A PRELIMINARY ASSESSMENT OF A FRAMEWORK FOR THE ALLOCATION OF COMPREHENSIVE PRIMARY DENTAL SERVICES

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for the Allocation of Comprehensive Primary Dental Services

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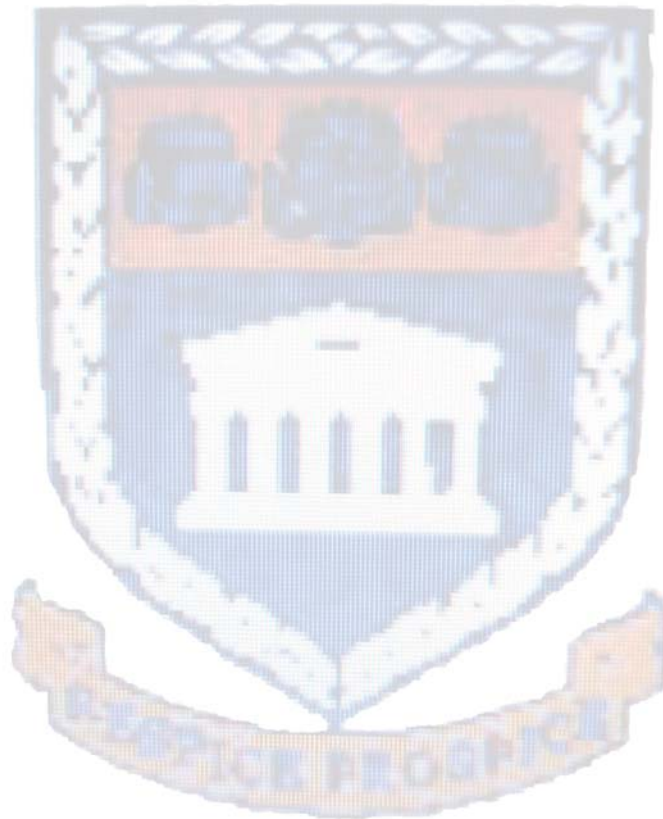
DECLARATION

I declare that "*A Preliminary Assessment of a Framework for the Allocation of Comprehensive Primary Dental Services*" is my own work, which has not been submitted 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 references

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Signed by
Denise Antunes do Nascimento

Date**: March 2010**

ACKNOWLEDGEMENTS

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SUMMARY

Background

The author of this dissertation has developed a first version of a *Dental Resource Allocation Framework* (DRAF). The aim of the DRAF is to help improve equity of access to primary dental services by providing health teams and managers of the Brazilian Family Health Programme with a tool to guide the allocation human resources according to primary dental care needs, and therefore to assist them to meet the Family Health Programme targets for improving equity of access to its services. The DRAF comprises three inter-related components: a diagnostic classification tool, a timeframe for primary dental services, and dental team members of the Brazilian Family Health Programme.

Aim

The aim of this study was to produce a preliminary assessment of the DRAF by determining its face validity, testing reliability and usability of its diagnostic classification tool, and to produce a set of preliminary recommendations on the viability of the DRAF before it is released for use within the Family Health Programme.

Method

Primary care dentists assisted with the preliminary assessment of the DRAF. They participated in three assessment phases.

Phase 1 involved distributing the first version of DRAF to dentists for them to determine its face validity in three sessions of consensus group. Across the three sessions, they made changes within each component of the DRAF until a second version was produced at the end of the third session.

Phase 2 involved providing dentists with calibration training on the diagnostic classifications and then applying the 5-level diagnostic classification tool by performing clinical examinations in a sample of the Family Health Programme users.

Phase 3 involved distributing to dentists a questionnaire that uses a composite measure of general usability attributes marked in a Likert-scale. By self-completing that questionnaire, dentists were asked to provide information regarding their first experience of using the diagnostic classification tool in the phase 2.

Main Findings

Phase 1: the second version of the DRAF, which was drawn from the consensus group discussions, was deemed face valid by the dentists.

Phase 2: the absolute level of inter-rate reliability of diagnostic classification tool achieved regular to poor reliability level. When classifications differed in just one classification level, reliability ranged from good to excellent.

Phase 3: the general usability level of the diagnostic classification tool achieved an average mark of 79.16 out of 100.

Conclusions

The outcome of this study was the development of an improved and tested version of the *Dental Resource Allocation Framework*. It is concluded that the second version of the DRAF produced in this study demonstrates face validity, and its diagnostic classification tool achieved high level of usability according to its end-users, but did not reach the reliability level recommended by the WHO for epidemiological survey tools in dentistry.

Recommendations

It is recommended that the second version of the DRAF undergo other types of validity measures within evaluative primary care settings. Further calibration training on the proposed diagnostic classification criteria is indicated to dentists. In addition, specific usability measures should be taken in order to identify specific usability problems from the actual usage of the diagnostic classification tool in the "real world" of the Family Health Programme.

5. INTRODUCTION

"Comprehensive primary health care goes beyond interventions alone to include action in all domains, from prevention to treatment and rehabilitation, and incorporating behavioural, institutional, and social change."

(Legge et al., 2009)

A comprehensive approach to primary dental care comprises not only promotive, preventive, curative and rehabilitative activities to fulfill dental care needs of the population, but also includes a range of transformations in dental practice and beliefs. Standardized frameworks of timely allocation of human resources to primary dental services may support equitable provision of comprehensive dental care. However, such frameworks, which are applicable to primary care settings in Brazil, were not found. This study addresses the development and preliminary assessment of the "*Dental Resource Allocation Framework*" (DRAF) which was designed by the author of this dissertation to assist timely allocation of different streams of dental services in primary health care settings, particularly those settings covered by the Brazilian Family Health Programme.

The inclusion of wait time benchmarks for primary dental services in the design of the "*Dental Resource Allocation Framework*" is an attempt to bring about greater knowledge on the quality of access to primary dental care experienced by people living within catchment areas of the Family Health Programme.

This study was undertaken in Porto Alegre (1.4 million inhabitants), the capital of the Southern Brazilian state, Rio Grande do Sul.

The first chapter provides an overview on the national and local contexts, which motivated the development of the DRAF.

The following chapters report the research process, whose phases aimed at reaching the preliminary stages of a validation process of the proposed DRAF; particularly face validity, inter-rater reliability and usability of the instrument by dental health professionals in primary care settings.

The last chapters provide discussions and recommendation on the study results.

BACKGROUND

5.1 Brazilian Context Underpinning the Development of the DRAF

Apart from being a genuine human right, oral healthcare is an ongoing need across lifespan and is essential to ensure general health and well-being of individuals and populations (Bratthall *et al*., 2006). The right to healthcare has been recognized as a constitutional right of the Brazilian citizens since 1988 (Brasil, 1988). Because of the legislation currently in place in Brazil, the Brazilian Public Health System should provide universal and equitable access to comprehensive public health services. This has challenged public health planners and managers to implement the right to healthcare policy and to build accountability into the overall public health system, which provides health care services. Importantly, since 1990 the Brazilian Constitution also ensures that health service users take part in the financial and managerial decision-making process related to the public health system, at national, provincial, and municipal level within the legally mandated and participatory Health Councils (Brasil, 1990).

Despite having the largest economy in South America and a productive industry and agriculture, Brazil has faced great disparities in the social-economic status of populations across its regions (Instituto Brasileiro de Geografia e Estatística, 2005). Regarding income, Brazil shows one of the highest inequalities in the world as well as inequitable access to

social welfare services (SustainAbility, 2006). The oral health status of the Brazilian population is a further expression of such inequity. It has been demonstrated by the results of the latest epidemiological oral health survey, carried out in Brazil between 2000 and 2003 (Brasil, 2004c). The results showed an uneven distribution of the burden of poor oral health, with people from Northern areas faring considerably worse when compared to the Southern richer population. The prevalence of "free of dental decay" children under 12 years (Brasil, 2004c), for example, was found generally higher in the richest the regions of the country (Instituto Brasileiro de Geografia e Estatística, 2005).

Due to deep socio-economic disparities in Brazil, equity of access to public health care has been a particular challenge facing public health planners and managers. The waiting time for public health services associated with poor health status of selected population groups is a clear pressing concern in relation to the quality of access to public health care. In order to tackle inequities of access to public health services across the country, the Brazilian Ministry has implemented the so-called Family Health Programme as the strategic model to expand the coverage of primary health care services in Brazil (Brasil, 2004a).

5.1.1 Family Health Programme General Features

The Family Health Programme guidelines recommend that the programme catchment population should encompass a group of approximately 4,000 people living in a geographically defined area. Those people should be assigned to a Family Health Clinic, whose location should be placed within walking distance from person's house. The Family Health teams are accounted for providing comprehensive primary health care services to their catchment population. Each team generally consists of one general practitioner, one nurse, two nursing assistants, one dentist, one dental assistant, one dental hygienist and four to six community health workers.

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Once a Family Health Clinic is set up, community health workers start collecting data from those inhabitants living in the catchment area, by visiting all families. Community health workers enumerate each household, identify, and register every family member. They collect data about socio-demographic characteristics until the baseline information of that community is completed. Community health workers keep on visiting the families systematically as well as perform non-routine home visits when any special need is found. Thus, vital events such as new pregnancies, occurrence of illness, disabilities, etc can be routinely updated. This makes available to Family Health teams the knowledge on the characteristics of people at greatest risk for developing health problems and on the environment in which activities will take place. Based on such knowledge, Family Health teams can plan their activities, which should be developed under a comprehensive approach to primary health care (Brasil, 2004c).

5.2 Family Health Programme Performance

The coverage of the Family Health Programme reached 49.44% of the Brazilian citizens in October 2008, which is nearly 90 million people (Brasil, 2008). The Family Health Programme has indeed represented a more equitable approach for access to primary health care in Brazil, as demonstrated by its impact on infant mortality by decreasing deaths from diarrhoea in children (Macinko *et al*., 2006). However, recent evaluations have showed weaknesses in relation to the programme implementation due to both the non-homogenous manner used to integrate health professionals into the Family Health teams and the insufficient ability of the majority of health professionals to perform the Family Health Programme model (Gil, 2006, Roncalli and Lima, 2006). These authors argue that most health professionals working on the Family Health Programme do not have enough academic background on public health-related practices. Such results include dentistry staff as well.

Baldani *et al* (2005) have reported the need of an adequate professional profile of dentists for them to work in the Family Health Programme, while Oliveira and Saliba (2005) found in their study that dental services offered by the Family Health Programme has been basically limited to curative practices. Souza and Roncalli (2007) also identified problems faced by oral health teams of the Family Health Programme in changing the health care model to integrate epidemiological diagnoses, work evaluation and inter-sector activities as suggested by the Family Health Programme guidelines (Brasil, 2004c).

In addition, access to public health care services has become increasingly competitive, resulting in more and more popular pressure for public health services across the country. This has been demonstrated in the last few years by the great amount of appeals to justice courts for people to be provided with health care and medicines (Vieira, 2008).

5.3 Specific Context Motivating the Development of the DRAF

Between 2003 and 2004, health professionals working in Porto Alegre, Brazil, due to the implementation of a health intervention, the so-called "Projeto Acolhimento" by the municipal government, experienced particular pressure for public dental services. That intervention's goal was to increase access to public health care services at the primary care level by an "embracing patient scheduling" strategy. A similar strategy had been previously adopted by health authorities of Porto Alegre towards speeding up access to a number of elective surgeries, when practitioners, planners and managers (Municipal Health Department, 2001) participated in the review of both diagnostic practices, delegation of tasks and wait times for urgent treatments at the hospital level. Afterwards, by the implementation of the "Projeto Acolhimento", issues such as: (i) dental diagnostic practice and its influence in the waiting times for access to primary dental care and (ii) available human resources for undertaking promotive, preventive, curative and rehabilitative activities came into several

discussions among municipal health workers.

In fact, in a number of primary health care facilities across the city, the adoption of such "embracing strategy" resulted in increased demand for primary care services generally and for primary dental services in particular. Although such an increase was to some extent expected, dental teams were neither sufficiently prepared nor were they using appropriate methods to deal with that sudden demand. Further pressure was felt by the Family Health teams because of the additional guarantee of timely access to health care given to people registered to the Family Health Programme. Thus, local and district health service's coordinators in Porto Alegre were seeking for a suitable method able to identify what and when primary dental services were required by community members, so that Family Health Programme providers could improve their responsiveness.

Within such a pressing context, the DRAF was developed as a theoretical equity-oriented model for the allocation of human resources of the Family Health Programme across primary dental needs of community members. The DRAF's initial development was based upon a review of existing diagnostic classification tools for use in public dental services in Brazil (Moyses, 2002, Zanetti and Lima, 1998) and on the personal experiences of the author in her work as a public health dentist and manager. Afterwards, several colleagues from public dental services in Porto Alegre kindly reviewed the resulting draft framework for clarity and completeness. A first version of the *Dental Resource Allocation Framework* was then the subject to this study.

5.3.1 The First Steps of the DRAF Assessment

Aligned with the objectives of the Ministry of Health, the Municipal Health Department of Porto Alegre entered into a partnership in 2006 with a local stakeholder, namely Moinhos de Vento Hospital Association, to expand the coverage of comprehensive

primary health care in that city. Key aspects of the partnership agreement included the commitment of the Moinhos de Vento Hospital Association to (i) adopting the Family Health Programme model to deliver primary health care services and (ii) developing effective strategies to improve equity of access to its local health services.

Following this agreement, a working group of health professionals (among those the author of this dissertation) was established at the request of the Moinhos de Vento Hospital Association board with the purpose of addressing issues concerning equity of access to those primary dental services managed by that institution.

By analysing the appointment system in place within the primary dental services managed by the Moinhos de Vento Hospital Association, the working group identified that administrative staff was scheduling dental treatment under subjective and inconsistent criteria. In addition, dentists were not using uniform diagnostic measures to determine oral disease severity. Consequently, people seeking primary dental services might have been experiencing potentially unfair variations in waiting times for primary dental treatment; thereby inequities of access to primary dental care were likely occurring.

Thus, within the commitment of the Moinhos de Vento Hospital Association board to supporting research initiatives relate to equity access to health services, the *Dental Resource Allocation Framework* was subjected to a research process in order for it to be assessed in its viability for and applicability to the primary dental care level.

5.4 Operational Overview of the Dental Resource Allocation Framework

As highlighted earlier, the DRAF has been designed for use of the Family Health Programme. The DRAF consists of three inter-related component parts, which were tailored according to the Family Health Programme guidelines.

The DRAF was developed to guide a systematic process for the allocation of streams of

dental care in primary care settings, particularly those of the Brazilian Family Health Programme. An overview of the DRAF is depicted in the graph below. The three component parts of the DRAF are described afterwards.
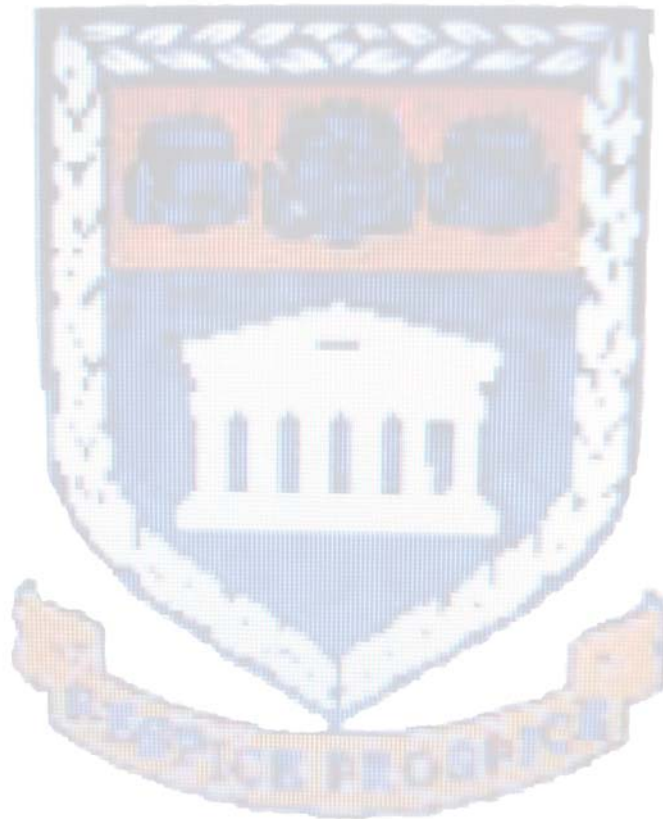
Graph 1: Dental Resource Allocation Framework: Version subjected to this study

Qualifying Oral Conditions (identified by visual diagnosis)	Streams of Primary Dental Care	Wait Time Benchmarks for Primary Dental Care by Family Health Programme Personnel			
		Community Health Worker Family Schedule	Dental Hygienist Group Schedule	Dental Hygienist Individual Appointment	Dentist Individual Appointment
Chronic dentally-related pain /discomfort Skin or mucous lesion needing further examination, relief of trauma, haemorrhage, swelling, medically compromised patients with a doctor's referral	E				≤1 day
Active deep cavity Fistula intra oral Severe dental mobility Residual roots and factors retaining dental plaque.	D		≤2 days		≤2 months
Active medium cavity Tartar Slight dental mobility Lateral cross bite	C	≤ 15 days	≤4 months	≤8 months	≤6 months
Partially erupted teeth Initial active cavities Dental plaque Active white spots	B	≤ 1 month	≤3 months	≤6 months	≤12 months
Filled teeth Sound teeth completely irrupted Controlled dental plaque Normal skin and mucous	A	≤ 2 months			≤18 months

5.5 Description of the Three Components of the DRAF

5.5.1   **A simplified diagnostic classification tool** for systematic data collection of the oral health status of people living in a given catchment area: this tool consists of five categories of the oral health status. Each category includes dental conditions usually encountered by primary care dentists in their daily practice. By proactively performing ongoing visual diagnostic classifications, dentists may categorize all primary dental care needs of the catchment population according to five different streams of dental care.

5.5.2   **A timeframe of a set of waiting time benchmarks for primary dental care**: those benchmarks represent the maximum length of time accepted for a diagnosed dental condition to wait for dental care across the respective stream of care, including the portions of the 'patient journey' through each stream. The benchmarks should represent the evidence-based timing required to prevent diagnosed dental conditions to deteriorate due to the waiting for care.

5.5.3   **Dental team of the Family Health Programme** (dentist, dental assistant, dental hygienist and community health worker) which job descriptions, once gathered together, include the provision of comprehensive primary dental care (promotive preventive, curative and rehabilitative activities), (Brasil, 2006). According to the Family Health Programme guidelines, comprehensive primary care can be approached either in individual, collective or on a family basis. Such an approach has been recommended by the National Policy on Oral Health as a key strategy for the delivery of dental services in primary care settings (Brasil, 2004b). For this reason, within the DRAF, all members of the dental team are ultimately linked to a defined diagnostic classification. By

delegating tasks according to their job descriptions, each member of the dental team is allocated to the correspondent stream of care.

5.6 Description of the Functioning of the DRAF

By linking its three components, the framework addresses the three principles of the Brazilian Public Health System:

Universal access (Component 1): all members of the catchment population are included in a lifelong oral health care through a continuous diagnostic classification process. Jaw quadrants are classified by clinical normative assessment into five categories. Even containing several conditions belonging to different categories, the most urgent dental care need will define the most appropriate stream of care for each jaw quadrant. Diagnostic categories, from A to E (Graph 1), include the wide range of primary dental care needs. Classification codes (A, B, C, D, or E) are assigned by the dentist to every jaw quadrant firstly at the baseline and subsequently throughout the dental care process according to the dental care needs remaining within the catchment area.

Equity access (Component 2): evidence-based waiting time benchmarks will underpin an equity-oriented dental appointment system for jaw quadrants to receive quality dental care. Equity access is further improved when jaw quadrants instead of individuals are classified. For example, two individuals whose four quadrants are classified as AAAD (individual 1) and DDDA (individual 2). As individuals both of them would have been classified according the most urgent dental care need as "D" and would compete for the same stream of dental care. As quadrants, both individuals will be assigned to different streams according to their burden of disease.

Comprehensive approach to health care (Component 3): by streamlining Component 1 and Component 2 towards members of the dental care team, according to their

suitability for performing rehabilitative, curative, preventive and promotion activities, the framework encompasses all elements of a comprehensive primary dental care.

The components of the DRAF described above formed the basis for this study. Equity access to primary dental services was selected as the focus area and efforts were made to reach a preliminary assessment of the proposed framework.
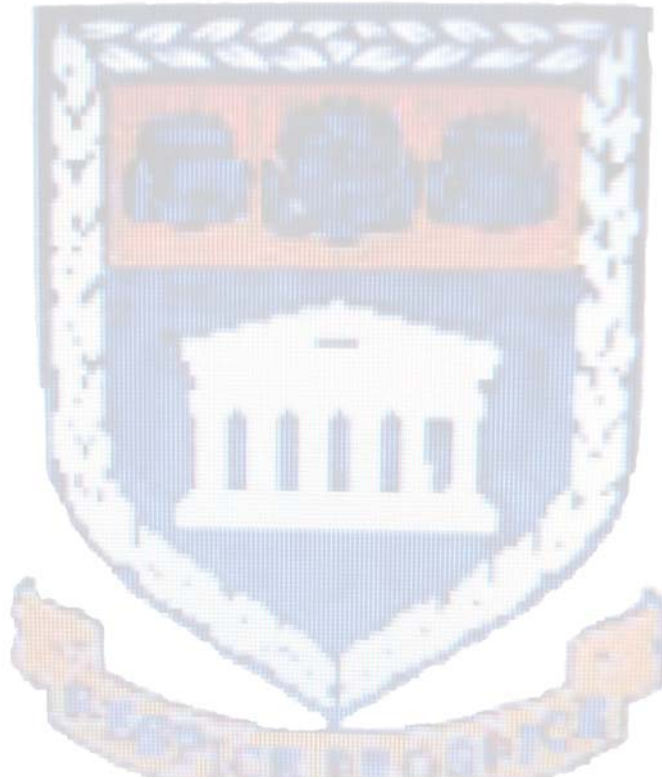
6. PROBLEM STATEMENT

Increasing demands for public dental services and unacceptable inequalities in the oral health status in Brazil (Brasil, 2005), have required the development of innovative strategies to improve access to comprehensive oral healthcare. The rationale for conducting this study was to verify whether the proposed DRAF is a viable option for the Family Health Programme.

To date, there has been no information on the viability of adopting the proposed DRAF to guide timely allocation of human resources across dental care needs within Family Health Programme catchment areas. Hence, one does not know whether such a framework is worth implementing and applicable to primary care settings since its components were not tested for usability, reliability, and accuracy.

In a context of evidence-based public health interventions, it is important to investigate whether the proposed framework is a viable option for dental resource allocation planning, before its implementation within Family Health Programme settings.

The Purpose of this study was to contribute to improving equity of access to primary dental services within Family Health Programme catchment areas by developing and testing the validity and applicability of the *Dental Resource Allocation Framework* (DRAF) to Family Health Programme settings.

7. LITERATURE REVIEW

One reviewed the literature to identify the key concepts, which underpinned the development of the *Dental Resource Allocation Framework*. One also searched for suitable methodologies for a preliminary validation process of the DRAF. In this chapter, one explores other researchers' views around primary care diagnostic research; particularly those studies on the development of diagnostic classifications tools and their relation with waiting times benchmarks for health services.

The literature review is divided into seven sections. The first section provides a brief overview about definitions and common understanding about equity of access to healthcare. The second section discusses diagnostic assessments in dental primary care. It also provides a brief insight into the definitions of health needs assessments. The third section covers the concepts of 'access to health services' and 'waiting times benchmarks'. It briefly explores the issue of barriers of access to health care from the demand and supply side and the strategies for managing waiting lists for selected health services. Section four reviews the Brazilian experience in implementing intervention programmes for improving access to public dental services, in which classification schemes were adopted for categorizing individual-level dental status. Section 5 describes the Canadian research experience on waiting lists for hospital services in the Western Canada. The methodological approach adopted in the "Western Canada Waiting Lists Project" inspired the methodological steps taken for assessing the DRAF in the present study. The sixth session reports on a further Canadian project for the management of waiting lists for hospital services, in which pediatric dentists from the "Hospital for Sick Children" developed diagnostic classification tools to qualify children dental conditions for access to dental treatment under general anesthesia. The last session, session seven, describes the definitions of usability and the available techniques

to test usability attributes of products. This session reports on the view of some authors who consider usability as a critical attribute of diagnostic tools.

A short summary on the implications of the literature review for this study is included at the end of this chapter.

7.1. Equity of Access to Healthcare

In the literature, the concept of equity of access to healthcare has been widely discussed and defined in different ways. Creese (1998) defines equity as a measure of the distribution of social, economic and cultural resources, which can be measured in terms of outcomes, or it is concerned with equity of access. Although little consensus is found on the literature on how "equitable access" can be defined and measured (Creese, 1998), most definitions have agreed upon a common point, in which equity of access to health care is the fair distribution of health services among competing needs of individuals or groups of individuals (Mutirua and Kapenambili, 2007). The public health literature generally agrees that equity of access is the utilization of health services by all those who actually need them.

As equity of access to health care may contribute to achieving equity in health, it is worth mentioning some definitions of equity in health. According to Whitehead (1990, p.7) equity in health "implies that ideally everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that no-one should be disadvantaged from achieving this potential, if it can be avoided." The International Society for Equity in Health (ISEqH) (2001) provided a further definition in which equity in health is "the absence of systematic and potentially remediable differences in one or more aspects of health across populations or population groups defined socially, economically, demographically, or geographically." Two main forms of health equity were identified: vertical equity and horizontal equity. Vertical equity is to provide people in greater needs of health services with

preferential treatment, and horizontal equity implies equal treatment for equivalent needs (Macinko and Starfield, 2002).

For the purposes of this study one adopted the definition agreed during the International Forum on Common Access to Health Care Services, held in Stockholm, in 2003, in which it was decided that equity for the healthcare should be considered "equal access to health care for those in equal need" (Oliver and Mossialos, 2004). In view of the assumption that universal access to health care is assured to people assigned to the Family Health Programme, factors such as location of residence, gender, age, or income do not play a determinant role in selecting those who receive or not primary dental care (Brasil, 2004c).

7.2. Health Needs and Diagnostic Assessments in Primary Dental Care

Bradshaw (1972) proposed to describe health needs from three broad concepts: "normative needs," determined by professionals; "felt needs," determined by self-assessment; "expressed needs," a felt need expressed by the request for assistance. According to Al-Jundi (2006), the understanding on health needs is critical for health service planning and management. Gherunpong, Tsakos and Sheiham (2006) recommend that, due to the contemporary concepts of health and well-being, health care needs should not be limited to clinical diagnostic assessments, but determined by a combination of methods using both clinical and subjective measures. Although recognizing that by conventional normative assessments alone, dental treatment needs are usually overestimated, Gherunpong, Tsakos and Sheiham (2006) argue that it would be unethical not to integrate normative assessments in the estimation of oral health needs.

Beltran, Malvitz and Eklund (1997) recommend that diagnostic classification methods should be developed in such a way as to match public health requirements for simpler and

less costly tools, which could routinely measure the extent and severity of disease (Beltran *et al.*, 1997). Gooch, Griffin and Malvitz (2006) argue that innovative methods for classifying oral disease severity must demonstrate credibility among the dental profession, and produce data easy to be understood by communities and non-dental decision makers. The Family Health Programme guidelines recommend that dental needs of community members should justify the allocation of human and material resources for primary dental services according to demonstrable needs rather than based on socio-economic status (Brasil, 2004a).

Brennan and Spencer (2005) have studied dentist-related factors influencing the pattern of dental service delivered. They found that treatment choices derived from different diagnostic criteria had been among factors influencing patterns of dental service delivery. Summerton (2000) emphasized the need of research focusing on the development of diagnostic methods and tools applicable within primary care settings, which are valid and reliable among general practitioners (GPs). He referred that diagnostics decisions made by GPs are different from those made by specialists due to the unselected nature of communities seeking primary health services. Hence, diagnostic research must be specifically designed to assist those GPs in their decisions concerning the sort of patients they usually treat at primary health care facilities (Summerton, 2000). This implies that, at the primary health care level, early decisions on the appropriate course of action are more important than those accurate diagnostic labels made by specialists (Summerton, 2000). This is because GPs' diagnostic primary objective is to identify a specific clinical qualifying condition (or a cluster of conditions) with high discriminant ability among patients seen in general practice. For this reason, Summerton (2000) recommended that, in validation studies of primary health care-related diagnostic methods, gold standards should be concerned more to the course of actions than to clinical diagnosis.

7.3. Access to Health Services and Waiting Times Benchmarks

Access to health care is a multidimensional concept, which includes physical, communication, attitudinal, cultural and information aspects of both supply and demand sides (Ensor and Cooper, 2004). Regardless of the definition of need, a number of factors may prevent people in need of healthcare from accessing health services. Ensor and Cooper (2004) argued that those factors must be analysed from both the supply side (factors derived from health care production) and the demand side (factors derived from barriers preventing patients from accessing health services). They mentioned that sometimes supply and demand factors might interact thereby influencing either positively or negatively the access to healthcare. They pointed out the issue of 'quantity rationing' as one example of barrier to healthcare access caused by the interaction between demand and supply. Quantity rationing may lead to inequities of access to healthcare due to excessive length of time people may have to wait to access medical staff (Ensor and Cooper, 2004).

The definition of 'waiting times' has not been consistent among researchers and policy makers in different countries. Generally, an evidence-based benchmark is a goal that expresses by clinical evidence the appropriate amount of wait for the provision of a particular health service. Jackson, Pederson and Boscoe (2006) refer to waiting times as "the length of time it takes people to access diagnostics and specialist treatment services. Postl (2006) defines a waiting time as commencing with the booking of a health service and ends with the commencement of the service. Fogarty and Cronin (2008) defined the waiting time for health care as the gap between identification of a health condition and its diagnosis and treatment. The National Health Services Scotland (National Health Services Scotland, 2008) defines wait time as the time between the request of a specialist consultant or surgery from the general practitioners and the outpatient or hospital appointment. The National Wait Times Strategy in Canada defines different kinds of waiting that may occur from initially noticing

health problems to getting appointments to primary care providers, specialists or the needed rehabilitation or other hospital-level service. In the context of this study, waiting time benchmark refers to the maximum length of time for a diagnosed dental condition to not deteriorate while waiting for the first appointment in the appropriate stream of dental care.

The issue of timely heath care has received increased attention from public health policies and this has stimulated a number of studies related to the management of waiting lists for access to health services in various developed countries, such as Canada, Australia, United Kingdom and New Zealand. However, the management of waiting lists for hospital or specialist outpatient services has received greater attention in the literature than that for primary care services. Regarding primary dental services, the only study addressing waiting time benchmarks for general dental treatment was found to be a not yet published PhD thesis conducted by Dr. Kelly Jones from the Australian Research Centre for Population Oral Health (Personal communication, Dr. K. Jones, 30th May 2008) (Jones *et al*., 2008). In her study, dentists from community dental clinics judged if dental treatment was a priority (it should be provided before six months) or was not a priority (it could be provided after six months). Dentists' judgements were considered the 'gold standards' for determining priority access to dental care, against which patients' self-reported priorities were validated. However, according to Jones (2008) consistency of dentists' judgements was not tested, which might have affected the validity and generalisibility the study results.

7.4. Diagnostic Classification Schemes in the Brazilian Primary Health Care

One found in the literature the reports from Zanetti and Lima (1998) and Moyses (2002) describing intervention programmes for priority access to dental services. In both

reports, the adopted classification schemes were intended to help guide decisions on preventive or curative course of actions in dental primary care services. Zanetti (1998) reported an intervention at Planaltina, a municipality of Greater Brasilia, where a classification system was implemented with the intent of ranking, using a point system for local families according to their need of curative dental treatment. Throughout that intervention programme, subsequent access to appointments for dental services was allowed, according the points attributed to each family (Zanetti and Lima, 1998).

The other intervention was that of the local health authority of Bairro Novo in the city of Curitiba, Brazil, where a ranking system was implemented to organize access, giving priority to those individuals with the most urgent needs for dental treatment (Moyses, 2002). In that programme, the degree of dental decay and periodontal disease was assessed by means of the "Disease Assessment Tool" which classifies the level of disease in terms of high or low risk. The tool was applied to pre-selected groups of families just after dentists had defined and agreed on the evaluation criteria. Oral examinations were carried out in the homes of the families, under natural light, without mirrors, and with the use of disposable tongue depressors. Those classification schemes were intended to help guide decisions on preventive or curative course of actions in dental primary care services.

From both interventions, one could learn about diagnostic methods used under epidemiological conditions, where easy-of-use data collection tools made available timely information on the oral health status of a greater number of community members. Unfortunately, those publications were limited to descriptions of both administrative and clinical course of actions without reporting results on the consistency of the diagnostic classifications or on the validity of the diagnostic criteria adopted.

More recently, the Oral Health Department of the city of Sao Paulo has established a set of criteria for organizing the access to dental services by categorizing individual risk for

dental caries, periodontal disease, and soft tissues lesions (SMS-SP, 2006). Such categorization allows that health professionals can take appropriate course of action for treating different oral health care demands until each individual dental treatment is completed.

7.5. Assessment of Diagnostic Tools in the Canadian Waiting Lists Project

A major ongoing project in Canada has involved various organizations in the development and validation of scoring diagnostic tools for prioritizing patients on hospital waiting lists (Noseworthy *et al.*, 2003). In its first stages, the Canadian project adopted consensus group activities in which health authorities, medical association members and researchers were brought together to develop and validate diagnostic classification tools (Noseworthy *et al.*, 2003). Because, at that stage, no gold standard existed for diagnostic priority across Canadian waiting lists, the adoption of face validity technique was deemed sufficient evidence for the implementation of the diagnostic tools in further evaluative settings. The Canadian Waiting Lists project also tested reliability of clinical examinations by applying the diagnostic tools in a series of consecutive patients who attended the participating hospitals. Usability of those newly created diagnostic tools was a further concern in the Canadian project. They tested usability through qualitative and quantitative methods of data collection.

7.6. Development of Criteria for Access to Dental Hospital Services

Casas *et al* (2007) report in an ongoing study in The Hospital for Sick Children, in Toronto, the development, validation and the implementation of a prioritization system for children who require dental treatment under general anesthesia. In the development of that

prioritization system (a 6-level scale of priority), medical and dental conditions were listed, paired and classified by three pediatric dentists according to the potential effect of children's dental diseases on their medical status. By consensus, those three professionals defined and validated criteria for maximum acceptable waiting times for dental treatment according to each health condition. The authors argued that since no evidence on the validity of maximum waiting time benchmarks has been published, face validity should be adopted as a first approach to investigate priority access for dental treatment in that hospital (Casas *et al*., 2007). A reliability test was also used to evaluate of that priority scale.

7.7. Usability Attributes of Diagnostic Tools

The term usability has been used for the last ten years with the intention to supplant the term user-friendly due to its vague and subjective definitions. However, there remain several views of what usability means and how it should be measured. Bevan, Kirakowski and Maissel (1991, p.4) states that "usability lies in the interaction of the user with the product or system and can only be accurately measured by assessing user performance, satisfaction and acceptability". These authors refer to three approaches to measuring usability: product-oriented view (product attribute measures), user-oriented view (user mental effort and attitude measures), and user performance view (the easy-of-use and acceptability measures). Brooke (1986) argues that usability is a context-specific test. Thus, it is not always possible to make comparison on usability of a product or system across different contexts. However, this author indicates some broad general measures that can be applied to usability tests across a range of contexts. Brooke (1986) suggests that measures of usability should include (i) the ability to complete tasks by using the system, and the quality of the output of those tasks, (ii) the level of resource consumed in performing tasks and (iii) users'

satisfaction in using the system. Brooke (1986) validated a score for general usability attributes of systems/products in different contexts. Such a score is the result of a self-completed structured set of questions from which one can find preliminary evidence on the acceptability and the ease of use.

A review of the literature shows a number of usability studies performed on medical diagnostic tools. Usability studies done on dental diagnostic tools used in primary care diagnostic research are less apparent. One found a usability study conducted in the United Kingdom (UK) by Burke *et al* (2003), in which the researchers designed a diagnostic scoring tool (named Oral Health Score) and then assessed its usability attributes. These authors argue that usability is a critical attribute of diagnostic tools. In their study, primary care dentists used the Oral Health Score for a period of one year. After this, by sending semi-structured questionnaires to dentists, the Oral Health Score was tested for its usability in the specific context of the UK primary dental services.

7.8 Implications of the Literature Review for this study:

The objective of the DRAF is to assist the planning of equitable access to primary dental services by the identification of the necessary amount of human resources for responding people's differing dental care needs. As such, whether the allocation of human resources is measured relative to individual dental needs, it is more likely that unfair variations in health outcomes are uncovered. Hence, the adoption of a clear definition of 'equity of access to healthcare' is an important requisite for evaluating the DRAF's performance.

The identification of those dental care needs that are unfairly distributed amongst community members is a major concern of the DRAF. For the reason, the DRAF must be

assessed in its capacity to (i) identify the differential degree of clinical dental care needs amongst individuals living in the Family Health Programme catchment areas, (ii) be an easy-of-use, and not costly tool, and (iii) produce reliable and valid data that are understood not only by health professionals but also by communities and non-dental decision makers.

In sum, the review of the literature helped to identify a preliminary approach to assessing the viability and applicability of the DRAF.
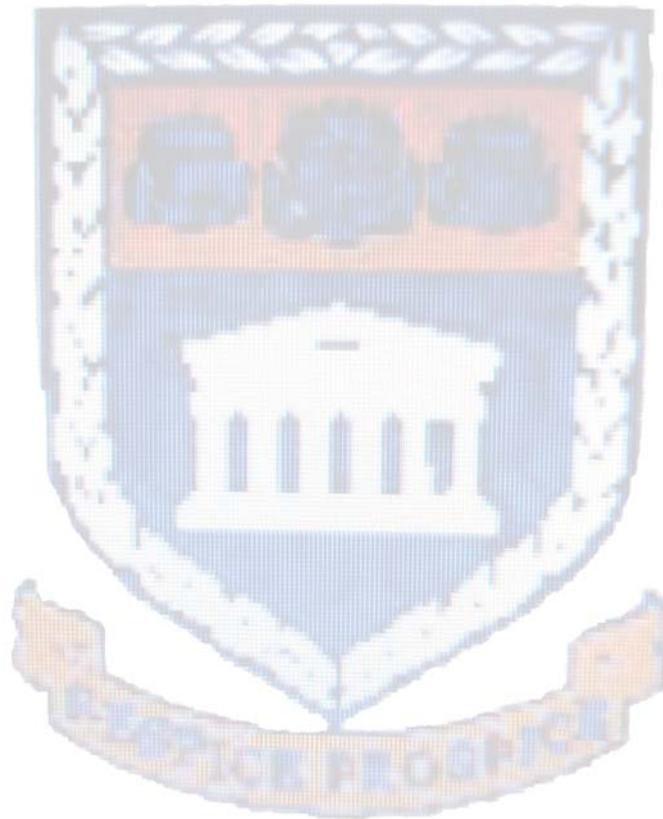
8. AIM OF THE STUDY

The aim of this study is to conduct the preliminary assessment of the *Dental Resource Allocation Framework* (DRAF) in a primary health care setting.

8.1 Objectives of the Study

1. To determine face validity of the *Dental Resource Allocation Framework*

2. To determine inter-rater reliability of the proposed diagnostic classification tool

3. To determine usability of the proposed diagnostic classification tool.

4. To make recommendations on the study findings to the Moinhos de Vento Hospital Association board.

9. METHODOLOGY

STUDY DESIGN

The overall methodology was developed under a validation study design.

a) Rationale for use of a validation study design:

The evidence-based practice in public health recommends that any new measurement method be validated before its implementation (World Health Organization, 2003). Moreover, the use of psychometrically sound instruments or tools is a prerequisite for assuring valid study findings (DeVon *et al*., 2007).

The right to health care approach and equity access to healthcare approach are two major reference points for the conceptual framework used in this study, as both of them are the legal understanding of the citizenship experience in Brazil. Access and equity are defining principles of human rights legislations and social policy practices.

The 1990 Public Health Act in Brazil (Brasil, 1990) gave reference to the Brazilian citizens' right to universal access to public health services, i.e., the right to being treated regardless of age, religion, education, income or cultural background.

The legal context in Brazil, underpinned by the Brazilian Law, informed the decision of undertaking a preliminary assessment of the DRAF under a construct-oriented validation process. According to Trochim (2006), construct validity is an "overarching category," which is appropriate for structuring the initial key set of questions, when a previously defined construct exist.

For the purpose of this study, the Brazilian health-related legislation is the underlying construct against which the performance of the DRAF should be validated; in which

Universality, Comprehensiveness, and Equity are indivisible guiding principles in the process of population health development.

a) Scope of the Study:

By undertaking a face validity test, a reliability test and a usability test, the scope of this study aimed to cover the preliminary stages of a validation process of the DRAF

i) Face Validity

It is important to acknowledge the exploratory nature of this study, as there is a lack of knowledge on evidence-based benchmarks for primary dental services. Reliance on expert opinions was necessary at this stage, as there are no established guidelines on the allocation of human resources of the Family Health Programme according to wait time benchmarks for primary dental services. For this reason, in the present study, the validity of the DRAF was established through on a non-empirical method, namely face validity. Face validity is a type of inferred validity in which validity relies on intuitive judgment based on current understanding of the subject being assessed which might provide the theoretical basis for other types of validity undertaken in 'real life' (Trochim, 2006). Although other validity types, such as: predictive validity, concurrent validity, convergent validity and discriminant validity are steps required to answer whether the DRAF is worth adopting, they were not included in the scope of this study for two reasons. Firstly, because those validation processes require a number of performance behaviours and expected outcomes that need to be measured over many years, and this would take longer than the time available to conduct this master degree research. Secondly, the resource available to conduct this study covered just the preliminary steps of the assessment of the DRAF.

Consensus group was the technique adopted for determining face validity. Consensus

group is an alternative research technique, proposed by Dennis List in the late 80s (List, 2001) to be used when researcher seeks similarities rather than differences. This author argued that consensus group leads to synthesis rather than analysis. In this study, consensus group was considered the appropriate technique for determining face validity firstly because it made possible for participating dentists to negotiate and decide the findings. This would not be the case if one had chosen focus groups for example, because in focus groups the moderator or the analyst decides the outcomes (List, 2001). Secondly, consensus group technique has been indicated in formative research and in preliminary data collection (List, 2001). Thirdly, this technique is applicable whether an underlying agreement already exists. The underlying agreement underpinning this investigation was the Brazilian Law regarding access to public health services. As recommended by List (2001), participants must set themselves a criterion level of agreement to be met in consensus group activities. This author states that usually the level of agreement is set around 75%.

ii) Reliability

This study also addressed reliability of the diagnostic classification tool. Fyffe *et al* (2000) have argued that reliability (examiners agreement) can be used as a proxy for accuracy because no true "gold standard" is available in dental examinations conducted under epidemiological conditions. Furthermore, it is important to determine reliability as it is a pre-requisite to validity; hence, it is a necessary component in the validation process (DeVon *et al*., 2007). Reliability also produces trustworthy data and allows comparability with other studies (Fyffe *et al*., 2000, McDonald, 2002).

iii) Usability

Usability test was chosen in order to raise further evidence on whether the diagnostic

classification tool is applicable within the Family Health Programme context. Usability is in principle a user-centred research (Bevan *et al*., 1991). By testing usability, it was possible to examine the easy and quick it is for dentists to apply the diagnostic classification tool and to look at potential usability problems. By incorporating end user's feedback into the validation process, improvements in the diagnostic classification tool could be made before its implementation.

METHOD

a) Ethics:

The procedures started after the Ethics Committee of the Education and Research Institute of the Moinhos de Vento Hospital to the 196 Resolution of October 10, 1996, National Health Council, which refers to participation of human beings in research, have approved the project. Ethics clearance was also obtained from the University of the Western Cape's Senate Research and Ethics Committee.

i) Study phases:

Research methods involved a three-stage process, each one conducted according to its particular methodological features. It was adopted a quantitative approach to measure both qualitative and quantitative data collected within the limits of resources across the study phases.

In the first phase, face validity of the DRAF was determined. In the second phase, reliability of the diagnostic classification tool (DRAF's first component) was determined. In the last phase, usability of the diagnostic classification tool was tested. Detailed description of the three study phases is provided in the next session.

ii) Study Population

The study population included dentists currently working at the primary health care facilities managed by the Moinhos de Vento Hospital Association in Porto Alegre. Although there are other professional categories in the oral health teams, such as dental assistants and dental hygienists, they were not included for the purpose of this study.

iii) Sample Size / Sampling Procedures

The Moinhos de Vento Hospital Association currently runs three primary health care facilities. Since one dentist works in each facility, the study population included three members. In view of the small size of the study population, sampling procedures were not necessary, as all its members were invited and accepted to participate in this study.

iv) Target Population

The target population was the population assigned to a Family Health clinic located in an urban area of Porto Alegre, which is currently managed by the Moinhos de Vento Hospital Association.

Sampling procedures of the target population are described in the reliability study session.

9.1 First Phase: Determining Face Validity

Study design: face validity

Method: Face validity of the DRAF components was assessed in three confirmatory consensus groups.

The face validity phase started with the clarification of the DRAF's main objective,

when such framework relates a diagnostic classification system in oral health to a set of acceptable wait times for primary dental services and to a set of working categories.

During that exploratory stage, consensus group participants were dentists working in primary care clinics, due to their expertise in the provision of primary dental services. In the consensus group sessions, dentists developed an understanding on the concept of equity used in this study. They modified the items included in each diagnostic category, based on their utility for monitoring equity of access to primary dental services.

By sharing their professional experience, they aimed to gather valid knowledge on the salient dimensions of access experienced by communities living in the Family Health Programme catchment areas. That research process was inductive and flexible in allowing consensus to emerge out of the discussions.

Data collection procedures:

In the first meeting, participating dentists set in 66.67% the level of agreement to be achieved by the end of the consensus group discussions..

The first version of the DRAF was presented to participants in printed document. The dentists examined the whole framework, discussed its content, and modified its items so that the framework reached a reasonable clinical sense, giving their current knowledge and understanding on the content of, and relationship between, the three component parts of the DRAF.

<u>Data collection instruments</u>

By the end of the third session, a second version of the DRAF emerged because of the dentists' consensus. The author of this study took notes of the modified items.

<u>Analysis:</u> there was no statistical analysis in this phase. A description of the modified items within each component part of the DRAF is provided in the next chapter.

9.2 Second Phase: Determining Reliability

The reliability study involved clinical assessments of the oral health status of a sample of Family Health service users. Inter-examiner reliability was measured upon diagnostic codes determined by dentists while using the proposed 5-level diagnostic classification tool. Clinical criteria for each classification level had been validated in the first phase. The primary measure used was that of the most urgent clinical need observed in each jaw quadrant. Once classified, quadrants are qualified to undergo one out five streams of primary dental care.

Previously to the reliability test, the diagnostic tool was pilot-tested in a calibration exercise. In order to avoid measurement bias, a calibration exercise was undertaken to standardise dentists' judgement about diagnostic thresholds in accordance to the criteria established in the first phase.

Calibration Exercise

<u>Study Design</u>: Cross-sectional Pilot Study

Method: the pilot study was conducted in order to gain insight into the ability of examiners to consistently perform diagnostic classifications related to the oral health status. It consisted of a calibration exercise (first round examinations) and a preliminary reliability testing of the diagnostic classification tool (second round examinations). Participating dentists underwent a practical training to ensure that in the next study phase (the reliability study) they would increase consistency in recording their findings. During the calibration exercise, dentists had the opportunity to discuss to each other on the diagnostic thresholds. When their observations differed, the oral exam was repeated and a consensus decision made. Soon after the training, dentists performed oral examinations without discussing their findings in order to preliminary test their diagnostic consistency. The diagnostic classifications were reported according to the most urgent clinical need of the jaw quadrant.

Sampling of the target population: users from different age groups who spontaneously arrived at a Family Health clinic were invited and consented to undergo oral examinations. The sample size of the calibration exercise was limited to 16 people (64 jaw quadrants), because after discussing about those 64 cases, participating dentists felt confident enough on their diagnostic consensus. A minimum of 20 cases has been indicated for calibration exercises in dental epidemiological surveys (British Association for the Study of Community Dentistry, 2004). The next 25 people (100 jaw quadrants) comprise the sample size in the preliminary reliability test.

Data collection methods and procedures: All diagnoses were made according to the diagnostic criteria validated in the first phase. Oral exams were conducted under natural light, without mirrors, and using disposable tongue depressors. One pilot-

tested the data collection tools used to classify jaw quadrant status.

Reliability Study

Study Design: cross-sectional

Sampling Procedures of the target population: The target population comprised 3,840 people, who live in a Family Health clinic catchment area, located in an urban area of Porto Alegre. Eligible participants were the inhabitants living in the target area. All of them are assigned to the Family Health service. A series of consecutive people seeking general dental care was selected for the reliability test. As the data collection took place in an ordinary booking day, the number of people, who consecutively demanded dental treatment or dental review, determined the sample size. Thus, children accompanied by their parents and adults were invited to undergo oral exams as they arrived in the clinic. Such a convenience sample consisted of a series of consecutive 125 patients who consented to participate and whose ages ranged from zero to 73 years.

Data collection methods and procedures: As in the previous phase, dentists examined each person in sequence, under natural light, and using just disposable tongue depressors. However, in this phase, they did not discuss or exchange information about their findings.

Data capturing: data from the oral examinations entered on a ready-made form by the dentists themselves (Appendix 5). The completed data were captured in Excel and

imported into the Statistical Package for the Social Sciences (SPSS, version 16; SPSS, Inc, Chicago, Il, USA) for analysis. Data cleaning and duplicate data entry were carried out to assure data quality.

Analysis: the unit of analysis was the jaw quadrant. The reason for adopting the jaw quadrant as the unit of observation instead of using the individual mouth was that by classifying each quadrant one could obtain a more detailed picture about the population oral status. The degree of inter-observer agreement was estimated using the Kappa statistic as it has long been identified as a suitable test in the assessment of the level of observer agreement between examiners (Pinto, 2000). The criteria established by Landis and Koch (1977) were used to interpret Kappa values. According to these criteria, agreement can be considered excellent if the values are over 0.75; good, if they are between 0.59 and 0.74; regular, if they are between 0.40 and 0.58; and poor, if they are below 0.40.

9.3. Third Phase: Determining Usability

Study Design: Usability test

Method: the diagnostic classification system's usability was assessed by reporting dentists experience about the general usability requirements of the diagnostic tool while participating in the reliability study (second phase). Dentists were surveyed using an electronic file containing a self-completing questionnaire (Appendix 4). This questionnaire was designed by John Brooke, in 1986 and is considered a valid measure for general usability requirements (Brooke, 1986). Dentists were asked to respond on issues such as whether the classification

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tool was easy or difficult to apply and other strengths and weaknesses.

Data collection methods and procedures: dentists' responses entered into a five degree Likert scale, raging from 1=strongly disagree to 5=strongly agree. Data cleaning and duplicate data entry were carried out to assure data quality. If dentists felt they could not respond to a particular item, they were asked to mark the centre point of the scale (3=not sure).

Analysis: a quantitative analysis of dentists' responses was carried out to determine the usability of the classification system. A single number ranging from zero to 100 represented a composite measure of the overall usability, since individual items alone are not meaningful in this test (Brooke, 1986). To calculate the final score, one adopted Brooke's calculation as follows: to sum the score contributions from each item of the Likert scale, taking into account that those values range from zero to 4. For items 1, 3, 5, 7, and 9 the score contribution is the scale position minus 1. For items 2, 4, 6, 8 and 10, the contribution is 5 minus the scale position. Multiply the sum of the scores by 2.5 to obtain the overall usability value of the system.

10. LOGISTICS

This chapter describes how the logistics for this study was handled during the three study phases and the necessary steps taken for running the fieldwork.

Firstly, one drew up a preliminary implementation plan that outlined the general logistics needs and then discussed it with the Moinhos de Vento Hospital Association board, since that institution had committed to provide logistics support for this study in terms of human and material resources currently available in its primary health care facilities. That plan included all scheduled dates, personnel, office space, equipment and other operational logistics. One described times for initiation and completion of all study phases regarding training, sample selection and data collection as well as team members required for the fieldwork. The requirements of human and material resources included the following items:

Personnel	1 researcher (the author of this dissertation) 3 primary care dentists 2 field workers: dental assistants from the Family Health clinics Supervision for the group discussions and fieldwork kindly provided by the Brazilian supervisor of this dissertation
Transportation	Vehicle and fuel
Refreshments	During group discussions, training and fieldwork
Research supplies (for training, fieldwork, analysis, report writing, and dissemination)	Tongue depressors Stationary: paper, pencils (for all activities) Photocopies for consent forms, information sheets and data collection tools
Other expenses	No extra-payment for field workers and dentists since group discussions and fieldwork took place during the working hours of the Family Health clinics and all of them are current employees of the Moinhos de Vento Hospital Association
Administrative expenses	Receptionist support provided by staff of participating Family Health clinics

Once the Moinhos de Vento Hospital Association board approved the preliminary logistics plan, one contacted the coordinator of the primary care facilities and the participating dentists in order to explain how this study would be conducted. As soon as each dentist agreed to participate in the study, one asked for coordinator's permission for dentists to leave their workplaces in order to participate in the group meetings and field research.

The logistics plan was also discussed with the health personnel of its primary health care facilities, including the participating dentists. This allowed the researcher to have a clearer picture of the logistics issues involved in the daily working routine of those health facilities. The final logistics plan was outlined collectively with the staff and managers of the participating health facilities. It included setting up meetings with dentists, securing venue for the group discussions and choose the appropriate booking day for the oral exams.

Researcher met with facility staff to anticipate and resolve any difficulty in obtaining collaboration from community members during the oral exams. A preliminary meeting took place on the participating health facility two weeks earlier the booking day to plan and work out logistics for the study. The objective of those meetings was to facilitate planning for the resources and arrangements needed to conduct the fieldwork. Staff who wished to be part of the field activities joined the meetings. That group discussed ideas on how to better arrange the logistics in a way as not to alter much the working routine at the health facilities. Researcher provided clarifications about the purpose of the study and the group came to a consensus about the location and materials for the oral exams. Logistics were discussed with participating dentists in particular to oversee the data collection process from the three study phases. A brief management plan was then agreed to indicate who would be responsible for field operations, such as welcoming community members and explaining the research and collecting the consent terms.

Selection of the Field Team

The recruitment process started during the meetings with the health services' staff. The researcher, assisted by the Brazilian supervisor of this dissertation, selected staff members, including two more than needed for the fieldwork, and provided them with brief training for the preparation and distribution of tasks. A few additional selected staff allowed leeway to replace workers who could later quit participating or who become ill.

Training of the Field Team

Researcher conduct a brief training so that staff could become familiar with the background and general issues related to the study. One brought them all together for an overview session in which materials were distributed, including an outline of the study, its objectives, format, schedule, and a reference document on oral health policy. The training session was highly participatory, in which the researcher covered topics related to the expectations of field staff regarding their attitudes and responsibilities as well as the supervision of the fieldwork. Trainees discussed all logistical arrangements and field conditions for a successful fieldwork.

The dental assistants took responsibility of welcoming groups of participants and collecting participant's consent, after the explanation of the study provided by the researcher. Due to their familiarity with local languages and cultures, dentists and dental assistants could make suggestions on improving efficiency in the implementation of the fieldwork.

Fieldwork

The researcher coordinated all field logistics, including field access at health facilities.

The Brazilian supervisor of this study participated as volunteer observer in the group discussions and provided close and supportive supervision to field activities, both in the calibration exercise and reliability study. He also followed the data collection process in the first phase, including the three sessions of group discussions, in order to testify the validity of the process. During the oral exams, the Brazilian supervisor offered suggestions for improvements in the quality control of the data collection process such as to provide patients with a number stuck in their clothes. That simple and easy to adopt procedure was highly useful and ensured that scores given to patients matched with the numbers in the data collection forms, thereby decreasing inconsistencies. This also helped the researcher to collect the consent forms.

The researcher contributed to field supervision in order to ensure the conditions for the staff and dentists to approach and examine patients in an effective and friendly environment. During and after the fieldwork, the researcher careful reviewed the data collected, as this was an important determinant of data quality. The researcher also supervised the fieldwork to avoid any problems regarding the clarifications for patients about the exams being undertaken by dentists and to assure the collection of patients' consent form.

Conclusions

Logistics of this study went well and in accordance with the researcher's plan. The Moinhos de Vento Hospital Association supported the study's total expenses, including human and materials resources and supplies.

11. ETHICAL CONSIDERATIONS

The study protocol was approved by the institutional ethical committee of the University of the Western Cape, Cape Town, South Africa and by the Research Committee of the Moinhos de Vento Hospital Association, Porto Alegre, Brazil.

This study was conducted in accordance with the PAHO Ethical Guidelines for Research Involving Human Subjects (Pan American Health Organization and World Health Organization, 2007). The researcher agreed to conduct this study ethically and in accordance with the rules regarding ethics in health research published by the Brazilian National Health Council (Brasil, 1995).

All patients and health professionals who accepted to participate in this study were asked to sign an informed-consent form, shown in Appendix 2. Additionally, an information sheet was given to every participant in the three study phases. The information sheet is shown in detail in Appendix 1 and its major items are described below:

1. The purpose of the study.

2. All information given by the participants during the research process is kept anonymous.

3. Participation is voluntary.

4. No individual is identified in the research report.

5. There are not consequences to those who refuse to participate in the study.

6. Any participant can withdraw from the study at any stage, and no reason is required.

7. Each participant may allow or not the use data collected from his/her mouth in the study.

8. The researcher protects the data from being uncovered, ensuring confidentiality.

9. The Family Health clinics managed by Moinhos de Vento Hospital Association is available to those participants who wish to undergo dental treatment.

12. RESULTS

First Phase: Face Validity Results

The results of this phase supports the face validity of the *Dental Resource Allocation Framework* (DRAFT), in view of the level of consensus achieved at the end of the consensus group sessions on the items included in each of the component parts of the DRAF.

The face validity of the DRAF was based on the results of the consensus groups discussions conducted with primary care dentists. Face validity for the DRAF components and their related items was established by submitting the proposed instrument to those expert dentists' judgment.

The health-related legislation in place in Brazil had represented the underlying agreement required for conducting the consensus technique. Thus, the DRAF should not represent a way of rationing dental care, but reflect a patient-centric approach for the allocation of primary dental resources. The DRAF should ultimately be validated against the public health-related principles of universality, comprehensiveness, and equity.

Based on such underlying agreement, dentists reached consensus on the items of the three component parts of the DRAF. Thus, dentists validated DRAF's theoretical ability to improve equity access by allocating human resources according to wait time benchmarks for primary dental services.

At the beginning of the consensus group technique, participating dentists had set the level of agreement at 66.67%. Thus, consensus was reached when two out of three participants agreed upon the inclusion, exclusion, or modification of any item of the DRAF.

In the three-session consensus group technique, the discussions were made around frequent issues encountered by primary care dentists in daily clinical situations, at which

scheduled primary dental services were being considered.

The next graph depicts the validated DRAF, whose items resulted from the consensus discussions. The researcher captured it at the end of the last discussion group session.

Graph 2: **Dental Resource Allocation Framework:** Second Version

Qualifying Oral Conditions (identified by visual diagnosis	Streams of Primary Dental Care	Wait Time Benchmarks for Primary Dental Care by Family Health Programme Personnel			
		Community Health Worker Family or Community Schedule	Dental Hygienist Group Schedule	Dental Hygienist Individual Appointment	Dentist Individual Appointment
Chronic dentally-related pain /discomfort Skin or mucous lesion needing further examination, relief of trauma, haemorrhage, swelling, medically compromised patients with a doctor's referral	E				≤2 days
Active deep and extended cavity Fistula intra or extra oral Severe dental mobility Residual roots and factors retaining dental plaque. Children / adolescents with face cross bite	D		≤2 days		≤2 months
Active medium cavity Tartar Slight dental mobility Open bite in young children Lateral cross bite	C	≤ 2 days	≤2 months	≤4 months	≤6 months
Partially erupted tooth Initial active cavities Dental plaque Active white spots	B	≤ 1 month	≤3 months	≤6 months	≤12 months
Filled teeth Sound teeth fully erupted Controlled dental plaque Normal skin and mucous	A	≤ 2 months			≤12 months

Brief Description on the issues discussed by dentists while determining Face Validity of the DRAF:

Consensus upon the first component (in blue):

In reviewing the concept of universality of access to dental services, dentists discussed how the DRAF could guide the delivery of primary dental care to all community members living in the Family Health clinic catchment areas. At this stage, dentists deeply debated on the extent to which normative assessments of dental needs and diagnostic classification methods may influence the quality of access to primary dental care. Based on

dentists' discussions, the items to be included in the five-level diagnostic classification tool were reviewed. Wording modifications were also considered. Oral health conditions usually encountered by primary care dentists were then confirmed or replaced into five diagnostic categories, namely: A, B, C, D and E. Consensus was reached regarding the items belonging to each category (shown above in blue in Graph 2).

Consensus upon the second component (in yellow):

In reviewing concepts of equity of access to primary dental services, dentists discussed ways of attempting to achieve fairness to the community they serve. They compared and contrasted methods of access to dental services, such as: "first-come-first-served", urgency, special merits and lottery. Dentists also discussed about what kind of response they would give if, for instance, a community member from the Family Health service catchment area had asked them: "Doctor, how long ought I (or my children) to wait for the dental services I (or my children) need?"

The group of dentists set out to establish theoretical evidence on the benchmark waiting times in the sense that access to dental care should be both timely and appropriate when clinical needs were normatively assessed.

Based on such discussions, dentists established a set of waiting times benchmarks for five streams of primary dental services (shown above in yellow in Graph 2).

Consensus upon the third component (in green):

In reviewing concepts of comprehensiveness, dentists debated about the involvement of Family Health teams other than just dentists in the delivery of primary dental services. They discussed the professional competencies of Community Health Workers, Dental Hygienists, and Dental Assistants and reviewed the role those health workers can play when

compared to dentists' role in the performance of rehabilitative, curative, preventive and promotive activities.

From their consensus, dentists established the linkage between all Family Health Programme professional categories and the wait time benchmarks for every primary dental service.

12.2 Second Phase: Reliability Results

After incorporating dentists' suggestions, the diagnostic classification tool was used to categorize patients' clinical data; thereby reliability was tested upon the diagnostic classifications. A survey was employed to assess levels of inter-examiner diagnostic agreement measured by Kappa statistics when dentists applied that tool. Kappa values were obtained using the Statistical Package for the Social Sciences (SPSS), version 16.0. The jaw quadrant was the unit of observation. Since each mouth can be divided in four jaw quadrants, each patient contributed to the sample with four quadrants. The jaw quadrant was adopted as the unit of observation instead of adopting the individual mouth, because in that way one can obtain a more detailed picture about the population oral status.

The distribution of the age groups according to those groups represented in the last dental epidemiological survey in Brazil was adopted (Brasil, 2004c).

Pilot Study Results

A two-round pilot study was conducted as to calibrate dentists' clinical judgments. Forty-six people from different age groups who arrived at a Family Health clinic were invited to participate in the pilot study.

The first round of the diagnostic classifications included a group of persons (n=16) who underwent oral exams. The level of agreement were not calculated in the first round,

because dentists discussed their findings while were performing the examinations.

The second round included a group of persons (n=25) who were examined without any discussions on the diagnostic classifications. This made it possible to take a preliminary measure of agreement between examiners.

Table 1 shows the demographic profile of the sample examined in the pilot study. It shows the number of people examined by age group in both first and second rounds.

Table 1: Number of people examined in the Pilot Study, according to age groups (n=41)

	Age groups								Total
	0-2y	3-6y	7-11y	12-19y	20-34y	35-44y	45-59y	60y+	
Number of patients in the first round	1	2	2	2	3	2	2	2	16
Number of patients in the second round	2	6	3	3	3	2	4	3	25

The table above (Table 1) shows the opportunities dentists had for calibrating their clinical judgment (first round) and to take a practical training on the use of the diagnostic classification tool (second round) across different age groups. This table shows that 41 persons were examined in the calibration exercise (pilot study).

The following three tables (Table 2, 3 and 4) depict the distribution of diagnostic classifications across five diagnostic categories, namely A, B, C, D and E, when 25 people (n=96 valid quadrants) were examined by three examiners. The underlined figures depicted in these three tables represent the number of quadrants who received similar diagnostic classifications by pair of examiners.

Table 2: Number of quadrants diagnosed by Examiner 1 and Examiner 3 across diagnostic categories A, B, C, D and E (n=96)

Diagnostic Categories		Ex_3					
		A	B	C	D	E	Total
Ex_1	A	13	8	1	0	0	22
	B	0	8	7	0	0	15
	C	0	1	22	4	0	27
	D	0	4	6	18	1	29
	E	0	0	0	0	3	3
	Total	13	21	36	22	4	96

Ex_1=Examiner 1   Ex_3=Examiner 3

Table 3: Number of quadrants diagnosed by Examiner 2 and Examiner 3 across diagnostic categories A, B, C, D and E (n=96)

Diagnostic Categories		Ex_3					
		A	B	C	D	E	Total
Ex_2	A	13	5	2	0	0	20
	B	0	11	4	0	0	15
	C	0	4	24	2	0	30
	D	0	1	6	18	0	25
	E	0	0	0	2	4	6
	Total	13	21	36	22	4	96

Ex_2=Examiner   Ex_3=Examiner 3

Table 4: Number of quadrants diagnosed by Examiner 1 and Examiner 2 across diagnostic categories A, B, C, D and E (n=96)

Diagnostic Categories		Ex_2					
		A	B	C	D	E	Total
Ex_1	A	18	3	1	0	0	22
	B	2	9	4	0	0	15
	C	0	3	17	7	0	27
	D	0	0	8	18	3	29
	E	0	0	0	0	3	3
	Total	20	15	30	25	6	96

Ex_1=Examiner   Ex_2=Examiner 2

In the three tables above one can see the total number of people who were diagnosed in each diagnostic category by examiner.

The next table (Table 5) shows Kappa values resulted from the diagnostic agreement between dentists in the second round examinations.

Table 5: Measure of diagnostic agreement between pair of dentists in Kappa values in the calibration exercise (n=96)

Pairs of Examiners	Level of Agreement Kappa	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
E1 * E2	0.575	96	96.0%	4	4.0%	100	100.0%
E2 * E3	0.643	96	96.0%	4	4.0%	100	100.0%
E1 * E3	0.561	96	96.0%	4	4.0%	100	100.0%

E1=Examiner   E2=Examiner 2   E3=Examiner 3

From those 25 people examined in the second round, a number of 100 quadrants were observed. However, only 96 cases were considered valid to calculate Kappa value. Four quadrants were missed in the data collection tools, because one examiner forgot to write down the data collected from one examinee.

The inter-rater agreement between pairs of examiners in the calibration training was satisfactory to good (Kappa from 0.561 to 0.643). The table above show that the highest level of agreement occurred between Examiner 2 and 3 (Kappa=0.643) and the lowest level of agreement occurred between Examiner 1 and 3 (Kappa=0.561).

When agreements between raters up to one diagnostic classification level were measured, Kappa values increased substantially. Such increase is shown in the next table (Table 6). If one takes, for instance, examiner 1 and 2, when examiner 1 classified a quadrant as "C" and examiner 2 classified the same quadrant as "B" or "D", such classifications were considered an agreement, because they differ in just one classification level. In this way, Kappa values in the table 6 show only those disagreements in more than one classification level. Taking the example above, if examiner 2 had classified the same quadrant as "A" or "E", then this result would be considered a disagreement between this pair of examiners.

Table 6: Measure of diagnostic agreement (up to one classification level) between paired dentists in Kappa values in the calibration exercise (n=96)

| Pairs of Examiners | Level of Agreement | Cases | | | | | | |
| | | Valid | | Missing | | Total | |
	Kappa	N	Percent	N	Percent	N	Percent
E1 * E2	0.985	96	96.0%	4	4.0%	100	100.0%
E2 * E3	0.940	96	96.0%	4	4.0%	100	100.0%
E1 * E3	0.927	96	96.0%	4	4.0%	100	100.0%

E1=Examiner   E2=Examiner 2   E3=Examiner 3

As mentioned above, Kappa values increased when one does not take into account differences between paired examiners in just one diagnostic classification level, in the calibration exercise. The increase was from 0.575 to 0.985 between examiner1 and 2, from 0.643 to 0.940 between examiner 2 and 3 and from 0.561 to 0.927 between examiner 1 and 3.

Reliability Study Results

The day after the calibration exercise dentists participated in the reliability study.

In a voluntary convenience sample, a consecutive series of 125 people living in a Family Health service catchment area, whose ages varied between zero and 73 years old, underwent oral exams.

There was no refusal among participants to undergo oral examination. The likely reasons for no refusals could be firstly that the oral exams were conducted in an ordinary booking day for dental services, i.e., people expected to undergo oral examinations. Secondly, because the three participating dentists currently work in that area and are well known by those community members.

The demographic characteristics of the sample examined in the Reliability Study are summarized in the table 7 below:

Table 7: Number of people examined in the Reliability Study, according to age groups (n=125)

	Age groups								Total
	0 -2	3-6	7-11	12-19	20-34	35-44	45-59	60 +	
Number of people examined	15	13	16	21	27	18	11	4	125

The above table demonstrates the different age groups, which were included in the sample in the reliability study.

The following three tables (Table 8, 9 and 10) depict the distribution of diagnostic classifications across five diagnostic categories, namely A, B, C, D and E, when 125 people (n=500 valid quadrants) were examined by three examiners.

As mentioned earlier, the underlined figures represent the number of diagnostic agreements between pair of examiners. The following three tables also show the total number of quadrants who were diagnosed in each category by examiner.

Table 8: Number of quadrants diagnosed by Examiner 1 and Examiner 3 across diagnostic categories A, B, C, D and E (n=500).

Diagnostic Categories		**Ex_3**					
		A	B	C	D	E	Total
Ex_1	A	<u>47</u>	55	34	30	0	166
	B	1	<u>89</u>	16	35	1	142
	C	4	13	<u>28</u>	53	0	98
	D	0	15	5	<u>63</u>	1	84
	E	0	1	1	1	<u>7</u>	10
	Total	52	173	84	182	9	500

Ex_1=Examiner   Ex_3=Examiner 3

Table 9: Number of quadrants diagnosed by Examiner 2 and Examiner 3 across diagnostic categories A, B, C, D and E (n=500).

Diagnostic Categories		Ex_3					
		A	B	C	D	E	Total
Ex_2	A	48	42	15	11	0	116
	B	3	91	23	15	0	132
	C	0	24	30	32	0	86
	D	1	16	16	122	1	156
	E	0	0	0	2	8	10
	Total	52	173	84	182	9	500

Ex_2=Examiner 2   Ex_3=Examiner 3

Table 10: Number of quadrants diagnosed by Examiner 1 and Examiner2 across diagnostic categories between Examiner 1 and Examiner2 (n=500).

Diagnostic Categories		Ex_2					
		A	B	C	D	E	Total
Ex_1	A	99	42	12	13	0	166
	B	7	76	29	29	1	142
	C	5	11	39	43	0	98
	D	5	2	5	70	2	84
	E	0	1	1	1	7	10
	Total	116	132	86	156	10	500

Ex_1=Examiner   Ex_2=Examiner 2

Table 11 below shows the level of agreement between pair of examiners measured by

Kappa statistics.

Table 11: Measure of diagnostic agreement between pair of dentists in Kappa values in the Reliability Study (n=500).

		Cases							
Pairs of Examiners	Level of Agreement	Valid		Missing		Total			
	Kappa	N	Percent	N	Percent	N	Percent		
E1 * E2	0.451	500	100.0%	0	0	500	100.0%		
E2 * E3	0.458	500	100.0%	0	0	500	100.0%		
E1 * E3	0.312	500	100.0%	0	0	500	100.0%		

E1=Examiner   E2=Examiner 2   E3=Examiner 3

Kappa coefficient was found to be below 0.40 for agreements between Examiner 1

and 3. When measures were taken between the other two pair of examiners (E1* E2 and E2*E3), kappa value lied between 0.451 and 0.458, respectively.

The same as in the calibration exercise, for the reliability study one calculated an additional level of agreement, by not considering differences between raters up to one diagnostic classification level. In this way, Kappa values also increased substantially. Such increase is shown in the next table (Table 12) when compared with Kappa values shown in table 11.

Table 12: Measure of diagnostic agreement between pair of examiners in Kappa values when examiners disagreed up to one diagnostic classification level in the Reliability Study (n=500).

| Pairs of Examiners | Level of Agreement | Cases | | | | | | |
| | | Valid | | Missing | | Total | |
	Kappa	N	Percent	N	Percent	N	Percent
E1 * E2	0.815	500	100.0%	0	0	500	100.0%
E2 * E3	0.842	500	100.0%	0	0	500	100.0%
E1 * E3	0.667	500	100.0%	0	0	500	100.0%

E1=Examiner   E2=Examiner 2   E3=Examiner 3

In the reliability study, the first calculation of Kappa values demonstrated poor to regular level of agreement (Kappa raging from 0.312 to 0.458). However, the level of agreement increased when disagreements occurred up to one diagnostic classification level. Then, Kappa showed values ranging from 0,667 to 0.842, which is considered good to excellent level of agreement.

Overall, the reliability study results showed that dentists reasonably agreed with each other in the allocation of jaw quadrants into different streams of dental care, during the experimental use of the proposed diagnostic classification tool.

12.3 Third Phase: Usability Results

In the third study phase, participating dentists were surveyed by a self-completing questionnaire on the usability properties of the diagnostic tool. They reported their experience by applying the tool during the reliability study phase. Dentists ranked the tool by completing a Likert Scale-like form.

Table 13 below shows the scores determined by examiners to the questionnaire items. These scores ranged from 1 (strongly disagree) to 5 (strongly agree).

Table 13: Scores on the general usability properties of the diagnostic classification tool by examiner

General Usability Properties of the Diagnostic Classification Tool			
Questionnaire Items	Examiner 1	Examiner 2	Examiner 3
1. I think that I would like to use this system frequently	4	5	5
2. I found the system unnecessarily complex	2	2	2
3. I thought the system was easy to use	4	4	5
4. I think that I would need the support of a technical person to be able to use this system	3	2	2
5. I found the various functions in this system were well integrated	4	4	5
6. I thought there was too much inconsistency in this system	4	2	1
7. I would imagine that most people would learn to use this system very quickly	5	4	5
8. I found the system very cumbersome to use	3	2	1
9. I felt very confident using the system	3	4	5
10. I needed to learn a lot of things before I could get going with this system	2	2	1

Based on the scores above (Table 13), the calculation suggested by Broke (1986) was performed in order to measure the overall usability of the diagnostic classification tool.

Table 14 below summarizes Brooke's calculation (Brooke, 1986) and the respective usability results.

Table 14: Usability values of the diagnostic tool by examiner, according to Brooke's (1986) calculation.

Questionnaire Items	Examiner 1	Examiner 2	Examiner 3
1 (score - 1)	4-1=3	5-1=4	5-1=4
2 (5 - score)	5-2=3	5-2=3	5-2=3
3 (score - 1)	4-1=3	4-1=3	5-1=4
4 (5 - score)	5-3=2	5-2=3	5-2=3
5 (score - 1)	4-1=3	4-1=3	5-1=4
6 (5 - score)	5-4=1	5-2=3	5-1=4
7 (score - 1)	5-1=4	4-1=3	5-1=4
8 (5 - score)	5-3=2	5-2=3	5-1=4
9 (score - 1)	3-1=2	4-1=3	5-1=4
10 (5 - score)	5-2=3	5-2=3	5-1=4
Sum	26	31	32
Multiplying Factor	2.5	2.5	2.5
Usability Value*	**65**	**77.5**	**95**

*Usability value ranges from zero to 100

The Examiner 1 considered the diagnostic tool less usable than Examiner 2, from whose responses the tool reached a value of 77.5 out of 100. The diagnostic tool was most appreciated by Examiner 3, from whose questionnaire the tool achieved a mark of 95 out of 100. The main discrepancies regarding the usability of the tool occurred between Examiner 1 and 3. The average level of usability between examiners was of 79.16 out of 100.

13. DISCUSSION

In this chapter, one discusses the methodology adopted for the preliminary assessment stages of the DRAF, as well as the results obtained in each study phase.

Reliability and Generalisibility of this Study Results

Although the face validity results are plausible or consistent with theoretical predictions, they should nevertheless be interpreted with caution. This is because the small size of the study population decreased generalisibility of results for primary health care settings more broadly. However, dentists who validated the *Dental Resource Allocation Framework* have long been working at primary health care services in accordance with the Family Health Strategy guidelines. As typical members of the Family Health teams, they are assumed to have enough expertise in the Family Health Programme dental practice to judge the framework under investigation. Hence, regardless of the small number of dentists participating in this study, the results might be of reasonable relevance for planning the allocation of primary dental resources within Family Health Programme areas, other than within those managed by the Moinhos de Vento Hospital Association.

By documenting a firsthand evaluation of that newly developed tool, this study precludes comparisons with other findings. The degree of reliability of the study results could have been established by repeating the three study phases (group discussions, oral examinations and usability test) under similar settings. However, this was not possible due to resource constraints. Although the actual findings are representative within primary care areas of the Moinhos de Vento Hospital Association and could not be generalized to other Family Health Programme settings in Brazil, the methodology employed to assess the DRAF

in this study's setting could be generalized to other primary care settings of the Family Health Programme.

Validity of this study

The sampling for the face validity study created a threat to external validity, because experts' opinions in this study are representative just of primary care dentists working at the Moinhos de Vento Hospital Association.

The characteristics of the population sampled for the reliability study may have engendered greater discriminative power to the reliability test because people who demand dental services at the Family Health services are usually symptomatic. To minimize such potential spectrum bias, driven in this study by patient characteristics, one selected either patients seeking dental treatment or dental review. This allowed capture the typical diversity of demands for dental services in a deprived urban area of Porto Alegre.

The adoption of convenience sampling raises some concerns about the implications of possible selection bias in this study sample. In order to minimize potential selection bias, patients were consecutively selected thereby dental needs for both treatment and review were included.

By conducting previous calibration training, one intended to minimize the issue of verification/instrumentation bias.

Discussion on the Methodology and Results

Face Validity

The technique applied to the face validity phase – consensus group – requires that a

previous underlying agreement already exists (List, 2001). Thus, in the study, such technique was appropriate because the discussions on the face validity of the DRAF were based on the assumption that dentists agreed upon the health-related legislation in place Brazil, which states that the Brazilian public health system should provide universal and equitable access to comprehensive dental care (Brasil, 1990). Therefore, the Brazilian Law represented the underlying agreement upon which participating dentists decided to include, modify or exclude items from each component of the DRAF.

The consensus group technique also allowed dentists to discuss on how their different diagnostic and treatment choices could have a positive or negative influence on equity of access to primary dental services. Brennan and Spencer (2005) have studied the dynamics of dentists' decision-making and dentist-related factors influencing the pattern of dental service delivered. They found that besides professional background, also practice beliefs, preferences for patients and even demographic characteristics of dentists had an impact on service delivery patterns.

The resulting items of the DRAF, reported by dentists by the end of the consensus group technique represented dentists' first approach to developing clinically coherent classification levels according to wait time benchmarks for dental services of the Family Health Programme. Those benchmarks should be considered flexible by essence, given the dynamic environment in which new information constantly becomes available in healthcare. Furthermore, evidence-based benchmarks for primary dental services must be supported by health managers (and governs) and acceptable to community members. Some of the benchmarks were chosen based on guidelines of the Family Health Programme, such as that of two months for patients' quadrants classified as "A" to wait for stream "A" of dental care. Those guidelines suggest that community health workers visit families living in the catchment areas every two months. Then, "A" quadrants are supposed to remain as "A"

through promotion activities performed by community health workers. Every 12 months, a diagnostic classification would be undertaken by the dentist in order to confirm or change that previous classification "A".

Reliability Study

In epidemiological caries diagnosis, there is no true gold standard (Fyffe *et al*., 2000). Therefore, in this study the level of inter-rater reliability of the classification tool was used as a proxy measure of validity. The reliability indicated the consistence of the results when the diagnostic tool was applied under similar circumstances (Klein and Costa, 1987).

The statistical test adopted for measuring reliability (Kappa statistic) assured that the results were not due to chance, thereby increasing validity of the reliability test. Kappa statistics has been used to analyze the similarities and discrepancies of diagnostic classifications between examiners who have participated in epidemiological dental surveys in Brazil (Assaf *et al*., 2006). However, as this measure is influenced by the disease prevalence, it can not be used in comparative studies across different populations (Frias *et al*., 2004). In the present study, Kappa was chosen on account of its suitability as a statistical test for the assessment of the level of agreement between dentists who examined the same individuals (Pinto, 2000). The highly accepted criteria in the literature established by Landis and Koch (1977) were used to interpret the Kappa values obtained.

The adoption of the oral quadrant as the unit of classification instead of classifying the individual mouth aimed to obtain a more detailed picture about the population oral health status. Such detailed information would improve equity access to primary dental care by distributing individuals into each stream according to their burden of dental disease.

Calibration Exercise

Expert**s** have discussed the development of scientifically based protocols for calibrating examiners, who are going to participate in epidemiological dental surveys. This is because there is no validated method in the literature which can be used by researchers for calibration training (Ismail, 2004). In view of the absence of a validated method, one adopted in this study a proxy calibration method (based on our resource and time constraints) for pilot testing the standardization of dentists' clinical judgment.

For children caries surveillance, the British Association for the Study of Community Dentistry (2004) recommends that during the calibration training dentists examine a minimum of 10 pre-selected children with and without caries experience. In our study, the sample for the calibration exercise included people from different age groups, aiming to anticipate the conditions examiners would encounter in the reliability study (British Association for the Study of Community Dentistry BASCD, 2004).

Reliability Test

In this study, the sample size was defined on the basis of the Calibration Guidelines, used in the last dental epidemiological survey in Brazil (Brasil, 2004b). Those guidelines consider that one must take at least 20 cases per age group to measure the level of agreement between examiners. By adopting a series of consecutive sample, one could not manage to achieve this target with relation to the elderly people (60 years of age and over), where just 16 out of 20 jaw quadrants (i.e. cases) were examined. This might have decreased the validity of the reliability test.

Even though the absolute Kappa values showed that dentists did not achieve a

reasonable level of absolute agreement, a close look into the reliability results showed that most of their disagreements did not exceed one classification level. The World Health Organization recommends that Kappa value should be of >0,850 for those examiners who are going to participate in epidemiological surveys. In this study, the absolute results of inter-rater reliability did not reached such level. However, most of the variations between examiners were not too broad and may be acceptable to some extent. Variability between dentists' diagnoses and treatment choices have been widely documented in the literature (Bader and Shugars, 1995, Bader and Shugars, 1997, Lewis *et al.*, 1996, Shugars and Bader, 1996). Variability between dentists is actually a problematic issue when it contributes to making patterns of access to dental services less equitable and influences dental services outcomes negatively (Baelum *et al.*, 2006). Dentists play a major role on the identification of individuals and population oral health status, as dentists' primary accountability is the oral health diagnosis. Hence, data generated by dentists' normative assessments at the primary health care level may have deep implications on the quality of access and delivery of dental services not only at this level, but also across the public health system as a whole.

1. **Usability test**

One decided to conduct a usability test for the assessment of the diagnostic classification tool because research in primary dental care has suggested the adoption of 'easy to learn and quick to use' outcome measures (Williams *et al.*, 2004). One found in Brooke's questionnaire, a valid measure of general usability attributes that is applicable to general tools or systems. The pilot testing of data collection tools used by dentists to jot down the classification scores was conducted to maximize validity of reliability results.

The results of the usability test showed that on average the classification tool is a user-friendly instrument. However, the usability level, according to Brooke's calculation, varied

from regular to excellent in the dentists' opinions.

Overall, the choice of the methodology adopted for the preliminary assessment of the DRAF was inspired by those methods used by stakeholders of the Western Canada Waiting List Project (Western Canada Waiting List Project (WCWL), 2003). Our choice was because that project has undertaken robust studies in the development of new tools and methods to organize health care delivery and in the measurement of the effects of waits on patients and providers, in a legal context similar to Brazil with regard to the right to healthcare.
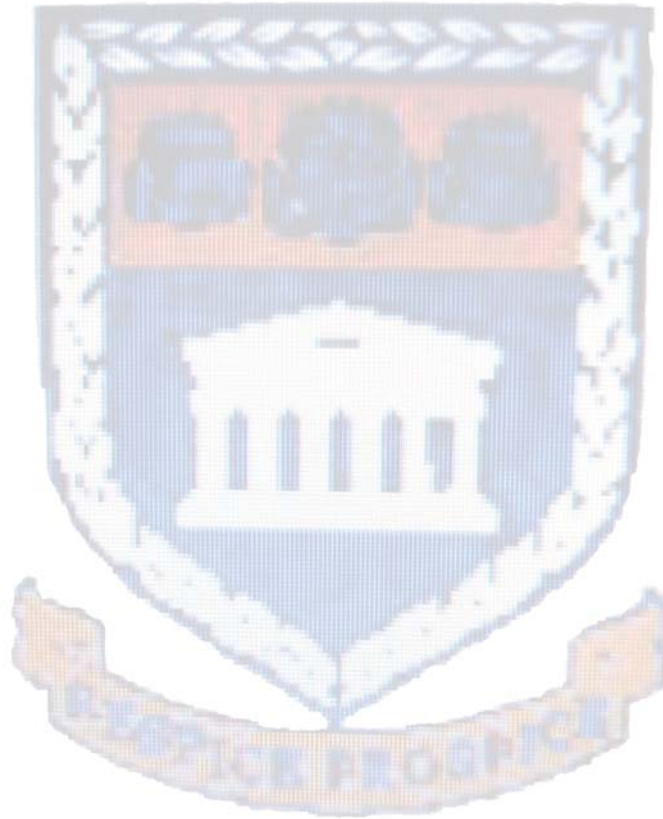
14. LIMITATIONS OF THE STUDY

In conducting the three study phases, several limitations are important to mention.

Limitations of the first phase (Face Validity):

A limitation related to the design is that face validity results were merely the opinions of expert dentists. Reliance on expertise is not a substitute method for empirical evidence of validity (Secolsky, 1987). Then, ultimate validity of the DRAF was not proven. On the other hand, such a non-empirical validity test (face validity) has been considered sufficient evidence for newly developed tools to be implemented in further evaluative settings (Noseworthy *et al.*, 2003). This implies that additional validations tests are required for the DRAF be considered valid. The accuracy of experts' opinions is another limitation by virtue of the design not exploring differences in the participants' professional background. A further limitation is that the study design did not include the opinion of members of the dental team, other than dentists.

Limitations of the second phase (Reliability Study):

Pilot Study:

Although there is no validated calibration method for dental epidemiological surveys in the literature, some calibration methods have been widely accepted. In this study, the calibration exercise was designed according to the guidelines of both the British Association for the Study of Community Dentistry (2004) and the Ministry of Health in Brazil (Brasil, 2001). However, one did not follow the BASCD advice of excluding from the survey those examiners who fail to maintain examiner consistency, because one was measuring agreement between all participants, and then all should be included in the sample of the reliability test.

This limitation in the design decreased the chance of the tool to achieve higher inter-rater reliability.

Another limitation in the design of the calibration exercise was found in the process of searching for suitable cases (sampling) among patients who spontaneously arrived at the participating clinic in the calibration day. Hence, some age groups, such as young children, were under represented in the calibration training discussions. Moreover, the short-period calibration training limited the opportunities for dentists to compare and contrast their classifications.

Reliability Study:

The diagnostic measures used in the study derived from visual assessments rather than visual-tactile data. For this reason, data from this kind of oral health screening initiative is likely to be an underestimate when compared to those results reported from official epidemiologic surveys.

Gold standard measure for clinical assessments in dentistry is a contentious issue among practitioners and researchers. Where gold standard references or objective criteria do not exist either for dental diagnosis or dental treatment, high level of discrepancy between dentists' opinion always remained (Bader and Shugars, 1997). In the present study, despite examiners had been calibrated for clinical diagnosis, the issue of verification bias may have not been resolved.

Another limitation is related to the source of agreements or disagreements between examiners when they were allocating quadrants to different streams of dental care. This may not be clearly identified because this information was not collected during the oral examinations.

<u>Limitations of the Third phase (Usability test):</u>

Usability testing took into account just dentists' first experience in using the diagnostic classification tool by answering a questionnaire that addresses just broad usability issues of general systems. Therefore, despite applying a validated questionnaire, the results may have not uncovered major usability problems of this particular diagnostic classification tool under investigation in the present study.

A limitation of the Brooke's calculation is that the resulting value collapses the responses of 10 items, and this did not allow analyzing particular usability attributes.
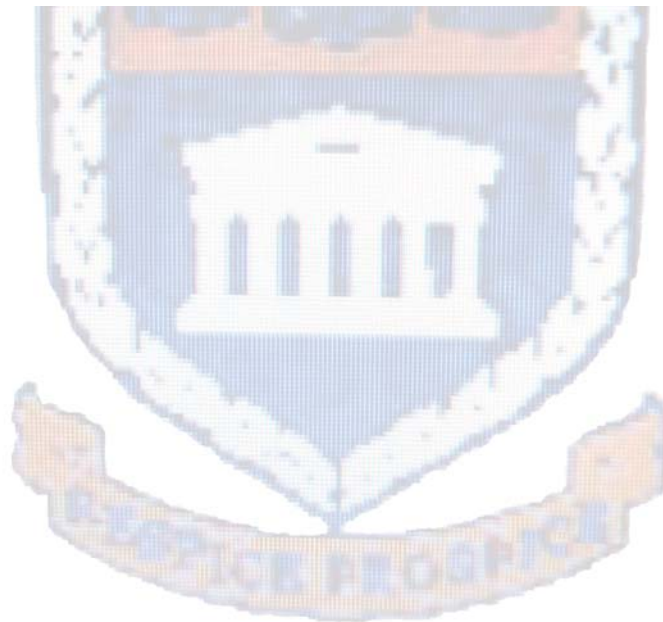
15. CONCLUSIONS

The present study reports on the development and subsequent preliminary assessment of a resource allocation framework in dentistry, designed for use in the Brazilian Family Health Programme. This work appears to be the first in primary dental care-related literature that has defined and organized theoretical wait time benchmarks for access to the Brazilian Family Health Programme dental services. The framework under investigation has reached its preliminary validation stages and demonstrated, according to participating dentists' judgment, a logical approach to timely allocation of human resources for primary dental services within a defined local area of the Family Health Programme.

A standardized diagnostic classification protocol for assessing the oral health status of people living within Family Health Programme catchment areas was refined and tested for its reliability and usability. The results of the reliability test made it clear that variability in dentists' clinical diagnosis was ubiquitous, even when differences in dentists' clinical judgments and patients' dental status were controlled by calibrating examiners and by rating the same consecutive series of patients respectively. Thus, one may conclude that variability in dentists' clinical judgment may not be eliminated just through calibration training.

The level of inter-rater reliability achieved in this study indirectly identified potential training gaps among primary care dentists in relation to primary care diagnostic practice. Those variations found between dentists in diagnostic classification patterns may influence equity of access to dental services between catchment areas of the Family Health Programme. While determining the consequences of such variations was not the focus of the present study, there remains a need to examine the extent to which access to dental care might have been affected by those variations. The inter-rater reliability, measured by Kappa values, ranged from 0.312 to 0.458 between examiners. Such values are below the level of agreement

recommended by the WHO (1979). Hence, this level of agreement is not acceptable for examiners who are going to undertake epidemiological surveys. However, when one did not take into account variations up to one classification level, Kappa values sharply increased, reaching the WHO's recommendation. Hence, one may conclude that such variations could be reduced, because differences in dentists' clinical judgment are amendable to further calibration exercises (Brasil, 2001). In sum, the results of the second phase showed that, according to Landis and Koch criteria (1977), the proposed diagnostic classification tool achieved poor-to-regular inter-rater reliability, and good-to-excellent inter-rater reliability, when classifications differed just up to one classification level. Subsequent research is now required to further develop and assess validity of this classification tool.

To our knowledge, the present study was the first to address wait times benchmarks for primary dental services in Brazil. The set of wait time benchmarks defined by participating dentists are not at this stage based on sound evidence, but fulfill the objective of reaching face validity. Testing of sensitivity and specificity of the proposed benchmarks are needed to ensure their validity.

The level of usability of the diagnostic classification tool provided further evidence of the DRAF's face validity. By reaching an average of 79.16 out of 100 points in the usability test, one may conclude that from the point of view of its end-users the diagnostic classification tool demonstrated to be an easy-to-use instrument. For being assessed by 100% of the primary care dentists of the Moinhos de Vento Hospital Association, such conclusion is highly representative within that institution, but does not necessarily represent the opinion of further primary care dentists' groups.

Although one must be cautions given the small scale of the present study, the overall conclusion that can be drawn from these study findings, indicated that the DRAF is worth considering for implementation in further evaluation settings as an innovative approach to

researching equity of access to primary dental care.
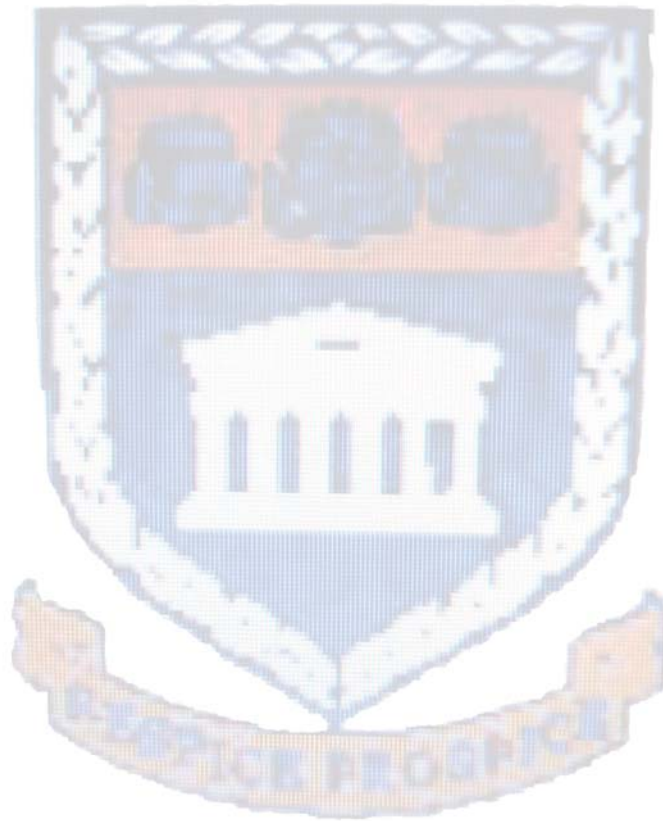
16. RECOMMENDATIONS

The following recommendations seek to inform Family Health Programme decision makers, particularly those from the Moinhos de Vento Hospital Association, on dental practice, dental research and oral health policy, based on the results of the present study.

First, one recommends that the results of this study be disseminated and discussed with the various stakeholders of the Moinhos de Vento Hospital Association, and associated hospitals head office level. Furthermore, findings must be shared with community advocacy groups and Local Health Councils representatives of target areas.

One expects that the study results be used by the Moinhos de Vento Association board for further research on the validation process of the *Dental Resource Allocation Framework*. This would allow further improvements in the DRAF and would demonstrate the institution's commitment to tackling inequities of access to primary dental care. It is further expected that by proceeding into this research process, improvements in dental referral pathways are achieved, leading to a more effective community dental care.

PRACTICE

As the Family Health Programme model evolves, intra-dental team collaboration in dental care delivery should be stimulated. Strategies aimed at increasing dental practice capacity should be developed and tested. By delegating tasks, the DRAF aims to effectively increase supply of human resources of the Family Health Programme. The vital role of dentists for communities requiring access to primary dental services extends beyond dental profession to include dental care provided by the dental hygienists, dental assistants as well as the community health workers. The importance of all these health workers' competencies in the delivery of comprehensive primary dental care within the Family Health Programme

should not be neglected, otherwise, one would fail to acknowledge the full waiting times that communities might experience.

Dental services planners and administrators should be provided with sound and timely information on dental disease prevalence within local communities. The proposed DRAF may be adopted to help in this purpose and help to delineate actions for oral health promotion for populations assigned to the Family Health Programme. Once validated, the DRAF could facilitate the development of appropriate oral health programmes; reduce the need for emergency dental treatment and its respective financial burden. However, the DRAF does not aim to be a static and simple formula, by which an extremely complex process, such as the equity of access to primary dental services could be dealt with. In fact, the DRAF could serve as a more formal framework for commissioning oral health promotion, dental disease prevention and population programmes for screening and surveillance. This would facilitate co-ordination of interventions and provide a more holistic approach to dental services within the Family Health Programme.

From the conclusion of the reliability study phase, one can recommend that dentists adopt standardized diagnostic classification, through which oral health status and treatment outcomes can be consistently monitored. The diagnostic classification tool under investigation, in contrast to protocols for resource-intensive and detailed visual-tactile oral exams, with multiple data fields, intends to be a simpler and less costly instrument for routine assessment of the burden of dental disease. Moreover, it is expected that non-dental decision makers and laypersons can easily understand the diagnostic classifications results. Because disease prevalence is highly influenced by the kind of instrument adopted (Stevens and Gillam, 1998), the diagnostic tool under investigation should be further tested against findings of comprehensive visual-tactile oral examinations in order to determine validity of its results.

Additional breakdown into sub diagnostic categories could assist with the development of specific streams of dental care, which could streamline access to specific promotive, preventive, curative, and rehabilitative interventions. This would facilitate timely information for planning and evaluation of dental programmes. However, for its quality assurance, the proposed diagnostic codes must be tested on how easily they can be stored and analyzed, along with the subsequent delivery of dental treatment. A further test must be performed on the extent to which the diagnostic classification tool would reduce the cost of collecting and recording epidemiologic surveillance data in primary dental care. A continued use of the proposed classification protocol could allow both population and individual-based data to be available on the oral health status of communities assigned to the Family Health Programme. Thus, trends could be tracked, dental care needs promptly identified, and strategies developed to ensure equity of access to primary dental services.

For future research purposes, one recommends studies focusing on diagnostic methods/tools applicable within primary care settings. It is important not to ignore the role of diagnostic classifications in striving for equity of access to primary dental services, as there has been an increasing recognition on the accountability of health professionals for the allocation of health resources (Pitt *et al*., 2004). This is both an ethical and a legal issue to be addressed in Brazil, where the legislation in place imposes to the public health system the accountability for the provision of health services (Brasil, 1988). A current example of such recognition is the call released by the Supreme Court of Brazil for a nationwide debate among health professionals and authorities towards consensus about the responsibility of the public health system in providing or not whatever prescribed diagnostic procedure or health treatment (Supremo Tribunal Federal, 2009).

Once validated and recognized by community members as a sound management tool, the DRAF could be used to ensure that people are assessed and scheduled in an ongoing basis

by the Family Health dentists. This would give community members guarantee that they would be followed through the lifelong process of dental care. This could contribute to making the patient's needs the focus for the decisions on the allocation of dental resources.

It is recommended that the adoption of the DRAF should not impose barriers to the full use of the dental team's skills in the provision of comprehensive primary dental care. Moreover, a further exploration of the potential of dental hygienists, dental assistants and community health workers in the provision of primary dental services would go towards achieving the goal of expanding equitable access to primary dental services.

Findings from this study can aid in creating training programmes for the Family Health Programme personnel, with a focus on competencies and not on professions, which could particularly enhance the community health workers' skills in oral health promotion. Furthermore, research could address the respective roles of the Family Health doctors and nurses in providing dental care, particularly among children. One also recommends that studies address dentists' attitudinal, cultural, and methodological aspects of their diagnostic practice and how such practice influences access to dental needs at the primary health care level. In addition, dentists must be trained to improve consistence of diagnostic classifications because it is envisaged that high level of reliability between dentists would give people with similar dental needs equal chance of accessing dental services.

As dentists are end-users of the diagnostic classification tool, one recommends that they be surveyed regarding specific usability attributes of such tool. High level of usability may encourage dentists to adopt the diagnostic classification tool and thus proactively identify potential demands for primary dental services. As the diagnostic classification tool was found usable, one recommends its adoption if its specific usability attributes have been previously tested.

RESEARCH

One recommends that the Moinhos de Vento Hospital Association develops a research plan to address primary dental care associated with wait time benchmarks.

These would fall into the following areas:

- Research on further development and improvement of primary care diagnostic tools and methods.

- Health system research that investigates the impact of the proposed benchmarks on the access to dental services and the correspondent oral health outcomes of catchment populations.

A number of studies have identified differences in self-perceived dental treatment needs when compared to needs professionally assessed. Such differences may have huge financial implications for the public health system (Locker and Miller, 1994). Further research to elicit local community's views may help clarify their perception regarding diagnostic classifications and the subsequent streams of dental care. In addition, research on benchmarks for primary dental services should not only tell us that a defined dental treatment cannot be delayed but should also address the appropriateness of those treatments. Results on evidence-based benchmarks for dental services may have huge funding implications for the public health system and could serve as accepted standards in litigations. Furthermore, research on the evidence-based benchmarks for primary dental services could guide the establishment of targets set by Family Health team as performance goals. In order to apply benchmarks for access to dental services, Family Health teams must: 1) adopt information technology to collect clinical data; 2) improve dental services delivery, making them patient-focused and efficient; 3) use consistent criteria to assess clinical dental needs; 4) provide

clear information for the public regarding the access-to-dental-care management; 5) evaluate oral health outcomes. To deepen research on evidence-based benchmarks for access primary dental care could be an important milestone in the efforts to reduce wait times for primary dental services within defined catchment areas. Future studies should raise evidence on how the outcome of an intervention is negatively affected after a certain period of waiting for primary dental services delivery has elapsed. A further challenge is to define a range of optimal wait time benchmarks measurement tools. However, along with the establishment of benchmarks, the guarantee of wait time benchmarks is a collective effort that must be made by funding agencies, managers, practitioners, researchers and communities.

The diagnostic classification provides individually based measures of the oral health status without reference to other variables. Such a categorization is based on the assumption that people living in given area of the Family Health Programme have similar demographic and socio-economic characteristics. Further studies should identify the extent to which likely variation in those socio-economic characteristics affect equity of access to the proposed streams of dental care.

The use of consensus group technique with Family Health dental teams to further develop the DRAF can configure a useful contribution to primary care diagnostic research and give more credibility to the results obtained. Moreover, to employ such technique would offer a professionally driven approach to the assessment of the DRAF thereby professionals' accountability for the allocation dental resources in primary care settings could be enhanced.

Once consistently collected in different catchment areas, the diagnostic classification codes could serve as comparable indicators that would measure progress against the established wait time benchmarks for dental services. Measurements against benchmarks would then allow community members to follow how well Family Health teams are performing with regard of timely delivery of dental services.

POLICY

Implementing access-according-to-need policies would ensure equitable access for identified community groups. Incorporating the proposed DRAF into the Family Health Programme may help reduce the impact of the lack of diagnostic criteria that might result in inequity access to primary dental care. In order to gain an accurate account of people' dental care needs, the DRAF could assist Family Health teams to uniformly collect clinical data from different dental need categories. This would enable comparisons on the oral health status within community members and between other Family Health Programme catchment populations and appropriate targeting of resources.

Some provinces in Brazil have established wait time benchmarks for access to selected health services such as cancer-related surgeries and respective therapies. This has allowed the public to track the delivery of those health services. Given the fact that benchmarked dental care would require adequate funding it would be important to plan efforts collaboratively between Family Health teams, researchers, and funders to determine major strategic actions. Furthermore, one could expect that this process would attract Family Health dentists' and local community's attention, so that they put forward their choices and opinions on the adoption of benchmarks for primary dental care.

The proposed DRAF intends to be an evidence-based, transparent, and accountable process of allocating primary dental services by which communities are aware of their dental care needs as a whole. The framework under investigation could serve as a compromise to be collectively pursued for addressing the problem of access to primary dental services. In this way, such a process could legitimate popular pressure for the provision of primary dental services whether communities are under-supplied.

It is also of a major importance to define the accountability for implementing the evidence-based benchmarks once they are available. The Family Health Programme planers, particular

those working the Moinhos de Vento Hospital Association must be aware of the broad range of funding implications that would derive from the implementation of these recommendations. Thus, it would be necessary to share responsibilities on such recommendations among health professionals, research community and government officials in order to consider the achievement of high standards of oral health for all community members other than the merely the access to a set of basic dental procedures. In this way, it would be possible to build the kind of primary dental care system that makes benchmark guarantees possible to fulfill.

It is expected that the process of implementing the DRAF will arise many questions, which require further investigations. Therefore, creative solutions must be adopted to overcome likely implementation problems. In addition, financial resources will need to be available to develop an information system to support the DRAF implementation management.

Hopefully, the results and recommendations of the present study encourage a number of primary care dentists from Porto Alegre to engage in forward-thinking research and practice collaborations.

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18. APPENDICES
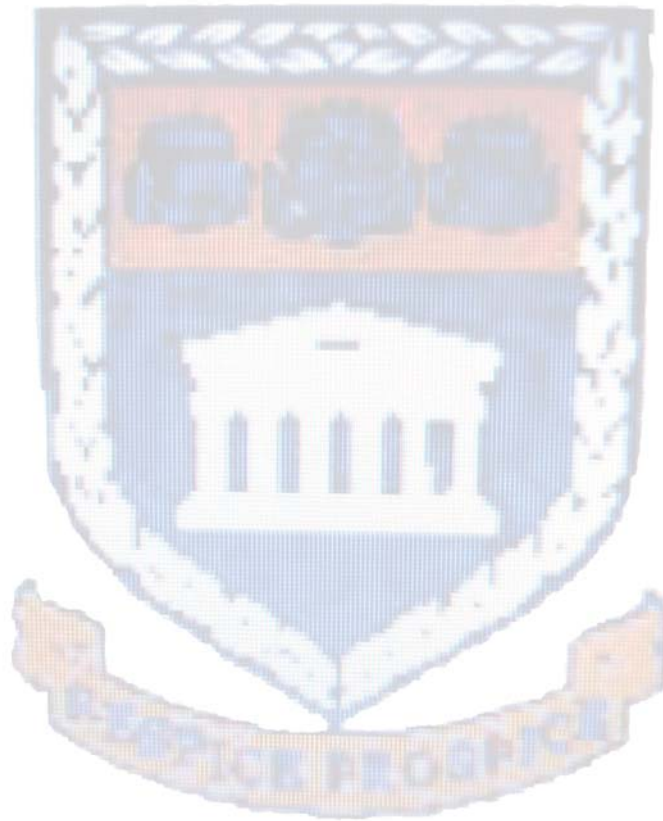
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PARTICIPANT INFORMATION SHEET

Project Title:

A Preliminary Assessment of a Framework for Allocation of Primary Dental Services

What is this study about?
This is a research project being conducted by Denise Antunes do Nascimento at the University of the Western Cape. We are inviting you to participate in this research project because you, as a Family Health clinic user are a key element in the validation process of the proposed approach to improving provision and access to dental services for communities. The purpose of this research is to contribute to equity access to primary dental services by testing a dental resources allocation framework. The information you give during this study will allow the Moinhos de Vento Hospital Association to develop a more equitable way to allocate primary dental treatment.

What will I be asked to do if I agree to participate?
You will be asked to undergo a sequence of oral examinations conducted by three dentists who work in the Family Health clinics run by the Moinhos de Vento Hospital Association. The dentists will exam your mouth using disposable tongue depressors. The oral exam will last just few minutes. This exam will allow the dental surgeons to classify your oral health status according to your need of dental treatment.

Would my participation in this study be kept confidential?
We will do our best to keep your personal information confidential. To help protect your confidentiality, all data collected will be kept at locked filing cabinets at the Institute of Education and Research of the Moinhos de Vento Hospital Association. . Data collected from your mouth will be only identified by a code. Using an identification key, the researcher will be able to link the data from your questionnaire and your oral health classification to your identity. Only the researcher will have access to the identification key.

If we write a report or article about this research project, your identity will be protected to the maximum extent possible.

What are the risks of this research?
The risks from participating in this research study might be related to fear of being examined by a dentist.
Apart from that, there are no other known risks associated with participating in this research project.

What are the benefits of this research?
This research is not designed to help you personally, but the results may help the investigator to make recommendation to the managers of the Family Health clinics to which you are assigned for future improvements in the access to dental services for you community. We hope that, in the future, not only your community but also other communities in Porto Alegre might benefit from this study through improved understanding on the proposed classification system. At the moment, this evaluation study will help the Moinhos de Vento Hospital Association's managers to improve the access and provision to dental services in the Family Health clinics they manage.

If you wish, after the oral examination your dental treatment needs will be passed on to the Family Health clinic you have been assigned to so that an appointment can be made for you to see a dentist.

If you have any doubts or questions, please do not hesitate to ask us before you decide whether to participate. You may also withdraw from the study whenever you wish, and your participation will be completely free of charge.

Do I have to be in this research and may I stop participating at any time?
Your participation in this research is voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify. You do not need to give reasons if you decide to withdraw from the study. You can also choose how to use or not the information you have already given to this study.

Is any assistance available if I am negatively affected by participating in this study?
The Family Health clinics run by Moinhos de Vento Hospital will be available to your needs of referral for health care within the public health services of Porto Alegre.

What if I have questions?
This research is being conducted by Dr. Denise Antunes do Nascimento, in the School of Public Health at the University of the Western Cape. If you have any questions about the research study itself, please contact Denise Antunes do Nascimento at: Rua José Honorato Santos, nº 100 ap 608   Porto Alegre, RS, Brazil, phone numbers: (51) 9913 6086, (51) 32893353 or (51) 32228002. You can also email to deni.atn@gmail.com.

The University of the Western Cape's Senate Research Committee and Ethics Committee has approved this research. It is also has been approved by the Moinhos de Vento Hospital

Association's Research and Ethics Committee. Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Head of School of Public Health: Prof. David Sanders
Dean of the Faculty of Community and Health Sciences: Prof. RMB Mpofu
University of the Western Cape   Private Bag X17   Bellville
7535
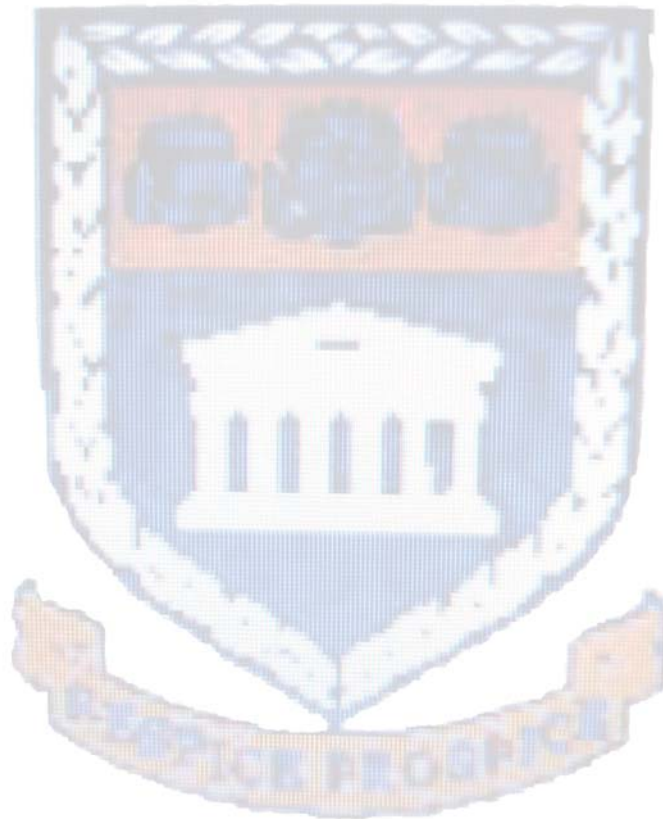
Appendix 2

INFORMED CONSENT

University of the Western Cape, South Africa

Moinhos de Vento Hospital Association, Brazil

Study in Oral health

We would like to invite you to participate in a study of oral health, which will take place in the Districts of Ilha dos Marinheiros and Ilha da Pintada (in Porto Alegre, Brazil) in November, 2008.

The purpose of this project is to study the access to oral health care of those members of the local populations registered in Family Health Units (FHUs). Participants will be selected according to age group.

Your participation is voluntary, and will involve an examination of your mouth, which will be carried out in sequence by three dental surgeons. The examiners will use disposable tongue depressors. The data collected from the examinations will be classified, but your privacy will be respected, and you will be assisting in the setting up of an appropriate form of oral health care among the population registered in your local FHU.

If you wish, after the oral examination your dental treatment needs will be passed on to your local FHU so that an appointment can be made for you to see a dentist. If you have any doubts or questions, please do not hesitate to ask us before you decide whether to participate. You may also withdraw from the study whenever you wish, and your participation will be completely free of charge.

If you require further clarification, please speak to the coordinator of the study: Dr. Denise Antunes do Nascimento, phone number: 3222 8002/ 9913 6086/ 3289 3353 or in the following address: Rua José Honorato Santos, nº 100 AP 608 Porto Alegre, RS.

_____   _____
Examinee   Researcher

Date:
Researcher: Denise Antunes do Nascimento, Brazilian, Dental Surgeon,
ID 5008572496, CRO RS 5851
Address: Rua José Honorato Santos, nº 100 AP 608   Porto Alegre, RS
Phone Numbers: 9913 6086 / 3222 4662 / 3222 8002

Moinhos de Vento Hospital Ethics Council   Phone Number 33 14 36 90

Appendix 3

ASSESSMENT QUESTIONAIRE ON USABILITY

(Designed by John Brooke, 1986)

Dear Colleague

As an integral part of this research in oral health in which you are participating, and which is taking place under the aegis of the Moinhos de Vento Hospital Association, we request your assistance in completing this questionnaire. The questionnaire will collect information about general aspects regarding the usability of the diagnostic classification system during its use in the reliability study. We would like to thank you in advance for your valuable contribution to our research.

	Strongly disagree				Strongly agree

1. I think that I would like to use this system frequently

1	2	3	4	5

2. I found the system unnecessarily complex

1	2	3	4	5

3. I thought the system was easy to use

1	2	3	4	5

4. I think that I would need the support of a technical person to be able to use this system

1	2	3	4	5

5. I found the various functions in this system were well integrated

1	2	3	4	5

6. I thought there was too much inconsistency in this system

1	2	3	4	5

7. I would imagine that most people would learn to use this system very quickly

1	2	3	4	5

8. I found the system very cumbersome to use

1	2	3	4	5

9. I felt very confident using the system

1	2	3	4	5

10. I needed to learn a lot of things before I could get going with this system

1	2	3	4	5

CALCULATION OF THE USABILITY SCORE

To calculate the final usability score, Brooke (1986) proposes the following: to sum the score contributions from each item of the Likert scale, taking into account that those values range from zero to 4. For items 1, 3, 5, 7, and 9 the score contribution is the scale position minus 1. For items 2, 4, 6, 8 and 10, the contribution is 5 minus the scale position. Multiply the sum of the scores by 2.5 to obtain the overall the usability value of the system.

Appendix 4

DATA COLLECTION TOOL

Reliability Study in Dentistry   **November / 2008**

Observer number:
Q = quadrant
Nº = Patient Number

Nº	Q 1	Q 2	Q3	Q4	////////////	Nº	Q 1	Q 2	Q 3	Q 4	////////////	Nº	Q 1	Q 2	Q 3	Q 4
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