently reported migration 3-5 years prior to 1999 (data not shown).

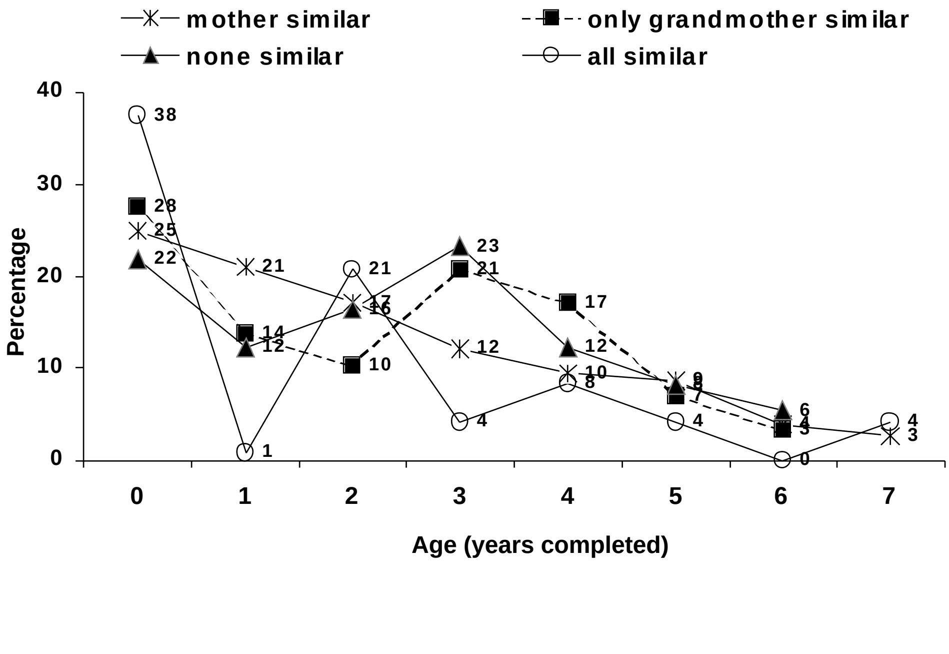
As age is such an important possible confounder, the mean age at which children migrated was calculated (age at migration = current age - number of years living at current residence). Analyses were then performed according to the mean age of children who migrated for different variables as well as the proportions of children from different age groups. The mean age at which children migrated is just over 2 years of age. There is no statistical difference between the mean age at which children migrated, or the proportion of the children who migrated at each age when analysed by province, area of residence, gender, ethnic origin or income category. The children, who moved urban-to-rural, have a greater proportionate share in migration at younger ages – especially before the age of one year (Figure 4.17).

Figure 4.17: Age at which children migrated (current age – number of years at current residence) by direction of migration: South Africa 1999



There is a significant difference in the proportion of children who moved at each age whether they were with their own mother or not (Figure 4.18).

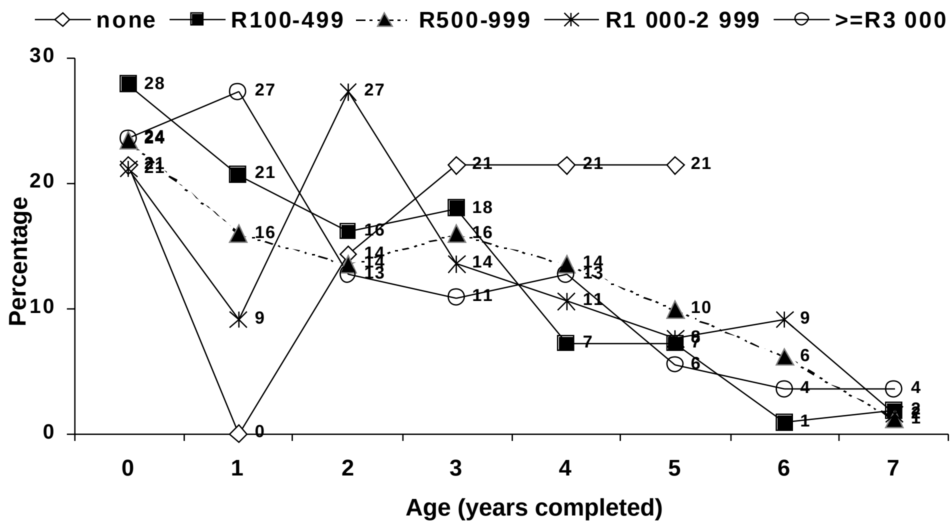
Figure 4.18: Age at which children migrated (current age – number of years at current residence) by similarity of migration patterns with mother and grandmother: South Africa 1999



Although it is not statistically significant, it is interesting to note the greater proportions of older children (3-5 years of age) who migrated where the household reported no income (Figure 4.19). Furthermore, this group did not report any migration for children after the age of 5 years. Children from households who reported no income are slightly underrepresented in all age groups.

Persons other than the mother provide proportionately more childcare for children who migrated at ages older than 3 years. Children from the highest income categories reported a peak migration at ages 2 years and 3 years and again an increase at the age of seven years. The latter is probably a reflection of the migration facilitated by the search for quality schools. For all other groups, and in general for all other variables, migration decreases as children approach school-going age.

Figure 4.19: Age at which children migrated (current age – number of years at current residence) by household income category: South Africa 1999



Language and ethnic origin

The highest rate of moving was reported for English- and Sepedi-speaking children (Table 4.12) with the lowest rate of moving for children from Ndebele and Swati language groups. For Pedi-speaking groups rural-to-rural migration was most prevalent compared to urban-to-urban migration for English-speaking groups. Similarity of migration patterns with grandmother and mother were particularly low in Venda- and Tsonga-speaking groups and English-speaking groups for grandmothers only. Afrikaans- and Pedi-speaking groups reported the greatest proportionate recent migration, i.e.1996-1999. The African languages were also re-categorised according to the original groups, i.e. Nguni (Swazi, Zulu, Ndebele, Xhosa), Sotho (South west and north Sotho, Tswana and Pedi) and Tsonga (Venda, Tsonga, Shangaan). In this case most of the differences disappear except for the Tsonga group that reported significantly lower similarity of migration patterns with mothers. This re-categorisation was done primarily to identify a possible genetic link with growth. This will be discussed further in the section on anthropometry.

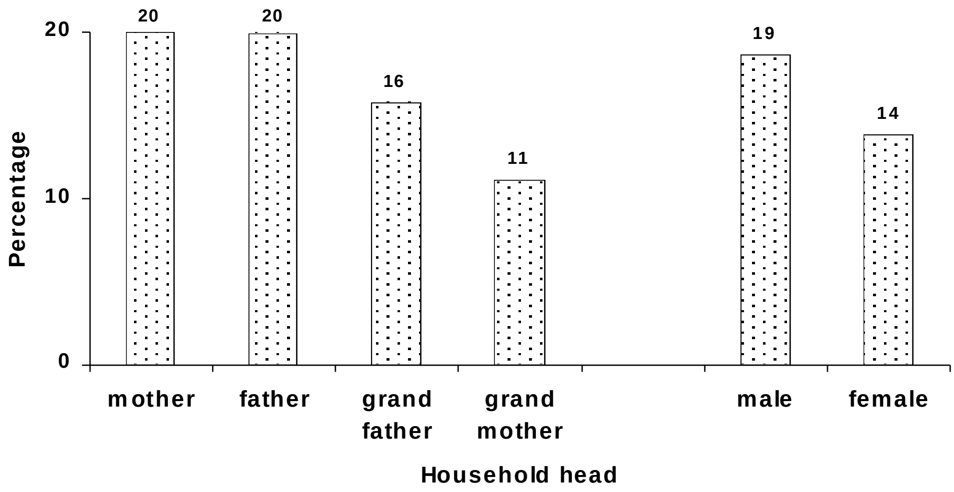
Caretaker

Mothers cared for more than 60% of children and another 22% stayed with their grandparents. Children who were cared for by siblings or an aunt/uncle had a higher rate of moving (Table 4.12) and more frequently did not have the same migration pattern as their mother or grandmother. The phenomenon of children being cared for by fathers or siblings seems to be much more common in urban areas regardless of migration while aunts and uncles more frequently cared for children for whom rural-to-rural migration was reported. The lowest recent migration was reported for children cared for by siblings. There appears to be some inverse relationship between the proportion of children being cared for by parents and grandparents based on the duration of stay. Those who moved 1996-1999, are cared for by their mothers proportionately more while children who moved >6 years previously, i.e.1989-1992 have double the proportion being cared for by their grandparents. This is a function of the current age of the child and the age at which children migrated. The caretaker of children may be expected to change in the near future in view of the HIV/AIDS pandemic.

Household headship

Sixty per cent of children lived in male-headed households. Children from these male-headed households were significantly more mobile than female-headed households. The lowest rate of moving was reported for children living in households headed by their grandmothers (11%) (Figure 4.20; Table 4.12). This was true for rural and urban areas. Fathers headed most of the households who moved urban-to-urban and, although still in the majority, they headed fewer households who moved rural-to-urban.

Figure 4.20: Proportionate migration reported for children by household headship: South Africa 1999

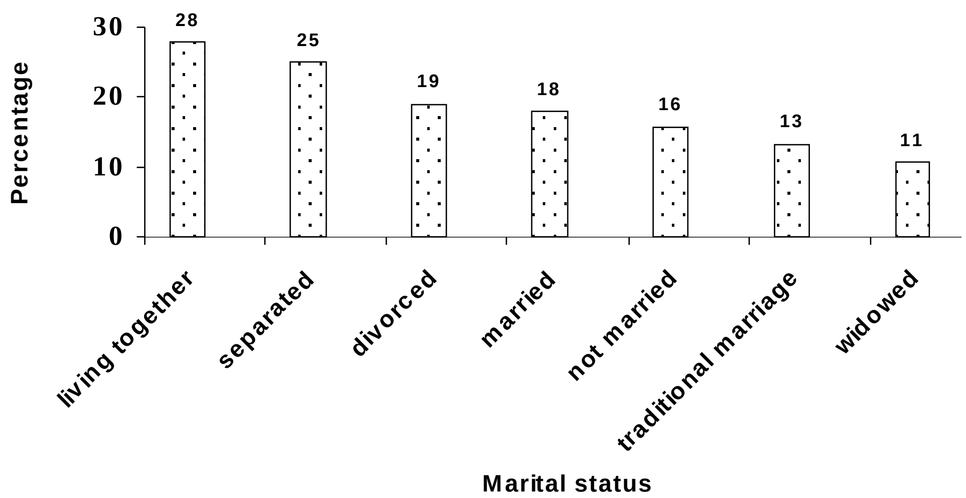


The group of children who moved rural-to-urban had the highest proportion of mothers as household head although this only amounts to 20%. This group also had the highest proportion of female-headed households (41%). Seventy-six per cent of households where the migration patterns were similar for the child, mothers and grandmother, were headed by one of the grandparents. Similarly grandparents headed 92% of households where only the child and grandmother had the same migration pattern. Almost 80% of households headed by the father or the mother reported similar migration patterns for the child and the mother. There seems to be little difference between groups with different durations of stay at current residence based on household headship including gender of the household head.

Marital status of mother

In almost equal proportions of households (around 40% each) mothers reported being married or not married although there was no difference in migration occurrence reported for these two groups. However, there were significant differences in the migration rates reported for the different categories of marital status (Figure 4.21; Table 4.12) with women who are separated or living together reporting the highest rates of migration although they are in the minority in this study sample.

Figure 4.21: Proportionate migration reported for children by marital status of mother: South Africa 1999

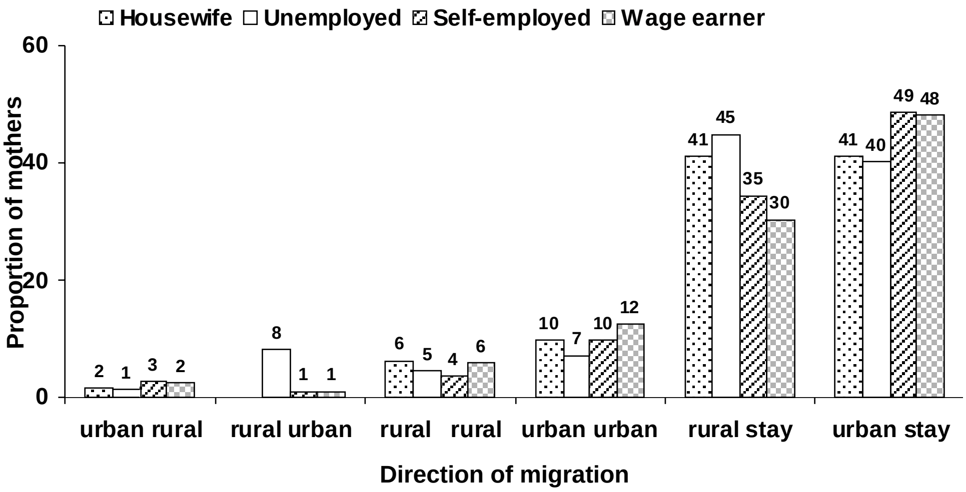


A higher proportionate migration from rural to urban areas was reported for children whose mothers were not married. Mothers in traditional marriages reported a higher proportionate urban-to-rural migration. In households where the grandmother had the same migration pattern as the child (with or without the mother), the mother was single (either not married or widowed). Women who were separated from their partners reported the highest prevalence of not having the same migration pattern for the child and mother. There was no difference in duration of stay at current residence based on marital status of mother.

Employment status of mother

More than half of the children's mothers were unemployed (56%). These children have a proportionately greater share in rural-to-urban migration and in staying rural. The highest rate of moving was reported for children of wage earners (Table 4.12) who moved mostly urban-to-urban (Figure 4.22). Housewives (by choice) did not report any rural-to-urban migration. They also reported the greatest proportionate similarity between migration pattern for mother and child. There appears to be no consistent difference in duration of stay with regards to employment status of mother.

Figure 4.22: Proportionate direction of migration reported for children by employment status of mother: South Africa 1999

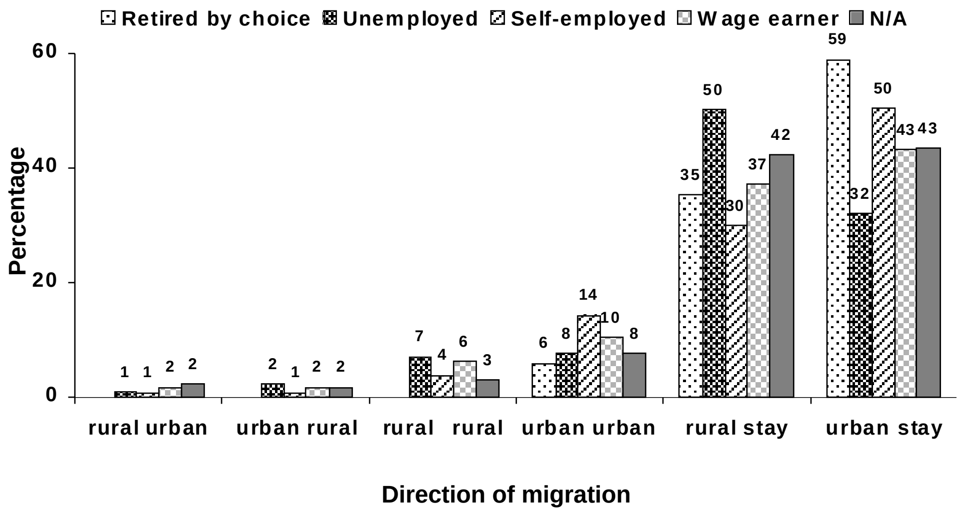


Employment status of father

The findings related to the employment status of mothers are similar to the employment of fathers with wage earners reporting the greatest migration although this is at a much greater scale (Table 4.12). It is noteworthy that for 27.6% of the children, information on the father's employment was not relevant. For this particular group of children a greater share of urban-to-rural and rural-to-urban migration was reported. A greater proportion of these children also did not have migration patterns similar to that of their mothers. This group is equally distributed amongst rural and urban children who did not move. The reported rate of moving was the lowest for children whose fathers retired by choice. The greatest share of recent migration was reported for unemployed fathers.

In general, retired fathers are a rare and mainly urban phenomenon with some urban-to-urban migration. Only about 5% of mothers and fathers are self-employed. They are again concentrated in urban areas in a ratio 5:3. The migration rate for wage earners is the highest with 23% migrating if the mother is a wage earner and 47% migrating if the father is a wage earner. The proportionate direction of migration of children of both groups is similar for all employment categories (Figure 4.22; Figure 4.23), i.e. urban-to-urban, rural-to-rural, urban-to-rural, and rural-to-urban, except for children of unemployed mothers who have a higher urban-to-rural than rural-to-urban migration.

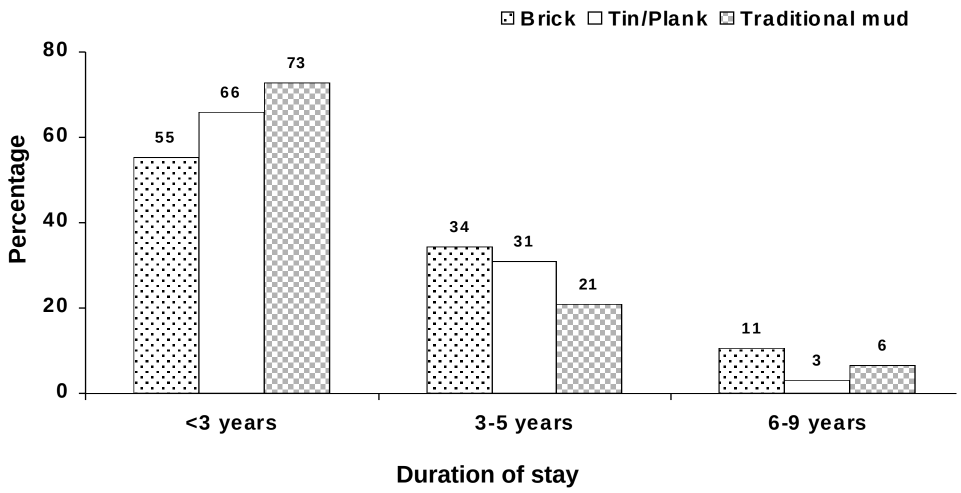
Figure 4.23 Proportionate direction of migration reported for children by employment status of father: South Africa 1999



Type of dwelling

The majority of the children lived in brick houses (67%), which is higher than for children aged 1-9 years as recorded by the 1996 Census (57%). The highest rate of moving (27%) was reported for children living in “temporary” structures of tin/plank (Table 4.12). These children mostly moved within urban areas and almost 80% of them had similar migration patterns to their mothers. Children who reported recent migration in the period 1996-1999 lived proportionately more in temporary structures (Figure 4.24).

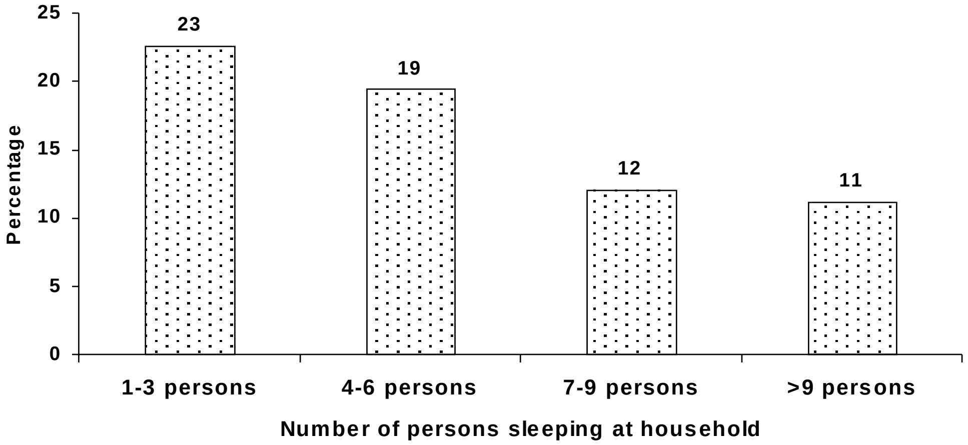
Figure 4.24: Type of house occupied by children who migrated by duration of stay at current residence: South Africa 1999



Household size

Fifty per cent of children lived in households with 4-6 persons. Another 25% lived in bigger households with 7-9 persons. Lower rates of migration were reported with an increase in the size of the household (Figure 4.25; Table 4.12)

Figure 4.25: Proportionate migration of children by household size: South Africa 1999

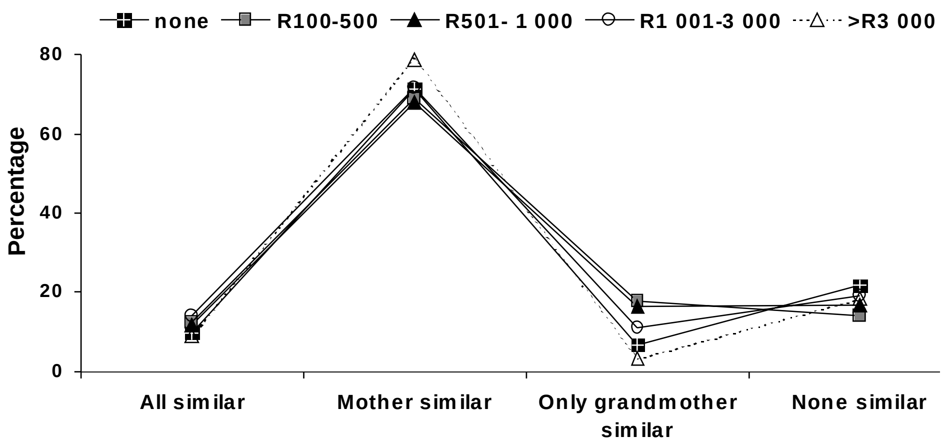


The biggest households remained rural (no migration for 56%) and the smallest households had the highest rate of moving from urban to rural areas (3%). Bigger households also had a proportionately lower occurrence of migration patterns similar to the mother. There are no significant differences based on household size and duration of stay.

Household income

The highest rate of migration (31%) was reported for children where the monthly household income was reported to be more than R3000 per month although only 9% of children fit in this category (Figure 4.26; Table 4.12). Children from this income category accounts for 17% of all the children who moved. These children were mostly reported to migrate urban-to-urban (26%), and to have the same migration pattern as their mother. The rate of moving amongst all the other income categories was similar around 15%. The lowest income categories reported greater proportionate recent migration. Children who have been living at their current residence for 3-5 years have a greater proportionate share in the higher income groups (>R3 000).

Figure 4.26: Proportionate similarity of migration patterns of child with mother and grandmother by household income category: South Africa 1999



Household food expenditure

The rate of moving of children was similar in households of different weekly expenditure on food, except in households where >R400 was spent on food migration was much higher (Table 4.12). This latter group constitutes less than 5% of the total population and had a proportionately higher migration occurrence from urban to urban or urban to rural areas. Households for whom low food spending was reported, i.e. less than R50/week, reported a proportionally lower migration from urban to urban areas and in the group who stayed (no migration) in urban areas. The rate of moving was similar for all groups regardless of similarity of migration except for households with a relatively higher food expenditure (R300-350) where there was a proportionate lower similarity between the child and the grandmother's migration patterns. The lowest proportionate recent migration was reported for children living in households where R100-R150 is spend on food weekly and 3-5 years of stay having a greater proportionate share in the higher food expenditure groups.

As both income data and food expenditure data were collected as categories, calculation of proportionate expenditure of income on food is not accurate as the margin of error might be increased. However, by using the midpoints of each category, a calculation of the proportionate food expenditure was done. The highest income categories reported that they spend about 6% of income on food with the lowest income categories spending about 37% of income on food. The mean proportionate expenditure of income on food is statistically significantly different for children who migrated and those who did not move (Table 4.13). This aspect is a topic for future investigation, if more detailed information on income and food expenditure were to be available.

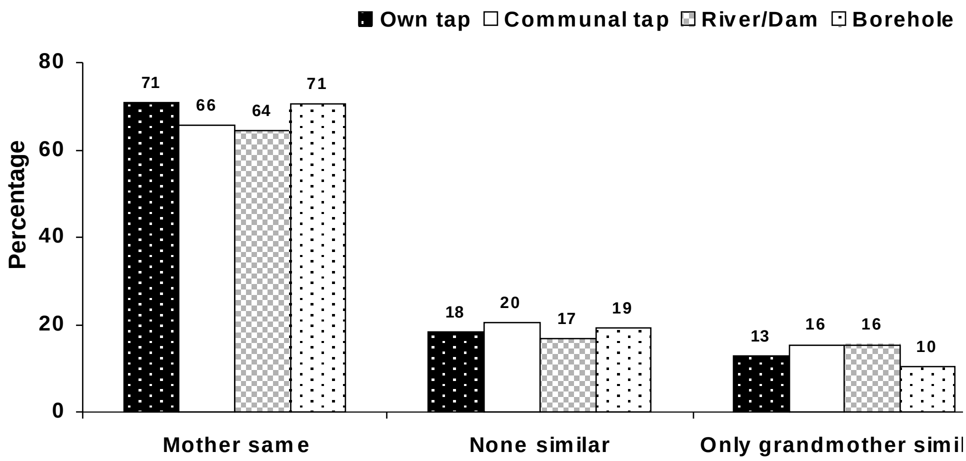
Table 4.13: Mean proportion of income spent on food for households with children aged 1-9 years: South Africa 1999

Migration status	n	Mean	SD	95% CI for Mean lower	95% CI for Mean upper	ANOVA p-value
stay	1 519	23.2	28.7	21.8	24.7	0.034
move	311	19.6	22.7	17.0	22.1	
Total	1 830	22.6	27.8	21.3	23.9	

Source of drinking water

Just over half of the children had access to water from their own tap (56%). The lowest proportionate migration was reported for children where the household use the river or dam as their source of water (Table 4.12). A "communal tap" and "own tap" was proportionately most often the source of water in rural and urban areas respectively. A response of "other sources of water" was recorded in all rural areas regardless of migration status although this was not mentioned in urban areas. There was no difference in source of water when analysed according to similarity of migration patterns (Figure 4.27). Those children with access to their own water tap had the lowest share in recent migration while children who are reliant on communal taps had the highest share in recent migration. None of the differences with regard to the source of drinking water is statistically significant.

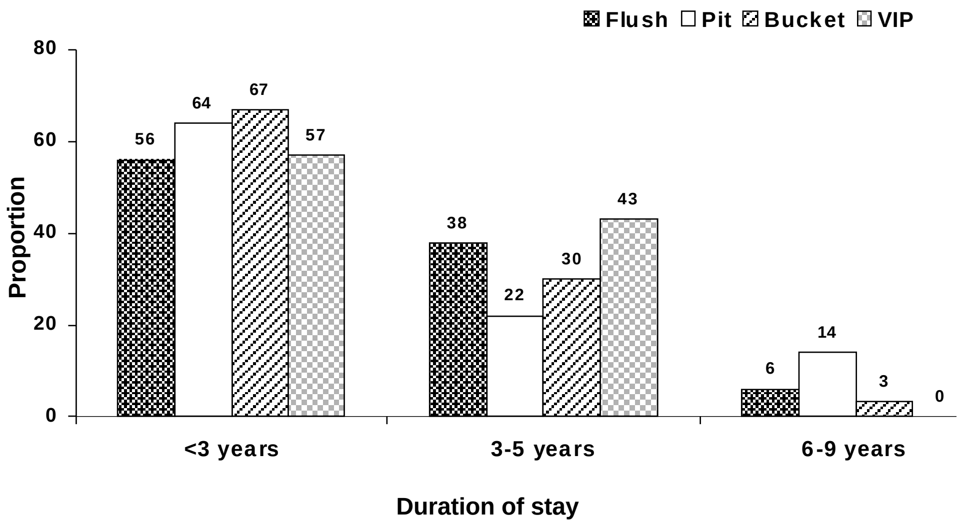
Figure 4.27: Proportionate similarity of migration pattern of child with mother and grandmother by source of drinking water: South Africa 1999



Type of toilet

Access to flush toilets and pit toilets were similar at 42% each. The highest rate of moving was reported for VIP toilets and the lowest for pit toilets (Table 4.12). Flush toilets were proportionately more common in urban areas and pit toilets in rural areas regardless of migration status or similarity of migration patterns. There is a statistically significant difference in the type of toilet with children who have been at their current residence for 3-5 years having the greatest share of flush toilets and 6-9 years' stay more reliant on pit toilets (Figure 4.28).

Figure 4.28: Type of toilet facility available to children who migrated by duration of stay at current residence: South Africa 1999



Fuel used for cooking

The majority of households use either electricity (45%) or paraffin (32%) as fuel for cooking. The rate of migration was the highest for children where the household use gas as cooking-fuel and the lowest where an open fire was used for cooking (Table 4.12). The latter group also reported the lowest proportionate occurrence of similar migration patterns for the mother and child. The proportionate distribution of use of electricity and paraffin was similar for rural-to-rural and rural-to-urban migration. Migration from urban to rural areas was mostly associated with the use of paraffin whereas urban-to-urban migration was more associated with the use of electricity. Although an open fire was used only by 8% of households, 66% of children who moved and who used an open fire, migrated in the period 1996-1999. None of the differences with regards to the type of fuel used, was statistically significant.

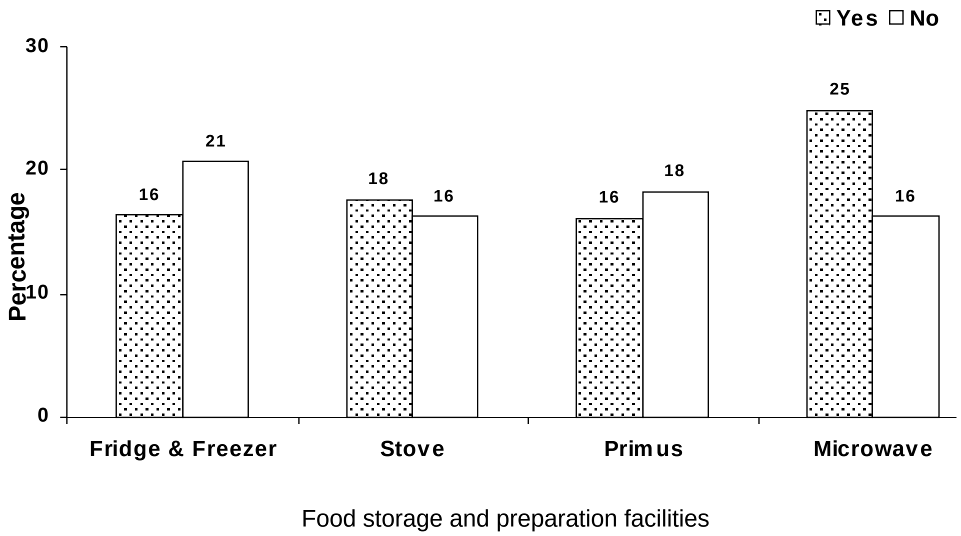
Cold food storage

The highest rate of moving took place in households of children who have access to both a working fridge and freezer although the majority of households (48%) did not have access to any food storage equipment (Figure 4.29; Table 4.12). Most households in rural areas (more than 62%) did not have a fridge or a freezer regardless of migration status. Children who migrated within urban areas had proportionately more access to both (45%) – even more than those who remained in urban areas (no migration) (36%) while children who moved from rural to urban areas did not have access to either a fridge or freezer (48%). The availability of a fridge and freezer was proportionately the lowest where children had the same migration pattern as their grandmothers or when there was no similarity in migration patterns. There is a statistically significant difference based on the availability of cold storage with 52% of recent migrants not having access to any cold storage facilities.

Cooking facilities

As far as access to cooking facilities are concerned, the only significant difference in rate of moving was with regard to a microwave oven where children in households with a microwave had a higher rate of moving (Figure 4.29; Table 4.12). This was specifically true for children for whom urban-to-urban migration was reported. Access to a stove and a microwave had a greater share in migration pattern similar to the mother and in intermediate migration in the period 1993-1995, while access to a primus was not as much associated with migration patterns similar to the mother.

Figure 4.29: Proportionate migration reported for children by access to food storage and preparation facilities: South Africa 1999

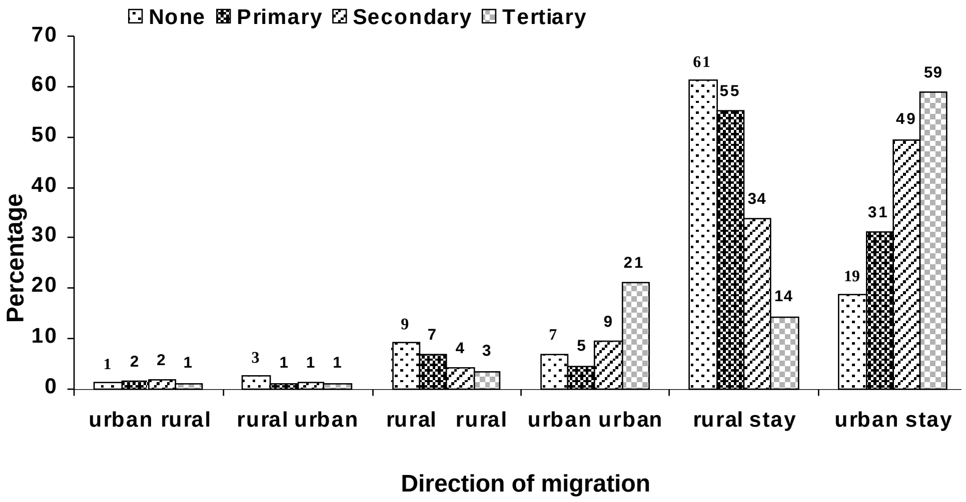


Educational level of mother

In households where the mother had tertiary education (7.7%) or no education (10.1%), the highest rate of moving (27% and 20% respectively) was reported for the child (Table 4.12). This finding agrees with the data of the UP/BU Migration Survey. Mothers with tertiary education reported the highest proportionate urban-to-urban migration whereas women with no education reported a proportionately higher share in rural-to-rural or rural-to-urban migration (Figure 4.30). For children with rural-to-rural migration the highest proportionate primary education was reported. In the case of mothers with tertiary education the proportion of children for whom no similarity in migration pattern was reported was the greatest. Children, whose mothers have secondary education, have the greatest proportionate share in recent migration in the period 1996-1999, while mothers with no education have the greater share in past migration.

The general pattern of proportionate migration reported for children according to their mother’s educational level mirrors that of the household income. This is to be expected in view of the relative availability of educational opportunities in urban areas and more and specifically higher education-related employment opportunities available in urban areas.

Figure 4.30: Proportionate direction of migration reported for children by educationallevel of mother: South Africa 1999



Television and radio

Although the rate of moving was similar for access to radio or television or both, the children for whom migration in an urban direction was reported had the highest access to both television and radio (Table 4.12). There was no significant difference based on the similarity of migration patterns and access to radio and television. Those children who did not have access to either television or radio reported the greatest proportionate recent migration.

Adjusted association between migration and socio-economic variables

As mentioned before, age can act as an important possible confounder, especially as a person's opportunity for migration is greater at a higher age. Therefore, the association of migration and socio-economic characteristics was assessed by looking at the relative risk (odds ratio) for migration (Table 4.14) after adjusting for age (numeric age i.e. age in months completed expressed as a proportion of 12). In order to calculate the odds ratio, socio-economic variables were transformed into dichotomous variables. The association between migration and the socio-economic characteristics of the study population (crude and adjusted for age) is summarized in Table 4.14. The same variables that were significantly associated with migration before adjustment were significantly associated with migration after adjustment for age, except the type of house that became significant and water source that was not significant after controlling for age. It would appear as if age is not a confounder in this study sample as all adjusted odds ratios are within 10% of the crude odds ratio.

A similar adjustment for socio-economic status was considered. However, as most of the variables are expressions of socio-economic status, it was not deemed necessary to control for income in the calculation of odds ratios.

Table 4.14: Association between migration of children aged 1-9 years and selected socio-economic variables: South Africa 1999 (crude and adjusted for age)

Variable	Category	n	Crude					Adjusted for age				
			Wald	Sig.	Exp(B) Odds ratio	95% C.I. Lower	95% C.I. Upper	Wald	Sig.	Exp(B) Odds ratio	95% C.I. Lower	95% C.I. Upper
Gender	Male	1 267	0.485	0.486	**0.929**	**0.754**	**-1.144**	0.280	0.597	**0.945**	**0.766**	**-1.166**
	Female	1 237										
Area of residence	**Urban**	1 296	13.393	0.000	**1.485**	**1.202**	**-1.836**	13.601	0.000	**1.494**	**1.207**	**-1.849**
	Rural	1 208										
Caretaker	**Mother**	1 621	0.384	0.535	**0.932**	**0.745**	**-1.165**	0.111	0.739	**0.962**	**0.768**	**-1.206**
	Other	804										
Gender of household head	**Female**	894	9.430	0.002	**0.696**	**0.552**	**-0.877**	9.957	0.002	**0.687**	**0.544**	**-0.867**
	Male	1 464										
Marital status of mother	**Married**	984	0.871	0.351	**1.107**	**0.894**	**-1.371**	0.214	0.644	**1.052**	**0.848**	**-1.305**
	not married	1 466										
Mother's employment	**Unemployed**	1 218	8.019	0.005	**0.723**	**0.577**	**-0.905**	6.004	0.014	**0.753**	**0.601**	**-0.945**
	not unemployed	951										
Type of house	**Brick**	1 638	2.951	0.086	**0.827**	**0.666**	**-1.027**	4.210	0.040	**0.795**	**0.639**	**-0.990**
	Other	837										
No. of people in household	**1-3 people**	326	8.391	0.004	**1.520**	**1.145**	**-2.018**	9.474	0.002	**1.567**	**1.177**	**-2.086**
	>3 people	2 162										

Table 4.14: Association between migration of children aged 1-9 years and selected socio-economic variables: South Africa 1999 (crude and adjusted for age) (continued)

Variable	Category	n	Crude					Adjusted for age				
			Wald	Sig.	Exp(B) Odds ratio	95% C.I. Lower	Upper	Wald	Sig.	Exp(B) Odds ratio	95% C.I. Lower	Upper
Income	**>R1000**	635	13.434	0.000	**1.555**	**1.228**	**-1.968**	13.467	0.000	**1.561**	**1.231**	**-1.980**
	<R1000	1 561										
Water source	**Own tap**	1 406	3.832	0.050	**1.238**	**1.000**	**-1.532**	3.350	0.067	**1.222**	**0.986**	**-1.515**
	Other	1 076										
Toilet	**Flush**	1 062	468.934	0.010	**1.335**	**1.073**	**-1.662**	6.437	0.011	**1.330**	**1.067**	**-1.658**
	Other	1 224										
Energy source	**Electricity**	1 136	3.699	0.054	**1.227**	**0.996**	**-1.512**	3.137	0.077	**1.209**	**0.980**	**-1.492**
	Other	1 359										
Cold storage	**Yes**	1 291	0.535	0.464	**1.082**	**0.876**	**-1.335**	0.167	0.683	**1.045**	**0.845**	**-1.292**
	None	1 183										
Microwave	**Yes**	254	11.222	0.001	**1.689**	**1.243**	**-2.295**	8.347	0.004	**1.579**	**1.158**	**-2.152**
	No	2 179										
Mothers' education	**>Std 8**	765	3.498	0.061	**1.242**	**0.990**	**-1.558**	3.780	0.052	**1.254**	**0.998**	**-1.576**
	<=Std 8	1 510										
Radio/TV	**Yes**	2 142	0.000	0.987	**1.002**	**0.741**	**-1.356**	0.041	0.839	**0.969**	**0.715**	**-1.313**
	No	346										

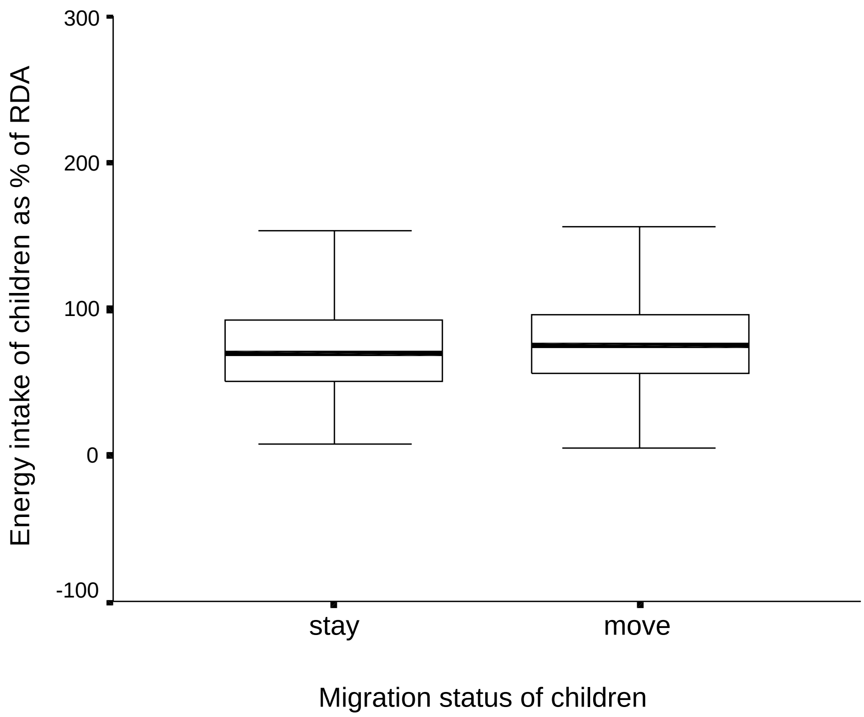
Nutrient intake

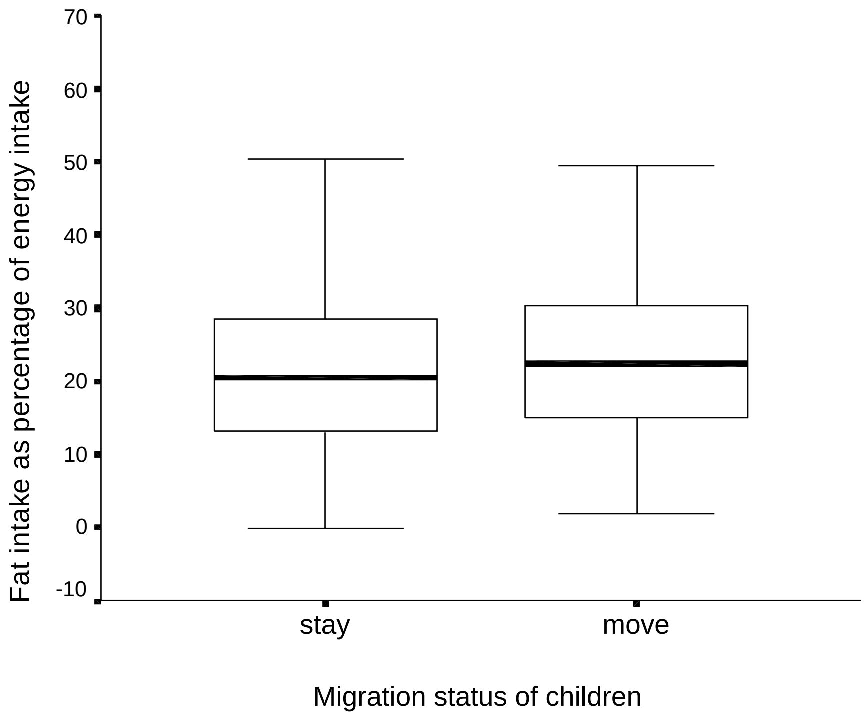
Internal migration and nutrient intake

As reported in the NFCS (Labadarios (ed.), 2000:224) nearly 96% of children were reported to follow their usual eating patterns on the day of the interview. Nutrient intake was calculated as the proportion of the Recommended Dietary Allowance (RDA) (Institute of Medicine, 1997:71-145; Institute of Medicine, 1998:58-147, 566-567; Earl & Borra, 2000:332-335; Institute of Medicine, 2000:82-185, 290-393, 442-501, 770-773) consumed for each specific age category, as this would render this variable age independent. This was deemed essential in view of the colinearity between migration and age. For fibre intake the Adequate Intake (AI) was used as the recommended reference value as an RDA does not exist (Institute of Medicine 2002: 12). For fat intake the contribution of fat to the energy consumption was calculated and 30% of energy was used as the recommended reference intake as the recommendation (Institute of Medicine, 2002:661) is given as a range of 30-40% for children 1-3 years, and 25-35% for children 4-18 years. For ease of reference the recommended value for fibre and fat will also be included when general reference for the group of nutrients is made to the RDA, but when listed individually, like in tables, it would be stipulated clearly that the AI for fibre (and <67% of AI for insufficient intake) and the recommendation for fat as a proportion of energy intake (and >30 % of energy from fat as excessive) is used for classification. The source of information for the RDA value will be as stated in each table and figure, or when reference is made to the concept of the RDA the source of information will always be Earl & Borra (2000:332) and Institute of Medicine (2000:30) as stated in the definitions. The RDA for energy, protein (Institute of Medicine, 2002:10, 16, 93-696), vitamin A, iron, and zinc (Institute of Medicine 2001:1-81) was revised in 2001 and 2002, but the values as was available in 2000 was used in this thesis to ensure comparability with the source study, the NFCS.

The proportion of the RDA consumed by children for all the nutrients analysed, i.e. energy, protein, fat, fibre, vitamin A, vitamin C, thiamin, niacin, riboflavin, iron and zinc, was higher for children who moved. These differences were statistically significant for energy, fat, vitamin C, niacin, iron, and zinc (Figure 4.31; Figure 4.32; Table 4.15; Table 4.16).

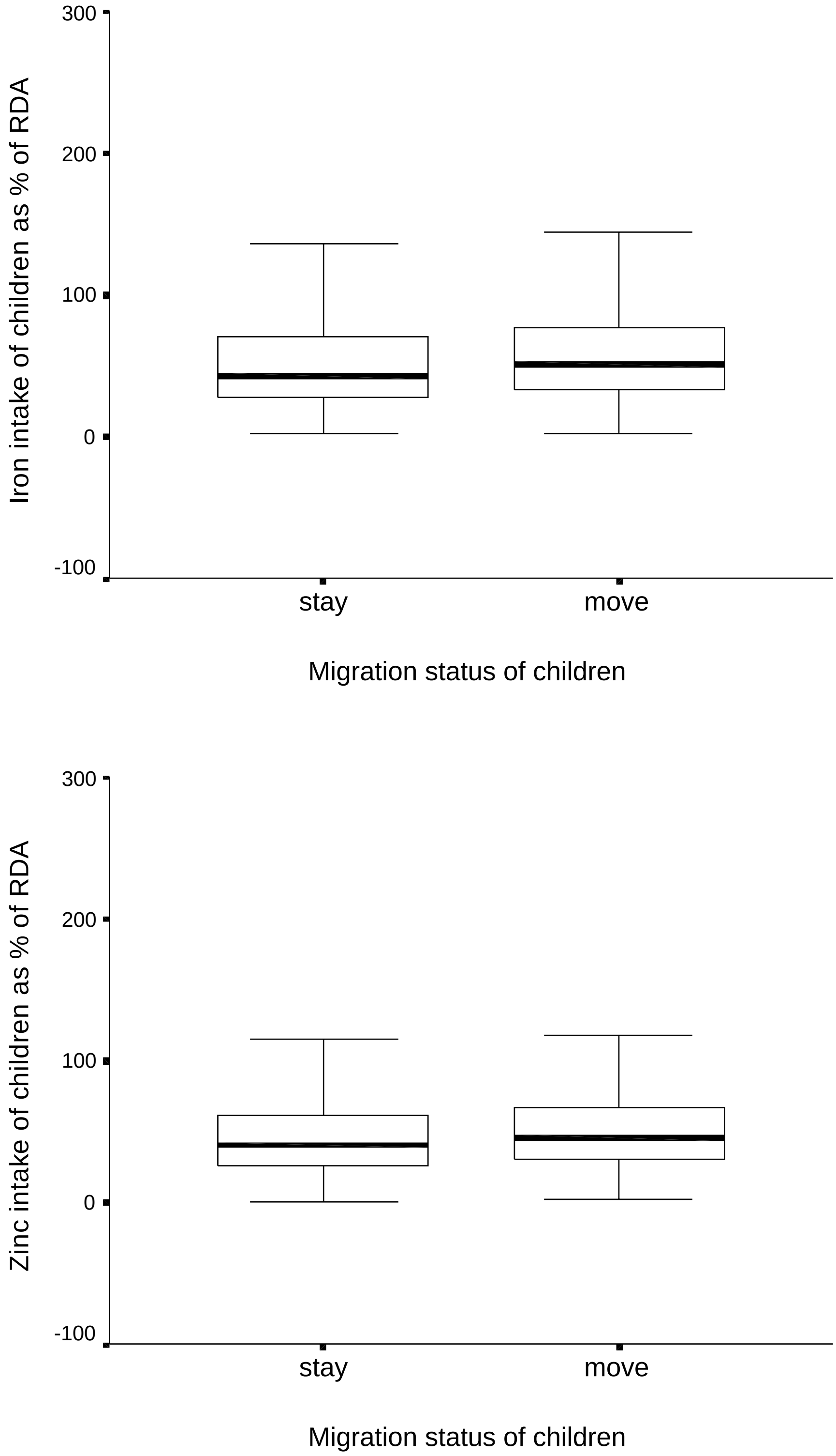
Figure 4.31: Box-and-whisker plots for proportion of the RDA* consumed of energy and fat for children aged 1-9 years by migration status: South Africa1999 (extreme values and outliers excluded)





*** (Earl & Borra, 2000:334-335; Institute of Medicine, 2002:16)**

Figure 4.32: Box-and-whisker plots for proportion of the RDA* consumed of iron and zinc for children aged 1-9 years by migration status: South Africa 1999 **(extreme values and outliers excluded)**



*** (Institute of Medicine, 1998:566-567; Earl & Borra, 2000:334-335)**

Table 4.15: Proportion of the RDA* for selected macronutrients consumed by children aged 1-9 years by migration status: South Africa 1999

Nutrient	Migration status	n	Mean	SD	95% CI for Mean Lower	95% CI for Mean Upper	Median Q2	Quartile Q1	Quartile Q3	ANOVA p-value
Energy	stay	2 069	74.0	32.9	72.5	75.4	69.3	50.3	92.0	0.002
	move	423	79.4	35.4	76.0	82.7	75.3	55.1	96.4	
	Total	2 492	74.9	33.4	73.6	76.2	70.1	50.9	93.0	
Protein	stay	2 069	173.9	96.1	169.7	178.0	154.6	102.3	226.6	0.152
	move	423	181.2	91.7	172.4	190.0	167.1	115.1	234.3	
	Total	2 492	175.1	95.4	171.4	178.9	157.1	103.9	227.3	
Fat	stay	2 071	21.2	10.7	20.8	21.7	20.4	13.1	28.3	0.007
(% of E)	move	426	22.8	10.2	21.8	23.7	22.4	15.0	30.2	
	Total	2 497	21.5	10.6	21.1	21.9	20.8	13.4	28.7	
Fibre	stay	2 069	51.5	36.1	49.9	53.0	44.1	27.1	66.0	0.084
(% of AI))	move	426	54.8	35.8	51.4	58.2	47.4	32.0	69.4	
	Total	2 495	52.1	36.1	50.6	53.5	44.6	27.6	66.3	

* (Earl & Borra, 2000: 334-335; Institute of Medicine, 2002: 16, 661)

Table 4.16: Proportion of the RDA* for selected micronutrients consumed by children aged 1-9 years by migration status: South Africa 1999

Nutrient	Migration status	n	Median Q2	Quartiles Q1	Quartiles Q3	Mean	SD	**Mann Whitney p-value**
Vitamin A	stay	2 067	36.5	15.5	80.2	84.0	196.4	0.117
	move	423	40.1	18.5	80.0	93.9	266.3	
	Total	2 490	37.4	16.1	80.2	85.7	209.9	
Vitamin C	stay	2 068	34.8	7.9	78.1	80.6	313.2	0.001
	move	423	43.1	10.4	108.9	94.8	177.1	
	Total	2 491	36.7	8.3	80.6	83.0	294.6	
Thiamin	stay	2 068	105.8	72.9	150.8	118.5	64.2	0.155
	move	423	108.8	76.9	151.2	122.6	65.4	
	Total	2 491	106.5	73.5	150.8	119.2	64.4	
Niacin	stay	2 068	74.5	41.2	124.0	93.5	70.0	0.001
	move	423	86.3	49.3	138.8	104.8	73.2	
	Total	2 491	76.4	42.4	127.7	95.4	70.6	
Riboflavin	stay	2 069	69.3	37.9	134.6	113.4	127.9	0.136
	move	423	77.6	40.3	141.0	118.6	129.7	
	Total	2 492	70.2	38.4	136.1	114.3	128.2	

* (Institute of Medicine, 1998:566-567; Earl & Borra, 2000:334-335)

Table 4.16: Proportion of the RDA* for selected micro-nutrients consumed by children aged 1-9 years by migration status: South Africa 1999 (continued)

Nutrient	Migration status	n	Median Q2	Quartiles Q1	Q3	Mean	SD	Mann Whitney p-value
Calcium	stay	2 069	36.7	16.9	68.1	52.2	54.5	0.401
	move	423	37.7	18.8	72.8	51.8	47.2	
	Total	2 492	37.0	17.4	68.7	52.1	53.3	
Iron	stay	2 066	43.6	27.2	70.8	54.5	40.0	0.001
	move	423	51.2	32.7	77.6	60.4	42.0	
	Total	2 489	45.5	27.9	71.7	55.5	40.4	
Zinc	stay	2 069	40.7	25.8	61.7	47.5	30.4	<0.001
	move	423	46.2	29.7	66.5	52.7	31.6	
	Total	2 492	41.5	26.4	62.4	48.4	30.7	

* (Institute of Medicine, 1998:566-567; Earl & Borra, 2000:334-335)

The seemingly superiority of the nutrient intake of children who migrated is mainly the result of the significantly lower intakes of children in rural areas (as described by Labadarios (ed.), 2000:260-282), the low intakes of children who stayed rural, and the relatively higher intakes of children who moved urban-to-urban (Table 4.17, Table 4.18, Table 4.19). Of children who moved, those children who moved rural-to-rural reported the lowest consumption of the RDA for protein, fat, riboflavin, and calcium and those who moved rural-to-urban reported the lowest intakes for energy, fibre, vitamin C and thiamin. Urban-to-rural movers reported the lowest intakes of vitamin A, niacin and iron. Children who stayed rural had lower intakes for all nutrients than those who stayed urban except for fibre. The protein, fat, vitamin A, niacin, and zinc intake of children who stayed rural was lower than all other children, even lower than those rural children who moved (Figure 4.33; Figure 3.34). The differences in the mean intake were statistically significant by direction of migration for all macronutrients. The differences in the median intake of micronutrients by the direction of migration were also statistically significant for all nutrients except thiamin, according to the Kruskal-Wallis statistic (Table 4.17; Table 4.18; Table 4.19).

Although the picture is not as clear for the median proportion of the micronutrients consumed, a similar general pattern is found as for the macronutrients with children who stayed rural and those who moved rural-to-rural consuming the lowest proportions of the RDA and children who moved urban-to-urban and who stayed urban consuming the highest proportions of the RDA. The rural-to-urban and urban-to-rural migrants always assume the “middle” position. This finding is supported by the socio-economic characteristics of migrants where urban migrants are often from higher socio-economic strata.

It should be noted that the data mentioned above is presented in this thesis as line graphs although it is acknowledged that the data is not a continuum. This approach was chosen to allow a graphical comparison of a number of different nutrients on one graph. The line is used to highlight the often very subtle trends across the different categories — direction of migration and similarity of migration patterns.

Figure 4.33: Mean proportion of the RDA for selected macronutrients consumed by children aged 1-9 years by direction of migration: South Africa 1999 (24-HR-Q)

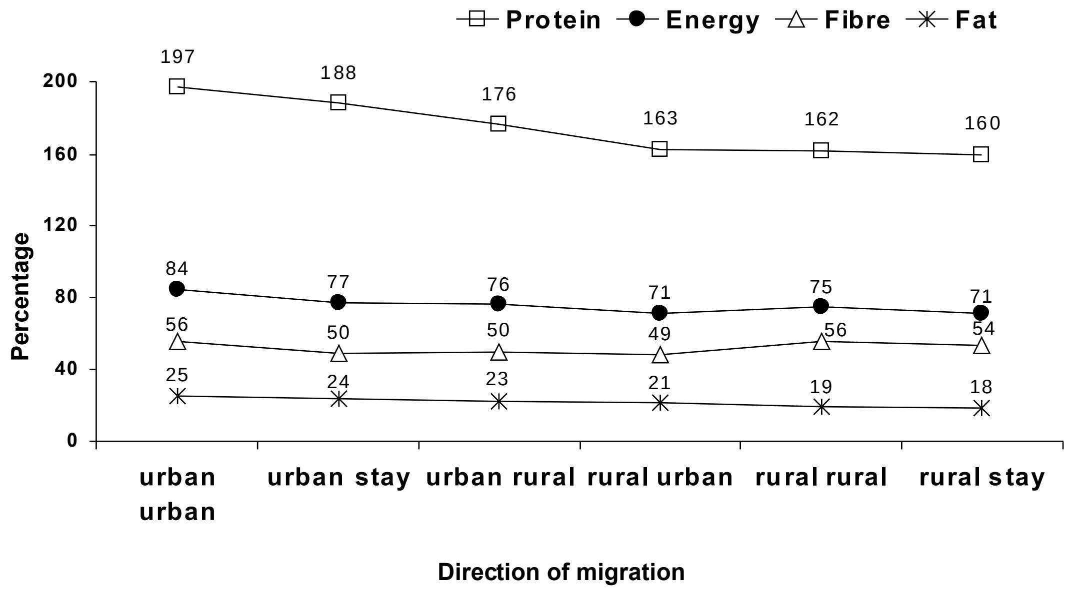


Figure 4.34: Median proportion of the RDA for selected micronutrients consumed by children aged 1-9 years by direction of migration: South Africa 1999 (24-HR-Q)
(data values not indicated as they are too close together)

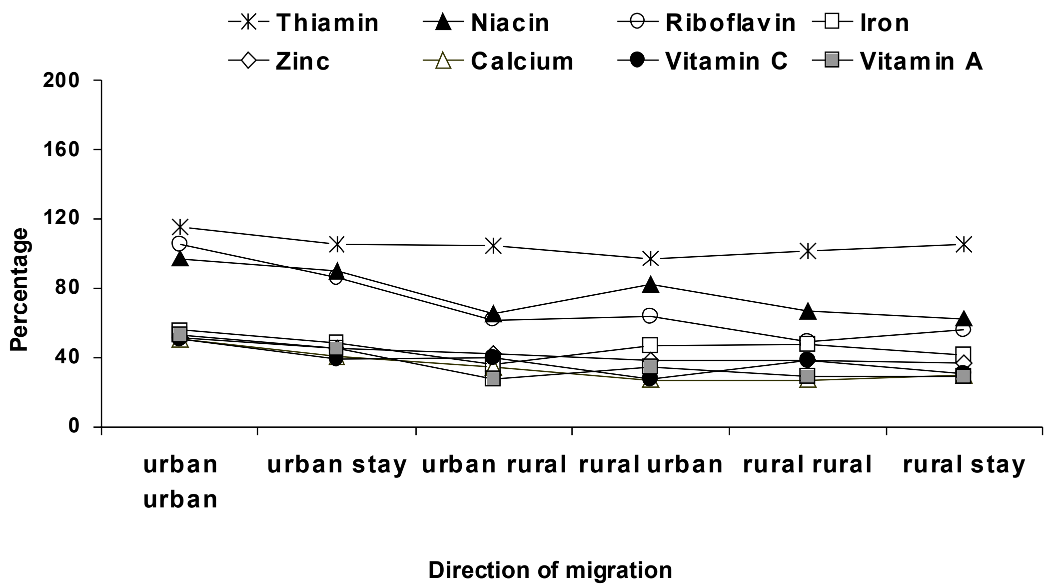


Table 4.17: Proportion of the RDA* for selected macronutrients consumed by children aged 1-9 years by direction of migration: South Africa 1999

Nutrient	Direction	n	Mean	SD	95% CI for Mean		ANOVA
					Lower	Upper	p-value
Energy	rural stay	1 034	71.0	31.5	69.1	72.9	<0.001
	rural rural	130	74.9	36.4	68.6	81.3	
	rural urban	37	70.9	28.6	61.4	80.4	
	urban rural	41	75.8	32.3	65.6	86.0	
	urban stay	1 035	76.9	33.9	74.8	79.0	
	urban urban	215	84.2	35.9	79.4	89.0	
	Total	2 492	74.9	33.4	73.6	76.2	
Protein	rural stay	1 034	159.7	87.6	154.3	165.0	<0.001
	rural rural	130	161.8	87.4	146.6	176.9	
	rural urban	37	162.5	78.6	136.3	188.7	
	urban rural	41	175.8	88.8	147.7	203.8	
	urban stay	1 035	188.1	102.0	181.8	194.3	
	urban urban	215	197.2	94.4	184.5	209.9	
	Total	2 492	175.1	95.4	171.4	178.9	
Fat (% of energy)	rural stay	1 034	18.4	10.3	17.8	19.0	<0.001
	rural rural	130	19.4	10.7	17.5	21.2	
	rural urban	37	21.4	9.0	18.4	24.4	
	urban rural	41	22.6	10.3	19.4	25.9	
	urban stay	1 037	24.1	10.4	23.4	24.7	
	urban urban	218	25.1	9.4	23.8	26.3	
	Total	2 497	21.5	10.6	21.1	21.9	
Fibre (% AI)	rural stay	1 033	53.5	38.9	51.1	55.9	0.040
	rural rural	130	56.3	35.3	50.1	62.4	
	rural urban	37	48.5	26.3	39.7	57.3	
	urban rural	41	50.2	32.0	40.1	60.3	
	urban stay	1 036	49.5	33.0	47.5	51.5	
	uban urban	218	55.9	38.2	50.8	61.0	
	Total	2 495	52.1	36.1	50.6	53.5	

* (Earl & Borra, 2000:334-335; Institute of Medicine, 2002:16, 661)

Table 4.18: Proportion of the RDA* for selected vitamins consumed by children aged 1-9 years by direction of migration: South Africa 1999

Nutrient	Direction	n	Median	Quartiles Q1	Q3	Mean	SD	Kruskal-Wallis p-value
Vitamin A	rural stay	1 033	29.2	10.5	65.5	57.3	99.0	<0.001
	rural rural	130	29.8	11.2	68.6	95.9	395.6	
	rural urban	37	34.8	13.8	62.6	70.1	123.5	
	urban rural	41	28.3	15.0	62.3	69.6	128.6	
	urban stay	1 034	45.3	21.2	94.1	110.7	256.8	
	urban urban	215	52.7	27.4	103.2	101.3	198.9	
	Total	2 490	37.4	16.1	80.2	85.7	209.9	
Vitamin C	rural stay	1 033	30.7	6.4	63.2	67.9	393.5	<0.001
	rural rural	130	38.3	6.0	91.0	97.1	250.6	
	rural urban	37	27.8	4.8	73.6	65.9	104.9	
	urban rural	41	40.0	12.9	106.7	92.9	155.2	
	urban stay	1 035	39.0	10.5	92.0	93.2	203.1	
	urban urban	215	50.8	18.2	127.9	98.8	132.2	
	Total	2 491	36.7	8.3	80.6	83.0	294.6	
Thiamin	rural stay	1 033	106.0	73.2	150.9	118.9	64.1	0.333
	rural rural	130	101.7	74.6	155.1	125.3	79.2	
	rural urban	37	97.1	65.3	137.5	110.5	57.1	
	urban rural	41	105.2	76.5	142.6	112.3	52.8	
	urban stay	1 035	105.7	72.7	150.8	118.1	64.5	
	urban urban	215	115.2	80.6	151.2	125.0	59.4	
	Total	2 491	106.5	73.5	150.8	119.2	64.4	
Niacin	rural stay	1 033	63.0	37.0	102.9	78.3	56.8	<0.001
	rural rural	130	67.5	40.9	123.5	91.6	71.8	
	rural urban	37	82.8	48.4	128.9	93.4	58.9	
	urban rural	41	65.3	39.1	129.5	90.7	73.8	
	urban stay	1 035	89.8	48.8	151.1	108.7	78.1	
	urban urban	215	97.3	60.0	164.4	117.4	74.5	
	Total	2 491	76.4	42.4	127.7	95.4	70.6	
Riboflavin	rural stay	1 034	55.9	31.5	102.2	85.8	94.4	<0.001
	rural rural	130	49.2	29.1	91.9	84.2	121.4	
	rural urban	37	64.3	45.1	109.1	94.7	92.2	
	urban rural	41	62.2	47.4	131.9	123.8	139.8	
	urban stay	1 035	85.7	46.4	185.3	140.9	149.4	
	urban urban	215	106.0	49.9	192.0	142.6	133.5	
	Total	2 492	70.2	38.4	136.1	114.3	128.2	

* (Institute of Medicine, 1998:566-567; Earl & Borra, 2000:334-335)

Table 4.19: Proportion of the RDA for selected minerals consumed by children aged 1-9 years by direction of migration: South Africa 1999

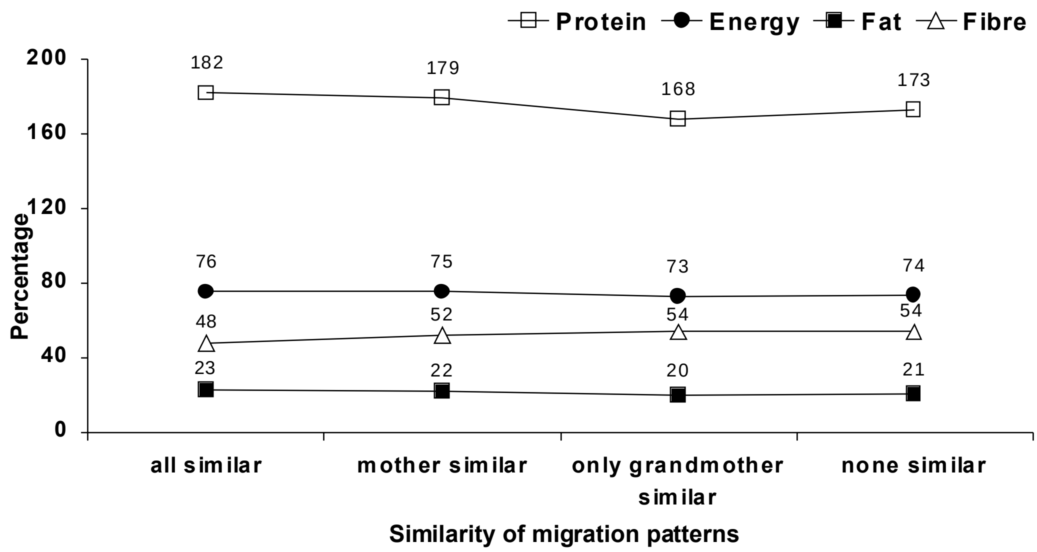
Nutrient	Direction	n	Median	Quartiles		Mean	SD	Kruskal-Wallis
				Q1	Q3			p-value
Calcium	rural stay	1 034	30.3	14.3	64.5	48.2	54.0	<0.001
	rural rural	130	27.3	13.2	50.3	38.2	34.0	
	rural urban	37	27.5	15.4	49.2	39.7	35.9	
	urban rural	41	34.6	16.6	85.9	55.7	56.6	
	urban stay	1 035	41.0	20.8	73.2	56.1	54.7	
	urban urban	215	50.3	22.0	83.2	61.4	51.4	
	Total	2 492	37.0	17.4	68.7	52.1	53.3	
Iron	rural stay	1 031	41.6	26.6	65.8	52.5	41.3	<0.001
	rural rural	130	47.8	28.0	71.6	56.3	40.7	
	rural urban	37	46.8	33.8	68.0	50.6	25.1	
	urban rural	41	36.1	21.6	71.7	48.3	32.4	
	urban stay	1 035	48.1	28.8	76.1	56.6	38.7	
	urban urban	215	56.0	37.0	85.8	66.8	45.7	
	Total	2 489	45.5	27.9	71.7	55.5	40.4	
Zinc	rural stay	1 034	37.2	24.5	53.8	43.3	27.3	<0.001
	rural rural	130	38.8	26.8	58.6	47.3	31.5	
	rural urban	37	38.5	29.5	63.3	50.0	34.4	
	urban rural	41	42.5	26.5	61.6	49.3	29.2	
	urban stay	1 035	45.4	27.6	67.9	51.8	32.7	
	urban urban	215	51.5	33.7	73.4	57.0	31.3	
	Total	2 492	41.5	26.4	62.4	48.4	30.7	

* (Institute of Medicine, 1998:566-567; Earl & Borra, 2000:334-335)

Traditionally, investigations of the health and nutritional status of migrations would provide for a comparison not only with the destination (host), but also with the origin as was done, for example, by Kouris-Blazos (2002:S569), Fredriks *et al.* (2003:788), and Guendelman *et al*. (1999:177). Such a comparison could provide more information on the estimation of the impact of migration on adults and children. In this study it was not deemed appropriate to do a comparison based on origin and destination, as that would require combining groups with distinct differences i.e. heterogeneous effect measures (Rothman & Greenland, 1998:51), for example, combining children who moved rural-to-rural with those who moved urban-to-rural (as they would have the same destination) or urban-to-urban and urban-to-rural (as they would have the same origin).

Children who had migration patterns which are not similar to their mother's, reported to consume lower proportions of the RDA for energy, protein, vitamin C, niacin, riboflavin and calcium. When analysed according to migration status, the children who had similar migration patterns as their grandmothers in general – and specifically those who moved – had the lowest proportionate consumption of the RDA. The difference according to similarity of lifetime patterns was only statistically significant for protein and fat intake of children who moved (Figure 4.35; Table 4.20). None of the differences in micronutrient intake were statistically significant according to similarity of migration patterns, regardless of migration status.

Figure 4.35: Mean proportion of the RDA for selected macronutrients consumed by children aged 1-9 years by similarity of migration patterns: South Africa 1999 (24-HR-Q)



Children who migrated in the period 1989-1992 consumed the lowest proportions of the RDA for the macronutrients (energy and protein) and children who migrated most recently consumed the lowest proportions of the RDA for the micronutrients, except riboflavin and calcium. None of these differences in proportion of the RDA consumed by migrants according to the duration of stay at current residence were statistically significant (data not shown).

Table 4.20: Proportion of the RDA for macronutrients consumed by children aged 1-9 years by similarity of migration pattern with mother and grandmother and migration status: South Africa 1999

Nutrient	Migration status	Category	n	Mean	SD	95% CI for Mean Lower	95% CI for Mean Upper	ANOVA p- value
Energy	stay	both similar	255	75.0	33.2	70.9	79.1	0.731
		only mother similar	1 129	74.2	33.6	72.3	76.2	
		only grandmother similar	293	72.7	30.0	69.2	76.1	
		none similar	128	76.3	36.3	70.0	82.7	
		Total	1 805	74.2	33.2	72.7	75.8	
	move	both similar	27	81.9	44.8	64.1	99.6	0.401
		only mother similar	226	81.7	33.7	77.3	86.1	
		only grandmother similar	34	71.6	31.8	60.6	82.7	
		none similar	78	78.2	30.6	71.3	85.1	
		Total	365	80.0	33.8	76.5	83.5	
Protein	stay	both similar	255	182.0	104.9	169.0	194.9	0.426
		only mother similar	1 129	176.4	98.5	170.6	182.1	
		only grandmother similar	293	170.3	90.9	159.8	180.7	
		none similar	128	168.2	87.6	152.8	183.5	
		Total	1 805	175.6	97.5	171.1	180.1	
	move	both similar	27	183.0	124.8	133.6	232.4	0.035
		only mother similar	226	191.9	88.2	180.3	203.4	
		only grandmother similar	34	148.1	73.2	122.5	173.6	
		none similar	78	171.0	87.3	151.3	190.7	
		Total	365	182.7	90.6	173.3	192.0	
Fat (%E)	stay	both similar	255	22.7	11.1	21.3	24.1	0.063
		only mother similar	1 131	21.9	11.0	21.2	22.5	
		only grandmother similar	293	20.7	9.5	19.6	21.8	
		none similar	128	20.3	10.3	18.5	22.1	
		Total	1 807	21.7	10.7	21.2	22.2	
	move	both similar	27	22.2	12.1	17.4	27.0	0.001
		only mother similar	226	24.9	9.7	23.7	26.2	
		only grandmother similar	35	19.7	10.7	16.0	23.3	
		none similar	79	20.7	9.2	18.6	22.7	
		Total	367	23.3	10.1	22.3	24.3	
Fibre	stay	both similar	255	47.5	31.3	43.7	51.4	0.256
		only mother similar	1 130	51.8	35.2	49.7	53.8	
		only grandmother similar	293	53.5	44.8	48.4	58.7	
		none similar	128	52.5	37.2	46.0	59.0	
		Total	1 806	51.5	36.6	49.8	53.2	
	move	both similar	27	51.5	30.5	39.4	63.6	0.652
		only mother similar	226	52.7	30.3	48.8	56.7	
		only grandmother similar	35	59.0	60.5	38.2	79.7	
		none similar	79	56.6	31.1	49.7	63.6	
		Total	367	54.1	34.4	50.6	57.6	

* (Earl & Borra, 2000:334-335; Institute of Medicine, 2002:16, 661)

In summary, on the basis of nutrient consumption expressed as the proportion of the RDA for each age category consumed, it is clear that children who remained rural were worst off and those who moved urban-to-urban were best off. Overall the nutrient intake of all children who moved was better off except children who moved and had similar migration patterns to their grandmothers only. Recency of migration showed no statistical differences between groups.

From a public health nutrition perspective it is important to identify specific groups at risk of insufficient intake. An intake of less than 67% of the RDA is regarded as insufficient to maintain health and will therefore be used as the cut-off to classify children's diets. The analyses of these groups of children with "insufficient" intake compared to those with adequate intake by migration differentials will provide an estimate of the extent of the public health problem and can also be used for comparison of prevalence of insufficient intake in other studies. The Chi-square statistic will be used as a measure of difference within each nutrient. This dichotomised nutrient intake will also be used later in logistic regression to obtain an odds ratio adjusted for various socio-economic covariates.

Fat and fibre will not be included in these general comparisons that are indicative of undernutrition, but will rather be analysed and illustrated separately, later in this chapter, to reflect on a possible nutrition transition.

For all the nutrients analysed (except fat and fibre), a smaller proportion of children who migrated consumed less than 67% of the RDA. These differences were statistically significant for energy (odds ratio 0.685), vitamin C (odds ratio 0.665), niacin (odds ratio 0.775), iron (odds ratio 0.726) and zinc (odds ratio 0.751) (Figure 4.36; Table 4.21).

Figure 4.36: Proportion of children aged 1-9 years with insufficient nutrient intake (<67% RDA) by migration status: South Africa 1999 (24-HR-Q)

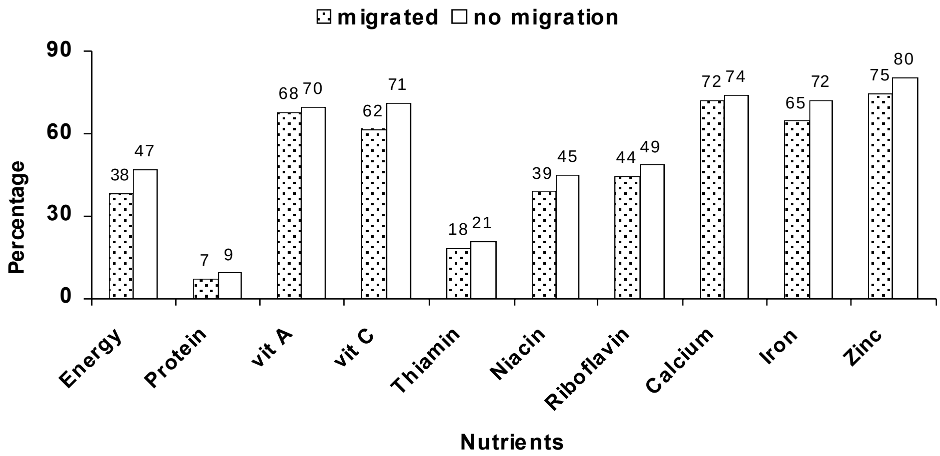


Table 4.21: Proportion of children aged 1-9 years who consumed <67% of the RDA by migration status: South Africa 1999

Nutrient	Total %	Migration status: No movement n=2070	Migration status: Moved N=423	Odds ratio for move, <67% RDA	95% CI Lower	95% CI Upper	Chi-square p-value
Energy	45.50	47.10	37.90	0.685	0.553	0.850	0.001
Protein	9.00	9.40	7.30	0.764	0.514	1.134	0.181
Vitamin A	69.30	69.90	67.70	0.911	0.728	1.140	0.412
Vitamin C	69.50	71.00	61.90	0.665	0.535	0.827	<0.001
Thiamin	20.20	20.60	18.20	0.860	0.657	1.125	0.273
Niacin	43.90	45.00	38.80	0.775	0.626	0.960	0.019
Riboflavin	47.80	48.50	44.40	0.850	0.689	1.049	0.132
Calcium	73.70	74.00	72.30	0.916	0.724	1.158	0.471
Iron	71.00	72.10	65.20	0.726	0.581	0.906	0.004
Zinc	79.50	80.30	75.40	0.751	0.587	0.961	0.022

* (Institute of Medicine, 1998:566-567; Earl & Borra, 2000:334-335; Institute of Medicine, 2002:16, 661)

When analysed according to the direction of migration, the general finding that a smaller proportion of children who migrated consumed <67% of the RDA for the ten nutrients analysed, holds true only for those children for whom urban-to-urban migration was reported (Figure 4.37; Table 4.22). A similar general trend as was displayed by the mean proportion of the RDA consumed is found on the basis of proportion of children who consumed <67% of the RDA for the two “best off” groups i.e. the urban-to-urban movers and those who stayed urban. Children who moved urban-to-urban were reported to have the smallest proportion of children who consumed insufficient proportions of the RDA for all ten of the nutrients. Those children who stayed urban reported the second lowest proportion with insufficient intake for 6/10 nutrients (protein, vitamin A, thiamine, niacin, riboflavin, calcium and zinc).

In contrast to the finding based on mean or median nutrient consumption, where those that stayed rural and children who moved rural-to-rural clearly were worse off than the others, the “worst off” group would appear to be children who stayed rural as they were the group for whom the highest proportion of insufficient intake was reported for 6/10 nutrients (energy, vitamin C, niacin, riboflavin, iron and zinc). The “intermediate” group, with no clear trend within the group, is made up of children who moved rural-to-rural, rural-to-urban and urban-to-rural with each group being reported as having the highest or second highest proportion of insufficient nutrient intake for at least two or three nutrients. The differences in the proportion of insufficient intake on the basis of direction of migration were statistically significant for all nutrients except for thiamine.

Figure 4.37: Proportion of children aged 1-9 years with insufficient nutrient intake (<67% RDA) according to direction of migration: South Africa 1999

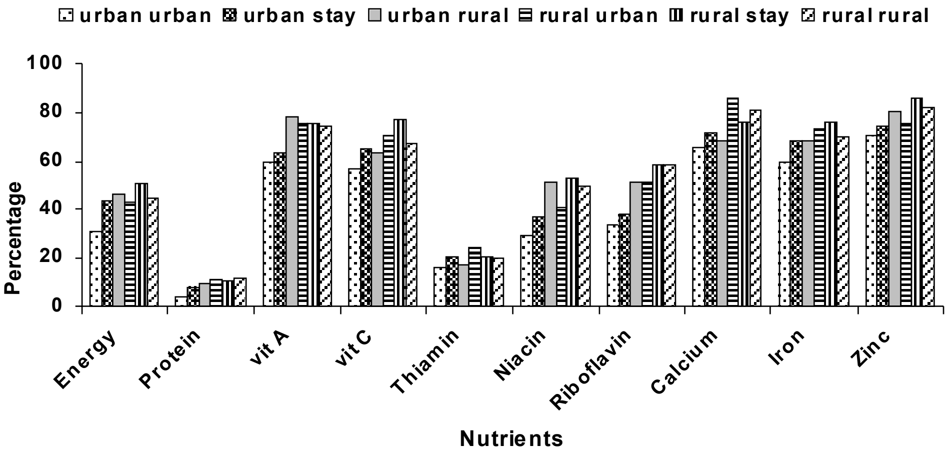


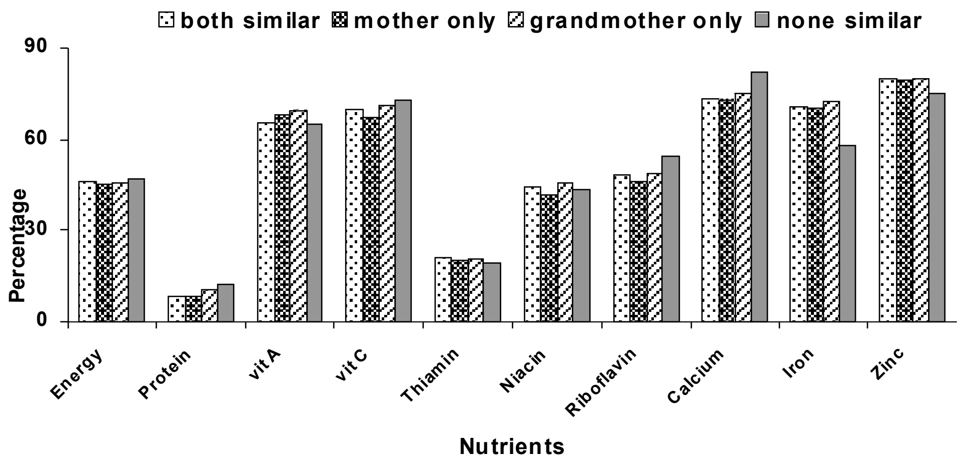
Table 4.22: Proportion of children aged 1-9 years with nutrient intake <67% of the RDA* by direction of migration: South Africa 1999

Nutrient	Direction of migration						Chi-square p-value
	rural stay	rural rural	rural urban	urban rural	urban stay	urban urban	
Number (n)	1035	130	37	41	1035	215	
Energy	50.6%	44.6%	43.2%	46.3%	43.5%	31.3%	<0.001
Protein	10.5%	11.5%	10.8%	9.8%	8.2%	3.7%	0.032
Vitamin A	75.5%	74.6%	75.7%	78.0%	63.7%	60.0%	<0.001
Vitamin C	77.1%	67.7%	70.3%	63.4%	64.9%	56.7%	<0.001
Thiamin	20.5%	20.0%	24.3%	17.1%	20.6%	16.3%	0.722
Niacin	53.1%	50.0%	40.5%	51.2%	36.9%	29.3%	<0.001
Riboflavin	58.5%	58.5%	51.4%	51.2%	38.5%	33.5%	<0.001
Calcium	76.3%	80.8%	86.1%	68.3%	71.6%	65.6%	0.001
Iron	75.9%	70.8%	73.0%	68.3%	68.4%	60.0%	<0.001
Zinc	86.1%	82.3%	75.7%	80.5%	74.6%	70.2%	<0.001

* (Institute of Medicine, 1998:566-567; Earl & Borra, 2000:334-335; Institute of Medicine, 2002:16, 661)

Those children for whom information on the mother and/or grandmother was available, and who had the same migration pattern as both their mother and grandmother, had the highest proportion of children with intake <67% of the RDA for two nutrients (thiamin at 21% and zinc at 80%), with only grandmother similar having three nutrients (vitamin A at 70%, niacin at 46%, and iron at 72%), and no similarity in migration patterns having the highest proportion of children with intakes <67% of the RDA for five nutrients (energy at 47%, protein at 12%, vitamin C at 73%, riboflavin at 54% and calcium at 82%) (Figure 4.38; Table 4.23; Table 4.24). These differences were statistically significant for only three nutrients, i.e. riboflavin, calcium and iron.

Figure 4.38: Proportion of children aged 1-9 years with insufficient nutrient intake (<67% RDA) according to similarity of migration patterns: South Africa 1999



When the prevalence of insufficient nutrient intake (<67% of the RDA) is analysed according to whether the child has been with the mother during his/her lifetime — even though information on this aspect was available for only 70% of children — then higher proportions of children who have been with their mother all the time consumed <67% of the RDA for vitamin A, thiamine, iron and zinc, while children who have not been with their mother, took in less of the RDA for all other nutrients. This was statistically significant for protein, vitamin C, riboflavin, calcium and iron (data not shown).

Table 4.23: Proportion of children aged 1-9 years with nutrient intake <67% of the RDA* by similarity of migration patterns: South Africa 1999 (n=2163)

Nutrient	Similarity of migration pattern				Chi-square p-value
	All similar	**Only mother similar**	**Only grandmother similar**	**None similar**	
Number (n)	284	1 369	331	454	
Energy	46.1%	45.5%	45.8%	47.0%	0.952
Protein	8.1%	8.3%	10.6%	12.3%	0.056
Vitamin A	65.5%	68.2%	69.8%	64.9%	0.390
Vitamin C	70.1%	67.4%	71.3%	72.7%	0.141
Thiamin	21.1%	20.3%	20.8%	19.6%	0.958
Niacin	44.4%	41.7%	45.9%	43.6%	0.508
Riboflavin	48.6%	46.2%	48.9%	54.3%	0.028
Calcium	73.5%	73.2%	75.2%	82.2%	0.002
Iron	70.7%	70.4%	72.2%	58.1%	<0.001
Zinc	79.9%	79.3%	79.8%	75.1%	0.240

* (Institute of Medicine, 1998:566-567; Earl & Borra, 2000:334-335; Institute of Medicine, 2002:16, 661)

Analyses of the prevalence of insufficient nutrient intake by similarity with the mother and migration status, reveals that being with the mother has a protective effect on the proportion of children who consumed insufficient proportions of the RDA except for energy and zinc of children who did not migrate (odds ratio 1.131 and 1.227 respectively) (Table 4.24). The difference in the children who consumed insufficient proportions of the RDA for the various nutrients according to their similarity with their mother was statistically significant for protein, niacin, and riboflavin intake of children who migrated and for vitamin C intake of children who did not migrate.

There seems to be no significant trend with regards to nutrient intake based on the duration of stay at the current residence of migrants.

Table 4.24: Proportion of children aged 1-9 years with nutrient intake <67% of the RDA* by similarity of migration patterns and migration status: South Africa 1999

Nutrient	Migration status	Total n=1 755	Similarity with mother		Odds ratio for mother similar, <67% RDA	95% CI		
			yes	no		Lower	Upper	p-value
Energy	stay	46.6%	47.2%	44.1%	1.131	0.899	1.423	0.292
	move	36.4%	34.4%	40.9%	0.758	0.482	1.193	0.231
Protein	stay	9.1%	8.9%	9.8%	0.894	0.607	1.315	0.569
	move	6.5%	3.6%	12.9%	0.248	0.105	0.586	0.001
Vitamin A	stay	68.9%	68.5%	70.7%	0.902	0.702	1.157	0.416
	move	66.4%	64.4%	70.7%	0.751	0.467	1.208	0.237
Vitamin C	stay	70.4%	69.3%	74.5%	0.773	0.597	1.001	0.050
	move	61.5%	58.9%	67.2%	0.698	0.440	1.107	0.126
Thiamin	stay	20.7%	20.8%	20.2%	1.039	0.783	1.379	0.790
	move	18.4%	16.6%	22.4%	0.689	0.398	1.192	0.181
Niacin	stay	44.3%	43.6%	46.8%	0.878	0.699	1.104	0.267
	move	37.4%	31.6%	50.0%	0.462	0.295	0.725	0.001
Riboflavin	stay	47.9%	47.5%	49.2%	0.936	0.745	1.175	0.568
	move	43.4%	39.9%	50.9%	0.642	0.412	0.999	0.049
Calcium	stay	73.6%	73.4%	74.5%	0.945	0.728	1.226	0.669
	move	72.0%	71.0%	74.1%	0.855	0.520	1.406	0.537
Iron	stay	71.3%	71.6%	70.2%	1.070	0.834	1.374	0.594
	move	63.7%	63.6%	63.8%	0.993	0.629	1.569	0.977
Zinc	stay	79.3%	80.1%	76.6%	1.227	0.934	1.611	0.142
	move	75.9%	74.7%	78.4%	0.811	0.480	1.372	0.435

* (Institute of Medicine, 1998:566-567; Earl & Borra, 2000:334-335; Institute of Medicine, 2002:16, 661)

The mean fat intake (as proportion of energy consumed) of children who migrated was statistically significantly higher than that of children who did not migrate while the mean fibre intake (as proportion of the AI consumed) was lower, although not statistically significantly so (Table 4.15, see p.159). The analyses of the consumption of fat and fibre intake by direction of migration suggest that all children with an urban connection (i.e. urban stay, urban-to-urban, urban-to-rural, and rural-to-urban migration) consumed a greater proportion of energy from fat while those with no urban connection (i.e. rural stay and rural-to-rural migration) reported the highest proportionate consumption of the recommended fibre intake (Figure 4.33; Table 4.17, see p.162-3). This picture would fit well with the nutrition transition phenomenon described by various researchers (Popkin, 1999:1908), except that for children who migrated urban-to-urban a similar (lower) proportion of children were reported to consume insufficient fibre intake as for children who stayed rural, but higher than those who moved rural-to-rural. This relatively higher fibre consumption by children, who migrated urban-to-urban, might be explained by the higher overall food consumption of these children as indicated by their higher proportionate consumption of energy, protein, as well as micronutrients.

Analyses on the basis of an excessive fat intake (>30% of energy from fat) and an insufficient intake of fibre (<67% of the AI) also suggest the looming nutrition transition as children who migrated had a statistically significant 1.3 times greater risk of an excessive fat intake (Table 4.25). The differences in the proportion of children who consume excessive fat are also statistically significant by direction of migration (Table 4.26).

Table 4.25: Proportion of children aged 1-9 years who consumed excessive proportions of fat (>30% energy) and insufficient proportions of fibre (<67% of AI) by migration status: South Africa 1999

Nutrient	Total	Migration status		Odds ratio for move, <67%RDA	95% CI		Chi-square p-value
		No movement n=2070	Moved n=423		Lower	Upper	
Fat	21.2%	20.4%	25.4%	1.330	1.043	1.697	0.021
Fibre	75.6%	75.9%	74.2%	0.913	0.719	1.160	0.456

The highest prevalence of an excessive proportion of fat consumed by children who moved urban-to-rural and the highest insufficient fibre consumption by children who moved rural-to-urban suggest an interesting area for future investigation to assess which changes in the dietary practices of these two groups of children, who are experiencing possibly the greatest changes (environmentally, geographically and also as far as accessibility and availability of food products are concerned) as a result of migration, contributes to the change in nutrient intake.

Table 4.26: Proportion of children aged 1-9 years who consumed excessive proportions of fat (>30% energy) and insufficient proportions of fibre (<67% of AI) by direction of migration: South Africa 1999

Nutrient	Direction of migration						Chi-square p-value
	rural stay	rural rural	rural urban	urban rural	urban stay	urban urban	
Number (n)	1035	130	37	41	1035	215	
Fat	13.0%	18.5%	18.9%	31.7%	27.8%	29.5%	<0.001
Fibre	74.4%	71.5%	81.1%	78.0%	77.3%	73.9%	0.459

Hypothesis testing

Crude analyses

The data analyses so far have focused on different levels and aspects of nutrient intake. Firstly, the mean intake of the various nutrients have been compared using Analysis of Variance (ANOVA) based on two migration differentials i.e. whether the child migrated, and the direction of migration. The results of these analyses indicate that children who migrated consumed 79% of the RDA for energy, 181% of protein, 54% fibre while fat contributes 21% to the total energy consumption (Table 4.15). The differences between consumption of children who migrated and those who did not migrate were statistically significant for energy and fat only (Table 4.15). As the distribution of the micronutrient consumption was skewed non-parametric tests were applied to the micronutrients. The analyses revealed that the median proportion of the RDA consumed by children was always higher for those children who migrated (Table 4.16). This was statistically significant according to the Mann-Whitney test for vitamin C, niacin, iron and zinc. Children reported a median consumption in excess of 70% of the RDA for the three B-vitamins (thiamine, niacin and riboflavin). This could have been expected in view of the high protein consumption reported. All other micronutrients were consumed at median levels below 45% of the RDA.

Based on these findings, the null hypothesis that there is no difference between the nutrient intake of children who migrated and those who did not migrate is rejected for energy, fat, vitamin C, niacin, iron and zinc. For protein, fibre, vitamin A, thiamine, riboflavin and calcium it is concluded that sampling variation is a possible explanation of the discrepancy between the null hypothesis and the sample values.

When analysed according to the direction of migration (i.e. rural-to-rural, urban-to-urban, rural-to-urban, urban-to-rural, rural stay, or urban stay), the proportion of the RDA consumed was statistically significant for all nutrients (Table 4.17; Table 4.18; Table 4.19). For the macronutrients it is clear that children who migrated urban-urban as well as those who live in an urban area and did not migrate consumed the highest proportions of the RDA while children who live in rural areas of residence and who did not migrate as well as rural-to-rural migrants consumed the lowest proportion of the RDA. These findings again support the rejection of the null hypothesis that the nutrient intake of children who migrated is not different from children who did not migrate.

Subsequently the dietary outcome, nutrient intake, was dichotomised to indicate an insufficient intake as defined by a consumption of <67% of the RDA. Less than 10% of children consumed insufficient amounts of protein, regardless of migration status. More than 60% of children consumed insufficient amounts of micronutrients (with the exception of the B-vitamins) and about 40% of children consumed insufficient amounts of energy. The odds ratio coefficient (Table 4.21) suggests that children who migrated are less likely to consume insufficient amounts of energy, vitamin C, niacin, iron and zinc than those who did not migrate. Analyses of the proportion of the RDA consumed by direction of migration also support the rejection of the null hypothesis on the nutrient intake of children who migrated and those who did not, for all nutrients except for thiamin.

Assessment of potential confounding

According to Kleinbaum *et al.* (1988:64) confounding exists if "… *a meaningful different interpretation of the relationship of interest result when an extraneous variable is ignored or included in the data analyses*". To assess possible database confounders to be controlled for in the regression analyses, a list of eligible variables was constructed based on prior knowledge (literature review) and on findings from this study. The requirements for a confounder as proposed by Rothman & Greenland (1998:23) are that it must be a risk factor associated with the outcome (including for the unexposed); it must be associated with the exposure under study; it must <u>not</u> be affected by the exposure i.e. an intermediate factor; and information on the variable(s) must be available for all cases. These criteria were used to construct a list of variables to be controlled for as possible confounders. The following variables were identified as possible confounders: household income, mother's education, caretaker, marital status of mother, employment status of mother, number of people that sleep in the house, toilet facilities available, availability of cold storage, availability of microwave oven.

Assessment of colinearity, i.e. the possibility that one predictor (variable) is an exact linear combination of the other (Kleinbaum *et al*., 1988:06; Thiessen, 1993:89), was performed using the standard SPSS command. Tolerance (1/variance inflation factor) (Kleinbaum *et al*., 1988:210) smaller than 0.1 or an R^2 greater than 0.90 would have been regarded as troublesome and these variables excluded from the list of variables to control for database confounding as part of regression procedures, but no variable met this criteria (tolerance ranged between 0.7 and 0.9 – data not shown) and all variables mentioned above were included for assessment as potential confounders. The two ordinal variables i.e. income and education of the mother were entered as ordinal variables in the regression where as all other variables were dichotomised using the category identified by Labadarios (2000:246) as risk factor for underweight and stunting, as reference, and entered as categorical variables in the regression analyses.

Regression procedures were performed with all of the outcome variables: linear regression for macronutrients and anthropometric variables, and logistic regression for micronutrients (dichotomised analyses performed due to the violation of normality assumption for continuous variables). Variables were entered in blocks into the regression procedure. The adjusted estimate of association (for each procedure containing different combinations/blocks of variables) was compared with the crude estimate (ß-regression coefficient), together with the confidence intervals, to select the best model to ensure adequate controls while maintaining the highest possible precision. The full model i.e. a regression model with all the variables identified as possible confounders were deemed the best option based on the % correct predictions (logistic regression), which were highest for the full model and ranged from 70-80% (data not shown). The McFaddens R^2 increased from around zero to between 0.060 – 0.100 for the different micronutrients. For the linear regression procedure the full model was also deemed the best option based on the higher R^2.

The criteria for the assessment of possible confounding in the estimate of association between migration and nutrient intake was taken as a change of 10% in the estimate of interest i.e. (exp)ß or Odds ratio for logistic regression and ß or mean difference for linear regression (Rothman & Greenland, 1998:256).

The linear regression reveals the following three categories of decisions:

- The mean proportion of the RDA consumed for energy is confounded but remained statistically significantly higher for children who migrated compared to those who did not migrate [crude ß 5.403 p=0.002 vs. adjusted ß 4.432 p=0.045].
- The mean proportion of the RDA consumed for protein and the mean proportion of the AI consumed for fibre is confounded and remain not statistically significantly associated with migration after controlling for socio-economic covariates [protein: crude ß 7.299 p=0.152 vs. adjusted ß –0.029 p=996; fibre: crude ß 3.314 p=0.084 vs. adjusted ß 4.371 p=0.071].
- The mean proportion of energy consumed as fat is also confounded and the statistically higher proportionate fat consumption disappeared after controlling for socio-economic covariates [crude ß 1.535 p=0.007 vs. adjusted ß 0.598 p=0.369]. The differences in the proportion of energy consumed from fat are therefore not predicted by migration, but rather by socio-economic characteristics of migrants.

Table 4.27: Linear regression of macronutrient intake (%RDA) and migration (crude and adjusted for selected socio-economic covariates*)

	Crude						Adjusted					
			95% CI for β						95% CI for β			
	β	Sig	Lower	Upper	R	R^2	β	Sig	Lower	Upper	R	R^2
Energy	5.403	0.002	1.917	8.889	0.061	0.004	4.432	0.045	0.109	8.756	0.258	0.067
Protein	7.299	0.152	-2.684	17.282	0.029	0.001	-0.029	0.996	-12.551	12.493	0.280	0.078
Fat (%Energy)	1.535	0.007	0.428	2.642	0.054	0.003	0.598	0.369	-0.708	1.904	0.390	0.152
Fibre (%AI)	3.314	0.084	-0.449	7.076	0.035	0.001	4.371	0.071	-0.378	9.121	0.124	0.015

*** Income, education of mother; and dichotomised: mother as caretaker, mother married, mother employed, 1-3 people sleep in household, flush toilet, cold storage, microwave available**

The logistic regressions performed on micronutrients suggest four different categories of decisions:

- The proportion of children with an insufficient intake (<67% of the RDA) of vitamin C is confounded by socio-economic covariates, but migration remains a statistically significant predictor of the proportion of children who consume insufficient proportions of vitamin C after controlling for socio-economic covariates [crude (exp)ß 0.665 p<0.001 vs. adjusted (exp)ß 0.745 p=0.043].
- The proportion of children who consumed insufficient proportions (<67% of the RDA) for vitamin A, riboflavin, and calcium, is confounded and remain <u>not</u> statistically significantly associated with migration after controlling for socio-economic covariates [vitamin A: crude (exp)ß 0.911 p=0.415 vs. adjusted (exp)ß 1.266 p=0.129; riboflavin: crude (exp)ß 0.850 p=0.130 vs. adjusted (exp)ß 1.052 p=0.734; calcium: crude (exp)ß 0.916 p=0.461 vs. adjusted (exp)ß 1.168 p=0.335].
- The proportion of children who consume insufficient proportions (<67% of the RDA) of niacin, iron and zinc is also confounded and the statistical significance disappeared after controlling for socio-economic covariates [niacin: crude (exp)ß 0.775 p=0.019 vs. adjusted (exp)ß 0.845 p=0.200; iron: crude (exp)ß 0.726 p=0.005 vs. adjusted (exp)ß 0.965 p=0.816; zinc: crude (exp)ß 0.751 p=0.023 vs. adjusted (exp)ß 1.038 p=0.822]. The lower

proportions of children who consumed insufficient niacin, iron and zinc is therefore not predicted by migration, but rather by socio-economic characteristics of migrants, which lead to higher accessibility of food sources high in these nutrients.

- The consumption of thiamine appeared not to be confounded by socio-economic characteristics. Controlling for socio-economic covariates did not lead to a greater than 10% difference in the odds ratio, and the proportion of children who consume insufficient proportions of thiamine remains not significantly associated with migration [crude (exp)ß 0.860 p=0.271 vs. adjusted (exp)ß 0.858 p=0.392].

Table 4.28: Logistic regression of insufficient micronutrient intake (<67% RDA) and migration (crude and adjusted for selected socio-economic covariates*)

	Crude					Adjusted				
	sig	Exp(β)	95.0% CI Exp(β)		$R^{2\#}$	sig	Exp(β)	95% CI Exp(β)		$R^{2\#}$
			lower	upper				lower	upper	
Vitamin A	0.415	0.911	0.728	1.140	0.000	0.129	1.266	0.933	1.700	0.062
Vitamin C	0.000	0.665	0.535	0.827	0.004	0.043	0.745	0.559	0.991	0.059
Thiamin	0.271	0.860	0.657	1.125	0.000	0.392	0.858	0.603	1.219	0.062
Niacin	0.019	0.775	0.626	0.960	0.002	0.200	0.845	0.654	1.093	0.102
Riboflavin	0.130	0.850	0.689	1.049	0.001	0.734	1.052	0.784	1.413	0.108
Calcium	0.461	0.916	0.724	1.158	0.000	0.335	1.168	0.852	1.600	0.061
Iron	0.005	0.726	0.581	0.906	0.003	0.816	0.965	0.718	1.298	0.062
Zinc	0.023	0.751	0.587	0.961	0.003	0.822	1.038	0.747	1.443	0.067

*** Income, education of mother; and dichotomised: mother as caretaker, mother married, mother employed, 1-3 sleep people in household, flush toilet, cold storage, microwave available**
 # McFaddens R^2

Based on the linear and logistic regressions, the socio-economic variables that were most often predictive of the consumption of the various nutrients were income and education level of the mother, and to a lesser extent the marital status of the mother, employment status of the mother, presence of a microwave in the house, availability of a microwave, flush toilet, and cold storage in the house, and room density as indicated by the number of people sleeping in the house (data not shown).

In summary, it is concluded that migration is independently associated with an improved intake of energy and vitamin C. All other differences reported for all other nutrients are mediated by socio-economic covariates.

Anthropometry

Internal migration and anthropometric status of children

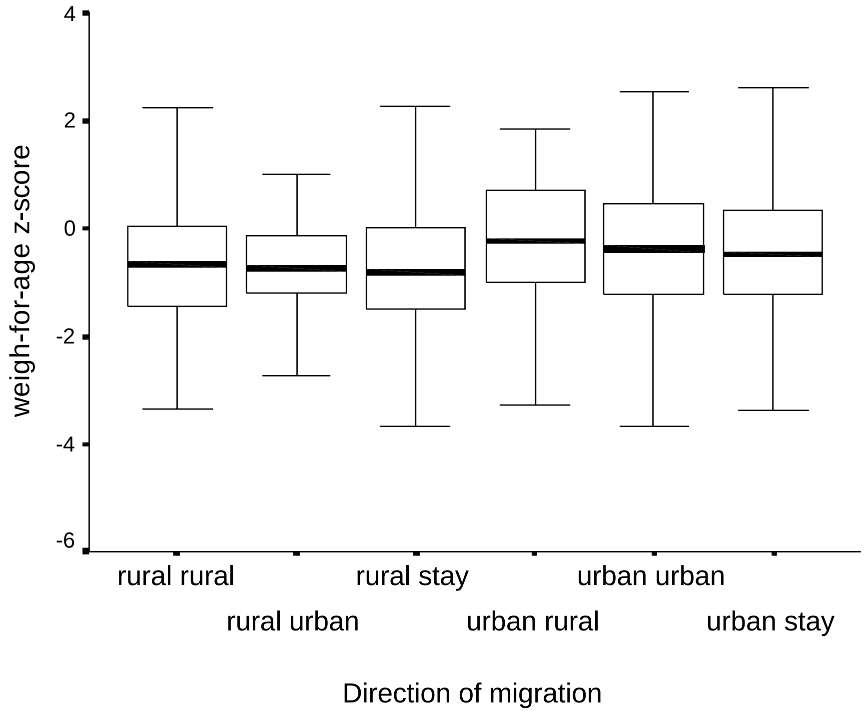
The mean z-score for weight-for-age, height-for-age and weight-for-height are higher for children who migrated than those who did not, although none of these differences are statistically significant (Figure 4.39; Table 4.29).

Table 4.29: Mean z-score for anthropometric indicators of children aged 1-9 years by migration status: South Africa 1999

Indicator	Migration status	n	Mean	SD	95% CI for Mean Lower	95% CI for Mean Upper	ANOVA p-value
weigh-for-age z-score	stay	1 892	-0.553	1.255	-0.610	-0.497	0.216
	move	381	-0.466	1.239	-0.591	-0.342	
	Total	2 273	-0.539	1.252	-0.590	-0.487	
height-for-age z-score	stay	1 892	-0.928	1.496	-0.995	-0.860	0.249
	move	381	-0.832	1.454	-0.978	-0.685	
	Total	2 273	-0.912	1.490	-0.973	-0.851	
weight-for-height z-score	stay	1 892	0.059	1.285	0.001	0.117	0.684
	move	381	0.088	1.127	-0.025	0.202	
	Total	2 273	0.064	1.259	0.012	0.116	

In contrast to the clear picture that emerged for mean dietary intake according to the direction of migration, the picture based on mean anthropometric z-scores are mixed. Children who remained rural have the lowest mean weight-for-age. Children who moved rural-to-rural had the lowest mean height-for age and weight-for-height (Figure 4.40). These differences are all statistically significant (Table 4.30).

Figure 4.39: Box-and-whisker plots of mean z-score for weight-for-age and height-for-age of children 1-9 years of age according to direction of migration: South Africa 1999



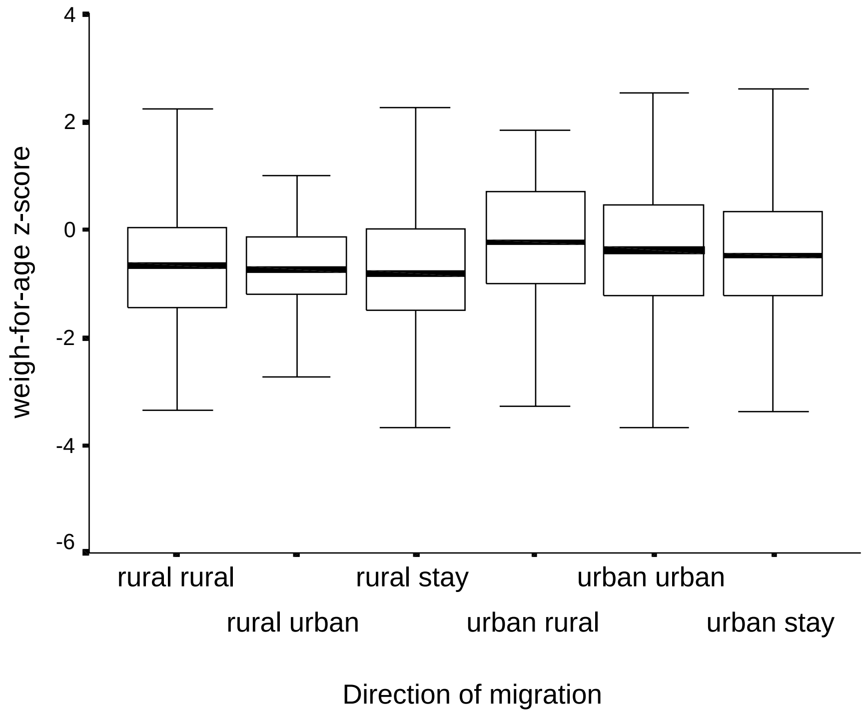
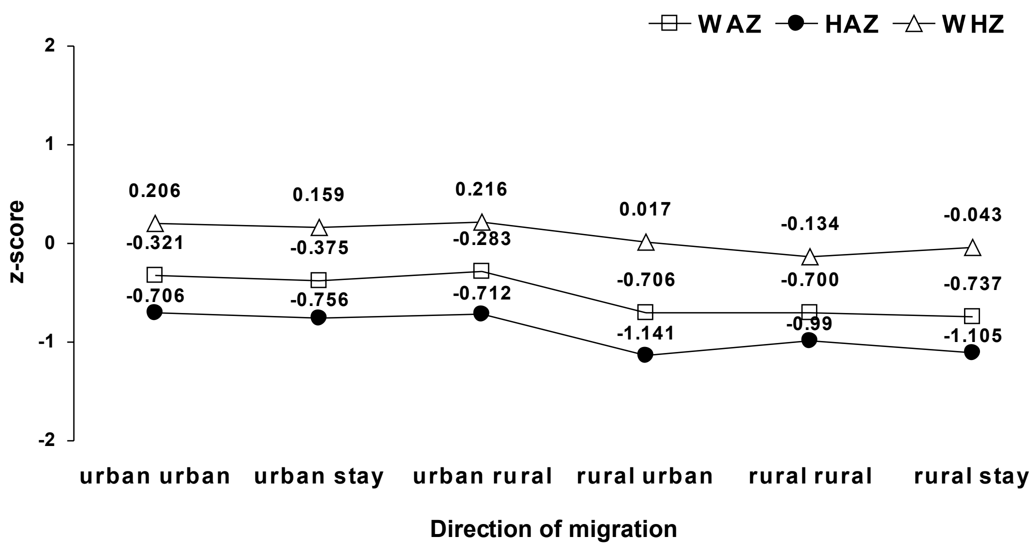


Table 4.30: Mean z-score for anthropometric indicators of children aged 1-9 years by direction of migration: South Africa 1999

Indicator	Direction of migration	n	Mean	SD	95% CI for Mean Lower	95% CI for Mean Upper	ANOVA p-value
weigh-for-age	rural stay	933	-0.737	1.169	-0.812	-0.661	0.000
z-score	rural rural	114	-0.700	1.119	-0.908	-0.493	
	rural urban	35	-0.706	0.970	-1.039	-0.373	
	urban rural	35	-0.283	1.342	-0.744	0.178	
	urban stay	959	-0.375	1.309	-0.458	-0.292	
	urban urban	197	-0.321	1.308	-0.505	-0.137	
	Total	2 273	-0.539	1.252	-0.590	-0.487	
height-for-age	rural stay	933	-1.105	1.485	-1.200	-1.009	0.000
z-score	rural rural	114	-0.990	1.486	-1.266	-0.715	
	rural urban	35	-1.141	1.159	-1.539	-0.743	
	urban rural	35	-0.712	1.642	-1.276	-0.148	
	urban stay	959	-0.756	1.488	-0.850	-0.662	
	urban urban	197	-0.706	1.441	-0.908	-0.503	
	Total	2 273	-0.912	1.490	-0.973	-0.851	
weight-for-height	rural stay	933	-0.043	1.240	-0.122	0.037	0.003
z-score	rural rural	114	-0.134	1.052	-0.329	0.062	
	rural urban	35	0.017	0.887	-0.287	0.322	
	urban rural	35	0.216	1.083	-0.156	0.588	
	urban stay	959	0.159	1.320	0.075	0.242	
	urban urban	197	0.206	1.200	0.038	0.375	
	Total	2 273	0.064	1.259	0.012	0.116	

Figure 4.40: Mean anthropometric z-score for children aged 1-9 years by direction of migration: South Africa 1999



In general however, the same difference between urban and rural areas of origin are observed with children from a rural origin (including those who did not migrate) having a lower anthropometric z-score for all three indices. The effect-measure modification mentioned with nutrient intake, again prevents a comparison of migrants with children who did not migrate on the basis of origin and destination (i.e. collapsing of categories across direction of migration) as rural-to-urban migrant children are worst off while urban-to-urban migrant children have the highest mean anthropometric z-scores.

There is not much difference in mean anthropometric z-scores based on whether the child has the same migration pattern as the mother or not, but those children who did not have any similarity with mother or grandmother had the highest mean z-score for weight-for-age and height-for-age. Children who reported similar migration patterns to the grandmother only had the lowest mean height-for-age z-score (Table 4.31). The lowest mean z-score for both weight-for-age and height-for-age was found for children who had similar migration patterns to both the mother and grandmother. There were no statistically significant differences between mean anthropometric z-scores based on the duration of stay at the current residence.

Table 4.31: Mean z-score for anthropometric indicators of children aged 1-9 years by similarity of migration pattern with mother and grandmother and migration status: South Africa 1999

Indicator	Migration status	Category	n	Mean	SD	95% CI for Mean Lower	95% CI for Mean Upper	ANOVA p-value
WAZ	stay	Both similar	230	-0.584	1.252	-0.747	-0.421	0.817
		Only mother similar	1 040	-0.556	1.278	-0.634	-0.478	
		Only grandmother	268	-0.555	1.252	-0.706	-0.404	
		None similar	120	-0.450	1.245	-0.675	-0.225	
		Total	1 658	-0.552	1.267	-0.613	-0.491	
	move	Both similar	26	-0.458	1.245	-0.962	0.045	0.396
		Only mother similar	199	-0.375	1.249	-0.550	-0.200	
		Only grandmother	31	-0.783	1.087	-1.182	-0.385	
		None similar	69	-0.463	1.245	-0.762	-0.164	
		Total	325	-0.439	1.234	-0.574	-0.305	
HAZ	stay	Both similar	230	-0.855	1.363	-1.033	-0.678	0.496
		Only mother similar	1 040	-0.949	1.481	-1.039	-0.858	
		Only grandmother	268	-0.956	1.564	-1.144	-0.768	
		None similar	120	-0.758	1.648	-1.055	-0.460	
		Total	1 658	-0.923	1.492	-0.995	-0.851	
	move	Both similar	26	-1.125	1.455	-1.713	-0.537	0.147
		Only mother similar	199	-0.700	1.433	-0.900	-0.499	
		Only grandmother	31	-1.259	1.294	-1.733	-0.784	
		None similar	69	-0.863	1.573	-1.241	-0.485	
		Total	325	-0.822	1.459	-0.981	-0.662	
WHZ	stay	Both similar	230	-0.033	1.304	-0.202	0.136	0.707
		Only mother similar	1 040	0.068	1.332	-0.013	0.149	
		Only grandmother	268	0.092	1.195	-0.052	0.236	
		None similar	120	0.047	1.166	-0.164	0.258	
		Total	1 658	0.056	1.295	-0.006	0.119	
	move	Both similar	26	0.341	1.099	-0.103	0.785	0.761
		Only mother similar	199	0.116	1.171	-0.048	0.280	
		Only grandmother	31	0.049	0.904	-0.282	0.380	
		None similar	69	0.087	1.127	-0.184	0.358	
		Total	325	0.121	1.130	-0.002	0.245	

The mean weight-for-height has been analysed as mentioned above, but it should be borne in mind that this anthropometric indicator reflects both wasting (at the lower end of the scale) and overweight (at the top end of the scale).

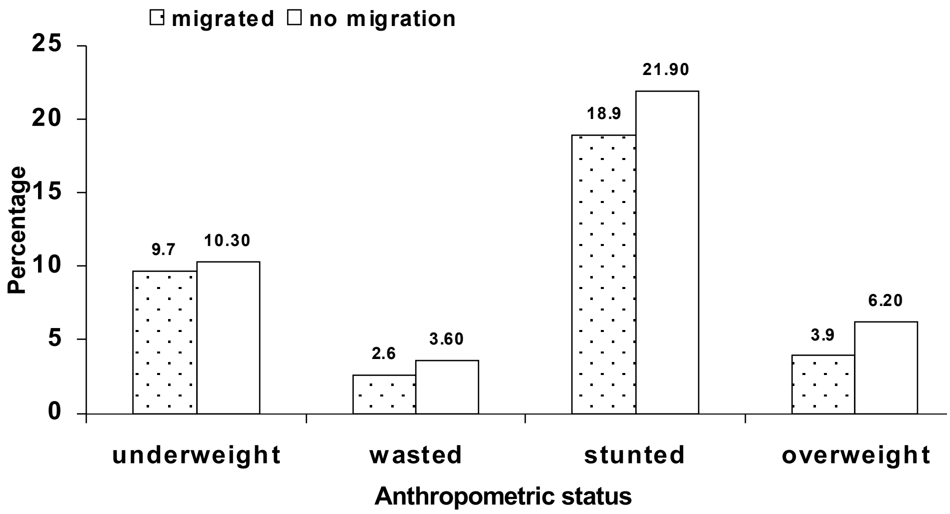
The remainder of the discussion on anthropometric status will focus on the prevalence of underweight, stunting and wasting as indicated by a z-score below –2 standard deviations (SDs), and overweight as indicated by a z-score >+2SDs. These anthropometric indicators have been well established and the WHO developed criteria (WHO, 15/8/2004:8) for the interpretation of these indicators as a public health nutrition problem.

At a national level, stunting (height-for-age <–2SDs) remains by far the most common nutritional disorder affecting nearly one out of five children (Labadarios (ed.), 2000:167). The children least affected were those in urban areas. Nationally, children who migrated were less affected by stunting, wasting (weight-for-height <–2SDs), and underweight (weight-for-age <–2SDs) than their counterparts who did not move (Figure 4.41; Table 4.32). An exception to this is severe underweight children (weight-for-age <–3SDs), where the migrants were more affected. It should, however, be noted that nationally only about 1% of children suffered from severe underweight so that estimates of this variable are likely unstable.

Table 4.32: Anthropometric status of children aged 1-9 years by migration status: South Africa 1999

Indicator	Total	Migration status		Chi-square	Odds	95% CI of OR	
		stay	move	p-value	Ratio	Lower	Upper
Number (n)	**2 273**	1 892	380				
W/A <-2SDs	**10.2%**	10.3%	9.7%	0.726	0.934	0.647	1.355
H/A <-2SDs	**21.4%**	21.9%	18.9%	0.195	0.832	0.630	1.099
W/H <-2SDs	**3.4%**	3.6%	2.6%	0.343	0.723	0.369	1.417
W/A <-3SDs	**1.3%**	1.2%	2.1%	0.144	1.823	0.806	4.126
H/A <-3SDs	**6.3%**	6.4%	6.0%	0.793	0.940	0.594	1.490
W/H <-3SDs	**0.8%**	0.9%	0.5%	0.465	0.582	0.134	2.530
W/H >+2SDs	**5.8%**	6.2%	3.9%	0.087	0.622	0.359	1.077

Figure 4.41: Anthropometric status of children 1-9 years of age according to migration status: South Africa 1999

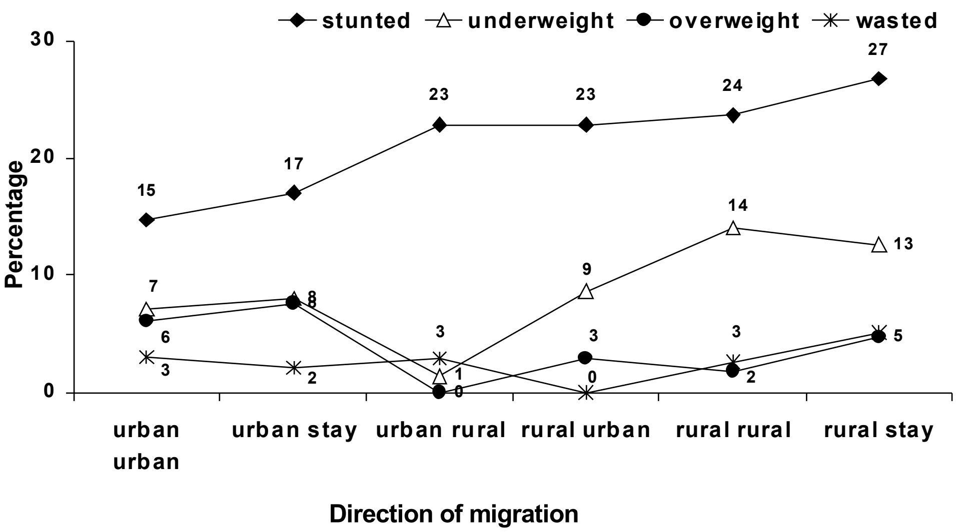


By contrast, the prevalence of overweight (weight-for-age >+2SDs) was higher (6.2%) in children who did not move than in children who migrated (3.9%). Overall the prevalence of overweight was higher (7.5%) in urban areas than the national average (6%) (Labadarios (ed.), 2000:167); this remains the case among the children who did not move, with the prevalence of overweight in urban children who did not move (7.6%) being higher than in rural children who did not move (4.7%) (Figure 4.42). Children who moved from urban-to-urban areas were an exception as they had a prevalence of overweight (6.1%) comparable to that of children who stayed urban (Table 4.33). It is important to note that none of the differences in prevalence of underweight, stunting, wasting and overweight were statistically significant based on whether children migrated or did not migrate. The differences based on direction of migration were however statistically significant for all anthropometric indicators except severe underweight although it is recognised that the latter could be influenced by the small numbers in each cell and the degrees of freedom.

Table 4.33: Anthropometric status of children aged 1-9 years by migration status and direction of migration: South Africa 1999

Indicator	Direction of migration						Chi-square p-value
	rural stay	rural rural	rural urban	urban rural	urban stay	urban urban	
Number (n)	933	59	35	35	959	197	
W/A <-2SDs	12.6%	14.0%	8.6%	1.4%	8.0%	7.1%	0.010
H/A <-2SDs	26.8%	23.7%	22.9%	22.9%	17.1%	14.7%	0.000
W/H <-2SDs	5.1%	2.6%	0.0%	2.9%	2.1%	3.0%	0.010
W/A <-3SDs	1.6%	1.8%	0.0%	2.9%	0.7%	2.5%	0.246
H/A <-3SDs	8.0%	6.1%	8.6%	14.3%	4.8%	4.1%	0.015
W/H <-3SDs	1.5%	0.9%	0.0%	2.9%	0.3%	0.0%	0.037
W/H >+2SDs	4.7%	1.8%	2.9%	0.0%	7.6%	6.1%	0.016

Figure 4.42: Anthropometric status of children 1-9 years of age according to direction of migration: South Africa 1999



The similarity between the trends observed for stunting and underweight above (Figure 4.42) and that of the proportion of children with insufficient intakes (Figure 4.37, p.192; Table 4.22, p.165) where children who stayed rural are "worst off" and those who moved urban-to-urban and who stayed urban are "best off", is expected. Wasting does however not correspond with the finding on nutrient intake except for children who stayed rural to be “worst off”.

The prevalence of all forms of undernutrition is similar amongst children when compared on the basis of whether they have been with their mother all the time or not (Table 4.34). Of the children who moved, there is not a consistent pattern of difference based on the duration of stay in the current area. However, those who moved in the period 1989-1992 usually have the lowest prevalence of undernutrition, except in the case of wasting and severe underweight.

Table 4.34: Anthropometric status of children aged 1-9 years by similarity of migration patterns: South Africa 1999

Indicator	Similarity of migration pattern				Chi-square p-value
	All similar	Only mother similar	Only grandmother similar	None similar	
Number (n)	257	1 253	303	411	
W/A <-2SDs	8.9%	10.7%	11.2%	9.2%	0.684
H/A <-2SDs	18.7%	21.3%	23.4%	20.0%	0.521
W/H <-2SDs	4.7%	3.8%	1.7%	4.4%	0.187
W/A <-3SDs	1.6%	1.0%	1.3%	2.4%	0.217
H/A <-3SDs	5.8%	6.4%	7.3%	6.6%	0.918
W/H <-3SDs	0.4%	1.2%	0.3%	0.7%	0.357
W/H >+2SDs	5.1%	6.2%	5.6%	6.1%	0.896

Hypothesis testing

Crude analyses

Data analyses related to the anthropometric status of children indicated that children who migrated have a mean z-score for weight-for-age, height-for-age and weight-for-height that is higher than that of children who did not migrate (Table 4.29: p.168), but this is not statistically significant. Based on these findings, the null hypothesis that there is no difference between the anthropometric status of children who migrated and those who did not cannot be rejected.

When analysed by the direction of the migration (Table 4.30: p.168) using Analysis of Variance (ANOVA), there is an overall statistical significant difference for all of the mean anthropometric z-scores. The underlying factor contributing to the significant differences based on direction of migration is the significant differences by area of residence (origin) with rural children having lower z-scores.

There was no statistical significance on the bases of similarity of migration patterns with the mother or the grandmother, or the duration of stay at the current residence. It is concluded that for the direction of migration, sampling variation is a possible explanation of the discrepancy between the null hypothesis and the sample values.

Anthropometric z-scores were also dichotomised to indicate public health significance of underweight, stunting, wasting, and overweight. The odds ratio coefficient for children who migrated suggest that those who migrated are less likely to be underweight, stunted, wasted and overweight (Table 4.32: p.170) than those who did not migrate, although this was not statistically significant. However, the differences in the prevalence of underweight, stunting, and wasting was statistically significant when analysed according to the direction of migration (Table 4.33: p.171) with children who stayed rural (did not migrate) being the worst off on all indicators except for underweight and severe underweight where children who moved rural-to-rural was worst off. The prevalence of overweight was also statistically significant by direction of migration with children in urban areas who did not migrate having the highest prevalence (7.6%) and those who moved urban-to-urban (6%) having the second highest prevalence.

Assessment of potential confounding

In order to further test the hypothesis, the same socio-economic variables identified as possible confounders that were used for nutrient intake (household income, mothers education, mother as caretaker, mother married, mother employed, household size 1-3 persons, flush toilet, cold storage and microwave available) were applied in a linear regression of the mean anthropometric z-score and migration (Table 4.35). Controlling for this full model increased the R^2 from around zero to 0.080 for WAZ and HAZ.

Table 4.35: Linear regression of anthropometric z-scores and migration (crude and adjusted for selected socio-economic covariates*)

	Crude						Adjusted					
			95% CI for B						95% CI for B			
	B	Sig	Lower	Upper	R	R^2	B	Sig	Lower	Upper	R	R^2
WAZ	0.087	0.216	-0.051	0.225	0.026	0.001	0.020	0.819	-0.152	0.193	0.281	0.079
HAZ	0.096	0.249	-0.068	0.260	0.024	0.001	0.048	0.634	-0.151	0.248	0.285	0.081
WHZ	0.029	0.684	-0.110	0.167	0.009	0.000	0.001	0.993	-0.178	0.179	0.148	0.022

*** Income, education of mother; and dichotomised: mother as caretaker, mother married, mother employed, sleep 1-3 people in household, flush toilet, cold storage, microwave available)**

The linear regression confirms that there is no significant linear relationship between migration and anthropometric status. Controlling for the socio-economic covariates reveals that the mean z-score for weight-for-age [crude ß 0.087 p=0.216 adjusted ß 0.020 p=0.819], height-for-age [crude ß 0.096 p=0.249 adjusted ß 0.048 p=0.634] and weight-for-height [crude ß 0.029 p=0.684 adjusted ß 0.001 p=0.993] is confounded as indicated by more than a 10% change in the ß, but al three remained not statistically significantly associated with migration.

Because weight-for-height is indicative of two different measures of malnutrition i.e. wasting and overweight, it was deemed necessary to also perform a logistic regression with these two indicators and the identified socio-economic covariates. For completeness underweight and stunting are also included in the logistic regression.

The logistic regression performed on these indicators suggest two different categories of decisions:

- The proportion of children with underweight and stunting is not confounded but remains not statistically significantly associated with migration after controlling for socio-economic covariates, similar to the linear regression [underweight: crude (exp)ß 0.926 p=0.726 adjusted (exp)ß 0.932 p=0.785; stunting: crude (exp)ß 0.832 p=0.195 adjusted (exp)ß 0.797 p=0.236]
- The proportion of children with wasting is confounded but remain not statistically significant after controlling for socio-economic covariates [crude (exp)ß 0.723 adjusted (exp)ß 0.503 p=0.198].

- The proportion of children who are overweight is confounded and becomes statistically significantly associated with migration after controlling for socio-economic covariates [crude (exp)ß 0.622 p=0.090 adjusted (exp)ß 0.368 p=0.014] (Table 4.36).

Table 4.36: Logistic regression of anthropometric status and migration (crude and adjusted for selected socio-economic covariates*)

	Crude					Adjusted				
	sig	Exp(B)	95.0% C.I. Exp(B)		$R^{2\#}$	sig	Exp(B)	95.0% C.I. Exp(B)		$R^{2\#}$
			lower	upper				lower	upper	
Underweight	0.726	0.926	0.647	1.355	0.000	0.785	0.932	0.561	1.549	0.052
Stunting	0.195	0.832	0.630	1.099	0.001	0.236	0.797	0.547	1.160	0.040
Wasting	0.345	0.723	0.369	1.418	0.001	0.198	0.503	0.177	1.431	0.033
Overweight	0.090	0.622	0.359	1.077	0.003	0.014	0.368	0.166	0.814	0.042

*** Income, education of mother; and dichotomised: mother as caretaker, mother married, mother employed, sleep 1-3 people in household, flush toilet, cold storage, microwave available)**
\# McFadden's R^2

In summary, it is concluded that the marginal protective effect of migration on underweight and stunting indicators is not mediated by differences in socio-economic characteristics. The protective effect of migration on wasting and overweight is masked by the differences in socio-economic characteristics. However, migration is independently statistically significantly associated with overweight only.

Socio-economic context of internal migration, nutrient intake and anthropometric status of children.

In view of the complexity of migration itself (the causes, direction and outcomes), the diversity of the characteristics of migrants in this study population, as well as the complex associations observed between migration, nutrient intake and anthropometric status, it was deemed necessary to further investigate the latter associations by performing stratified cross tabulations i.e. controlling for the various categories within each variable. The consumption reported of all macronutrients except fat and fibre, categorised as an insufficient/sufficient intake (< or > than 67% of the RDA consumed) as well as underweight, stunting and wasting will be summarized in an attempt to form a picture of those factors from the proposed conceptual framework (Figure 2.11: p.78) that would be active in this particular study population. Fat, fibre and overweight will be summarized together to understand which factors related to a possible nutrition transition are present in this study population.

Firstly the socio-economic variables were grouped together into broad categories. These variables were not originally planned in the source study to resemble aspects of the UNICEF conceptual framework of the causation of malnutrition, and, therefore, do not necessarily match exactly, but most variables could be fitted into some logical group. The following groups were identified:

- Demographic variables: gender, age, language, ethnic origin
- Childcare variables: caretaker, household headship, gender of household head, marital status of the mother
- Educational variables: educational level attained by the mother and availability of communication technology (radio/TV)
- Economic variables: employment status of mother, employment status of father, type of house, number of people who sleep in the house, income, money spent on food
- Environmental variables: type of toilet and source of water
- Food preparation variables: fuel used for cooking, availability of food preparation equipment such as a stove, oven, primus, microwave and cold storage

Within each of these groups the direction of the difference between the proportion of children who migrated and who consumed an insufficient proportion of each nutrient or who are underweight, stunted or wasted, and children who did not migrate and also consumed insufficient proportions of nutrients or were underweight, stunted or wasted, was indicated by three symbols. Children who migrated were used as the reference. A plus sign (+) was used to indicate a lower proportion of children with insufficient intake or undernutrition in children who migrated i.e. they were better off. If the difference was statistically significant, (++) was used. A negative sign (-) was used to indicate a higher proportion of children who migrated to consume insufficient nutrient proportion or have undernutrition. A (--) indicated a statistical significant difference. In cases where the prevalence was similar a zero (0) was used. Table 4.37 and table 4.38 summarize the association between migration and insufficient nutrient intake and undernutrition indicators respectively. The supporting raw data is provided as Table 5.1.1- Table 5.13.4 in Appendix E.

Undernutrition

Within the limitations of this kind of comparison, it is clear that although there are differences in the factors associated with nutrient intake and those associated with anthropometric indicators of undernutrition, Table 4.37 does however display some common threads. Intake of 10 nutrients (excluding fat and fibre) analysed for this study as well as underweight, stunting and wasting were all consistently positively associated with the characteristics listed below. This means that children who moved had a lower proportionate prevalence of nutrient intakes less than 67% of the RDA and had a lower prevalence of children <-2SDs and could be classified as better off. All of these 10 nutrients and the anthropometric indicators were therefore marked as + or ++ in Table 4.37 for each of the variables listed below:

- Gender (both male and female positively associated with all nutrients and anthropometric indicators, therefore it is not regarded as a factor in dietary intake or anthropometric status)
- Mother as the caretaker
- Father as household head
- Male headed households

- Mother being married
- Mother never married (unmarried)
- Access to both television and radio or neither
- Mother being a housewife by choice
- Fathers who are self-employed or wage earners

Even though household income *per se* has not been identified as a factor, these characteristics in some way all point towards children from more stable and better socio-economic households moving and likely being better off as a result of migration

The other characteristics positively associated with dietary intake and anthropometric status of children who moved demonstrate the differential factors affecting dietary intake and nutritional status. Dietary intake was more related to food preparation facilities available, while anthropometry was more associated with sanitation and income characteristics. Only the Tsonga ethnic group (Venda, Tsonga, Shangaan) was negatively associated (indicated by a - or --) with all of the 10 nutrients and with underweight, stunting and wasting (i.e. children who moved had a higher prevalence of insufficient dietary intake as expressed by <67% of the RDA and anthropometric indices <–2SDs and they can therefore be described as worse off). Dietary intake of children who moved was negatively associated (at least 7 out of 10 nutrients indicated as - or --) with Xitsonga and Tsivenda language groups, father as the caretaker, grandmother as household head, mothers with no formal education, and households with no income. All three anthropometric indices of migrant children were negatively associated (indicated with a - or --) with aunt/uncle as caretaker, access to television only, unemployment of the father, larger household size of 7-9 persons, borehole as water source, use of wood/coal for food preparation, and access to only a refrigerator.

Table 4.37: Comparison of prevalence of dietary intake <67% RDA and anthropometric indicators <-2SD of children who moved and those who did not, by socio-demographic characteristics: South Africa 1999

+ indicates a lower prevalence for children who migrated i.e. better off (++ is statistically significant)
- indicates a higher prevalence for children who migrated i.e. worse off (-- is statistically significant)
0 indicates no difference (within 0.5 percentage points) between children who migrated and those who did not move

			Energy	Protein	Vit A	Vit C	Thiamin	Niacin	Riboflavin	Calcium	Iron	Zinc	Underweight	Stunting	Wasting
Demographic variables	Gender	Male	+	+	+	++	+	+	+	+	++	++	+	+	+
		Female	++	+	-	++	+	+	+	+	+	+	+	+	+
	Age	1-3 years	++	+	0	+	++	+	++	+	+	+	-	0	+
		4-6 years	+	0	+	++	-	-	+	+	+	0	+	+	+
		7-9 years	++	+	++	+	0	++	++	+	++	++	-	-	+
	Language	Afrikaans	+	-	+	0	+	-	-	+	+	+	-	+	+
		English	+	+	+	-	-	+	-	-	+	+	+	+	-
		Isi Ndebele	-	+	-	-	-	-	+	-	+	+	0	+	+
		IsiXhosa	++	+	-	++	+	+	+	+	+	+	+	+	+
		IsiZulu	++	+	-	+	+	+	+	-	+	0	+	-	-
		Sepedi	-	-	+	-	-	0	-	+	+	-	0	+	+
		Sesotho	-	-	-	+	+	+	+	-	+	-	+	+	+
		SiSwati	-	+	+	+	+	+	+	-	-	-	+	-	+
		Setswana	-	+	+	+	-	-	-	-	+	+	-	+	0
		Tsivenda	+	-	-	-	-	-	+	0	-	-	-	-	+
		Xitsonga	-	+	-	+	-	-	-	-	-	-	-	-	++
	Ethnic origin	Nguni	++	+	+	+	+	+	+	0	+	+	+	+	+
		Sotho	-	-	0	+	+	0	-	-	+	0	+	+	+
		Tsonga	-	-	-	-	--	-	-	-	-	-	-	-	--

Table 4.37: Comparison of prevalence of dietary intake <67% RDA and anthropometric indicators <-2SD of children who moved and those who did not, by socio-demographic characteristics: South Africa 1999 (continued)

- \+ indicates a lower prevalence for children who migrated i.e. better off (++ is statistically significant)
- \- indicates a higher prevalence for children who migrated i.e. worse off (-- is statistically significant)
- 0 indicates no difference (within 0.5 percentage points) between children who migrated and those who did not move

			Energy	Protein	Vit A	Vit C	Thiamin	Niacin	Riboflavin	Calcium	Iron	Zinc	Underweight	Stunting	Wasting
Childcare variables	Caretaker	Mother	++	+	+	++	+	++	++	+	+	+	+	+	+
		Father	--	-	+	+	-	-	-	-	-	-	-	-	+
		Grandparent	+	-	+	++	+	-	-	-	++	+	+	+	+
		Sibling	+	+	-	+	+	+	+	-	+	+	+	+	0
		Aunt/Uncle	+	+	+	+	+	-	+	+	-	0	-	-	-
	Household head	Father	++	+	+	+	+	++	+	+	+	+	+	+	+
		Grandfather	+	-	+	+	+	-	-	-	+	+	+	-	+
		Grandmother	-	-	-	+	-	-	-	-	-	+	-	+	+
		Mother	++	+	+	++	++	++	++	+	+	+	-	+	-
	Gender of household head	Male	++	+	+	++	+	++	+	+	+	+	+	+	+
		Female	+	-	0	++	+	+	+	+	+	+	-	+	+
	Marital status of mother	Not married	+	+	+	++	+	+	+	+	+	++	+	+	+
		Married	++	+	+	++	+	+	++	+	+	+	+	+	+
		Divorced	-	-	-	+	-	-	-	+	+	+	-	+	0
		Separated	-	0	+	+	+	0	-	-	-	+	-	-	0
		Widowed	0	+	+	+	+	+	+	-	-	-	+	+	0
		Living together	-	+	-	-	+	+	+	-	-	+	-	+	+
		Traditional marriage	+	+	+	++	+	++	++	+	+	+	+	-	+
Educational variables	Mother's Education	None	+	-	-	+	-	-	-	--	-	+	+	+	+
		Primary	+	+	+	+	0	+	+	+	+	+	-	++	0
		Std 6-8	+	+	+	+	+	+	+	-	+	-	+	-	+
		Std 9-10	++	+	-	+	+	+	+	+	-	+	+	-	+
		Tertiary	+	-	+	++	+	++	+	+	+	+	+	+	+
	Radio/TV	Radio	-	-	-	+	-	+	+	-	+	+	+	+	+
		Television	-	-	+	+	+	-	+	-	+	0	-	-	-
		Both	++	+	+	++	+	+	+	+	+	+	+	+	+
		None	+	++	+	+	+	++	+	+	+	+	+	+	+

Table 4.37: Comparison of prevalence of dietary intake <67% RDA and anthropometric indicators <-2SD of children who moved and those who did not, by socio-demographic characteristics: South Africa 1999 (continued)

+ indicates a lower prevalence for children who migrated i.e. better off (++ is statistically significant)
- indicates a higher prevalence for children who migrated i.e. worse off (-- is statistically significant)
0 indicates no difference (within 0.5 percentage points) between children who migrated and those who did not move

			Energy	Protein	Vit A	Vit C	Thiamin	Niacin	Riboflavin	Calcium	Iron	Zinc	Underweight	Stunting	Wasting
Economic variables	Employment of mother	Housewife by choice	++	++	+	++	+	++	+	++	+	++	+	+	+
		Unemployed	+	+	-	+	+	+	+	--	+	0	+	+	+
		Self-employed	+	+	+	+	-	+	+	+	-	++	-	+	-
		Wage earner	++	+	+	++	+	+	+	+	+	0	-	+	+
	Employment of father	Unemployed	0	+	-	+	+	-	+	-	+	+	-	-	-
		Self-employed	++	+	+	++	++	+	+	+	+	++	+	+	+
		Wage earner	++	+	+	+	+	++	+	+	+	+	+	+	+
		Retired by choice	-	+	-	-	+	+	+	-	+	-	0	+	+
		Not applicable	+	-	+	+	+	+	+	-	+	+	0	+	+
	Type of dwelling	Brick	++	+	+	++	+	++	+	+	++	+	-	+	+
		Traditional/Mud	+	+	-	++	-	-	+	-	+	+	+	+	-
		Tin/Plank	+	+	-	-	+	++	-	-	+	+	+	-	+
	No of people sleeping at house	1-3 persons	+	+	+	+	++	+	++	-	+	++	+	+	-
		4-6 persons	++	+	+	++	0	++	+	+	++	+	+	+	++
		7-9 persons	+	+	0	+	-	+	-	+	+	+	-	-	-
		>9 persons	+	+	0	+	-	-	+	-	+	-	+	-	+
	Household income (monthly)	None	-	+	-	-	-	-	-	-	-	+	+	+	+
		R100-R499	+	+	-	++	+	+	+	-	+	+	-	+	0
		R500-R999	+	-	0	++	-	+	+	-	+	-	+	+	+
		R1000-R2999	++	+	-	-	-	-	-	+	+	+	+	-	+
		>=R3000	+	+	+	+	0	+	0	+	-	-	-	+	+
	Weekly food expenditure	0-R49	+	+	-	+	-	+	-	-	+	0	-	+	-
		R50-R99	+	+	-	+	0	+	0	--	+	0	+	+	+
		R100-R149	+	-	+	0	+	+	-	-	++	+	+	-	+
		R150-R199	+	+	-	+	-	0	-	+	+	0	+	-	+
		R200-R249	++	0	+	+	+	+	+	+	+	+	-	-	-
		R250-R299	+	+	+	+	+	+	+	+	+	-	+	+	+
		R300-R349	+	+	0	+	-	+	+	+	+	+	+	+	-
		R350-R399	+	-	+	+	-	+	+	+	+	++	-	+	-
		>R400	+	+	+	+	-	+	+	++	+	+	-	+	+

Table 4.37: Comparison of prevalence of dietary intake <67% RDA and anthropometric indicators <-2SD of children who moved and those who did not, by socio-demographic characteristics: South Africa 1999 (continued)

- \+ indicates a lower prevalence for children who migrated i.e. better off (++ is statistically significant)
- \- indicates a higher prevalence for children who migrated i.e. worse off (-- is statistically significant)
- 0 indicates no difference (within 0.5 percentage points) between children who migrated and those who did not move

			Energy	Protein	Vit A	Vit C	Thiamin	Niacin	Riboflavin	Calcium	Iron	Zinc	Underweight	Stunting	Wasting
Environmental variables	Source of drinking water	Borehole	-	+	-	-	+	-	+	-	+	+	-	-	-
		Communal tap	+	0	-	+	-	+	-	-	-	+	+	++	-
		Own tap	++	+	+	++	+	+	+	+	++	+	+	-	+
		River/dam	+	+	+	+	-	-	+	+	+	+	0	+	+
	Type of toilet	Bucket	+	+	-	-	+	+	-	+	++	++	+	+	+
		Flush	++	+	+	++	+	+	+	+	+	+	-	-	+
		Pit	+	0	-	++	0	+	-	-	+	+	+	++	+
		VIP	+	+	0	-	+	-	+	-	+	+	+	0	-
Food preparation variables	Fuel used	Electricity	++	+	+	+	+	+	+	+	+	+	-	+	+
		Gas	+	+	-	+	-	+	-	0	-	-	-	-	+
		Open fire	+	+	+	+	+	+	-	+	+	+	+	+	-
		Paraffin	+	+	-	+	+	+	+	-	+	++	+	+	+
		Wood/Coal	+	+	-	+	+	-	+	-	-	+	-	-	-
	Cold storage	Fridge	+	0	+	+	+	-	+	+	-	-	-	-	-
		Freezer	+	+	-	+	+	+	-	+	0	0	+	+	+
		Both	++	+	++	++	+	++	+	++	++	++	+	-	+
		None	+	+	-	+	0	++	+	-	+	++	+	+	0
	Stove	Yes	++	+	+	++	+	+	+	+	++	+	-	-	+
		No	+	+	-	++	-	+	+	-	-	++	+	++	+
	Primus	Yes	+	0	-	++	+	+	-	-	++	+	+	++	+
		No	++	+	+	+	+	+	+	+	-	+	+	-	+
	Microwave	Yes	++	+	+	+	+	+	+	++	-	++	+	+	+
		No	++	+	-	++	+	+	+	-	+	+	-	+	+

Nutrition transition

A comparison of excessive fat intake, insufficient fibre intake and overweight in this study sample in this study sample would find limited commonalities as the initial significant higher proportion of children with excessive fat intake amongst those children who migrated was confounded by socio-economic covariates while on the other hand these same covariates confounded the relative protective effect of migration on overweight.

Subsequently, the only categories within the variables where all three aspects (fat, fibre and overweight) were negatively associated with migration, i.e. migrant children had higher proportions of excessive fat intake, higher proportions of low fibre intake and higher proportions of overweight, were for the Setswana language group.

Groups with a potential problem related to the nutrition transition as indicated by higher proportions of excessive fat intake and higher proportions of insufficient fibre intake, were:

- older children, 7-9 years
- Ndebele, Sesotho, Tsivenda, and Xitsonga language groups
- Mother as caretaker
- Father as the household head
- Mother housewife by choice
- Father unemployed
- Houses of brick and tin/plank
- Smaller households (1-3 and 4-6 persons)
- Low household income (<R1000)
- Food expenditure of R25-R300/month
- Mothers with no education and Std 9-10
- Availability of a radio only
- Water from a borehole
- Access to a freezer
- Although there are some aspects of the traditionally accepted high risk groups present in this list such as the more affluent portion of the

population who have access to a freezer and where the mother can choose not to work, it also include groups that are at risk for undernutrition. This could imply, as was suggested by other researchers, that the nutrition transition is also taking place at lower socio-economic levels in developing countries. Alternatively, it could be a reflection of the low food consumption of children in the country and possibly the use of nutrition advice to increase energy density of children's diets in order to prevent and manage undernutrition. These aspects warrant future monitoring and investigation.

Table 4.38: Comparison of prevalence of fat intake >30% of energy, fibre intake <67% of AI and overweight of children who moved and those who did not move, by socio-demographic characteristics: South Africa 1999

+ indicates a lower prevalence for children who migrated i.e. better off (++ is statistically significant)
- indicates a higher prevalence for children who migrated i.e. worse off (-- is statistically significant)
0 indicates no difference (within 0.5 percentage points) between children who migrated and those who did not move

			Fat	Fibre	Overweight
Demographic variables	Gender	Male	--	+	+
		Female	-	+	+
	Age	1-3 years	-	+	+
		4-6 years	-	+	+
		7-9 years	--	-	0
	Language	Afrikaans	+	+	+
		English	++	-	-
		Isi Ndebele	-	-	+
		IsiXhosa	0	++	-
		IsiZulu	-	+	+
		Sepedi	-	-	0
		Sesotho	-	--	+
		SiSwati	+	+	+
		Setswana	-	-	-
		Tsivenda	-	-	0
		Xitsonga	-	-	+
	Ethnic origin	Nguni	-	-	+
		Sotho	--	+	+
		Tsonga	-	+	+

Table 4.38: Comparison of prevalence of fat intake >30% of energy, fibre intake <67% ofAI and overweight of children who moved and those who did not move, by socio-demographic characteristics: South Africa 1999 (continued)

- \+ indicates a lower prevalence for children who migrated i.e. better off (++ is statistically significant)
- \- indicates a higher prevalence for children who migrated i.e. worse off (-- is statistically significant)
- 0 indicates no difference (within 0.5 percentage points) between children who migrated and those who did not move

			Fat	Fibre	Overweight
Childcare variables	Caretaker	Mother	--	-	+
		Father	+	-	+
		Grandparent	+	+	+
		Sibling	-	+	-
		Aunt/Uncle	-	+	-
	Household Head	Father	--	-	+
		Grandfather	+	+	+
		Grandmother	+	+	+
		Mother	-	+	+
	Gender of Household head	Male	-	+	+
		Female	-	0	+
	Marital status of mother	Not married	+	+	+
		Married	--	+	+
		Divorced	-	-	+
		Separated	-	+	+
		Widowed	0	+	-
		Living together	-	+	-
		Traditional marriage	-	+	-
Educational variables	Mother's Education	None	-	-	0
		Primary	--	+	+
		Std 6-8	-	0	+
		Std 9-10	-	-	++
		Tertiary	+	+	-
	Radio/TV	Radio	--	-	+
		Television	-	+	+
		Both	-	0	+
		None	-	+	+

Table 4.38: Comparison of prevalence of fat intake >30% of energy, fibre intake <67% of AI and overweight of children who moved and those who did not move, by socio-demographic characteristics: South Africa 1999 (continued).

- \+ indicates a lower prevalence for children who migrated i.e. better off (++ is statistically significant)
- \- indicates a higher prevalence for children who migrated i.e. worse off (-- is statistically significant)
- 0 indicates no difference (within 0.5 percentage points) between children who migrated and those who did not move

			Fat	Fibre	Overweight
Economic variables	Employment of mother	Housewife by choice	-	-	+
		Unemployed	--	+	++
		Self-employed	+	-	0
		Wage earner	+	+	+
	Employment of father	Unemployed	--	-	+
		Self-employed	+	+	+
		Wage earner	--	0	+
		Retired by choice	+	-	--
		Not applicable	-	+	+
	Type of dwelling	Brick	-	-	+
		Traditional/Mud	0	-	+
		Tin/Plank	--	-	+
	No of people sleeping at house	1-3 persons	--	-	+
		4-6 persons	-	-	+
		7-9 persons	+	+	_
		>9 persons	+	-	+
	Household income (monthly)	None	-	-	+
		R100-R499	--	-	+
		R500-R999	-	-	+
		R1000-R2999	+	-	+
		>=R3000	++	+	+
	Weekly food expenditure	0-R49	--	+	+
		R50-R99	-	+	+
		R100-R149	-	0	+
		R150-R199	+	0	+
		R200-R249	0	-	+
		R250-R299	-	-	+
		R300-R349	+	+	-
		R350-R399	-	+	+
		>R400	+	+	-

Table 4.38: Comparison of prevalence of fat intake >30% of energy, fibre intake <67% of AI and overweight of children who moved and those who did not move, by socio-demographic characteristics: South Africa 1999 (continued)

+ indicates a lower prevalence for children who migrated i.e. better off (++ is statistically significant)
- indicates a higher prevalence for children who migrated i.e. worse off (-- is statistically significant)
0 indicates no difference (within 0.5 percentage points) between children who migrated and those who did not move

			Fat	Fibre	Overweight
Environmental variables	Source of drinking water	Borehole	-	-	+
		Communal tap	-	+	+
		Own tap	-	+	+
		River/dam	-	+	+
	Type of toilet	Bucket	-	++	+
		Flush	+	+	+
		Pit	-	+	+
		VIP	-	+	+
Food preparation variables	Fuel used	Electricity	+	0	+
		Gas	-	0	-
		Open fire	-	0	+
		Paraffin	--	+	+
		Wood/Coal	-	+	+
	Cold storage	Fridge	0	-	+
		Freezer	-	-	+
		Both	0	-	+
		None	-	+	+
	Stove	Yes	-	+	+
		No	--	0	+
	Primus	Yes	--	+	++
		No	-	0	+
	Microwave	Yes	+	-	-
		No	--	+	+

Summary

The first objective of this study was to describe the internal migration of South African children aged 1-9 years. Seventeen percent of the study population (1999) reported to have migrated during their lifetime. The destination of migration was primarily within the province of origin and usually within urban areas (50%). Equal proportions of children reported urban-to-rural and rural-to-urban migration. Commercial farming areas and informal urban areas rendered the highest volume of migrants. The main destinations for inter-provincial migration were Gauteng and to a lesser extent the Western Cape. Mpumalanga, the North West, Free State and Limpopo provinces were net origins of migrants.

Migration is an outcome of socio-economic situations. In this study population the prevalence of migration appears in diverse groups. A high prevalence of migration was observed in categories that reflect higher socio-economic groups and is probably an indication of their upward social mobility. There was, however, also a relative high prevalence of migration in the lowest socio-economic groups that is probably a reflection of their need to move in order to survive. The overall relative low prevalence of migration amongst children aged 1-9 years old, combined with the general socio-economic context of the study population would, however, suggest that despite the changed socio-political environment since abolition of measures preventing the free movement of people within the country, the majority of children did not migrate, possibly as their families/households could not afford migration.

The practice of family members, and in this study population, specifically, mothers, migrating without their children appears to be common. The prevalence of migration was not confounded by the age of the children in this study population.

The second and third objectives were to relate the nutrient intake and anthropometric status to internal migration of South African children aged 1-9 years (1999), with corresponding research hypotheses that migration is associated with both these nutritional outcomes. The results of this study showed that the nutrient intake and anthropometric status of children who migrated are marginally better than children who did not migrate. Migration is an independent predictor of energy and vitamin C intake, and of the prevalence (absence) of overweight in children aged 1-9 years after controlling for socio-economic covariates. In addition, selected socio-economic variables appear to be predictors of nutrient intake and anthropometric status of 1-9 year old children within the context of migration in this particular study sample.

Chapter 5

Discussion

Introduction

The three main themes of this study, *viz*. migration, dietary intake and anthropometric status of children, are complex issues and all are multi-factorial in nature and can be regarded as the outcome of one another. The logic applied in the construct of this study is that migration, as an outcome, is the most independent of the three, followed by dietary intake. Anthropometry is regarded mainly as the outcome of complex social, economic and public health issues (UNICEF, 1990:22; Shell-Duncan & Obeiro, 2000:185). In this particular study it is considered as the outcome of factors such as dietary intake and migration. An important common factor in all three themes is socio-economic conditions.

As expected, on the basis of the sampling strategy employed, the number of children, mothers and grandmothers studied varied among the provinces and in total. The urban-to-rural distribution of the study population is similar to the 1996 Census although there are some slight differences in provincial distribution.

Migration

Volume of migrants

The volume of migration reported for children in this study (17%) is comparable to the findings of the 1996 Census and the University of Pretoria/Brown University Migration survey that took part in the latter part of 1999/2000. However, the migration reported for children is lower than for adults, and similar to the situation in Mexico (Corona Vasquez, 1999:15), but different to the United States where similar proportions of migration (20%) were reported for children aged 1-9 years and for women aged 15-49 years for the period March 1999 – March 2000 (U.S. Census Bureau, 2000:n.p.). Comparison of migration rates between different countries was not pursued further than this general comparison of the volume of children and women who migrated, as the differences between countries, and, therefore, the reasons for and directions of migration are so complex that further comparisons were not deemed to be useful in this study.

Other studies on specific communities in South Africa reported migration rates ranging from 14% for women 30-49 in Agincourt (Tollman *et al.*, 1998:862) to 30% in Khayelitsha (Cooper *et al.*, 1991:427). The lower migration rate of children compared to adults is partly the result of the difference in migration opportunity because of the difference in age of the child and adults, and partly the result of the practice where the adults (often mothers) might move in search of new opportunities or a better quality of life, leaving the children behind with (usually) family members – hence the finding that almost one out of four children did not have lifetime patterns similar to their mothers, but rather a similarity with their grandmothers (one in eight children) or no similarity with either the mother or the grandmother (one in ten). Bekker (ed.), (2002:vi) also documented this practice in their study of migration in the Western Cape. Traditionally, children are also sent "home" to be cared for by their grandmother or a family member while the mother earns income in another area (Cooper *et al.*, 1991:426; Adepoju & Oppong, 1994:218; Broster, 1967:118). This form of fostering has been described as a common practice in Africa and is believed to be without any negative connotations or consequences (Shell-Duncan & Obiero, 2000:187). However, findings of this study, as discussed under the dietary intake and anthropometric status of children in the latter part of this chapter, will demonstrate the contrary.

Frequency of migration

The frequency of migration mostly reported in this study as only one move, is lower – especially in adults – than that reported by the UP/BU Migration study 1999 where a maximum of three moves was reported for adults (Proceedings of a graduate workshop on internal migration, 2000:7). A possible explanation for this finding is that the main emphasis of this study has been on migration of children. The questions on migration of mothers and grandmothers might, therefore, have been too few, with too few reminders to ensure an accurate reflection of the migration of women. The time period taken as migration in this study was one year; this is longer than the unusually short period of one month used by the UP/BU Migration study. Another important reason for the differences in frequency of migration reported for adults might be the fact that the child was used as the point of reference. Thirty per cent of mothers were not available to provide information on migration (and might very well have migrated) and only 33% of grandmothers were available to be included in the survey. Households in which there were no children in the relevant age groups were not included in the survey and might have different migration rates and frequencies.

Socio-demographics and migration

Although this study has not attempted to investigate the reasons for migration, the socio-demographic profile of migrants does suggest possible underlying differences between migrants and non-migrants, which might have mediated the migration decision. The data seems to suggest that migration in South Africa is economically driven and that there is a “bi-polar” occurrence of migration, which means that migration was most common on two extreme ends of ordinal variables such as income, educational level, etc. One could argue that these two streams would represent, on the one hand, a group that migrated for survival purposes as documented by various authors (Adepoju, 2002:4; Martin & Widgren, 2002:8) and, on the other hand, a group for whom migration is partly an expression of their upward social mobility or improved opportunities (International Institute for Environment and Development, 2003:). This argument is supported by the probability for migration on various variables such as higher income education levels of the mother, as well as the comparison between migrants with the population at the origin and destination, based on the urbanicity of the area.

Firstly, there is the highest income group (9% with households earning >R3 000) who reported the highest migration rate followed by a small group (4%) of the lowest income (no income) that reported the second highest migration rate.

The high-income group also reported:

- The highest food expenditure;
- Children are mainly cared for by their mothers;
- The similarity of migration patterns is with their mothers only;
- There is a high proportion of recent migration although the older children have a greater share in these households;
- Most households are male headed;

- Live in a brick house with their own tap;
- Own a microwave, fridge and freezer, television and radio;
- Mother has tertiary education;
- Father is a wage earner or self-employed;

There is a high proportion of Afrikaans- and English-speaking children in this group with the African language group categories equally represented. This group was mainly living in urban areas (60%) and reported the highest urban-to-urban migration.

This group could be indicative of a high level of modernisation (Gelderbloem & Kok, 1994:7) and migration as a means to or as a result of upward social and economic mobility. The odds ratio greater than 1 which indicates that migrants more frequently fall within the higher income bracket, i.e. household income more than R1000 per month, would confirm this postulation. The income differences based on origin and destination were, however, only statistically significant for urban migrants (destinations and origin) as compared to urban non-migrants. The cross-sectional design of this study does however not allow us to confirm whether this difference is the cause (positive selection) or the result of the migration. The concurrent odds ratio for migrants to have mothers with an educational level greater than Std. 8, which is also greater than one, although not statistically significant for any of the groups, might suggest selection as a possible reason for some of the findings on nutrient intake and anthropometric status to be discussed later in this chapter.

The group who reported the second highest migration occurrence is the lowest income group, and report that:

- They are also mostly cared for by the mother, but have the greatest share in no similarity of migration patterns.
- Live in female-headed households in temporary structures with the greatest share in no food preparation or storage facilities.
- Children from this group are in the youngest age groups and reported the second highest recent migration. Fifty per cent of them remained in rural areas (no migration), and those who moved, did so within urban areas.

This group represents the most vulnerable, and migration is a survival strategy even though it is not possible for many to move as the cost of migration (social and economic) is too high.

The third significant group that can be identified reported the lowest migration occurrence. They make up almost 40% of the sample and also live below the poverty line of R800/month like the lowest income group. These children have a distribution similar to the lowest income group of language groups, water source and education level of mother. However, this third group reported:

- An equal share in male and female-headed households;
- Live in brick and traditional houses.
- Have the greatest share of grandmothers as caretakers and similarity of migration pattern with grandmother only.
- The majority of children in this group remained rural and those who moved reported mostly rural-to-rural migration.

These children, although they have not migrated themselves, are familiar with the concept, as the mother has probably moved to support the household and, therefore, the child does not have a lifetime pattern similar to the mother. It is accepted that urban earnings, especially in terms of money as support for children staying with family members or as remittance to wives, parents or grandparents, remains a major source of financial support to rural areas (Demeney & McNicoll, 1998:317; Cooper *et al.*, 1991:427). In this sense the persons who remain behind in rural and maybe even in urban areas might benefit from the improvements experienced by people who migrate and find employment. However, some researchers are of the opinion that especially in rural areas these remittances contribute to greater dependency (Byarugaba, 1991:448). These children are doubly disadvantaged by poverty and the opportunity cost of employment for the mother/parents, as anecdotal reports indicate that remittances are insufficient and irregular.

By far the highest migration was reported for English-speaking children, followed by Sepedi- and Afrikaans-speaking children. In total these three groups make up 18% of the study sample. The significant difference between these groups is that the majority of movement for Afrikaans- and English-speaking children was urban-to-urban, whereas the Sepedi-speaking children's movement was almost exclusively rural-to-rural. The proportionate occurrence of migration of children is similar for the other language groups. The two main streams of movement for these language groups are urban-to-urban and rural-to-rural except for the Tsivenda reporting proportionately high rural-to-urban movement.

Although the mean age of children who migrated was around 2 years of age, and age was not found to be a confounder, there is an age-related link between specific socio-economic conditions and migration of children. In general, there is a tapering off of migration which ceases at age seven, i.e. school-going age. More than one out of every three children for whom urban-to-rural migration was reported moved before their first birthday. This probably represents working women (of lower income categories) in towns and cities, who might return to their rural origin soon after giving birth, or children sent to relatives in rural areas after they have been weaned.

The assumption is made that this migration takes place after or around weaning as it has been documented by the NFCS that more than 90% of children had received breast milk and that nationally 63% were breastfed beyond their first birthday (Labadarios (ed.), 2000:320). One can only postulate if and how the HIV/AIDS epidemic will influence migration and breastfeeding practices, especially in view of the contribution of breast milk towards mother-to-child transmission (Piwoz & Preble, 2000:5) and that either exclusive breastfeeding or exclusive formula feeding is promoted as possible risk-reducing practice (Coutsoudis *et al.*, 1999:471), combined with the decreased prevalence of breastfeeding associated with urbanisation (Romero-Gwynn, 1989:804).

Migration of children from households who reported no income remained constant and above 20% at older age groups. This is to be expected and supports the hypothesis that migration is often a search for employment and income generation. These children might not necessarily be with their mother as this group did report a greater share in similarity with migration patterns with the grandmother only and in no similarity of migration patterns. A small minority, especially from the highest income groups, reported a slight increase in migration at ages 6 or 7 years. This is probably a reflection of amenity migration in search of quality educational facilities.

Childcare is expected to change rapidly and dramatically as a result of HIV/AIDS. Currently mothers or grandmothers are caring for the majority of children. It is expected that grandmothers might be taking a greater share of childcare because the infection rate and HIV/AIDS related mortality rate in older women are believed to be lower (HSRC 2002:2). Modernisation and urbanisation, on the other hand, might weaken these familial support systems and an increase in siblings or persons other than direct family members might be taking a greater share in childcare. This type of childcare could also influence the migration patterns and frequency of these HIV/AIDS orphans.

The general summary of the characteristics of migrants in this study is similar to the conclusion by Kok *et al.* (2003:71) based on the 1996 Census that migrants, in contrast to popular expectations, "*… are primarily* <u>*not*</u> *vulnerable, poorly educated rural residents*".

Direction of migration

The main direction of migration that took place for all three groups investigated, i.e. children, mothers and grandmothers, was urban-to-urban. This supports the general migration trend of gravitation towards a few large cities in sub-Saharan Africa as people search for an improvement in their situation (Montgomery & Brown, 1990:75; Findlay & Findlay, 1995:60). It should be noted that urban areas, using the 1996 Census definitions (which have also been used in this study), included semi-urban and peri-urban areas. Ideally migration data should be recorded in such a way that differentiates between these areas, as there is great heterogeneity within urban and rural areas (McDade & Adair, 2001:55). Kok *et al.* (2003:78) support this opinion in their recommendations for future census-based studies of migration in South Africa.

The second largest volume of migration of children and mothers took place within rural areas. The rural-to-rural migration observed could be a function of changes in the agricultural sector as a consequence of drought, mechanisation, and declining material conditions on farms (Findlay & Findlay, 1995:55; Demeney & Nicholls 1998:12). It could also be the result of fear of the land reform issues and land claims that result in evictions (Todes, 2000:3; Ministry of Agriculture and Land Affairs, 2001:n.p.; Ministry of Labour, 1995:n.p.). All these factors contribute to depopulation of farms. This confirms earlier findings that farm workers tend to move to the nearest town, and not further afield (Cross, 2000:41). Although the sample size does not allow a conclusion other than a general observation, grandmothers reported a higher rural-to-urban migration than mothers and children (urbanisation as defined by Mears, 1997:596 and Rogers *et al.*, 1990:253).

The lowest volume of migrants moved from urban into rural areas. Urban-to-rural migration is commonly reported in developed countries as common for people at retirement age and for young executives. Within the South African context this could be due to the inability to find employment in urban areas and subsequently returning to rural origins or a move by urban dwellers to rural edges around towns where livelihood can partially be drawn from natural resources (Cross, 2000:41). Historically, a significant difference between food access in urban and rural areas is that rural people often produce some of their own food (Ruel *et al.*, 1999:1917). According to the NFCS (Labadarios (ed.), 2000:491-521) households in rural areas do grow/produce more of their own food supply, but on average food production for own use is low (6%). Urban-to-rural migration is currently reported as dominant for West Africa due to the overpopulation and unemployment in their cities (Toubon, 2002:4).

Migration in this study sample is more prevalent amongst people in urban areas. The non-movers in rural areas might have some assets and security in place on to which they are holding, or the social and economic cost of migration might be too high, preventing mobility. There is no difference between the prevalence of migration whether the child's lifetime migration pattern is similar to the mother's or not. We can, therefore, assume that having children is not a deterrent to migration.

The greatest migration reported for children (73%), mothers (66%) and grandmothers (66%) was intra-provincial. The net inter-provincial migration in this study and the 1996 Census clearly identifies Gauteng and the Western Cape as net destinations. If one bears in mind that the motivation for migration is often economic (Gibson, 1973:83; Kosinski & Prothero, 1975:8; Detang-Dessendre, 1999:1417; Cross, 2000:23;

Todes, 2000:1; Martin & Widgren, 2002:8), then this finding is to be expected, as these two provinces are the only provinces where less than 20% of the population is classified as poor, i.e. with a monthly household expenditure at less than R800 (Hirschowitz, 2000:27). In the case of the Free State and the North West, the poverty levels might also explain the negative net migration. However, this is not the case in the Northern Cape (Hirschowitz 2000:33, 37, 41, 39, 43, 45, 47, 49, 51). Possible pull factors to the Northern Cape could be the development of and increase in governmental offices in the Northern Cape since the first democratic elections in 1994 and the restructuring of the old Cape Province into three provinces, i.e. the Western Cape, Eastern Cape and Northern Cape. Another possibility could be that the Northern Cape might be an interim destination in gravity flow migration from the Northern Provinces towards the Western Cape (cf. Figure 3.6) necessitated by the distance between the origin and the intended destination as suggested by Greenwood & Sweetland (1972:674).

The volume of inter-provincial flow of children requires that one treats any conclusions with caution, but it is noteworthy that there are pertinent differences in the net direction of provincial migration reported for children and their mothers as illustrated by Figure 3.6 and Figure 3.7. The volume of migration is higher, but most importantly the general pattern of net migration (as expressed by the difference in place of birth and current residence) is similar for children, mothers and grandmothers (cf. Figure 3.4) except for mainly the Eastern Cape and KwaZulu-Natal. In the Eastern Cape there is a net stream of mothers who reported migration to the Western Cape, while the net flow of children is in the opposite direction. The same applies to Gauteng with children having a net migration towards the Eastern Cape although on a much smaller scale. Mothers from KwaZulu-Natal reported net migration flow to Gauteng, Mpumalanga, Free State, and Eastern Cape, but the net flow of children is from Free State and Gauteng towards KwaZulu-Natal. One possible explanation might be that the children are returned “home” (without the mother) or that the stream of women without children (either not having had any yet, or without them) exceeds the flow/stream of women with children in these different directions. Based on his findings in the Western Cape, Bekker (2002:vi) reported that family members (fathers and/or mothers) often migrate individually and that the children will follow once they are established – often a number of years later. In addition the measure used for the calculation of net migration might not have been able to pick up circulatory migration and could actually erroneously include those as intra-provincial migration.

Children who migrated between different provinces as compared to children who migrated within one province displayed similar socio-economic characteristics except for statistically significantly higher inter-provincial migration being reported by the Tsonga language group, mothers from traditional marriages, mothers who are either unemployed or self-employed, and households who reported no access to a stove. Significantly lower inter-provincial migration was reported for widowed and divorced women and for households with no income. The cost of moving has been raised as an important deterrent to migration (Cross *et al.*, 1999:69) and would probably apply to the latter finding and the high inter-provincial migration of self-employed women. Along the same lines, the identification of services and infrastructure as important motivations for migration could explain the groups with high inter-provincial migration (Cross *et al.*, 1999:71).

On the basis of the small proportion of children, mothers and grandmothers who reported having moved more than once, one would assume that this would not explain the high levels (almost 80%) of intra-provincial migration reported by this study and the 1996 Census (cf. Table 3.9; Table 3.10; Table 3.12; Table 3.13; Table 3.15). Another possible explanation for the high intra-provincial and relative dominance of urban-to-urban migration may be the pattern of step-wise metropolisation as described by Kok *et al.* (2003:38), by which people gradually move closer to the centre of Johannesburg by first moving from one developed urban area such as Witbank to another such as Vanderbijlpark.

Consequences of migration

Migration as reported in this study took place in the decade between 1989 and 1999 within the context of the first inclusive elections in 1994 following the abolition of the apartheid regime, as well as its related control movement control mechanisms at the end of 1987. This period also preceded the upsurge in the South African HIV/AIDS epidemic. Temporality is an important concept in the context of migration as well as health and nutrition outcomes. The consequences of migration presented as part of this report need to be considered within this context and one may assume that many consequences have not been measured as part of this study. At the same time some consequences might not have manifested yet, as sufficient time has not passed while others might have disappeared after some time. Furthermore, the consequences of migration do not operate in isolation, but are influenced by social and cultural practices, perceptions and norms. Although the duration of stay at the current residence is available for the study sample, the cell numbers do not allow meaningful analyses and conclusions other than the relative timing of mobility within areas. This is an important area for future investigation with sufficient sample sizes such as the bi-annual Demographic and Health survey.

Urbanization

Urbanization, in a purist demographic sense of the word, would indicate the growth of urban populations (Forde, 1976:56; Gupta, 1984:67; Rietveld, 1988:73; Gupta & Sharma, 1994:147; Yaakoubd, 1997:243; Cohen, 2003:7), and would not appear to be the main consequence of migration as reported during this period, as rural-to-urban migration was reported for only 1.5% of children and 4.9% of their mothers. However, this should be considered within the context of the high levels of urbanization reported for the South African population whereby 96% of the Whites, 91% of the Asians, 83% of the coloureds were classified as “urban” by 1991 (CSS, 1995:3). The urbanization level of Africans was reported to have changed from 35% to 43 % between 1991 and 1996 (Statistics SA, 2000:1.5). Although other South African researchers have documented a similar finding (Cross, 2000:41), it is acknowledged that the migration of individuals and households without children – who were excluded from this survey – might be considerably different.

Poverty

The economic links between migration and economics in South Africa have been documented previously (Cross, 2000:23; Kok *et al*., 2003:52-74) and are supported by data from this study. The generalisation that migration might contribute to shifting the poor and unemployed (specifically to urban areas) does not hold true for urban areas as the odds ratio for migrants to earn a household income >R1000/month was 1.3 and

1.47 for migrants with a rural and urban destination respectively and 1.2 and 1.5 for migrants with a rural and urban origin compared to the non-migrants at the comparative areas of residence. As mentioned before, the other alternative that the poorest cannot afford to migrate might therefore hold true for this study population. As an example, it would appear that both migrants with a rural origin or a rural destination have greater odds to have access to safe waste disposal compared to the rural non-migrant counterparts (4.26 and 1.87 respectively to have a flush toilet), while in urban areas this is not the case (0.56 and 0.86 origin and destination respectively to have a flush toilet). Although on a lesser scale a similar situation exists for water (own tap) and availability of electricity. The possibility does exist that the current housing shortages that are regularly reported in the media might have an influence on this finding where migrants might be living in temporary housing structures without services despite their having a somewhat better income situation than urban non-migrants.

Health and disease

The scope of this study is limited to the nutrient intake and anthropometric status of children and has not investigated the possible health and disease outcomes. Diseases of lifestyle might, or might not, develop only much later as these children grow into adulthood. Any discussion on possible implications for diseases (infectious and lifestyle related) would therefore be speculation.

Nutrient intake

In line with the conclusion on the characteristics of migrants, the nutrient intake — expressed as the mean proportion of the RDA (Institute of Medicine, 1997:71-145; Institute of Medicine, 1998:58-147, 566-567; Institute of Medicine, 2000:82-185, 290-393, 442-501, 509, 770-773; Institute of Medicine, 2001: 1-81; Institute of Medicine, 2002:93-696, 10, 12, 16.) consumed for each age category — of children who moved is higher than the nutrient intake of children who did not migrate (Table 4.14, p141). This difference is only statistically significant for energy, fat, fibre, vitamin C, niacin, iron and zinc and after controlling for selected socio-economic covariates remained significant only for energy and vitamin C. The generalisation on better dietary intake by migrant children holds true for most groups. Children who migrated urban-to-urban

(8.6%) consistently consumed higher proportions of the RDA when compared to those who remained urban (41.5%). Children who moved rural-to-urban (1.5%) consumed higher proportions of the RDA (and are, thus, better off) than those who remained rural (no movement), but are worse off than children who remained urban. Children who moved urban-to-rural (1.6%) are also better off than those who remained rural (no movement), but the comparison with urban non-movers is mixed. The linear regression (controlled for selected socio-economic variables) suggests that even though differences in mean intake might be significant, the actual contribution of migration as a variable to the outcome is very small. It would appear as if specific socio-economic variables such as income, a mother's education, availability of cold storage, and gender of the household head are predictors of nutrient intake. It should be noted that even these combination of factors explain only 1-15 % of the variation in mean intake.

Children who remained rural (no migration) (41.5%) are consistently consuming a diet lower in all nutrients compared to all other migration/no migration groups. Children who moved rural-to-rural (5.2%) are generally comparable to those who remained rural (no movement). Nutrient intake as assessed by the 24-hour recall methodology is an indicator of children's current consumption. Two factors that could, therefore, explain these findings are (i) that the urban food supply is superior in quality and/or quantity (Byarugaba, 1991:446; Solomon & Gross, 1995:91; Guo *et al.*, 1999:994; Labadarios (ed.), 2000:260-282) and (ii) that migration for children with an urban destination meant an improvement in socio-economic conditions (Guilmoto, 1998:85; Corona Vazquez, 1999:15), which translates into improved access to the superior food supply and results in better dietary intakes reported (Kennedy & Peters, 1992:1084; Roos *et al.*, 1998:1519).

The most vulnerable group of children identified is equally divided between rural and urban areas of residence and is made up of children who have migration patterns similar only to their grandmother (13.5%). These children consistently consume the lowest dietary intake except for energy. Within this group, one out of ten children migrated and are worse off. Almost similar rates in all directions of migration were reported for these children although slightly lower for urban origins. This finding could be the result of the elderly being most destitute, and reflects on the high dependency on a limited old age pension, lack of financial support from the parents of the children (due to unemployment, low wages or absence due to HIV/AIDS mortality) and has important implications for access to child support grants by grandmothers as well as appropriate interventions to ensure sustainable developments for this group.

Although all migrant children are at a lower risk of consuming insufficient amounts of nutrients, they are at a greater risk of consuming excessive fat. Although the inverse relationship with fibre does not yet exist, this might be the early sign of nutrition transition as documented by various authors (Dagan *et al*., 1984:1029; Wandel, 1993:117; Popkin, 1994:285; Steyn *et al*., 1996:758; Johnson-Down *et al*., 1997:2313; Drewnowski & Popkin, 1997:40; Pomerleau *et al*., 1998:41; Popkin 1999:1908; Vorster *et al*., 1999:341; Popkin, 2001:S872; Yach *et al*., 2001:236; Hyman *et al*., 2002:125; Kouris-Blazos, 2002:S569; Varghese & Moore-Orr, 2002:72; Kim & Chan, 2004:469). The nutrition transition is traditionally described as a change from high-fibre, low fat diets to a more affluent type of diet rich in animal fat and low in fibre (Vorster *et al*., 1999:342). Although not conclusive, data from this study would seem to confirm that the nutrition transition now occurs at lower socio-economic levels as suggested by Drewnowski & Popkin (1997:40). Concurrent with the changes in diet structure the nutrition transition is also marked by a shift in activity and body composition patterns amongst all age groups.

Developing countries, where non-communicable diseases become more prevalent and infectious diseases remain undefeated, are subject to a double burden of disease (Vorster *et al*., 1999:341). In South Africa, with rising crime levels and especially safety of children as reported in popular media daily, the situation will also contribute to changes in children's free play activities and further contribute to sedentary lifestyles at earlier stages of the lifecycle.

The nutrition transition has traditionally been related to migration and exposure to urbanisation and modernisation linked to socio-economic development. This process is expected to continue independently beyond the initial causational factors especially with the developments in communication and sharing of information.

It is clear from the data on the contribution of fat to the total energy intake that children who currently have or have had contact with urban areas consume a diet with a higher fat content although the mean fat intake is still relatively prudent. Most children in this study consumed diets that provide insufficient amounts of fibre. The mean fibre intake differs only about1g for children who migrated and those who did not. This low fibre intake is possibly a result of the low total food consumption, which is assumed based on the proportion of children who consume insufficient amounts of energy and other nutrients. Although interventions should already be planned to ensure that children consume sufficient amounts of fibre as well as other nutrients, further investigations would be required to monitor the situation and act as an early warning should fibre intake decrease even further and inversely to the energy contribution of fat to the diet.

This risk of excessive fat consumption and possible resultant diseases of lifestyle and cancer as adults for these children is further increased by the fact that they migrated at an early age before internalisation of possible "protective traditional practices" such as the consumption of high fibre diets or cruciferous vegetables. Therefore, they would not be able to benefit from these practices as has been documented by Kouris-Blazos (2002:S569) for Greek migrants to Australia who returned to traditional practices with advancing years. In view of the known effect of urbanisation and the nutrition transition especially on fat intake and related chronic diseases, further analyses and investigations of the fat composition of children's diets (beyond total fat consumed) need to be performed to assess the possible differences in dietary intake and risk of chronic diseases by migration differential.

Traditionally, Africans consume only two meals a day and commonly consume snacks and drinks in between (Coetzee, 1982:20). The conceptual framework proposed by Koctürk-Runefors (Wandel, 1993:28) suggests that migrants maintain their identity through their staple food, but that the complementary items to the staple as well as accessory foods, such as snacks and drinks, are regulated by taste and availability, which contributes to the changes in fat, sugar and fibre intake of migrants. It has been proposed by Kockturk-Runefors (Wandel, 1993:24) that in a scenario similar to the

African traditional meal pattern, emphasis on dietary consultation should be placed on snacks and drinks rather than the composition of meals.
None of the studies on internal migration and nutritional status of children reported on the nutrient intake of migrant children. The two reports on international migration and dietary intake could unfortunately not be compared to the findings of this study, as Wandel (1993:117-133) focussed on dietary patterns rather than nutrient intake and Meulmeester & Hulshof (1993:320-322) were not accessible for comparison, and the abstract did not indicate levels of nutrient consumption other than the statement that Turkish and Moroccan children in the Netherlands consume a diet that is more compatible with the Dutch recommendations than that of their Dutch counterparts.

Anthropometric status

Anthropometric indices reflect a longer-term undernutrition or overnutrition than dietary intake. Individual growth reflects genetic, socio-economic and environmental conditions of the growing child in general and dietary adequacy of children's diets specifically and is usually monitored by occasional measurements of stature and weight (Alberman *et al.*, 1991:127; Durnin, 1991:93; Singh & Harrison, 1996:101; Ginsburg *et al.*, 1998:320; Hermanussen *et al.*, 1998:359; Story *et al.*, 1998:172).

Underweight (as measured by weight-for-age below – 2SDs) and stunting (as measured by height-for-age below – 2SDs) are indicators of acute and chronic undernutrition respectively while wasting (as measured by weight-for-height below – 2SDs) is an indicator of both acute and chronic undernutrition (United Nations 1990: 33). In addition, stunting has been linked to delayed mental development and measurable deficits in behaviour and cognitive performance in school-aged children and is an independent risk factor for a number of diseases (Luke *et al.*, 2001:54).

The overall anthropometric status of children who moved is better than those who did not move. These differences are marginal and only significantly lower with regard to overweight in children who migrated after controlling for selected socio-economic covariates. None of the differences in mean anthropometric z-score between migrant children and non-movers is statistically significant. This "protective" effect of migration would follow logically from the socio-economic profile of migrants as well as their dietary intake. A similar protective effect has been demonstrated before for immigrants in Zaire (Bertrand *et al.*, 1988:566). However, the majority of research reports have demonstrated higher rates of malnutrition in migrant children in developing countries (Bogin & Mac Vean, 1981:1373; Malina *et al.*, 1981:277; Schumacher *et al.*, 1987:861; Carnell & Guyon, 1990:111; Pelto, 1991:55; Goduka & Poole, 1992:523; Núñez-Rocha *et al.*, 1998:248; Hulanicke *et al.*, 1999:556; Fredriks *et al.*, 2003:788). The protective effect of the findings by Bertrand *et al.* (1988:566) might be due to the fact that migration of the father was used as the point of reference in the classification of children into migrant and non-migrant groups. Similar to findings from the Bedouin Infant study, these children could have benefited from the possible economic or environmental benefits of the migration. A higher prevalence of undernutrition is expected in migrants if they are mainly from the lower socio-economic groups.

In general it would appear as if the order suggested by dietary intake would also apply to anthropometric status, i.e. urban-to-urban migrants and urban non-movers being best off, with rural-to-rural migrants and rural non-movers being worst off and urban-to-rural and rural-to-urban migrants better off than rural non-movers, but worse off than urban non-movers. However, conclusive statements based on the direction of migration cannot be made, as multivariate regression analysis was not available due to the small number of children in each category.

Children, who had similar migration patterns only to their grandmother, have the highest prevalence of underweight and stunting, and those who migrated within this group are worst off. Wasting is highest in non-migrant children who had a similarity in migration pattern during their own lifetime to both the mother and grandmother. Only stunting had a positive association with the lifetime presence of the mother i.e. a lower prevalence for migrants and non-movers were associated with similar migration patterns of the mother. None of these differences was statistically significant. Within the limitations of the use of information on the duration of stay at the current residence, comparisons based on how recently children migrated, does not support the finding by Pelto (1991:52) that the most recent movers will have the lowest proportionate nutrient intake and nutritional status.

Stunting is an independent risk factor for a number of diseases. It has been suggested that stunting, together with age-adjusted BMI for children, should be used in assessing the disease risk in developing countries (Caballero, 2001:S867). Stunted children are at risk of obesity and may gain weight over time when food supplies become sufficient to allow *ad lib.* consumption. This might explain the increased prevalence of obesity among stunted children and short adults in developing countries (Hofman *et al.*, 2000:706). Impaired fat oxidation has been identified as a possible mechanism for this process. Data from a number of cross-sectional surveys from countries with different socio-economic levels indicate that the risk of obesity is higher in the highest socio-economic groups, and that it is on the increase for developing countries and that urban residence *per se* is not a cause for obesity (Monteiro *et al.*, 1995:105; Drewnowski & Popkin, 1997:40; Caballero, 2001:S868; Griffiths & Bentley, 2001:2689). In some developed countries the poor are at risk of becoming more obese than the rich. In highly developed countries the turnabout in obesity levels is believed to be related to a conscious effort to control body weight (Harrison *et al.*, 2000:2049) and to consume healthier diets (Roos *et al.*, 1998:1519).

As far as overweight is concerned all children who moved, regardless of direction, had a lower prevalence of overweight than their counterparts at both the origin and the destination.

Socio-economic context of nutrient intake and growth of migrant children

The socio-economic characteristics of migrants in some way all point towards children from more stable and better socio-economic households moving and being better off as a result of migration (Bustos *et al.*, 2001:1645). This would suggest that migrants are experiencing upward socio-economic mobility, which translates into improved access to food, dietary intake and subsequently improved nutritional status and health of children (Mwadime & Baldwin, 1994:571).

A difference in the characteristics associated with dietary intake and with anthropometric status is to be expected as these two outcomes reflect different time scales. The composite summary of the direction of the difference in the prevalence of insufficient nutrient intake and anthropometric indicators (Table 4.37; Table 4.38), provide the following conclusions:

- Children from the Tsonga ethnic group (Tsonga, Venda & Shangaan languages) appear to be at the highest risk of insufficient nutrient intake and undernutrition.
- Children who are at risk of health and nutrition problems associated with nutrition transition are those who have the lowest proportionate share in insufficient nutrient intake and underweight, and the highest share in excessive fat consumption, and low fibre intake. The following characteristics have been identified relating to this group of children:
  - mother as caretaker;
  - mother who is a housewife by choice;
  - fathers as household head;
  - households with 4-6 persons living in brick and tin/plank houses.
- The dual burden of disease is relevant in this study population in the lower socio-economic strata.

The composite summary has also assisted in identifying specific variables, which are associated with insufficient nutrient intake, as more related to the available food preparation facilities, while anthropometry has rather been associated with sanitation and income characteristics. Researchers have also described most of these characteristics as being related to child health and nutritional status.

Those factors highlighted by this study will be summarised briefly. Malnutrition has been conceptualised as a consequence of poverty (Gillespie *et al.*, 1996:3; Shell-Duncan & Obiero, 2000:85; Allen & Gillespie, 2001:4). Improvements in income levels are, however, not directly and proportionately translated into dietary intake or anthropometric status of children. They need to be balanced with food preparation and childcare time, i.e. the opportunity costs of employment, to ensure good infant and child nutrition (Gussler, 1987:159). The African Diaspora illustrates the impact of differential environmental and economic conditions on the nutritional status of people with an historical and genetic common origin (Luke *et al.*, 2001: 55). In this study the

Tsonga language group appears to be negatively impacted by migration and its associated impacts. Brockerhoff & Hewett (2000:36) allude to the social inequalities between ethnic groups in sub-Saharan Africa even within impoverished communities. Male-headed households, especially within the context of nuclear families, are important as they increase the probability of income generation, and sometimes dual incomes in the family, which would translate into less vulnerable socio-economic conditions. In addition, Devin & Erickson (1996:479) confirm the importance of male parental involvement in child development. They and other researchers (Kennedy & Peters, 1992:1083; Roos *et al.*, 1998:1519; Shell-Duncan & Obiero, 2000:186) confirm that although female-headed households are often to be found among the poorest of the poor, females have better care-giving practices. From this they conclude that child nutrition is influenced more by a complex interaction between gender and income rather than strictly by the one or the other. Family size also negatively influences child nutrition by reducing per capita income and access to nutritional resources (dilution model) (Shell-Duncan & Obiero, 2000:185). Control of infectious diseases through interventions such as potable water and sanitation services, breaks the malnutrition-infection cycle and has been demonstrated to improve especially the anthropometric status of children (Gillespie & Mason, 1991:104).

As the nature of this study is cross-sectional, it does not give an indication of whether the current socio-economic situation, dietary intake or anthropometric status is an improvement on the situation before migration for households and individual children. Ideally, a comparison should not only be made between those who migrated and those who did not, with children at the destination, but also with children at the origin. Unfortunately, the numbers of children who moved between different origins and destinations did not allow for this type of analysis beyond the urban/rural classification of areas. According to Cross *et al.* (1999:43) migrants perceived themselves and their households to be better off after migration. Therefore, it is possible that the improved dietary intake and anthropometric status of children who migrated might be a reflection of this improvement. Another possible explanation for the positive associations between migration, dietary intake and anthropometric status of children might be the general profile of migrant children as not the most vulnerable rural people. If the assumption is that family members (and in this case particularly mothers) migrate and that children will follow only once they have established themselves, then this provides the explanation for the conclusion that children who migrate are not the most vulnerable.

Migration *per se* would not appear to be an indicator of nutritional risk of all nutrients and anthropometric indicators, but it has been found to be an independent predictor of energy and vitamin C intake as well as the lower prevalence of overweight in this study. Migration also contributes to changes in the socio-economic and childcare context of children in South Africa. The latter two aspects have been demonstrated repeatedly by various researchers and are accepted as the norm by nutrition workers (UNICEF, 1990:33; Black & Krishnakumar, 1999:S1073; Brockerhoff & Hewett, 2000:36; Bustos *et al.*, 2001:1645).

Data from this study would suggest that the impact of migration on nutritional status and dietary intake is mediated through the changes in resources (especially economic) that result from migration, as well as access to food, child care, safe and less harsh environments and access to and quality of health services. The current levels of poverty and unemployment in South Africa may act as a deterrent to migration for the most destitute due to the cost of migration and contribute to the overall general finding, which is — in contrast to most international studies — that children who migrated are better off than non-movers. To understand best the association between migration, dietary intake, nutritional status, and socio-economic conditions, including urbanicity as a factor, all of these should be considered as a continuum.

The differences in outcomes would depend on where the individual child started off, i.e. from an urban or rural environment. The starting point not only influences the outcomes, but also influences the propensity to migrate. Children (and their households) living in an urban environment might have a better nutritional status (dietary intake and anthropometric status) than their rural counterparts. As a result of their environment and the accessibility of employment and housing opportunities, these households might not only find it easier to find employment (better employment in some cases), but might also find it easier to migrate. This would support the general conclusion that children who migrate are better off than those who did not migrate.

On the other hand, children in rural areas have a lower socio-economic status, poorer nutrient intake and lower anthropometric status. Migration opportunities are limited for them as a result of differences in distance – both physical distance and distance in income, social aspects, etc. Those who do migrate might have been forced to do so to survive. Alternatively, their family members may have succeeded in securing a place to live, a job or social networks or all of these, and, therefore, the children migrate to reunite the family. In this case the nutritional status of these two groups of children might be similar to start off with, but the impact of migration might be very different.

Conceptual framework

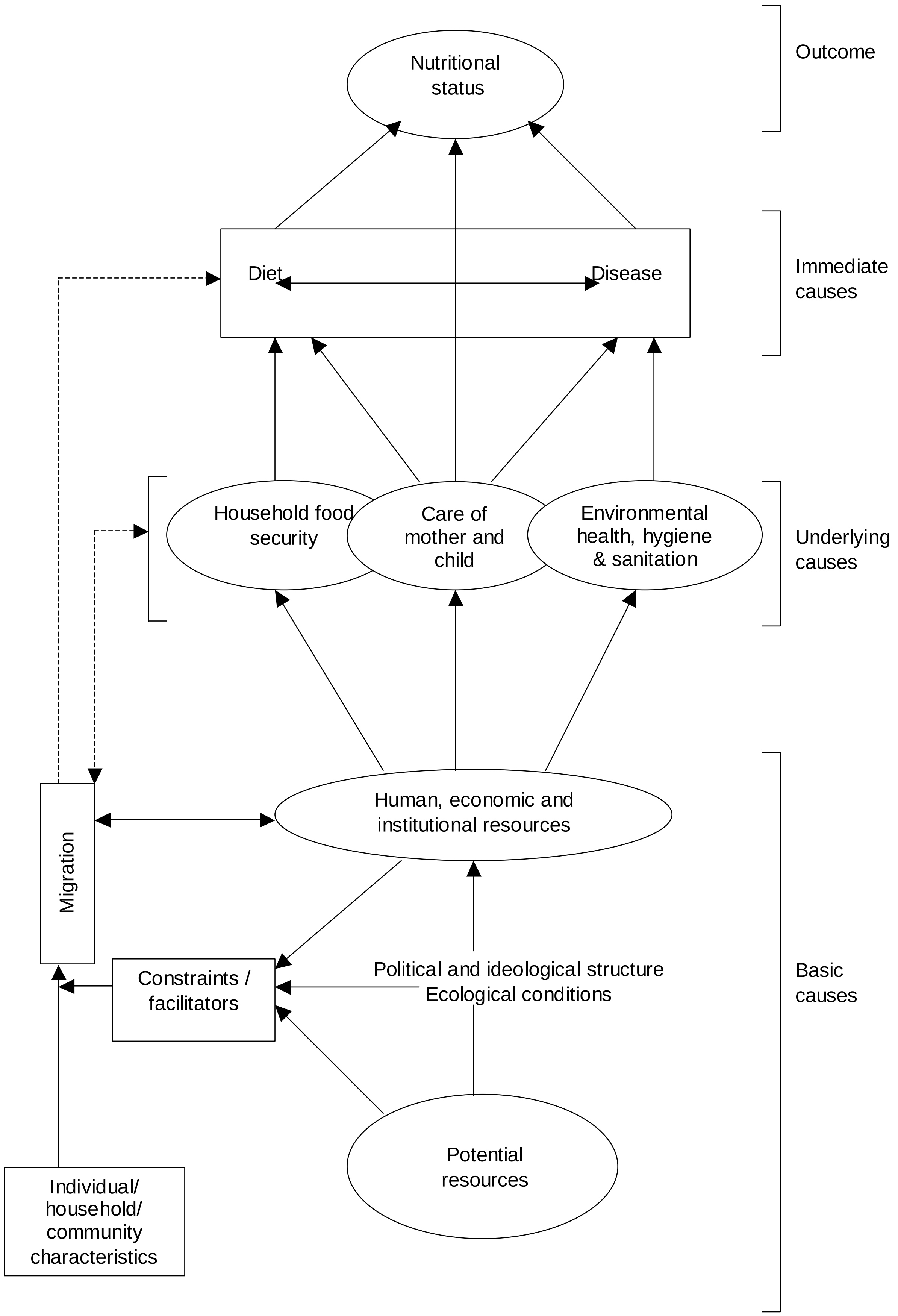
Findings from this study seem to suggest that migration is not the primary critical factor that determines nutritional outcomes although it is predictive of energy and vitamin C intake. The conceptual framework that has been proposed, as part of the literature review (cf. Figure 2.11), should therefore be amended to indicate the bi-directional influence on the level of economic resources, i.e. the basic causes, and a weak influence on the level of underlying and immediate causes (cf. Figure 5.1).

Migration is mediated through economic resources in the sense that the “better off” moved. This movement is associated with higher nutrient intakes (specifically energy and vitamin C) that confirm that migration might have contributed to children who migrated being better off. However, on the basis of all other nutrients as well as the anthropometric status of children in this study sample, it is not possible to conclude that migration results in children being better off.

Migration does impact to some extent on environmental conditions such as toilet facilities, water and electricity, as well as caring of mothers and children and household food security. It is suggested that these impacts are mediated by the socio-economic factors.

However, the cross-sectional nature of this study to the directionality of the relation between migration and socio-econmic factors and basic causes could not be confirmed and is a clear direction for future investigation.

Figure 5.1: Conceptual framework to illustrate the role and importance of migration in the nutritional status of children (An adaptation of Figure 2.11)



Chapter 6

Conclusions and Recommendations

This cross-sectional study has set out to describe the migration patterns for children aged 1-9 years in South Africa, and to investigate possible associations between migration, nutrient intake and anthropometric status of these children. These objectives were linked to two specific hypotheses, i.e. that migration is associated with a difference in the nutrient intake of children, and that migration is associated with a difference in the anthropometric status of children. The main findings of this study as well as some generalised conclusions will be summarized according to these aspects: migration, nutrient intake and anthropometric status.

1. Migration patterns
    a. Higher income groups predominate as migrants. Residential mobility or migration is a strategy that different groups employ differently in specific situations. For some it is a survival strategy whilst for others it is part of the expression of their development and self-perception. Most importantly it is dynamic and responds to changes in political, social, environmental and economic environments. In South Africa migration is less frequently selected as an option by the poorest, rural people with low education. This may be a reflection that the social and economic costs of moving are not achievable at the current levels of poverty, combined with the lack of employment opportunities nationally.

    b. The direction of migration is primarily urban-to-urban or rural-to-rural and intra-provincial. The socio-economic profile of current migrants in South Africa serves as an explanation of the observed direction of migration. It has been suggested that the high levels of intra-provincial migration can be accredited both to a step-wise metropolisation and to the phenomenon of farm workers being unable to move beyond the nearest town. The greatest deterrent for people living in farming areas to migrate beyond their nearest town is their perception of skills as well as employment opportunities available to them. This apparent negative selection of migration, especially in rural areas, has important implications for development in these areas.

c. Only 60% of children have lifetime patterns similar to those of their mothers. The tendency of individual migration versus household migration is not only part of the legacy of labour migration during the apartheid era, but also a financial consideration, because the cost of migration is lower for individuals. Furthermore, a return to the origin is less costly in cases of unsuccessful migration, i.e. not achieving the objectives that motivated the move in the first place, e.g. finding employment, housing, etc. This would appear to be a strategy also employed in other developing countries such as Mexico.

d. Migration stops when children reach school going age. Education of children is an important factor in every household, and not only because it is mandatory. In this study no migration was reported to have taken place after the age of seven years. A superficial analysis of the 1996 Census data would appear to confirm the conclusion that migration will only increase again around the ages of 12-15 years.

2. Nutrient intake and anthropometric status

   a. The dietary intake reported for children who migrated is better than for non-movers. After controlling for socio-economic covariates, this remained statistically significant for energy and vitamin C. The null hypothesis that there is no difference between the nutrient intake of children who migrated and those who did not is rejected, therefore, with regard to energy and vitamin C.

   b. Migrant children also had a marginally better anthropometric status, although only the prevalence of overweight was statistically significantly lower for migrants after controlling for socio-economic covariates. The null hypothesis that there is no difference between the anthropometric status of children who migrated and those who did not is rejected, therefore, with regard to overweight only.

c. The main migration groups identified by dietary intake and anthropometric status are similar, as children who migrated urban-to-urban were the best off of all children, and non-migrant rural children were worst off. Of great importance is the most vulnerable group that is equally present in rural and urban areas. These children reported low migration rates and had migration/non-migration patterns similar to their grandmothers only. The lowest dietary intake and anthropometric status was reported for this group of children. As grandmothers are often the “natural” selection for fostering, additional support of this human resource needs to be secured as this study found that they might not have the socio-economic means to provide sufficient childcare. The expected increase in HIV/AIDS orphans makes this essential.

d. Despite the relatively high levels of rural residency in South Africa, only a small proportion of people are still at the early stages of nutrition transition. As nutrition transition is the result of the demographic transition, epidemiological transition and urbanisation, one would assume that rural residency is not necessarily an indicator of urbanisation. Information and communication technology has developed so much that people do not have to move in order to come into contact with new foods and lifestyles. This has important relevance for nutrition programming. Griffiths & Bentley (2001:2692) conclude that even though the factors associated with underweight, obesity and overweight are very similar, the solutions and challenges are not. Nutrition education and interventions should include recommendations to improve dietary quantity and quality to prevent undernutrition whilst preventing overweight and its related health effects. Monteiro *et al.* (1995:105) suggest that education might be sufficient for higher socio-economic classes. Lower socio-economic groups would require a different approach to ensure food security and rural development and simultaneously to help people understand the components of a healthy diet, and to ensure access to health care.

e. Migration does not take place in a vacuum. The differences measured in terms of diet and growth are not only the result of migration, but also reflect changes in the environment, employment, etc. that might have changed as a result of migration or as a result of broader economic developments or regressions. By the same token, diet, eating patterns and growth are also dynamic and are influenced by migration and by socio-economic conditions, which can both influence food security, childcare practices, health and environmental services. Simultaneously, there is also a flow of information between areas of destination and origin as a result of communication with migrants specifically, but also through modern communication networks. Various authors suggest that as a result of migration, the heterogeneity between areas appears to increase, but within each area the heterogeneity appears to decrease. Migration mostly facilitates or expedites the process of change/modernisation/urbanisation regardless of the urbanicity of residence. In the current South African context migration might contribute to the divide between rural and urban areas.

f. Future investigations into migration and nutritional status should include larger numbers to increase the power of the findings. The possibility of including migration questions in the bi-annual Demographic and Health Survey should be investigated as this survey already collects anthropometric information. The health information that forms part of the DHS will expand the possibilities with regard to investigations into the health implications of migration. Qualitative investigations into the process of migration related dietary changes especially might provide useful information to assist in the planning of appropriate strategies to address both over- and undernutrition. Studies investigating the directionality of the association between migration and socio-economic status in South Africa would also be useful to examine as both impact on dietary intake and nutritional status of children.

g. This study found that the patterns of migration and the related prevalence of insufficient dietary intake and poor anthropometric status varied across the population of South African children aged 1-9 years. This not only confirms the conclusion that migration, dietary intake and anthropometric status is interdependent, but also confirms the relative importance of socio-economic status in all three these outcomes. The impact of migration on the dietary intake and anthropometric status of South African children is therefore dependant on the starting point of each individual child. Instead of focussing exclusively on the consequences of migration (past movement), it is important that we adopt a stance as dynamic as the phenomenon itself. We need to understand the dynamics of migration, urbanisation, dietary intake and nutritional status in order to develop appropriate interventions, and should avoid homogenising assumptions.

These findings suggest that the focus of attention as far as nutrition support and socio-economic development should be on rural areas where 40% of the population earn less than R800/month. As Ruel *et al.* (1999:1918) suggest (rural /urban) poverty is not primarily a lack of work, but the lack of well-paying jobs. In addition, the urban poor tend to have better safety nets compared to the rural poor as a result of better logistics/infrastructure in urban areas. The observation by some researchers (e.g. Solomons & Gross, 1995:93) that there is greater community support for single poor persons in rural areas highlights the fact that, despite possible better rural social support networks, there are limited financial resources and infrastructure in the South African rural areas.

Various authors have suggested previously that urbanisation exposes people to both beneficial and adverse consequences related to health and nutrition (Solomons & Gross, 1995:93; Yan *et al.,* 1999:121). In this study sample it was again confirmed that children living in urban environments are better off than their rural counterparts. However, this does not imply the absence of undernutrition in urban areas. There is still a need for development in social and economic conditions that would lead to improved dietary intake and anthropometric status. However, within urban populations and, especially, for children who migrated urban-to-urban, recommendations on improving dietary intake and anthropometric status need to be coupled with recommendations on dietary and physical activity practices to prevent overweight and other undesirable effects of the nutrition transition (Robertson *et al*., 1995:S11; Drewnowski & Popkin, 1997:31; Monteiro *et al*., 1995:105; Popkin, 1999:1905; Ruel *et al*., 1999:1924; Vorster *et al*., 1999:348; Stookey *et al*., 2001: 2433). The latter might prove to be difficult as it is known that people exert an unwillingness to return to diets of poverty (Drewnowski & Popkin, 1997:41) – which are often healthier than diets followed by migrants.

It should be borne in mind that migrants, especially circulatory migrants, together with the increased availability of modern communication technology in rural areas, act as a valuable source of information to non-movers. This might lead to rapid changes in dietary intake of non-movers. Data on hypertension in South Africa, where differences between urban and rural areas have been levelling off, has already been attributed to the exposure of rural people to urban influences as a result of circular migration (Steyn *et al.*, 1996:758). Therefore, appropriate nutrition and health information should be made available to all groups, but with the urban population as a primary target.

In both rural and urban areas, children who are with their grandmothers are most vulnerable, and those who migrated with their grandmothers should be prioritised for support as they are at the greatest risk of nutritional deficiencies. Access to and control over child support grants should be available to this group as a priority. Although it has not been the objective of this study, and while the findings are definitely inconclusive, the data seems to suggest that elderly migration in South Africa is different to other countries. The elderly do not migrate to stay with adult children, but rather children stay with the elderly who might be receiving a meagre pension as the only household income as a result of high unemployment levels.

Todes (2000:1) argues that migration to the cities and disappearance of "artificially created" settlements as was suggested by some in view of the termination of apartheid controls, is doubtful and hardly possible in view of the cost of migration. Findings from this study, which took place five years after the first democratic elections and twelve years after the abolition of influx control, appear to support the opinion expressed by Todes. Strategies by national and provincial housing and development planning to facilitate the disappearance of these “artificially created” settlements might change the prevalence of malnutrition in urban areas and the nutritional status of migrants dramatically. A possible and probable increase in second-generation migration (especially linked to increased opportunities in higher education for the children included in this study) might also contribute to very different findings should the same study be repeated in twenty years’ time.

In summary, it is concluded that, although there are many aspects for future investigations, it would appear as if children aged 1-9 years who migrated in South Africa during their lifetime (birth-1999) are not the most vulnerable rural children, and migration most likely contributed to their improved dietary intake.

Chapter 7

List of references

Adepoju, A. & Oppong, C. 1994. *Gender, work & population in Sub-Saharan Africa*. London: James Curry.

Adepoju, A. 2002. Fostering free movement of persons in West-Africa: achievements, constraints, and prospects for intra-regional migration. *International Migration,* 40(2):3-28.

Adepoju, A. 2003. Migration in West Africa. *Development*, 46(3): 37-41.

Aguayo, V. 1999. Profiles Guideline: Calculating the effects of malnutrition on economic productivity, health and survival. *Report in preparation for workshop*. AED: Washington.

Alberman, E., Filakti, H., Williams, S., Evans, S.J. & Emanuel, I. 1991. Early influences on secular change in adult height between parents and children of the 1958 birth cohort. *Annales of Human Biology,* 18(2):127-136.

Alderman, H., Babita, M., Lanjouw, J., Lanjouw, P., Makhatha, N., Mohamed, A., Ozler, B. & Qaba, O. 2000. **IN** Hirschowitz R. 2000. *Measuring Poverty in South Africa*. Pretoria: Statistics South Africa.

Alexander, G.R., Mor, J.M., Kogan, M.D., Leland, N.L. & Kieffer, E. 1996. Pregnancy outcomes of US-born and foreign-born Japanese Americans. *American Journal of Public Health*, 86(6):820-824.

Allen, L.H. & Gillespie, S.R. 2001. What works? A review of the efficacy and effectiveness of nutrition interventions. ACC/SCN: Geneva in collaboration with Asian Development Bank: Manila.

Anderson, W.F., Umar, A. & Brawley, O.W. 2003. Colorectal carcinoma in black and white race. *Cancer and Metastasis Review*, 22(1):67-82.

Ankerl, G. 1983. Rapid urbanisation in the third world, with special reference to Tropical Africa: social impact and perspectives. *Labour Society,* 8(3):277-88.

Anon. 2001. Malaysia's population growth slows down. *Populi*, 28(1):2-3.

Anon. 2002. Migration, urbanization and poverty: urbanization and internal migration. ESCAP report item 7(b) of *the 5th Asian and Pacific Population Conference.*

Baba, N., Shaar Hamadeh, S. & Adra, N. 1994. Nutritional status of Bedouin children aged 6-10 years in Lebanon and Syria under different nomadic pastoral systems. *Ecology of Food and Nutrition,* 32(3-4):247-259.

Badibanga, A. 1985. [Imitative urbanisation and the outward growth of African cities]. *Tiers Monde*. 26(104):849-59. (Abstract only. Article in French.)

Bailey, R.C., Jenike, M.R., Ellison, P.T., Bentley, G.R., Harrigan, A.M. & Peacock, N.R. 1992: The ecology of birth seasonality among agriculturalists in central Africa. *Journal of Biosocial Science,* 24(3):393-412.

Bain, D.J. 1981: Patient mobility and consulting behaviour: a comparative study between the United Kingdom and the United States. *Journal of Family Practice,* 12(5):891-895.

Bateman, C. 2002. Long-term strategy to retain local nurses. *South African Medical Journal,* 92(2):107.

Bateman, C. 2003. Cuban doctors get raw deal. *South African Medical Journal,* 93(9):640-641.

Bean, F.D., Corona, R., Tuirán, R. & Woodrow-Lafield, K.A. 1998. The quantification of migration between Mexico and the United States. **IN** Mexican Ministry of Foreign Affairs & U.S. Commission on Immigration Reform. 1998.

Migration between Mexico and the United States: Binational Study. Texas: Morgan Printing.

Beaton, G.H. 1983. Supplementary feeding program in pregnancy and lactation: Consideration for intervention programs. **IN** Underwood, B.A. (ed.). 1983. *Nutrition Intervention Strategies in National Development*. New York: Academic Press.

Becker, G. 2002. Dying away from home: quandaries of migration for elders in two ethnic groups. *Journal of Gerontology Series B: Psychological Sciences and Social Sciences,* 57(2):S79-S95.

Beesey, A. 2000. HIV vulnerability and mobile populations: Thailand and its borders. *Development Bulletin,* (52):38-41.

Beighton, P., Solomon, L., Soskolne, C.L. & Sweet, M.B. 1977. Rheumatic disorders in the South African Negro. Part IV. Gout and hyperuricaemia. *South African Medical Journal,* 51(26):969-972.

Bekker, S. 1999. Migration and its implications for rural and urban development in South Africa. **IN** *Union for African Population Studies.* Volume 1: The African population in the 21st century. Proceedings of the Third African Population Conference, Durban.

Bekker, S. 2002. The migration study commissioned by the Department of Planning, Local Government and Housing of the Provincial Government of the Western Cape. *Proceedings of the Annual Conference of the Demographic Society,* 24- 27 September 2002. University of the Western Cape.

Bekker, S. 2002. Personal communication. Lecturer at the Department of Sociology, University of Stellenbosch.

Bekker, S.B. (ed.) 2002. Migration study in the Western Cape 2001. Report. Cape Town: Provincial Government of the Western Cape.

Bekker, S.B. & Swart K. 2002. Migration study in the Western Cape 2001: The relationship between migration and the HIV/AIDS pandemic: a preliminary South African analyses. Report. Cape Town: Provincial Government of the Western Cape. [Online]. Available http://dws.wcape.gov.za/dmsvs25/download?WEBID+29190.

Belhedi, A. 2001. Socio-economic factors of migration **IN** Vallin J & Locoh T (ed.). (2001). Population et developpement en Tunisie: la metamorphose. *UNFPA Project,* No. TUN/94/POA.

Belammy, C. 2000. *The state of the world's children 2000.* New York:UNICEF.

Benyoussef, A., Cutler, J.L., Baylet, R., Collomb, H., Diop, S., Lacombe, B., Vaugelade, J. & Levine, A. 1973. Sante, Migration et Urbanisation. *Bulletin of the World Health Organization,* 49:517-537.

Berk, M.L., Schur, C.L., Dunbar, J.L., Bozzette, S. & Shapiro, M. 2003: Short report: migration among persons living with HIV. *Social Science and Medicine,* 57(6):1091-1097.

Bertrand, W.E., Mock, N.B. & Franklin, R.R. 1988: Differential correlated of nutritional status in Kinshasa, Zaire. *International Journal of Epidemiology,* 17(3):556-567.

Beukens, P., Masuy-Stroobant, G. & Delvaux, T. 1998. High birthweights among infants of north African immigrants in Belgium. *American Journal Of Public Health,* 88(5):808-811.

Bilsborrow, R.E. & United Nations Secretariat **IN** United Nations. 1993. Internal Migration of Women in Developing Countries. Proceedings of the United Nations Expert Committee on the Feminization of Internal Migration. New York: United Nations.

Bingham, S.A., Nelson, M., Paul, A.A., Haraldsdotter, J., Bjørge-Loken, E. & Van Staveren, W.A. 1988. Methods for data collection at an individual level. **IN** Cameron, M.E. & Van Staveren, W.A. 1988. Manual on methodology for food consumption studies. Oxford: Oxford University Press.

Black, M.M. & Krishnakumar, A. 1999. Predicting longitudinal growth curves of height and weight using ecological factors for children with and without early growth deficiencies. *Journal of Nutrition,* 129(2Supplement):S539-S543.

Blacket, R.B. 1990. Foreign medical graduates. The experience of the Australian Medical Examination Council and the Australian Medical Council, 1978-1989: implications for medical immigration and the medical workforce. *The Medical Journal of Australia,* 153(3):125-132.

Bocquier, P. 1997: [Contribution of migrations to the process of urbanization.] *Pop Sahel: bulletin d'information sur la population et le developpement,* 26:23-25. (Abstract only. Article in French.)

Bogin, B. & Mac Vean, R.B. 1981. Biosocial effects of urban migration on the development of families and children in Guatemala. *American Journal of Public Health,* 71(12):1373-1377.

Bona ,G., Zaffaroni, M., Cataldo, F., Sandri, F. & Salvioli, G.P. 2001. Infants of immigrant parents in Italy. A national multicentre case control study. *Panminerva Medica,* 43(3):155-159.

Booysen, F. 2004. Out-migration in the context of the HIV/AIDS epidemic: Evidence from the Free State Province. Paper presented at the SASA Congress on "10 years into democracy: challenges facing South Africa", 27-30 June 2004, Bloemfontein.

Brockerhoff, M. 1990. Rural-to-urban migration and child survival in Senegal. *Demography,* 27(4):601-615.

Brockerhoff, M. 1994. The impact of rural-urban migration on child survival. *Health Transition Review,* 4(2):127-149.

Brockerhoff, M. 1995: Child survival in big cities: the disadvantage of migrants. *Social Science and Medicine,* 40(10):1371-1383.

Brockerhoff, M. & Hewett, P. 2000. Inequality of child mortality among ethnic groups in sub-Saharan Africa. *Bulletin of the World Health Organization,* 78(1):30-41.

Broster, J.A. 1967. *Red Blanket Valley*. Johannesburg: Hugh Keartland Press.

Brown, A.A. & Neuberger, E. (eds.). 1977. *Internal Migration: A Comparative Perspective.* New York: Academic Press.

Brown, L.A. & Sanders, R.L. 1981. Toward a development paradigm of migration, with particular reference to Third World settings. **IN** De Jong, G.F. & Gardner, R.W. (ed.). 1981. *Migration decision-making: multidisciplinary approaches to microlevel studies in developed and developing countries*. New York: Pergamon.

Buescher, P.A. 2003. A review of available data on the health of the Latino population in North Carolina. *North Carolina Medical Journal,* 64(3):97-105.

Bures, R.M. 2003: Childhood residential stability and health at midlife. *American Journal of Public Health,* 93(7):1144-1148.

Bustamante, J.A., Jasso, G., Taylor, E. & Legarreto, P.T. 1998. Characteristics of migrants: Mexicans in the United States. IN Mexican Ministry of Foreign Affairs & U.S. Commission on Immigration Reform. 1998. *Migration between Mexico and the United States: Binational Study.* Texas: Morgan Printing.

Bustos, P., Amigo, H., Munoz, S.R. & Martorell, R. 2001. Growth in indigenous and nonindigenous Chilean schoolchildren from 3 poverty strata. *American Journal of Public Health,* 91(10):1645-1649.

Byarugaba, J. 1991. The impact of urbanisation on the health of black pre-school children in the Umtata district, Transkei, 1990. *South African Medical Journal,* 79(8):444-448.

Caballero, B. 2001. Symposium: Obesity in developing countries: biological and ecological factors: Introduction. *Journal of Nutrition,* 131(3):866S-870S.

Callister, L.S. & Birkhead, A. 2002. Acculturation and perinatal outcomes in Mexican immigrant childbearing women: and integrative review. *Journal of Perinatal and Neonatal Nursing,* 16(3):22-38.

Cameron, N. 1991. Human growth, nutrition, and health status in Sub-Saharan Africa. *Yearbook of Physical Anthropology,* 34:211-250.

Carnell, M.A. & Guyon, A.B. 1990. Nutritional status, migration, mortality and measles vaccine coverage during the 1983-1985 drought period: Timbuktu, Mali. *Journal of Tropical Paediatrics,* 36(3):109-13.

Centre for Disease Control and Prevention. 1994. Epi Info, Version 6: a word processing, database, and statistics program for epidemiology on microcomputers. Atlanta, Georgia. [Online]. Available http://www.cdc.gov/epiinfo/

Cervantes, A., Keith, L. & Wyshak, G. 1999. Adverse birth outcomes among native-born and immigrant women: replicating national evidence regarding Mexicans at the local level. *Maternal and Child Health Journal,* 3(2):99-109.

Chang, S. 1996. The floating population: an informal process of urbanisation in China. *International Journal of Population Geography,* 2(3):197-214.

Cheetham, R.W., Edwards S.D, Naidoo, L.R, Griffiths, J.A. & Singh, V.G. 1983. Deculturation as a percipient of parasuicide in an Asian group. *South African Medical Journal,* 63(24):942-945.

Cheng, T.A. 1989. Urbanisation and minor psychiatric morbidity. A community study in Taiwan. *Social Psychiatry and Psychiatric Epidemiology*, 24(6):309-16.

Cheung, Y.B. & Yip, P.S. 2001. Social patterns of birth weight in Hong Kong, 1984-1997. *Social Science and Medicine*, 52(7):1135-1141.

Choi, H. 2001. Cultural marginality: a concept analysis with implications for immigrant adolescents. *Issues in Comprehensive Pediatric Nursing,* 24(3):193-206.

Chowdhury, A.K. 1986. Infant mortality in relation to internal migration in rural Bangladesh. *Journal of Biosocial Science*, 18(4):4449-4456.

CIA. 2003. The World Factbook 2002 – South Africa. [Online]. Available http://www.odci.gov/cia/publication/factbook/geos/sf.html

Cobas, J.A, Balcazar, H., Benin, M.B., Keith, V.M. & Chong, Y. 1996. Acculturation and low-birthweight infants among Latino women: a reanalysis of HHANES data with structural equation models. *American Journal of Public Health,* 86(3):303-305.

Coetzee R. 1982. *Funa food from Africa: Roots of traditional African food culture.* Durban: Butterworth & Co.

Cohen B. 2004. Urban growth in developing countries: a review of current trends and caution regarding existing forecasts. *World Development* 32(1):23-51

Cole, T.J., Bellissi, M.Z., Flegal, K.M., Dietz, W.H. 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal,* 320:1240.

Colton, T. 1974. *Statistics in Medicine.* Boston: Little, Brown and Company.

Colvin, M., Abdool Karim, S.S. & Wilkinson, E. 1995. Migration and AIDS (letter). *Lancet,* 346(8985): 1303-1304.

Conolly C, Davies GR & Wilkinson D. 1999. Who fails to complete tuberculosis treatment? Temporal trends and risk factors for treatment interruption in a community-based directly observed therapy programme in a rural district of South Africa. *International Journal of Tuberculosis and Lung Disease,* 3(12):1081-1087.

Cooper, D., Pick, W.M., Myers, J.E., Hoffman, M.N., Sayed, A.R. & Klopper, J.M. 1991. Urbanisation and women's health in Khayelitsha. Part I. Demographic and socio-economic profile. *South African Medical Journal,* 79(8):423-427.

Corona Vazquez, R. 1999. Internal migration. Behaviour of migrants between 1960 and 1995. *DEMOS,* (12):15-17.

Costello, E.J., Keeler, G.P. Angold, A. 2001: Poverty, race/ethnicity, and psychiatric disorder: a study of rural children. *American Journal of Public Health,* 91(9):1494-1498.

Coutsoudis, A., Pillay, K., Spooner, E. 1999. Influence of infant-feeding patterns on early mother-to-child transmission of HIV-1 in Durban, South Africa: A prospective cohort study. *Lancet,* 354:471-476.

Cronje, M. & Africa, M. 2002. The concepts and definitions used in the Census and household Surveys in Statistics South Africa. *Proceedings of the Annual Conference of the Demographic Society 24- 27 September 2002.* University of the Western Cape.

Cross, C., Bekker, S. & Eva, G. 1999. Migration and Settlement in the Cape Metropolitan Area 1999. University of Stellenbosch and Cape Metropolitan Area. *Report SADA, 0074.*

Cross, C. 1999. Population migration in South Africa's coastal provinces: an overview of trends. Paper presented at the conference "Between Town & country: Livelihoods, settlement and identity formation in Sub-Saharan Africa", 27-30 June 1999, East London.

Cross, C. 2000. **IN** Graduate Workshop on Internal Migration 2000: Occasional Paper No. 11. Department of Sociology: University of Stellenbosch.

CSS. 1995. *Demographic statistics 1995.* Pretoria: Government printers for Central Statistical Services.

Curren, S.R. & Rivero-Fuentes, E. 2003. Engendering migrant networks: the case of Mexican migration. *Demography,* 40(2):289-307.

Dagan, R., Sofer, S., Klish, W.J., Hundt, G., Saltz-Rennert, H. & Moses, S.W. 1984. Infant feeding practices among Bedouin in transition from seminomadic to settlement conditions in the Negev area of Israel. *Israel Journal of Medical Sciences,* 20:1029-1034.

Davidow, A.L., Mangura, B.T., Napolitano, E.C. &r Reichman, L.B. 2003: Rethinking the socio-economics and geography of tuberculosis among foreign-born residents of New Jersey, 1994-1999. *American Journal of Public Health,* 93(6):1007-1012.

Dean, G. & Kurtzke, J.F. 1971. On the risk of multiple sclerosis according to age at immigration to South Africa. *British Medical Journal,* 3(777):725-729.

Defesche, J.C., Van Diermen, D.E., Hayden, M.R. & Kastelein, J.P. 1996. Origin and migration of an Afrikaner founder mutation FHAfrikaner-2 (V408M) causing familial hypercholesterolemia. *Gene Geography*, 10(1):1-10.

De Jong, G.F. 2000. Expectations, gender, and norms in migration decision-making. *Population Studies,* 54(3):307-319.

Del Rey Calero, J. 2002. [Immigrations from the perspective of demography. Impact on health.] *Anales de la Real Academia Nacional de Medicina,* 119(1):123-138. (Abstract only. Article in Spanish.)

Delvaux, T., Beukens, P., Thoumsin, H., Dramaix, M. & Collette, J. 2003. Cord C-peptide and insulin-like growth factor-I, birth weight, and placenta weight among North African and Belgian neonates. *American Journal of Obstetrics and Gynecology,* 189(6):1779-1784.

Demeny, P. & McNicoll, G. 1998. *The earthscan reader in population and development.* Bedford: St Martins Press. Earthscan Publications Ltd.

Detang-Dessendre, C. 1999. Reciprocal link between exit from unemployment and geographical mobility. *Environment and Planning A,* 31(8):1417-1431.

Devin, R.B. & Erickson, P.I. 1996. The influence of male care-givers on child health in rural Haiti. *Social Science and Medicine,* 43(4): 479-488.

De Walt, K.M. 1993. Nutrition and the commercialisation of agriculture: Ten years later. *Social Science and Medicine,* 36(11):1407-1416.

De Wit, D.J. 1998. Frequent childhood geographic relocation: its impact on drug use initiation and the development of alcohol and other drug-related problems among adolescents and young adults. *Addictive Behaviors,* 23(5):623-634.

De Woude, A.D, Hayami, A. & De Vries. J. 1990. *Urbanization in history: A process of dynamic interactions.* Oxford: Clarendon Press.

Diani, F., Zanconato, G., Foschi, F., Turinetto, A. & Franchi, M. 2003. Management of the pregnant immigrant in the decade 1992-2001. *Journal of Obstetrics and Gynaecology,* 23(6):615-617.

Diaz, V.A. Jr. 2002. Cultural factors in preventive care: Latinos. *Primary Care,* 29(3):503-517.

Diwaka,r A. & Qureshi, M.H. 1992. Demographic processes of urbanisation in Delhi. *Population Geography,* 14(1-2):27-36.

Dollar, D. 2001. Is globalization food for your health? *Bulletin of the World Health Organisation,* 79(9):827-833.

Donald, P.R. 1998. The epidemiology of tuberculosis in South Africa. *Novartis Foundation Symposia,* 217:24-35.

Doucet, H., Baumgarten, M. & Infante-Rivard, C. 1992. Risk of low birthweight and prematurity among foreign-born mothers. *Canadian Journal of Public Health,* 83(3):192-195.

Drewnowski, A. & Popkin, B.M. 1997. The nutrition transition: New trends in the global diet. *Nutrition Reviews,* 55(2):31-43.

Dreyer, B., Tranebjaerg, L., Brox, V., Rosenberg, T., Moller, C., Beneyto, M., Weston, M.D., Kimberley, W.J., Cremers, C.W., Liu, X.Z. & Nilssen, O. 2001. A common ancestral origin of the frequent and widespread 2299delG USH2A mutation. *American Journal of Human Genetics,* 69(1):228-234.

D'souza, R.M. & Bryant, J.H. 1999. Determinants of childhood mortality in slums in Karachi, Pakistan. *Journal of Health and Population in Developing Countries,* 2(1):33-44.

Durnin, J.V.B.A. 1991. Aspects of anthropometric evaluation of malnutrition in childhood. *Acta Paediatrica Scandinavica,* 374:89-94.

Earl, R. & Borra, S.T. 2000. Guidelines for dietary planning. **IN** Mahan, L.K & Escott-Stump, S. 2000. Food, nutrition and diet therapy. 10th edition. Philadelphia: W.B. Saunders Company.

Elford, J., Phillips, A.N., Thomson, A.G. & Shaper, A.G. 1989. Migration and geographic variations in ischaemic heart disease in Great Britain. *Lancet,* 1(8634):343-346.

Elford, J., Phillips, A., Thomas, A.G. & Shaper, A.G. 1990. Migration and geographic variations in blood pressure in Britain. *British Medical Journal,* 300(6720):291-294.

Ellison, G.T., de Wet, T., Ijsselmuiden, C.B. & Richter, L.M. 1996. Desegregating health statistics and health research in South Africa. *South African Medical Journal,* 86(10):1257-1262.

Ezra, M. 2002. Ecological degradation, rural poverty and migration in Ethiopia: a contextual analysis. Unpublished PIP 164865.

English, P.B, Kharrazi, M. & Guendelman, S. 1997. Pregnancy outcomes and risk factors in Mexican Americans: the effect of language use and mother's birthplace. *Ethnicity and Disease,* 7(3):229-240.

Esterhuyse, T. & Doyle, P. 1993. AIDS update: the HIV epidemic: what lies ahead? *Nursing RSA,* 8(10):14-15.

Evian, C. 1993. AIDS and the cycle of poverty. *Nursing RSA,* 8(1):45.

Fennelly, K., Cornwell, G. & Casper, L. 1992. A comparison of the fertility of Dominican, Puerto Rican and mainland Puerto Rican adolescents. *Family Planning Perspectives,* 24(3):107-110.

Findlay, A. & Findlay. A. 1995. *Population and development in the Third World.* London: Routledge.

Flowers, N. 1994. Demographic crises and recovery: a case study of the Xavante Pimental Barbosa. *South American Indian studies,* (4):18.

Fontana, B. 1996. The state of migration in South Africa. *Occasional Paper No. 8. Foundation for Global Dialogue*: Johannesburg.

Forde, E.R. 1976. Recent population redistribution in Ghana. *Jimlar Mutane,* 1(1):56-76.

Forman, M.R., Hundt, G.L., Abu-Saad, K., Zangwill, L., Chang, D., Bellmaker, I., Abu-Saad, I. & Graubard, B.I. 1995. Undernutrition among Bedouin Arab children: a follow-up of the Bedouin infant feeding study. *American Journal of Clinical Nutrition,* 61:495-500.

Forna, F., Jamieson, D.J., Sanders, D. & Lindsay, M.K. 2003. Pregnancy outcomes in foreign-born and US-born women. *International Journal of Gynaecology and Obstetrics,* 83(3):257-265.

Fowler, M.G., Simpson, G.A. & Schoendorf, K.C. 1993. Families on the move and children's health care. *Pediatrics*, 91(5):934-940.

Fredriks, A.M., Van Buuren, S., Jeurissen, S.E., Dekker, F.W., Verloove-Vanhorick, S.P. & Wit, J.M. 2003. Height, weight, body mass index and pubertal development reference values for children of Turkish origin in the Netherlands. *European Journal of Pediatrics,* 162(11):788-793.

Friborg, J., Koch, A., Stenz, F., Wohlfahrt, J. & Melbye, M. 2004. A population-based registry study of infant mortality in the Arctic: Greenland and Denmark, 1973-1987. *American Journal of Public Health,* 94(3):452-457.

Fuentes-Afflick, E., Hessol, N.A. & Perez-Stable, E.J. 1998. Maternal birthplace, ethnicity, and low birth weight in California. *Archives of Pediatric and Adolescent Medicine*, 152(11):1105-1112.

Fullilove, M.T. 1996. Psychiatric implications of displacement: contributions from the psychology of place. *American Journal of Psychiatry,* 153(12):1516-1523.

Gagahe NK. 2000. The process of internal movement in Solomon Islands: the case of Malaita, 1978-1986. *Asia-Pacific Population Journal* 15(2): 53-75.

Galle, O.R. & Williams. M.W. 1972. Metropolitan migration efficiency. *Demography,* 9(4):655-665.

Gang, I.N. & Stuart, R.C. 1999. Mobility where mobility is illegal: internal migration and city growth in the Soviet Union. *Journal of Population Economics,* 12(1):117-134.

Garnier D, Simondon KB, Hoarau T & Benefice E. 2003. Impact of the health and living conditions of migrant and non-migrant Senegalese adolescent girls on their nutritional status and growth. *Public Health Nutrition,* 6(6):535-547.

Garnier, D., Ndiaye, G. & Benefice, E. 2003. [Influence of urban migration on physical activity, nutritional status and growth of Senegalese adolescents or rural origin.] *Bulletin Société de Pathologie Exotigue,* 96(3):223-227. (Abstract only. Article in French)

Gelderbloem, D. & Kok, P. 1994. Urbanisation: South Africa's challenge. Volume 1: Dynamics. Pretoria: HSRC Publishers.

Gibson, C. 1973. Urbanization in New Zealand: A comparative analysis. *Demography,* 10(1):71-84.

Gibson JB, Harrison GA & Hiorns RW. 1984. Migration and the structure of the Otmoor villages. *Annals of Human Biology,* 11(4):275-280.

Gilbert, A. & Crankshaw, O. 1999. Comparing South African and Latin American experiences: migration and housing mobility in Soweto. *Urban Studies,* 36(13):2375-2400.

Gillespie, S. & Mason, J. 1991. Nutrition-relevant actions. *ACC/SCN State-of –the-art Series* No 10. Geneva: UN ACC/SCN.

Gillespie, S., Mason, J. & Martorell, R. 1996. How nutrition improves. *ACC/SCN State-of-the-Art Series* No 15. Geneva: United Nations.

Ginsburg, E., Livshits, G., Yakovenko, K. & Kobyliansky, E. 1998. Major gene control of human body height, weight and BMI in five ethnically different populations. *Annals of Human Genetics,* 62:307-322.

Gissler, M., Pakkanen, M. & Olausson, P.O. 2003. Fertility and perinatal health among Finnish immigrants in Sweden. *Social Science and Medicine,* 57(8):1443-1454.

Gjorup, I.E., Skinhoj, P., Bottiger, B. & Plesner, A.M. 2003. Changing epidemiology of HBV infection in Danish children. *Journal of Infection,* 47(3):231-235.

Goduka, I.N., Poole, D.A. & Aotaki-Phenice, L. 1992. A comparative study of black South African children from three different contexts. *Child Development,* 63(3):509-525.

Goldstein, S. & Goldstein, A. 1978. Thailand's urban population reconsidered. *Demography,* 15(3):239-258.

Golomb, M.R., Hune, S., MacGregor, D.L. & Deveber, G.A. 2003. Alternative therapy use by Chinese-Canadian children with stroke and cerebrovascular disease. *Journal of Child Neurology,* 18(10):714.

Gonzalvo, G. 2000. [Assessing the health and nutritional status of illegal immigrant adolescents from Maghrab.] *Anales Espanoles de Pediatria,* 53(1):17-20. (Abstract only. Article in Spanish).

Gooszen, H. 2000. *A demographic history of the Indonesian archipelago, 1880-1942.* Singapore: Institute of Southeast Asian Studies.

Gordon-Larsen, P., Harris, K.M., Ward, S.D, Popkin, B.M., National Longitudinal Study of Adolescent Health. 2003. Acculturation and overweight-related behaviours among Hispanic immigrants to the US: the National Longitudinal Study of Adolescent Health. *Social Science and Medicine*, 57(11):2023 –2034.

Gould, J.B., Madan, A., Qin, C. & Chaves, G. 2003. Perinatal outcomes in two dissimilar immigrant populations in the United States: a dual epidemiologic paradox. *Pediatrics,* 111(6 Pt 1):e676-e682.

Graaff, J.F. 1987. The present state of urbanisation in the South African homelands: rethinking the concepts and predicting the future. *Development Southern Africa,* 4(1):46-66.

Greenwood, M.J. & Sweetland, D. 1972. The determinants of migration between standard metropolitan statistical areas. *Demography,* 9(4):665-681.

Griffiths, P.L. & Bentley, M.E. 2001. The nutrition transition is underway in India. *Journal of Nutrition,* 131:2692-2700.

Guarnaccia, P.J. & Lopez, S. 1998. The mental health and adjustment of immigrant and refugee children. *Child and Adolescent Psychiatric Clinics of North America,* 7(3):537-553.

Guendelman, S. & English, PB. 1995. Effect of United States residence on birth outcomes among Mexican immigrants: an exploratory study. *American Journal of Epidemiology,* 142(9):S30-S38.

Guendelman, S., Beukens, P., Blondel, B., Kaminski, M., Notzon, F.C. & Masuy-Stroobant, G. 1999. Birth outcomes of immigrant women in the United States, France, and Belgium. *Maternal-Child Health Journal,* 3(4):177-187.

Guendelman, S., Malin, C., Herr-Harthorn, B. & Vargas, P.N. 2001. Orientation to motherhood and male partner support among women in Mexico and Mexican-origin women in the United States. *Social Science and Medicine*, 52(12):1805-1813.

Guendelman, S., Schauffler, H.H., & Pearl, M. 2001. Unfriendly shores: how immigrant children fare in the U.S. health system. *Health Affairs (Millwood),* 20(1):257-266.

Guilmoto, C.Z. 1998. Insitutions and migrations. Short-term versus long-term moves in rural West Africa. *Population Studies,* 52(1):85-103.

Guo, A., Popkin. B.M., Mroz, T.A. & Zhai, F. 1999. Food price policy can favourably alter macronutrient intake in China. *Journal of Nutrition,* 129:994-1001.

Gupta, S.K. 1984. Role of migration in the urbanisation process of Assam. *Social Action*, 34(1):67-76.

Gupta, M.P. & Sharma, S. 1994. In-migration in Madhya Pradesh. *Transactions of the Institute of Indian Geographers,* 16(2):147-54.

Gussler, J. 1987. Culture, Community and the course of infant feeding. **IN** Johnson FE (ed). 1987. *Nutritional Anthropology,* New York: Alan R. Liss, Inc.

Haas, J.D., Martinez, E.J., Murdoch, S., Conlisk, E., Rivera, J.A. & Martorell, R. 1995. Nutritional Supplementation during the preschool years and physical work capacity in adolescent and young adult Guatemalans. *Journal of Nutrition,* 125:1078S-1089S.

Hamal, P.K. 26/02/2004. Migrant child labour in Kathmandu Valley. [Online]. Available http://www.cdps.edu.np/Documents/Abstracts-P&D-Vol6.htm. 26 February 2004.

Harmsen, H., Meeuwesen, L., van Wieringen, J., Bernsen, R. & Bruijnzeels, M. 2003: When cultures meet in general practice: intercultural differences between GPs and parents of child patients. *Patient Education and Counseling,* 51(2):99-106.

Harrison, G.G., Galal, O.M., Ibrahim, N., Khorshid, A., Stormer, A., Leslie, J. & Saleh, N.T. 2000. Underreporting of food intake by dietary recall is not universal: A comparison of data from Egyptian and American women. *Journal of Nutrition,* 130:2049-2054.

Hermanussen, M., Thiel, C., Von Buren, E., Rol de Lama, M.A., Perez Romero, A., Ariznaverreta Ruiz, C., Burmeister, J. & Tresguerres, J.A. 1998. Micro and macro perspectives in auxology: findings and considerations upon the variability of short term and individual growth and the stability of population derived parameters. *Annals of Human Biology,* 25(4):350-385.

Hirschowitz, R,, Orkin, M, & Alberts, P. **IN** Hirschowitz, R. 2000. *Measuring Poverty in South Africa.* Pretoria: Statistics South Africa.

Hitchcock, R.K. 2002. Mobility strategies among foragers and part-time foragers in the eastern and north-eastern Kalahari desert, Botswana. [Online]. Available http://www.kalaharipeople.org/documents/mobility.html. 14 April 2004.

Hoffman, D.J., Sawaya, A.L., Verreschi, I., Tucker, K.L. & Roberts, S.B. 2000. Why are nutritionally stunted children at increased risk of obesity? Studies of metabolic rate and fat oxidation in shantytown children from São Paulo, Brazil. *American Journal of Clinical Nutrition,* 72:702-707.

Hoorweg, J., Foeken, D., Klaver, W., Okello, W., Veerman, W. 1996. Nutrition in agricultural development: land settlement in Coast Province, Kenya. *Ecology of Food and Nutrition,* 35(3):161-178.

Hope, K.R. Sr. 2000. Mobile workers and HIV/AIDS in Botswana. *Aids Analysis Africa,* 10(4):6-7.

Horwitz, S. 2001. Migrancy and HIV/AIDS: A historical perspective. *South African Historical Journal,* 45:103-123.

HSRC. 2002. First nationally representative survey results of HIV prevalence. [Online]. Available http://www.hsrc.ac.za/media/2002/12/20021205_1.html. 5 December 2002.

HSRC. 2003. Media release: Study to investigate HIV/AIDS in young children. [Online]. Available http://www.hsrc.ac.za/media/2003/5/20030512_1.html. 12 December 2003.

Hsu-Hage, B.H., Ibielele, T. & Wahlqvist, M.L. 1995. Food intakes of adult Melbourne Chinese. *Australian Journal of Public Health,* 19(6):623-628.

Hulanicka, B., Gronkiewicz, L. & Zietkiewicz, B. 1999. Stature of boys post World War II migrants. *Annals of Human Biology,* 26(6):549-559.

Huth, M.J. 1984. The impact of rapid population growth, expanding urbanisation, and other factors on development in sub-Saharan Africa: the contrasting responses of Tanzania and Kenya. *The International Journal of Sociology and Social Policy,* 4(2):1-16.

Hyman, I. & Dussault, G.. 1996. The effect of acculturation on low birthweight in immigrant women. *Canadian Journal of Public Health,* 87(3):158-162.

Hyman, I. & Dussault, G. 2000. Negative consequences of acculturation on health behaviou, social support and stress among pregnant Southeast Asian immigrant women in Montreal: an exploratory study. *Canadian Journal of Public Health,* 91(5):357-360.

Hyman, I., Guruge, S., Makarchuk, M.J., Cameron, J. & Micevski, V. 2002. Promotion of healthy eating among new immigrants women in Ontario. *Canadian Journal of Dietetic Practice and Research,* 63(3):125-129.

Institute of Medicine. 1997. Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D and fluoride. Food and Nutrition Board. National Academy Press: Washington DC. [Online]. Available www.nap.edu. 15 June 2004.

Institute of Medicine. 1998. Dietary reference intakes for thiamine, riboflavin, niacin, vitamin B_6, pantothenic acid, biotin and choline. Food and Nutrition Board. National Academy Press: Washington DC. [Online]. Available www.nap.edu. 15 June 2004

Institute of Medicine. 2000. Dietary reference intakes for vitamin C, vitamin E, selenium and carotenoids. Food and Nutrition Board. National Academy Press: Washington DC. [Online]. Available www.nap.edu. 15 June 2004.

Institute of Medicine. 2001. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium and zinc. Food and Nutrition Board. National Academy Press: Washington DC. [Online]. Available www.nap.edu. 15 June 2004.

Institute of Medicine. 2002. Dietary reference intakes for energy, carbohydrate, fibre, fat, fatty acids, cholesterol, and protein and amino acids. Food and Nutrition Board. National Academy Press: Washington DC. [Online]. Available www.nap.edu. 15 June 2004.

International Institute for Environment and Development. 2003. Environment & Urbanization Brief No. 7. [Online]. Available http://www.ingentaselect.com/titles or from http://www.iied.org/humans. 15 May 2004.

Jalil, F., Karlberg, J., Hanson, L.A. & Lindblad, B.S. 1989. Growth disturbances in an urban area of Lahore, Pakistan, related to feeding patterns, infections and age, sex, socio-demographic factors and seasons. *Acta Paediatrica Scandinavica Supplement,* 350:44-54.

Jochelson, K., Mothibeli, M. & Leger, J.P. 1991. Human immunodeficiency virus and migrant labor in South Africa. *International Journal of Health Services,* 21(1):157-173.

Johnson-Down, L., O'Loughlin, J., Koski, KG. & Gray-Donald, K. 1997. High prevalence of obesity in low income and multi-ethnic schoolchildren: A diet and physical activity assessment. *Journal of Nutrition,* 127:2310-2315

Jones, M.E. & Bond, M.L. 1999. Predictors of birth outcome among Hispanic immigrant women. *Journal of Nursing Care Quality,* 14(1):56-62.

Jones, M.E., Kubelka, S. & Bond, M.L. 2001. Acculturation status, birth outcomes, and family planning compliance among Hispanic teens. *The Journal of School Nursing,* 17(2):83-89.

Jooste, P.L., Weight, M.J. & Lombard, C.J. (2000): Short-term effectiveness of mandatory iodization of table salt, at an elevated iodine concentration, on iodine and goiter status of schoolchildren with endemic goiter. *American Journal of Clinical Nutrition,* 71(1):75-80.

Kaiser, L.L. & Dewey, K.G. 1991. Migration, cash cropping and subsistence agriculture: relationship to household food expenditure in rural Mexico. *Social Science and Medicine,* 33(10):1113-1126.

Kalipeni, E. 1996. Demographic response to environmental pressure in Malawi. *Population and Environment,* 17(4):285-308.

Kanaiaupuni, S.M. & Donato, K.M. 1999. Migradollars and mortality: the effects of migration on infant survival in Mexico. *Demography,* 36(3):339-353.

Karim, A.Q., Karim, A.S.S., Singh, B., Short, R. & Ngxongo, S. 1992. Seroprevalence of HIV infection in rural South Africa. *AIDS,* 6(12):1535-1539.

Kasper, J., Gupta, S.K., Tran, P., Cook, J.T. & Meyers, A.F. 2000. Hunger in legal immigrants in California, Texas, and Illinois. *American Journal of Public Health,* 90(10):1629-1633.

Katzenellenbogen, J.M., Joubert, G., Hoffman, M. & Thoman, T. 1988. Mamre Community Health Project – demographic, social and environmental profile of Mamre at baseline. *South African Medical Journal,* 74(7):328-334.

Kelaher, M. & Jessop, D.J. 2002. Differences in low-birthweight among documented and undocumented foreign-born and US-born Latinas. *Social Science and Medicine,* 55(12):2171-2175.

Kelley, M.L., Finkel, L.B. & Ashby, J. 2003. Geographic mobility, family, and maternal variables as related to the psychosocial adjustment of military children. *Military Medicine,* 168(12):1019-1024.

Kennedy, E. & Peters, P. 1992. Household food security and child nutrition: the interaction of income and gender of household headship. *World Development,* 20(8):1077-1085.

Kim, J. & Chan, M.M. 2004. Acculturation and dietary habits of Korean Americans. *British Journal of Nutrition,* 91(3):469-478.

Kleinbaum, D.G., Kupper, L.L. & Muller, K.E. 1988. *Applied regression analysis and other multivariable methods.* 2nd edition. Boston: PWS-KENT Publishing Company.

Kok, P.C. 1985. [Bevolkingsherverspreiding: 'n oorsig en evaluasie van teoretiese bydraes, strategiee en beleidsinstrumente.] *Population redistribution: a review and evaluation of theoretical contributions, strategies and policy instruments.* Verslag S-131. Pretoria: Raad vir Geesteswetenskaplike Navorsing.

Kok, P.C., Hofmeyer, B.E., Bärbel, E. & Gelderblom, D. 1985. *Black migration to the PWC complex: selective spatial and motivational aspects.* Report S-122. Pretoria: Human Sciences Research Council.

Kok, P.C. 1986. *Population redistribution: A summarized review and evaluation of theoretical contributions, strategies and policy instruments, with specific reference to the South African situation.* Pretoria: Human Sciences Research Council.

Kok, P.C. 1990. The determinants of migration and urbanisation. **IN** Mostert, W.P. & Lotter, J.M. (eds.) 1990. *South Africa's demographic future.* Pretoria: Human Sciences Research Council.

Kok, P.C. 2002. Migration data from South African censuses: evaluation and suggestions. *Proceedings of the Annual Conference of the Demographic Society 24-27 September 2002.* University of the Western Cape.

Kok, P., O'Donovan, M., Bouare, O. & Van Zyl, J. 2003. *Post-apartheid patterns of internal migration in South Africa.* Cape Town: HSRC.

Kolodziej, H., Szklarska, A. & Malina, R.M. 2001. Young adult height of offspring born to rural-to-urban migrant parents and urban born parents. *American Journal of Human Biology,* 13(1):30-34.

Korenbrot, C.C., Dudley, R.A .& Greene, J.D. 2000. Changes in births to foreign-born women after welfare and immigration policy reforms in California. *Maternal and Child Health Journal,* 4(4):241-250.

Kosinski, L.A. & Prothero, R.A. 1975. *People on the Move: Studies on internal migration.* London: Methuen.

Kotze, H. & Hill, L. 1997. Emergent migration policy in a democratic South Africa. *International Migration,* 35(1):5-35.

Kouris-Blazos, A., Wahlqvist, M.L., Trichopoulou, A., Polychronopoulos Trichopoulos, D. 1996. Health and nutritional status of elderly Greek migrants to Melbourne, Australia. *Age Ageing,* 25(3):177-189.

Kouris-Blazos, A. 2002. Morbidity mortality paradox of 1st generation Greek Australians. *Asian Pacific Journal of Clinical Nutrition,* 11(Supplement 3):S569-575.

Kpedekpo, G.M.K. 1982. *Essentials of demographic analysis for Africa.* London: Exeter, N.H. Heinemann.

Krige, E. J. 1962. *The social system of the Zulus.* Pietermaritzburg: Shuter & Shooter.

Kruger, D.J. 2002. Deans ponder skills drain. *South African Medical Journal,* 92(2):100.

Kruger, M., Sayed, N., Langenhoven, M. & Holing, F. 1999. Composition of South African foods. Vegetables and fruit. *Supplement to the MRC Food Composition Tables 1991.* Parow: Medical Research Council.

Labadarios, D.L. (ed.). 2000. The National Food Consumption Survey (NFCS): Children aged 1-9 years, South Africa, 1999. *Report to the Department of Health.*

Landale, N.S. & Hauan, S.M. 1996. Migration and premarital childbearing among Puerto Rican Women. *Demography,* 33(4):429-442.

Langenhoven, M.L., Kruger, M., Gouws, E., Faber, M. 1991. *MRC Food Composition Tables.* 3rd edition. Medical Research Council: Parow.

Laor, A., Seidman, D.S. & Danon, Y.L. 1991. Changes in body height among selected ethnic groups. *Journal of Epidemiology and Community Health,* 45:169-170.

Lebowitz, M.D. & Burrows, B. 1975. Tucson epidemiology study of obstructive lung diseases: Effects of in-migration factors on the prevalence of obstructive lung diseases. *American Journal of Epidemiology,* 102(2):153-163.

Leslie, P.W., Campbell, K.L. & Little, M.A. 1993. Pregnancy loss in Nomadic and settled women in Turkana, Kenya. A prospective study. *Human Biology,* 65(2):237-254.

Leventhal T & Brooks-Gunn J. 2003. Moving to opportuantiy: an experimental study of neighborhood effects on mental health. *American Journal of Public Health,* 93(9):1576-1582.

Liamputtong, P. & Naksook, C. 2003. Life as mothers in a new land: the experience of motherhood among Thai women in Australia. *Health Care for Women International,* 24(7):650-668.

Liao, P.-S. 2001. Contextual analysis of rural migration intention: A comparison of Taiwanese and Pennsylvania data. Leiden: Koninklijke Brill. *EJCS,* XLII 5:435-460.

Lin, G.C. 1994. Changing theoretical perspectives on urbanisation in Asian developing countries. *Third World Planning Review,* 16(1):1-23.

Lindtjorn, B. 1990. Famine in southern Ethiopia 1985-6: population structure, nutritional state, and incidence of death among children. *British Medical Journal,* 301(6761):1123-1127.

Lizarzaburu, J.L. & Palinkas, L.A. 2002. Immigration, acculturation, and risk factors for obesity and cardiovascular disease: a comparison between Latinos of Peruvian descent in Peru and in the United States. *Ethnicity and Disease,* 12(3):342-352.

Luke, A., Cooper, R.S., Prewitt, T.E., Adeyemo, A.A. & Forrester, T.E. 2001. Nutrition consequences of the African diaspora. *Annual Review of Nutrition,* 21:47-71.

Lurie, M., Harrison, A,. Wilkinson, D. & Abdool Karim, S. 1997. Circular migration and sexual networking in rural KwaZulu-Natal: implications for the spread of HIV and other sexually transmitted diseases. *Health Transition Review,* 7(Suppl 3):17-27.

Lurie, M.N., Williams, B.H., Zuma, K., Mkaya-Mwamburi, D., Garnett, G.P., Sweat, M.D., Gittelsohn, J. & Karim, S.S. 2003. Who infects whom? HIV-1 concordance and discordance among migrant and non-migrant couples in South Africa. *AIDS,* 17(15):2245-2252.

Magwaza, A.S. 1992. Influence of involuntary migration on children's perception of control. *Psychological Reports,* 70(3, 1):707-710.

Magwaza, A.S. 1994. Migration and psychosocial status in South African black migrant children. *The Journal of Genetic Psychology; child behaviour, animal behaviour and comparative psychology,* 155(3):283-288.

Malina, R.M., Himes, J.H., Stepick, C.D., Lopez, F.G. & Buschang, P.H. 1981. Growth of rural and urban children in the valley of Oaxaca, Mexico. *American Journal of Physical Anthropology,* 55(2):269-280.

Mandrup, G.H. 1992. [Health care. From village to concrete suburb.] *Sygeplejersken,* 92(31):8-11. (Abstract only. Article in Danish.)

Margetts, B.M., Vorster, H.H. & Venter, C.S. 2002. Evidence-based nutrition – the impact of information and selection bias on the interpretation of individual studies. *South African Journal of Clinical Nutrition,* 16(3):79-87.

Marino, R., Stuart, G.W., Wright, F.A., Minas, I.H. & Klimidis, S. 2001. Acculturation and dental health among Vietnamese living in Melbourne, Australia. *Community Dentistry and Oral Epidemiology,* 29(2):107-119.

Martin, P. & Widgren, J. 2002. International Migration: Facing the challenges. *Population Bulletin,* 57(1):1-40.

Martorell, R. 1996. The role of nutrition in economic development. *Nutrition Reviews,* 54:S66-S71.

Mascie-Taylor, C.G.& Lasker, G.W. 1995. Effect of interregional migration on geographic variability in biological and social traits in Great Britain. *Human Biology,* 67(4):629-640.

Mathew, J.L., Babbar, H., Yadav, S. 2002. Reasons for non-immunization of children in an urban, low-income group in north India. *Tropical Doctor,* 32(3):135-158.

McDade, T.W. & Adair, L.S. 2001. Defining the "urban" in urbanisation and health: a factor analysis approach. *Social Science & Medicine,* 53(1):55-70.

McGuinness, T. 2000. A quiet migration: cultural influences impacting children adopted from the former Soviet Union. *Journal of Cultural Diversity,* 7(3):59-64.

McMichael, A.F., McCall, M.G., Hartshorne, J.M. & Woodings, T.L. 1980. *International Journal of Cancer,* 25(4):431-437.

Mears, R. 1997. Rural-urban migration or urbanization in South Africa. *The South African Journal of Economics,* 65(4):595-614.

Merryweather-Clarke, A.T., Pointon, J.J., Juanolle, A.M., Rochette, J. & Robson, K.J. 2000. Geography of HFE C282Y and H63D mutations. *Genet Test,* 4(2):183-198.

Meulmeester, J.F., van den Berg, H., Wedel, M., Boshuis, P.G., Hulshof, K.F. & Luyken, R. 1990. Vitamin D status, parathyroid hormone and sunlight in Turkish Moroccan and Caucasian children in The Netherlands. *European Journal of Clinical Nutrition,* 44(6):461-470.

Meulmeester, J.F. & Hulshof, K.F. 1993. [Dietary habits of Turkish and Moroccan children in the Netherlands.] *Nederlandse Tijdschrift voor Tandheelkde,* 100(7):320-322. (Abstract only. Article in Dutch.)

Mexican Ministry of Foreign Affairs & U.S. Commission on Immigration Reform. 1998. *Migration between Mexico and the United States: Binational Study.* Texas: Morgan Printing.

Ministry of Agriculture and Land Affairs. 2001. Land redistribution for agricultural development: A sub-programme of the land redistribution programme. [Online]. Available http://land.pwv.gov.za/redistribution.lrad.html. 15 June 2003.

Ministry of Labour. 1995. Labour Relations Act. Act 66 of 1995. [Online]. Available http://www.lis.co.za/labouract.html. 15 June 2003.

Moilanen, I., Myhrman, A., Ebeling, H., Penninkilampi, V., Vuorenkoski, L. 1998. Long-term outcome of migration in childhood and adolescence. *International Journal of Circumpolar Health,* 57(2-3):180-187.

Monteiro, C.A., Mondini, L., Medeiros de Souza, A.L. & Popkin, B.M. 1995. The nutrition transition in Brazil. *European Journal of Clinical Nutrition,* 49:105-113.

Montgomery, M.R. & Brown, E.K. 1990. Accommodating urban growth in Sub-Saharan Africa. **IN** Ascadi, G.T.F. *et al*. 1990. *Population growth and reproduction in Sub-Saharan Africa*. Washington, DC: World Bank.

Morrison, P.A. 1990. Demographic factors reshaping ties to family and place. *Research on Aging,* 12(4):399-408.

Morrison, P.A., Bryan, T.M. Swanson, D.A. 2004. Internal migration and Short-distance mobility. **IN** Siegal, J.S. & Swanson, D.A. (eds.). 2004. *The methods and materials of demography*. 2nd edition. Elsevier Academic Press: San Diego.

Mouton, J. & Marais, H.C. 1988. *Metodologie van die geesteswetenskappe: Basiese Begrippe*. Pretoria: Raad vir Geesteswetenskaplike Navorsing.

Mukherjee, M., Sujaya, C.P. & Jain, D. 1994. Women: work and employment – some notes. *Indian Journal of Social Sciences,* 7(3-4):223-249.

Mullen, K., Williams, R. & Hunt, K. 2000. Irish descent, religion and food consumption in the west of Scotland. *Appetite,* 34(1):47-54.

Mwadime, R.K. & Baldwin, S.L. 1994. Relationship between household access to food and malnutrition in eastern and southern Africa. *East African Medical Journal,* 71(9):571-579.

Naggan, L., Forman, M.R., Sarov, B., Lewando-Hundt, G., Zangwill, L., Chang, D. & Berendes, H.W. 1991. The Bedouin infant feeding study: study design and factors influencing the duration of breast feeding. *Paediatric and Perinatal Epidemiology,* 5(4):428-444.

Nanthamongkolchai. S. 2000. Factors associated with choice of destination among out-migrants from Bangkok. *Journal of Population and Social Studies,* 8(2):91-114.

National Center for Health Statistics. 1977. NCHS Growth curves for children. Birth – 18 years. US Department of Health, Education and Welfare. Public Health Services. Hyattsville Med. DHEW Publication Number (PHS) 78-1650.

National Population Unit. 2000. *State of South Africa's Population Report 2000.* National Population Unit. Department of Social Development: Pretoria.

Newbold, K.B. & Danforth, J. 2003. Health status and Canada's immigrant population. *Social Science & Medicine,* 57(10):1981-1995.

Newell, G.R. & Mills, P.K. 1986. Low cancer rates in Hispanic women related to social and economic factors. *Women & Health,* 11(3-4):23-35.

Ntozi, J.P. 1997. Widowhood, remarriage and migration during the HIV/AIDS epidemic in Uganda. *Health Transition Review,* 7 (Supplement): S125-S144.

Núñez-Rocha, G.M., Bullen-Navaro, M., Castillo-Treviño, B.C. & Solís-Pérez, E. (1998): [Malnutrition in pre-school infants in migrant families]. *Salud Publica de Mexico,* 40(3):248-255. (Abstract only. Article in Spanish.)

Nurse, G.T. & Jenkins, T. 1975. The Griqua of Campbell, Cape Province, South Africa. *American Journal of Physical Anthropology,* 43(1):71-78.

Nurse, G.T., Jenkins, T, Africa, B.J. & Stellmacher, F.F. 1982. Sero-genetic studies on the Basters of Rehoboth, South West Africa/Namibia. *Annals of Human Biology,* 9(2):157-166.

Nyaruhucha, C.N., Msuya, J.M. & Augustino, B. 2001. Health status of hospitalised elderly in Morogoro Regional Hospital. *East African Medical Journal,* 78(9):489-492.

Onyango, A., Tucker, K. & Eisemon, T. 1994. Household headship and child nutrition: a case study in West-Kenya. *Social Science and Medicine,* 39(12):1633.

Oppong, J.R. & Ghosh, J. 2003. Concluding remarks: Beyond epidemiology. **IN** Kalipeni, E., Craddock, S., Oppong, J.R. & Gosh, J. 2004. *HIV and AIDS in Africa.* Oxford:Blackwell.

Oropesa, R.S. & Landale, N.S. 2000. From austerity to prosperity? Migration and child poverty among mainland and island Puerto Ricans. *Demography,* 37(3):323-338.

Pallotto, E.K., Collins, J.W. Jr & David, R.J. 2000. Enigma of maternal race and infant birth weight: a population-based study of US-born Black and Caribbean-born Black women. *American Journal of Epidemiology,* 151(11):1080-1085.

Papadopoulos, R., Lay, M., Lees, S. & Gebrehiwot, A. 2003. The impact of migration on health beliefs and behaviours: the case of Ethiopian refugees in the UK. *Contemporary Nurse,* 15(3):210-221.

Park, K.J. & Peterson, L.M. 1991. Beliefs, practices, and experiences of Korean women in relation to childbirth. *Health Care for Women International,* 12(2):261-269.

Pawson, I.G. & Janes, C. 1981. Massive obesity in a migrant Samoan population. *American Journal of Public Health,* 71(5):508-513.

Pechoux, P.-Y. 1995. [The populations of Cyprus at the end of 1994]. *Mediterranee Medicale,* 81(1.2):63-69. (Abstract only. Article in French.)

Pelletier, D.L., Frongillo, E.A. Jr, Schroeder, D.G. and Habicht, J.-P. 1994. A methodology for estimating the contribution of malnutrition to child mortality in developing countries. *Journal of Nutrition,* 124:2106S-2122S.

Pelto, G.H. 1991. Ethnic minority, migration and risk of undernutrition in children. *Acta Paediatrica Scandinavica,* 374 (Supplement):51-57.

Pereira, L., Gusmao, L., Alves, C., Amorim, A. & Prata, M.J. 2002. Bantu and European Y-lineages in Sub-Saharan Africa. *Annals of Human Genetics,* 66(Pt5-6):369-378.

Perez Cuadrado, S., Munoz Avalos, N., Robledo Sanchez, A., Sanchez Fernandez, Y., Pallas Alonso. C. & De la Cruz Bertolo, J. 2004. [Characteristics of immigrant women and their neonates.] *Anales de Pediatria (Barcelona),* 60(1):3-8. (Abstract only. Article in Spanish)

Pick, W.M. & Obermeyer, C.M. 1996. Urbanization, household composition and the reproductive health of women in a South African city. *Social Science & Medicine,* 43(10):1431-1441.

Pick, W, & Cooper, D. 1997. Urbanisation and women's health in South Africa. *African Journal of Reproductive Health,* 1(1):45-55.

Piwoz, E,G, & Preble, E,A. 2000. *HIV/AIDS and nutrition: A review of the literature and recommendations for nutritional care and support in Sub-Saharan Africa.* Washington: United States Academy for International Development (USAID).

Plorde, D,A. 1981. Sexually transmitted diseases in Ethiopia. Social factors contributing to their spread and implications for developing countries. *The British Journal of Venereal Diseases,* 57(6):357-62

Pomerleau, J., Ostbye, T. & Bright-See, E. 1998. Place of birth and dietary intake in Otario. II. Protein and selected micronutrients. *Preventive Medicine,* 27(1):41-49.

Popkin, B.M. & Udry, J.R. 1998. Adolescent obesity increases significantly in second and third generation US immigrants: the National Longitudinal Study of Adolescent Health. *Journal of Nutrition,* 128(4):701-706.

Popkin, B.M. 1994. The nutrition transition in low-income countries: an emerging crisis. *Nutrition Reviews,* 52(9):285-298.

Popkin, B.M. 1999. Urbanization, lifestyle changes and the nutrition transition. *World Development,* 27(11):1905-1916.

Popkin BM. 2001. The nutrition transition and obesity in the developing world. *Journal of Nutrition,* 131(13):871S-873S.

Population Crises Committee (PCC). 1988. [Food and population: a study of three countries.] *Profamilia,* 4(13):35-47. (Abstract only. Article in Spanish.)

Portes, A. 2000. Immigration and the Metropolis: Reflections on urban history. *Center for Migration & Development Working Paper Series*, Princeton University: Princeton.

Premi, M.K. 1981. Role of migration in the urbanisation process in third world countries: a case study of India. *Social Action,* 31(3):291-310.

Press, F., Katz, M., Leiberman, J.R., Shoham, I. & Glezerman, M. 1993. Obstetric performance in Ethiopian immigrants compared with Israeli parturients. *Israel Journal of Medical Sciences,* 29(6-7):403-407.

Pressat, R. & Wilson, C. 1985. *The dictionary of demography.* New York: Basil Blackwell.

Prior, C.R. & Buckle, G.C. 1990. Blood donors with antibody to the human immunodeficiency virus – the Natal experience. *South African Medical Journal,* 77(12):623-625.

Proceedings of a graduate workshop on internal migration. 2000. *Occasional Paper No. 11.* Department of Sociology: University of Stellenbosch.

Qutub, S.A. 1993. Comments on "Urbanisation and Environmental Degradation in Pakistan". *Pakistan Development Review,* 32(4 Pt 2):648-9.

Rabain-Jamin, J. & Wornham, W.L. 1990. [Changes in maternal behavior and care practices in migrant women from Western Africa.] *La Psychiatrie de l'Enfant,* 33(1):287-319. (Abstract only. Article in French.)

Ramirez, A.G., Villarreal, R., Suarez, L. & Flores, E.T. 1995. The emerging Hispanic population: a foundation for cancer prevention and control. *Journal of the National Cancer Institute, Monographs* (18):1-9.

Ramphele, M.A., Heap, M. & Trollip, D.K. 1991. Health status of hostel dwellers. Part IV. Immunisation of children. *South African Medical Journal,* 79(12):710-713.

Rasmussen F, Oldenburg, E., Ericson, A. & Gunnarskog, J. 1995. Preterm birth and low birthweight among children of Swedish and immigrant women between 1978 and 1990. *Paediatric and Perinatal Epidemiology,* 9(4):441-454.

Reed, D., Labarthe, D. & Stallones, R. 1995. Health effects of westernisation and migration among Chamorros. *American Journal of Epidemiology,* 142(7):673:691.

Reichman, N.E. & Kenney, G.M. 1998. Prenatal care, birth outcomes and newborn hospitalisation costs: patterns among Hispanics in New Jersey. *Family Planning Perspectives,* 30(4):182-187.

Renzaho, A.M. 2004. Fat, rich and beautiful: changing socio-cultural paradigms associated with obesity risk, nutritional status and refugee children from sub-Saharan Africa. *Health Place,* 10(1):105-113.

Rivera, J.A., Martorell, R., Ruel, M.T., Habicht, J.-P. & Haas, J.D. 1995. Nutritional supplementation during the preschool years influences body size and composition of Guatemalan adolescents. *Journal of Nutrition,* 125:1068S-1077S.

Rietveld, P. 1988. Urban development patterns in Indonesia. *Bulletin of Indonesian Economic Studies,* 24(1):73-95.

Robertson, A., Fronczak, N., Jaganjac, N., Hailey, P., Copeland, & Duprat, M. 1995. Nutrition and infant feeding survey of women and children in Sarajevo during July 1993. *European Journal of Clinical Nutrition, 49(Supplement)*2:S11-S16.

Robinson, W.C., Lee, M.K., Hill, K., Hsu, E. & Burnham, G. 2001. Demographic methods to assess food insecurity: A North Korean case study. *Prehospital and Disaster Medicine,* 16(4):286-292.

Rogers, A., Watkins, J.F. & Woodward, J.A. 1990. Interregional elderly migration and population redistribution in four industrialized countries. *Research on Aging,* 12(3):251-293.

Romero-Gwynn, E. 1989. Breastfeeding pattern among Indochinese immigrants in Northern California. *American Journal of Diseases of Children,* 143:804-808.

Roos, E., Lahelma, E., Virtanen, M., Prattala, R. & Pietinen, P. 1998. Gender, socio-economic status and family status as determinants of food behaviour. *Social Science and Medicine,* 46(12):1519-1529.

Rosenberg, K.D., Desai, R.A. & Kan, J. 2002. Why do foreign-born blacks have lower infant mortality than native-born blacks? New directions in African-American infant mortality research. *Journal of the National Medical Association,* 94(9):770-778.

Ross, F.C. 1995. *Houses without Doors: Diffusing domesticity in Die Bos.* Pretoria: Human Sciences Research Council.

Rothman, K.J. & Greenland, S. 1998. *Modern Epidemiology*. Philadelphia: Lippincott-Raven Publishers.

Roux, N. 2000. **IN** Graduate Workshop on Internal Migration 2000: Occasional Paper No. 11. Department of Sociology: University of Stellenbosch.

Roville-Sausse, F., Truc, J.B. & Jacob, D. 2001. [Maternal weight gain during pregnancy in various immigrant communities living in France.] *Revue d' Epidemiologie et de Sante Publique,* 49(5):439-447. (Abstract only. Article in French.)

Ruel, M.T., Haddad, L. & Garrett, J.L. 1999. Some urban facts of life: Implications for research and policy. *World Development,* 27(11):1917-1938.

Rundle, D., Barclay, L,. Nivison-Smith, I. & Lloyd, B. 1996. Maternal country of origin and infant birthplace: implications for birth-weight. *The Australian and New Zealand Journal of Obstetrics and Gynaecology,* 36(4):430-434.

Salcedo-Rocha, A.L. & Prado-Aguilar, C.A. 1992. [The migration process as risk factor in chronic malnutrition of pre-school children from Jalisco.] *Salud Publica de Mexico* 34(5):518-527. (Abstract only. Article in Spanish.)

SAVACG. 1995. Children aged 6-71 months in South Africa, 1994: Their anthropometric, vitamin A, iron and immunisation coverage status. Chapter 4, p.1-18. [Online]. Available www.sahealthinfo.org/nutrition/chapter4anthropometricstatus.pdf. 15 June 2004.

Sayed, N., Frans, Y. & Schönfeldt, H. 1999. *Composition of South African Foods. Milk & milk products, eggs, meat & meat products.* Parow: Medical Research Council.

Schnaiberg, A. 1970. Rural-urban residence and modernism: a study of Ankara Province, Turkey. *Demography,* 7(1):71-85.

Schroeder, D.G., Martorell, R. & Flores, R. 1999. Infant and child growth and fatness and fat distribution in Guatemalan adults. *American Journal of Epidemiology,* 149(2):177-185.

Schumacher, L.B., Pawson, I.G. & Kretchmer, N. 1987. Growth of immigrants children in the newcomer schools of San Francisco. *Pediatrics,* 80(6):861-868.

Scott, S., Duncan, S.R. & Duncan, C.J. 1998. The interacting effects of prices and weather on population cycles in a pre-industrial community. *Journal of Biosocial Sciences,* 30:15-32.

Seedat, Y.K., Seedat, M.A. & Hackland, D.B. 1982. Biosocial factors and hypertension in urban and rural Zulus. *South African Medical Journal,* 61(26):999-1002.

Seedat, Y.K. 1990. Hypertension and vascular disease in India and migrant Indian population in the world. *Journal of Human Hypertension,* 4(4):421-424.

Seedat, Y.K. 1996. Is the pathogenesis of hypertension different in black patients? *Journal of Human Hypertension,* 10:S35-37.

Seedat, Y.K. 1996. Ethnicity, hypertension, coronary heart disease and renal disease in South Africa. *Ethnicity & Health,* 1(4):349-357.

Shell-Duncan, B. & Obiero, W.O. 2000. Child nutrition in the transition from nomadic pastoralism to settled lifestyles: Individual, household, and community level factors. *American Journal of Physical Anthropology,* 113:183-200.

Siegal, J.S. & Swanson, D.A. (eds.). 2004. *The methods and materials of demography*. 2nd edition. San Diego: Elsevier Academic Press.

Simon, G. 2002. International migration trends. *Population & Society,* (382):1-4.

Simondon, K.B., Simon, I. & Simondon, F. 1997. Nutritional status and age at menarche of Senegalese adolescents. *Annals of Human Biology,* 24(6):521-532.

Simpson, G.A. & Fowler, M.G. 1994. Geographic mobility and children's emotional/behavioural adjustment and school functioning. *Pediatrics*, 93(2):303-309.

Singh, A. 1992. Urbanisation, poverty and employment: the large metropolis in the third world. *Contributions to Political Economy,* 11:15-40.

Singh, L.P. & Harrison, G.A. 1996. Impact of migration, environment and socio-economic conditions on the physique of Sikhs. *Journal of Biosocial Science,* 28(1):101.

Singh, G.K. & Siahpush, M. 2002. Ethnic-immigrant differentials in health behaviours, morbidity, and cause-specific mortality in the United States: and analysis of two national databases. *Human Biology,* 74(1):83-109.

Sjoberg, O. 1992. Underurbanisation and the zero urban growth hypothesis: diverted migration in Albania. *Geografiska Annaler, Series B* 74(1):3-19.

Skeldon, R. 1990. *Population mobility in developing countries.* London: Belhaven Press.

Skreblin, L. & Sujoldzic, A. 2003. Acculturation process and its effects on dietary habits, nutritional behaviour and body-image in adolescents. *Collegium Antropologicum,* 27(2):469-477.

Smith, P.B. 1986. Sociologic aspects of adolescent fertility and childbearing among Hispanics. *Journal of Developmental and Behavioral Pediatrics* 7(6): 346-349.

Solomons, N.W. & Gross, R. 1995. Urban nutrition in developing countries. *Nutrition Reviews,* 53(4):90-95.

Spengler, J.J. & Myers, G.C. **IN** Brown, A.A. & Neuberger, E. (eds.). 1977. *Internal Migration: A Comparative Perspective*. New York: Academic Press.

Statistics South Africa. 1998. The people of South Africa. Population census, 1996. Pretoria: Statistics South Africa.

Statistics South Africa. 2000. South African Statistics 2000. Pretoria: Government printers for Central Statistical Services.

Statistics South Africa. 2003. Census in brief. Census 2001. Pretoria: Statistics South Africa.

Stampi, S., Matteini, P., Zanetti, F. & Baldi, E. 2003. [Immigration and health: observational study concerning the foreign children attending the Bologna community pediatric service.] *Annali di Igiene,* 15(3):261-270. (Abstract only. Article in Italian.)

Stephenson, R., Matthews, Z. & McDonals, J.W. 2003. The impact of rural-urban migration on under-two mortality in India. *Journal of Biosocial Science,* 35(1):15-31.

Steyn, K., Jooste, P.L., Bourne, L., Fourie, J.F., Badenhorst, C.J., Bourne, D.E., Langenhoven, M.L., Lombard, C.J., Truter, H., Katzenellenbogen, J., Marais, M. & Oelofsen, A. 1991. Risk factors for coronary heart disease in the black population of the Cape Peninsula. The BRISK Study. *South African Medical Journal,* 79:480-484.

Steyn, K., Fourie, J., Lombard, C., Katzenellenbogen, J., Bourne, L. & Jooste, P. 1996. Hypertension in the Black community of the Cape Peninsula, South Africa. *East African Medical Journal,* 73(11):758-763.

Stookey, J.D., Adair, L., Stevens, J. & Popkin, B.M. 2001. Patterns of long-term change in body composition are associated with diet, activity, income and urban residence among older adults in China. *Journal of Nutrition,* 131(9):2433-2440.

Story, M., Strauss, K.F., Zephier, E. & Broussard, B.A. 1998. Nutritional concerns in American Indian and Alaska native children: Transitions and future directions. *Journal of the American Dietetic Association,* 98(2):170-176.

Sundquist, J. & Winkleby, M.A. 1999. Cardiovascular risk factors in Mexican American adults: a transcultural analysis of NHANES III, 1988-1994. *American Journal of Public Health,* 89(5):723-730.

Sundquist, J. & Winkleby, M. 2000. Country of birth, acculturation status and abdominal obesity in a national sample of Mexican-American women and men. *International Journal of Epidemiology*, 29(3):470-477.

Thiessen, V. 1993. *Arguing with numbers: Statistics for the social sciences.* Halifax: Fernwood Publishing.

Todes, A. 2000. South African urbanisation dynamics and the normalisation thesis. Paper presented to the Conference, Urban Futures, University of the Witwatersrand, Johannesburg, 10-14 July 2000. [Online] Available http://sunsite.wits.ac.za/urbanfeatures/papers/todes.html.

Tollman, S.M., Herbst, K., Garenne, M., Gear, J.S.S. & Kahn, K. 1998. The Agincourt demographic and health study – site description, baseline findings and implications. *South African Medical Journal,* 89(8):858-864.

Toole, M.J. 1995: Mass population displacement. A global public health challenge. *Infectious Disease Clinics of North America,* 9(2):353-366.

Toubon, R. 2002. Is West-Africa undergoing “rurbanization”? *Equilibres et Populations,* (75):4.

Trostler, N. 1997. Health risks of immigration: the Yemenite and Ethiopian case in Israel. *Biomedicine and Pharmacotherapy* 51(8):352-359.

Tsai, J.H. 2003. Contextualizing immigrants’ lived experience: story of Taiwanese immigrants in the United States. *Journal of Cultural Diversity,* 10(3):76-83.

UNICEF. 1970. *Manual: Measuring Internal migration.* Geneva: UNICEF.

UNICEF. 1990. *Conceptual framework for improved nutrition of children and women in developing countries*. New York: UNICEF.

United Nations. 1993. *Internal Migration of Women in Developing Countries.* Department for Economic and Social Information and Policy Analysis. New York:United Nations.

Unterhalter, B. 1982. Inequalities in health and disease: the case of mortality rates for the city of Johannesburg, South Africa, 1910-1979. *International Journal of Health Services,* 12(4):617-636.

US Census Bureau. 2000. Census 2000. United States of America. [Online] Available http://www.census.gov/population/www/socdemo/migrate.html. 12 September 2003.

US Department of Housing and Urban Development Residential mobility programs. No date. Washington DC:HUD.

Van der Spuy, D. 1999. Personal communication. Chief dietician, Red Cross Children's Hospital, Cape Town.

Van Hook, J. & Balistreri, K.S. 2002. Diversity and change in the institutional context of immigrant adaptation: California schools 1985-2000. *Demography,* 39(4):639-654.

Van Tonder, L. 2003. Personal communication. Population Unit. University of Pretoria.

Varghese, S. & Moore-Orr, R. 2002. Dietary acculturation and health-related issues of Indian immigrant families in Newfoundland. *Canadian Journal of Dietetics Practice and Research,* 63(2):72-79.

Vega-Franco, L. 1985. [Breastfeeding during the process of transculturation]. *Boletin Medico del Hospital Infantil de Mexico,* 42(7):407-408. (Abstract only. Article in Spanish.)

Verheij, R.A. 1996. Explaining urban-rural variations in health: A review of interactions between individual and environment. *Social Science and Medicine,* 42(6):923-935.

Verhoeven, W.P. 1993. [Turkish and Moroccan migrants in the Netherlands. Some background information.] *Nederlandse Tijdschrift voor Tandheelkunde,* 100(4):191-194. (Abstract only. Article in Dutch.)

Vorster, H.H., Bourne, L.T., Venter, C.S. & Oosthuizen, W. 1999. Contribution of nutrition to the health transition in developing countries: A framework for research and intervention. *Nutrition Reviews,* 57(11):341-349.

Wahlqvist, M. 2002. Asian migration to Australia: food and health consequences. *Asia Pacific Journal of Clinical Nutrition,* 11(Supplement 3):S562-568.

Walters, W.H. 2002. Place characteristics and later-life migration. *Research on Aging,* 24(2):243-277.

Wandel, M. 1993. Nutrition-related diseases and dietary change among third world immigrants in Northern Europe. *Nutrition and Health,* 9: 117-133.

Ward, K.R. 1992. The road to Mamre: Migration, memory and the meaning of community C1900-1992. MA thesis: University of the Western Cape.

Weeks, J.R. & Rumbaut, R.G. 1991. Infant mortality among ethnic groups. *Social Science and Medicine,* 33(3):327-334.

Westerway, S.C., Keogh, J., Heard, R. & Morris, J. 2003. Incidence of fetal macrosomnia and birth complications in Chinese immigrant women. *Australian and New Zealand Journal of Obstetrics and Gynaecology,* 43(1):46-49.

Whiteford, L.M. 1993. Child and maternal health and international economic policies. *Social Science and Medicine,* 37(11):1391-1400.

Wilkinson, D., Abdool Karim, S.S., Williams, B. & Gouws, E. 2000. High HIV incidence and prevalence among young women in rural South Africa: developing a cohort for intervention trials. *Journal of Acquired Immune Deficiency Syndromes,* 23(5):405-409.

Williams, B.T. 1990. Assessing the health impact of urbanisation. *World Health Statistics Quarterly,* 43(3):145-152.

Williams, B.G. & Gouws, E. 2001. The epidemiology of human immunodeficiency virus in South Africa. *Philosophical Transactions of the Royal Society of London, Series B: Biological Science,* 356(1411):1077-1086.

Williams-Blangero, S. & Blangero, J. 1989. Anthropometric variation and the genetic structure of the Jirels of Nepal. *Human Biology,* 61(1):1-12.

Wolanski, N. 1992. Biological traits of spouses: socio-cultural and economic context in the urban and rural environments. *Studies in Human Ecology,* 10:323-334.

Wood, D., Halfon, N., Scarlata, D., Newacheck, P. & Nessim, S. 1993. Impact of family relocation on children's growth, development, school function, and behaviour. *Journal of the American Medical Association,* 270(11):1334-1338.

WHO. 1995. The World Health Organisation quality of life assessment (WHOQOL): position paper from the World Health Organisation. *Social Science and Medicine,* 41(10):1403-1409.

WHO. 2003. Diet, nutrition and the prevention of chronic diseases. Report of a joint WHO/FAO Expert Consultation. WHO: Geneva.

WHO. 2004. WHO global database on child growth and malnutrition. World Health Organisation / Programme of Nutrition. Available [Online]. Retrieved 15/8/2004. www.who.int/nutgrowthdb/intro_text.htm.

Yaakoubd, A.I. 1997. [The socio-demographic situation of Morocco on the eve of the year 2000]. *Genus*, 53(3-4):243-59. (Abstract only. Article in French.)

Yach, D., Fluss, S. & Bettcher, D. 2001. Targets met, new needs. *Politica Internazionale,* 1-2:233-252.

Yan, H., Dibley, M.J., D'Este, K. & Hou, R. 1999. The National survey of the constitution and health of Chinese students in 1995: Nutritional status of school students aged 10-17 years in Shaanxi, China. *Asia Pacific Journal of Clinical Nutrition,* 8(2):121-128.

Yeh, W.C. 2003. Living arrangements and lifestyle satisfaction among the elderly Chinese immigrant families: a preliminary study. *Chang Gung Medical Journal*, 26(10):729-736. (Abstract only – Journal not accessible)

Young, H. & Jaspars, S. 1995. Nutritional assessment, food security and famine. *Disasters,* 19(1):26-36.

Ysunga-Ogazon, A., Diez-Urdanivia-Coria, S. & Lopez-Nunez, L. 1993. [A programme of community action research on migration and nutrition.] *Salud Publica de Mexico,* 35(6):569-575. (Abstract only. Article in Spanish.)

Yu, S.M., Huang, Z.J. & Singh, G.K. 2004. Health status and health service utilization among US Chinese, Asian Indian, Filipino, and other Asian/Pacific Islander Children. *Pediatrics,* 113(1Pt1):101-107.

Zeeb, H., Baune, B.T., Vollmer, W., Cremer, D. & Kramer, A. 2004. [Health situation of and health service provided for adult migrants – a survey conducted during school admittance examinations. *Gesundheitswesen,* 66(2):76-84. (Abstract only. Journal not accessible.)

Zukifli, S.N., U, K.M., Yusof, K. & Lin, W.Y. 1994. Maternal and child health in urban Sabah, Malaysia: a comparison of citizens and migrants. *Asia Pacific Journal of Public Health,* 7(3):151-158.

Zuma, K., Gouws, E., Williams, B. & Lurie, M. 2003. Risk factors for HIV infection among women in Carletonville, South Africa: migration, demography and sexually transmitted diseases. *International Journal of STD and AIDS,* 14(12):814-817.

Appendix A:

Variables and values

Variables and values

Type	Variable	Categories	Label
Independent/ exposure variable	Migration status	0=no movement 1=migrated	move_c
	Number of times child moved during his/her lifetime	0=no movement; or number	ch_freq
	Migration direction	1=rural rural 2=rural urban 3=rural stay 4=urban rural 5=urban urban 6=urban stay	c_move2
	Destination and host urban	1=urban stay 2=destination urban	dest_urb
	Destination and host rural	1=rural stay 2=destination rural	dest_rur
	Origin and destination urban	1=urban stay 2=origin urban	orig_urb
	Origin and destination rural	1=rural stay 2=origin rural	orig_rur
Outcome variables	Weight-for-age	z-score	waz
	Height-for-age	z-score	haz
	Weight-for-height	z-score	whz
	Underweight	1=underweight (<-2SD WAZ) 2=not underweight	indwaz
	Stunted	1=stunted (<-2SD HAZ) 2=not stunted	indhaz
	Wasted	1=wasted (<_2SD WHZ) 2=not wasted	indwhz
	Overweight	1=overweight (>+2SD WHZ) 2=not overweight	overweig
	Energy intake	% RDA	p_kj
	Protein intake	% RDA	p_prot
	Fat intake	% of energy intake	pe_fat
	Fibre intake (g)	Amount consumed	fibre
	Vitamin A	% RDA	p_vita
	Thiamin	%RDA	p_thiami
	Niacin	%RDA	p_niacin
	Riboflavin	%RDA	p_ribofl
	Calcium	%RDA	p_ca
	Iron	%RDA	p_iron
	Zinc	%RDA	p_zinc
	Energy intake category	1=insufficient intake (<67%RDA) 2=sufficient intake	kj_c
	Protein intake category	1=insufficient intake (<67%RDA) 2=sufficient intake	prot_c
	Vitamin A intake category	1=insufficient intake (<67%RDA) 2=sufficient intake	vita_c
	Thiamin intake category	1=insufficient intake (<67%RDA) 2=sufficient intake	thiami_c

Type	Variable	Categories	Label
	Niacin intake category	1=insufficient intake (<67%RDA) 2=sufficient intake	niacin_c
	Riboflavin intake category	1=insufficient intake (<67%RDA) 2=sufficient intake	ribofl_c
	Calcium intake category	1=insufficient intake (<67%RDA) 2=sufficient intake	ca_c
	Iron intake category	1=insufficient intake (<67%RDA) 2=sufficient intake	iron_c
	Zinc intake category	1=insufficient intake (<67%RDA) 2=sufficient intake	zinc_c
Possible confounding variables/ covariates	Gender	1=male 2=female	sex
	Age	Years completed	age_years
	Age category	1=1-3 years 2=4-6 years 3=7-9 years	age_c
	Langauge	1=Afrikaans 2=English 3=IsiNdebele 4=IsiXhosa 5=IsiZulu 6=Sepedi 7=Sesotho 8=Siswati 9=Setswana 10=Tsivenda 11=Xitsonga	langu
	Ethnic origin	1=Nguni 2=Sotho 3=Tsonga	langu_c
	Caretaker	1=Mother 2=Father 3=Grandparents 4=Sibling 5=Aunt/Uncle	relation
	Household head	1=Father 2=Grandfather 3=Grandmother 4=Mother	head
	Gender of household head	1=Male 2=Female	hhead_g
	Marital status of mother	1=not married 2=married 3=divorced 4=separated 5=widowed 6=living together 7=traditional marriage	

Type	Variable	Categories	Label
	Employment of mother	1=housewife by choice 2=unemployed 3=self-employed 4=wage earner	employ_m
	Employment of father	1=unemployed 2=self-employed 3=wage earner 4=retired by choice 5=not applicable	employ_f
	Type of dwelling	1=brick 2=traditional/mud 3=tin/plank	house
	Number of people sleeping at the house	1=1-3 persons 2=4-6 persons 3=7-9 persons 4=>9 persons	c_sleep
	Household income	1=none 2=R100-R499 3=R500-R999 4=R1000-R2999 5=>R3000	income_c
	Weekly food expenditure	1=0-R49 2=R50-R99 3=R100-R149 4=R150-R199 5=R200-R249 6=R250-R299 7=R300-349 8=R350-R399 9=>R400	spend_f
	Source of drinking water	1=borehole 2=communal tap 3=own tap 4=river/dam	water
	Type of toilet	1=bucket 2=flush 3=pit 4=VIP	toilet
	Fuel used for cooking	1=electricity 2=gas 3=open fire 4=paraffin 5=wood/coal	fuel
	Cold storage	1=fridge 2=freezer 3=both 4=none	fridge_f
	Stove	1=yes 2=no	stove
	Primus	1=yes 2=no	primus
	Microwave	1=yes 2=no	Micro_w

Type	Variable	Categories	Label
	Mother's education	1=none 2=primary 3=Std6-8 4=Std 9-10 5=tertiary	Edu_m
	Radio/TV	1=radio 2=TV 3=both 4=none	Radio_tv
	Similarity of migration patterns	1=all similar 2=only mother same 3=only grandmother same 4=none similar	Similar
	Duration of stay at current residence	1=1-3 years 2=4-6 years 3=7-9 years	C_long_c
	Education of mother dichotomised	0=<=Std8 1=>Std8	Edu_m2
	Caretaker dichotomised	0=other 1=mother	Relatio2
	Income dichotomised	0=<R500 1=>=R500	Income_2
	Toilet dichotomised	0=other 1=flush	Toilet2
	Cold storage dichotomised	0=none 1=fridge and/or freezer	Fridge2
Other/ identification variables	Identification number		ID
	Enumerator area number		EA
	Person code		Code
	Province	1=EC 2=FS 3=GP 4=KZN 5=LP 6=MP 7=NC 8=NW 9=WC	Province
	Classification of current area of residence	1=formal urban 2=informal urban 3=commercial farm 4=tribal	Area

Appendix B:

Consent form

FOOD CONSUMPTION PATTERNS SURVEY IN CHILDREN 1-9 YEARS OF AGE IN SOUTH AFRICA: A NATIONAL SURVEY

ETHIC COMMITTEE REFERENCE NUMBER (US 98/140)

DECLARATION BY OR ON BEHALF OF THE PARTICIPANT

I, the undersigned, ………………………………. participant OR in my capacity as ………..……. of the participant (child) in the survey of …………………………… (address)

A I confirm that:

1. I/the participant (child) ………………. Has been asked to participate in the above-mentioned research survey of the Department of Health carried out by the University of ……………………………..
2. It has been explained to me, that:

2.1 The purpose of the research survey is to collect information on what types of foods children in the ages 109 years in South Africa eat in order to decide whether extra nutrients should be added to foods children eat to make them more nutritious.

2.2 I have been told that a number of questions regarding the types and amounts of foods the participant (child) eats and how often these foods are eaten. I have also been told that the person asking me the questions will have a look in my food cupboards to see what foods are in the house. The participant (child) will also be weighed and his height/length and the circumference of his/her right upper arm and head will be measured without causing any pain to the child.

2.3 I have also been told that this research survey is being done in the whole country for the benefit of the country's children, and that 3000 children will take part in the survey countrywide.

3. It was also explained to me that the information I will give shall be kept confidential, but that it will be used anonymously for making known the findings to other scientists.
4. I/the participant (child) can have no direct access to the results of the survey but I can contact the researcher who will inform me of the findings on the participant (child).
5. It was also clearly explained to me that I can refuse to participate in this research survey or I can stop answering questions at any time during the interview. If this was to happen, I will not be disadvantaged in any way and it will not be held against me. No pressure was applied to me to take part in the survey and I participate voluntarily without any cost to myself.
6. The information in this consent form was explained to me by …………. (name of interviewer) in ……………. (language) and I confirm that I have a good command in this language and understood the explanations, OR it was translated to me by …………………. (name of translator) in my language. I was also given the opportunity to ask questions on things I did not understand clearly.

B. I/the participant (child) hereby agree voluntarily to take part in this research survey.

Signed/confirmed at ………………………………...…. on ………….19…

Participant's/repesentative of participant's signature or hand mark	…………………….. Witness

DECLARATION BY OR ON BEHALF OF RESEARCHER

I, ………………………………………………………, declare that:

1. I have explained the information in this document to ………………………. (name of participant) or his/her representative …………………………………… (name of representative).;
2. I asked the participant OR his/her representative to ask any questions of clarification, if something was not clear to him/her.
3. That this interview was conducted in English/Afrikaans/Xhosa (or ……………….. (language) OR that the interview was conducted in ……………….. (language) with the help of a translator ………………………… (name of translator).
4. Dr/Ms/Mr ……………………………………..
   Signed at …………………………………….. on ……………..19…
   …………………………………… Signature ………………………
   Researcher or his/her representative Witness

DECLARATION BY TRANSLATOR (WHERE APPLICABLE)

I, ………………………………………………………, confirm that:

1. I have explained the content of this document from English into ……………. (language) to ………………………. (name of participant) or his/her representative and that I have also translated the participant's or his/her representative's questions to the researcher or his/her representative as well as the answers of the latter to the participant or his/her representative; and
2. That the information that I have so translated was a correct interpretation of what I was asked to translate.

   Signed at …………………………………….. on ……………..19…
   …………………………………… Signature ………………………
   Researcher or his/her representative Witness

Appendix C:

Protocol

Research Proposal

Internal migration, dietary intake and anthropometric status of children aged 1-9 years in South Africa

To be completed in fulfilment of the requirements of the degree D.Phil (Public Health) in the School of Public Health, University of the Western Cape.

Name of candidate:	Elizabeth Catherina Swart
Student number:	9465950
Proposed degree:	D.Phil (Public Health)
Department:	School of Public Health
Supervisor(s):	Dr Debra Jackson
	Prof Robert Shell
Date:	July 2002

Key words: migration, residential mobility, height, weight, nutritional status, children, dietary intake, women, growth, South Africa

Abstract

The migration transition in South Africa has not been completed for most of the population groups. Information on migration is usually collected as part of the Census, but only international migration is reported as part of the South African Census reports.

The aim of this study is to investigate the internal migration that took place during the life span of the National Food Consumption Survey (NFCS) study population and to relate that to the anthropometric status and dietary intake of the children.

The NFCS was conducted during 1999 on a cross sectional nationally and provincially representative sample of children aged 1-9 years in South Africa. A total number of 2895 children were selected using a multi-stage selection process from 156 Enumerated Areas (EAs) as defined by the 1996 Census in the categories urban (82) and non-urban (74). The source survey (NFCS) as well as the migration specific survey component was conducted during the period February – June 1999. Fieldworkers fluent in the language of the different provinces were trained to complete the various questionnaires and execute measurements. Dietary data was based on a 24-hr recall reported for each child by the caretaker. Anthropometric indices was calculated based on measurement of height and weight of children, mothers and grandmothers. The researcher checked and cleaned all migration data. Data relevant to this study was exported into a spreadsheet, Excel, and the researcher will use a statistical package, SPSS PC, for data analysis. Ethical approval for the NFCS was obtained from the Ethical Committee of the University of Stellenbosch.

Findings from this study will render new information on a national representative scale on the internal migration patterns of children, and their mothers and grandmothers during the lifespan of each child i.e. between 1989 and 1999 as well as identify possible associations between these migration patterns, the dietary intake and the anthropometric status of the children.

Introduction and Rationale

The South African 1996 Census included questions to estimate how long people have lived in a particular area, and what their place of birth was (Census questionnaire, question12.1 and12.2). However, the results of these questions were not reported in the Census 1996 report (Statistics South Africa 1998) or the State of the Population 2000 (National Population Unit 2000). The BRISK study (Steyn et al 1991: 480) has provided information on nutritional status and dietary intake and the number of years adult Africans had spent in urban areas. A national survey on migration patterns were conducted by the University of Pretoria in 1999, but the findings of this study are not yet available (Roux 2001: 4; personal communication Kok 2002). To date, no other studies have reported the patterns of internal migration of children in South Africa, or related these mobility patterns to the nutritional status of children or adults. Nutritional surveys usually include information on urbanicity i.e. the extent to which the area of residence is urban or rural, but there is more to the understanding of urban/rural difference than a simple assumption that everybody has been in that particular area for their lifespan.

Literature review

Migration is defined as the movement of persons either individual, collective or mixed in character (Brown & Neuberger 1977:14) from one distinct place to another (Cross 2001:12) i.e. either in the same city or town, or between cities, states/countries or communities. Some authors also add qualifiers such as frequent change of residence (Kpedekpo 1982: 146), permanency of the move, and that the move must be out of free will (Cross 2001:12). Migration information is therefore biased towards long-term movement as it eliminates temporary movements that have important social and economic implications. An alternative term that is being used by the Medical Bibliographic Index is that of residential mobility. Although the definition provided for residential mobility is the same as for migration i.e. movement of person(s) from one place to another, this might be more sensitive to pick up short distance movements, which is usually missed by migration statistics, as people do not always cross magisterial boundaries when they move (Cross 2001: 16). Migration is most often equated to and recorded in official documentation as immigration or emigration i.e. international migration (Kpedekpo 1982: 146; National Population Unit 2000: 14; Cross 2000: 16). Attempts to describe internal or national migration i.e. the movement within a country, is usually included in Census data, or in specialized surveys such as the South African Demographic Health Survey. Due to the nature of these instruments and surveys it is understandable that they can only provide a crude measure of movement and are biased towards long distance migration (Kok 2002: 3). In South Africa the 1996 Census included – for the first time – questions on migration, and this was expanded and adjusted for the 2001 Census, but no reports on internal migration has been made available to date (Cronje 2002: 1; Kok 2002: 3). The Provincial Government commissioned a survey on migration in the Western Cape in 2000/1, but the report has not yet been released (Bekker 2002: 1).

Migration behaviour i.e. the when, where to, and why of movement, is influenced by numerous factors such as economic factors, political factors, social factors, institutional factors, demographic factors, information factors, and in South Africa specifically also housing and infrastructure delivery factors (Cross 2001: 23). Migration also consists of a variety of movements i.e. circulatory migration, oscillating migration and gravity flow migration. According to Spengler and Myers (1977: 11) and Billsborrow (1993: 1) migration movements are evolutionary and development-fostering processes with the purpose being to correct rural-urban, interurban and interregional imbalances. It is proposed that if the population transition i.e. demographic, urban and migration transition together, is completed successfully in South Africa, there will then be a situation where most of the people have a decent income, decent housing and transport, and live in the cities. People living in rural areas will also be making a good living and have a quality life (Cross 2001: 31; United Nations 1999:42).

Traditionally the view of a migrant was that of a man looking for a job. This image is slowly changing as half of all internal migrants in developing countries are women (Billsborrow 1993: 3). Women have a greater proportionate long-term migration than temporary migration. Often female migration is also categorized as “associational” i.e. to join or accompany husbands / families, to get married, leave husbands, etc. Women also migrate for reasons other than employment or survival. These reasons would include so-called pull factors at the destination such as better housing, schools or health services for the children especially if females are the head of the household (United Nations 1993: 29).

The urban migrant population tends to be younger than the rural population and according to a study in Dakar it includes twice as many single females (Benyoussef et al 1973: 536). Children younger than 12 years of age are usually not counted as migrants as they usually do not move independently and do not have free will in relation to the move (Roux 2001: 6 & 7).

Individuals and/or families usually move around from one place of residence to another in search of upward socio-economic mobility or in search of an improvement in quality of life which is not only economically related (CMA Report 2001: 16). Poverty appears to be more severe in non-urban areas (Alderman et al 2000: 25). Unemployment in South Africa has been increasing since the 60's and was estimated to be 33.9% (Statistics SA 1998: 40). As a result of this migration is invariably a move towards urban areas or within urban areas by people looking for jobs or better housing, medical and educational services. In some cases there is a return back to rural areas by people from higher socio-economic groups looking for tranquillity at retirement age. Migration in South Africa also includes an increase in rural-rural movement, most probably as people realize that employment opportunities in the cities are not that abundant. The decision around the destination of migration is a complicated one and depends on institutional factors, either social or special, that help them gain access into an area. People go where they have connections of some kind. In disadvantaged communities understanding the destination requires understanding the rules and processes of finding a destination. This is generally less important in more advantaged groups (Cross 2001: 20).

In addition, people also migrate as a result of emergency situations such as humanitarian or environmental emergencies. War and civil strife have been largely responsible for epidemic mass migrations (Toole et al 1993: 600). During the drought of 1983-85 in Mali, 19% of the population moved to urban centers in one year. However, only 3% of children younger than five years of age were part of this migration. The existence of feeding centers in the rural areas might have contributed to the lower migration of children in Mali. 40% of the adult male population aged 15-45 in the Timbuktu region migrated to urban centers and this accounted for 67% of migration (Carnell & Guyon 1990: 111).

At the time that this study was planned, there was no detailed information available on the migration/residential mobility patterns of children in South Africa and specifically to what extent children accompany their mothers if and when they migrate. In some ethnic groups it is custom to send children "home" to grandparents when they reach school going age and often grandparents raise children from early ages when the single mother has to return to her workplace soon after birth or according to traditional cultural practices as a "future caretaker" of the ageing grandparents (Broster 1967: 118). According to anecdotal reports the migration rate is lower in children than for their parents (personal communication Bekker 2002).

Consequences of migration

Migration can have social, cultural, economic (Billsborrow 1993: 4) and health (Lebowitz & Burrows 1975: 153; Reed et al 1995: 673) implications for individuals and families. Benyoussef et al (1973: 536) found that the levels of education as measured by school attendance and numbers of years spent in school increased for people who moved to the city. The level of maternal education is an important determinant in the development of under nutrition (Labadarios 2000: 177). The prevalence of stunting i.e. children, who are too short for their age, is known to reflect socio-economic standards (Karlberg et al 1988: 400; Jalil et al 1989: 44; Bustos et al 2001: 1645).

Findings from the National Food Consumption Survey (Labadarios 2000: 183) described children living in rural areas to have a poor nutritional status and specifically so for children living on commercial farms areas. Other studies have also found differences in terms of urbanicity i.e. the extent to which the place of residence is urban or rural. For adults urban/rural differences have been related to height (Laor et al 1991: 170), overweight (Pawson & Janes 1981: 508), dietary intake and food consumption (Benyoussef et al 1973: 536; Labarthe et al 1973: 161; Reed et al 1995:

673). For children, urban/rural differences have also been described in terms of obesity (Story et al 1998: 174) and stunting / height (Byarugaba 1991: 446; Bustos et al 2001: 1646; Saleemi et al 2001: 1307). Very few of these studies however explain the mechanism for the interactions between health, environment and individual characteristics. Verheij (1996: 923) reviewed a number of studies and concluded that the extent to which the environment exerts its influence on a person's health is dependent on that person's individual characteristics.

Migration, regardless of urbanicity, has also been identified as being related to child growth. The reasons for these findings are mostly environmental such as related changes in poverty levels, food availability, transportation, sanitation and/or access to health services. Some studies described an increase in the height achieved at adulthood, of children who migrated and that the differences between ethnic groups diminished (Laor et al 1991: 169), whilst others found higher levels of wasting (thinness) and stunting in children of migrants (Carnell & Guyon 1990: 111; Pelto 1991: 55). These difference were often more significant in cases where migration took place in the recent past (Pelto 1991: 52).

Research hypotheses

The following research hypotheses will be tested:

1) The net direction of movement is towards urban areas.
2) Movement to urban areas is not associated with improved anthropometric status or dietary intake.
3) Children who experienced more frequent movement have a poorer anthropometric status and dietary intake.
4) There is an association between the anthropometric status of children and their mothers and grandmothers.

Aim of the study

The aim of this study is to investigate the internal migration that took place during the life span of children aged 1-9 years in South Africa and to determine the relationship between these internal migration patterns and their current dietary intake and nutritional status.

Objectives of the study

- To determine the internal migration of South African children and their mothers and grandmothers during the lifespan of the child
- To relate the internal migration patterns of children aged 1-9 years to their socio-demographic characteristics
- To relate the internal migration patterns of children aged 1-9 years to their nutrient intake
- To relate the internal migration patterns of children aged 1-9 years to their anthropometric status
- To relate the anthropometric status of children to that of their mothers and grandmothers
- To relate the internal migration patterns of mothers and grandmothers to the migration patterns, anthropometric status and nutrient intake of the children.

Operational definitions

Demographic transition	Refers to changes in the size of population through changes in the balance between births and deaths.
Migration	Migration is defined as the change of residence i.e. movement of person(s) who change their usual place of residence from one country to another i.e. international migration, or from one magisterial district to another i.e. internal migration (Kpedekpo 1982: 146).
International migration	This consists of immigration which involves a move into a country, and emigration which indicates migratory moves out of one country to another (Kpedekpo 1982: 146)
Internal migration	This entails both in-migration – movement into an area – or out-migration – movement from a particular area – within the same country (The National Population Unit 2001: 15). For the purposes of this study it is described as geographic movement within South Africa and includes urban-urban, rural-urban, urban-rural, and rural-rural movements.

Circulatory migration	Refers to the moves made during a lifetime i.e. a rural born person might move to the city early in his working life, and stay in the city (although he might move with his family to different locations during their life in the city) for his working life, and then move back to the rural sector at retirement.
Oscillatory migration	This is often also termed labour migration and it means that a worker moves to wherever they find a job, and return home for a while. This could be for periods of a year, six months or three months at a time
Gravity flow migration	Refers to a relative permanent move from one area to another, usually rural urban. People move to town/city to stay. "Water runs downhill, but it does not run back." These moves are based on the relative attractiveness of different areas.
Migration transition	Refers to how migrations change as development sets in. Transition process is from a low migration state through a high migration period to a lower migration period, but different to the previous low migration state.
Poverty	Refers to the denial of opportunities and choices most basic to human development to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-esteem and respect from other. In terms of income <R800/month/household is usually defined as poor and extreme poverty is defined as monthly household income of <R250 (Hirschowitz et al 2000: 54)
Urbanicity	Refers to the extent to which the place of residence is urban or rural
Urbanisation or urban transition	The process through which the population becomes urbanised. This happens as a result of economic and developmental forces impacting on people. Traditional rural areas can become urbanised. Urbanization does not refer to

the physical presence in an urban area / city, but also requires participation/ contribution to the economy of that urban area/city. Informal settlements are sometimes seen as part of the rural sector as their socio-economic system is still very rural (rely on each other, have not accepted township lifestyle yet). On the other hand in South Africa peri-urban areas with extreme population density might also exist in rural areas. These are mainly the result of apartheid laws.

Research methodology

Study variables:

The objectives of this study centres on the empirical description of internal migration of children and their primary caretakers i.e. mothers and grandmothers, and the possible associations between these patterns of internal migration and dietary intake as well as growth of children – specifically the height of these children. The key questions are:

1. What is the nature of internal migration of children and their primary caretakers, mothers and grandmothers, in South Africa?
    - Duration of stay in current area of residence
    - Frequency of movement during lifespan
    - Direction / description of movement during lifespan of child (birth province, birth town, birth urban/rural/farm and current province/town/urban/rural/farm as well as names of places in between)
    - Is the internal migration pattern of children the same as that of their mothers and/or grandmothers
2. Is the dietary intake of children who move worse than those who stayed in one place?
3. Is the anthropometric status (as indicated by weight-for-age, height-for-age and weight-for-height) of children who move different to those who do not move?
4. Are the socio-demographic characteristics of children who move different to those who do not move?

Study design

This study will be based on data collected as part of the National Food Consumption Survey 1999. The NFCS collected quantitative data in a cross-sectional survey of a national probability sample with provincial representation, of children aged 1-9 years in South Africa and their mothers and grandmothers.

Study population

The NFCS target population consisted of all the children aged 1-9 years in South Africa. For this purpose a nationally representative sample with provincial representation was selected by Statistics South Africa using the Census 1996 information. The initial sample was adapted by means of 50% over sampling to accommodate for children that would not be at home at the time of the survey and allowing an over representation of children living in high risk areas i.e. low socio-economic status (a requirement of the Department of Health who commissioned the survey) as well as meeting the requirements of the 24-hour recall methodology in terms of the minimum recommended number of subjects.

The migration study used the same study population and included the mothers and grandmothers of the children if they were at home at the time of the survey. A multi-staged random selection process was followed.

Sample size

The NFCS collected data from 2985 children, which amounts to a 93% response rate of the planned sample size. The sample was selected using a multi-staged selection process from 156 Enumerated Areas (EAs) as defined by the 1996 census in the categories urban (82) and non-urban (74). The total number of EAs in the country for 1996 Census was 86 200.

Selection criteria for EAs were as follows:

- At least 16 qualifying households per EA, except on commercial farms where only six qualifying households were accepted for inclusion. A qualifying household was defined as any household with at least one child aged between 1-9 years in it.
- EAs with hostels and special institutions as well as EAs classified as “other rural” were excluded from the sample.

All EAs were randomly selected from the list of EAs that met these criteria. The distribution of EAs per province was determined proportionately to the distribution of the total population and the urban/non-urban distribution in each province. See Table 1 for a summary of the number of EAs and children included per province.

Table 1: Number of random EAs selected per province for the NFCS

	Number of EAs for urban areas	Number of EAs for rural areas
KwaZulu Natal	13	16
Gauteng	25	4
Eastern Province	8	14
Limpopo (Northern Province)	4	14
Western Cape	14	4
North West Province	4	8
Mpumalanga	4	6
Free State	6	4
Northern Cape	4	4
Total	82	74
Grand total	156	

Selection of households in each selected EA was done after the maps of the relevant EAs were obtained. Estimation was made of the total number of households in each EA in order to determine the approximate number of qualifying households. The Snowball Sampling method was used to set up the sampling frame in each EA. A household was selected randomly as a starting point in each EA. At this household it was asked whether there were other households in the vicinity with children in the prescribed age range. This process was repeated at each of the mentioned households and households were then recorded on the EA map. Eventually a list of qualifying households was created for each EA. Fieldworkers made sure that the list of households created was evenly spread throughout the EA and that a minimum of 30 households were listed. From this list, 20 households in each EA were selected randomly using computer generated random numbers. In each selected household all the occupants were listed. If there was more than one child in the age range 1-9 years, a random numbers table was used to select ONE child in a given household to be included in the survey.

In the case of commercial farms and sparsely populated rural areas, a small number of farms were selected using a random numbers table. On these farms all households were listed, and from the list a simple random sample was drawn.

Exclusion criteria were:

- Death in the family in the past 3 weeks
- Acute illness of child within the last 48 hours
- Caregiver not available
- Caregiver incapable
- Child away from home the past 24 hours
- Caregiver younger than 12 years
- For children older than 2 years, the caregiver must have looked after the child for more than 3 months

The whole sample selected for the NFCS will be included in the migration study.

Extent of data to be used for this study:

No of households: 2895

No of variables: 10

No of children included in the survey: 2895 (2153 with migration data)

No of variables: 34

No of mothers included in the survey: 2033

No of variables 12

No of grandmothers included in the survey: 943

No of variables: 10

Data collection

The NFCS was conducted during the period February to June 1999. Fieldworkers visited the selected households, and following the following procedure:

- fieldworker introduced him/herself and explained the purpose of the survey
- the interviewee was assured of the confidentiality of the information and was asked to answer questions truthfully
- informed consent was obtained
- the socio-demographic questionnaire was completed

- anthropometric assessment of children were completed
- anthropometry of the mother and grandmother was completed if they were present in the household
- the migration questionnaire was completed
- the 24-hr recall questionnaire was completed
- the food frequency questionnaire was completed
- the food procurement and household inventory was completed in all households in high risk EAs as well as in one randomly selected household in other EAs
- the hunger scale was completed

The fieldworkers completed all questionnaires except the hunger scale, which was filled in by the mother/caregiver. Fieldworkers had master copies of all questionnaires in the local languages.

For the purpose of this study, data from the socio-demographic questionnaire, the migration questionnaire and the 24-hour recall, as well as the anthropometric measurements will be analysed.

Questionnaires and measurements

The socio-demographic questionnaire was used to obtain information on the household composition and general information on the socio-economic conditions of the household such as employment status and income of the household. Other general socio-economic information that can be related to the nutritional status of children such as education level of mother/caretaker, household cooking equipment, water and sanitation were also collected.

The 24-hour recall questionnaire used was pre-coded to limit errors by interviewers and was used to obtain information on all food and drink consumed by children during on the day preceding the interview. Special procedures were put in place to ensure that the 24-hour recall questionnaires completed in each EA, covered all days of the week, including weekends. Dietary intake was calculated from the 24-hour recall questionnaire using the food composition database provided by the Medical Research Council. Dietary intake was calculated for energy, protein, vitamin A, vitamin C, thiamine, niacin, riboflavin, calcium, iron and zinc. The nutrient intake of each child was expressed as a proportion of the Recommended Daily Allowance (RDA). Two thirds of the RDA will be used to identify children with insufficient dietary intake.

The migration questionnaire was used to obtain information related to the movement of children aged 1-9 years, and for mothers and grandmothers during the lifespan of these children. Additional information was also obtained on the birthplace and early life of the mother and grandmother in order to establish whether similar patterns exist for the different generations and to be able to calculate net migration rates for the different generations.

As time was a factor in the data collection process and the battery of questions were quite substantial, the questionnaire on migration had to be limited. This influenced the decision to use one year as the critical duration of stay in a particular place. The literature on migration requires a degree of permanency in order to qualify as migration, but often a three to six month period might be deemed sufficient (Cross 2001: 12).

The questions asked for children, mothers and grandmothers pertained primarily to:

- The duration of stay in the current place of residence
- The place (defined by type of area such as urban/rural, the province and whether it was a town, village or farm) where the first year of life was spent. The question was specifically phrased in this way and not as the place where they were born, as people often would travel to towns/cities with better medical facilities for the birth and return immediately after birth. This move was not regarded as migration for the purposes of this study.
- The place (defined as above) where the next four years of life was spent. This specification of a time period was selected specifically to summarize (together with information from the first question) the pre-school years. It could however have introduced some degree of inaccuracy for mothers and grandmothers if they had spent these four years in more than one place. Attempts were made to limit the inaccuracy by requesting fieldworkers, during

the training, to add the relevant information if it was indicated during the interview.

- The last question tried to capture a list of places where children, mothers and grandmothers lived during the last ten years i.e. the lifespan of the children included in this survey. This question provided the opportunity to capture migration of children from birth to date. Names of places were asked purposefully, and not only in how many places did people live, as it is usually easier for respondents to remember the places where they lived. During data entering the names of these places will be captured, but for analysis these will be translated into frequency. For children frequency of movement reflects the total number of movements during their lifespan. For grandmothers and mothers the frequency of movement reflects only the number of moves during the last ten years.
- Based on the information provided by these questions the researcher compared the places mentioned, the duration of stay in the particular place and the age of the child in order to decide whether the movement pattern was the similar for the children, mother and grandmother.

Anthropometric measurements:
Body weight was measured with an electronic platform scale to the nearest 0.1kg. Height was recorded to the nearest 0.1cm by using a stadiometer for adults and children older than 2 years. For children younger than 2 years of age supine length was determined by means of a measuring board. All measurements were repeated twice. Measurements were repeated if these two measurements differed more than 0.1kg or 0.5cm. Children and adults were measured with light clothing on and without shoes.

Weights and heights of children were compared with those of the National Centre of Health Statistics of the USA using Epi Info version 6.02. For each child a z-score (i.e. the number of standard deviations from the reference population median) was calculated for weight-for-height (WHZ), weight-for-age (WAZ), and height-for-age (HAZ). For adults the Body Mass Index was calculated as the (weight in kg)/(height in m)^2. For children a z-score of <-2 Standard Deviations (SD) and <-3 SD will be used to classify moderate and severe under nutrition respectively i.e. for underweight, stunting and wasting. A z-score of > +2 SD weight-for-height would be used to classify overweight in children. For adults a BMI of <16 would be classified as underweight a BMI of >30 would be classified as overweight.

Pilot study

For the NFCS an initial pilot study was carried out in 50 households each in a rural area in the Northern Province and an urban urea in the Western Cape. A further pilot was carried out in one urban and one non-urban EA in each province. This pilot also included a validation of the questionnaires. Once the pilot was completed possible problems were attended to, and thereafter the formal survey started.

Training

A set of questionnaires, a training manual and a video were specifically developed for the NFCS. These instruments covered all aspects of the survey methodology and were used for this purpose. Training happened in a stratified manner i.e. the directors trained coordinators for each province. The coordinators then trained the fieldworkers using the training tools and with some standardisation activities from the directors.

The migration questionnaire was included in the training package and process together with the NFCS.

Quality control

Relative validation for the NFCS was determined by repeating the Quantified Food Frequency Questionnaire (QFFQ) and anthropometric measurements in 2 randomly selected HHs for each EA by the coordinator and combined with two additional repeats of the 24-hr recall in these HHs on two randomly selected days, one week apart each. The three 24-hr recalls were used to determine the relative validity of the QFFQ.

Repeatability was determined by the repeat of the QFFQ and the anthropometric measurements in one randomly selected HH per EA by the same interviewer. All fieldworkers were tested for repeatability during the course of the survey. The coordinator, without the prior knowledge of the fieldworkers, implemented the repeats.

Data management and data analysis

The coordinator as well as the director for each province checked each questionnaire. A template was created for each questionnaire using D-base, a database programme. Once data was entered for each EA by a data typist, it was checked and corrected by a second data typist and cleaned by the statistician. The researcher was responsible for checking and cleaning of all migration specific data. Data relevant to this study was exported into a spreadsheet, Excel, and a statistical package, SPSS PC, will be used by the researcher for data analysis.

The NFCS reported descriptive information on the study sample such as socio-demographic characteristics, anthropometric status, dietary intake, food procurement practices and perceived hunger. See Labadarios (2000) for the full report. The report is also available on www.healthinfo.mrc.ac.za.

This study will use descriptive statistics to present the migration patterns of children, mothers and grandmothers. The socio-demographic characteristics, anthropometric status and dietary intake of the study sample will be analysed according to the migration patterns of children, mothers and grandmothers. Spearman's rank order correlations will be used to assess the correlations between migration patterns of children and the differences in dietary intake and anthropometric status. Cross-tabulations Chi-square will be used to assess possible correlations between categorical variables. Regression models such as analyses of variance and co-variance will be used to estimate the differences in height and dietary intake for different migration patterns after adjusting for potential confounding factors. Logistic regression will be used to estimate the differences between categorical variables for different migration patterns e.g. proportion of the children categorized as underweight, wasted, stunted, or with insufficient dietary intake by province and different migration patterns. Odds ratios and 95% confidence intervals will be calculated to measure the strength of the associations.

Assumptions

This study did not investigate the validity of motherhood and assumes that the person indicated as the mother of the child would be the biologic mother. In addition to this and in line with the instructions provided as part of the migration questionnaire, the assumption is that information was obtained for the maternal grandmother unless otherwise specified. Measures were implemented to ensure the validity and reliability of anthropometric and dietary measurements as part of the NFCS. It is assumed that the information provided on internal migration would be accurate. The validation of the Quantified Food Frequency Questionnaire as part of the NFCS suggests that the 24-hr recall methodology provided an accurate indication of the dietary intake of the children. It needs to be accepted that there would however be some degree of inaccuracy as the mother is the respondent on behalf of the child. Other studies have however found that children younger that 9 years of age cannot give a reliable report of their own dietary intake.

Contribution by the researcher

The source survey i.e. the NFCS was planned and executed by a consortium of the Heads of the nine Dietetics Departments at Universities, of which the researcher was an active member. Each director of this consortium was assigned a province for coordination of the fieldwork. The researcher, as one of the directors of the consortium, was responsible for the Eastern Cape. The consortium approved the draft proposal on migration as prepared by this researcher and agreed that the researcher could use the information from the NFCS for a doctoral thesis on the basis of the involvement of and contributions by the researcher in the conceptualisation, planning, implementation, analyses and reporting of the NFCS. The researcher developed the migration questionnaire independently. As mentioned before the researcher was also responsible for the checking and cleaning of the migration data and the anthropometry of the mothers and grandmothers. This data was not analysed as part of the NFCS report, but will be written up by the researcher as an addendum to the NFCS.

Ethical considerations

The Ethics Committee of the University of Stellenbosch approved the protocol of the source study (reference number US 98/140). Written informed consent was obtained from the mother/caregiver of each child that was included in the survey. The protocol for this study will be submitted to the Higher Degrees Committee of the Faculty of Community and Health Sciences of the University of the Western Cape.

The source study i.e. the National Food Consumption Survey of children aged 1-9 years of age was the first national representative study of children's dietary intake in South Africa. The anthropometric supplement extended the database on children 0-6 years of age as collected by the South African Vitamin A Consultative Group in 1994. Information on eating practices of children could highlight the impact of internal migration and explain possible differences in growth patterns. The following new information on a national representative scale will be provided by this study:

- Information on the internal migration patterns of children, and their mothers and grandmothers during the lifespan of each child i.e. between 1989 and 1999.
- Information on possible associations between the anthropometric status of children, and the anthropometric status of their mothers and grandmothers.
- Information on possible associations between internal migration patterns and the anthropometric status and dietary intake of children.

List of references

Alderman H, Babita M, Lanjouw J, Lanjouw P, Makhatha N, Mohamned A, Ozler B & Qaba O **in** Hirschowitz R (2000): Measuring Poverty in South Africa. Statistics South Africa: Pretoria.

Bekker S (2002): Proceedings of the Annual Conference of the Demographic Society 24- 27 September 2002. University of the Western Cape.

Benyoussef A, Cutler JL, Baylet R, Collomb H, Diop S, Lacombe B, Vaugelade J & Levine A (1973): Sante, Migration et Urbanisation. Bulletin of the World Health Organization, 49: 517-537.

Billsborrow R E & United Nations Secretariat **in** United Nations (1993): Internal Migration of Women in Developing Countries. Proceedings of the United Nations Expert Committee on the Feminization of Internal Migration. United Nations: New York.

Brown AA & Neuberger E (eds) 1977: Internal Migration: A Comparative Perspective. Academic Press: New York.

Bustos P, Amigo H, Munoz SR & Martorell R (2001): Growth in indigenous and nonindigenous Chilean schoolchildren from 3 poverty strata. American Journal of Public Health 91(10):1645-1649

Byarugaba J (1991): The impact of urbanisation on the health of black pre-school children in the Umtata district, Transkei, 1990.

Carnell MA & Guyon AB (1990): Nutritional status, migration, mortality and measles vaccine coverage during the 1983-1985 drought period: Timbuktu, Mali. Journal of Tropical Paediatrics 36(3): 109-13

CMA Report (2001): Migration and Settlement in the Cape Metropolitan Area 1999. University of Stellenbosch and Cape Metropolitan Area. SADA 0074.

Cronje M (2002): Proceedings of the Annual Conference of the Demographic Society 24- 27 September 2002. University of the Western Cape.

Elford J, Phillips A, Thomas AG & Shaper AG (1990): Migration and geographic variations in blood pressure in Britain. British Medical Journal 300(6720): 291-294.

Gelderblom D & Kok P (1994): Urbanisation: South Africa's challenge. Volume 1: Dynamics. HSRC Publishers: Pretoria.
Graduate Workshop on Internal Migration 2000: Occational Paper No11. Department of Sociology: University of Stellenbosch.

Hirschowitz R, Orkin M & Alberts P **in** Hirschowitz R (2000): Measuring Poverty in South Africa. Statistics South Africa: Pretoria.

Jalil F, Karlberg J, Hanson LA & Lindblad BS (1989): Growth disturbances in an urban area of Lahore, Pakistan, related to feeding patterns, infections and age, sex, socio-demographic factors and seasons. Acta Paediatric Scand, Supplement 350: 44-54.

Karlberg j, Jalil F & Lindblad BS (1988): Longitudinal analysis of infantile growth in an urban area of Lahore, Pakistan. Acta Paediatric Scand, 77: 392-401.

Kok PC (2002): Proceedings of the Annual Conference of the Demographic Society 24- 27 September 2002. University of the Western Cape.

Kpedekpo GMK (1982): Essentials of Demographic analysis for Africa. Heineman: London.

Labadarios (ed) (2000): The National Food Consumption Survey (NFCS): Children aged 1-9 years, South Africa, 1999. Report to the Department of Health.

Labarthe D, Reed D, Brody J & Stallones R (1995). Health Effects of Westernisation and Migration Among Chamorros. American Journal of Epidemiology, 98 (3): 161-174.

Laor A, Seidman DS & Danon YL (1991): Changes in body height among selected ethnic groups. Journal of Epidemiology and Community Health 45:169-170

Lebowitz MD & Burrows B (1975): Tucson epidemiology study of obstructive lung diseases: Effects of in-migration factors on the prevalence of obstructive lung diseases. American Journal of Epidemiology 102(2): 153-163.

Pawson IG & Janes C (1981): Massive obesity in a migrant Samoan population. American Journal of Public Health 71(5): 508-513.

Pelto GH (1991): Ethnic minority, migration and risk of undernutrition in children. Acta Paediatrica Scandinavia 374 (Supplement): 51-57.

Reed D, Labarthe D & Stallones R (1995): Health effects of westernisation and migration among Chamorros. American Journal of Epidemiology 142(7): 673:691.

Saleemi MA, Ashraf RN, Mellander L & Zaman S (2001): Determinants of stunting at 6, 12, 24 and 60 months and postnatal linear growth in Pakistani children. Acta Paediatrica 90: 1304-1308.

National Population Unit (2000): State of South Africa's Population Report 2000. The National Population Unit. Department of Social Development: Pretoria.
Spengler & Myers **in** Brown AA & Neuberger E (eds) 1977: Internal Migration: A Comparative Perspective. Academic Press: New York.

Statistics South Africa (1998): The people of South Africa. Population census, 1996. Statistics South Africa: Pretoria.

Steyn K, Jooste PL, Bourne L, Fourie JF, Badenhorst CJ, Bourne DE, Langenhoven ML, Lombard CJ, Truter H, Katzenellenbogen J, Marais M & Oelofsen A (1991): Risk factors for coronary heart disease in the black population of the Cape Peninsula. The BRISK study. South African Medical Journal 79: 480-484.

Story M, Strauss KF, Zephier E & Broussard BA (1998): Nutritional concerns in American Indian and Alaska native children: Transitions and future directions. Journal of the American Dietetic Association 98(2): 170-176.

Toole MJ & Waldman RJ (1993). Refugees and Displaced Persons. Journal of the American Medical Association, 270 (5): 600-605.

United Nations (1993): Internal Migration of Women in Developing Countries. Department for Economic and Social Information and Policy Analysis. United Nations: New York.

United Nations (1999): World Urbanization Prospects. The 1999 Revision. United Nations: New York.

Verheij RA (1996): Explaining urban-rural variations in health: A review of interactions between individual and environment. Soc Sci Med 42(6): 923-935.

NATIONAL FOOD CONSUMPTION SURVEY: SA CHILDREN 1-9 YEARS OLD

Subject Number:		**Birth Date:** DD MM YY	**Interview Date:** DD MM YY

Province:_________ EA.: ________ Interviewer: _________ Interviewer Code: __________

DIETARY INTAKE QUESTIONNAIRE (24HR RECALL)

1. Name of child:													
2. Day of the week recalled	1 Mon	2 Tue	3 Wed	4 Thu	5 Fri	6 Sat	7 Sun						
3. Was yesterday typical/routine for the child?	1 YES	2 NO IF NOT, WHY?											
4. What kind of fat does the child usually eat on bread?	1 B-3479	2 HM-3484	3 MED-3531	4 PM-3496	5 WF-3516	6 Ghee-3525	7 PB-3485	8 Butro-3523	9 None	10 Other: Specify			
5. What kind of fat does the child usually eat in cooking?	1 B-3479	2 HM-3484	3 MED-3531	4 PM-3496	5 WF-3516	6 Ghee-3525	7 PB-3485	8 Butro-3523	9 SO-3507	10 Canola Oil 4280	11 Olive Oil 3509	12 None	13 Other: Specify
6. What kind of bread does the child usually eat/use?	1 White 3210	2 Brown 3211	3 Whole Wheat 3212	4 None									
7. What kind of milk does the child usually drink?	1 CON WM-2714	2 CON SM-2744	3 CON ND-P0042	4 Evap WM-2715	5 Evap SM-2827	6 Evap Lite-P0043							
	7 ND Creamer-2751	8 WM Powder-2831	9 SM-2719	10 WM-2718	11 BL-2771	12 2%-2772							
	13 Longlife SM-2775	14 Soy-2737	15 Breast-2741	16 Goat-2738	17 Formula: Specify	18 None							
8. Did the child eat at a feeding scheme or crèche yesterday?	1 YES If YES, specify (fill in page 15)				2 NO								
	1 PEM	2 PSNP	3 NGO's	4 Self-funded									

<u>Instructions</u>:
Now I want you to tell me everything that this child ate and drank yesterday. Lets start with when the child woke up. Did he/she have anything to eat or drink? Proceed through the day following the child's activities. When you have finished, summarise it for the caregiver. Any forgotten items can then be added.

- Enter each item eaten in grams under the correct interval of the day eaten.
- Make sure that the code is circled.
- Items not on the questionnaire should be looked up in the Quantity Manual or list of food codes.
- Specify fully when new items are entered and look up the code later.
- Recipes should be added on page 15.

ABBREVIATIONS:

<u>Measures</u> 1t = 1 rounded teaspoon 1T = 1 rounded tablespoon (15ml) 1SP = 1 rounded servingspoon (30ml) c = measuring cup (250ml) s/s = small size m/s medium L/s = large E = enriched P = plain <u>Milk</u>: SM = skim milk WM = whole milk BL = blend CON = condensed milk ND = non-dairy	B<u>read</u>: Wh = white Br = brown Ww = wholewheat <u>Meat</u>: F = with fat FT = fat trimmed <u>Oil/Fat</u> B = butter HM = hard margarine Med = medium fat/light PM =- polyunsaturated SO = sunflower oil WF = white fat PB = peanut butter	BR = breakfast (Up to 09h00) IS = in-between snack L = lunch (midday (12h00-14h00) D = dinner (evening) (17h00 – 20h00) AD = after dinner Comm = commercial Home = homemade Pot = potato Cab = cabbage Carr = carrot Fill = filling Usually = at least 4x/week

	FOOD ITEMS	QUANTITY (g/ml)	BR	IS	L	IS	D	AD
TEA & COFFEE	Tea: 4038; Rooibos 4054	teacup = 180ml; mug = 250ml						
	Coffee 4037	cup = 180ml; mug = 250ml						
	+ Sugar White-3989; Brown-4005;Syrup-3988;Honey-3984	1 t sugar = 6g 1 t honey/syrup = 15g						
	+ Condensed Milk: WM -2714; Cond Milk: SM-2744; Condensed Milk, Non-Dairy-P0042	1t = 10g						
	+ Evaporated WM-2715; Evaporated SM-2827; Lite-P0043	1t = 3g						
	+ Non-Dairy Creamer-2751	1t = 4g						
	+ WM Powder-2831	1t = 4g						
	+ Milk: SM-2719; WM-2718	MEDIUM PORTIONS: 20ml - tea in cup 35ml - tea in mug 40ml - coffee in cup 75ml - coffee in mug						
	BL-2771; 2%-2772							
	Soy-2737; Breast-2741; Goat-2738							
	Formula (Specify):_______________ No of Scoops/Bottle:______________							
	Other (Specify) _______________							
MILK & MILK DRINKS	Buttermilk - 2713	s/s = 175ml l/s = 500ml ½c = 125g						
	Maas/Amazi/Sourmilk - 2787							
	Custard: SM-2717; WM-2716	s/s = 350 ml						
	Milk: SM-2719; WM-2718	to drink ½c = 125ml baby bottle = 250ml						
	BL-2771; 2%-2772							
	Soy-2737; Breast-2741; Goat-2738							
	∗ Formula (Specify):_______________ No of Scoops/Bottle:______________							
	+ Sugar White-3989;Brown-4005; Syrup-3988;Honey-3984	1 t sugar = 6g 1 t honey/syrup = 15g						
	+ Ice Cream-3519; Sorbet-3491	1 scoop = 40g						
	+ Sustagen-4079; Complan-4082	2 scoops = 25g; 1T = 15g						
	+ Milo/Cocoa/Horlicks/Ovaltine-2736; Drinking Chocolate-4287	1t = 5g						
	Yoghurt: Plain SM-2734; WM-2757	s/s = 175ml Yogisip = 350ml ½c = 125g						
	Flav-2756; Fruit-2732							
	Flavoured milk - 2774	carton = 250ml s/s plastic = 350ml						
	Other (Specify) ______________________							
COLD DRINKS/JUICE	Apple Juice – No Sugar – 3606	Liquifruit s/s = 250ml L/s = 500ml Ceres s/s = 200ml cartons/bottles s/s = 350ml L/s = 500ml						
	Apricot: + Sugar-3539; No Sugar-3610							
	Mango-3683; Granadilla-3680; Grape-3690							
	Orange: +Sugar-3562; No sugar-3638							
	Guava: +Sugar-3554; No Sugar-3629							
	Peach-3642; Pear-3645; Naartjie-3682							
	Cold drinks: Squash-3982	s/s bottle = 350ml L/s bottle = 500ml s/s can = 340ml						
	Mageu-4056							
	Carbonated-3981							
	Diet Cold. & Low-Cal - 3990							
	Dairy Fruit Mix - 2791							

∗ Infasoy-2808; Isomil-2796; Lactogen 1-2821; Lactogen 2-2822; Nan-2819; Pelargon-2820; Portagen-2799; Pregestimil-2800; Prosobee-2795; S26-2806; S26 Infagro-2810; SMA-2814; Similac-2797; Similac PM-2817

	FOOD ITEMS	QUANTITY (g/ml)	BR	IS	L	IS	D	AD
	+ Sugar White-3989;Brown-4005;Syrup-3988; Honey-3984	1t = 6g						
	Syrup (undiluted)-2865; Guava Syrup-2864	1t = 5g						
	Other (Specify) ___________________							
BREAKFAST CEREALS	Maltabella: Soft-3241; Mabella: Soft-3437	½c = 125g						
	M/Meal: Soft: Plain-3399; Enrich-4277	1c soft = 250g						
	Stiff: Plain-3400; Enrich-4278	1c stiff = 250g						
	Crumbly: Plain-3401; Enrich-4279	1c crumbly = 140g						
	Sour Porridge: Maize with Vinegar-P0001, Maize Fermented- P0002 Mabella with Vinegar-P0003; Mabella Fermented-P0004	½c = 125g 1c = 250g						
	Oats-3239; Tastee Wheat-3240	½c = 125g						
	Corn Flakes-3243; Sugar Frosted-3374	1c = 40g						
	Honey Crunch and Muesli - 3303	½c = 65g						
	Pronutro: Great Start-3438; High Energy-3245; Wholewheat-3436	½c = 50g						
	Puffed Wheat-3325; Sweetened-3376 (Honey Smacks)	½c = 12g						
	Raisin Bran-3373; Fruit Loops-3425	Raisin Bran ½c = 45g Fruit Loops ½c = 18g						
	Special K-3322; All Bran-3242	½c = 25g						
	Rice Crispies-3252; Cocopops-3372	½c = 20g						
	Weetbix – 3244	1 = 25g						
	+ Fat: B -3479; HM-3484; Med-3531; PM-3496; WF-3516	1 t PB = 12g; 1 t marg/oil = 5g						
	Ghee-3525; PB-3485; Butro-3523; SO-3507							
	+ Sugar White-3989;Brown-4005; Syrup-3988;Honey-3984	1 t sugar = 6g 1 t honey/syrup = 15g						
	+ Cond Milk:SM-2744; Cond WM-2714;Cond ND- P0042	1t = 10g						
	+ Evap WM-2715; Evap SM-2827; Evap Light-P0043	1t = 3g						
	+ Non-Dairy Creamer-2751	1t = 4g						
	+ WM Powder-2831	1t = 4g						
	+ Milk: SM-2719; WM-2718	125g – instant cereal 60g – porridge 180g – Pro Nutro						
	BL-2771; 2%-2772							
	Soy-2737; Breast-2741; Goat-2738							
	Formula (Specify):________________ No of Scoops/Bottle:_							
	Other (Specify) ___________________							
BREAD & ROLLS	Bread: Comm & Home: Wh-3210	Wh + Br 10mm = 30g Ww 10mm = 35g Wh + Br 20mm = 60g Ww 20mm = 70g						
	Br-3211							
	Ww-3212							
	Cream Crackers-3230; Provita-3235; Tuc 3331; Crackers Ww-3391	Cr Cracker = 8g; Tuc = 4g; Provita = 6g						
	Maize Meal Bread - 3278	m/s = 30g; L/s = 50g						
	Muffins: Plain-3408; Bran-3407	6cm diam = 35g 8cm diam = 60g						
	Rolls: Wh-3210; Br-3211; Ww-3212	Wh round (10cm) = 30g Wh long (16cm) = 40g s/s = 50g (Roti)						
	Roti: SO-3358; HM-3357							

	FOOD ITEMS	QUANTITY (g/ml)	BR	IS	L	IS	D	AD
	Rusks: Comm Wh-3364; Bran-3330	Outspan = 15g; All Bran = 30g						
	Comm Buttermilk: Wh-3329;	Wh = 35g; Ww = 30g						
	Home Buttermilk: Wh-3215; Ww-3255; Bran & Raisins-3380	Wh = 30g; Ww = 30g						
	Scones: (Wh) SM-3411; WM-3237 (Ww) SM-3412; WM-3320	6cm diam = 35g 8cm diam = 60g						
	Vetkoek: Wh-3257; Ww –3324; Dumpling-3210 (no yeast)	8cm diam = 60g						
	Other (Specify) ___________________							
SPREADS ON BREAD	Beef Fat-3494; Mutton Fat-3497; Lard-3495	Thin Med Thick 5 10 15						
	Butter-3479; Butro-3523							
	Ghee-3525; WF-3516;							
	Fishpaste-3109; Liver Spread-2922; Meat Paste-2917	5 7 10						
	Jam-3985; Honey-3984; Syrup-3988	10 20 35						
	Marg: H-3484	5 7 10						
	Med-3531							
	PM-3496							
	Marmite-4030; Meat Spread (Bovril)-4029	2 4 7						
	Peanut Butter-3485; Sandwich Spread-3522; ChSpread-P0005	5 10 20						
	Other (Specify) ________________________							
EGGS	Eggs: Boiled/Poached - 2867	1 egg = 50g						
	Curried - 2902	1 egg + sauce (IT) = 75g						
	Fried: B-2868; HM-2877; PM-2878	1 egg = 52g						
	SO-2869; Bacon Fat-2870							
	Scrambled/Omelette: SM + B-2886; SM + HM-2887	IT = 35g; 1SP = 80g ½c = 115g (± 2 eggs) omelette = 60g egg (med) 120g (L/s)						
	SM+PM-2888; SM+SO-2889; WM+B-2874							
	WM+HM-2890; WM+PM-2891; WM+SO-2873							
	Other (Specify) _________________________							
CHEESE	Cheddar-2722;	grated: med = 10g Thick = 15g 1 cheezi = 20g; cubes = 30g 1 slice = 8g						
	Gouda/Sweetmilk-2723							
	Cheese Spread-2730	med = 12g; thick = 25g						
	Cottage Cheese; Creamed-2759; Cream Cheese-2725	thin = 10g med = 20						
	Cottage Cheese: Fat Free-2729; Low Fat-2760	med = 20g; thick = 30g						
	Macaroni Cheese: SM-3343; WM-3301	1T = 45g; 1 SP = 90g; ½c = 115g						
	Pizza (Cheese + Tomato)-3353	S/s = 90g; L/s = 340g						
	Savoury Tart+Asparagus-3367;+Vienna-3326;+Tuna-366	wedge: small = 65g; med = 75g ; large = 110g						
	Other (Specify) _________________________							
MEAT	Bacon: Fried: Lean-2915 F-2906	1 rasher = 10g						
	Beef:Corned/Silverside/Cold cuts:F-2924;BullyBeef-2940	138 x 85 x 3 = 20g ½c = 100g						
	Lean-2962; Curry Beef-P0006							
	Fillet: F-2933; FT-2929	100 x 70 x 10 = 90g						

	FOOD ITEMS	QUANTITY (g/ml)	BR	IS	L	IS	D	AD
MEAT	Mince: Pan Fried F-2910; Lean-2961; Curry-3015	T = 40; SP = 85g ½c = 100g						
	- Savoury (Tomato + Onion)-2987							
	- Cottage Pie: WM + HM-3009							
	Roast: F-2944; FT-2960	120 x 60 x 5 = 35g 120 x 60 x 10 = 70g						
	Rump: Fried: F-2908; FT-2959	S/s 130 x 70 x 15 = 125g L/s 165 x 70 x 30 = 270g						
	Sirlion/T-Bone: Grilled: F-2946; FT-2907							
	Stew: Vegetables (Fat Meat)-3006	1 SP = 105g; ½c = 125g						
	: Pot + Carrots + Peas + Onions (Lean Meat)-2909							
	Biltong: Beef-2911; Game-2912	grated 1SP = 10g beefeater = 18g sliced 1SP = 35g						
	Bobotie: Lean, SM, SO-3013; F, WM, S0-2986	1SP = 85g; ½c = 115g						
	Chicken: Boiled + Skin-2926; No Skin-2963; Curry-P0007	breast + skin = 125g thigh = 80g drumstick = 42g foot = 30g wing = 30g pie(comm)=150g home = 90g liver = 30g; stomach = 20g						
	Feet-2997; Giblets-2998; Heads-2999							
	Pie (Comm)-2954							
	Roast + Skin-2925; No Skin-2950; Fried-2925							
	Stew: Vegetables-3005	1SP = 90g; ½c = 125g						
	Tomato + Onion – 2985							
	Batter Dipped-Fried eg. Kentucky-3018	1SP = 105g; ½c = 125g						
	Burger Pattie –2950	1 pattie = 80g						
	+ Bun (4 cm diam)-3210	1 bun = 60g						
	Cornish Pie: (Comm) - 2953	med = 150g						
	Frankfurter-2937	155 x 20 = 45g 168 x 21 = 60g						
	+ Roll (16 cm long)-3210	1 roll = 40g						
	Goat meat: Stewed (plain)-4281; (+ Veg)-4282	120 x 60 x 5 = 35g 120 x 60 x 10 = 70g						
	Fried F-P0008; Fried FT-P0009							
	Grilled F-P0010; Grilled FT-P0011							
	Ham-2967; Ham & Tongue loaf-2990	med slice = 25g						
	Heart: Beef-2968; Sheep-2969	sheep heart = 60g sheep kidney = 30g beef kidney = 85g						
	Kidney: Beef-2923; Sheep-2956							
	Lung: Beef-3019							
	Lasagne: SM-3440; WM-3261	T = 40g; SP = 75g; ½c = 120g						
	Liver: Fried : Beef-2920; Sheep-2955; Patty (Fried) -2971	sheep = 55g chicken = 30g beef = 80g						
	Cooked: Chicken-2970							
	Meat Ball: F + Egg-2965; F-No Egg-2966	50mm = 60; 75mm = 120g						
	Lean + Egg-3033; Lean, No Egg-3034							
	Meat Loaf: F-3035; Lean-3002	80 x 85 x 15mm slice = 80g						
	Meat Patty: (Hamburger)-2984	s/s = 50g; m/s = 100g						
	+ Bun (4 cm diam)-3210	1 bun = 60g						
	Mutton: Chop (grilled) F-2927; FT-2934	loin chop = 60g rib chop = 40g						
	Roast: F-2947; FT-2973	s/s slice = 30g med = 70g						

	FOOD ITEMS	QUANTITY (g/ml)	BR	IS	L	IS	D	AD
MEAT	Stew: Plain-2974; Irish-2916 (Vegetables) Curry-3039; Greenbean-3040	1SP = 105g; ½c = 125g						
	Offal: Cooked-Tripe(Pens&Pootjies)-2951;Vetderm-P0023 (Specify): ___________________	1SP = 105g; ½c = 125g						
	Oxtail: Stewed-2976							
	Polony-2919	slice 5mm thick = 8g comm slice = 16g						
	Pork: Chop (Grilled) F-2930; FT-2977	chop: 115 x 80 x 20 = 100g schnitzel: 115 x 80 x 20 =110g roast: 110 x 65 x 5 = 30g 1SP = 105g; ½c = 125g 3 ribs = 130g						
	Crumbed-2992; Spareribs-3010							
	Rib, Braised: F-3046; FT-3045							
	Roast: F-2958; FT-2978							
	Salami and Russians-2948	slice 5mm thick = 12g 1 Russian = 50g						
	+ Roll-3210	1 roll = 40g						
	Samoosa: with Veg-3414; Meat-3355	s/s = 42g						
	Sausage: Beef: Dry-2949; Cooked-2931 (Boerewors)	thin x 200mm = 45g thick x 165mm = 90g						
	+ Roll-3210	1 roll = 40g						
	Pork: Cooked-2932	med = 55g						
	+ Roll-3210	1 roll = 40g						
	Roll/Meat Pie (Comm)-2939	25mm pie = 120g roll x 135mm = 165g						
	Spaghetti Bolognaise: Lean-3388; F-3260	T=40g; SP = 75g; ½c = 100g						
	Steak & Kidney: Pie-2957; Stew-2979	comm pie = 120g (30mm) 1SP = 100g; ½c = 135g						
	Tongue: Ox-2935; Sheep:2980	slice 75 x 45 x 10 = 40g						
	Toppers/Imana: Cooked-3196	SP = 85g; ½c = 120g						
	Veal: Cutlet (Fried): Plain-3049; Crumbed-2983	1 chop = 90g						
	Vienna Sausage/Canned Sausage-2936	100mm = 30g; 150mm = 40g						
	+ Roll-3210	1 roll = 40g						
	Worms/Insects:Mopani,Dried-4250;Mopani,Canned-4284;							
	Wild Birds, Animals; Specify:							
	Other (Specify) ______________________							
FISH	Bokkems (Dry Fish)-3097	1 s/s = 25g (120mm) L/s = 40g (135mm)						
	Fatty Fish: Kipper; Galjoen; Snoek; Shad: Fried (SO)-3084; Batter-3094; Grill-3082	small 50 x 55 x 30 = 60g med 100 x 55 x 30 = 120g stew 1 SP = 95; ½c = 140g						
	Salted-3097; Steam-3103; Smoked-3112							
	Stew-3076 (Tomato and Onion) / Pickled / Curried							
	Fish Cakes: (Fried): Home-3098; Comm-3080	65 x 15mm = 50g						
	Fish Fingers: (Fried)-3081	85mm = 35g						
	Haddock: Smoked (Boiled)-3061	70 x 70 x 15 = 65g						
	Mackerel Canned-3113	1 = 80g (15 mm)						
	Pilchards: Tomato Sauce-3102; Brine-3055	1 = 75g						

	FOOD ITEMS	QUANTITY (g/ml)	BR	IS	L	IS	D	AD
	Sardines: + Sauce-3087; + Oil-3104	s/s = 7g; L/s = 25g						
	Smoorsnoek-3074	1SP = 55g; ½c = 80g						
	Sole: Fried-3090; Grilled-3073	baby sole: 180mm = 70g						
	Tuna: Oil Pack-3093; Tuna: Water-3054; Salmon-3058	¼c = 50g						
	White Fish: Hake, Haddock, Kingklip; Cod : Stew-3076 (Tom + On); Baked+Fat-3092; No Fat-3089	s/s piece 50 x 55 x 30 = 60g med 100 x 55 x 30 = 120g stew 1 SP = 95g; ½c = 140g						
	: Grilled-3079; Batter-3072; Fried-3060							
	Other: eg Fresh Water Fish; Specify:__________ P0012							
	Other (Specify) ______________________							
STARCH	**M/Meal: Soft: Plain-3399; Enrich-4277**	T SP ½c						
	Stiff: Plain-3400; Enrich-4278	stiff 75 120 125						
	Crumbly: Plain-3401; Enrich-4279	crum 30 75 70						
	Mabella Cornrice/Sorghum cooked (soft or stiff)-3437	soft 75 120 125						
	Sour Porridge: Maize & Vinegar-P0001, Fermented-P0002							
	Mabella with Vinegar-P0003; Fermented-P0004							
	Maize Rice (Mealie Rice)-3250	25 45 65						
	Samp: (Cooked) –3250; Fresh Mealies-3725	55 125 125						
	Rice: Wh-3247; Br-3315	25 60 65						
	Spaghetti/Macaroni: (Cooked)-3262	35 70 90						
	Spaghetti + Tomato Sauce -3258	45 80 125						
	Stamped Wheat/Wheat Rice-3249	30 80 80						
	+ Fat: B -3479; HM-3484; Med-3531; PM-3496; WF-3516	1 t PB = 12g; 1 t marg/oil = 5g						
	Ghee-3525; PB-3485; Butro-3523; SO-3507							
	Other (Specify) _________________________							
SOUPS AND LEGUMES	**Baked Beans-3176**	**T SP ½ c** **50 105 135**						
	Beans: (Cooked) Haricot-3185; Sugar-3205; Kidney-3183	50 85 135						
	Breyani: Rice + Lentils + Ghee-3194; +SO-3193	40 80 85						
	Lentils: Cooked/curried-3179	40 80 90						
	Samp and Beans (1:1)-3402; Comm-P0045 (No fat added)	50 125 125						
	Samp & Peanuts (80:20) P0013							
	Soup: Comm (Packets)-3165	125						
	Split Pea-3157; Lentil-3153; Beef + Veg-3159; Bean-3145	35 80 130						
	Sousboontjies (Dried Bean Salad)-3174	40 105 135						
	Stew: Bean + Potato + Onion-3178	60 120 125						
	Other (Specify) __________________							

		Boil	Fat Added (or Fried)													
COOKED VEGETABLES		**NF**	**B**	**HM**	**PM**	**SO**	**T**	**SP**	**½C**							
	Gr Beans	**3696**		**3788**	**3789**		25	60	80							
	Gr Bean Curry	**3791**					40	75	120							
	GrBean+Pot+Onion			**3792**		**3794**										

	FOOD ITEMS						QUANTITY (g/ml)			BR	IS	L	IS	D	AD
COOKED VEGETABLES	Beetroot + Sugar	3699													
	- No Sugar	3698					40	70	80						
	Brinjal	3700		3800		3802	1 slice = 20g (70mm) + batter = 30g								
	- Fried + Egg					3803									
	- + Tomato + Onion			3796		3798	50	100	130						
	Brocolli	3701		3805			25	60	75						
	Brussels Sprouts	3703		3808			50								
		Boil	Fat Added (or Fried)												
		NF	B	HM	PM	SO	T	SP	½C						
	Cabbage	3756		3810		3812	30	55	80						
	Cab + Pot + Onion			3813		3815	35	75	80						
	Carrots	3757		3816	3817		20	50	80						
	Car + Pot + Onion			3822		3824	35	70	105						
	Carrot + Sugar	3818		3819	3820		25	50	85						
	Cauliflower	3716		3825	3826		40	65	80						
	Caul + Cheese Sauce	3715					43	70	90						
	Marogo/imifino* Amaranth leaves	3980					40	105	90						
	Marog + Peanuts Ratio: 80:20	P0014					55	120	105						
	Mealies (corn)	3725					30	60	95						
	Sweetcorn	3726					55	125	135						
	Canned Whole Kernel	3942					55	125	135						
	Mix Veg (Froz)	3727		3835	3836	4269	35	75	75						
	Mushroom (Sliced)	3729		3839		3841	30	65	80						
	Mushroom, Raw					3842	30	65	80						
	Onions (Sliced)	3773		3844		3730	50								
	Onion + Batter					3846	rings: med = 40g								
	Peas	3719		3856			30	65	85						
	Peas, Frozen	4146					30	65	85						
	Peas + Sugar	3720		3859			30	65	85						
	Potato: + Skin	4155					s/s = 60; m/s = 90g								
	: Baked + Skin	3736					s/s = 60g; m/s = 90g								
	: Chips					3740	½c = 50g; med = 80g								
	: Peeled	3737		3867	3868		s/s = 60g; m/s = 90g; (90 x 60 x 40)								
	: Sauté			3871		3873	3	50	90						
	Potato Cake					3915	1 med = 40g (75 x 30)								
	Potato Mash (SM)				3875										
	Potato Mash (WM)			3876			50	115	125						
	Potato (Roast):Beef Fat-3878; Chicken-3923; Lamb-3736; Pork-3956						1 med = 90g								

* If indigenous, specify local name: ____

	FOOD ITEMS						QUANTITY (g/ml)			BR	IS	L	IS	D	AD
		Boil	Fat Added (or Fried)												
		NF	B	HM	PM	SO	T	SP	½c						
COOKED VEGETABLES	Pumpkin (Yellow)	4164					45	85	105						
	Butternut	3759													
	Pump + Sugar	3728		3893											
	Pump Fritter					3784	75 x 50 x 9 = 25g								
	Spinach	3913		3898	3899		40	105	90						
	Spinach + Peanuts Ratio: 80:20	P0015					55	120	105						
	Spin + Pot + Onion			3901		3786	50	105	110						
	Squash –Gem	3760					½ gem = 45g 1 SP marrow = 85g								
	Gem Squash + Sugar	3754													
	Squash –Marrow	4179													
	Marrow + Sugar			3885											
	Sw Potato:without skin	3903					50	110	145						
	Sw Potato with Skin	3748													
	Sw Pot + Sugar			3749											
	Tomato + Onion	3925					35	75	140						
	Tom + Onion +Sugar	3910													
	Tomato			3908		3767	1 slice 5mm = 15g (thin); med = 25g								
	Turnips	3911					25	45	90						
	Other (Specify)														
SALAD	Asparagus-3695						med asparagus = 15g								
	Avocado-3656						¼ avo (80 x 50mm) = 40g								
	Beetroot (Grated) + Sugar-3699						1T = 25g; SP = 65g								
	Carrot: (Grated)+ Sugar-3721						1T = 25g;								
	+ Pine + Orange - 3710; + Orange Juice = 3711						1T = 35g; 1SP = 60g								
	Coleslaw + Mayonnaise-3705						T = 20g; SP = 40g; ½c = 50g								
	Cucumber Raw/Pickled-3718						med slice = 10g; thick = 15g								
	Lettuce-3723						1 med leaf = 30g								
	Mixed (Tom + Cucum + Lett) - No Dressing-3921						1T = 40g; 1SP = 85g								
	Mixed Green - No Dressing-3927														
	Potato Salad + Mayonnaise (Comm), Egg-3928						T = 45g; 1SP = 105g; ½c = 120g								
	Tomato (Raw)-3750						med = 120g; slice = 15g								
	Other (Specify) ________________														

	FOOD ITEMS					QUANTITY (g/ml)	BR	IS	L	IS	D	AD
DRESSINGS	French Dressing-3487					1t = 5g; 1T = 15g						
	Mayonnaise: Home-3506; Comm-3488; Low Fat- 3489					1t = 10g 1T = 40g						
	Oil: Olive-3509; Sunflower-3507; Canola-4280					1t = 5g; 1T = 15g						
	Salad Dressing: Cooked-3503; Low-Oil-3505											
FRUIT		Canned + Sugar	Raw	Dry	Stewed							
	Apple	3599	3532	3600	3603	1T = 60g; ½c = 120g; 1 med = 150g (52 x 66)						
	Apricot	3535	3534	3536	3537	1 med = 35g						
	Banana		3540			1 med = 75g						
	Dates		3543			1 med = 10g						
	Figs		3544	3557		1 med = 40g (45 x 44) 1 dry = 20g						
	Fruit Salad	3580	3605	3593	3590	½c = 110g (med)						
	Granadilla		3545			1 med = 22g						
	Grape Fruit	3547	3546			½ med = 125g						
	Grapes	3623	3550			med bunch = 230g; ½c =90g						
	Guava	3553	3551			med (6cm) = 95g						
	Litchi	3631	3632			med (3cm) = 8g						
	Mango	3633	3556			135mm = 350g						
	Naartjie	3635	3558			med = (5cm) = 75g						
	Orange		3560			med (7cm) = 180g						
	Pawpaw		3563			wedge 165 x 26 x 27 = 90g						
	Peach	3567	3565	3568	3569	1 med = 150g (60 x 65)						
	Pear	3583	3582	3585	3586	1 med (80 x 65mm) = 165g						
	Pineapple	3648	3581			1 slice (85 x 10mm) = 40g						
	Plum		3570			1 med = 50g (45 x 40)						
	Prunes	3676	4230	3596	3564	1T = 50g; ½c = 110g; 1 = 12g						
	Raisins		3552			handfull = 27g						
	Strawberries	3653	3573			1 med = 12g; ½c = 80g						
	Sweetmelon, Green		3575			1 wedge (145 x 31 x 20mm) = 60g; ¼ = 110g						
	Sweetmelon, Yellow		3541									
	Watermelon		3576			slice (330 x 70mm) = 220g						
	Wild Fruit, Berries: Specify: ___________											
	Other Fruit:											

	FOOD ITEMS			QUANTITY (g/ml)	BR	IS	L	IS	D	AD
		SM	WM							
PUDDINGS	Apple + Batter	3345	3327	med serving = 70g						
	Apple Crumble		3334	med serving = 70g						
	Baked Pudd + Syrup	3348	3312	med serving = 30g 30 x 65 x 65 = 50g						
	- No Syrup	3347	3221							
	Blancmange	3282	3281	SP = 75; ½c = 95g						
	Egg Type eg. Bread, Sago	3346	3263	1T = 50g; ½c = 140g; SP = 100g						
	Ice Cream: Commercial Regular-3483			scoop = 40g; 1SP = 65g; ½c = 75g						
	Commercial Rich-3519									
	Ice Lollies-3982									
	Soft Serve-3518			plain = 135g; + flake = 155g						
	Sorbet-3491			1SP = 65g; ½c = 75g						
	Instant Pudding	3314	3266	T = 45g; SP = 95g; ½c = 145g						
	Jelly-3983			1T = 35g; 1SP = 75g; ½c = 110g						
	Jelly + Fruit-4006			1T = 40g; 1SP = 90g; ½c = 125g						
	Jelly Whip	2749	2750	1T = 55g; SP = 95g; ½c = 120g						
	Pancake/Crumpets	3344	3238	1 crumpet = 25g pancake = 70g						
	Trifle-3311; Vermicelli Pudding-3385			½c = 130g (med)						
	Other Puddings (Specify) ______________________									
SAUCES	Cream: Plant-3492; Canned-3499			1T = 13g (not whipped)						
	- Fresh (12%) -3481; Heavy (dessert, 20%)-3480			1T = 30g (whipped)						
	Chocolate Sauce-3129			T = 15g						
	Custard: SM-2717; WM-2716			T = 13g; SP = 40g						
	Sugar-3989			1t = 6g						
	Other (Specify) __________________									
CAKE	Banana Loaf: WM + HM-3333; SM + PM-3370			slice = 45g; 90 x 80 x 10mm						
	Cake –Carrot-3392			80 x 40 x 40 = 50g						
	- Plain: SM + HM-3286; PM-3287			single slice = 50g (75 x 75 x 20mm) double slice = 100g (plain) icing = 10g per slice						
	WM + B-3218; HM-3288; SO-3290									
	Cake Icing: HM-4014; PM-4015									
	- Chocolate (No Icing) WM-3289; SM-3339									

	FOOD ITEMS	QUANTITY (g/ml)	BR	IS	L	IS	D	AD
CAKE	- Fruit: Comm-3291; Home-3427	home: 70 x 85 x 15mm = 70g comm: 90 x 70 x 15mm = 35g						
	- Sponge (Plain)-3219	100 x 50 x 50 = 40g						
	- Swiss Roll-3292	slice = 60g; 15cm thick						
	Cheese Cake: Baked-3293; Unbaked-3294	slice 95 x 50 x 30mm = 70g						
	Other (Specify) ________________							
COOKIES & SPECIAL BREADS	Comm + Fill-3217; Plain-3216; Shortbread-3296	plain = 10g + fill = 15g						
	Home: Plain HM-3233; PM-3341	plain = 15g + fill = 20g hertzog = 50g; cupcake = 35g shortbread = 12g						
	Jam-3295; Oats-3265							
	Custard Slice-3338	110 x 45 x 35mm = 250g						
	Date Loaf; HM-3256; PM-3340	slice 90 x 75 x 10mm = 40g						
	Doughnuts: Jam-3423; Plain-3232	med round = 45g med long = 90g						
	Eclairs + Cream + Chocolate-3268	1 = 120g (160mm)						
	Gingerbread: HM-3253; PM-3371	90 x 75 x 15 = 70g						
	Koeksister-3231	100 x 35 = 60g						
	Pumpernickel Bread-3283	slice 85 x 100 x 10mm = 30g						
	Raisin Bread-3214	slice 85 x 100 x 10mm = 30g						
	Rye Bread-3213	slice 85 x 100 x 10mm = 30g						
	Sweetcorn Bread-3379	slice 85 x 100 x 10mm = 30g						
	Other (Specify) ______________________							
TARTS	Apple: HM-3224; PM-3352	50 x 50 x 50mm = 70g (med)						
	Coconut-3228	wedge 50 x 100 x 30mm= 55g						
	Condensed: HM-3294; PM-3439	95 x 70 x 30mm = 90g						
	Fridge (Fruit): HM-3394; PM-3434							
	Lemon Meringue: HM-3226; PM-3349	100 x 70 x 35mm = 75g						
	Milk (Short) WM + HM-3360; SM + PM-3351	120 x 70 x25mm = 75g						
	Milk (Flaky) WM + B-3443; WM + HM-3229							
	Savoury: Aspar-3367; Tuna-3366; Vienna-3326	120 x 50 x 25 = 75g						
	Tipsy: HM-3323; Jam-3225	87 x 70 x 50mm = 90g						
	Other (Specify) ________________							

	FOOD ITEMS	QUANTITY (g/ml)	BR	IS	L	IS	D	AD

SWEETS	**Bubble/Chewing gum-3993**	See Manual						
	Chocolates: Assorted-3992							
	Coated Bars eg. Tex, Lunch, Chomp-3997							
	Milk (White Chocolate)-3987							
	Nuts/Raisins-3994							
	Plain eg Smarties, Flake, Aero-4003							
	Dry Fruit Sweets-3995							
	Fruit Gums-4000							
	Hard/Jelly Sweets eg. Sugus, Jelly Tots, Fruit Drops-3986							
	Ice Lollies-3982							
	Marshmallows-4001							
	Meringues-4008							
	Peanuts: Raw-4285; Peanut Brittle-4002;							
	Roasted, Salted-3458; Roasted Unsalted-3452							
	Peppermints-4004							
	Popcorn: Plain-3332; Sugar Coated-3359							
	Potato Crisps eg. Simba, O=Gradys-3417							
	Raisins, Seedless-4232							
	Snacks – Fritos, Niknaks, Cheese Curls-3267							
	Soft Sweets - Fudge, Toffees, Caramel-3991							
	Other (Specify) ________________							
OTHER	**Cheese Sauce: WM + HM-3125; SM + PM-3128**	SP = 65g; 1T = 25g						
	Curry Sauce-3130	1T = 25g						
	Chutney-3168; Atjar-3117; Tomato Chutney-3114	1T = 14g; 1T = 60g						
	Gravy: Comm-3119; Meat-3122; NF-3121	1T = 15g; SP = 35g						
	Mustard-4034	1t = 6g						
	Pickles-3866	1 = 10g						
	Tomato Sauce (Comm)-3139	1t = 6g; 1T = 25g						
	White Sauce: WM + HM-3142; SM + PM = 3141							

	FOOD ITEMS	QUANTITY (g/ml)	BR	IS	L	IS	D	AD
INFANT FOODS	**Baby Cereals (dry):** **Nestum 1-2832; Nestum 2-2834**	1t = 2g 1T = 8g ½c = 20g						
	Purity:Mixed-2842;Wholewheat-2861; Rice-2862							
	Cerelac-2836; Nestum Rice & Maize-2835							
	Junior-2833							
	Milk: SM-2719; WM-2718	to drink ½c = 125ml baby bottle = 250ml						
	BL-2771; 2%-2772							
	Soy-2737; Breast-2741; Goat-2738							
	Formula (Specify):_______________ **No of Scoops/Bottle: _____________**							
	+ Sugar, White-3989;Brown-4005;Syrup-3988;Honey-3984	1t = 6g						
	First Food Fruit-2852; First Food Veg-2851	jar = 80g; 1t = 11g						
	Fruit Juice (Strained)-2860; Fruit Juice-2866	½c = 125ml						
	Infant Dinners (Dry): Beef + Veg-2841; Chicken+Veg-2840	1t = 5g 1T = 15g ½c = 47g						
	Guava + Custard-2837; Mix Veg-2839							
	Orange + Banana-2838							
	Junior Food (Jar): Veg + Meat-2848; Mix Veg-2849; Pasta + Beef-2850	jar = 200g 1t = 11g ½c = 125g						
	Junior Fruit (Jar): Fruit-2863; Guava-2855							
	Junior Pudding: Fruit+Yog-2858; Vanilla Cust-2859							
	Strained Food (Jar): Macaroni Beef-2845; Veg+Meat-2846	jar = 125g 1t = 11g ½c = 125g						
	Fruit + Yog-2857; Fruit-2854;							
	Av. Pudding-2844; Meat Soup-2847;							
	Veg Soup-2843; Vegetables-2853;							
	Junior Fruit Guava-2856							
OTHER								

9. Did this child go to bed hungry last night?	1 Yes	2 No	3 Don't Know
10. Did this child eat from the same pot as the rest of the family at the main meal yesterday?	1 Yes	2 No	3 Don't Know
11. Did this child eat from the same plate as the siblings, at the main meal yesterday?	1 Yes	2 No	3 Don't Know

A. SCHOOL/CRECHé FEEDING SCHEME

3. Name of School/Creché: ____

4. Address: ____

____

5. Telephone: ____

6. Person to Contact: ____

7. Composition of the Meals/Supplements

ITEMS	CODE	AMOUNT (g)
i)		
ii)		
iii)		

Description:

____

____

____

B. ADD ADDITIONAL ITEMS EATEN TO THE 24-HR RECALL QUESTIONNAIRE RECIPES

NAME OF DISH	INGREDIENTS	CODES	AMOUNT (g) OR (mg)

If this space is not sufficient, write overleaf.

APPENDIX D:

QUESTIONNAIRES

NATIONAL FOOD CONSUMPTION SURVEY: SA CHILDREN 1-9 YEARS OLD

Subject number: [| | | | |] **Birth Date:** DD MM YY [| | | | |] **Interview Date:** DD MM YY [| | | | |]

Province:_________ EA.: ________ Interviewer: _________ Interviewer Code: __________

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

(All information in this questionnaire is confidential).

NB: THE MOTHER/CAREGIVER MUST BE INTERVIEWED (Circle here who is the interviewee)

Child's Name: ……………………………………………………….. Gender … **M** [ ] **F** [ ]

Address: ……………………………………………………………… Religion: …………………………………..

……………………………………………………………………… Mother's Language: …………………..

Tel No (H): …………………………………….. (W) …………………………………………

Check that none of the following is true in this household:

- ☐ 1. Death in the family in past 3 weeks
- ☐ 2. Acute illness of child (within past 48 hours)
- ☐ 3. Caregiver not available.
- ☐ 4. Caregiver mentally incapacitated.
- ☐ 5. Caregiver under the influence of alcohol.
- ☐ 6. Child away from home for past 24 hours.
- ☐ 7. Caregiver younger than 12 years old.
- ☐ 8. Child does not eat and sleep at this house for 4 or more days a week.
- ☐ 9. For children older than 2 years, the caregiver must have looked after the child for more than 3 months. So ask:

Has the caregiver been looking after the child for less than 3 months? YES [ ] NO [ ]

If you have ticked any of the above options or the YES option in question 9 – exclude this household from the survey BUT DO NOT DISCARD THIS QUESTIONNAIRE. GIVE IT BACK TO THE COORDINATOR.

1. Relationship to child: Mother [ ] Father [ ] Grandparent [ ] Sibling [ ] Aunt/Uncle [ ] Other [ ]

2. Household composition:

Names of Household Members	Age (yrs)	Gender		Family Relationship to the child*		Does this person eat and sleep at home at least 4 days a week?	
		M	**F**	**Relationship***	**Code***	**Yes**	**No**

*Relationships (use the child as reference): Father (1), Mother (2), Sibling (3), Grandmother (4), Grandfather (5), Aunt (6), Uncle (7), Cousin (8), Friend (9), Other (10).

3. Marital status of mother (Tick one):

1	2	3	4	5	6	7	8
Unmarried	Married	Divorced	Separated	Widowed	Living Together	Traditional Marriage	Other Please Specify:

Tick one block only for every question:	Father	Mother	Sibling	Grandma	Grandpa	Aunt	Uncle	Cousin	Friend	Other
4. Who is mainly responsible for food preparation in the house	1	2	3	4	5	6	7	8	9	10
5. Who decides on what types of food are bought for the household?	1	2	3	4	5	6	7	8	9	10
6. Who is mainly responsible for feeding/serving the child?	1	2	3	4	5	6	7	8	9	10
7. Who is the head of this household?	1	2	3	4	5	6	7	8	9	10
8. Who decides how much is spent on food?	1	2	3	4	5	6	7	8	9	10

Now look at this child and tick one block only for every question.

9. Would you (fieldworker) consider this to be a healthy child?	1 Yes	2 No	If no, specify:
10. Is this child disabled?	1 Yes	2 No	If yes, specify:

Now decide on the following (considering the household where this child lives):

11. Type of dwelling: **You can tick more than one Block if necessary**		1 Brick, Concrete	2 Traditional Mud	3 Tin	4 Plank, Wood	5 Other Specify:
12. Number of people sleeping in the house for at least 4 nights per week?						
13. Number of rooms in house (excluding bathroom, toilet and kitchen, if separate):						
14. Number of people per living/sleeping room **(Tick one)**		1 0-2 persons	2 3-4 persons	3 More than 4		
15. Where do you get drinking water most of the time? **(Tick one)**		1 Own Tap	2 Communal Tap	3 River, Dam	4 Borehole, Well	5 Other (Specify)
16. What type of toilet does this household have? **(Tick one)**		1 Flush	2 Pit	3 Bucket, Pot	4 VIP	5 Other (Specify)
17. What fuel is used for cooking most of the time? **(You can tick more than one)**	1 Electric	2 Gas	3 Paraffin	4 Wood/Coal	5 Sun	6 Open Fire

Tick one box only:

18. Does the child's home have a **working**: (i) Refrigerator/Freezer	1 Fridge	2 Freezer	3 Both	4 None			
(ii) Stove	1 Yes	2 No	If yes, choose one: Gas	Coal	Electricity	If yes, choose one: With Oven	Without Oven
(iii) Primus or Paraffin Stove	1 Yes	2 No					
(iv) Microwave	1 Yes	2 No					
(v) Hot Plate	1 Yes	2 No					
(vi) Radio or Television	1 Radio	2 TV	3 Both	4 None			

Now ask questions about:

19 Education level of mother **(Tick one only)**	1 None	2 Primary School	3 Std 6-8	4 Std 9-10	5 Tertiary Education	6 Don't Know	
20. Mother's employment status (**Tick one only)**	1 Housewife By choice	2 Unemployed	3 Self-Employed	4 Wage-Earner	5 Other Specify	6 Don't Know	
21. Education level of caregiver **(Tick one only)**	1 None	2 Primary School	3 Std 6-8	4 Std 9-10	5 Tertiary Education	6 Not Applicable	
22. Father's employment status **(Can tick more than one)**	1 Unemployed	2 Self-Employed	3 Wage-Earner	4 Retired by Choice	5 Other Specify	6 Not Applicable e.g. dead	
23. How many people contribute to the total income? **(Tick one only)**	1 1 person	2 2 persons	3 3-4 persons	4 5-6 persons	5 More than 6		
24. Household income per month (including wages, rent, sales of vegs, etc. State grants). (**Tick one only)**	1 None	2 R100-R500	3 R500-R1000	4 R1000-R3000	5 R3000-R5000	6 Over R5000	7 Don't know
25. Is this the usual income of the Household? **(Tick one box only)**	1 Yes	2 No	If NO, what other income is available, specify:				
26. Is this more or less the income that you had over the past six months? **(Tick one only)**	1 Yes	2 No					

27. How much money is spent on food weekly? **(Tick one only)**	1 R0-R50	2 R50-R100	3 R100-R150	4 R150-R200	5 R200-R250	6 R250-R300	7 R300-R350	8 R350-R400	9 Over R400	10 Don't know

Now you have to weigh and measure the child. NB. Head circumference should only be measured of children 1-3 years.

28. Anthropometry

Weight , Kg , Kg Height , m , m

MUAC , cm , cm Head Circm , cm , cm

In the case where you weigh the child with the mother/caregiver, use the following tables:

Weight of Mother/Caregiver , Kg , Kg

Weight of Mother/Caregiver and Child , Kg , Kg

Difference , Kg , Kg

NATIONAL FOOD CONSUMPTION SURVEY: SA CHILDREN 1-9 YEARS OLD

Subject number: ☐☐☐☐☐☐ **Birth Date:** DD MM YY ☐☐☐☐☐☐ **Interview Date:** DD MM YY ☐☐☐☐☐☐

MIGRATION QUESTIONNAIRE

Complete section 2.1 below in ALL households. Complete all other sections below
If the birthmother and / or the grandmother is not available, do not complete this questionnaire.

Thank you for your patience and for giving up your time to participate in this survey. Now we would like to weigh and measure the mother and the grandmother of the child and ask some questions about your place of birth and your movement between provinces in the country. This information will help us find out if children are growing bigger than their parents and grandparents. *(*If both grandmothers are present, do measurements & interview only with maternal grandmother.)*

Anthropometry

Mother: Birth date: DD MM YY ☐☐☐☐☐☐

Weight ☐☐☐ , ☐ kg ☐☐☐ , ☐ Height ☐ , ☐☐☐ cm ☐ , ☐☐☐

*Grandmother:** Maternal | Paternal Birth date: DD MM YY ☐☐☐☐☐☐

Weight ☐☐☐ , ☐ kg ☐☐☐ , ☐ Height ☐ , ☐☐☐ cm ☐ , ☐☐☐

Migration

(If the respondent is not sure about where life was spend for first five years of life, record as Don't know)

History of this child:

For how long has this child been living in the current area of residence: Years: ☐☐☐ Don't know ☐

	Name of Town/Area/ District	Province	Farm/ Village/ Town/City
Where did this child spend his/her first year of life			
Where did this child live the next four years of his/her life i.e. years 1-5			

Did this child spend more than one year in any place other than mentioned above during the last ten years? Please list names of places

....

History of the mother:

For how long has the mother been living in the current area of residence?: Years: | | | | Don't know | |

	Name of Town/Area/ District	Province	Farm/Village/ Town/City
Where did the mother spend her first year of life			
Where did the mother live the next four years of her life i.e. years 1-5			

Did you (mother) spend more than one year in any place other than mentioned above during the last ten years? Please list names of places
....

History of the grandmother:

For how long has the grandmother been living in the current area of residence?: Years: | | | | Don't know | |

	Name of Town/Area /District	Province	Farm/Village/ Town/City
Where did the grandmother spend her first year of life			
Where did the grandmother live the next four years of her life i.e. years 1-5			

Did you (grandmother) spend more than one year in any place other than mentioned above during the last ten years? Please list names of places
....

Appendix E:

Tables

Table 5.1.1: Proportion of children aged 1-9 years with energy intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			47.1%	37.9%	0.001	45.5%
Province	**EC**		45.9%	29.2%	0.013	43.2%
	FS		64.6%	64.3%	0.982	64.6%
	GP		54.4%	48.0%	0.271	52.7%
	KZN		34.4%	23.5%	0.076	32.9%
	MP		58.0%	44.4%	0.428	57.0%
	NC		65.5%	68.0%	0.814	66.0%
	LP		59.4%	88.9%	0.079	61.3%
	NW		52.8%	55.9%	0.742	53.3%
	WC		26.0%	20.4%	0.275	24.4%
Urbanicity	**Urban**		43.5%	33.1%	0.003	41.5%
	Rural		50.6%	45.0%	0.175	49.8%
Type of area	**Formal urban**		42.7%	29.8%	0.442	40.3%
	Informal urban		46.2%	41.1%	0.001	45.0%
	Commercial farm		60.3%	50.0%	0.142	57.7%
	Tribal		48.3%	41.9%	0.215	47.6%
Similarity	**All similar**		46.2%	44.4%	0.558	46.1%
	Only mother/child similar		47.4%	33.2%	<0.001	45.0%
	Only grandmother/child similar		45.2%	50.0%	0.595	45.7%
	None similar		44.5%	35.1%	0.182	41.0%
Mother	**Mother the same as child**		47.2%	34.4%	<0.001	45.2%
	Mother not the same as child		44.1%	40.9%	0.535	43.4%
Gender	**Male**		44.5%	37.4%	0.059	43.3%
	Female		49.8%	38.4%	0.002	47.8%
Age	**1-3 years**	RDA = 5460kJ	45.3%	33.6%	0.018	43.9%
	4-6 years	RDA = 7200kJ	47.1%	42.5%	0.250	46.2%
	7-9 years	RDA = 8400kJ	52.7%	34.9%	0.003	48.9%
Language	**Afrikaans**		33.5%	23.8%	0.143	31.4%
	English		26.4%	23.5%	0.752	25.5%
	Isi Ndebele		59.5%	66.7%	0.806	60.0%
	IsiXhosa		47.3%	34.1%	0.027	45.3%
	IsiZulu		40.7%	28.7%	0.028	38.8%
	Sepedi		61.1%	75.0%	0.492	65.4%
	Sesotho		59.5%	61.2%	0.821	59.7%
	SiSwati		52.0%	50.0%	0.957	51.9%
	Setswana		54.8%	55.1%	0.973	54.9%
	Tsivenda		55.6%	50.0%	0.887	54.5%
	Xitsonga		63.2%	87.5%	0.173	66.2%
Ethnic origin	**Nguni**		44.6%	32.0%	0.002	42.7%
	Sotho		57.6%	59.4%	0.730	57.9%
	Tsonga		62.1%	80.0%	0.271	64.5%

Table 5.1.2: Proportion of children aged 1-9 years with energy intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		47.1%	37.9%	0.001	45.5%
Childcare variables					
Caretaker	**Mother**	47.8%	37.9%	0.003	46.2%
	Father	46.5%	54.5%	0.634	48.1%
	Grandparent	45.9%	44.2%	0.774	45.7%
	Sibling	54.3%	38.5%	0.312	50.8%
	Aunt/Uncle	42.2%	26.3%	0.080	38.3%
Household head	**Father**	43.8%	33.5%	0.008	41.8%
	Grandfather	44.6%	36.1%	0.181	43.3%
	Grandmother	49.4%	52.2%	0.657	49.7%
	Mother	56.7%	37.7%	0.013	53.0%
Gender of household head	**Male**	44.1%	34.2%	0.003	42.3%
	Female	51.4%	45.8%	0.254	50.7%
Marital status of mother	**Not married**	48.9%	41.2%	0.068	47.7%
	Married	42.9%	29.7%	0.001	40.6%
	Divorced	50.0%	62.5%	0.524	52.4%
	Separated	60.0%	80.0%	0.417	65.0%
	Widowed	49.3%	50.0%	0.968	49.3%
	Living together	49.4%	53.1%	0.720	50.4%
	Traditional marriage	59.0%	25.0%	0.110	54.5%
Educational variables					
Mother's education	**None**	54.4%	48.9%	0.507	53.3%
	Primary	53.3%	47.1%	0.283	52.5%
	Std 6-8	45.0%	36.2%	0.177	45.9%
	Std 9-10	27.0%	21.7%	0.049	44.0%
	Tertiary	52.9%	42.1%	0.485	25.6%
Radio/TV	**Radio**	49.7%	41.0%	0.089	48.2%
	Television	51.3%	53.6%	0.823	51.6%
	Both	42.6%	31.3%	0.002	40.6%
	None	54.2%	49.2%	0.480	53.3%

Table 5.1.3: Proportion of children aged 1-9 years with energy intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		47.1%	37.9%	0.001	45.5%
Employment of mother	**Housewife by choice**	41.2%	28.8%	0.076	39.0%
	Unemployed	49.8%	44.8%	0.214	49.0%
	Self-employed	45.7%	31.6%	0.256	43.4%
	Wage earner	42.6%	31.4%	0.038	40.2%
Employment of father	**Unemployed**	45.8%	45.1%	0.909	45.7%
	Self-employed	37.6%	16.0%	0.040	33.3%
	Wage earner	43.9%	32.8%	0.004	41.7%
	Retired by choice	73.3%	100.0%	0.551	75.0%
	Not applicable	50.1%	45.9%	0.472	49.5%
Type of dwelling	**Brick**	45.6%	32.4%	<0.001	43.4%
	Traditional/Mud	44.8%	35.3%	0.200	43.6%
	Tin/Plank	55.6%	51.5%	0.475	54.5%
No of people sleeping at house	**1-3 persons**	54.4%	41.9%	0.059	51.5%
	4-6 persons	47.2%	38.9%	0.021	45.6%
	7-9 persons	45.7%	34.7%	0.072	44.3%
	>9 persons	42.1%	28.1%	0.130	40.5%
Household income (monthly)	**None**	51.8%	56.3%	0.745	52.5%
	R100-R499	52.2%	48.0%	0.381	51.5%
	R500-R999	46.6%	44.3%	0.696	46.2%
	R1000-R2999	40.3%	23.6%	0.008	37.5%
	>=R3000	25.5%	19.4%	0.341	23.6%
Weekly food expenditure	**0-R49**	50.9%	48.7%	0.716	50.6%
	R50-R99	49.7%	40.7%	0.142	48.1%
	R100-R149	47.2%	36.5%	0.161	45.3%
	R150-R199	45.1%	39.5%	0.521	44.2%
	R200-R249	41.5%	21.4%	0.051	37.3%
	R250-R299	44.4%	30.0%	0.233	42.0%
	R300-R349	35.6%	22.2%	0.439	33.3%
	R350-R399	32.7%	9.1%	0.115	28.6%
	>R400	28.2%	25.0%	0.739	27.4%

Table 5.1.4: Proportion of children aged 1-9 years with energy intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		47.1%	37.9%	0.001	45.5%
Environmental variables					
Source of drinking water	**Borehole**	32.4%	44.4%	0.338	34.8%
	Communal tap	51.3%	50.0%	0.818	51.1%
	Own tap	45.5%	32.9%	<0.001	43.2%
	River/dam	45.3%	35.7%	0.245	43.9%
Type of toilet	**Bucket**	60.7%	44.1%	0.080	57.4%
	Flush	42.1%	31.2%	0.005	40.0%
	Pit	51.4%	44.8%	0.139	50.5%
	VIP	50.0%	42.9%	0.745	48.1%
Food preparation variables					
Fuel used	**Electricity**	41.1%	30.8%	0.006	39.2%
	Gas	44.4%	25.0%	0.084	40.4%
	Open fire	56.2%	54.5%	0.856	56.0%
	Paraffin	52.3%	46.9%	0.260	51.4%
	Wood/Coal	46.9%	41.4%	0.583	46.0%
Cold storage	**Fridge**	44.1%	37.7%	0.289	43.2%
	Freezer	49.6%	33.3%	0.144	46.9%
	Both	38.3%	23.0%	0.002	35.2%
	None	52.2%	48.7%	0.377	51.6%
Stove	**Yes**	44.8%	30.1%	<0.001	42.2%
	No	49.0%	48.4%	0.867	48.9%
Primus	**Yes**	49.9%	43.0%	0.064	48.8%
	No	44.0%	33.7%	0.007	42.1%
Microwave	**Yes**	30.4%	17.5%	0.046	27.2%
	No	48.6%	42.0%	0.025	47.55

Table 5.2.1: Proportion of children aged 1-9 years with protein intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration: No movement	Migration: Moved	Chi-square p-value	Total
Total			9.4%	7.3%	0.181	9.0%
Province	**EC**		15.0%	4.5%	0.022	13.3%
	FS		13.0%	21.4%	0.376	13.6%
	GP		8.0%	8.0%	0.996	8.0%
	KZN		4.9%	4.4%	0.873	4.8%
	MP		6.3%	11.1%	0.572	6.6%
	NC		19.3%	24.0%	0.596	20.1%
	LP		12.8%	33.3%	0.086	14.1%
	NW		11.2%	2.9%	0.140	9.9%
	WC		2.4%	3.1%	0.705	2.5%
Urbanicity	**Urban**		8.2%	4.8%	0.063	7.5%
	Rural		10.5%	11.1%	0.820	10.6%
Type of area	**Formal urban**		7.8%	3.9%	0.068	7.1%
	Informal urban		9.6%	6.8%	0.475	9.0%
	Commercial farm		8.5%	12.1%	0.389	9.4%
	Tribal		11.0%	10.5%	0.870	10.9%
Similarity	**All similar**		7.5%	14.8%	0.184	8.2%
	Only mother/child similar		9.2%	2.2%	<0.001	8.0%
	Only grandmother/child similar		9.9%	14.7%	0.385	10.4%
	None similar		10.9%	11.5%	0.894	11.2%
Mother	**Mother the same as child**		8.9%	3.6%	0.004	8.1%
	Mother not the same as child		9.8%	12.9%	0.344	10.6%
Gender	**Male**		9.0%	6.8%	0.294	8.6%
	Female		9.8%	7.9%	0.390	9.4%
Age	**1-3 years**	RDA = 16g	8.4%	6.3%	0.382	8.20%
	4-6 years	RDA = 24g	9.2%	9.3%	0.987	9.20%
	7-9 years	RDA = 28g	12.7%	4.7%	0.034	11.00%
Language	**Afrikaans**		4.4%	4.8%	0.904	4.5%
	English		5.6%	-	0.161	3.8%
	Isi Ndebele		8.1%	-	0.608	7.5%
	IsiXhosa		13.5%	9.6%	0.332	12.9%
	IsiZulu		5.1%	3.2%	0.435	4.8%
	Sepedi		-	25.0%	0.027	7.7%
	Sesotho		9.8%	12.2%	0.595	10.1%
	SiSwati		4.0%	-	0.773	3.7%
	Setswana		14.5%	12.2%	0.684	14.1%
	Tsivenda		22.2%	-	0.461	18.2%
	Xitsonga		14.0%	25.0%	0.421	13.4%
Ethnic origin	**Nguni**		8.9%	6.0%	0.208	8.4%
	Sotho		11.4%	13.2%	0.598	11.7%
	Tsonga		15.2%	20.0%	0.695	15.8%

Table 5.2.2: Proportion of children aged 1-9 years with protein intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		9.4%	7.3%	0.181	9.0%
Childcare variables					
Caretaker	**Mother**	9.4%	6.7%	0.162	8.9%
	Father	9.3%	18.2%	0.403	11.1%
	Grandparent	10.1%	11.7%	0.679	10.4%
	Sibling	8.7%	7.1%	0.854	8.3%
	Aunt/Uncle	8.6%	2.6%	0.213	7.1%
Household head	**Father**	6.7%	4.0%	0.151	6.2%
	Grandfather	10.2%	6.9%	0.390	9.7%
	Grandmother	10.1%	17.9%	0.055	11.0%
	Mother	14.8%	7.5%	0.164	13.4%
Gender of household head	**Male**	7.8%	4.8%	0.078	7.3%
	Female	11.5%	13.3%	0.552	11.7%
Marital status of mother	**Not married**	10.1%	9.7%	0.878	10.0%
	Married	6.9%	4.5%	0.259	6.4%
	Divorced	8.8%	12.5%	0.750	9.5%
	Separated	20.0%	20.0%	1.000	20.0%
	Widowed	16.4%	12.5%	0.775	16.0%
	Living together	9.6%	6.3%	0.563	8.7%
	Traditional marriage	14.3%	6.3%	0.377	13.2%
Educational variables					
Mother's education	**None**	12.5%	17.8%	0.354	13.5%
	Primary	11.2%	4.7%	0.068	10.3%
	Std 6-8	7.4%	5.5%	0.470	7.1%
	Std 9-10	9.2%	5.2%	0.192	8.5%
	Tertiary	4.8%	6.4%	0.669	5.2%
Radio/TV	**Radio**	10.6%	11.9%	0.685	10.8%
	Television	9.5%	14.3%	0.440	10.2%
	Both	7.5%	5.1%	0.198	7.1%
	None	13.3%	3.4%	-	11.6%

Table 5.2.3: Proportion of children aged 1-9 years with protein intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		9.4%	7.3%	0.181	9.0%
Employment of mother	**Housewife by choice**	7.9%	-	0.025	6.5%
	Unemployed	10.0%	8.8%	0.634	9.8%
	Self-employed	6.4%	5.3%	0.853	6.2%
	Wage earner	7.7%	6.6%	0.715	7.4%
Employment of father	**Unemployed**	9.6%	7.0%	0.503	9.1%
	Self-employed	10.8%	-	0.086	8.7%
	Wage earner	6.1%	4.0%	0.238	5.7%
	Retired by choice	18.8%	-	0.633	17.6%
	Not applicable	12.3%	17.6%	0.171	13.0%
Type of dwelling	**Brick**	8.4%	5.7%	0.145	7.9%
	Traditional/Mud	11.2%	9.8%	0.770	11.0%
	Tin/Plank	11.2%	9.9%	0.714	10.9%
No of people sleeping at house	**1-3 persons**	12.7%	8.1%	0.279	11.7%
	4-6 persons	8.6%	7.1%	0.433	8.3%
	7-9 persons	9.7%	6.7%	0.391	9.4%
	>9 persons	8.3%	6.3%	0.688	8.1%
Household income (monthly)	**None**	20.2%	6.3%	0.182	18.0%
	R100-R499	11.9%	10.4%	0.633	11.7%
	R500-R999	6.3%	10.1%	0.186	6.8%
	R1000-R2999	6.4%	4.2%	0.472	6.0%
	>=R3000	3.6%	1.6%	0.436	3.0%
Weekly food expenditure	**0-R49**	12.8%	9.0%	0.344	12.2%
	R50-R99	9.1%	6.2%	0.392	8.6%
	R100-R149	7.2%	11.5%	0.297	8.0%
	R150-R199	8.7%	7.9%	0.875	8.5%
	R200-R249	3.8%	3.6%	0.960	3.7%
	R250-R299	4.0%	-	0.360	3.4%
	R300-R349	6.7%	-	0.425	5.6%
	R350-R399	1.9%	9.1%	0.218	3.2%
	>R400	7.1%	3.4%	0.484	6.1%

Table 5.2.4: Proportion of children aged 1-9 years with protein intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		9.4%	7.3%	0.181	9.0%
Environmental variables					
Source of drinking water	**Borehole**	6.9%	5.6%	0.833	6.7%
	Communal tap	11.8%	12.0%	0.946	11.8%
	Own tap	7.5%	5.1%	0.166	7.1%
	River/dam	11.7%	9.5%	0.682	11.4%
Type of toilet	**Bucket**	11.9%	8.8%	0.617	11,.2%
	Flush	7.3%	3.5%	0.053	6.5%
	Pit	11.3%	11.2%	0.958	11.3%
	VIP	5.0%	-	0.547	3.7%
Food preparation variables					
Fuel used	**Electricity**	6.5%	5.3%	0.494	6.3%
	Gas	9.9%	8.3%	0.818	9.6%
	Open fire	16.3%	9.1%	0.282	15.4%
	Paraffin	11.6%	10.9%	0.828	11.5%
	Wood/Coal	5.4%	3.4%	0.656	5.1%
Cold storage	**Fridge**	7.8%	7.8%	0.996	7.8%
	Freezer	4.8%	4.2%	0.887	4.7%
	Both	5.9%	2.4%	0.120	5.2%
	None	12.5%	10.9%	0.539	12.2%
Stove	**Yes**	5.2%	0.4%	6.600	6.6%
	No	12.5%	9.8%	0.303	12.0%
Primus	**Yes**	10.3%	10.3%	0.983	10.3%
	No	8.1%	4.4%	0.070	7.5%
Microwave	**Yes**	5.8%	-	0.051	4.3%
	No	9.8%	8.8%	0.622	9.6%

Table 5.3.1: Proportion of children aged 1-9 years with fat intake >30 % of energy by migration status and demographic variables: South Africa 1999

		Migration		Chi-square	Total
		No movement	Moved	p-value	
Total		20.4%	25.4%	0.021	21.2%
Province	**EC**	10.6%	10.6%	0.997	10.6%
	FS	13.1%	6.7%	0.471	12.6%
	GP	24.5%	33.0%	0.097	26.7%
	KZN	14.2%	8.7%	0.215	13.4%
	MP	22.3%	33.3%	0.451	23.1%
	NC	21.7%	16.0%	0.525	20.7%
	LP	10.6%	10.0%	0.952	10.6%
	NW	14.0%	26.5%	0.068	16.0%
	WC	53.8%	45.4%	0.160	51.4%
Urbanicity	**Urban**	27.8%	28.0%	0.964	27.8%
	Rural	13.0%	21.6%	0.003	14.2%
Type of area	**Formal urban**	30.7%	29.3%	0.703	30.5%
	Informal urban	18.7%	24.7%	0.265	20.1%
	Commercial farm	27.8%	34.8%	0.276	29.5%
	Tribal	9.5%	13.3%	0.210	9.9%
Similarity	**All similar**	24.5%	26.9%	0.786	24.7%
	Only mother/child similar	22.4%	31.4%	0.004	23.9%
	Only grandmother/child similar	18.4%	22.9%	0.527	18.9%
	None similar	17.3%	16.5%	0.872	17.0%
Mother	**Mother the same as child**	22.8%	31.0%	0.005	24.0%
	Mother not the same as child	16.0%	17.8%	0.646	16.4%
Gender	**Male**	18.8%	25.4%	0.031	19.9%
	Female	22.2%	25.5%	0.271	22.6%
Age	**1-3 years**	22.4%	27.8%	0.155	23.1%
	4-6 years	18.9%	21.1%	0.486	19.4%
	7-9 years	17.2%	31.0%	0.004	20.2%
Language	**Afrikaans**	47.6%	46.0%	0.828	47.2%
	English	54.9%	30.3%	0.019	47.1%
	Isi Ndebele	18.9%	33.3%	0.548	20.0%
	IsiXhosa	13.1%	13.3%	0.978	13.2%
	IsiZulu	14.2%	17.9%	0.352	14.8%
	Sepedi	5.6%	12.5%	0.540	7.7%
	Sesotho	14.7%	28.0%	0.018	16.4%
	SiSwati	24.0%	0.0%	0.432	22.2%
	Setswana	20.8%	28.0%	0.262	22.0%
	Tsivenda	44.4%	50.0%	0.887	45.5%
	Xitsonga	12.3%	25.0%	0.329	13.8%
Ethnic origin	**Nguni**	14.1%	15.8%	0.546	14.4%
	Sotho	16.9%	26.9%	0.015	18.4%
	Tsonga	16.7%	30.0%	0.311	18.4%

Table 5.3.2: Proportion of children aged 1-9 years with fat intake >30% of energy by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		20.4%	25.4%	0.021	21.2%
Childcare variables					
Caretaker	**Mother**	21.4%	31.1%	0.001	23.0%
	Father	25.6%	18.2%	0.608	24.1%
	Grandparent	17.4%	15.4%	0.662	17.1%
	Sibling	17.8%	21.4%	0.759	18.6%
	Aunt/Uncle	13.8%	10.5%	0.603	13.0%
Household head	**Father**	24.9%	33.0%	0.020	26.5%
	Grandfather	19.4%	16.7%	0.591	18.9%
	Grandmother	15.2%	13.0%	0.633	15.0%
	Mother	18.2%	25.9%	0.204	19.8%
Gender of household head	**Male**	16.1%	18.7%	0.463	16.4%
	Female	23.1%	28.7%	0.055	24.2%
Marital status of mother	**Not married**	19.2%	20.2%	0.755	19.4%
	Married	24.1%	32.0%	0.029	25.5%
	Divorced	23.5%	50.0%	0.136	28.6%
	Separated	6.7%	20.0%	0.389	10.0%
	Widowed	11.9%	12.5%	0.963	12.0%
	Living together	19.3%	25.0%	0.499	20.9%
	Traditional marriage	9.5%	25.0%	0.071	11.6%
Educational variables					
Mother's education	**None**	14.1%	15.2%	0.851	14.3%
	Primary	15.9%	27.1%	0.012	17.5%
	Std 6-8	20.0%	28.2%	0.057	21.4%
	Std 9-10	26.9%	29.6%	0.585	27.4%
	Tertiary	33.3%	27.7%	0.476	31.8%
Radio/TV	**Radio**	13.4%	21.7%	0.021	14.9%
	Television	19.0%	21.4%	0.763	19.4%
	Both	25.8%	28.6%	0.390	26.2%
	None	15.4%	22.0%	0.211	16.5%

Table 5.3.3: Proportion of children aged 1-9 years with fat intake >30% of energy by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		20.4%	25.4%	0.021	21.2%
Employment of mother	**Housewife by choice**	23.0%	27.1%	0.502	23.7%
	Unemployed	17.4%	26.9%	0.002	18.8%
	Self-employed	32.6%	26.3%	0.591	31.5%
	Wage earner	28.3%	26.2%	0.666	27.8%
Employment of father	**Unemployed**	14.3%	26.8%	0.011	16.6%
	Self-employed	36.6%	24.0%	0.233	34.1%
	Wage earner	24.2%	31.7%	0.029	25.7%
	Retired by choice	18.8%	0.0%	0.633	17.6%
	Not applicable	17.1%	20.7%	0.419	17.6%
Type of dwelling	**Brick**	24.2%	27.2%	0.313	24.7%
	Traditional/Mud	9.8%	9.8%	0.993	9.8%
	Tin/Plank	16.2%	30.7%	0.002	20.2%
No of people sleeping at house	**1-3 persons**	20.4%	32.4%	0.031	23.1%
	4-6 persons	22.8%	28.5%	0.062	23.9%
	7-9 persons	18.9%	13.3%	0.239	18.3%
	>9 persons	13.8%	12.5%	0.836	13.7%
Household income (monthly)	**None**	18.1%	31.3%	0.229	20.2%
	R100-R499	11.9%	20.6%	0.008	13.2%
	R500-R999	20.4%	22.5%	0.652	20.7%
	R1000-R2999	28.9%	27.4%	0.797	28.6%
	>=R3000	50.0%	32.8%	0.025	44.7%
Weekly food expenditure	**0-R49**	13.0%	25.6%	0.004	14.8%
	R50-R99	19.4%	26.8%	0.131	20.7%
	R100-R149	20.0%	23.1%	0.619	20.6%
	R150-R199	25.8%	12.5%	0.071	23.5%
	R200-R249	28.0%	28.6%	0.955	28.1%
	R250-R299	27.3%	47.4%	0.081	30.5%
	R300-R349	42.2%	33.3%	0.620	40.7%
	R350-R399	32.1%	36.4%	0.783	32.8%
	>R400	39.3%	37.9%	0.897	38.9%

Table 5.3.4: Proportion of children aged 1-9 years with fat intake >30% of energy by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		20.4%	25.4%	0.021	21.2%
Environmental variables					
Source of drinking water	**Borehole**	12.5%	16.7%	0.642	13.3%
	Communal tap	14.1%	21.0%	0.077	15.2%
	Own tap	27.3%	29.5%	0.490	27.7%
	River/dam	5.6%	11.9%	0.129	6.6%
Type of toilet	**Bucket**	17.6%	29.4%	0.125	20.0%
	Flush	30.7%	28.7%	0.580	30.3%
	Pit	13.2%	18.2%	0.109	13.9%
	VIP	20.0%	57.1%	0.064	29.6%
Food preparation variables					
Fuel used	**Electricity**	29.9%	28.4%	0.665	29.7%
	Gas	23.1%	37.5%	0.152	26.1%
	Open fire	9.0%	15.2%	0.266	9.8%
	Paraffin	11.9%	21.1%	0.005	13.4%
	Wood/Coal	16.3%	24.1%	0.313	17.6%
Cold storage	**Fridge**	20.5%	20.5%	0.999	20.5%
	Freezer	8.8%	12.5%	0.569	9.4%
	Both	37.7%	36.6%	0.814	37.5%
	None	13.5%	22.2%	0.002	14.9%
Stove	**Yes**	27.9%	31.0%	0.336	28.5%
	No	12.0%	18.5%	0.017	13.0%
Primus	**Yes**	13.8%	20.4%	0.013	14.9%
	No	28.0%	29.6%	0.651	28.3%
Microwave	**Yes**	47.9%	35.5%	0.088	44.8%
	No	17.6%	23.0%	0.016	18.5%

Table 5.4.1: Proportion of children aged 1-9 years with fibre intake <67% of the AI by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			75.9%	74.2%	0.456	75.6%
Province	**EC**		78.2%	57.6%	0.000	74.8%
	FS		83.3%	80.0%	0.740	83.1%
	GP		84.3%	78.0%	0.150	82.7%
	KZN		62.9%	62.3%	0.924	62.8%
	MP		73.2%	77.8%	0.765	73.6%
	NC		88.3%	96.0%	0.252	89.7%
	LP		66.7%	80.0%	0.385	67.6%
	NW		83.8%	97.1%	0.042	85.9%
	WC		75.3%	74.5%	0.876	75.1%
Urbanicity	**Urban**		77.3%	74.9%	0.413	76.8%
	Rural		74.4%	73.1%	0.710	74.3%
Type of area	**Formal urban**		78.0%	78.0%	0.986	78.0%
	Informal urban		75.3%	67.1%	0.164	73.5%
	commercial farm		85.9%	80.3%	0.273	84.5%
			71.7%	68.6%	0.504	71.4%
Similarity	**All similar**		79.2%	77.8%	0.861	79.1%
	Only mother/child similar		75.2%	75.7%	0.888	75.3%
	Only grandmother/child similar		75.8%	74.3%	0.847	75.6%
	None similar		76.6%	70.9%	0.363	74.4%
Mother	**Mother the same as child**		76.0%	75.9%	0.982	75.9%
	Mother not the same as child		74.7%	69.5%	0.260	73.5%
Gender	**Male**		73.1%	72.7%	0.900	73.1%
	Female		78.7%	75.6%	0.309	78.2%
Age	**1-3 years**	RDA = 19g	77.3%	74.3%	0.423	76.9%
	4-6 years	RDA = 25g	76.9%	75.9%	0.761	76.7%
	7-9 years	RDA = 25g	68.8%	70.1%	0.813	69.1%
Language	**Afrikaans**		80.3%	73.0%	0.214	78.7%
	English		77.8%	88.2%	0.199	81.1%
	Isi Ndebele		75.7%	100.0%	0.332	77.5%
	IsiXhosa		79.3%	66.3%	0.009	77.3%
	IsiZulu		66.9%	65.3%	0.752	66.7%
	Sepedi		83.3%	87.5%	0.786	84.6%
	Sesotho		76.9%	78.0%	0.857	77.0%
	SiSwati		60.0%	50.0%	0.782	59.3%
	Setswana		85.6%	92.0%	0.224	86.7%
	Tsivenda		88.9%	100.0%	0.621	90.9%
	Xitsonga		67.9%	87.5%	0.255	70.3%
Ethnic origin	**Nguni**		72.5%	66.1%	0.079	71.5%
	Sotho		80.7%	85.2%	0.266	81.3%
	Tsonga		70.8%	90.0%	0.200	73.3%

Table 5.4.2: Proportion of children aged 1-9 years with fibre intake <67% of the AI by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		75.9%	74.2%	0.456	75.6%
Childcare variables					
Caretaker	**Mother**	75.6%	77.0%	0.604	75.8%
	Father	62.8%	90.9%	0.073	68.5%
	Grandparent	77.8%	67.1%	0.040	76.2%
	Sibling	84.8%	64.3%	0.093	80.0%
	Aunt/Uncle	68.1%	63.2%	0.574	66.9%
Household head	**Father**	74.7%	76.1%	0.675	75.0%
	Grandfather	77.2%	72.2%	0.359	76.4%
	Grandmother	75.3%	73.9%	0.799	75.2%
	Mother	79.6%	70.4%	0.143	77.8%
Gender of household head	**Male**	76.5%	72.4%	0.315	76.0%
	Female	75.5%	75.1%	0.892	75.4%
Marital status of mother	**Not married**	75.8%	72.6%	0.379	75.3%
	Married	74.3%	73.3%	0.773	74.2%
	Divorced	82.4%	87.5%	0.725	83.3%
	Separated	86.7%	80.0%	0.718	85.0%
	Widowed	77.6%	75.0%	0.868	77.3%
	Living together	83.1%	81.3%	0.811	82.6%
	Traditional marriage	81.0%	75.0%	0.578	80.2%
Educational variables					
Mother's education	**None**	78.3%	80.4%	0.747	78.7%
	Primary	76.3%	69.4%	0.170	75.4%
	Std 6-8	76.8%	77.3%	0.907	76.8%
	Std 9-10	76.4%	78.8%	0.613	76.8%
	Tertiary	68.0%	63.8%	0.605	66.9%
Radio/TV	**Radio**	76.9%	73.3%	0.408	76.3%
	Television	76.6%	82.1%	0.517	77.4%

Table 5.4.3: Proportion of children aged 1-9 years with fibre intake <67% of the AI by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		75.9%	74.2%	0.456	75.6%
Employment of mother	**Housewife by choice**	74.2%	78.0%	.544	74.9%
	Unemployed	76.2%	72.5%	.285	75.7%
	Self-employed	76.6%	78.9%	.824	77.0%
	Wage earner	73.5%	72.2%	.796	73.2%
Employment of father	**Unemployed**	72.4%	77.5%	.379	73.3%
	Self-employed	75.5%	68.0%	.444	74.0%
	Wage earner	74.1%	74.4%	.935	74.2%
	Retired by choice	68.8%	100.0%	.506	70.6%
	Not applicable	80.0%	78.2%	.699	79.7%
Type of dwelling	**Brick**	75.7%	74.8%	.764	75.5%
	Traditional/Mud	71.0%	64.7%	.355	70.3%
	Tin/Plank	82.3%	76.2%	.187	80.7%
No of people sleeping at house	**1-3 persons**	80.1%	75.7%	.413	79.1%
	4-6 persons	77.0%	72.4%	.137	76.1%
	7-9 persons	73.5%	80.0%	.229	74.3%
	>9 persons	72.7%	71.9%	.919	72.6%
Household income (monthly)	**None**	71.1%	68.8%	.851	70.7%
	R100-R499	77.5%	73.8%	.367	76.9%
	R500-R999	75.3%	71.9%	.498	74.8%
	R1000-R2999	76.7%	71.2%	.317	75.8%
	>=R3000	67.6%	77.4%	.161	70.7%
Weekly food expenditure	**0-R49**	75.8%	71.8%	.443	75.3%
	R50-R99	75.9%	68.3%	.154	74.5%
	R100-R149	76.7%	76.9%	.972	76.7%
	R150-R199	80.1%	80.0%	.988	80.1%
	R200-R249	68.9%	85.7%	.076	72.4%
	R250-R299	69.7%	90.0%	.062	73.1%
	R300-R349	82.2%	66.7%	.290	79.6%
	R350-R399	79.2%	72.7%	.634	78.1%
	>R400	74.1%	62.1%	.217	71.1%

Table 5.4.4: Proportion of children aged 1-9 years with fibre intake <67% of the AI by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		75.9%	74.2%	0.456	75.6%
Environmental variables					
Source of drinking water	**Borehole**	63.9%	77.8%	0.264	66.7%
	Communal tap	76.3%	74.0%	0.628	75.9%
	Own tap	77.4%	76.1%	0.641	77.2%
	River/dam	71.8%	61.9%	0.195	70.3%
Type of toilet	**Bucket**	86.8%	70.6%	0.023	83.5%
	Flush	76.6%	75.4%	0.715	76.3%
	Pit	74.8%	72.7%	0.603	74.5%
	VIP	75.0%	71.4%	0.853	74.1%
Food preparation variables					
Fuel used	**Electricity**	75.7%	75.0%	0.822	75.6%
	Gas	79.1%	79.2%	0.996	79.1%
	Open fire	72.5%	75.8%	0.696	72.9%
	Paraffin	77.2%	72.7%	0.271	76.4%
	Wood/Coal	73.5%	69.0%	0.619	72.7%
Cold storage	**Fridge**	73.9%	75.6%	0.741	74.1%
	Freezer	73.6%	79.2%	0.567	74.5%
	Both	74.4%	75.0%	0.885	74.5%
	None	78.2%	73.7%	0.174	77.4%
Stove	**Yes**	76.0%	72.5%	0.266	75.4%
	No	75.9%	75.5%	0.911	75.9%
Primus	**Yes**	76.2%	72.7%	0.270	75.6%
	No	75.6%	76.0%	0.916	75.7%
Microwave	**Yes**	69.6%	73.0%	0.610	70.5%
	No	76.6%	74.4%	0.375	76.3%

Table 5.5.1: Proportion of children aged 1-9 years with vitamin A intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			69.6%	67.6%	0.412	69.3%
Province	**EC**		72.9%	75.8%	0.626	73.3%
	FS		77.6%	85.7%	0.478	78.2%
	GP		71.1%	67.0%	0.443	70.0%
	KZN		70.9%	79.4%	0.143	72.0%
	MP		81.3%	66.7%	0.291	80.2%
	NC		77.3%	84.0%	0.459	78.5%
	LP		54.9%	44.4%	0.543	54.2%
	NW		83.1%	88.2%	0.459	84.0%
	WC		45.1%	42.9%	0.704	44.5%
Urbanicity	**Urban**		63.7%	62.3%	0.672	63.5%
	Rural		75.5%	75.4%	0.979	75.5%
Type of area	**Formal urban**		62.3%	53.6%	0.032	60.7%
	Informal urban		68.1%	83.6%	0.010	71.6%
	Commercial farm		74.4%	69.7%	0.457	73.2%
	Tribal		75.8%	79.0%	0.463	76.2%
Similarity	**All similar**		66.7%	59.3%	0.440	66.0%
	Only mother/child similar		68.9%	65.0%	0.258	68.2%
	Only grandmother/child similar		69.6%	70.6%	0.908	69.7%
	None similar		71.7%	70.5%	0.861	71.2%
Mother	**Mother the same as child**		68.5%	64.4%	0.205	67.8%
	Mother not the same as child		70.7%	70.7%	0.996	70.7%
Gender	**Male**		69.5%	62.8%	0.056	68.4%
	Female		69.7%	72.2%	0.466	70.2%
Age	**1-3 years**	RDA = 400(RE)	65.3%	65.0%	0.958	65.20%
	4-6 years	RDA = 500(RE)	70.9%	69.1%	0.622	70.50%
	7-9 years	RDA = 700(RE)	80.9%	68.6%	0.014	78.30%
Language	**Afrikaans**		55.1%	52.4%	0.705	54.5%
	English		43.1%	322.4%	0.293	39.6%
	Isi Ndebele		94.6%	10.0%	0.679	95.0%
	IsiXhosa		70.7%	72.3%	0.765	70.9%
	IsiZulu		74.3%	79.8%	0.259	75.2%
	Sepedi		83.3%	75.0%	0.619	80.8%
	Sesotho		68.0%	73.5%	0.437	68.7%
	SiSwati		76.0%	50.0%	0.419	74.1%
	Setswana		81.5%	75.5%	0.338	80.5%
	Tsivenda		66.7%	100.0%	0.338	72.7%
	Xitsonga		57.9%	75.0%	0.355	60.0%
Ethnic origin	**Nguni**		75.3%	76.4%	0.414	73.9%
	Sotho		74.0%	74.5%	0.903	74.0%
	Tsonga		59.1%	80.0%	0.205	61.8%

Table 5.5.2: Proportion of children aged 1-9 years with vitamin A intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		69.6%	67.6%	0.412	69.3%
Childcare variables					
Caretaker	**Mother**	69.6%	66.9%	0.382	69.2%
	Father	62.8%	54.5%	0.617	81.1%
	Grandparent	68.7%	67.5%	0.835	68.5%
	Sibling	71.1%	78.6%	0.583	72.9%
	Aunt/Uncle	77.6%	71.1%	0.413	760.0%
Household head	**Father**	66.0%	63.2%	0.452	65.4%
	Grandfather	70.4%	69.4%	0.868	70.3%
	Grandmother	70.0%	80.6%	0.071	71.2%
	Mother	78.2%	62.3%	0.016	75.1%
Gender of household head	**Male**	67.4%	64.8%	0.417	66.9%
	Female	72.3%	72.5%	0.986	72.3%
Marital status of mother	**Not married**	74.1%	73.3%	0.834	764.0%
	Married	63.8%	60.8%	0.448	63.3%
	Divorced	67.6%	87.5%	0.263	71.4%
	Separated	86.7%	60.0%	0.197	80.0%
	Widowed	64.2%	62.5%	0.925	64.0%
	Living together	71.1%	75.0%	0.675	72.2%
	Traditional marriage	73.3%	62.5%	0.369	71.9%
Educational variables					
Mother's education	**None**	71.7%	77.8%	0.414	72.9%
	Primary	75.1%	72.9%	0.664	74.8%
	Std 6-8	73.0%	70.9%	0.654	72.6%
	Std 9-10	63.9%	69.1%	0.327	64.7%
	Tertiary	49.2%	34.0%	0.075	45.1%
Radio/TV	**Radio**	73.8%	78.8%	0.253	74.6%
	Television	76.6%	75.0%	0.856	76.3%
	Both	64.2%	59.4%	0.188	63.4%
	None	77.3%	71.2%	0.317	76.2%

Table 5.5.3: Proportion of children aged 1-9 years with vitamin A intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		69.6%	67.6%	0.412	69.3%
Employment of mother	**Housewife by choice**	68.2%	54.2%	0.040	65.8%
	Unemployed	70.8%	78.5%	0.033	71.9%
	Self-employed	66.0%	57.9%	0.503	64.6%
	Wage earner	66.1%	57.5%	0.104	64.3%
Employment of father	**Unemployed**	68.7%	78.9%	0.090	70.6%
	Self-employed	51.0%	44.0%	0.532	49.6%
	Wage earner	67.1%	64.4%	0.457	66.6%
	Retired by choice	68.8%	100.0%	0.506	70.6%
	Not applicable	78.2%	69.4%	0.076	76.9%
Type of dwelling	**Brick**	67.3%	62.0%	0.096	66.4%
	Traditional/Mud	73.7%	74.5%	0.898	73.8%
	Tin/Plank	74.9%	76.2%	0.792	75.3%
No of people sleeping at house	**1-3 persons**	74.6%	67.6%	0.231	73.0%
	4-6 persons	66.6%	65.8%	0.821	66.5%
	7-9 persons	70.8%	70.7%	0.985	70.8%
	>9 persons	74.6%	75.0%	0.961	74.6%
Household income (monthly)	**None**	63.1%	68.8%	0.666	64.4%
	R100-R499	75.8%	82.4%	0.105	76.8%
	R500-R999	70.5%	70.8%	0.953	70.5%
	R1000-R2999	65.0%	69.4%	0.468	65.7%
	>=R3000	43.1%	33.9%	0.221	40.2%
Weekly food expenditure	**0-R49**	74.3%	80.8%	0.218	75.2%
	R50-R99	73.7%	77.8%	0.449	74.4%
	R100-R149	72.9%	71.2%	0.800	72.6%
	R150-R199	68.4%	71.1%	0.744	68.8%
	R200-R249	56.2%	39.3%	0.111	52.6%
	R250-R299	60.6%	55.0%	0.641	59.7%
	R300-R349	44.4%	44.4%	1.000	44.4%
	R350-R399	53.8%	27.3%	0.109	49.2%
	>R400	55.3%	48.3%	0.513	53.5%

Table 5.5.4: Proportion of children aged 1-9 years with vitamin A intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		69.6%	67.6%	0.412	69.3%
Environmental variables					
Source of drinking water	**Borehole**	66.7%	72.2%	0.652	67.8%
	Communal tap	75.0%	80.0%	0.287	75.8%
	Own tap	66.4%	61.7%	0.154	65.5%
	River/dam	75.0%	73.8%	0.869	74.8%
Type of toilet	**Bucket**	70.4%	79.4%	0.293	72.2%
	Flush	61.7%	55.5%	0.106	60.5%
	Pit	76.3%	81.1%	0.200	76.9%
	VIP	70.0%	71.4%	0.933	704.0%
Food preparation variables					
Fuel used	**Electricity**	62.7%	57.4%	0.153	61.8%
	Gas	69.2%	75.0%	0.582	70.4%
	Open fire	67.0%	60.0%	0.471	66.2%
	Paraffin	78.1%	82.0%	0.315	78.7%
	Wood/Coal	77.6%	79.3%	0.835	77.8%
Cold storage	**Fridge**	69.7%	68.8%	0.878	69.6%
	Freezer	71.0%	79.2%	0.411	72.3%
	Both	58.5%	45.5%	0.010	55.8%
	None	74.8%	79.3%	0.191	75.6%
Stove	**Yes**	65.9%	59.6%	0.068	64.8%
	No	73.8%	77.2%	0.339	74.4%
Primus	**Yes**	73.6%	78.5%	0.132	74.4%
	No	64.3%	57.6%	0.074	63.1%
Microwave	**Yes**	41.9%	28.6%	0.060	38.6%
	No	72.4%	75.1%	0.309	72.9%

Table 5.6.1: Proportion of children aged 1-9 years with vitamin C intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			71.0%	61.9%	<0.001	69.5%
Province	**EC**		77.9%	63.6%	0.014	75.5%
	FS		81.8%	78.6%	0.766	81.6%
	GP		71.1%	72.0%	0.861	71.3%
	KZN		66.2%	63.2%	0.628	65.8%
	MP		75.0%	77.8%	0.853	75.2%
	NC		79.0%	80.0%	0.910	79.2%
	LP		82.7%	88.9%	0.632	83.1%
	NW		78.8%	64.7%	0.076	76.5%
	WC		45.1%	37.8%	0.212	43.1%
Urbanicity	**Urban**		64.9%	58.7%	0.067	63.7%
	Rural		77.1%	66.7%	0.003	75.6%
Type of area	**Formal urban**		63.8%	54.2%	0.017	62.0%
	Informal urban		68.5%	69.9%	0.828	68.8%
	Commercial farm		74.4%	63.6%	0.093	71.7%
	Tribal		77.7%	68.6%	0.037	76.7%
Similarity	**All similar**		69.8%	70.4%	0.951	69.9%
	Only mother/child similar		69.1%	57.5%	0.001	67.2%
	Only grandmother/child similar		72.7%	55.9%	0.041	70.9%
	None similar		67.2%	67.9%	0.910	67.5%
Mother	**Mother the same as child**		69.3%	58.9%	0.001	67.7%
	Mother not the same as child		74.5%	67.2%	0.126	72.8%
Gender	**Male**		71.9%	63.3%	0.013	70.5%
	Female		70.0%	60.6%	0.007	68.4%
Age	**1-3 years**	RDA = 40mg	69.7%	60.1%	0.022	68.50%
	4-6 years	RDA = 45mg	783.0%	63.9%	0.013	71.10%
	7-9 years	RDA = 45mg	70.7%	60.5%	0.071	68.50%
Language	**Afrikaans**		53.3%	54.0%	0.925	53.4%
	English		37.5%	44.1%	0.516	39.6%
	Isi Ndebele		83.8%	100.0%	0.449	85.0%
	IsiXhosa		76.0%	59.0%	0.001	73.4%
	IsiZulu		68.7%	64.9%	0.469	68.1%
	Sepedi		66.7%	100.0%	0.063	76.9%
	Sesotho		78.0%	73.5%	0.474	77.5%
	SiSwati		60.0%	50.0%	0.782	59.3%
	Setswana		78.7%	67.3%	0.085	76.8%
	Tsivenda		77.8%	100.0%	0.461	81.8%
	Xitsonga		91.2%	87.5%	0.733	90.8%
Ethnic origin	**Nguni**		72.2%	62.6%	0.009	70.8%
	Sotho		78.0%	72.6%	0.227	77.2%
	Tsonga		89.4%	90.0%	0.954	89.5%

Table 5.6.2: Proportion of children aged 1-9 years with vitamin C intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		71.0%	61.9%	<0.001	69.5%
Childcare variables					
Caretaker	**Mother**	70.4%	61.0%	0.002	68.8%
	Father	58.1%	36.4%	0.196	53.7%
	Grandparent	72.7%	59.7%	0.021	70.8%
	Sibling	84.8%	71.4%	0.258	81.7%
	Aunt/Uncle	73.3%	76.3%	0.711	74.0%
Household head	**Father**	66.3%	60.2%	0.107	65.0%
	Grandfather	71.7%	61.1%	0.071	70.0%
	Grandmother	75.9%	68.7%	0.198	75.1%
	Mother	76.4%	52.8%	0.001	71.7%
Gender of household head	**Male**	68.0%	60.4%	0.017	66.6%
	Female	76.0%	61.7%	0.001	74.1%
Marital status of mother	**Not married**	72.7%	64.2%	0.027	71.4%
	Married	67.0%	55.1%	0.003	64.8%
	Divorced	79.4%	75.0%	0.784	78.6%
	Separated	100.0%	80.0%	0.076	95.0%
	Widowed	71.6%	62.5%	0.591	70.7%
	Living together	69.9%	78.1%	0.377	72.2%
	Traditional marriage	81.0%	56.3%	0.027	77.7%
Educational variables					
Mother's education	**None**	74.5%	68.9%	0.449	73.4%
	Primary	75.7%	65.9%	0.054	74.3%
	Std 6-8	72.3%	60.9%	0.017	70.4%
	Std 9-10	66.4%	62.9%	0.506	65.8%
	Tertiary	54.8%	36.2%	0.030	49.7%
Radio/TV	**Radio**	77.6%	68.6%	0.038	76.1%
	Television	66.5%	64.3%	0.823	66.1%
	Both	66.2%	55.3%	0.002	64.3%
	None	76.9%	71.2%	0.348	75.9%

Table 5.6.3: Proportion of children aged 1-9 years with vitamin C intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		71.0%	61.9%	<0.001	69.5%
Employment of mother	**Housewife by choice**	63.5%	47.5%	0.022	60.7%
	Unemployed	74.3%	69.6%	0.187	73.6%
	Self-employed	51.1%	36.8%	0.258	48.7%
	Wage earner	68.6%	55.7%	0.013	65.9%
Employment of father	**Unemployed**	74.6%	69.0%	0.322	73.6%
	Self-employed	53.9%	24.0%	0.007	48.0%
	Wage earner	68.2%	61.4%	0.066	66.9%
	Retired by choice	81.3%	100.0%	0.633	82.4%
	Not applicable	74.7%	64.7%	0.054	73.3%
Type of dwelling	**Brick**	68.6%	56.3%	<0.001	66.6%
	Traditional/Mud	76.1%	60.8%	0.019	74.2%
	Tin/Plank	74.9%	75.2%	0.946	75.0%
No of people sleeping at house	**1-3 persons**	71.4%	66.2%	0.389	70.2%
	4-6 persons	70.6%	60.8%	0.003	68.7%
	7-9 persons	72.2%	62.7%	0.086	71.1%
	>9 persons	69.2%	62.5%	0.444	68.4%
Household income (monthly)	**None**	79.8%	87.5%	0.470	81.0%
	R100-R499	76.5%	67.2%	0.026	75.1%
	R500-R999	72.2%	60.7%	0.028	70.5%
	R1000-R2999	66.7%	68.1%	0.819	66.9%
	>=R3000	40.9%	35.5%	0.471	39.2%
Weekly food expenditure	**0-R49**	78.5%	69.2%	0.072	77.2%
	R50-R99	73.2%	70.4%	0.606	72.7%
	R100-R149	64.8%	65.4%	0.940	64.9%
	R150-R199	68.4%	52.6%	0.061	65.8%
	R200-R249	59.0%	46.4%	0.232	56.4%
	R250-R299	62.6%	45.0%	0.143	59.7%
	R300-R349	53.3%	33.3%	0.273	50.0%
	R350-R399	59.6%	36.4%	0.159	55.6%
	>R400	58.8%	48.3%	0.323	56.1%

Table 5.6.4: Proportion of children aged 1-9 years with vitamin C intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		71.0%	61.9%	<0.001	69.5%
Environmental variables					
Source of drinking water	**Borehole**	65.3%	72.2%	0.576	66.7%
	Communal tap	75.2%	70.0%	0.270	74.4%
	Own tap	66.8%	57.0%	0.003	65.0%
	River/dam	81.0%	69.0%	0.076	79.3%
Type of toilet	**Bucket**	72.6%	76.5%	0.648	73.4%
	Flush	63.0%	52.5%	0.006	61.0%
	Pit	77.6%	67.8%	0.011	76.3%
	VIP	65.0%	85.7%	0.302	70.4%
Food preparation variables					
Fuel used	**Electricity**	84.0%	55.5%	0.064	61.1%
	Gas	73.6%	70.8%	0.784	73.0%
	Open fire	79.8%	72.7%	0.349	78.9%
	Paraffin	77.9%	66.4%	0.005	76.1%
	Wood/Coal	76.2%	69.0%	0.412	75.0%
Cold storage	**Fridge**	69.5%	64.9%	0.418	68.9%
	Freezer	79.8%	58.3%	0.023	76.4%
	Both	58.3%	44.7%	0.007	55.5%
	None	76.7%	72.0%	0.167	75.9%
Stove	**Yes**	65.9%	57.8%	0.020	64.5%
	No	76.9%	67.4%	0.006	75.4%
Primus	**Yes**	75.0%	66.4%	0.008	73.7%
	No	66.3%	57.1%	0.014	64.6%
Microwave	**Yes**	44.0%	30.2%	0.053	40.6%
	No	73.6%	67.4%	0.017	72.6%

Table 5.7.1: Proportion of children aged 1-9 years with thiamin intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			20.6%	18.2%	0.273	20.2%
Province	**EC**		20.4%	13.6%	0.205	19.3%
	FS		31.3%	28.6%	0.834	31.1%
	GP		24.1%	19.0%	0.293	22.8%
	KZN		11.5%	8.8%	0.516	11.1%
	MP		18.8%	22.1%	0.798	19.0%
	NC		43.7%	48.0%	0.694	44.4%
	LP		21.1%	44.4%	0.104	22.5%
	NW		19.6%	8.8%	0.134	17.8%
	WC		15.3%	18.4%	0.482	16.1%
Urbanicity	**Urban**		20.6%	17.5%	0.264	20.0%
	Rural		20.5%	19.3%	0.717	20.3%
Type of area	**Formal urban**		20.4%	15.1%	0.104	19.4%
	Informal urban		21.2%	23.3%	0.703	21.7%
	Commercial farm		32.7%	25.8%	0.293	30.9%
	Tribal		17.6%	15.2%	0.546	17.3%
Similarity	**All similar**		21.2%	18.5%	0.747	20.9%
	Only mother/child similar		20.8%	16.4%	0.132	20.0%
	Only grandmother/child similar		20.5%	23.5%	0.678	20.8%
	None similar		20.3%	20.5%	0.972	20.4%
Mother	**Mother the same as child**		20.8%	16.6%	0.123	20.2%
	Mother not the same as child		20.2%	22.4%	0.609	20.7%
Gender	**Male**		19.9%	16.9%	0.316	19.4%
	Female		21.2%	19.4%	0.564	20.9%
Age	**1-3 years**	RDA = 0.5mg	22.1%	14.7%	0.042	21.2%
	4-6 years	RDA = 0.6mg	20.0%	21.6%	0.606	20.3%
	7-9 years	RDA = 0.6mg	16.9%	16.3%	0.885	16.8%
Language	**Afrikaans**		23.3%	22.2%	0.851	23.1%
	English		6.9%	8.8%	0.732	7.5%
	Isi Ndebele		24.3%	33.3%	0.729	25.0%
	IsiXhosa		20.9%	19.3%	0.739	20.6%
	IsiZulu		14.2%	7.4%	0.074	13.2%
	Sepedi		27.8%	37.5%	0.620	30.8%
	Sesotho		26.1%	20.4%	0.391	25.4%
	SiSwati		12.0%	-	0.603	11.1%
	Setswana		22.5%	24.5%	0.706	22.8%
	Tsivenda		33.3%	50.0%	0.658	36.4%
	Xitsonga		28.1%	62.5%	0.051	32.3%
Ethnic origin	**Nguni**		17.5%	13.2%	0.155	16.8%
	Sotho		24.7%	23.6%	0.811	24.5%
	Tsonga		28.8%	60.0%	0.050	32.9%

Table 5.7.2: Proportion of children aged 1-9 years with thiamin intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		20.6%	18.2%	0.273	20.2%
Childcare variables					
Caretaker	**Mother**	20.8%	19.7%	0.680	20.6%
	Father	11.6%	27.3%	0.192	14.8%
	Grandparent	21.1%	15.6%	0.262	20.7%
	Sibling	30.4%	21.4%	0.513	28.3%
	Aunt/Uncle	19.0%	10.5%	0.228	16.9%
Household head	**Father**	18.3%	16.4%	0.542	17.9%
	Grandfather	19.6%	16.7%	0.557	19.2%
	Grandmother	20.5%	29.9%	0.079	21.5%
	Mother	29.6%	13.2%	0.015	26.4%
Gender of household head	**Male**	18.7%	16.5%	0.389	18.3%
	Female	23.1%	22.5%	0.889	23.0%
Marital status of mother	**Not married**	22.9%	20.0%	0.417	22.4%
	Married	16.4%	14.2%	0.481	16.0%
	Divorced	14.7%	25.0%	0.482	16.7%
	Separated	33.3%	20.0%	0.573	30.0%
	Widowed	25.4%	12.5%	0.420	24.0%
	Living together	27.7%	25.0%	0.769	27.0%
	Traditional marriage	24.8%	18.8%	0.600	24.0%
Educational variables					
Mother's education	**None**	21.7%	22.2%	0.944	21.8%
	Primary	23.1%	23.5%	0.939	23.2%
	Std 6-8	20.4%	15.5%	0.233	19.6%
	Std 9-10	19.1%	17.5%	0.724	18.8%
	Tertiary	11.9%	8.5%	0.525	11.0%
Radio/TV	**Radio**	20.5%	23.7%	0.436	21.1%
	Television	22.2%	17.9%	0.610	21.5%
	Both	19.1%	15.2%	0.174	18.5%
	None	23.4%	18.6%	0.424	22.6%

Table 5.7.3: Proportion of children aged 1-9 years with thiamin intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		20.6%	18.2%	0.273	20.2%
Employment of mother	**Housewife by choice**	16.6%	15.3%	0.799	16.4%
	Unemployed	22.4%	20.4%	0.553	22.1%
	Self-employed	14.9%	15.3%	0.921	15.0%
	Wage earner	17.65	14.2%	0.400	16.9%
Employment of father	**Unemployed**	19.5%	11.3%	0.102	18.0%
	Self-employed	21.6%	4.0%	0.041	18.1%
	Wage earner	18.4%	17.3%	0.712	18.2%
	Retired by choice	31.3%	-	0.506	29.4%
	Not applicable	22.8%	25.0%	0.528	23.2%
Type of dwelling	**Brick**	20.5%	17.1%	0.214	19.9%
	Traditional/Mud	14.6%	15.7%	0.841	14.9%
	Tin/Plank	27.1%	21.8%	0.300	25.6%
No of people sleeping at house	**1-3 persons**	29.0%	17.6%	0.050	26.4%
	4-6 persons	20.9%	20.8%	0.983	20.9%
	7-9 persons	18.8%	13.3%	0.253	18.1%
	>9 persons	14.6%	9.4%	0.421	14.0%
Household income (monthly)	**None**	22.6%	25.0%	0.836	23.0%
	R100-R499	22.4%	19.2%	0.424	21.9%
	R500-R999	21.3%	24.7%	0.475	21.8%
	R1000-R2999	18.9%	16.7%	0.658	18.5%
	>=R3000	9.5%	9.7%	0.967	9.5%
Weekly food expenditure	**0-R49**	21.2%	23.1%	0.704	21.4%
	R50-R99	22.3%	22.2%	0.995	22.2%
	R100-R149	22.0%	13.5%	0.166	20.5%
	R150-R199	21.9%	23.7%	0.813	22.2%
	R200-R249	18.1%	7.1%	0.158	15.8%
	R250-R299	22.2%	5.0%	0.075	19.3%
	R300-R349	17.8%	22.2%	0.754	18.5%
	R350-R399	9.6%	18.2%	0.411	11.1%
	>R400	15.3%	20.7%	0.501	16.7%

Table 5.7.4: Proportion of children aged 1-9 years with thiamin intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		20.6%	18.2%	0.273	20.2%
Environmental variables					
Source of drinking water	**Borehole**	13.9%	11.1%	0.756	13.3%
	Communal tap	21.6%	23.0%	0.756	21.3%
	Own tap	21.2%	16.8%	0.113	20.4%
	River/dam	14.5%	16.7%	0.717	14.3%
Type of toilet	**Bucket**	31.9%	17.6%	0.103	29.0%
	Flush	20.5%	17.5%	0.340	19.9%
	Pit	19.5%	19.6%	0.992	19.6%
	VIP	20.0%	14.3%	0.738	18.5%
Food preparation variables					
Fuel used	**Electricity**	20.5%	16.3%	0.167	19.7%
	Gas	19.8%	29.2%	0.321	21.7%
	Open fire	21.9%	18.2%	0.627	21.4%
	Paraffin	21.5%	20.3%	0.765	21.3%
	Wood/Coal	15.6%	13.8%	0.800	15.3%
Cold storage	**Fridge**	19.0%	15.6%	0.474	18.5%
	Freezer	16.9%	12.5%	0.589	16.2%
	Both	18.0%	13.8%	0.272	17.1%
	None	22.9%	22.8%	0.965	22.9%
Stove	**Yes**	21.0%	16.5%	0.126	20.2%
	No	19.8%	20.1%	0.931	19.9%
Primus	**Yes**	21.6%	19.6%	0.521	21.3%
	No	19.2%	17.2%	0.517	18.9%
Microwave	**Yes**	12.6%	9.5%	0.517	11.8%
	No	21.2%	20.1%	0.614	21.0%

Table 5.8.1: Proportion of children aged 1-9 years with niacin intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			45.0%	38.8%	0.019	43.9%
Province	**EC**		61.7%	56.1%	0.300	62%8
	FS		62.5%	71.4%	0.504	63.1%
	GP		42.5%	40.0%	0.661	41.9%
	KZN		38.0%	30.9%	0.259	37.0%
	MP		41.1%	33.3%	0.649	40.5%
	NC		48.7%	64.0%	0.165	51.4%
	LP		51.1%	55.6%	0.797	51.4%
	NW		47.5%	47.1%	0.964	47.4%
	WC		18.4%	16.3%	0.644	17.8%
Urbanicity	**Urban**		36.9%	31.0%	0.078	35.7%
	Rural		53.1%	50.3%	0.497	52.7%
Type of area	**Formal urban**		34.4%	26.3%	0.036	32.9%
	Informal urban		44.6%	42.5%	0.744	44.1%
	Commercial farm		50.3%	42.4%	0.270	48.3%
	Tribal		53.8%	55.2%	0.776	53.9%
Similarity	**All similar**		43.9%	48.1%	0.674	44.3%
	Only mother/child similar		43.5%	29.6%	<0.001	41.2%
	Only grandmother/child similar		46.1%	47.1%	0.913	46.2%
	None similar		44.5%	48.7%	0.559	46.1%
Mother	**Mother the same as child**		43.6%	31.6%	<0.001	41.7%
	Mother not the same as child		46.8%	50.0%	0.547	47.6%
Gender	**Male**		44.2%	37.2%	0.062	43.1%
	Female		45.8%	40.3%	0.137	44.8%
Age	**1-3 years**	RDA = 6NE	47.9%	39.9%	0.072	46.9%
	4-6 years	RDA = 8NE	42.8%	43.3%	0.799	43.0%
	7-9 years	RDA = 8NE	40.8%	25.6%	0.010	37.5%
Language	**Afrikaans**		20.3%	30.2%	0.096	22.4%
	English		9.7%	5.9%	0.508	8.5%
	Isi Ndebele		43.2%	66.7%	0.433	45.0%
	IsiXhosa		57.6%	50.6%	0.240	56.5%
	IsiZulu		41.2%	33.0%	0.132	40.0%
	Sepedi		50.0%	50.0%	1.000	50.0%
	Sesotho		55.5%	53.1%	0.749	55.2%
	SiSwati		36.0%	-	0.299	33.3%
	Setswana		49.4%	51.0%	0.835	49.7%
	Tsivenda		33.3%	50.0%	0.658	36.4%
	Xitsonga		50.9%	62.5%	0.538	52.3%
Ethnic origin	**Nguni**		48.3%	41.2%	0.076	47.3%
	Sotho		52.8%	51.9%	0.860	52.7%
	Tsonga		48.5%	60.0%	0.497	50.0%

Table 5.8.2: Proportion of children aged 1-9 years with niacin intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		45.0%	38.8%	0.019	43.9%
Childcare variables					
Caretaker	**Mother**	44.8%	35.3%	0.004	43.2%
	Father	32.6%	36.4%	0.811	33.3%
	Grandparent	48.5%	50.6%	0.722	48.8%
	Sibling	47.8%	35.7%	0.425	45.0%
	Aunt/Uncle	40.5%	50.0%	0.305	42.9%
Household head	**Father**	39.1%	29.9%	0.015	37.2%
	Grandfather	48.7%	51.4%	0.674	49.1%
	Grandmother	49.4%	55.2%	0.375	50.0%
	Mother	49.5%	28.3%	0.005	45.4%
Gender of household head	**Male**	42.2%	35.5%	0.043	41.0%
	Female	49.4%	43.3%	0.215	48.6%
Marital status of mother	**Not married**	46.7%	44.2%	0.556	46.3%
	Married	37.8%	31.3%	0.103	36.6%
	Divorced	44.1%	50.0%	0.764	45.2%
	Separated	60.0%	60.0%	1.000	60.0%
	Widowed	53.7%	50.0%	0.842	53.3%
	Living together	56.6%	37.5%	0.066	51.3%
	Traditional marriage	62.9%	31.3%	0.017	58.7%
Educational variables					
Mother's education	**None**	56.0%	64.4%	0.303	57.6%
	Primary	50.9%	43.5%	0.210	49.8%
	Std 6-8	46.7%	42.7%	0.449	46.0%
	Std 9-10	35.5%	29.9%	0.293	34.5%
	Tertiary	26.2%	10.6%	0.028	22.0%
Radio/TV	**Radio**	54.9%	50.8%	0.425	54.2%
	Television	43.0%	50.0%	0.494	44.1%
	Both	35.7%	29.0%	0.061	34.5%
	None	60.8%	45.8%	0.033	58.3%

Table 5.8.3: Proportion of children aged 1-9 years with niacin intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		45.0%	38.8%	0.019	43.9%
Employment of mother	**Housewife by choice**	37.2%	22.0%	0.026	34.5%
	Unemployed	49.7%	47.5%	0.594	49.3%
	Self-employed	34.0%	21.1%	0.268	31.9%
	Wage earner	35.5%	32.1%	0.516	34.7%
Employment of father	**Unemployed**	51.1%	57.7%	0.309	52.3%
	Self-employed	30.4%	12.0%	0.063	26.8%
	Wage earner	38.4%	29.2%	0.015	36.6%
	Retired by choice	37.5%	-	0.446	35.3%
	Not applicable	51.2%	48.2%	0.616	50.8%
Type of dwelling	**Brick**	38.7%	30.8%	0.015	37.4%
	Traditional/Mud	56.9%	58.8%	0.796	57.1%
	Tin/Plank	58.1%	46.5%	0.048	54.9%
No of people sleeping at house	**1-3 persons**	47.2%	43.2%	0.564	46.3%
	4-6 persons	44.0%	35.0%	0.011	42.3%
	7-9 persons	46.1%	41.3%	0.433	45.6%
	>9 persons	44.7%	50.0%	0.568	45.3%
Household income (monthly)	**None**	66.7%	75.0%	0.513	68.0%
	R100-R499	55.5%	53.6%	0.690	55.2%
	R500-R999	45.1%	34.8%	0.070	43.6%
	R1000-R2999	28.9%	33.3#	0.451	29.6%
	>=R3000	11.7%	6.5%	0.256	10.1%
Weekly food expenditure	**0-R49**	54.4%	53.8%	0.928	54.3%
	R50-R99	45.0%	34.6%	0.085	43.2%
	R100-R149	41.9%	38.5%	0.644	41.3%
	R150-R199	39.8%	39.5%	0.970	39.7%
	R200-R249	30.5%	25.0%	0.572	29.3%
	R250-R299	36.4%	30.0%	0.587	35.5%
	R300-R349	35.6%	11.1%	0.149	31.5%
	R350-R399	34.6%	9.1%	0.094	30.2%
	>R400	32.9%	20.7%	0.213	29.8%

Table 5.8.4: Proportion of children aged 1-9 years with niacin intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		45.0%	38.8%	0.019	43.9%
Environmental variables					
Source of drinking water	**Borehole**	45.8%	61.1%	0.246	48.9%
	Communal tap	52.2%	45.0%	0.183	51.1%
	Own tap	37.3%	30.9%	0.051	36.1%
	River/dam	61.3%	64.3%	0.712	61.7%
Type of toilet	**Bucket**	57.8%	50.0%	0.414	56.2%
	Flush	32.6%	27.5%	0.166	31.6%
	Pit	54.0%	46.9%	0.111	53.0%
	VIP	25.0%	57.1%	0.121	33.3%
Food preparation variables					
Fuel used	**Electricity**	31.0%	25.4%	0.105	30.0%
	Gas	38.5%	29.2%	0.400	36.5%
	Open fire	58.8%	51.5%	0.428	57.9%
	Paraffin	60.1%	56.3%	0.421	59.4%
	Wood/Coal	45.6%	51.7%	0.544	46.6%
Cold storage	**Fridge**	38.7%	46.8%	0.179	39.8%
	Freezer	41.1%	25.0%	0.137	38.5%
	Both	24.6%	15.4%	0.031	22.7%
	None	58.4%	50.8%	0.050	57.2%
Stove	**Yes**	34.3%	27.8%	0.059	33.2%
	No	57.2%	52.7%	0.262	56.5%
Primus	**Yes**	53.5%	49.1%	0.236	52.8%
	No	35.3%	29.1%	0.088	34.2%
Microwave	**Yes**	18.8%	7.9%	0.041	16.1%
	No	48.3%	44.5%	0.192	47.6%

Table 5.9.1: Proportion of children aged 1-9 years with riboflavin intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			48.5%	44.4%	0.132	47.8%
Province	**EC**		57.9%	53.0%	0.461	57.1%
	FS		56.3%	57.1%	0.948	56.3%
	GP		41.1%	48.0%	0.231	42.9%
	KZN		47.7%	42.6%	0.438	47.0%
	MP		53.6%	44.4%	0.598	52.9%
	NC		58.0%	60.0%	0.852	58.3%
	LP		64.7%	77.8%	0.423	65.5%
	NW		53.1%	55.9%	0.763	53.5%
	WC		21.2%	23.5%	0.640	21.8%
Urbanicity	**Urban**		38.5%	36.1%	0.492	38.0%
	Rural		58.5%	56.7%	0.671	58.2%
Type of area	**Formal urban**		35.7%	30.7%	0.206	34.8%
	Informal urban		47.0%	49.3%	0.729	47.5%
	Commercial farm		51.3%	53.0%	0.803	51.7%
	Tribal		60.2%	59.0%	0.825	60.0%
Similarity	**All similar**		47.1%	63.0%	0.116	48.6%
	Only mother/child similar		47.7%	37.2%	0.004	45.9%
	Only grandmother/child similar		47.1%	61.8%	0.105	48.6%
	None similar		51.6%	46.2%	0.451	49.5%
Mother	**Mother the same as child**		47.5%	39.9%	0.025	46.4%
	Mother not the same as child		49.2%	50.9%	0.755	49.6%
Gender	**Male**		47.2%	44.0%	0.393	46.7%
	Female		49.8%	44.9%	0.196	48.9%
Age	**1-3 years**	RDA = 0.5mg	38.9%	28.0%	0.011	37.6%
	4-6 years	RDA = 0.8mg	57.5%	56.2%	0.747	57.2%
	7-9 years	RDA = 0.8mg	58.3%	45.3%	0.033	55.5%
Language	**Afrikaans**		32.2%	33.3%	0.860	32.4%
	English		13.9%	17.6%	0.614	15.1%
	Isi Ndebele		56.8%	33.3%	0.433	55.0%
	IsiXhosa		53.9%	51.8%	0.728	53.6%
	IsiZulu		49.2%	44.7%	0.418	48.5%
	Sepedi		33.3%	62.5%	0.165	42.3%
	Sesotho		56.4%	55.1%	0.866	56.2%
	SiSwati		52.0%	50.0%	0.957	51.9%
	Setswana		47.8%	57.1%	0.231	49.3%
	Tsivenda		55.6%	50.0%	0.887	54.5%
	Xitsonga		57.9%	75.0%	0.355	60.0%
Ethnic origin	**Nguni**		51.6%	47.8%	0.344	51.0%
	Sotho		52.2%	56.6%	0.397	52.8%
	Tsonga		57.6%	70.0%	0.456	59.2%

Table 5.9.2: Proportion of children aged 1-9 years with riboflavin intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		48.5%	44.4%	0.132	47.8%
Childcare variables					
Caretaker	**Mother**	49.0%	40.9%	0.015	47.6%
	Father	30.2%	54.5%	0.132	35.2%
	Grandparent	48.9%	57.1%	0.181	50.1%
	Sibling	56.5%	42.9%	0.370	53.3%
	Aunt/Uncle	55.2%	50.0%	0.579	53.9%
Household head	**Father**	44.4%	38.3%	0.118	43.2%
	Grandfather	45.3%	54.2%	0.166	46.7%
	Grandmother	51.3%	58.2%	0.283	52.0%
	Mother	58.3%	37.7%	0.007	54.3%
Gender of household head	**Male**	44.7%	42.5%	0.501	44.3%
	Female	53.3%	49.2%	0.404	52.7%
Marital status of mother	**Not married**	50.6%	49.1%	0.730	50.3%
	Married	42.5%	38.1%	0.278	41.7%
	Divorced	47.1%	50.0%	0.881	47.6%
	Separated	46.7%	60.0%	0.606	50.0%
	Widowed	67.2%	50.0%	0.335	65.3%
	Living together	55.4%	46.9%	0.411	53.0%
	Traditional marriage	58.1%	31.3%	0.045	54.5%
Educational variables					
Mother's education	**None**	66.8%	71.1%	0.584	67.7%
	Primary	58.4%	50.6%	0.174	57.4%
	Std 6-8	45.4%	43.6%	0.733	45.1%
	Std 9-10	33.4%	35.1%	0.529	37.9%
	Tertiary	22.2%	17.0%	0.453	20.8%
Radio/TV	**Radio**	58.0%	52.5%	0.276	57.1%
	Television	53.2%	42.9%	0.314	51.6%
	Both	38.6%	38.2%	0.913	38.6%
	None	60.8%	52.5%	0.237	59.4%

Table 5.9.3: Proportion of children aged 1-9 years with riboflavin intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		48.5%	44.4%	0.132	47.8%
Employment of mother	**Housewife by choice**	44.0%	30.5%	0.056	41.7%
	Unemployed	52.3%	50.3%	0.611	52.0%
	Self-employed	35.1%	21.1%	0.234	32.7%
	Wage earner	41.3%	39.6%	0.752	41.0%
Employment of father	**Unemployed**	53.4%	50.7%	0.681	52.9%
	Self-employed	31.4%	20.0%	0.262	29.1%
	Wage earner	42.8%	37.6%	0.179	41.8%
	Retired by choice	37.5%	-	0.446	35.3%
	Not applicable	55.3%	54.1%	0.845	55.1%
Type of dwelling	**Brick**	43.7%	37.3%	0.055	42.6%
	Traditional/Mud	63.6%	54.9%	0.230	62.5%
	Tin/Plank	49.4%	55.4%	0.304	51.1%
No of people sleeping at house	**1-3 persons**	49.6%	36.5%	0.047	46.6%
	4-6 persons	46.4%	44.2%	0.537	46.0%
	7-9 persons	52.2%	53.3%	0.855	52.3%
	>9 persons	47.4%	43.8%	0.694	47.0%
Household income (monthly)	**None**	66.7%	75.0%	0.513	68.0%
	R100-R499	59.0%	58.4%	0.896	58.9%
	R500-R999	48.0%	46.1%	0.736	47.7%
	R1000-R2999	32.7%	36.1%	0.573	33.3%
	>=R3000	16.1%	16.1%	0.990	16.1%
Weekly food expenditure	**0-R49**	57.3%	57.7%	0.951	57.4%
	R50-R99	48.0%	48.1%	0.979	48.0%
	R100-R149	49.6%	50.0%	0.956	49.7%
	R150-R199	42.3%	55.3%	0.143	44.4%
	R200-R249	36.8%	32.1%	0.648	35.8%
	R250-R299	39.4%	30.0%	0.429	37.8%
	R300-R349	26.7%	22.2%	0.781	25.9%
	R350-R399	28.8%	18.2%	0.469	27.0%
	>R400	34.1%	20.7%	0.176	30.7%

Table 5.9.4: Proportion of children aged 1-9 years with riboflavin intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		48.5%	44.4%	0.132	47.8%
Environmental variables					
Source of drinking water	**Borehole**	56.9%	38.9%	0.170	53.3%
	Communal tap	54.7%	61.0%	0.244	55.7%
	Own tap	40.3%	35.5%	0.158	39.4%
	River/dam	66.1%	64.3%	0.816	65.9%
Type of toilet	**Bucket**	60.0%	61.8%	0.851	60.4%
	Flush	34.4%	28.5%	0.109	33.3%
	Pit	58.3%	61.5%	0.462	58.7%
	VIP	45.0%	28.6%	0.446	40.7%
Food preparation variables					
Fuel used	**Electricity**	35.6%	29.7%	0.102	34.5%
	Gas	39.6%	50.0%	0.356	41.7%
	Open fire	64.4%	69.7%	0.549	65.0%
	Paraffin	60.9%	60.2%	0.881	60.8%
	Wood/Coal	52.4%	48.3%	0.686	51.7%
Cold storage	**Fridge**	41.0%	39.0%	0.731	40.7%
	Freezer	43.5%	58.3%	0.183	45.9%
	Both	29.4%	21.1%	0.067	27.7%
	None	61.7%	59.1%	0.492	61.3%
Stove	**Yes**	38.4%	32.6%	0.097	37.4%
	No	59.7%	58.2%	0.699	59.4%
Primus	**Yes**	55.6%	56.5%	0.792	55.7%
	No	39.4%	32.5%	0.067	38.2%
Microwave	**Yes**	19.4%	15.9%	0.535	18.5%
	No	51.1%	49.9%	0.669	50.9%

Table 5.10.1: Proportion of children aged 1-9 years with calcium intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			74.0%	72.3%	0.471	73.7%
Province	**EC**		73.5%	64.6%	0.142	72.1%
	FS		82.3%	85.7%	0.745	82.5%
	GP		80.4%	81.0%	0.900	80.6%
	KZN		68.4%	72.1%	0.540	68.8%
	MP		77.8%	79.3%	0.904	79.5%
	NC		88.2%	84.0%	0.561	87.5%
	LP		74.4%	77.8%	0.824	74.6%
	NW		82.7%	88.2%	0.423	83.6%
	WC		55.5%	57.1%	0.782	56.0%
Urbanicity	**Urban**		71.6%	63.5%	0.330	71.0%
	Rural		76.3%	77.8%	0.674	76.5%
Type of area	**Formal urban**		70.3%	65.2%	0.177	69.4%
	Informal urban		75.7%	76.7%	0.858	75.9%
	Commercial farm		79.4%	80.3%	0.874	79.6%
	Tribal		75.6%	76.2%	0.889	76.2%
Similarity	**All similar**		73.2%	74.1%	0.925	73.3%
	Only mother/child similar		74.4%	70.7%	0.399	72.9%
	Only grandmother/child similar		74.15	82.4%	0.291	74.9%
	None similar		78.9%	71.8%	0.245	76.2%
Mother	**Mother the same as child**		73.45	71.0%	0.442	73.0%
	Mother not the same as child		74.5%	74.1%	0.943	74.4%
Gender	**Male**		71.7%	70.4%	0.697	71.5%
	Female		76.3%	74.1%	0.486	75.9%
Age	**1-3 years**	RDA = 500mg	63.9%	55.9%	0.063	63.0%
	4-6 years	RDA = 800mg	83.4%	82.9%	0.868	83.3%
	7-9 years	RDA = 800mg	84.4%	75.6%	0.057	82.5%
Language	**Afrikaans**		64.6%	60.3%	0.532	63.7%
	English		48.6%	55.9%	0.485	50.9%
	Isi Ndebele		81.1%	100.0%	0.407	82.5%
	IsiXhosa		74.7%	68.7%	0.250	73.8%
	IsiZulu		71.9%	76.6%	0.351	72.7%
	Sepedi		82.4%	62.5%	0.278	76.0%
	Sesotho		80.1%	83.7%	0.557	80.6%
	SiSwati		76.0%	100.0%	0.432	77.8%
	Setswana		81.1%	85.7%	0.446	81.9%
	Tsivenda		100.0%	100.0%	1.000	100.0%
	Xitsonga		78.9%	100.0%	0.151	81.5%
Ethnic origin	**Nguni**		73.6%	73.6%	0.991	73.6%
	Sotho		80.6%	83.0%	0.558	81.0%
	Tsonga		81.8%	100.0%	0.142	84.2%

Table 5.10.2: Proportion of children aged 1-9 years with calcium intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		74.0%	72.3%	0.471	73.7%
Childcare variables					
Caretaker	**Mother**	74.5%	69.5%	0.092	73.7%
	Father	62.8%	63.6%	0.959	63.0%
	Grandparent	74.0%	80.3%	0.244	74.9%
	Sibling	80.4%	100.0%	0.073	85.0%
	Aunt/Uncle	78.4%	76.3%	0.783	77.9%
Household head	**Father**	70.8%	68.2%	0.462	70.3%
	Grandfather	74.3%	76.1%	0.761	74.6%
	Grandmother	77.0%	79.1%	0.692	77.2%
	Mother	77.2%	71.7%	0.399	76.1%
Gender of household head	**Male**	71.9%	70.2%	0.575	71.6%
	Female	77.0%	75.8%	0.774	76.9%
Marital status of mother	**Not married**	78.0%	76.2%	0.609	77.7%
	Married	69.3%	66.5%	0.466	68.8%
	Divorced	79.4%	75.0%	0.784	78.6%
	Separated	66.7%	100.0%	0.136	75.0%
	Widowed	83.3%	87.5%	0.763	83.8%
	Living together	69.9%	78.1%	0.377	72.2%
	Traditional marriage	77.1%	56.3%	0.075	74.4%
Educational variables					
Mother's education	**None**	81.0%	95.6%	0.017	83.8%
	Primary	81.3%	74.1%	0.121	80.3%
	Std 6-8	73.5%	74.5%	0.814	73.6%
	Std 9-10	68.5%	66.7%	0.723	68.2%
	Tertiary	54.0%	48.7%	0.555	52.6%
Radio/TV	**Radio**	75.0%	79.5%	0.302	75.8%
	Television	81.0%	82.1%	0.888	81.2%
	Both	71.2%	66.8%	0.204	70.4%
	None	77.5%	74.6%	0.622	77.0%

Table 5.10.3: Proportion of children aged 1-9 years with calcium intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		74.0%	72.3%	0.471	73.7%
Employment of mother	**Housewife by choice**	71.5%	52.5%	0.005	68.2%
	Unemployed	75.8%	82.8%	0.041	76.9%
	Self-employed	65.6%	47.4%	0.135	62.5%
	Wage earner	72.2%	69.8%	0.629	71.7%
Employment of father	**Unemployed**	70.1%	78.9%	0.136	71.6%
	Self-employed	60.4%	40.0%	0.066	56.3%
	Wage earner	72.1%	68.7%	0.328	71.5%
	Retired by choice	87.5%	100.0%	0.707	88.2%
	Not applicable	81.1%	82.4%	0.776	81.2%
Type of dwelling	**Brick**	73.7%	66.8%	0.021	72.6%
	Traditional/Mud	74.2%	74.5%	0.962	74.2%
	Tin/Plank	75.7%	83.2%	0.122	77.7%
No of people sleeping at house	**1-3 persons**	73.8%	74.3%	0.929	73.9%
	4-6 persons	73.3%	70.7%	0.413	72.8%
	7-9 persons	75.3%	73.3%	0.709	75.1%
	>9 persons	73.5%	75.0%	0.858	73.7%
Household income (monthly)	**None**	72.6%	87.5%	0.208	75.0%
	R100-R499	78.3%	83.9%	0.160	79.1%
	R500-R999	76.1%	77.5%	0.777	76.3%
	R1000-R2999	70.8%	69.4%	0.824	70.5%
	>=R3000	49.6%	43.5%	0.426	47.7%
Weekly food expenditure	**0-R49**	77.4%	84.6%	0.151	78.4%
	R50-R99	73.1%	84.0%	0.041	75.1%
	R100-R149	75.0%	82.4%	0.263	76.3%
	R150-R199	73.7%	65.8%	0.318	72.4%
	R200-R249	71.7%	57.1%	0.140	68.7%
	R250-R299	68.7%	55.0%	0.237	66.4%
	R300-R349	60.0%	44.4%	0.389	57.4%
	R350-R399	61.5%	45.5%	0.325	58.7%
	>R400	62.4%	41.4%	0.049	57.0%

Table 5.10.4: Proportion of children aged 1-9 years with calcium intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		74.0%	72.3%	0.471	73.7%
Environmental variables					
Source of drinking water	**Borehole**	77.8%	83.3%	0.605	78.9%
	Communal tap	73.2%	81.0%	0.100	74.4%
	Own tap	73.4%	67.8%	0.073	72.4%
	River/dam	75.8%	73.8%	0.781	75.5%
Type of toilet	**Bucket**	85.2%	82.4%	0.682	84.6%
	Flush	69.2%	63.8%	0.139	68.2%
	Pit	76.8%	79.7%	0.447	77.2%
	VIP	75.0%	85.7%	0.557	77.8%
Food preparation variables					
Fuel used	**Electricity**	69.7%	63.2%	0.067	68.5%
	Gas	75.3%	75.0%	0.977	75.2%
	Open fire	76.4%	72.7%	0.645	75.9%
	Paraffin	79.2%	85.0%	0.128	80.1%
	Wood/Coal	72.8%	79.3%	0.465	73.9%
Cold storage	**Fridge**	71.9%	68.8%	0.586	71.4%
	Freezer	75.0%	70.8%	0.669	74.3%
	Both	66.9%	55.3%	0.017	64.5%
	None	78.5%	83.9%	0.095	79.4%
Stove	**Yes**	71.2%	65.2%	0.073	70.1%
	No	77.4%	81.4%	0.224	78.0%
Primus	**Yes**	77.3%	78.4%	0.734	77.5%
	No	69.6%	67.5%	0.563	69.2%
Microwave	**Yes**	53.2%	36.5%	0.022	49.0%
	No	76.0%	79.5%	0.147	76.5%

Table 5.11.1: Proportion of children aged 1-9 years with iron intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			72.1%	65.2%	0.004	71.0%
Province	**EC**		79.1%	69.7%	0.096	77.5%
	FS		87.0%	92.9%	0.523	87.4%
	GP		76.3%	74.0%	0.643	75.7%
	KZN		67.5%	54.4%	0.033	65.8%
	MP		70.5%	66.7%	0.807	70.2%
	NC		88.1%	84.0%	0.571	87.4%
	LP		53.4%	55.6%	0.899	53.5%
	NW		75.8%	79.4%	0.653	76.4%
	WC		55.7%	48.0%	0.192	53.5%
Urbanicity	**Urban**		68.4%	61.9%	0.049	67.1%
	Rural		75.9%	70.2%	0.111	75.0%
Type of area	**Formal urban**		65.2%	56.4%	0.028	63.6%
	Informal urban		78.5%	75.3%	0.570	77.8%
	Commercial farm		90.4%	75.8%	0.002	86.7%
	Tribal		72.4%	66.7%	0.217	71.7%
Similarity	**All similar**		71.7%	59.3%	0.180	70.5%
	Only mother/child similar		71.6%	64.2%	0.025	70.4%
	Only grandmother/child similar		74.1%	58.8%	0.060	72.5%
	None similar		68.8%	67.9%	0.904	68.4%
Mother	**Mother the same as child**		71.6%	63.6%	0.011	70.4%
	Mother not the same as child		70.2%	63.8%	0.192	68.7%
Gender	**Male**		69.9%	61.8%	0.022	68.6%
	Female		74.5%	68.5%	0.073	73.4%
Age	**1-3 years**	RDA = 10mg	79.7%	78.3%	0.693	79.60%
	4-6 years	RDA = 10mg	65.9%	62.4%	0.359	65.20%
	7-9 years	RDA = 10mg	62.1%	50.0%	0.043	59.50%
Language	**Afrikaans**		63.7%	58.7%	0.469	62.6%
	English		43.1%	35.3%	0.447	40.6%
	Isi Ndebele		81.1%	66.7%	0.548	80.0%
	IsiXhosa		78.2%	74.7%	0.479	77.7%
	IsiZulu		70.8%	63.8%	0.175	69.7%
	Sepedi		83.3%	75.0%	0.619	80.8%
	Sesotho		77.4%	75.5%	0.763	77.2%
	SiSwati		56.0%	100.0%	0.223	59.3%
	Setswana		77.0%	73.5%	0.593	76.4%
	Tsivenda		77.8%	100.0%	0.461	81.8%
	Xitsonga		47.4%	75.0%	0.143	50.8%
Ethnic origin	**Nguni**		74.1%	69.2%	0.173	73.3%
	Sotho		77.4%	74.5%	0.510	77.0%
	Tsonga		51.5%	80.0%	0.091	55.3%

Table 5.11.2: Proportion of children aged 1-9 years with iron intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		72.1%	65.2%	0.004	71.0%
Childcare variables					
Caretaker	**Mother**	72.2%	66.5%	0.062	71.3%
	Father	51.2%	63.6%	0.459	53.7%
	Grandparent	74.0%	59.7%	0.010	71.9%
	Sibling	73.9%	57.1%	0.231	70.0%
	Aunt/Uncle	65.2%	71.1%	0.508	66.7%
Household head	**Father**	67.7%	62.2%	0.135	66.6%
	Grandfather	76.6%	62.5%	0.012	74.3%
	Grandmother	73.3%	77.6%	0.451	73.8%
	Mother	74.5%	58.5%	0.021	71.4%
Gender of household head	**Male**	70.0%	62.3%	0.008	69.0%
	Female	73.7%	69.2%	0.302	73.1%
Marital status of mother	**Not married**	75.6%	66.7%	0.015	74.2%
	Married	66.6%	59.7%	0.080	65.3%
	Divorced	76.5%	62.5%	0.419	73.8%
	Separated	73.3%	80.0%	0.766	75.0%
	Widowed	67.2%	75.0%	0.653	68.0%
	Living together	78.3%	87.5%	0.262	80.9%
	Traditional marriage	80.0%	62.5%	0.117	77.7%
Educational variables					
Mother's education	**None**	76.1%	77.8%	0.811	76.4%
	Primary	77.8%	70.6%	0.147	67.8%
	Std 6-8	74.1%	71.8%	0.627	73.7%
	Std 9-10	65.3%	56.7%	0..108	63.9%
	Tertiary	54.0%	44.7%	0.277	51.4%
Radio/TV	**Radio**	77.4%	73.7%	0.385	76.8%
	Television	74.7%	71.4%	0.717	74.2%
	Both	67.2%	59.0%	0.020	65.8%
	None	77.6%	69.5%	0.182	76.2%

Table 5.11.3: Proportion of children aged 1-9 years with iron intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		72.1%	65.2%	0.004	71.0%
Employment of mother	**Housewife by choice**	65.3%	54.2%	0.108	63.4%
	Unemployed	76.7%	74.6%	0.532	76.4%
	Self-employed	60.6%	63.2%	0.837	61.1%
	Wage earner	64.5%	56.6%	0.138	62.8%
Employment of father	**Unemployed**	74.8%	69.0%	0.312	73.8%
	Self-employed	61.8%	44.0%	0.106	58.3%
	Wage earner	69.0%	64.9%	0.254	68.2%
	Retired by choice	62.5%	-	0.218	58.8%
	Not applicable	76.2%	72.9%	0.514	75.8%
Type of dwelling	**Brick**	69.6%	61.2%	0.008	68.2%
	Traditional/Mud	73.7%	66.7%	0.291	72.8%
	Tin/Plank	80.8%	72.3%	0.075	78.5%
No of people sleeping at house	**1-3 persons**	76.2%	67.6%	0.136	74.2%
	4-6 persons	70.8%	63.8%	0.032	69.5%
	7-9 persons	72.4%	68.0%	0.424	71.9%
	>9 persons	72.2%	65.6%	0.436	71.5%
Household income (monthly)	**None**	72.6%	75.0%	0.844	73.0%
	R100-R499	77.5%	73.6%	0.342	76.9%
	R500-R999	73.5%	68.5%	0.328	72.8%
	R1000-R2999	66.9%	63.9%	0.627	66.4%
	>=R3000	41.6%	43.5%	0.797	42.2%
Weekly food expenditure	**0-R49**	75.3%	73.1%	0.672	75.0%
	R50-R99	76.1%	67.9%	0.122	74.7%
	R100-R149	72.0%	55.8%	0.022	69.1%
	R150-R199	73.5%	63.2%	0.196	71.8%
	R200-R249	65.7%	64.3%	0.888	65.4%
	R250-R299	67.7%	65.0%	0.816	67.2%
	R300-R349	62..2%	44.4%	0.322	59.3%
	R350-R399	53.8%	36.4%	0.292	50.8%
	>R400	55.3%	48.3%	0.513	53.5%

Table 5.11.4: Proportion of children aged 1-9 years with iron intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		72.1%	65.2%	0.004	71.0%
Environmental variables					
Source of drinking water	**Borehole**	72.2%	61.1%	0.358	70.0%
	Communal tap	75.6%	76.0%	0.928	75.6%
	Own tap	69.7%	60.2%	0.003	68.0%
	River/dam	75.4%	71.4%	0.583	74.8%
Type of toilet	**Bucket**	84.4%	64.7%	0.009	80.5%
	Flush	66.1%	60.0%	0.103	65.0%
	Pit	74.4%	71.3%	0.433	74.0%
	VIP	90.0%	71.4%	0.234	85.2%
Food preparation variables					
Fuel used	**Electricity**	66.3%	58.4%	0.030	64.8%
	Gas	73.6%	75.0%	0.892	73.9%
	Open fire	67.2%	63.6%	0.681	66.8%
	Paraffin	80.5%	71.9%	0.028	79.1%
	Wood/Coal	76.9%	79.3%	0.774	77.3%
Cold storage	**Fridge**	69.3%	70.1%	0.888	69.4%
	Freezer	75.0%	75.0%	1.000	75.0%
	Both	60.6%	48.8%	0.018	58.2%
	None	78.2%	72.5%	0.086	77.3%
Stove	**Yes**	68.4%	60.0%	0.014	66.9%
	No	76.2%	71.7%	0.202	75.4%
Primus	**Yes**	77.8%	69.2%	0.006	76.4%
	No	65.1%	62.1%	0.415	64.5%
Microwave	**Yes**	47.6%	31.7%	0.027	43.7%
	No	74.5%	71.4%	0.218	74.0%

Table 5.12.1: Proportion of children aged 1-9 years with zinc intake <67% of the RDA by migration status and demographic variables: South Africa 1999

			Migration		Chi-square	Total
			No movement	Moved	p-value	
Total			80.3%	75.4%	0.022	79.5%
Province	**EC**		87.1%	77.3%	0.039	85.4%
	FS		87.0%	100.0%	0.150	87.9%
	GP		84.0%	85.0%	0.808	84.2%
	KZN		75.1%	70.6%	0.431	74.5%
	MP		83.9%	77.8%	0.633	83.5%
	NC		84.9%	84.0%	0.912	84.7%
	LP		80.5%	88.9%	0.532	81.0%
	NW		86.0%	82.4%	0.577	85.4%
	WC		63.9%	58.2%	0.317	62.3%
Urbanicity	**Urban**		74.6%	71.0%	0.249	73.9%
	Rural		86.1%	81.9%	0.147	85.5%
Type of area	**Formal urban**		72.6%	79.5%	0.182	71.7%
	Informal urban		80.9%	67.6%	0.787	80.6%
	Commercial farm		88.4%	86.4%	0.653	87.9%
	Tribal		85.5%	79.0%	0.081	84.8%
Similarity	**All similar**		80.0%	77.8%	0.785	79.8%
	Only mother/child similar		80.1%	74.3%	0.053	79.1%
	Only grandmother/child similar		79.9%	76.5%	0.643	79.5%
	None similar		75.8%	78.2%	0.690	76.7%
Mother	**Mother the same as child**		80.1%	74.7%	0.054	79.2%
	Mother not the same as child		76.6%	78.4%	0.678	77.0%
Gender	**Male**		77.9%	71.5%	0.045	76.9%
	Female		82.9%	79.2%	0.198	82.2%
Age	**1-3 years**	RDA = 10mg	86.8%	85.3%	0.634	86.60%
	4-6 years	RDA = 10mg	73.8%	73.7%	0.985	73.80%
	7-9 years	RDA = 10mg	74.8%	62.8%	0.027	72.30%
Language	**Afrikaans**		68.7%	58.7%	0.137	66.6%
	English		65.3%	64.7%	0.954	65.1%
	Isi Ndebele		83.8%	66.7%	0.453	82.5%
	IsiXhosa		84.9%	79.3%	0.132	83.9%
	IsiZulu		76.5%	76.6%	0.977	76.5%
	Sepedi		88.9%	100.0%	0.326	92.3%
	Sesotho		86.6%	87.8%	0.831	86.8%
	SiSwati		84.0%	100.0%	0.540	85.2%
	Setswana		84.3%	81.6%	0.638	83.9%
	Tsivenda		88.9%	100.0%	0.621	90.9%
	Xitsonga		78.9%	87.5%	0.571	80.0%
Ethnic origin	**Nguni**		80.6%	77.5%	0.326	80.1%
	Sotho		85.8%	85.8%	0.981	85.8%
	Tsonga		80.3%	90.0%	0.461	81.6%

Table 5.12.2: Proportion of children aged 1-9 years with zinc intake <67% of the RDA by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		80.3%	75.4%	0.022	79.5%
Childcare variables					
Caretaker	**Mother**	80.0%	77.0%	0.143	80.2%
	Father	69.8%	81.8%	0.426	72.2%
	Grandparent	80.6%	71.4%	0.066	79.3%
	Sibling	82.6%	78.6%	0.732	81.7%
	Aunt/Uncle	76.7%	76.3%	0.959	76.6%
Household head	**Father**	77.3%	74.1%	0.342	76.7%
	Grandfather	81.4%	77.8%	0.472	80.8%
	Grandmother	81.5%	79.1%	0.632	81.3%
	Mother	84.7%	69.8%	0.012	81.8%
Gender of household head	**Male**	78.7%	75.1%	0.196	78.0%
	Female	82.4%	75.0%	0.052	81.4%
Marital status of mother	**Not married**	83.0%	75.2%	0.016	81.8%
	Married	75.1%	72.7%	0.519	74.6%
	Divorced	82.4%	75.0%	0.634	81.0%
	Separated	86.7%	80.0%	0.718	85.0%
	Widowed	86.6%	87.5%	0.942	86.7%
	Living together	85.5%	84.4%	0.874	85.2%
	Traditional marriage	88.6%	81.3%	0.408	87.6%
Educational variables					
Mother's education	**None**	87.0%	84.4%	0.659	86.5%
	Primary	84.3%	77.6%	0.130	83.3%
	Std 6-8	80.2%	82.7%	0.537	80.6%
	Std 9-10	77.3%	71.1%	0.192	76.3%
	Tertiary	63.5%	57.4%	0.467	61.8%
Radio/TV	**Radio**	86.8%	82.2%	0.189	86.0%
	Television	82.3%	82.1%	0.986	82.3%
	Both	74.9%	71.0%	0.231	74.2%
	None	86.0%	76.3%	0.061	84.3%

Table 5.12.3: Proportion of children aged 1-9 years with zinc intake <67% of the RDA by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		80.3%	75.4%	0.022	79.5%
Employment of mother	**Housewife by choice**	78.7%	66.1%	0.038	76.5%
	Unemployed	82.9%	82.9%	0.989	82.9%
	Self-employed	77.7%	52.6%	0.024	73.5%
	Wage earner	72.2%	72.6%	0.927	72.3%
Employment of father	**Unemployed**	83.0%	78.9%	0.407	82.3%
	Self-employed	74.5%	48.0%	0.010	69.3%
	Wage earner	76.6%	75.7%	0.807	76.4%
	Retired by choice	87.5%	100.0%	0.707	88.2%
	Not applicable	84.6%	77.6%	0.107	83.6%
Type of dwelling	**Brick**	77.0%	71.9%	0.074	76.2%
	Traditional/Mud	87.5%	82.4%	0.307	86.9%
	Tin/Plank	86.5%	79.2%	0.084	84.5%
No of people sleeping at house	**1-3 persons**	84.5%	74.3%	0.044	82.2%
	4-6 persons	79.6%	74.2%	0.063	78.6%
	7-9 persons	81.4%	80.0%	0.765	81.3%
	>9 persons	76.3%	78.1%	0.817	76.5%
Household income (monthly)	**None**	92.9%	81.3%	0.137	91.0%
	R100-R499	86.4%	82.4%	0.233	85.8%
	R500-R999	80.4%	82.0%	0.717	80.6%
	R1000-R2999	72.9%	69.4%	0.555	72.3%
	>=R3000	57.7%	58.1%	0.958	57.8%
Weekly food expenditure	**0-R49**	84.1%	84.6%	0.908	84.2%
	R50-R99	81.8%	81.5%	0.952	81.7%
	R100-R149	82.6%	71.2%	0.058	80.6%
	R150-R199	79.1%	78.9%	0.985	79.1%
	R200-R249	73.6%	67.9%	0.547	72.4%
	R250-R299	76.8%	85.0%	0.416	78.2%
	R300-R349	68.9%	66.7%	0.896	68.5%
	R350-R399	67.3%	9.1%	<0.001	57.1%
	>R400	65.9%	62.1%	0.710	64.9%

Table 5.12.4: Proportion of children aged 1-9 years with zinc intake <67% of the RDA by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		80.3%	75.4%	0.022	79.5%
Environmental variables					
Source of drinking water	**Borehole**	86.1%	83.3%	0.764	85.6%
	Communal tap	85.0%	78.0%	0.078	84.0%
	Own tap	76.1%	72.3%	0.201	75.4%
	River/dam	87.1%	85.7%	0.806	86.9%
Type of toilet	**Bucket**	87.4%	70.6%	0.017	84.0%
	Flush	72.7%	71.0%	0.625	72.4%
	Pit	85.4%	83.2%	0.502	85.1%
	VIP	90.0%	85.7%	0.756	88.9%
Food preparation variables					
Fuel used	**Electricity**	72.8%	69.4%	0.324	72.1%
	Gas	73.6%	87.5%	0.154	76.5%
	Open fire	88.4%	87.9%	0.929	88.3%
	Paraffin	87.8%	78.9%	0.007	86.4%
	Wood/Coal	85.7%	79.3%	0.382	84.7%
Cold storage	**Fridge**	76.7%	85.7%	0.076	78.0%
	Freezer	75.0%	75.0%	1.000	75.0%
	Both	68.9%	58.5%	0.031	66.7%
	None	87.9%	81.3%	0.013	86.9%
Stove	**Yes**	74.6%	71.3%	0.303	74.0%
	No	86.9%	79.9%	0.013	85.7%
Primus	**Yes**	85.0%	79.9%	0.059	84.2%
	No	74.9%	71.9%	0.386	74.3%
Microwave	**Yes**	63.9%	47.6%	0.022	59.8%
	No	81.9%	81.0%	0.701	81.7%

Table 5.13.1: Proportion of children aged 1-9 years with weight-for-age z-score <-2SD (underweight) by migration status and demographic variables: South Africa 1999

		Migration		Chi-square	Total
		No movement	Moved	p-value	
Total		10.3%	9.7%	0.726	10.2%
Province	**EC**	7.9%	5.0%	0.421	7.4%
	FS	15.0%	7.1%	0.069	14.4%
	GP	10.1%	4.1%	0.599	8.6%
	KZN	6.0%	7.8%	0.564	6.2%
	MP	4.0%	0.0%	0.641	3.7%
	NC	22.6%	27.3%	0.604	23.4%
	LP	20.0%	12.5%	0.076	19.5%
	NW	12.9%	25.0%	0.206	14.8%
	WC	6.9%	11.2%	0.726	8.1%
Urbanicity	**Urban**	8.0%	7.3%	0.722	7.9%
	Rural	12.6%	13.4%	0.792	12.8%
Type of area	**Formal urban**	8.4%	6.7%	0.469	8.1%
	Informal urban	6.8%	8.8%	0.579	7.3%
	Commercial farm	19.5%	14.5%	0.383	18.2%
	Tribal	11.0%	12.6%	0.637	11.1%
Similarity	**All similar**	8.7%	11.5%	0.631	9.0%
	Only mother/child similar	11.2%	7.5%	0.129	10.6%
	Only grandmother/child similar	10.8%	16.1%	0.378	11.4%
	None similar	8.3%	10.1%	0.675	9.0%
Mother	**Mother the same as child**	10.7%	8.0%	0.218	10.3%
	Mother not the same as child	9.4%	9.7%	0.915	9.4%
Gender	**Male**	10.1%	9.1%	0.663	10.0%
	Female	10.5%	10.3%	0.942	10.5%
Age	**1-3 years**	12.2%	14.0%	0.566	12.4%
	4-6 years	8.9%	7.1%	0.446	8.5%
	7-9 years	7.5%	8.5%	0.764	7.8%
Language	**Afrikaans**	11.5%	14.0%	0.600	12.0%
	English	4.8%	3.3%	0.740	4.3%
	Isi Ndebele	-	-	-	-
	IsiXhosa	6.9%	2.7%	0.162	6.3%
	IsiZulu	7.1%	6.5%	0.839	7.0%
	Sepedi	-	-	-	-
	Sesotho	15.0%	8.5%	0.234	14.2%
	SiSwati	8.7%	-	0.664	8.0%
	Setswana	15.9%	22.4%	0.267	17.0%
	Tsivenda	44.4%	50.0%	0.889	45.5%
	Xitsonga	13.0%	14.3%	0.922	13.1%
Ethnic origin	**Nguni**	6.8%	4.5%	0.265	6.5%
	Sotho	14.9%	14.6%	0.919	14.9%
	Tsonga	17.5%	22.2%	0.728	18.1%

Table 5.13.2: Proportion of children aged 1-9 years with weight-for-age z-score <-2SD (underweight) by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		10.3%	9.7%	0.726	10.2%
Childcare variables					
Caretaker	**Mother**	10.7%	9.0%	0.429	10.4%
	Father	5.1%	20.0%	0.125	8.2%
	Grandparent	10.9%	10.3%	0.876	10.8%
	Sibling	11.6%	-	0.198	8.9%
	Aunt/Uncle	6.8%	12.9%	0.277	8.2%
Household head	**Father**	10.1%	8.9%	0.623	9.9%
	Grandfather	11.8%	6.6%	0.698	11.0%
	Grandmother	9.5%	10.6%	0.772	9.6%
	Mother	8.6%	10.4%	0.227	9.0%
Gender of household head	**Male**	10.7%	8.3%	0.273	10.2%
	Female	9.2%	10.5%	0.608	9.4%
Marital status of mother	**Not married**	11.2%	9.9%	0.642	11.0%
	Married	8.5%	8.4%	0.966	8.5%
	Divorced	5.9%	12.5%	0.513	7.1%
	Separated	7.7%	20.0%	0.457	11.1%
	Widowed	9.8%	-	0.385	8.8%
	Living together	11.5%	17.2%	0.437	13.1%
	Traditional marriage	13.1%	6.3%	0.435	12.2%
Educational variables					
Mother's education	**None**	16.6%	9.3%	0.236	15.0%
	Primary	13.4%	17.7%	0.303	14.0%
	Std 6-8	10.2%	9.3%	0.778	10.1%
	Std 9-10	6.0%	3.4%	0.319	5.6%
	Tertiary	5.4%	2.4%	0.430	4.5%
Radio/TV	**Radio**	12.1%	11.5%	0.876	12.0%
	Television	8.6%	17.4%	0.186	9.8%
	Both	8.0%	6.6%	0.524	7.7%
	None	16.2%	14.0%	0.691	15.8%

Table 5.13.3: Proportion of children aged 1-9 years with weight-for-age z-score <-2SD (underweight) by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		10.3%	9.7%	0.726	10.2%
Employment of mother	**Housewife by choice**	11.6%	7.4%	0.365	10.9%
	Unemployed	11.3%	7.5%	0.141	10.8%
	Self-employed	4.6%	16.7%	0.062	6.7%
	Wage earner	7.6%	10.1%	0.422	8.1%
Employment of father	**Unemployed**	9.8%	10.9%	0.790	10.0%
	Self-employed	7.4%	4.3%	0.598	6.8%
	Wage earner	10.0%	9.3%	0.797	9.9%
	Retired by choice	-	-	-	-
	Not applicable	11.6%	11.5%	0.989	11.6%
Type of dwelling	**Brick**	9.2%	11.9%	0.199	9.6%
	Traditional/Mud	11.6%	7.0%	0.362	11.1%
	Tin/Plank	12.2%	5.3%	0.059	10.3%
No of people sleeping at house	**1-3 persons**	9.9%	10.0%	0.975	9.9%
	4-6 persons	10.7%	10.6%	0.952	10.7%
	7-9 persons	8.7%	9.5%	0.833	8.8%
	>9 persons	11.9%	3.6%	0.182	11.0%
Household income (monthly)	**None**	14.9%	6.7%	0.397	13.5%
	R100-R499	11.0%	15.8%	0.141	11.7%
	R500-R999	10.3%	8.8%	0.675	10.1%
	R1000-R2999	9.3%	3.2%	0.106	8.3%
	>=R3000	1.7%	3.6%	0.413	2.3%
Weekly food expenditure	**0-R49**	9.1%	18.6%	0.016	10.4%
	R50-R99	12.5%	9.7%	0.505	12.0%
	R100-R149	7.7%	4.3%	0.426	7.1%
	R150-R199	10.9%	2.9%	0.148	9.7%
	R200-R249	6.1%	8.0%	0.724	6.5%
	R250-R299	6.7%	-	0.260	5.6%
	R300-R349	2.4%	-	0.655	2.0%
	R350-R399	2.0%	9.1%	0.239	3.3%
	>R400	6.7%	7.4%	0.896	6.9%

Table 5.13.4: Proportion of children aged 1-9 years with weight-for-age z-score <-2SD (underweight) by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		10.3%	9.7%	0.726	10.2%
Environmental variables					
Source of drinking water	**Borehole**	4.4%	11.8%	0.249	5.9%
	Communal tap	12.5%	11.5%	0.797	12.3%
	Own tap	9.5%	8.9%	0.798	9.4%
	River/dam	11.1%	11.1%	1.000	11.1%
Type of toilet	**Bucket**	12.9%	23.3%	0.150	14.9%
	Flush	7.5%	5.9%	0.452	7.2%
	Pit	12.0%	11.2%	0.791	11.9%
	VIP	10.5%	50.0%	0.058	17.4%
Food preparation variables					
Fuel used	**Electricity**	8.0%	9.0%	0.650	8.2%
	Gas	13.8%	21.7%	0.351	15.5%
	Open fire	16.3%	12.9%	0.632	15.8%
	Paraffin	10.2%	5.4%	0.110	9.5%
	Wood/Coal	3.0%	7.1%	0.552	3.7%
Cold storage	**Fridge**	7.6%	10.9%	0.360	8.0%
	Freezer	8.8%	4.5%	0.500	8.1%
	Both	6.3%	4.3%	0.428	5.9%
	None	13.6%	13.2%	0.884	13.6%
Stove	**Yes**	9.4%	10.7%	0.535	9.6%
	No	11.1%	8.7%	0.366	10.7%
Primus	**Yes**	11.3%	11.0%	0.890	11.3%
	No	9.1%	8.1%	0.653	8.9%
Microwave	**Yes**	2.9%	-	0.190	2.2%
	No	10.9%	11.3%	0.831	10.9%

Table 5.14.1: Proportion of children aged 1-9 years with height-for-age z-score <-2SD (stunting) by migration status and demographic variables: South Africa 1999

		Migration		Chi-square	Total
		No movement	Moved	p-value	
Total		21.9%	18.9%	0.195	21.4%
Province	**EC**	20.8%	18.3%	0.666	20.4%
	FS	30.5%	21.4%	0.475	29.9%
	GP	21.7%	18.6%	0.507	20.9%
	KZN	18.4%	19.6%	0.834	18.5%
	MP	26.0%	25.0%	0.950	25.9%
	NC	30.2%	22.7%	0.482	28.9%
	LP	22.4%	25.0%	0.865	22.6%
	NW	24.7%	25.0%	0.973	24.8%
	WC	14.3%	14.6%	0.942	14.4%
Urbanicity	**Urban**	17.1%	15.9%	0.674	16.9%
	Rural	26.8%	23.5%	0.395	26.3%
Type of area	**Formal urban**	17.0%	14.0%	0.359	16.4%
	Informal urban	17.5%	20.6%	0.564	18.2%
	Commercial farm	33.0%	24.2%	0.195	30.8%
	Tribal	25.3%	23.0%	0.642	25.0%
Similarity	**All similar**	18.7%	15.4%	0.679	18.4%
	Only mother/child similar	22.1%	17.1%	0.112	21.3%
	Only grandmother/child similar	23.5%	25.8%	0.776	23.7%
	None similar	19.2%	20.3%	0.851	19.6%
Mother	**Mother the same as child**	21.5%	16.9%	0.117	20.8%
	Mother not the same as child	22.6%	19.4%	0.505	21.8%
Gender	**Male**	23.2%	18.2%	0.134	22.4%
	Female	20.5%	19.6%	0.764	20.4%
Age	**1-3 years**	25.0%	25.6%	0.988	25.60%
	4-6 years	21.1%	17.1%	0.244	20.30%
	7-9 years	11.6%	12.2%	0.891	11.80%
Language	**Afrikaans**	21.5%	17.5%	0.510	20.7%
	English	4.8%	3.3%	0.740	4.3%
	Isi Ndebele	33.3%	-	0.230	30.6%
	IsiXhosa	19.3%	16.0%	0.501	18.8%
	IsiZulu	19.2%	19.5%	0.953	19.2%
	Sepedi	35.3%	14.3%	0.303	29.2%
	Sesotho	26.6%	23.4%	0.645	26.2%
	SiSwati	26.1%	50.0%	0.470	28.0%
	Setswana	26.1%	22.4%	0.590	25.5%
	Tsivenda	44.4%	100.0%	0.154	54.5%
	Xitsonga	16.7%	57.1%	0.014	21.3%
Ethnic origin	**Nguni**	19.9%	17.8%	0.541	19.6%
	Sotho	26.6%	22.3%	0.359	26.0%
	Tsonga	20.6%	66.7%	0.003	26.4%

Table 5.14.2: Proportion of children aged 1-9 years with height-for-age z-score <-2SD (stunting) by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		21.9%	18.9%	0.195	21.4%
Childcare variables					
Caretaker	**Mother**	21.4%	18.4%	0.284	20.9%
	Father	15.4%	40.0%	0.085	20.4%
	Grandparent	23.5%	19.1%	0.423	22.9%
	Sibling	23.3%	7.7%	0.216	19.6%
	Aunt/Uncle	22.3%	25.8%	0.687	23.1%
Household head	**Father**	20.1%	18.3%	0.597	19.7%
	Grandfather	20.2%	21.3%	0.839	20.3%
	Grandmother	24.7%	21.2%	0.534	24.3%
	Mother	19.3%	12.5%	0.272	18.0%
Gender of household head	**Male**	20.1%	19.1%	0.714	19.9%
	Female	23.2%	17.5%	0.180	22.4%
Marital status of mother	**Not married**	24.2%	21.1%	0.396	23.7%
	Married	18.9%	17.4%	0.666	18.6%
	Divorced	17.6%	-	0.199	14.3%
	Separated	7.7%	20.0%	0.457	11.1%
	Widowed	24.6%	14.3%	0.543	23.5%
	Living together	25.6%	17.2%	0.361	23.4%
	Traditional marriage	20.2%	25.0%	0.661	20.9%
Educational variables					
Mother's education	**None**	28.2%	25.6%	0.731	27.7%
	Primary	27.6%	27.8%	0.963	27.6%
	Std 6-8	20.4%	16.5%	0.372	19.8%
	Std 9-10	16.3%	12.4%	0.351	15.6%
	Tertiary	12.5%	11.9%	0.920	12.3%
Radio/TV	**Radio**	28.1%	26.0%	0.661	27.7%
	Television	20.5%	26.1%	0.544	21.3%
	Both	15.7%	11.7%	0.155	15.0%
	None	32.7%	28.7%	0.498	31.9%

Table 5.14.3: Proportion of children aged 1-9 years with height-for-age z-score <-2SD (stunting) by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		21.9%	18.9%	0.195	21.4%
Employment of mother	**Housewife by choice**	16.8%	18.0%	0.500	16.0%
	Unemployed	23.8%	21.7%	0.577	23.5%
	Self-employed	17.2%	22.2%	0.617	18.1%
	Wage earner	19.4%	15.2%	0.332	18.5%
Employment of father	**Unemployed**	23.3%	26.6%	0.575	23.8%
	Self-employed	13.8%	8.7%	0.509	12.8%
	Wage earner	20.5%	16.5%	0.224	19.7%
	Retired by choice	14.3%	-	0.685	13.3%
	Not applicable	25.3%	20.5%	0.366	24.6%
Type of dwelling	**Brick**	19.3%	16.2%	0.259	18.8%
	Traditional/Mud	27.5%	32.6%	0.490	28.1%
	Tin/Plank	25.5%	18.9%	0.201	23.7%
No of people sleeping at house	**1-3 persons**	24.9%	28.6%	0.537	25.7%
	4-6 persons	21.5%	15.1%	0.036	20.3%
	7-9 persons	19.3%	22.2%	0.578	19.6%
	>9 persons	26.5%	17.9%	0.320	25.6%
Household income (monthly)	**None**	29.7%	13.3%	0.192	27.0%
	R100-R499	26.2%	26.3%	0.980	26.2%
	R500-R999	22.2%	21.3%	0.846	22.1%
	R1000-R2999	18.6%	9.5%	0.079	17.2%
	>=R3000	8.3%	7.3%	0.822	8.0%
Weekly food expenditure	**0-R49**	23.5%	30.0%	0.239	24.4%
	R50-R99	25.1%	15.3%	0.075	23.3%
	R100-R149	23.4%	13.0%	0.120	21.6%
	R150-R199	18.6%	14.7%	0.589	18.0%
	R200-R249	11.1%	20.0%	0.236	12.9%
	R250-R299	18.9%	5.6%	0.166	16.7%
	R300-R349	7.3%	12.5%	0.624	8.2%
	R350-R399	14.3%	27.3%	0.296	16.7%
	>R400	12.0%	11.1%	0.902	11.8%

Table 5.14.4: Proportion of children aged 1-9 years with height-for-age z-score <-2SD (stunting) by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		21.9%	18.9%	0.195	21.4%
Environmental variables					
Source of drinking water	**Borehole**	16.2%	23.5%	0.477	17.6%
	Communal tap	24.8%	25.3%	0.916	24.8%
	Own tap	19.5%	15.7%	0.181	18.8%
	River/dam	29.5%	25.0%	0.585	28.8%
Type of toilet	**Bucket**	28.2%	23.3%	0.589	27.3%
	Flush	16.8%	11.9%	0.098	15.9%
	Pit	24.4%	24.0%	0.917	24.4%
	VIP	36.8%	50.0%	0.624	39.1%
Food preparation variables					
Fuel used	**Electricity**	17.7%	14.4%	0.267	17.1%
	Gas	20.0%	17.4%	0.780	19.4%
	Open fire	30.1%	38.7%	0.337	31.3%
	Paraffin	25.4%	19.8%	0.211	24.5%
	Wood/Coal	21.1%	25.0%	0.645	21.7%
Cold storage	**Fridge**	17.3%	20.3%	0.553	17.7%
	Freezer	18.6%	13.6%	o.579	17.8%
	Both	14.7%	6.1%	0.014	12.9%
	None	27.9%	27.6%	0.926	27.9%
Stove	**Yes**	19.1%	17.3%	0.529	18.8%
	No	25.1%	21.7%	0.361	24.6%
Primus	**Yes**	23.6%	23.0%	0.876	23.5%
	No	19.9%	14.5%	0.091	18.9%
Microwave	**Yes**	7.6%	3.5%	0.276	6.6%
	No	23.3%	21.6%	0.527	23.0%

Table 5.15.1: Proportion of children aged 1-9 years with weight-for-height z-score <-2SD (wasting) by migration status and demographic variables: South Africa 1999

		Migration		Chi-square	Total
		No movement	Moved	p-value	
Total		3.6%	2.6%	0.343	3.4%
Province	**EC**	2.3%	0.0%	0.234	1.9%
	FS	3.7%	0.0%	0.461	3.5%
	GP	1.1%	1.0%	0.963	1.1%
	KZN	3.9%	7.8%	0.193	4.3%
	MP	2.0%	0.0%	0.686	1.9%
	NC	9.4%	4.5%	0.457	8.6%
	LP	12.0%	0.0%	0.298	11.3%
	NW	5.1%	3.1%	0.637	4.8%
	WC	0.0%	3.4%	0.005	0.9%
Urbanicity	**Urban**	2.1%	2.6%	0.640	2.2%
	Rural	5.1%	2.7%	0.192	4.8%
Type of area	**Formal urban**	2.2%	2.4%	0.856	2.2%
	Informal urban	1.7%	2.9%	0.522	2.0%
	Commercial farm	4.9%	1.6%	0.261	4.0%
	Tribal	5.2%	3.4%	0.476	5.0%
Similarity	**All similar**	5.2%	0.0%	0.233	4.7%
	Only mother/child similar	3.9%	2.5%	0.328	3.7%
	Only grandmother/child similar	1.9%	0.0%	0.443	1.7%
	None similar	2.5%	4.3%	0.485	3.2%
Mother	**Mother the same as child**	4.2%	2.2%	0.162	3.9%
	Mother not the same as child	1.8%	3.9%	0.201	2.2%
Gender	**Male**	4.2%	3.2%	0.514	4.1%
	Female	2.9%	2.1%	0.508	2.8%
Age	**1-3 years**	3.5%	3.1%	0.805	3.50%
	4-6 years	3.8%	2.4%	0.370	3.50%
	7-9 years	3.4%	2.4%	0.655	3.20%
Language	**Afrikaans**	1.9%	1.8%	0.937	1.9%
	English	3.2%	6.7%	0.448	4.3%
	Isi Ndebele	3.0%	-	0.760	2.8%
	IsiXhosa	2.0%	-	0.219	1.7%
	IsiZulu	3.3%	5.2%	0.423	3.6%
	Sepedi	-	-	-	-
	Sesotho	5.9%	-	0.086	5.2%
	SiSwati	-	-	-	-
	Setswana	4.1%	4.1%	1.000	4.1%
	Tsivenda	11.1%	-	0.621	9.1%
	Xitsonga	7.4%	-	0.456	6.6%
Ethnic origin	**Nguni**	2.6%	2.5%	0.945	2.6%
	Sotho	5.0%	1.9%	0.171	4.5%
	Tsonga	7.9%	-	0.381	6.9%

Table 5.15.2: Proportion of children aged 1-9 years with weight-for-height z-score <-2SD (wasting) by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		3.6%	2.6%	0.343	3.4%
Childcare variables					
Caretaker	**Mother**	4.1%	3.3%	0.553	3.9%
	Father	2.6%	-	0.609	2.9%
	Grandparent	3.1%	1.5%	0.458	2.9%
	Sibling	-	-	-	-
	Aunt/Uncle	1.9%	3.2%	0.672	2.2%
Household Head	**Father**	4.0%	2.8%	0.425	3.8%
	Grandfather	4.6%	3.3%	0.640	4.4%
	Grandmother	3.0%	1.5%	0.502	2.8%
	Mother	2.5%	4.2%	0.544	2.9%
Gender of household head	**Male**	4.2%	2.9%	0.342	4.0%
	Female	2.8%	2.6%	0.898	2.8%
Marital status of mother	**Not married**	4.2%	3.9%	0.868	4.2%
	Married	3.3%	2.6%	0.648	3.2%
	Divorced	-	-	-	-
	Separated	-	-	-	-
	Widowed	-	-	-	-
	Living together	3.8%	-	0.284	2.8%
	Traditional marriage	4.0%	-	0.413	3.5%
Educational variables					
Mother's education	**None**	9.2%	-	0.044	7.3%
	Primary	4.0%	2.5%	0.526	3.8%
	Std 6-8	4.0%	4.1%	0.958	4.0%
	Std 9-10	2.5%	3.4%	0.621	2.6%
	Tertiary	0.9%	-	0.539	0.6%
Radio/TV	**Radio**	4.1%	1.0%	0.116	3.6%
	Television	3.3%	8.7%	0.221	4.0%
	Both	2.9%	2.6%	0.769	2.9%
	None	5.0%	3.5%	0.631	4.7%

Table 5.15.3: Proportion of children aged 1-9 years with weight-for-height z-score <-2SD (wasting) by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		3.6%	2.6%	0.343	3.4%
Employment of mother	**Housewife by choice**	7.8%	3.7%	0.291	7.1%
	Unemployed	3.6%	3.1%	0.751	3.5%
	Self-employed	-	-	-	-
	Wage earner	2.3%	2.0%	0.889	2.2%
Employment of father	**Unemployed**	5.2%	9.4%	0.205	6.0%
	Self-employed	3.2%	-	0.385	2.6%
	Wage earner	3.1%	2.2%	0.534	2.9%
	Retired by choice	-	-	-	-
	Not applicable	2.9%	-	0.128	2.5%
Type of dwelling	**Brick**	3.8%	1.7%	0.105	3.5%
	Traditional/Mud	3.4%	2.3%	0.718	3.2%
	Tin/Plank	2.4%	4.2%	0.354	2.9%
No of people sleeping at house	**1-3 persons**	2.6%	1.4%	0.576	2.3%
	4-6 persons	3.3%	1.8%	0.243	3.1%
	7-9 persons	3.0%	4.8%	0.468	3.2%
	>9 persons	6.6%	7.1%	0.920	6.7%
Household income (monthly)	**None**	4.1%	-	0.428	3.4%
	R100-R499	3.5%	0.9%	0.428	3.1%
	R500-R999	3.4%	3.8%	0.857	3.4%
	R1000-R2999	3.0%	4.8%	0.472	3.3%
	>=R3000	1.7%	-	0.338	1.1%
Weekly food expenditure	**0-R49**	4.7%	-	0.066	4.0%
	R50-R99	4.2%	2.8%	0.579	3.9%
	R100-R149	3.2%	6.5%	0.273	3.7%
	R150-R199	1.6%	2.9%	0.604	1.8%
	R200-R249	2.0%	4.0%	0.565	2.4%
	R250-R299	1.1%	-	0.653	0.9%
	R300-R349	4.9%	-	0.524	4.1%
	R350-R399	2.0%	-	0.633	1.7%
	>R400	1.3%	-	0.547	1.0%

Table 5.15.4: Proportion of children aged 1-9 years with weight-for-height z-score <-2SD (wasting) by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		3.6%	2.6%	0.343	3.4%
Environmental variables					
Source of drinking water	**Borehole**	2.9%	11.8%	0.124	4.7%
	Communal tap	7.2%	1.1%	0.032	6.3%
	Own tap	2.0%	3.0%	0.335	2.2%
	River/dam	3.4%	-	0.263	2.9%
Type of toilet	**Bucket**	4.0%	-	0.264	3.2%
	Flush	2.0%	3.8%	0.151	2.3%
	Pit	4.8%	0.8%	0.039	4.3%
	VIP	-	-	-	-
Food preparation variables					
Fuel used	**Electricity**	3.0%	2.1%	0.534	2.8%
	Gas	3.8%	8.7%	0.331	4.9%
	Open fire	8.1%	3.2%	0.333	7.5%
	Paraffin	3.1%	0.9%	0.195	2.8%
	Wood/Coal	3.0%	7.1%	0.294	3.7%
Cold storage	**Fridge**	4.4%	6.3%	0.505	4.6%
	Freezer	3.5%	-	0.370	3.0%
	Both	2.1%	2.6%	0.743	2.2%
	None	3.8%	1.1%	0.076	3.4%
Stove	**Yes**	2.5%	3.3%	0.518	2.6%
	No	4.7%	1.2%	0.045	4.1%
Primus	**Yes**	3.9%	1.0%	0.047	3.5%
	No	3.0%	4.3%	0.362	3.2%
Microwave	**Yes**	2.4%	1.8%	0.790	2.2%
	No	3.6%	2.8%	0.484	3.5%

Table 5.16.1: Proportion of children aged 1-9 years with weight-for-height z-score >+2SD (overweight) by migration status and demographic variables: South Africa 1999

		Migration		Chi-square	Total
		No movement	Moved	p-value	
Total		6.2%	3.9%	0.087	5.8%
Province	**EC**	6.9%	10.0%	0.408	7.4%
	FS	7.0%	0.0%	0.308	6.5%
	GP	6.5%	3.1%	0.208	5.6%
	KZN	6.5%	2.0%	0.200	5.9%
	MP	17.0%	0.0%	0.204	15.7%
	NC	4.7%	0.0%	0.299	3.9%
	LP	4.0%	0.0%	0.564	3.8%
	NW	0.6%	0.0%	0.671	0.5%
	WC	5.2%	5.6%	0.880	5.3%
Urbanicity	**Urban**	7.6%	5.6%	0.289	7.2%
	Rural	4.7%	1.3%	0.058	4.3%
Type of area	**Formal urban**	8.0%	7.3%	0.769	7.9%
	Informal urban	6.4%	1.5%	0.109	5.3%
	Commercial farm	3.2%	0.0%	0.151	2.4%
	Tribal	5.1%	2.3%	0.250	4.8%
Similarity	**All similar**	4.8%	3.8%	0.830	4.7%
	Only mother/child similar	6.6%	4.0%	0.162	6.2%
	Only grandmother/child similar	6.0%	3.2%	0.532	5.7%
	None similar	6.7%	5.8%	0.813	6.3%
Mother	**Mother the same as child**	6.3%	4.0%	0.179	6.0%
	Mother not the same as child	7.0%	4.9%	0.436	6.5%
Gender	**Male**	5.7%	4.8%	0.632	5.5%
	Female	6.7%	3.1%	0.056	6.1%
Age	**1-3 years**	6.8%	3.9%	0.200	6.50%
	4-6 years	5.9%	3.5%	0.227	5.40%
	7-9 years	4.8%	4.9%	0.975	4.80%
Language	**Afrikaans**	4.3%	1.8%	0.369	3.8%
	English	3.2%	13.3%	0.066	6.5%
	Isi Ndebele	24.2%	-	0.334	22.2%
	IsiXhosa	7.4%	8.0%	0.862	7.5%
	IsiZulu	7.4%	2.6%	0.109	6.9%
	Sepedi	-	-	-	-
	Sesotho	6.6%	-	0.070	5.7%
	SiSwati	13.0%	-	0.586	12.0%
	Setswana	1.6%	2.0%	0.840	1.7%
	Tsivenda	-	-	-	-
	Xitsonga	3.7%	-	0.605	3.3%
Ethnic origin	**Nguni**	8.3%	5.1%	0.172	7.8%
	Sotho	4.3%	1.0%	0.104	3.8%
	Tsonga	3.2%	-	0.588	2.8%

Table 5.16.2: Proportion of children aged 1-9 years with weight-for-height z-score >+2SD (overweight) by migration status and childcare and educational variables: South Africa 1999

		Migration		Chi-square	Total
		No Movement	Moved	p-value	
Total		6.2%	3.9%	0.087	5.8%
Childcare variables					
Caretaker	**Mother**	6.2%	3.3%	0.072	5.7%
	Father	12.0%	10.0%	0.808	12.2%
	Grandparent	5.5%	2.9%	0.381	5.1%
	Sibling	4.7%	7.7%	0.670	5.4%
	Aunt/Uncle	5.8%	9.7%	0.453	6.7%
Household head	**Father**	7.0%	3.9%	0.125	6.4%
	Grandfather	5.2%	1.6%	0.225	4.7%
	Grandmother	6.3%	4.5%	0.571	6.1%
	Mother	5.1%	4.2%	0.793	4.9%
Gender of household head	**Male**	6.4%	3.3%	0.063	5.9%
	Female	6.0%	4.4%	0.499	5.8%
Marital status of mother	**Not married**	6.1%	2.6%	0.089	5.5%
	Married	7.1%	3.2%	0.073	6.4%
	Divorced	14.7%	-	0.248	11.9%
	Separated	7.7%	-	0.523	5.6%
	Widowed	1.6%	14.3%	0.061	2.9%
	Living together	3.8%	10.3%	0.194	5.6%
	Traditional marriage	3.0%	12.5%	0.085	4.3%
Educational variables					
Mother's education	**None**	4.3%	4.7%	0.919	4.4%
	Primary	4.2%	2.5%	0.480	4.0%
	Std 6-8	6.2%	3.1%	0.225	5.7%
	Std 9-10	8.9%	2.2%	0.032	7.8%
	Tertiary	8.9%	11.9%	0.579	9.7%
Radio/TV	**Radio**	3.7%	1.0%	0.150	3.2%
	Television	7.9%	-	0.161	6.9%
	Both	7.2%	6.1%	0.580	7.0%
	None	6.5%	3.5%	0.383	6.0%

Table 5.16.3: Proportion of children aged 1-9 years with weight-for-height z-score >+2SD (overweight) by migration status and economic variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		6.2%	3.9%	0.087	5.8%
Employment of mother	**Housewife by choice**	14.3%	3.7%	0.851	4.2%
	Unemployed	6.5%	2.5%	0.047	5.9%
	Self-employed	5.7%	5.6%	0.975	5.7%
	Wage earner	9.6%	5.1%	0.155	8.6%
Employment of father	**Unemployed**	5.9%	1.6%	0.153	5.1%
	Self-employed	9.6%	4.3%	0.422	8.5%
	Wage earner	7.2%	4.4%	0.176	6.6%
	Retired by choice		100.0%	0.000	6.7%
	Not applicable	4.3%	3.8%	0.839	4.3%
Type of dwelling	**Brick**	6.5%	5.1%	0.413	6.3%
	Traditional/Mud	5.2%	4.7%	0.878	5.1%
	Tin/Plank	5.9%	1.1%	0.054	4.6%
No of people sleeping at house	**1-3 persons**	7.3%	2.9%	0.179	6.3%
	4-6 persons	6.7%	4.6%	0.249	6.3%
	7-9 persons	5.3%	4.8%	0.863	5.2%
	>9 persons	5.3%	-	0.212	4.7%
Household income (monthly)	**None**	9.5%	-	0.215	7.9%
	R100-R499	4.4%	1.8%	0.188	4.0%
	R500-R999	5.5%	1.3%	0.105	4.8%
	R1000-R2999	8.4%	4.8%	0.323	7.8%
	>=R3000	9.9%	9.1%	0.863	9.7%
Weekly food expenditure	**0-R49**	3.5%	2.9%	0.787	3.4%
	R50-R99	7.5%	2.8%	0.147	6.6%
	R100-R149	7.7%	-	0.052	6.3%
	R150-R199	6.0%	2.9%	0.472	5.5%
	R200-R249	8.1%	-	0.142	6.5%
	R250-R299	7.8%	5.6%	0.742	7.4%
	R300-R349	4.9%	12.5%	0,411	6.1%
	R350-R399	12.2%	9.1%	0.768	11.7%
	>R400	6.7%	11.1%	0.461	7.8%

Table 5.16.4: Proportion of children aged 1-9 years with weight-for-height z-score >+2SD (overweight) by migration status and environmental and food preparation variables: South Africa 1999

		Migration		Chi-square	TOTAL
		No Movement	Moved	p-value	
Total		6.2%	3.9%	0.087	5.8%
Environmental variables					
Source of drinking water	**Borehole**	2.9%	-	0.474	2.4%
	Communal tap	3.1%	1.1%	0.306	2.8%
	Own tap	7.6%	5.1%	0.180	7.1%
	River/dam	7.7%	5.6%	0.646	7.4%
Type of toilet	**Bucket**	8.6%	3.3%	0.609	5.2%
	Flush	8.7%	6.5%	0.331	8.3%
	Pit	4.1%	0.8%	0.070	3.6%
	VIP	15.8%	-	0.394	13.0%
Food preparation variables					
Fuel used	**Electricity**	8.0%	6.4%	0.442	7.7%
	Gas	2.5%	3.2%	0.444	1.9%
	Open fire	3.3%	1.8%	0.971	3.3%
	Paraffin	5.0%	-	0.132	4.3%
	Wood/Coal	6.0%	-	0.183	5.0%
Cold storage	**Fridge**	8.3%	6.3%	0.574	8.0%
	Freezer	5.3%	-	0.269	4.4%
	Both	8.6%	5.2%	0.227	7.9%
	None	4.0%	2.9%	0.470	3.9%
Stove	**Yes**	8.0%	4.2%	0.054	7.3%
	No	4.0%	3.7%	0.883	3.9%
Primus	**Yes**	5.1%	1.6%	0.032	4.5%
	No	7.4%	6.5%	0.643	7.2%
Microwave	**Yes**	9.4%	10.5%	0.806	9.7%
	No	5.9%	2.8%	0.026	5.4%