

**ASSESSMENT OF THE ASSOCIATION
BETWEEN HIV-INFECTED MOTHERS AND THE
MORTALITY OF CHILDREN LESS THAN TWO YEARS
IN KHAYELITSHA HEALTH DISTRICT OF THE WESTERN CAPE:
A CASE-CONTROL STUDY**

Mini-thesis submitted in partial fulfillment of the degree Master of Public Health.

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Low birth weight
Prematurity
Causes of death amongst children less than two years

DECLARATION

I, Angela Dunn declare that the contents of this mini-thesis represent my own unaided work, and that the mini-thesis has not previously been submitted before for any degree or examination towards any other qualification. Furthermore it represents my own opinions, and all the sources I have used or quoted have been indicated and acknowledged as complete references.

Angela Helena Anne Dunn

Signed: *Angela Dunn*

Date: *13 August 2007*

ABSTRACT

Introduction

Amongst child deaths, most occur in the first year of life and, according to the World Health Organisation, the mortality of children in the second year of life is due mostly to environmental factors and infections. Since 1960 the infant mortality rate and the under-five year mortality rate declined globally. However, the South African National antenatal HIV sero-prevalence increased from less than 1% in 1990 to 30% in 2005. This increase in HIV prevalence coincided with an increase in child deaths. This has been attributed to mother-to-child transmission of HIV/AIDS. There has been insufficient proven association or causation of HIV-positive mothers with child deaths. If there is an association between the HIV-positive status and deaths of children under-two years, the under-two year deaths will be further exacerbated by HIV/AIDS. The significance is that most infant and child deaths are preventable and it is important to identify disease factors associated with mortality in order to take preventative measures.

The study setting

The study setting is in Khayelitsha, a peri-urban district in the Western Cape composed mainly of informal settlements.

Study population

The study population includes all 10 670 infants born alive at Khayelitsha Midwife and Obstetric Units during the study period.

Objectives

The objectives are to determine the under-two year mortality in the Khayelitsha district, the association between the mothers' HIV status at the time of pregnancy and the <2 year mortality as well as the causes of death.

Study method

This is a case-control study of infants born at the Midwife Obstetric Units in Khayelitsha over a 19-month period from 01 September 2000 to 31 March 2002. The cases are the infants born alive and who died before the age of two years. The controls are the infants who were born immediately after the birth of the case, whose names were recorded in the Khayelitsha birth registers and whose names were not in the death records. The delivery register and the mothers' folders as well as the death registers were used to collect data.

Analysis

Analysis was done on the Epi-info 6 programme. The odds ratio was calculated and confounders excluded by means of bivariate as well as by multivariate regression on the SYSTAT 11 programme.

Results

Maternal HIV infection is strongly associated with death of children less than two years. The Odds Ratio is 4.16 (2.04-8.56). The infant mortality rate (IMR) and under-two year mortality rate (U2MR) in Khayelitsha is 41.05 and 46.03 respectively.

HIV/AIDS is the leading cause of death amongst all deaths of children less than two years. When the mother was HIV-positive, more than half of the children died of HIV/AIDS and about a third died due to potentially HIV-related infections. The results of this study highlight the need for preventative and supportive interventions.

Conclusion

The main finding of this study was that there is a strong association between the HIV-positive mothers and the deaths of children less than two years. This finding was statistically significant and none of the potential confounders measured had any confounding effect. It is highly likely that the association is causal, although it could be diluted by a confounding effect of several potential confounders that could not be measured. HIV is the leading cause of death.

Recommendations

The challenge is to use this data to reduce the number of deaths in children <2 years. Mothers need to be kept healthy and alive in order to care for the children. Interventions to prevent the vertical spread of HIV/AIDS to children through effective implementation of MTCT should be strengthened. Recordkeeping needs to be urgently improved and standards stringently maintained with uniformity in the different health institutions.

Ethics

System approval was obtained from the Health Department to collect data of children as well as the HIV status of their mothers. Strict confidentiality was adhered to. The proposal was approved by the ethics committee of the University of the Western Cape.

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LIST OF ABBREVIATIONS AND ACRONYMNS

AIDS	Acquired Immuno-deficiency Syndrome
ARV	Antiretroviral
AZT	Azidothymidine (Zidovudine)
HAART	Highly Active Antiretroviral therapy
HIV	Human Immunodeficiency Virus
IMR	Infant mortality rate
IUGR	Intra-uterine growth retardation
MDG	Millennium Development Goals
MOU	Midwife Obstetric Unit
MTCT	Mother-to-child-transmission
PMTCT	Prevention of mother-to-child transmission
PCP	Pneumocystis carinii pneumonia
RNA	Ribonucleic acid
SAINT	South African Intrapartum Nevirapine Trial
TB	Tuberculosis
U2MR	Under 2 year mortality rate
U5MR	Under 5 year mortality rate
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNICEF	United Nations Children's Fund
VCT	Voluntary HIV counselling and testing

<2 years	Less than two years of age
WC	Western Cape
WHO	World Health Organisation

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1. BACKGROUND TO THE STUDY

1.1 INTRODUCTION

The mortality of infants and children less than five years has always been of public concern as it is regarded as one of the key indicators that reflect the socio-economic status of a community or a country and is therefore a useful index for policy formation and planning purposes (WHO, 1981). Mortality among these age groups steadily declined globally from 1960 until the 1990's (World Bank, 1993; UNICEF, 2002; UNICEF, 2004).

However, since then, the mortality of infants and children under five years in sub-Saharan Africa showed an increase. During the same period, elsewhere, in developed countries such as in Europe, North America and Australasia, there was a consistent downward trend in child deaths (UNICEF, 2004). While these differences could be due to the better socio-economic circumstances and better health care in the developed countries, there should have been the same trend in developing countries, albeit at a much slower rate.

There appears to be a link between the trends in child deaths and the trends in the human-immunodeficiency virus (HIV) prevalence. Since the 1990's HIV statistics showed an increase globally. This increase in HIV prevalence coincided with an increase in the infant mortality rate (IMR) and mortality of children less than five years (U5MR) (UNAIDS & WHO, 2005; WHO, 2005). This increase in child mortality has been attributed to the mother-to-child transmission (MTCT) of HIV that results in high morbidity and mortality

of under-five year olds, mainly due to infections. (Bobat, Coovadia, Coutsooudis & Moodley, 1996; Bobat, Coovadia, Moodley & Coutsooudis, 1999; Spira et al., 1999; Taha, et al., 2000; UNAIDS & WHO, 2005). The relationship between MTCT of HIV and child mortality is suspected to be the cause because of increased levels of both in the same period and because the increased deaths in children are mainly due to infections (Lucas et al., 1996; Zwi, Pettifor & Sönderlund, 1999; Graham, Mtitimila, Kamanga, Walsh, Hart & Molyneux, 2000; Ansari et al., 2003; Gisselquist, Potterat & Brody, 2004; Colvin, 2005; Grandin, Westwood, Lagerdien & Shung-King, 2005). HIV in children causes increased susceptibility to infections (Gisselquist et al., 2004). In addition, HIV increases the severity of infections (Colvin, 2005; Scarlatti, 1996) and consequently results in early deaths (Colvin, 2005).

The South African national HIV sero-prevalence amongst pregnant women increased from 0.73 % in 1990 to 30.2% in 2005 (Department of Health, 2005) and the MTCT of HIV during pregnancy, labour, delivery as well as through breastfeeding has been shown to be approximately 30-40% when there are no prevention interventions (Spira et al., 1999; Bobat et al., 1999; Taha et al., 2000). Over 90% of HIV-1 (the HIV type most common in South Africa) infection in childhood occurs by vertical transmission and the increasing number of HIV-infected women will therefore lead to an increasingly large number of HIV-infected children (Bobat et al., 1996; UNAIDS & WHO, 2005).

Differences between the IMR of children of HIV-positive mothers and those of HIV-negative mothers have been confirmed in studies (Spira et al., 1999; Bobat, Moodley,

Coutsoudis & Coovadia, 1997). Therefore, during the 1990's, a programme for the prevention of mother-to-child transmission (PMTCT) of HIV was initiated (Conner et al., 1994). Subsequently, the infant mortality and the under-five mortality decreased due to the implementation of the PMTCT programme in Europe and the United States of America (Moodley & Moodley, 2001; Scarlatti, 2004; Coovadia, 2005).

On the other hand, HIV also increases the probability of morbidity and mortality amongst HIV infected mothers (Pattinson, 2001, UNAIDS & WHO, 2005; UNAIDS, 2006). The PMTCT programme prevents the transmission of the HIV to the child, but does not assist the mother who is HIV infected. Currently no vaccine or cure is available for HIV/AIDS although at present South Africa is taking a leading role in testing an AIDS vaccine (Gray, 2003; Daniels, 2004). Therefore the mother may become ill and be unable to care for the child or she may die (UNAIDS, 2004) decreasing the children's chances of survival (Ryder et al., 1989).

However, there is insufficient proven association or causality between HIV infection of the mother and increased child mortality. There has even been controversy over whether HIV causes AIDS. This prompted the South African Government to constitute a panel of scientists in 2001 to interrogate the evidence underlying the dominant view that HIV causes AIDS (Presidential AIDS Advisory Panel Report, 2001). The dissidents view malnutrition, chemical stressors in the environment, physical stressors affecting the immune system, biological and mental stressors as the risk factors for AIDS, with some even disputing the fact that HIV is an infectious and transmittable disease (Noble, no date). On the other hand,

proponents of the view that HIV causes AIDS argue that the virus could be isolated, and that HIV is present in almost all AIDS cases and that the virus does cause the disease when introduced into a healthy person quoting Koch's postulate linking disease-causing agents to disease (Noble, no date). The arguments of the dissidents had the impact of delaying the implementation of the South African Government policy to provide pregnant mothers with antiretroviral (ARV) treatment.

If this association of HIV/AIDS infection of the mother with child mortality is correct, then the HIV/AIDS epidemic now poses a major challenge to child health in South Africa, therefore more recent data to validate and assess the extent of this challenge is needed (Solarsh & Goga, 2004).

1.2 SETTING

Khayelitsha, the area of study, is an under resourced peri-urban district of Cape Town in the Western Cape and is situated 30 km from the centre of Cape Town (Abdullah, Young, Bitalo, Coetzee & Myers, 2001). Khayelitsha had a growing population of about 364 793 people in 2001 (Groenewald et al., 2001a). Based on the baseline 1996 census 83% of the dwellings are informal, 73% of the dwellings have piped water or water on site. More than half of the households have an income below the poverty line and 40.2% are unemployed (Equity Gauge Project, 1996).

Most of the deliveries, namely the actual birth, of newborns in Khayelitsha take place in the two Midwife Obstetric Units (MOU's) present in the district. A MOU is a type of primary level health facility where deliveries of babies of uncomplicated pregnancies are done by midwives. Any complicated pregnancies or complicated deliveries encountered at the MOUs are referred to the secondary or tertiary hospitals.

Khayelitsha had an HIV sero-prevalence rate of 14.2% in 1996, which had increased to 24.7% by 2002 amongst pregnant women (Abdullah et al., 2001; Department of Health, 2001c). Therefore a PMTCT programme was conducted as a pilot study at Khayelitsha in January 1999 (Abdullah et al., 2001) and is now permanently implemented (Department of Health, 2001b). At their first antenatal visit, pregnant mothers were offered voluntary counseling and given the option of an HIV test and ARV treatment to prevent transmission of HIV to the unborn child if they were HIV-positive. (Abdullah et al., 2001; Department of Health, 2001b). This PMTCT programme provided an opportunity to do this study because of the data available for the study.

1.3 PROBLEM

Infant mortality has been declining over the years due to improved public health strategies. However, with the advent of HIV/AIDS, the IMR has been steadily increasing in South Africa. Research has shown that providing the mother with antiretroviral drugs reduces the risk of MTCT of HIV/AIDS. Therefore, this PMTCT should reduce infant mortality. Infant

mortality remains high in the absence of such programmes. This programme does not cure HIV-positive mothers. There may therefore be an increase in morbidity and mortality amongst HIV-positive mothers which could possibly influence the quality of life of both mother and child and the likelihood of death of the children.

However, there has been some doubt and controversy as to whether HIV causes AIDS and hence whether HIV-positive mothers are associated with increased deaths of infants and children less than two years of age (<2 years). This study sets out to determine if there is an association between HIV-positive mothers and mortality of children <2 years.

Most studies assess the U5MR, however, this study will concentrate on the under-2 year mortality rate (U2MR), as assessing the U5MR will take too long. This is deemed appropriate considering the public health urgency and the lack of time and resources available in which to complete the masters mini-thesis.

1.4 PURPOSE

The purpose of this research is to determine whether there is an association between HIV positive mothers and the mortality rate of children <2 years. This would help to inform policy makers and consequently might contribute to recommendations designed to improve the health of children and the community. It is important to identify factors associated with disease and mortality in order to provide preventative measures at local level. There is also

a need to determine the association between the mortality of children <2 years and their mothers' HIV status because the healthy future of a society depends on the health of the children as well as their mothers who are the guardians of the future (UNICEF, 2004). This study will provide information to the Department of Health on the possible association between HIV-positive mothers and <2 year deaths, as well as the causes of death. The information obtained from this study would also serve to identify further research needs on intervention measures to reduce child mortality.

2. LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter the literature will be reviewed in order to develop an appropriate approach to the methodology for determining whether the deaths of children <2 years are associated with the HIV infection of their mothers before or during pregnancy.

Since there is a paucity of literature on the U2MR, the literature on the IMR and on the U5MR in both the developed and developing countries will be reviewed. Mortality rates are always calculated per 1000 live children and this will be the point of departure for all mortality rates stated in this document.

Thereafter, a discussion will follow on HIV and the global, national and local HIV prevalence among women leading to the MTCT of HIV infection and the resultant increased mortality of children <2 years. The influence of various confounders such as the maternal and infant risk factors for infant deaths, which could be mixed in with the association of HIV-positive mothers and child mortality, will also be reviewed. Lastly literature on the causes of death of children will follow.

2.2 INFANT AND CHILD MORTALITY RATES

Globally more than 10 million children in low-and middle-income countries die before they

reach their fifth birthday and most of these deaths are due to just five preventable and treatable conditions namely diarrhoea, respiratory infections, tuberculosis, pneumonia and infectious diseases. According to literature children die primarily due to poor socio-economic determinants of health (WHO, 1981; Hussey, 2004; World Bank, 1993; WHO, 2005).

Many efforts have been developed to reduce the IMR and the U5MR such as developmental programmes between 1960 and 1990 (Walker, Schwartländer & Bryce, 2002). There are also several international and national structures in place to ensure child survival such as the United Nations Convention on the Rights of the Child, the Millennium Development Goals of the United Nations and the South African Constitution (World Bank, 1993; Republic of South Africa, 1996; UNICEF, 2002).

2.2.1 Infant and child mortality in developed countries

In the developed countries, such as in the Americas, Europe and South East Asia, there have been vast improvements in child health (WHO, 2005). Infant and child mortality started to decline in Europe, North America and Australasia about two centuries ago. The improvement in living conditions in the developed world has influenced the health of infants positively and hence the lower IMR and U5MR. The control of communicable diseases as well as a fertility decline also contributed to the lower IMR and U5MR (World Bank, 1993; WHO, 2005).