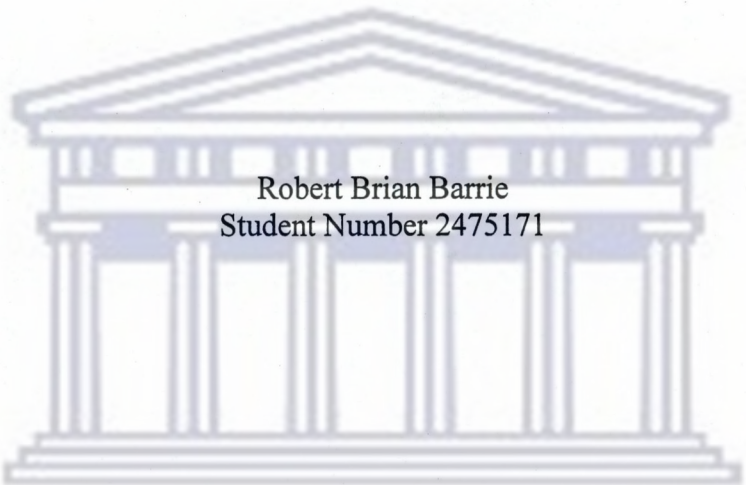
The Design, Implementation and Evaluation of a Management Information System for Public Dental Services

Robert Brian Barrie
Student Number 2475171



A thesis presented in fulfilment of the requirements for the degree Doctor Philosophiae in the Department of Community Oral Health at the University of the Western Cape

Supervisor

Professor Sudeshni Naidoo

The Design, Implementation and Evaluation of a Management Information System for Public Dental Services

Keywords

Work Performance

Public Dental Services

Management information

Treatment codes

Relative value units

Objectives Matrix

Health service statistics

Database management

Abstract

In order to manage public dental services, information is required about what work is being performed by the staff at the various clinics.

Tally sheets have been used in the past to record treatment procedures but this is not an effective method of recording the amount of work done by staff at public dental clinics. But tally sheets are inaccurate, open to abuse, and fail to provide the necessary information for managers. Nor is it of any real value for providing feedback to staff on their performance. This inhibits a core aspect of job satisfaction for the staff, which is feedback. The staff just persevere, continue doing the same thing and feel frustrated. This contributes to poor work performance.

Instead of using a tally sheet, 4 digit treatment codes are used for all treatment procedures (as used in the private sector for billing purposes) and additional codes were developed for services such as brushing programmes for which billing codes do not exist. These are recorded for each patient, together with a code for the patient category.

A relative value unit (RVU) has been developed for each treatment code that has been weighted according to policy guidelines and the amount of time and effort required to provide the service. This was done for clinical treatment procedures as well as for community-based preventive activities.

A computer program has been developed that captures the treatment codes which are saved in a number of databases that are linked to Excel pivot tables. The data can therefore be easily manipulated by the user to obtain the required information in the form of counts of procedures, monetary cost of the same clinical services in the private sector (useful with the proposed advent of National Health Insurance) and also in the form of relative value units.

This is available for the current reporting period as well as for previous periods, allowing a detailed analysis of services rendered and staff performance over a period of time to show trends.

Use is also made of an Objectives Matrix where the performance of each staff member can be measured according to seven objectives (Key Performance Areas) (five in the case of oral hygienists) to produce an overall Performance Index – which is a score out of ten. This enables performance appraisal to be carried out much easier than by comparing performance based on a number of diverse treatments provided.

The data for all the public dental clinics in the Western Cape Province has been analysed for the period 1994 to 2012 using this system, and it has been shown that the system is sensitive enough to highlight problem areas as well as provide a balanced overall view of the service, as measured by a number of variables.

The system is "low tech" in that it runs on a "stand alone" personal computer, but it could easily be applied to an integrated, networked information system provided the latter contained the treatment codes, and certain other patient, staff and clinic identifiers. It is therefore suitable for developing countries, such as South Africa, that may later develop a comprehensive Health Information System based on an electronic medical record.

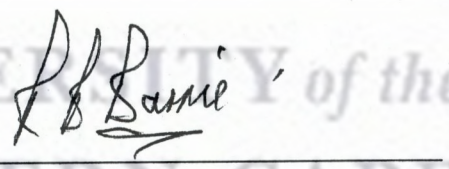
The emphasis is not on the information technology, it is focussed on the concepts behind the processing of the data into meaningful information for managing public dental services.

Declaration

I,

Robert Brian Barrie

hereby declare that the work contained in this thesis is my own original work and has not previously, in its entirety, or in part, been submitted at any university for a degree and that all sources I have used or quoted have been indicated and acknowledged as complete references.



Robert Brian Barrie

February 2014

Acknowledgements

To my Lord and Saviour, for His grace and many blessings showered on me

To my wife, Penny, for her love and support for me during many years of study

To my supervisor, Su Naidoo, for her prompting, encouragement and support

To my colleagues who supported me while I was developing this system and while writing this thesis

Contents

List of Tables

List of Figures

List of Appendices

Chapter 1: Introduction

Public dental services are rendered mainly to indigent patients in South Africa. Since they are provided for the poor and disadvantaged who have nowhere else to obtain affordable care and they are funded by tax revenue, it is essential that these services are well managed.

One of the most important aspects of good management is access to accurate reliable information about the services being provided. The saying "If you can't measure it, you can't manage it" holds true (Leyland, 2009).

Traditionally, headcounts have been used to provide management with a measure of production or output at primary health care facilities. However, for dental services this is not a reliable indicator because, unlike many other health disciplines, there is a large variety of differing services that can be provided to patients and the time and cost associated with them is obscured when use is made of simple headcounts.

Statistics are often collected manually. They are documented on sheets of paper (tally sheets) which rely on counts of procedures to be added at the end of the recording period and thereafter they are submitted to the relevant authorities. Reporting is often limited by the number of columns that can be fitted on the form, and if there are a large number of possible procedures, it is impossible to record them all.

Furthermore, the final collation at the end of the reporting period takes up an inordinate amount of the dentists' clinical time. In addition, in order to assess the records over a period of time, these cross-sectional reports require further calculation and analysis.

One also needs overall summary figures to measure production. The counts of number of patients, fillings, extractions, and fissure sealants are informative but cannot be used to measure production directly. What is actually needed is a Relative Value Unit (RVU) for each procedure, based on the private sector tariff for each procedure. The sum of the Relative Value Units gives an overall indication of production.

In the Public Dental Services, different categories of patients are seen - such as pre-school children, primary and high school children, mentally handicapped adults, adults, etc. and each of these patient types requires varying amounts of time (and energy) to complete the treatment, therefore a weighting system is required to enable comparisons to be made between operators who treat different patient profiles.

The reporting unit is usually the clinic, and this does not give an indication of the contribution to production of each operator (dentist, dental therapist or oral hygienist) who work at that clinic. Reporting separately for operators requires aggregation at some higher level.

It could also be tempting for some less than honest operators to "upwardly adjust" the totals submitted to improve the 'respectability' of their outputs. Therefore, an audit system is required to enable an investigator to verify the data and identify possible errors.

Many of these problems can be solved by implementing an online, networked computerized management information system. However, the cost of such a network is high and not often possible in a developing country such as South Africa and a more practical, low-cost approach was designed that utilised a combination of methods to solve the above-mentioned problems:

- Data is recorded on a data sheet for each operator and the clinic where the treatment was performed. However, instead of completing counts in

columns, the treatment codes for the procedures are recorded. This allows for a large number of potential codes to be used.

- Each row on the form also contains the patient's name (for audit purposes only) and the patient category for weighting purposes.
- No further calculations are done on the form at clinic level – it is merely submitted to the district office.
- The data on the forms are then captured using a custom designed computer program, the Public Dental Evaluation (PDE) system. This was developed in dBase and is a relational database system. The PDE system processes the data to allow reporting of a number of summary indicators as well as counts of procedures per operator and clinic.
- After each reporting period, the new data is added to the summary data per operator or clinic, allowing reporting of many variables over a time period to assess trends.
- The data is readily available for retrospective analysis.

This thesis describes how the system was designed, how it was implemented and its efficacy will be evaluated by examining how well it was able to measure the services rendered by the Public Dental Services in the Western Cape Province from 1994 to 2012.

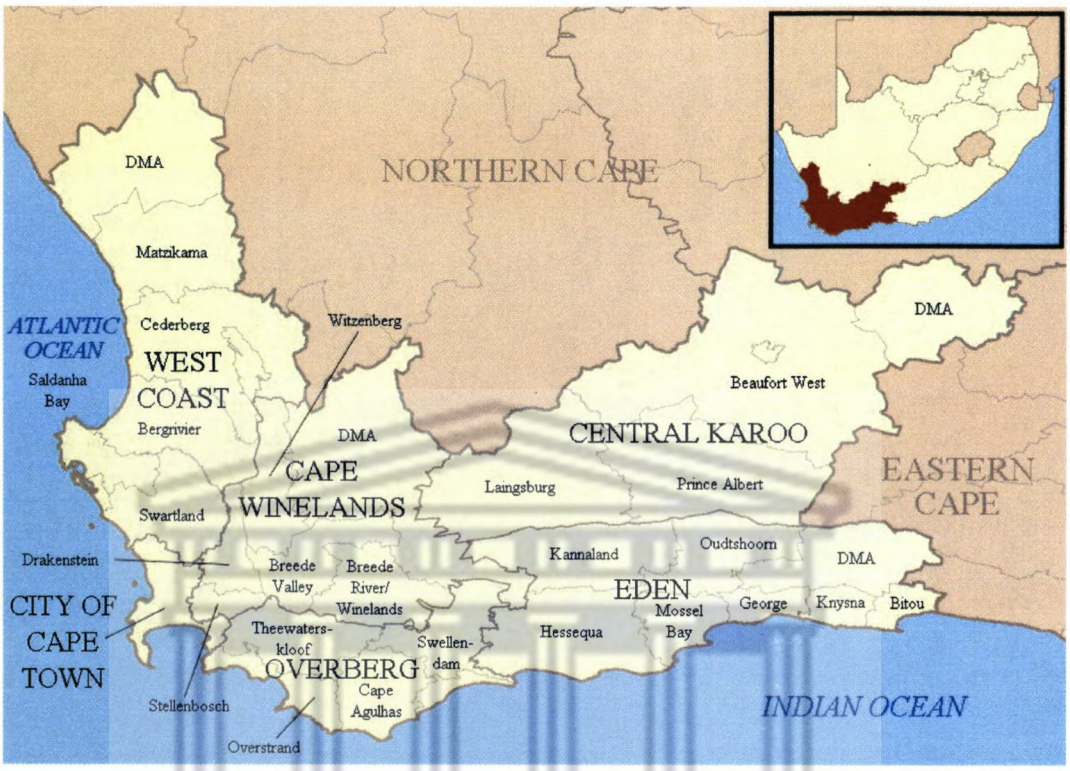
Chapter 2: Literature Review

South Africa has a two-tiered health system, with 14% of the population covered by medical insurance (medical aid) and 82% of the population relying on the state to provide their health services using tax revenue (Stats SA, 2010). The private health care system is costly for the consumer, but is generally of a standard comparable to any developed country. The public health system, on the other hand, is overburdened, underfunded and in general, not well managed which impacts negatively on the motivation of staff (George *et al*, 2013).

Public dental services are utilized by indigent patients who cannot afford to obtain their dental treatment in the private sector. Many estimates have been made on what proportion of the population is dependent on public services, but it is in the region of 76% in the Western Cape (Stats SA, 2011). Thus, the vast majority of the population relies on public health services.

The public dental services are rendered at 173 clinic points throughout the Western Cape Province in all six Health Districts (Figure 1). These range from multi surgery clinics to service points that are visited using portable equipment. The service is rendered by 83 dentists, 30 oral hygienists and two dental therapists.

Figure 1. Western Cape Province showing the six Health Districts (Asisbiz, 2009)



Since tax-payers money is used to fund the public health service, accountability has to be given on how the funds have been spent. This is clearly defined in the Public Finance and Management Act (National Treasury, 1999). This is in the form of reports by the provincial health departments in their legislatures every year – a normal process in any democracy.

Management at all levels needs information to manage the service. This statement apparently originally from Galileo but now attributed to a management consultant, Peter Drucker hols true: "If you can't measure it, you can't manage it!" (Leyland, 2009).

Management needs concrete data to make policy and on-going management decisions about a health service. While it makes most sense to base decisions on health outcomes, these often only become apparent years down the line, while decisions need to be made much sooner. Therefore, the information needed for

the running of dental services must also be related to process indicators such as money, manpower, materials and work performed. There is an increasing demand for better health statistics as they form the fundamental basis for good health planning (Shibuya *et al,* 2005).

Management is not just about getting subordinates to work hard. Many management theories have been formulated, which in itself is indicative of the complexity of the nature of management. Inextricably woven into management theory is the concept of leadership.

What is needed is a blend of good leadership and good management, and the latter is dependent on the former. The nature of leadership has been defined as: "enabling ordinary people to produce extraordinary things in the face of challenges and change, and to constantly turn in superior performance to the long term benefit of all concerned" (Charlton, 2000).

In South Africa today we are surrounded by challenges and change, especially in the public health sector, so managers need to lead in such a way that ordinary dentists and other public dental staff are able to produce extraordinary things.

A very good theory about how managers can create an environment in which staff can be motivated to produce their best and enjoy job satisfaction, was published by Hackman and Oldham (1975). They identified five core job characteristics that were necessary to produce four desired outcomes:

- Work motivation
- Growth Satisfaction
- General Satisfaction
- Work effectiveness.

Hackman and Oldham's five core job characteristics which need to be built into the job itself were:

- Skill variety

- Task identity (doing a task from beginning to end and observing the outcome)
- Task significance (the degree to which the job has a substantial impact on the lives of others)
- Autonomy (allowing employee to exercise freedom, independence and discretion in carrying out the task)
- Feedback (the degree to which the employee knows, on a continuous basis, how effectively he or she is performing her job.)

In public dental services it may be challenging to structure all jobs according to these characteristics, but much can, and should be done in this regard. This model has been applied in numerous fields (Udhayanan and Nirmal, 2011) and is still relevant today.

Management has a responsibility to provide much needed services to the community with a limited budget, using preventive and curative treatment services delivered by a widely spread team of dentists, dental therapists, oral hygienists and dental assistants. This is a challenge in itself. Doing it according to the framework of Hackman and Oldham (1975) as well can be extremely challenging.

Unfortunately many health managers have not received formal management training and their management abilities are limited. This is compounded by leadership styles which are varied and often ingrained and inflexible.

Booysens (2001) classifies leadership styles into four main categories:

- Team builder (participative style), where the manager consults staff before making decisions, sets standards in consultation with staff, guides the staff in attaining these standards and gives credit for work well done.
- Driver type (authoritative), where the manager acts as a policemen, watching staff all the time and is quick to find fault, apportion blame and

slow to praise the staff. This manager is also seldom uses other people's ideas.

- Maternal type (Parental style), where the manager sets standards herself, but gets involved in the staff members problems instead of helping them solve their problems themselves. Staff consider her as they would their mother.
- "*Stupor-visor*" (Bureaucratic style), where the manager gets buried in administrative detail and paperwork, remains aloof from the staff, does not set goals, cannot make decisions and blames failure on the staff members.

The "*stupor-visor*" is particularly dangerous to any organization, and will promote the "Peter principle" where every employee rises to their level of incompetence (Faria, 2000).

There must be a way to prevent job misery. Every manager needs to lead an effective, satisfied and motivated team. In a remarkable, best-selling book, Patrick Lencioni has identified three issues that need to be addressed (Lencioni, 2007). They are:

- Anonymity (staff need to be understood and appreciated by their supervisors)
- Irrelevance (staff need to know that their job matters to someone)
- Immeasurement (staff need to be able to measure their performance).

There is a degree of overlap between Lencioni and Hackman and Oldham despite over 30 years between their publications. This demonstrates that the underlying principles are still true and valid.

There are many other generic functions that managers have to perform, such as staffing, financing, policy formulation, organising and exercising control (Muller *et al*, 2009). But, at the risk of oversimplifying the issue, it is clear from the above that it is important that managers need to lead and plan in consultation with their staff and give feedback and praise to their staff for a job well done. This

results in satisfied workers who then provide exceptional service. It has been shown that satisfied staff will provide better services to their patients (Puriene *et al*, 2008). Job satisfaction among dental practitioners is known to be significantly higher in the private sector (Gilmour *et al*, 2005; Harris *et al*, 2009), therefore special leadership is called for in the public sector to also attract and retain staff.

This is vitally important in the health services in general and in public dental services in particular, since it tends to be a neglected part of the health service because it does not deal with lifesaving procedures. It needs satisfied, motivated staff.

The important issue is feedback, and how it is done (Lencioni, 2007). This is difficult to measure in terms of quality in public dental services. There are not enough dentists and oral hygienists to do the work, so where would one find peer reviewers to check on the quality of the work done, as well? However there are measurements of work performance available, and this is the main theme of this thesis.

Work performance by staff in dental services relates to production that is, clinical work performed by dentists, dental therapists and oral hygienists. Simply examining clinic expenditure on an annual basis does not assist management to conclude that the funds were well spent. It is likely that frugal expenditure indicates little production, in other words, poor service delivery.

But there is a link between the services rendered and financial management. The Public Finance and Management Act (National Treasury, 1999) in Section 45(b) states that an official is, "responsible for the effective, efficient, economical and transparent use of financial and other resources within the official's area of responsibility". This means that managers need to know exactly how services are being rendered and as efficiently and effectively as possible. For this they need information on the services provided.

One can measure both the amount and the type of work done, as well as the blend of preventive and curative services. For this one needs information on services rendered.

In 1997, the National Department of Health gave prominence for the first time to health information in the White Paper for the Transformation of the Health System in South Africa (Department of Health, 1997). This White Paper called for, *inter alia*, the establishment of a National Health Information System (NHISSA) to monitor the implementation and success of priority health programmes. In order to address this need, the National Health Care Management Information System (NHCMIS) was developed for South Africa. Although this resulted in implementation of large, networked Hospital Information Systems in the provinces, it has also been extended to major clinics as well. However, it does not cater for dental services except to report on headcounts of patients attending the dental clinics at the institutions where it has been implemented.

Objectives and Indicators were developed and published in the above-mentioned White Paper (Department of Health, 1997) and this was also a first, in that national objectives were set which necessitated systems to evaluate progress in achieving these goals. The importance of management information was clearly indicated, and remains an integral part of public health policy.

Further indication of the need for management information systems is seen in the Negotiated Service Delivery Agreement document (Department of Health, 2010). This document spells out the role of various stakeholders in assisting the Department of Health reach the goals set out in the 10-point plan of the Department of Health. An important issue that it highlights is the need for management of clinical staff:

> **More consistent performance management implementation for clinical staff:** a new strategic approach to maximizing workforce performance needs to be implemented and monitored so as to ensure that

staff performance is more patient- and outcomes-focused (Department of Health, 2010).

Another initiative that has been implemented successfully is the District Health Information System (DHIS). This was rolled out nationally in 1999 using the Health Information System Project (HISP) software and in effect captured tally sheet data into a Microsoft Access database management system (Williamson and Stoops, 2006). It has since been somewhat integrated within the NHCMIS of some of the provinces, and provides important information for management regarding patient headcounts and service based efficiency measures as well as measures of health outcome. It is interesting to note the extent of the lack of understanding by management about the importance and value of health information found during the early stages of implementation of the HISP project (Williamson and Stoops, 2006). One of the reasons for this is that the benefits of health information for good management is a relatively new development in the health field, and is not taught at undergraduate level (Rhode *et al*, 2008).

During to roll out of the DHIS, one of the problems encountered was the incomplete recording of ticks on the tally sheets (Muschel, 1999). This once again highlighted the problem of using tally sheets, but was probably more symptomatic of staff not understanding the importance of information for management purposes.

The tally sheet that is used to capture the Primary Health Care information for the Routine Monthly Report from a community health centre in the Western Cape is presented in Appendix 1. Each procedure that was carried out during a patient encounter is ticked along the line where the patient label is affixed. The range of items includes such procedures as "treat STI" (sexually transmitted infection), chronic care visit, cervical smear taken, etc.

These forms are then captured on the primary health care information system using a bar code reader – scanning a bar code for each procedure that was ticked on the tally sheet, as well as scanning the patient folder number.

Once captured, the data is sent via the local authority to the Provincial Health Department and to the National Health Department, according to the defined data flow policy (Department of Health, 2003a). This information is then available to health planners and other managers.

In the dental clinics, information is also required for the Routine Monthly Report, and a manual system is maintained by the staff for reporting on certain variables. The dental data collected is shown in Appendix 2. The data items collected are attendances, extractions, fillings, scaling and polishing and five other items. These are then sent, via the facility manager to the provincial Department of Health.

The subject of this thesis is the PDE system (which will be described below), and which has been in place throughout the Western Cape Province since 1994. All the oral health data collected on the RMR form (Appendix 2) has been available on the PDE system since 1994. This is a classic example of having a data set, yet creating another (manual) data collection system rather than utilizing what one already has and which is available electronically. The reason given was that the RMR data is required per month and the PDE system operates on a quarterly basis.

The PDE system is designed to also run on a monthly basis, if required. But it serves no purpose to report monthly on data that is not "mission critical" and especially if it is available quarterly anyway.

This is a classic example of staff having to complete administrative functions, manually and complete columns on a form on a weekly basis when it is totally unnecessary. This prevents them from doing what they are employed for –

attending to patients. And what makes this even more tragic is that the data items were chosen by the dental managers themselves. A better example of a "Stupor-visor" management style (Booysens, 2001) would be difficult to find.

In order to quantify the production by staff in a dental clinic, service statistics are used. These typically indicate the number of patients seen, the number of treatment (curative or preventive) procedures performed plus the number of community-based preventive programmes set up in schools in the community.

All public health services have a system of reporting statistics up the hierarchy so that an overall picture is obtained about the service rendered. However, in most cases, the reports concentrate on the number of patients seen. This is only a valid measure if patients are homogenous and all receive treatment that requires the same amount of time, etc. Then one could ascribe some value unit to "a patient" and calculate the total production within the reporting unit. It may also be applicable to a primary health care nurse seeing patients in a clinic where, although the conditions differ between patients, the time spent on each patient for examination, prescription and/or referral to the medical officer is standard.

However, in dentistry, patient headcounts are not a reliable indicator of production because of the large differences in time and cost required to treat different patients. A simple extraction is relatively quick and inexpensive, but placing a large filling is much more time consuming and expensive in terms of materials and equipment required. This is even more so when crowns and bridges are provided, but since these more complex restorative treatments are not carried out in public dental services, crowns and bridges will not be discussed further.

Prior to 1994, when the arrival of democracy led to major changes in the structure of public health services, all dental statistics were recorded on a tally sheet form Z800 (Appendix 3). This recorded the number of attendances, fillings, extractions, etc. per dentist or other operator. At the end of a reporting period, usually each quarter (three months), the totals from the Z800 were added up and

entered on the Z804 form (Appendix 4). These forms were then sent to the regional office of the Department of Health. These statistics were then collated at the regional offices and sent up to the national office in Pretoria.

The Z800 form recorded the number of a total of 29 treatment procedures, each one for three patient categories (school, department and prison patients).

The A3 sized Z800 form was a large data collection tool – an A3 sheet of paper which, apart from taking up valuable space on working surfaces (and having materials spilled on it), was limited by the number of columns that could fit on the paper, resulting in a number of procedures being listed under "other". This is a problem common to all column-based data collection tools and results in a loss of what could be valuable and important data.

Another problem encountered with the old system was that the staff at the dental clinics had to add the data from the multiple Z800 forms and transcribe them onto the Z804 form every three months. This was a laborious, time consuming task and often interfered with the clinical care and treatment of patients. Unfortunately, some clinics were less than honest when doing the calculations and inflated the numbers on the Z804 to make the data look "more respectable". After the PDE system was implemented, the calculated production at clinics managed by the then Department of Health, Administration House of Assembly dropped by nearly 30% (Dr J Smit, personal communication, August 1992).

The 29 procedures that were reported on the Z800 form included obvious items such as patients seen, radiographs taken, examinations with charting, teeth extracted, fillings placed, fissure sealants placed, etc. In addition, items of community prevention such as tooth-brushing programmes initiated, fluoride rinsing programmes in schools, number of patients screened, etc. It also contained data on specialist Maxillo-facial surgery, Periodontics and Orthodontics, but these were almost never performed at clinics.

The data from the Z804 forms were added up at the regional office to provide totals for the region, and were then submitted to the National Office, via the provincial offices. This process was time consuming and the summative reports only reflected the reporting period, so it was not possible to observe trends in treatment services at lower levels of the service. This made it almost impossible for managers to detect and correct problems and trends. Also, the reports were not aggregated per clinic because they were based on the treatment provided by individual operators, and some operators provided treatment at more than one clinic. Over a period of time, staff were transferred between clinics, making retrospective analysis per clinic impossible.

What is outlined above is not unique to the public dental services. Even today it is common to all paper-based data recording systems in other spheres of the health system. This has been shown with regard to the Routine Monthly Report (Appendix 1).

The solution, according to some, is to move away from a paper-based system to an Electronic Medical Record (EMR). However, many disagree that this is a solution that South Africa needs (Rhode *et al*, 2008). The costs involved are very high, and network infrastructure and systems may not be available and reliable. Furthermore it requires higher levels of technical skill and support that may not always be available in all areas. There is a great benefit for management when the data is collected manually and processed (and checked) on a system rather than being generated by a "big box" operated by experts, but who have little understanding of the health service situation on the ground (Rhode *et al*, 2008).

In the (medical) primary health care setting electronic medical records are of great value, especially with regard to drug interactions, medical history and attendance at different clinics within the health facility. Various systems have been implemented that have been shown to work well (Hannan *et al*, 2000; Rotich *et al*, 2003; Fraser *et al,* 2005).

However, in the dental setting, systems that record patient encounters by clicking on the relevant block on the input screen, would require a large number of input blocks in order to record all the different types of dental treatment provided. The alternative would be to design a field that could record the code of the treatment, but then provision has to be made for more than one treatment per encounter (for example, extraction plus fillings).

Thus, simply adapting existing systems designed for medical clinics into the dental environment can be problematic. Furthermore, dental clinics (although usually, but not always, located within a PHC clinic) function relatively independently and the types of treatment differ from the medical service, even in primary health care.

Many different electronic patient record systems are available and used by private dentists. However, these are expensive and designed for functions not carried out in the public sector. The most important of these is the billing system which, although vital in the private sector, does not apply in the public sector where almost all dental treatment at clinics is provided free of charge. It therefore does not make sense to try to adapt these systems for use in the public sector. Depending on what is analysed, the computer-based record and the paper-based record each have some of their own benefits (Schleyer *et al,* 2007). Despite the fact that the vast majority of dentists in the USA are in private practice, only about 2% of USA dentists use a completely electronic patient record (Schleyer *et al*, 2007).

In public dental services, the paper-based record is likely to remain in use for some time to come. The purpose of this thesis is not to address this issue, but rather, it seeks to address ways of deriving management information from these records in order to improve the management of the service.

The National Oral Health Policy (Department of Health, 2003b) lists certain treatment priorities, in descending order of importance as:

- Treatment of pain and sepsis and trauma
- Primary prevention
- Secondary prevention (basic restorations)
- Tertiary prevention (dentures)

However, the Comprehensive Oral Health Service Plan approved by the provincial government (Western Cape Department of Health, 2008) for the Western Cape Province has listed the priorities as:

Priority 1: Primary prevention [Water fluoridation, Dental screening of learners, Dental Health Education, Fluoride supplementation (brushing programmes)]

Priority 2: Curative services (Basic treatment package incl. Oral Examination, Intra-oral X-rays, Scaling & polish and fluoride treatment, Simple 1-3 surface fillings, Emergency relief of pain and sepsis, Dentures)

Priority 3: OHC outreach programme (Provision of Maxillo-facial and support services at L.1 and L.2 hospitals)

Priority 4: General anaesthetic-related primary care services (Establish oral health units at planned Khayelitsha and Mitchells Plain hospitals).

Despite the apparent lack of agreement between the two policies regarding treatment priorities, it would be unethical to refuse patients treatment for pain and sepsis, and this remains the highest priority. What is agreed on is the need for a higher priority for preventive services. This is not unique to South Africa, the emphasis is changing worldwide (Fejerskov *et al*, 2013).

The Management Information System in use for public dental services needs to be able to weight the priority services to provide management with information on how each clinic is performing in relation to the other work being done. This will form one of the major themes of this thesis.

In public dental services, in order to manage the service one needs to compare the outputs of various clinics. One way to compare the work done at various clinics is

to just count the number of patients seen at those clinics, but that does not account for the actual amount of work done at the clinics, because some procedures are quick and inexpensive and others are far more time consuming and incur greater costs.

In order to do this and one must be able to compare work actually done. This is very difficult. The Z804 form contains a number of procedures and making a sensible comparison between the clinics is an almost impossible task. What is needed is a method of translating all these procedures into some sort of overall score that can be used to compare all the procedures that are carried out by the operators in the dental clinics.

Such a method was designed by James Riggs in 1984 and is called an objectives matrix (Riggs, 1984). The objectives matrix is being used by many disciplines as diverse as education (Dervitsiotis, 1995) engineering (Noori and Gillen, 1995) and even the public sector (Jääskeläinen, 2010). It has stood the test of time because of its simplicity and effectiveness.

Comparing different scores is very difficult especially if they are more than seven. The Z804 Form contains over 90 different variables. Therefore some tool such as an objectives matrix is necessary in order to make meaningful comparisons between the operators or clinics.

The first step in creating an objectives matrix is to identify productivity criteria or Critical Success Factors (CSFs). A maximum of seven of these critical success factors are used.

The second stage is to allocate weighting factors to these critical success factors, the total weighting adding up to one. The most important factor, the one with the highest rank, has the highest weighing.

The third step is to define performance management scales. These are scales for the measurement of actual performance. Values are determined for each of the CSF's and they are all on a scale between zero and ten where zero equals the lowest level of performance and ten the maximum possible performance. The performance scale is designed in such a way that the "average" performance equates to a performance score of three (out of 10) which leaves plenty of room on the scale for improvement over time.

Then for each of the seven actual performance values obtained, the performance score is derived from the matrix. This performance score is multiplied by the weighting factor to provide a weighted score for each CSF. The sum of the weighted scores is the performance index. This is a value between 0 and 10 which reflects overall performance of the dentist for the evaluation period. See Appendix 7 for examples of the Objective Matrix Forms developed for Dentists and Oral Hygienists (Appendix 8). The detail will be explained in the next chapter.

The objectives matrix enables one to reduce all the clinical procedures into a single performance index score which enables managers to make an informed decision about the performance of staff. It has an additional purpose as a motivator for staff to improve their scores and if the area under the performance scales for each CSF is coloured in, it serves as a bar graph, thereby clearly showing staff which areas of their performance are good and which areas need improvement. It appears to be complex, but is conceptually straight-forward and the calculations are easily programmed into a computer application.

No reference could be found in the scientific literature on the development of a system similar to the PDE system, despite numerous searches by both the author and University librarians. The conclusion reached is that no one has developed one. This makes the publication of this PDE system all the more important.

Chapter 3. The Design of the Public Dental Evaluation system

The development of the system arose from the need to manage data as well as to enable dentists in the clinic to be more productive. This was borne out from personal experience of working in a clinic and having to add up all the statistics on a form in order to submit it to Head Office. Several hours per week were wasted on this unnecessary administrative task whereas it could have been more productively spent in rendering a clinical service.

This need for a better system was further strengthened by the perception that some dentists seem to get "better stats" than the author was able to achieve, but this did not seem possible as they could not be working twice as hard – there were not enough hours in the day. The conclusion drawn was that there was "something wrong" with the system. So work began on thinking creatively and solving the problem by devising a better system.

The new system was given a name: the Public Dental Evaluation (PDE) system. Originally it was called the Parc du Cap System (PDC), named after the building in which the Western Cape regional office of the Department of Health (Administration: House of Assembly) was situated when the development began in 1988. When the office moved it was decided to change the name to something more generic and which better describes its function. It was renamed the Public Dental Evaluation (PDE) system.

3.1 The Data Capture Instrument

Tally Sheets have been used in public health services for many years and have their limitations, the most important being that one is limited to the number of

columns on the Tally Sheet. What the PDE system sought to address was to come up with a solution to this problem. The solution lies in using treatment codes rather than Tally Sheets.

It is much easier to create and use a code for a new data variable than to design a new form with an additional column. Tally sheets have a limit to the number of columns that can fit the page (and remain legible, especially when many photocopies have been made). One solution is to increase the size of the form to A3. This was done with the Z800 form (Appendix 3) and it used up too much space in the working area in the clinic and got contaminated with spills from the working area. Apart from the mess and inconvenience, this also constituted a cross-infection risk.

Using codes, one can just create an extra code to be filled in as needs or requirements change. For example, when making a full denture one would normally just use the denture code (8231) at completion. But a denture requires five consultations. Therefore a code, without any associated tariff or RVU was created for each stage of the denture making process.

Over the last 18 years, very few codes have been changed or added. This keeps the system familiar and simple for the operator. However, when new codes were required, it was very easy to add them.

Data capture forms needed to be designed so that the treatment codes for each patient could be entered, as well as certain other important variables such as the name of the dentist providing the service, the clinic where the service was carried out, and the category of the patient.

The Clinical Service data capture forms were designed to be A4 size, so that they do not occupy too much workspace in the clinic (Appendix 5). The name of the dentist, therapist or hygienist is at the top of the form, the name of the clinic in

which the work was performed is captured in the block next to it, and the month and year of treatment as well as the page number in the last block.

When the form is completed, the date is recorded as well as the name of the patient (but only for audit purposes – it is not captured in the system). Then the patient category and the treatment codes are recorded. Provision is made for 10 treatment codes per patient. This was based on an analysis of the data in the past and it was found that very few patients received more than 10 treatment codes per visit. If ever it exceeds that, the treatment codes could continue on to the next line for the same patient. After each patient is treated the details are recorded on this form until one reaches the bottom of the page.

No further calculations are required from the dentists in the clinic. This means that all the adding up of figures can become a thing of the past. The forms are collected together and then submitted to a data capturer for input into the system. The system was designed in such a way that the treatment details for each patient could be completed by the dental assistant in-between patients so that there is no downtime from the dentists. This makes their life easier and improves productivity. The staff have expressed their satisfaction about this, many times over the years.

A separate form needs to be completed for each operator in cases where the operator works at more than one clinic. Should an operator work at a satellite clinic other than the one he normally works at (default clinic), the work done at that outside clinic must be on a separate form and that form would have the name of the satellite clinic on it.

This allows data aggregation for a dentist per particular clinic or at all the clinics that he worked at. It also allows the data to be collated for all the clinics or for other larger geographical areas. It also enables all the work done by various operators in a clinic to be calculated. This is a very important aspect of the system, is really easy to implement, and is not time-consuming. It enables data to

be collected for a clinic over a period of time, despite there being a number of different operators at that clinic – as is the case these days with community service dentists only staying for one year.

Provision is made for both the clinical treatment services and community-based services. For the latter, the Community Services Statistics Form is used which differs slightly from the treatment service form in that the number of individuals receiving the service is also filled in (Appendix 6).

The codes on the community services statistics form require some further explanation. The counts for these community services are not just the count of the treatment codes, but the sum of the individuals receiving the type of service, such as starting a tooth brushing programme, receiving dental health education. This is shown in the following table (Table 1).

Table 1. Community Services Statistics form indicating columns to be completed

Code	No. of Individuals	No. of Groups	No. needing Treatment	Travel/15 min	Session Absent
7000					
7001					
7002					
7003					
7004					
7005					
7100	X		X		
7200	X				
7300	X	X			
7400	X	X			
7500	X	X			
7600	X	X			
7700	X	X			
7800	X	X			
7900					
7950					
7960				X	
7970					X

It can be seen that some codes (7000 to 7005) are recorded on the form (Appendix 6) on their own – no other columns are filled in.

However, code 7100 (screening examination at a school) is recorded on the form together with the number of individuals screened in the "No. of Indiv." Column and the number who will require treatment in the "No. need Treat." Column.

Similarly, code 7300 (Group dental health education) is completed for the number of individuals as well as the number of groups. The "X" in the table indicates which codes require data to be completed in those columns.

The travel (per 15 minutes) is for the time that the staff spend travelling to satellite clinics, and the "sessions absent" is the number of half-days that the staff were not working as a result of attending a meeting, or being on leave, etc. It is only completed for code 7970.

The reason for the columns as well as the codes is that for some reports, only the number of schools visited is reported on. For others, the number of individuals as well as the number of groups are required because the number of individuals represents the coverage of the service whereas the number of groups indicates how much work was done. This does cause some confusion to the staff, but after being helped, they understand it and complete the forms correctly.

3.2 Staff and Clinic codes

Each staff member has a unique four digit code number. The numbers were allocated according to the operator type (dentist, dental therapist, etc.) and they just follow in numerical order as new staff are appointed. Dentists started with 3001, oral hygienists started with 3301 and dental therapists started with 3501. Numerical codes were used as they are easier to use than alphanumeric codes – the latter create problems with correct spelling and when a person changes their surname on getting married.

When a new staff member is added, the operator type and the clinic where he/she is based is also entered in the "Type" field. Thus, one can aggregate data for the type of operator in all reports, to compare like with like.

However, some dentists are paid commuted overtime and it is therefore necessary to be able to separate the work done during overtime hours from work done in normal hours. These dentists are given two different staff codes to solve this problem – the overtime staff codes start from 4001 and are derived by adding 1000 to the dentist's staff code used for normal hours.

Commuted overtime is only performed by some dentists and dental therapists, but one cannot compare dentists' production if only some of them work longer hours. Furthermore, managers need to be able to measure their production during these overtime hours to determine whether there is really a need for them to have an overtime contract.

Clinic codes were derived using alphanumerical codes as they are easier to understand than numeric codes – usually the first 4 letters of the clinic name are chosen.

Region codes were also developed for the 4 health regions of the province, but when they were replaced by health districts and later included sub-districts, modifications were made. But when a district boundary changes (clinic falls into a new area) there is a utility that can be used to update all the summary data to reflect this change. This enables one to look back on what happened in the past using the present organisational structure – a useful feature.

3.3 Patient Category Codes

Patient category codes are important and were devised for three main reasons:

- Reporting had traditionally been done on three separate patient types in the past – Schoolchildren, Departmental patients (adults) and Prisoners (in cases where services were rendered at Correctional Facilities). Two more categories were introduced (Under six-years-of age children and pregnant women) as these were to receive free services.

- Not all patients require the same amount of effort in order to provide the treatment. A "normal" adult patient is easy to treat whereas the mentally handicapped child takes at least three times as long to treat for a similar procedure. Therefore simply adding the codes in order to work out how much work was done ignores the complexity of certain patient categories. Therefore it is necessary to record the patient category in order to determine the productivity of the dentists. A weighting factor is applied in the system to adjust for the time and effort that is required to treat each different patient category.

- Some patient categories in terms of the national dental health policy rank higher than others. Therefore, in a similar fashion to the way that production is measured, the policy execution can also be measured by applying weighting factors for patient categories according to policy.

3.3.1 Production Weighting Factors

The first weighting was for production factors (Time and Effort). The category of the patient therefore determined the amount of work that was required to treat that patient, and the production factor was estimated. This was done in conjunction with a number of experienced public service dentists and consensus was reached on what these values should be. These factors would then be used to multiply the relative value units that were done on each of those different patient categories to obtain subtotals. The production factors for each patient category are shown in Table 2.

Table 2. Weighting Factors for each Patient Category

Category	Description	Policy Factor	Production Factor
1	Pre-school child	1.50	1.50
2	Scholar	1.50	1.00
3	Mentally handicapped child	1.50	3.00
4	Physically handicapped child	1.50	1.75
5	Mentally handicapped adult	1.25	3.00
6	Physically handicapped adult	1.25	1.75
7	Old age home resident	1.00	1.50
8	Hospitalized child	1.50	1.50
9	Hospitalized adult	1.25	1.50
10	Prisoner	0.75	1.25
11	Aged	1.00	1.25
12	Adult	0.75	1.00
13	Not applicable	1.00	1.00
14	Pregnant woman	1.00	1.00

3.3.2 Policy weighting factors

A further weighting would also be incorporated in terms of what the policy dictated. For example, the highest policy factor is for work with children and the lowest for adults. This would allow the relative value units to be weighted in terms of what policy dictates, and subtotals to be determined based on the type of patient that the work is being done on. This would reward dentists who are treating lots of children, which is what the policy requires. Since the weighting factor was 0.75 per adult, this would actually reduce the RVU total if they only treated adults at the clinic. Thus a measure could be made of the degree to which the policy was being implemented in terms of the service rendered at that clinic.

The first reaction from the dentists to this proposal was that the patients attending for treatment at a clinic were not under their control. The counter argument was that they should then go and get schoolchildren in by bus so that the emphasis of the treatment could be still according to what the dental health policy at the time described. The policy factors for each patient category are shown in Table 2.

3.4 *Relative Value Units (RVUs)*

The nature of public dental services means that certain priority services are supposed to be rendered which will improve the oral health of the community. The emphasis should be on preventive services (or procedures) as well as outreach programmes into the community. In the private sector a dentist can wait for a patient to come to them. However in the public sector, with patients who have difficulty in accessing health care, one needs to move out into the community to implement preventive programmes as well as to screen patients (usually schoolchildren), and organize for them to attend the clinic for the necessary treatment. Therefore for each treatment code, a policy priority can be determined whereby preventive services carry a higher weighting than curative or rehabilitative services.

Therefore all treatment codes that are used in dentistry in South Africa, which are also used commonly throughout the private sector, were used as the basis of the system. The advantage of this is that each code is also associated with a tariff. This is used in the private sector for billing purposes. If one was able to add up the value (in Rands) of the treatment that was provided by a particular dentist or clinic, one gets a very good idea on the amount of work that has been done by that person (output). Using a financial basis has further appeal in that one can understand the meaning in currency terms – and one can easily make a comparison with actual costs to obtain a measure of cost effectiveness of the service.

Obviously calculating all these things by hand would be very laborious and that is why a computerised system is necessary where only the codes are entered plus the patient category and after that the system generates counts of codes, number of codes for each patient category as well as the value of the work done in Rand terms. It is also possible to calculate the relative value units of work done in

terms of policy for each patient category as well and a measure of the productivity of the dentist.

Determining the weightings for the relative value units is a complex system that is based on the relative value units that are used in the public sector. In the previous, manual system, relative value units had been developed and were multiplied by the specific counts of procedures to produce a total per operator. However this could only be done per operator (dentist, hygienist or dental therapist). Using a computerised system has the additional benefit of being able to measure these per operator and clinic where the service was rendered. This is especially important when dentists rotate through different clinics at different times and so the measure of the work carried out by a dentist is not necessarily the same as the work that is carried out at a particular clinic where the dentist is based. The complexities of doing this manually are self-evident. By having a computerised system that can separate these and then add them together, and the report on all the work done at clinics, all the work done by a particular dentist at a particular clinic, or, the work that is done by the dentist and the oral hygienist at a given clinic makes the information derived from the data far more versatile. This makes good sense because the dentist and the oral hygienist at the clinic should be working as a unit to provide the necessary services. The dentist should not be doing fissure sealants, for example, that should be done by the oral hygienist, but together the work of the clinic should be the unit of evaluation. Therefore, many different reporting permutations are possible in the system. This makes it much easier for the manager to see the overall picture and also to be able to see the components which added up to provide that overall picture.

It is also important to measure trends over time. When this system began, the manual system that it replaced only reported per quarter on the work done by individuals without taking any of these other factors into consideration. In essence it was a snapshot per quarter of what a dentist, therapist or oral hygienist was doing. Comparison with previous quarters in previous years was not

performed as it was too labour intensive. So too, a slow decline in work performance by a dentist would not be detected using only a cross-sectional study.

The many benefits of using the system made further investigation worthwhile. The first step was to decide on the relative value units for each treatment code as well as dividing all the treatment codes (there are 350 of them), into the 92 item tallysheet (the old Z804 form) to enable retrospective comparisons.

Relative value units are units that are allocated to each treatment code and they are derived primarily from the amount of work that is involved in providing that particular treatment (time, effort, complexity and required skill) (American Health Information Management Association, 2009). Therefore the relative value units for a complex procedure such as bridge unit will be much more than for a straightforward extraction. These relative value units formed the basis on which tariffs are determined. The relative value units remain the same from year to year, but the Rand value associated to a single relative value unit increases by a certain percentage during the determination of fees. This prevents distortions occurring in the system whereby certain procedures that were inexpensive become more expensive. The relative value unit that was allocated to each code in terms of the tariff was therefore calculated and a database was set up listing each code, the procedure associated with it, plus these relative value units.

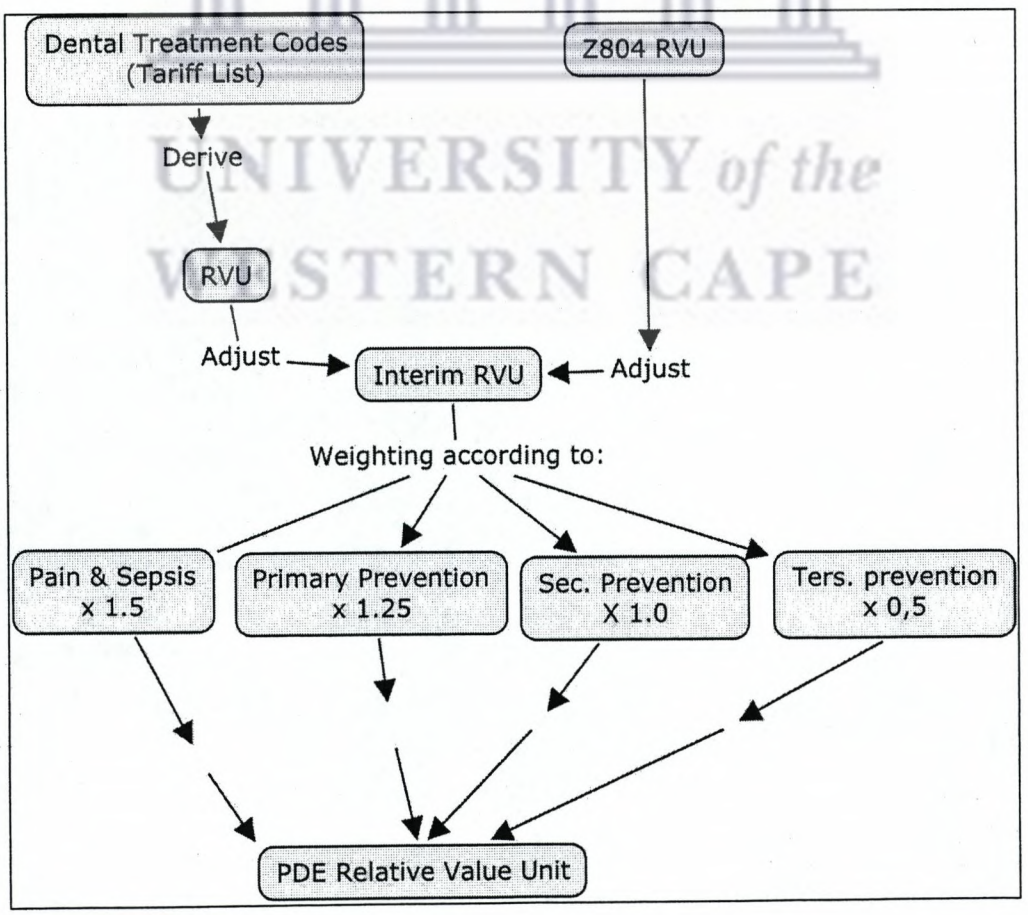
However some of the codes that would be needed in the public sector did not exist in the private sector. These were for activities such as screening examinations at schools, instituting new brushing programmes in schools, visits to the community such as schools, institutions or other public venues as well as giving dental health education to groups of schoolchildren. Therefore codes had to be created for these as they are not within the ambit of treatment in the private sector.

Then the old relative value unit (so called because it was part of the previous tally sheet system) was also captured in this database of treatment codes. This would allow a retrospective analysis of data to take place and to enable comparisons with

the old system. Management buy-in is always much better if one can produce for the manager the system that they are accustomed to in addition to the new system that is being developed. This was the strategy that was adopted in this case.

A new relative value unit called the PDE (Public Dental Evaluation) unit was derived (Figure 2.) by comparing the old relative value unit with the tariff-based relative value unit. For some of the codes that tariff-based relative unit seem to have a value that was too high when one considers how often that procedure is done in the public sector. A classic example would be an extraction of a single tooth which had a relative value unit of 1.0. The old relative value unit for that procedure was 0.75 but even this was considered excessive considering the number of extractions that are done by a dentist in the public sector and as they say, "Practice makes perfect" and one is able to do that procedure relatively quickly.

Figure 2. Derivation of the PDE Relative Value Unit



Each of the codes was allocated a prevention category ranging from 1 to 4 as follows:

- Prevention category 1 was those procedures that were considered to be for pain and sepsis and included codes such as all the fractures, abscesses, emergency treatment for pain relief, and treatment of a dry socket.

- Prevention category 2 contained all those codes that are applicable to primary prevention and they included all of the visits to the schools, brushing programmes etc., as well as X-rays, clinical preventive programmes in the surgery and planning treatment programmes for orthodontics.

- Prevention category 3 were for secondary prevention treatments such as fillings, root canal treatments, orthodontics and certain surgical procedures carried out by specialists.

- Prevention category 4 were all those codes that were considered rehabilitation and these were crowns, dentures, certain surgical procedures to repair craniofacial defects as well as all the extraction codes.

Placing the extraction codes in category 4 was a difficult concept to bring home to the dental staff. They considered it to be pain and sepsis, emergency type treatment that should enjoy a higher priority. The thinking behind placing it in category 4 was that it should be the treatment of last resort to remove the tooth (rehabilitation), one should do prevention first and if that fails secondary prevention and any that fails should the tooth be extracted. It is often that the reality on the ground, however, that all one can do is to extract the tooth. However to place extractions in category 1 would distort the system because the relative value unit for extractions was already too high.

The relative value units of each tariff item was then adjusted either upwards or downwards depending on the prevention category. If the prevention category was 1, the tariff relative value unit was increased. If the prevention category was 4, thereby indicating the lowest priority for the service, the tariff-based relative value unit was decreased. This procedure enables the PDE relative value to be calculated. Much time was spent on this derivation of the PDE relative value unit and comparisons were made with the codes, the old RVUs and with the experience of people who had worked in the clinics.

For the community-based procedures for which there was no tariff relative value unit, the PDE relative value unit was derived from the old RVUs. Most of the relative value units stayed the same as in the old system, however group dental health education was reduced from six to four and "Other community services" were increased from 0.5 to one.

Certain adjustments were made if it appeared that the PDE relative value unit was distorting the picture. Once all the calculations and comparisons had been made a database of codes with the procedures containing the PDE relative value unit, the old relative value units from the tally sheet, the relative value unit based on the tariff as well as the tariff amount in Rands were entered into the tariffs database.

In order for the system to carry out error trapping during data capture, it would be necessary to identify those codes which hygienists or dental therapists would not ordinarily use. Therefore another field have to be added to the database regarding the type of operator that would use that code. This would allow the system to alert the data-capturer if a code was being entered by an Oral Hygienist that was outside their scope of practice, and prompt the data-capturer to correct this.

Another field that was required in the codes / tariffs database was a "counts field". This is the counting unit for the procedure and came about because certain procedures had more than one unit. An example would be the tariff for extracting four teeth per quadrant (code 8204). The system must be able to recognise that

this is for four teeth that have been extracted although only one code was used. This was the way the tariff list was originally compiled, although it has subsequently been changed so that now a single code is used for each tooth extracted. The original system worked better, required less input codes and was therefore retained in the system.

Another variable was the number of surfaces and these related to the number of filled surfaces that were treated during certain filling procedures. This was to maintain backwards compatibility with the checklist system with tooth surfaces being counted and not just teeth filled.

The last variable that was included as a field in the treatment database was the sequence number for the Z804 report. This was to enable aggregation of the data to permit reporting on the same 92 items that had been reported on in the past – in essence, a shortened, summary treatment list (Appendix 9).

Therefore the treatment codes database is the basis on which treatment based calculations are made in the system. It contains 350 different codes, some of which are shown in appendix 10.

In order to be able to capture the data, the static databases were created. The staff details were captured for the staff, with a staff number, the name of the operator, the type of operator (dentist, dental therapist or oral hygienist) and a (default) clinic in which they worked. A "clinics" database was also created with the names of all the clinics and the sub-districts in which they are found. A "districts" database was created listing all the sub-districts which resorted under each district.

Therefore using a relational database system it is simple to aggregate the data by the name of the dentist and default clinic (which was user changeable during data capture), and the district in which it was situated. Summarised data could then be aggregated and viewed by clinic, sub-district, district or even the whole province.

This makes it easy to provide information about services rendered based on the geographic area.

3.5 *The Objectives Matrix*

The Objectives Matrix was set using key performance areas that were considered important for public dental services. Originally eight different objectives (Critical Success Factors or Key Performance Areas) were chosen, but two were never implemented because they were dependent on other systems which had not yet been put in place. These objectives that were left out were: reduction in DMFT (Decayed Missing and Filled Teeth), which would require an interface with epidemiological data, and, Patient satisfaction levels, which would be dependent on a system to be set up to measure patient satisfaction, and this has not been done.

The first Key Performance Area (KPA) is Production units. Production is measured as the total number of relative value units that were produced by a dentist in a quarter, and the expected total is 2000. For this criteria the performance scores range from zero to 5500. These values were chosen by analysing existing data at the time and determining the mean and range.

The second criterion (Key Performance Area) was the percentage increase of PDE units due to policy factors. What is, in essence, measured is the number of PDE units per quarter and how they increased due to the weighting from treating patients which were in line with the dental health policy. Since the policy encourages the treatment of children, a weighting for children when applied to the total will result in an increase in the PDE units. Few clinics are able to see children exclusively as there is always a demand from adults, and that is a state of affairs which exists at most clinics, however, the percentage increase due to policy execution is a good way to measure to what extent the patient priorities as laid

down in the policy being carried out at that clinic. The norm here is a 15% increase and the range is from -25% to 50%.

The third criterion (KPA) is the percentage increase in production, by weighting the unadjusted PDE units. This is as a result of applying the weighting factors for production such as patients which require more effort (such as mentally handicapped patients), and determining the percentage increase that results from that. The expected performance norm is also a 15% increase and the range is from 0 to 200%. This rewards dentists for the extra work that is required to treat time-consuming patients.

The fourth criterion (KPA) is the number of patients screened. It is important to go out of the clinic and find school children who need treatment and get them to come to the clinic before they experience symptoms, and therefore screening is very important and should be carried out by all clinics. The number of patients screened, usually primary school children, is used for this criterion. The norm is 300 and the range is from 0 to 1500.

The fifth criterion (KPA) is the ratio between primary and secondary or tertiary prevention services. This enables one to determine whether purely curative services are being carried out the clinic, or whether preventive services are also being performed. The preventive services are community-based services as well as clinical preventive services such as fluoride treatments fissure sealants etc. While it is understood that the services that are being measured are performed by dentists, one cannot expect a dentist to be doing all the tasks of the oral hygienist. However many dentists do not have the services of an oral hygienist and are therefore expected to do the work themselves. This criterion shows the extent to which it is being done. The expected performance is 0.6 which would indicate that 60% of the services carried out by the dentist are primary preventive in nature compared to the secondary and tertiary prevention services. The choice of this criterion was to encourage the dentist not to just fill and extract teeth. The performance scores range in value from zero to two. Obviously it would be

unusual for a person to score two for this criterion because then twice as much work would be done on primary prevention as on secondary and tertiary prevention and it would be most unusual for a dentist to do this.

As explained earlier the DMFT reduction is the sixth criterion and is not used at this stage.

The sixth criterion (KPA) is the ratio between fissure sealants and restorations. It would be expected for a dentist to do more restorations than fissure sealants and therefore the norm for this criterion is 0.6. The range is from zero to 2. It would be most unusual for a dentist to do the same number of fissure sealants as restorations, but management could determine the actual ratio from this performance score.

The seventh and final criterion is the ratio between special prevention programmes and dental health education. Due to the minimal benefit obtained from simple dental health education at the schools, it is important that special programmes, such as brushing programmes, rinsing programmes, etc. are implemented at the school as well as dental health education. The calculation is based on the proportion of children involved in respect of these special programmes and 0.05 was determined as the norm and the range being from 0 to 1. Human resource limitations prevent a score of 1 in most cases which would imply that every child that is receiving dental health education at the school is also on a brushing or rinsing programme. However, this would be a very beneficial situation in that great emphasis will be placed on community-based prevention programmes that are proven to be effective.

The weightings for each of these criteria were determined in such a way that they add up to one, the highest priority being given to the criterion with the lowest number so that the performance score would be weighted more for the important things and less for the less important criteria. The sum of the weighted scores

would then provide a performance index. This is a single score between zero and 10 with three being the expected performance of this dentist that quarter.

So, it can be seen in the Objectives Matrix considers a number of different aspects of the treatment that is being provided by the dentist, and provides a final weighted performance index on which the performance of the dentist can be rated.

Oral hygienists' have a separate Objectives Matrix. This is necessary primarily because they do not provide any secondary or tertiary preventive services, such as fillings and extractions. So the objectives matrix is similar to the dentists', except for criteria five and six, which are excluded. This affects the weightings, which are suitably adjusted. Their performance index can be calculated in a similar fashion as the dentists.

The performance scores in an Objectives Matrix differ depending on whether the system is based on a monthly or quarterly system. There are separate monthly and quarterly Objectives Matrices for both dentists and oral hygienists.

Over the years, few changes have been made in the norms or values in the objectives matrix, since there has been no request to do so from the dental services. This, however, may be due to the fact that the services are not using the Objectives Matrix performance indexes as often as they should.

When the reports are generated by the PDE system, the performance scores are saved in the summary databases and can be easily reported on for a given time period to see if improvement is taking place or not. This will be further discussed in Chapter 5.

3.6 *The Reports*

Originally, all the reports were printed on paper, as spreadsheets were not versatile enough to generate reports in the format of pivot tables. This meant that at the end of the reporting period, usually quarters, reports were printed for each operator and for each clinic according to three basic formats. When the reports were printed, the most important variables were saved in so-called summary databases. This enabled summary data to be printed at a later stage which included more than one quarter, without having to do all the calculations again. This was very important as computers at that time were slow, and printing all the reports was a laborious process.

As has been described above, treatment codes are captured in the PDE system for all operators (dentists, dental therapists and oral hygienists). The PDE system has been developed in a relational database (dBase) and this prevents so-called "data redundancy" by not including unnecessary data in the main database. Links, called "relationships" make it possible to only capture the code number of an operator in the main database, but the link to another database containing the staff number as well as the name allows the reports to reflect the name (as well as the number if desired). Thus, the name is not saved in the main database as it is "redundant" and subsequently the main database is much smaller. This was particularly important in the days when the system was originally developed, in the 1990's, as memory and storage capacity of personal computers was very small by today's standards. However, it is still a useful arrangement today as it prevents creating large files that cannot easily be distributed.

The first step in generating reports is therefore to utilize these relationships and append records into the summary databases with the names of staff, description of the treatment, name of the clinic, health district, etc. so that the report in user-friendly.

Originally the reports were printed, and many different permutations were created, such as a report for an operator for all clinics, a report for an operator only at a specific clinic, a report for all the operators at a specific clinic, a report for all clinics in a health district or sub-district, etc.

When certain reports were printed, the data that was printed was saved in summary databases for future use and comparison. However, after a number of years of making new report formats and changing others it became clear that this was becoming confusing to users and the possible permutations were becoming too numerous.

Fortunately, Microsoft added a very useful feature into Excel® in the mid-1990's which allowed a user to query a database using "Pivot Tables". The user now had unlimited possibilities to customise the output report, and even simultaneously create a graph of the data.

Another very useful feature of the pivot table was that it could import data directly from a dbase database. The earlier versions of Excel spreadsheets could only contain 32 000 rows – far too few for the PDE system. However, setting up an Open Database Connection (ODBC) with the database, meant that the pivot table could read data from a database containing over a million records. Also, updates to the database were possible without having to recreate the pivot table – all that was required was to refresh the pivot table.

It became obvious that printing reports was outdated and that pivot tables were the way of the future, so changes were made to the system to permit this. Certain data redundancy was built in so that the pivot tables were more user friendly, but that was a small price to pay.

A menu system was therefore created to prepare the data for pivot tables. This involved utilizing the relationships between databases to populate the summary databases. In this process, all the weightings were applied to the treatment codes

based on the category codes and the RVUs so that the summary databases contained a single summarised record for each operator or clinic for the given reporting period (quarter or year).

This, however, is not a simple as it sounds. This can be best explained by means of examples.

The treatment codes are captured for an operator in a database called "DATA.DBF". This database is shown in Table 3

Table 3. Structure of the main database (DATA.DBF)

MONTH	QUARTER	YEAR	STAFF_NO	CLINIC	CAT	CODE	SEQ	RECRD_NO
1	1	2012	3185	KRAA	2	8000	1	1
1	1	2012	3185	KRAA	2	8201	1	2
1	1	2012	3185	KRAA	12	8000	2	1
1	1	2012	3185	KRAA	12	8101	2	2
1	1	2012	3185	KRAA	12	8000	3	1
1	1	2012	3185	KRAA	12	8201	3	2
1	1	2012	3185	KRAA	12	8000	4	1
1	1	2012	3185	KRAA	12	8201	4	2
1	1	2012	3185	KRAA	12	8000	5	1
1	1	2012	3185	KRAA	12	8201	5	2
1	1	2012	3185	KRAA	12	8000	6	1
1	1	2012	3185	KRAA	12	8000	7	1
1	1	2012	3185	KRAA	12	8159	7	2
1	1	2012	3185	KRAA	12	8010	7	3
1	1	2012	3185	KRAA	12	8000	8	1
1	1	2012	3185	KRAA	12	8201	8	2
1	1	2012	3185	KRAA	2	8000	9	1
1	1	2012	3185	KRAA	2	8367	9	2
1	1	2012	3185	KRAA	2	8367	9	3
1	1	2012	3185	KRAA	12	8000	10	1
1	1	2012	3185	KRAA	12	8001	10	2

The field names are explained below:

MONTH	The month in which the treatment was performed
QUARTER	The quarter in which the treatment was performed
YEAR	The year in which the treatment was performed

STAFF_NO	The four digit staff number
CLINIC	The four character clinic code
CAT	The patient category
CODE	The treatment code
SEQ	The sequential record number of the patient (index code)
RECRD_NO	The sequential treatment number of the treatment for the particular patient (index code)

Thus in the main database (DATA.DBF), each treatment code is a separate record together with an identifier of who performed the treatment, on which type of patient, at which clinic and when.

Preparing the data for pivot tables involves converting this data into a format where each record is the total number of separate treatments performed by an operator in a given period (usually a quarter). The summary database structure depends on what type of report is required, and the three main report types will be described separately.

Summary databases are essential. In the main transactional database there are over 15 million records, although each quarter and year are separate databases. The largest of the summary databases contains just over a quarter of a million records. This represents a large size reduction which facilitates portability of data and speed of processing.

It is necessary to explain the naming of database files. The 8.3 convention is used because dBase does not recognize file names of a different format. The 8.3 convention requires the file name to be no more than eight characters long, separated from the three character file extension by a full stop. Therefore, this introduced limitations in the filenames and required files to be given short, but unique names. To an outsider they may appear confusing, but the logic will become apparent in the text where relevant.

3.6.1 The Z804 Operator report

This report, named after the Z804 form, listed each of the procedures grouped according to the categories on the old Z804 form that had been carried out by each operator for quarter. The procedures were grouped according to whether they were done on schoolchildren, departmental patients, or prisoners. Later an additional category, children under-six, was added as there was a need to determine the number of beneficiaries of the service when it was introduced as a free service in 1996.

The report was therefore simply a list of procedures performed. It detailed the number of patient attendances, the number of fillings, the number of extractions and so on. It was in essence a typical statistical report but one that was not very useful in terms of measurable objectives. It however provided information to the annual report which showed how many patients were seen and what treatment had been done. It did not provide much information to managers, but it was the only report that was produced about public dental services at the time.

This report lists all the treatment procedures performed by an operator for a selected period of time. It is based on the 92 treatment categories that were listed in the old, manual, Z804 form.

The first stage is to convert the data captured in data.dbf to the format shown in Table 4.

Table 4. Structure of summary database (Z804TSUM.DBF)

PTTYPE	REGCODE	SUBREG	STAFFNAME	STAFF_NO	MONTH	YEAR	QUARTER	Z1	Z2	Z3
SCHOOL	METR	TYGB	AHMED H	3002		2012	1	715	28	0
SCHOOL	METR	SOUT	BAILEY S	3006		2012	1	189	51	6
SCHOOL	METR	TYGB	BARDAY K M	3007		2012	1	475	43	1
SCHOOL	METR	KLIP	BASSIER A K	3009		2012	1	646	77	12
SCHOOL	METR	KLIP	BAWA A	3010		2012	1	236	4	0
SCHOOL	METR	MPLN	CORNELIUS C A	3015		2012	1	799	22	0
SCHOOL	WINE	STEL	DE WET H A	3019		2012	1	399	33	12
SCHOOL	EDEN	OUDT	EDWARDS R F	3025		2012	1	316	0	1
SCHOOL	METR	WEST	ENGELBRECHT J	3026		2012	1	128	0	1
SCHOOL	METR	TYGB	GRIMWOOD R	3032		2012	1	35	1	0
SCHOOL	WEST	SWAR	HORNIMANN M E	3035		2012	1	314	0	7

The field names are explained below:

PTTYPE	Patient category type (School, Department, Prison or Under 6 years)
REGCODE	District code
SUBREG	The sub-district in which the operator works
STAFFNAME	Name of the operator
STAFF_NO	Staff number
MONTH	Month of treatment (left blank if quarters are used as reporting period)
YEAR	Year of treatment
QUARTER	Quarter in which treatment was performed
Z1	Patient attendances
Z2	Examination and chartings performed
Z3	X-rays taken
Z4 to Z92	All the other treatments that were on the old Z804 form.

This file (Z804TSUM.DBF) is the total of Z804SSUM.DBF (Schools data), Z804DSUMM.DBF (Departmental patients data), Z804PSUM.DBF (Prisons data) and Z804FSUM.DBF (under-six data). The "T" in the fifth character in the filename indicates this.

It is now possible to use a pivot table to analyse the treatments for each operator, but this is tedious as there are 92 fields numbered Z1 to Z92 and this leads to complicated pivot tables. What is needed is to create a different layout, as shown in Table 5.

Table 5. Structure of summary database (ZENTSUMM.DBF)

STAFF_NO	TYPE	YEAR	QUARTER	ORDER	PROCEDURE	ENTRY
3002	D	2012	1	1	ATTENDANCES	715
3002	D	2012	1	2	EXAMINATION + CHARTING	28
3002	D	2012	1	7	AMALGAM - TEETH	3
3002	D	2012	1	8	AMALGAM - SURFACES	3
3002	D	2012	1	9	COMPOSITES - TEETH	116
3002	D	2012	1	10	COMPOSITES - SURFACES	193
3002	D	2012	1	21	EXTRACTIONS - TEETH	456
3002	D	2012	1	29	OTHER (TREATMENT SERVICES)	36
3002	D	2012	1	30	ATTENDANCE (PREVENTION)	218
3002	D	2012	1	33	ORAL HYGIENE INSTRUCTION	215
3002	D	2012	1	35	SCALE & POLISH	171
3002	D	2012	1	36	POLISH ONLY	1
3002	D	2012	1	37	FLUORIDE FULL	2
3002	D	2012	1	38	FLUORIDE PARTIAL	1
3002	D	2012	1	39	FISSURE SEALANTS	11
3002	D	2012	1	43	OTHER (CLINICAL PREVENTION)	3
3002	D	2012	1	86	MINOR SURGERY	42
3006	D	2012	1	1	ATTENDANCES	189
3006	D	2012	1	2	EXAMINATION + CHARTING	51
3006	D	2012	1	3	X-RAY	6
3006	D	2012	1	4	TEMPORARY FILLING	1
3006	D	2012	1	9	COMPOSITES - TEETH	60
3006	D	2012	1	10	COMPOSITES - SURFACES	90
3006	D	2012	1	21	EXTRACTIONS - TEETH	96
3006	D	2012	1	27	GENERAL ANAESTHESIA	2
3006	D	2012	1	29	OTHER (TREATMENT SERVICES)	11
3006	D	2012	1	30	ATTENDANCE (PREVENTION)	47
3006	D	2012	1	35	SCALE & POLISH	1
3006	D	2012	1	36	POLISH ONLY	45
3006	D	2012	1	38	FLUORIDE PARTIAL	1
3006	D	2012	1	39	FISSURE SEALANTS	92
3006	D	2012	1	43	OTHER (CLINICAL PREVENTION)	40

Fields relating to patient type, district, sub-district and staff name have been omitted in Table 5 due to space constraints. The field "Order" refers to the order of the procedure according to the original Z804 report. The list of procedures and their order can be found in Appendix 9.

One can see that the counts of procedures in Table 4 are all present in Table 5, but the format is altered so that each record is a summarized total of each treatment performed by the operator in a quarter, for, in this example, schoolchildren. This makes it much easier to be read into the pivot table.

A system does this conversion very quickly – using old, slow computers in the early 1990's this took long, but the conversion now takes about five seconds per operator.

As explained above regarding file names, data for the schools, department, prisons and under-six patients are first separated into databases ZENTSSUM.DBF, ZENTDSUM.DBF, ZENTPSUM.DBF and ZENTFSUM.DBF respectively. ZENTTSUM.DBF is the total of these category-based files. This allows one to "unscramble the egg" and list the patient categories separately.

3.6.2 The Z804 Clinic report

This report is in essence the same as the Z804 report for operators, described above, but lists all the procedures not according to a single operator, but according to all the operators who were working at a particular clinic. This indicates a better overview of work that was carried out by clinic where a dentist and an oral hygienists and maybe a part-time dentist were working. This is especially useful when dentists work at more than one clinic, or where more than one person works at a particular clinic. The data can be aggregated from the clinic up to the sub-district, the district, and eventually the province. This is easily done in the system is each treatment code is changing the database with the code of the operator and the code of the clinic. Knowing which clinic the work was performed in makes it easy to aggregated data per sub-district even if the borders of the sub-district change, as they have done on several occasions in the past few years. This means that historical data can easily be analysed even according to the new sub-district boundaries.

Essentially this is also just a list of procedures. It is very difficult to compare performance of clinics based on this type of data as there are so many variables and so much variation between the variables.

Managers are not only concerned about the work performance of the operators, they are also interested in the totals of treatment performed within a clinic by all the operators and collated per administrative entity (sub-district of district). As has been mentioned previously, some dentists and hygienists work at satellite clinics as well as their base clinic. If one only looks at the work performed by the operators, one cannot determine what was done at the base clinic and the satellite clinic.

Therefore, a similar Z804 report needs to be created where the clinic, and not the operator, is the unit of aggregation. This option has been created in the system, and takes the data in DATA.DBF (Table 3) and creates a database called Z804TCLI.DBF which is similar in structure to the Z804TSUM.DBF shown in Table 4.

As explained above regarding file names, data for the schools, department, prisons and under six patients are first separated into databases Z804SCLI.DBF, Z804DCLI.DBF, Z804PCLI.DBF and Z804FCLI.DBF respectively. Z804TCLI.DBF is the total of these category-based files. Again, this allows one to "unscramble the egg" and list the patient categories separately.

The database structure of Z804TCLI.DBF is shown in Table 6.

Table 6. Structure of Z804TCLI.DBF database

REGCODE	DISTCODE	CLINCODE	CLINIC	YEAR	QUARTER	Z1	Z2	Z3
EDEN	HESS	ALBE	ALBERTINIA	2012	1	56	0	0
METR	WEST	ALEX	ALEXANDRA HOSPITAL (C)	2012	1	5	5	0
WINE	WITZ	ANNI	ANNI BROWN	2012	1	15	0	0
OVER	AGUL	ARNI	ARNISTON	2012	1	10	0	0
WINE	BRER	ASHT	ASHTON	2012	1	72	22	0
METR	WEST	ATLA	WESFLEUR, ATLANTIS	2012	1	1106	0	0
OVER	SWEL	BARR	BARRYDALE	2012	1	53	0	0
METR	TYGB	BELL	BELLVILLE	2012	1	1402	5	0
METR	TYGB	BISH	BISHOP LAVIS	2012	1	2231	96	8
METR	WEST	BITF	BITTERFONTEIN	2012	1	7	0	0
WINE	BRER	BONV	BONNIEVALE	2012	1	68	18	0
OVER	THEE	BOTR	BOTRIVIER	2012	1	93	16	0
WINE	BREV	BRAN	BRANDVLEI PRISON	2012	1	151	0	0
OVER	AGUL	BRED	BREDASDORP	2012	1	220	0	0
WINE	WITZ	BREE	BREDE RIVER	2012	1	106	0	0
WINE	BREV	BREW	BREWELSKLOOF HOSPITAAL	2012	1	6	0	0
EDEN	OUDT	BRID	BRIDGTON	2012	1	367	0	0
OVER	SWEL	BUFK	BUFFELSJAGSRI VIER	2012	1	37	0	0
KARO	BEAU	BWES	BEAUFORT WEST	2012	1	720	30	0
OVER	THEE	CALE	CALEDON	2012	1	894	0	2
EDEN	KANN	CALI	CALITZDORP	2012	1	79	0	0
OVER	THEE	CALP	CALEDON PRISON	2012	1	22	0	0
WINE	WITZ	CERE	BELLA VISTA, CERES	2012	1	562	80	0
WEST	CEDE	CITR	CITRUSDAL	2012	1	47	0	0
WEST	CEDE	CLAN	CLANWILLIAM	2012	1	285	18	1
WINE	BRER	COGM	COGMANSKLOOF	2012	1	1	0	0
EDEN	GEOR	CONV	CONVILLE	2012	1	617	0	1
METR	MPLN	CROS	CROSSROADS	2012	1	610	0	0
WEST	SWAR	DARL	DARLING	2012	1	153	0	0
WINE	BREV	DEDO	DE DOORNS	2012	1	42	0	0
METR	TYGB	DELF	DELFT	2012	1	4122	16	1

Not shown in Table 6 are the fields: Type (of patient), Province, Region, District and Month, due to space constraints here.

It is also important to note that nomenclature changes over time, and this organizational change introduces complexities for computer programmers. The

names "Region" and "District" were changed to "District" and "Sub-district", respectively, in the mid 1990's. Changing the field names in several databases was therefore required, but this is no mean task as there is about 10 000 lines of programming code in the system and any references to any of these field names would have to be changed throughout the system. Then, there was no guarantee that changes would not occur in future. The old field names were therefore left unchanged.

As was the case with the operator summary database (Z804TSUMM.DBF), the Z804TCLI.DBF database has each procedure (Z1, Z2, Z3, etc.) in a separate field but in the same record but this time for the clinic. In a similar fashion, as with the operator summary database, the structure of the clinic summary database needs to change to prepare it for pivot tables.

Again, regarding file names, data for the schools, department, prisons and under-six patients are first separated into databases ZENTSCLI.DBF, ZENTDCLI.DBF, ZENTPCLI.DBF and ZENTFCLI.DBF respectively. ZENTTCLI.DBF is the total of these category-based files. As with the examples given above, this allows one to list the patient categories separately.

This new version of the data is a database named ZENTTCLI.DBF and is shown in Table 7.

Table 7. Structure of Summary database ZENTTCLI.DBF

REG CODE	DIST CODE	CLIN CODE	CLINIC	YEAR	QUARTER	PROCEDURE	ENTRY
EDEN	HESS	ALBE	ALBERTINIA	2012	1	ATTENDANCES	56
EDEN	HESS	ALBE	ALBERTINIA	2012	1	EXTRACTIONS - TEETH	78
EDEN	HESS	ALBE	ALBERTINIA	2012	1	OTHER (TREATMENT SERVICES)	27
EDEN	HESS	ALBE	ALBERTINIA	2012	1	OTHER (CLINICAL PREVENTION)	1
METR	WEST	ALEX	ALEXANDRA	2012	1	ATTENDANCES	5
METR	WEST	ALEX	ALEXANDRA	2012	1	EXAMINATION + CHARTING	5
METR	WEST	ALEX	ALEXANDRA	2012	1	OTHER (CLINICAL PREVENTION)	5
WINE	WITZ	ANNI	ANNI BROWN	2012	1	ATTENDANCES	15
WINE	WITZ	ANNI	ANNI BROWN	2012	1	OTHER (TREATMENT SERVICES)	6
WINE	WITZ	ANNI	ANNI BROWN	2012	1	ATTENDANCE (PREVENTION)	2
WINE	WITZ	ANNI	ANNI BROWN	2012	1	ORAL HYGIENE INSTRUCTION	2
OVER	AGUL	ARNI	ARNISTON	2012	1	ATTENDANCES	10
OVER	AGUL	ARNI	ARNISTON	2012	1	EXTRACTIONS - TEETH	16
OVER	AGUL	ARNI	ARNISTON	2012	1	OTHER (TREATMENT SERVICES)	2
WINE	BRER	ASHT	ASHTON	2012	1	ATTENDANCES	72
WINE	BRER	ASHT	ASHTON	2012	1	EXAMINATION + CHARTING	22
WINE	BRER	ASHT	ASHTON	2012	1	EXTRACTIONS - TEETH	123
WINE	BRER	ASHT	ASHTON	2012	1	OTHER (TREATMENT SERVICES)	16
WINE	BRER	ASHT	ASHTON	2012	1	ATTENDANCE (PREVENTION)	1
WINE	BRER	ASHT	ASHTON	2012	1	ORAL HYGIENE INSTRUCTION	1
WINE	BRER	ASHT	ASHTON	2012	1	OTHER (CLINICAL PREVENTION)	1
METR	WEST	ATLA	ATLANTIS	2012	1	ATTENDANCES	1106
METR	WEST	ATLA	ATLANTIS	2012	1	COMPOSITES - TEETH	21
METR	WEST	ATLA	ATLANTIS	2012	1	COMPOSITES - SURFACES	50
METR	WEST	ATLA	ATLANTIS	2012	1	EXTRACTIONS - TEETH	2307
METR	WEST	ATLA	ATLANTIS	2012	1	GENERAL ANAESTHESIA	52
METR	WEST	ATLA	ATLANTIS	2012	1	OTHER (TREATMENT SERVICES)	138
METR	WEST	ATLA	ATLANTIS	2012	1	ATTENDANCE (PREVENTION)	12
METR	WEST	ATLA	ATLANTIS	2012	1	SCALE & POLISH	7
METR	WEST	ATLA	ATLANTIS	2012	1	FLUORIDE PARTIAL	1
METR	WEST	ATLA	ATLANTIS	2012	1	OTHER (CLINICAL PREVENTION)	3
METR	WEST	ATLA	ATLANTIS	2012	1	SOFT TISSUE TRAUMA - MINOR	1
OVER	SWEL	BARR	BARRYDALE	2012	1	ATTENDANCES	53
OVER	SWEL	BARR	BARRYDALE	2012	1	EXTRACTIONS - TEETH	115
OVER	SWEL	BARR	BARRYDALE	2012	1	OTHER (TREATMENT SERVICES)	11

In order to solve the problem of administrative areas having the incorrect descriptor, regions were renamed "District" and sub-regions were renamed "Sub-districts" in the final conversion of the data for the pivot tables. The treatment was also divided into the patient types (in a similar fashion as for the operators). The resulting summary database for the services rendered at the clinics, aggregated by clinic) is ZREPCLI.DBF and is shown in Table 8.

Table 8. Structure of summary database ZREPCLI.DBF

TYPE	CLINIC	YEAR	QUARTER	ORDER	PROCEDURE	ENTRY
DEPARTMENT	ALBERTINIA	2012	1	1	ATTENDANCES	21
SCHOOL	ALBERTINIA	2012	1	1	ATTENDANCES	18
UNDER 6	ALBERTINIA	2012	1	1	ATTENDANCES	17
DEPARTMENT	ALBERTINIA	2012	1	21	EXTRACTIONS - TEETH	39
SCHOOL	ALBERTINIA	2012	1	21	EXTRACTIONS - TEETH	39
DEPARTMENT	ALBERTINIA	2012	1	29	OTHER (TREATMENT SERVICES)	3
SCHOOL	ALBERTINIA	2012	1	29	OTHER (TREATMENT SERVICES)	7
UNDER 6	ALBERTINIA	2012	1	29	OTHER (TREATMENT SERVICES)	17
DEPARTMENT	ALBERTINIA	2012	1	43	OTHER (CLINICAL PREVENTION)	1
DEPARTMENT	ALEXANDRA	2012	1	1	ATTENDANCES	5
DEPARTMENT	ALEXANDRA	2012	1	2	EXAMINATION + CHARTING	5
DEPARTMENT	ALEXANDRA	2012	1	43	OTHER (CLINICAL PREVENTION)	5
SCHOOL	ANNI BROWN	2012	1	1	ATTENDANCES	2
UNDER 6	ANNI BROWN	2012	1	1	ATTENDANCES	13
UNDER 6	ANNI BROWN	2012	1	29	OTHER (TREATMENT SERVICES)	6
SCHOOL	ANNI BROWN	2012	1	30	ATTENDANCE (PREVENTION)	2
SCHOOL	ANNI BROWN	2012	1	33	ORAL HYGIENE INSTRUCTION	2
DEPARTMENT	ARNISTON	2012	1	1	ATTENDANCES	10
DEPARTMENT	ARNISTON	2012	1	21	EXTRACTIONS - TEETH	16
DEPARTMENT	ARNISTON	2012	1	29	OTHER (TREATMENT SERVICES)	2
DEPARTMENT	ASHTON	2012	1	1	ATTENDANCES	38
SCHOOL	ASHTON	2012	1	1	ATTENDANCES	16
UNDER 6	ASHTON	2012	1	1	ATTENDANCES	18
DEPARTMENT	ASHTON	2012	1	2	EXAMINATION + CHARTING	1
SCHOOL	ASHTON	2012	1	2	EXAMINATION + CHARTING	3
UNDER 6	ASHTON	2012	1	2	EXAMINATION + CHARTING	18
DEPARTMENT	ASHTON	2012	1	21	EXTRACTIONS - TEETH	99
SCHOOL	ASHTON	2012	1	21	EXTRACTIONS - TEETH	24
DEPARTMENT	ASHTON	2012	1	29	OTHER (TREATMENT SERVICES)	9
SCHOOL	ASHTON	2012	1	29	OTHER (TREATMENT SERVICES)	6

TYPE	CLINIC	YEAR	QUARTER	ORDER	PROCEDURE	ENTRY
UNDER 6	ASHTON	2012	1	29	OTHER (TREATMENT SERVICES)	1
SCHOOL	ASHTON	2012	1	30	ATTENDANCE (PREVENTION)	1
SCHOOL	ASHTON	2012	1	33	ORAL HYGIENE INSTRUCTION	1
DEPARTMENT	ASHTON	2012	1	43	OTHER (CLINICAL PREVENTION)	1
DEPARTMENT	ATLANTIS	2012	1	1	ATTENDANCES	658
SCHOOL	ATLANTIS	2012	1	1	ATTENDANCES	292
UNDER 6	ATLANTIS	2012	1	1	ATTENDANCES	156
DEPARTMENT	ATLANTIS	2012	1	9	COMPOSITES - TEETH	21
DEPARTMENT	ATLANTIS	2012	1	10	COMPOSITES - SURFACES	50
DEPARTMENT	ATLANTIS	2012	1	21	EXTRACTIONS - TEETH	1214
SCHOOL	ATLANTIS	2012	1	21	EXTRACTIONS - TEETH	431
UNDER 6	ATLANTIS	2012	1	21	EXTRACTIONS - TEETH	662
UNDER 6	ATLANTIS	2012	1	27	GENERAL ANAESTHESIA	52
DEPARTMENT	ATLANTIS	2012	1	29	OTHER (TREATMENT SERVICES)	47
SCHOOL	ATLANTIS	2012	1	29	OTHER (TREATMENT SERVICES)	19
UNDER 6	ATLANTIS	2012	1	29	OTHER (TREATMENT SERVICES)	72
DEPARTMENT	ATLANTIS	2012	1	30	ATTENDANCE (PREVENTION)	10
SCHOOL	ATLANTIS	2012	1	30	ATTENDANCE (PREVENTION)	2
DEPARTMENT	ATLANTIS	2012	1	35	SCALE & POLISH	7
DEPARTMENT	ATLANTIS	2012	1	38	FLUORIDE PARTIAL	1
DEPARTMENT	ATLANTIS	2012	1	43	OTHER (CLINICAL PREVENTION)	1
SCHOOL	ATLANTIS	2012	1	43	OTHER (CLINICAL PREVENTION)	2
SCHOOL	ATLANTIS	2012	1	80	SOFT TISSUE TRAUMA - MINOR	1
DEPARTMENT	BARRYDALE	2012	1	1	ATTENDANCES	38
SCHOOL	BARRYDALE	2012	1	1	ATTENDANCES	15
DEPARTMENT	BARRYDALE	2012	1	21	EXTRACTIONS - TEETH	87
SCHOOL	BARRYDALE	2012	1	21	EXTRACTIONS - TEETH	28
DEPARTMENT	BARRYDALE	2012	1	29	OTHER (TREATMENT SERVICES)	6
SCHOOL	BARRYDALE	2012	1	29	OTHER (TREATMENT SERVICES)	5

Most of the field names are self-explanatory, but "Type" refers to the broad patient category (School, Department, Prison or under 6) that the old system reported on. This introduces an additional level of complexity as the report has to be broken down into these patient categories, the data for each patient category must be listed separately in the database. In Table 8 it can be seen that the attendances are divided into more than one record, based on the patient type. This is another example of data redundancy, but is necessary for the pivot tables to function as required.

The field name "Order" shows the order of the original procedures on the Z804 form and range from one to 92. Keeping the procedures for all the clinics in the same order makes it easier to interpret the reports and promotes familiarity with the previous system.

The essential difference from the operator reports is that the data has been collated by clinic for the quarter – irrespective of which operator, what type of operator or how many operators did the work. Clinics that were not visited during the quarter are omitted from the clinics summary databases.

The system converts the file into this format for pivot tables in just over two seconds per clinic. Once again an example of the speed of modern personal computers.

3.6.3 The PDE Report

This report seeks to move away from the list of procedures which have been used in tally sheet based systems, and to move towards measurable objectives, presenting the data in a meaningful form where summaries can be reported on for each operator per time period (quarter).

The report lists the total number of PDE units, the old RVUs and the private practice tariffs aggregated by patient category. This was the unadjusted data reflecting the work actually carried out.

Since a code is entered into the system for "sessions absent" (such as leave taken or time spent travelling) these codes can be compared to the total number of sessions that are available and the leave factor can be calculated. If this leave factor is then applied to the unadjusted data, it provides a table of similar patient category-based subtotals for PDE units, PDE production totals and PDE policy

execution subtotals. These adjusted figures enable a comparison to be made between different operators operating under different circumstances or for different periods of time in the reporting period due to leave, meetings attended, time spent travelling etc. It enables full-time and part-time staff to be compared with one another on the same basis. The tariffs are not adjusted, as this would be meaningless.

The information from the objectives matrix was also listed on the printout showing, for each operator, the actual performance and the performance score. The performance index was also displayed.

The PDE report provided management with another view of production, adjustments in production due to leave or time away from the clinic, policy execution, and measurable objectives for each operator. In addition, the tariffs gave an indication of the cost that the service would have cost had it been "outsourced" and been done by a private practitioner. This enables management to determine whether the clinic was cost-effective or not. Some clinics could possibly be closed down, as the cost of running them far exceeds the value of the work done. However such a step would assume that no community-based preventive services were performed, because there are no tariffs for brushing programmes etc. However, it remains a useful comparison which is not used in any other disciplines in the public health sector.

As mentioned previously, when any of the above-mentioned reports are printed, the summary data is saved in summary databases for future reference.

As spreadsheet software has developed over the years, one is now able to use pivot tables to query the back-end databases and use the data in a different way. Whereas previously one was limited by the number of different reports that had been set up, one can now create pivot tables to show many more variables in a different format.

In the original system there were many permutations of reports, some are operator per period, some per operator for more than one period, some for more than one operator per period, etc. But one still had a finite number of report formats to choose from.

Another major benefit of using spreadsheets, rather than printed paper, apart from being more eco-friendly, is that one can send the data electronically to the district offices for them to manage the data, and even compile graphs and do further analysis, based on the data.

Whereas the design of the summary databases for the Z804 operator and clinic reports utilized only counts of patient attendances and procedures, the PDE report was designed to utilize weighted Relative Value Units (RVUs). These have been described already, so will not be repeated.

The main database where all the treatment codes are captured (DATA.DBF) has already been described and shown (Table. 3)

The PDE system uses this database to create records showing the adjusted and weighted overall data that can be used to more accurately measure the job performance of the operators (dentists, dental therapists and oral hygienists). The PDE report does not present frequencies of treatment procedures, rather it provides an overview of the performance of the operators, as measured by several mechanisms.

Each treatment code in DATA.DBF is related to a tariff, RVU (both the "old" Z804 RVU and a PDE RVU) as well as a policy factor depending on the relative necessity for this procedure in a public dental setting. All the codes, which are so integral in the system, are contained in a database (TRCODES.DBF) and are listed in Appendix 10.

The structure of the TRCODES.DBF database is shown in Table 9.

Table 9. Field names in TRCODES.DBF

Field Name	Description of the contents of the field
PROCEDURE	The treatment procedure description
CODE	The treatment code
PDC_RVU	The PDE Relative Value Unit (RVU)
RVU	The RVU on which the tariff is based
OLDRVU	The Z804 RVU that was used in the past
PREF_TARIF	The Private Practitioner (GP) Tariff (2013 fees)
SPECPREF	The Private Practitioner (Specialist) Tariff (2013 fees)
RPLPROC	The descriptor of the procedure in private sector
PREV	The prevention category
Z804SEQ	The sequence order for the Z804 list for collation
TYPE	The category of operator that would use this code
UNITS	Units that are associated with this code
SURFACES	Number of surfaces filled

Some of these field names require further explanation.

The prevention category (field name PREV) indicates the level of prevention for the specific treatment code; emergency treatment is the highest prevention category and has a prevention category 1. Treatment codes associated with primary prevention (health promotion and disease prevention) have a prevention category of 2. Treatment codes relating to secondary prevention (early intervention) have a prevention code of 3. Those treatments that are rehabilitative by nature have a prevention code of 4. As mentioned and explained previously, extractions are included in prevention code 4.

Z804SEQ is the field which provides the cross match between all 343 treatment codes and the 92 Z804 items. Obviously, in some cases, several treatment codes are pooled under one of the 92 Z804 procedures. The case relating to the category "Other" on the Z804 list has been discussed already, and is especially interesting because this problem was one of the first reasons that the author sought to develop a fairer system. Having so many diverse treatments all listed as "Other" is patently unfair.

The TYPE field is used for error trapping during data input to alert the data capturer that they are entering a code for a procedure that the operator is not permitted to perform – such as an extraction by an oral hygienist. Dentists may use codes with any type number, dental therapists may only use codes with a type of 2 or less, oral hygienists may only use a code of type 1.

The UNITS field is for treatment codes that refer to more that one unit for counting. An example of this is for the extraction codes, as used by the PDE system (and here it differs from the private sector). An extraction code 8101 refers to a single tooth extracted per quadrant of the mouth, and the Units for that code will be 1. The treatment code 8105, however, refers to the extraction of five teeth per quadrant, and the units for this code will be 5.

SURFACES is another field used for counting multiple units and is used for the surfaces of a tooth filled with a code such as 8369 which is a three surface filling and so the surfaces field will be three. This is used for reporting not only the number of teeth filled, but how many surfaces are filled.

The report that summarizes the performance of each operator is called the Relative Value Unit report and the data for a particular operator in DATA.DBF is converted to a summarized format in a database that contains a record for each operator for the reporting period (usually a quarter). This record contains the information about the performance of the operator, in a database (called PDCSUMM.DBF) as shown in Table 10.

Table 10. Structure of Summary RVU database (PDCSUMM.DBF)

FIELD NAME	DESCRIPTION
PROVINCE	Name of the Province
DISTRICT	Name of the Health District
SUBDIST	Name of the Health Sub-district
STAFF_NO	Staff number
TYPE	Operator type (Dentist, Therapist or Oral Hygienist
NAME	Operator name
MONTH	Month (if the system is based on monthly reporting)
QUARTER	Quarter
YEAR	The year of the report
PDCCAT1	PDE RVUs of work performed on Category 1 patients
PDCCAT2	PDE RVUs of work performed on Category 2 patients
PDCCAT3	PDE RVUs of work performed on Category 3 patients
PDCCAT4	PDE RVUs of work performed on Category 4 patients
PDCCAT5	PDE RVUs of work performed on Category 5 patients
PDCCAT6	PDE RVUs of work performed on Category 6 patients
PDCCAT7	PDE RVUs of work performed on Category 7 patients
PDCCAT8	PDE RVUs of work performed on Category 8 patients
PDCCAT9	PDE RVUs of work performed on Category 9 patients
PDCCAT10	PDE RVUs of work performed on Category 10 patients
PDCCAT11	PDE RVUs of work performed on Category 11 patients
PDCCAT12	PDE RVUs of work performed on Category 12 patients
PDCCAT13	PDE RVUs of work performed on Category 13 patients
PDCCAT14	PDE RVUs of work performed on Category 14 patients
PDC_TOT	Total PDE RVUs for all patient categories listed above
OLDRVU	Total RVUs as used in the old (Z804) system
INCAT1	Total tariff value of work done on Category 1 patients
INCAT2	Total tariff value of work done on Category 2 patients
INCAT3	Total tariff value of work done on Category 3 patients
INCAT4	Total tariff value of work done on Category 4 patients
INCAT5	Total tariff value of work done on Category 5 patients
INCAT6	Total tariff value of work done on Category 6 patients
INCAT7	Total tariff value of work done on Category 7 patients
INCAT8	Total tariff value of work done on Category 8 patients
INCAT9	Total tariff value of work done on Category 9 patients
INCAT10	Total tariff value of work done on Category 10 patients
INCAT11	Total tariff value of work done on Category 11 patients
INCAT12	Total tariff value of work done on Category 12 patients
INCAT13	Total tariff value of work done on Category 13 patients
INCAT14	Total tariff value of work done on Category 14 patients

FIELD NAME	DESCRIPTION
TARIFF_TOT	Total tariff value (Rands) of work performed on all patient categories
LEAVE	The Leave factor
EXTFILL	The Extraction filling ratio
EXT	The number of Extractions
FILL	The number of teeth filled
OBMAT1	Actual performance of Objectives Matrix criterion 1
OBMAT2	Actual performance of Objectives Matrix criterion 2
OBMAT3	Actual performance of Objectives Matrix criterion 3
OBMAT4	Actual performance of Objectives Matrix criterion 4
OBMAT5	Actual performance of Objectives Matrix criterion 5
OBMAT6	Actual performance of Objectives Matrix criterion 6
OBMAT7	Actual performance of Objectives Matrix criterion 7
OBSCORE1	Performance Score of Objectives Matrix criterion 1
OBSCORE2	Performance Score of Objectives Matrix criterion 2
OBSCORE3	Performance Score of Objectives Matrix criterion 3
OBSCORE4	Performance Score of Objectives Matrix criterion 4
OBSCORE5	Performance Score of Objectives Matrix criterion 5
OBSCORE6	Performance Score of Objectives Matrix criterion 6
OBSCORE7	Performance Score of Objectives Matrix criterion 7
PERF_INDEX	Objective Matrix Performance Index

The PDE report therefore converts each treatment code and weights them according to production factors, policy execution factors, the tariff amount and RVUs. The summary database contains some of these items listed individually per patient category and some pooled for all patient categories.

The main items that are entered into the Objectives Matrix are also listed per criterion as well as the overall score.

The number of fillings and extractions was also incorporated into this database as it was requested by the managers, but it does not really belong in this database. The Extraction:Filling ratio was also incorporated, but can lead to misleading results when averaged over a period of time (because it would be a mean of a mean). Arithmetically, a better indication of this ratio for an operator would be to divide the total extractions by the total fillings for the period being investigated.

All the values are for work actually performed. However, the leave factor is calculated and saved in the database. Therefore, comparisons can be made between staff who were away from their clinics (leave, official meeting attendance, etc.) or who spent a long time travelling to satellite clinics. The variable in question needs to be multiplied by the leave factor to enable this comparison to be made.

Obviously, one needs to compare apples with apples – the operator type enables filtering the data so that comparisons can be made among dentists and oral hygienists and dental therapists separately. Comparisons between these operator types can be misleading as the nature of their work in so different.

This PDE report forms the basis of moving away from headcounts and treatment oriented frequencies towards more meaningful, weighted overall measures of production and policy execution.

3.7 Control systems

Several control measures have been built into the system to aid managers in ensuring that good quality information is produced. This is essential in any information system. Managers need to have faith in the accuracy and reliability of the information they use.

3.7.1 Error trapping during data entry

Treatment codes cannot be entered for staff who are not permitted to perform those procedures. This prevents a code for an extraction being entered for an oral hygienist, for example. This has proved to be useful.

However, if a dentist records a code of 8361 (a one surface inlay) instead of an 8163 (fissure sealant), the system cannot detect the error.

The system also does not allow the incorrect number to be captured from the community services forms. Only the relevant fields (number of children, leave days, etc.) are displayed for each community service code, preventing errors. In other words, when a code 7100 is entered, only the fields "No. of Indiv" and "No. need Treatm" are opened so that this data cannot be entered under the incorrect field (such as "Groups"). The fields that are associated with each community service code were shown in Table 1.

Over the years, the accuracy and completeness of the data capture forms by the operators has been very good. Even with staff moving clinics, and regular changing of community service dentists, the dental assistants ensure that the forms are correctly completed.

Another source of satisfaction has been the calibre of data capturers that have been used over the years. One data capturer in particular is extremely efficient and captures most of the data for the province at her clinic, as and when her duties as a dental assistant allow her the time to do so. The accuracy of her data capturing has been checked a few times and she has an unblemished record. It is necessary to check, from time to time, that the data recorded on the form matches the data captured in the databases (accuracy of data capture).

3.7.2 Audit of treatment

Just as it is necessary to check on the accuracy of data captured, it is also necessary to check that the data on the form is an accurate reflection of the treatment performed. It is possible for staff to record codes for treatment not carried out to artificially inflate their performance.

This was the case when the Z804 forms were used in the past, as it was easy to just change a total on a form before submitting it, and no-one was the wiser.

The Department of Health now has a policy that it must be possible to audit treatment data back to the source, in order to improve the quality of the data. This can be done in the PDE system as well.

The Data Capture form has a space where the patient's name is written. The names are not captured by the system, as this is both time consuming and meaningless due to spelling errors. However, a unique sequence number is generated for each patient for an operator per quarter and year. This sequence number is displayed on the data input screen. The data capturer needs, though, to write down that number on the data capture form, at the bottom of the form once the data on that form has been entered.

If an audit was required, the database could be interrogated, the sequence numbers obtained, and from the operator's form the patient name can be found. Armed with the names of the patients, the clinic could be visited and the patient records drawn to see whether the treatment was carried out as was recorded on the form.

This does seem a rather roundabout way of doing it, but it does save data capture time by not having to enter the names of each patient – even if the spelling was not a problem. Furthermore, the PDE system is designed to use numeric codes which can all be done using the numeric keypad. Having to use alphabetic keys

takes much longer, and requires both hands. But the result is the same – it is possible to audit the treatment codes.

3.7.3 Code abuse versus honest mistakes

Some codes are used in a consistent ratio to others, by most operators. For example, an attendance code (8000) is generated for every patient attendance. It is programmed into the system for convenience of the data capturer. However, it has the same RVU and tariff as a code 8104 (examination for a specific problem). The instructions to the operators are clear, that code 8104 is only to be used when no other treatment is performed on that particular patient, such as when no treatment is needed.

On average, the frequency of code 8104 is equal to about 5% of the frequency of code 8000. However, some dentists have anything from 50% to 90% which means that they have almost as many 8014s as attendances.

This artificially inflates the total RVUs for this person, and it is suspected that this is to make their performance look better than it really is, because the RVUs are used for performance appraisal in the Staff Performance Management System (SPMS) (Western Cape Education Department, 2013). This does not appear to be honest.

The PDE system has a code checking option built in for investigating such issues. The manager is able to enter up to seven different codes simultaneously to check on their relative frequencies. The "superfluous codes" (above a certain proportion) can then be deleted from the system, promoting fairness and good management.

Of course, the erroneous use of the codes should also be brought to the attention of the operator to ensure consistent recording of the codes.

Sometimes the codes indicate quality of care problems that need to be investigated. An example could be an operator who records numerous 8221 codes (post-extraction haemorrhage) and not many 8220 (place sutures). This could indicate that this operator needs some guidance from his/her supervisor.

The code 8220 (place sutures) is a PDE code that is not used in the private sector. This code was created for clinical management as has just been mentioned, but also could be used for a stock audit. It is possible that certain consumables are getting stolen somewhere along the supply chain. Code 8220 should tally with the number of suture sets ordered and supplied to the clinic.

The use of other consumables (needles, local anaesthetic, restorative materials, etc.) can also be estimated from the information in the system. This is a further control system for management to utilize to monitor supply chain costs and reduce wastage.

Chapter 4. Results of Implementation of the Public Dental Evaluation system

This chapter will describe the results of the design and implementation of the PDE system. The various reports and how they can be used to manage public dental services will also be shown and the problems and benefits will be discussed.

4.1 The Z804 report for an operator

These reports are referred to as "Z804" reports because they analyse the data according to the format of the previous Z804 forms that were replaced by this PDE system. This ensures compatibility with other provinces that still collect the data, manually, using the Z804 treatment categories.

The back-end database file used for the operator reports is ZENTTSUM.DBF (Table 5).

The Pivot table that has been created in Excel reads this back-end database and, when refreshed, presents the updated data. This has great advantages for the user who can customise Pivot tables and graphs for their personal use. When data is updated and added, only the back-end database is changed. The structure of the Pivot table layout remains the same – one only needs to click on "refresh data" in the Pivot table. Not having to recreate the layout every quarter when new data is added is very user-friendly.

4.1.1 Z804 Operator report for all procedures for a single operator

Essentially this report is simple a list of all procedures performed by an operator per reporting period – identical to the old Z804 system (Table 11).

Table 11. Z804 Operator report for all procedures for an operator per quarter (operator names removed in the interests of confidentiality)

STAFF_NO	(All)				
STAFF NAME	Removed (for Confidentiality)				
YEAR	2012				
QUARTER	1				
Sum of ENTRY		PTTYPE			
ORDER	**PROCEDURE**	**DEPT**	**SCHOOL**	**UNDER 6**	**Grand Total**
1	ATTENDANCES	801	569	240	1610
2	EXAMINATION + CHARTING		1		1
3	X-RAY	21			21
9	COMPOSITES - TEETH	10	88	14	112
10	COMPOSITES - SURFACES	26	138	18	182
13	INLAYS - TEETH		1		1
14	INLAYS - SURFACES		3		3
15	CROWNS & BRIDGES	1			1
21	EXTRACTIONS - TEETH	1472	372	553	2397
27	GENERAL ANAESTHESIA		3	46	49
29	OTHER (TREATMENT SERVICES)	194	34	89	317
30	ATTENDANCE (PREVENTION)	18	35	46	99
33	ORAL HYGIENE INSTRUCTION	18	17	46	81
36	POLISH ONLY			1	1
39	FISSURE SEALANTS		49		49
43	OTHER (CLINICAL PREVENTION)	37	299	9	345
76	MFOS. CONSULTATION	1			1
86	MINOR SURGERY	15	2		17
88	INFECTIVE CASES	13			13
Grand Total		2627	1611	1062	5300

The advantage of this type of report is the ease of understanding:

- it is clear how many patients were seen and what procedures were performed by this operator during this quarter.
- Only those procedures that were performed are listed – there are no blank rows or zero totals.
- The counts can be added easily by selecting more than one quarter for reporting purposes.

But there are several problem areas in this example::

- "Other treatment services" were performed 317 times on 1610 patients. These "other" are not defined – a major shortcoming in the old system and the result of limiting the tallysheet to only 92 treatment options.
- It is not possible to compare work performance using so many variables (especially if some are "other"). For example, is an operator working harder than one who saw fewer patients but provided more fillings?
- It is only a snapshot in time – it cannot show trends. To do so would require the use of a third dimension.

4.1.2 Z804 Operator report for a single procedure for all operators

This report is set up so that the Z804 treatment procedure can be chosen and the counts are displayed for all the operators over a selected time period (Table 12).

Table 12. Z804 Operator report for a procedure (attendances) for all operators per year for past three years (operator name replaced by staff code in the interests of confidentiality) data filtered for the Cape Winelands Health District

TYPE	D			
PROCEDURE	ATTENDANCES			
Sum of ENTRY	YEAR			
STAFF_NO	**2010**	**2011**	**2012**	**Grand Total**
3019	4095	4248	4272	12615
3034	4041	4284	2295	10620
3058	3299	3554	3621	10474
3065	2703	2831	1730	7264
3078	4125	2916	4104	11145
3080	4899	4594	3965	13458
3082	8730	7733	6408	22871
3104	2862	3278	2891	9031
5003	5603	5274	4058	14935
6013	4761			4761
6014	5226			5226
6024		4866		4866
6025		1542		1542
6031		2888	951	3839
6036			4273	4273
6037			914	914
6045			915	915
Grand Total	52789	50559	41903	145251

The advantages of this format are:

- a comparison can be made between the operators for a particular procedure over time
- the report easily provides the counts, and can be filtered by operator type and administrative area.

The disadvantages of this format are:

- only one procedure can be compared at a time – otherwise one would need a three dimensional spreadsheet.

- comparisons assume that all other conditions are equal, but some of the operators may have been on maternity leave or only be sessional staff. There is no way of allowing for this in this type of report.

The permutations for this type of pivot table are almost limitless, and cannot all be described here. All one does is select a different procedure for the list box in the pivot table. Graphs can also be linked to the Pivot tables, or created manually as well.

This is a huge improvement for reporting on this data and is also a huge improvement on the manual system it replaced.

It is however limited to the 92 treatment category reporting units (Appendix 9). If one used all 323 treatment codes, the reports could become unwieldy.

The question remains, how can one obtain an overall view of all the work being done by the operators, using this type of report? The short answer is that one cannot do it. There are too many confounding variables.

The data in Table 12 does show some interesting anomalies. The Cape Winelands district is a rural health district and one would expect an equal number of patients seen by each of the dentists. But some dentists, consistently, see more than twice the number that the other dentists see. Similarly, some see very much fewer patients. Reasons for this need to be sought.

But in order to interpret the data one needs to appreciate that the data source contains a total for the quarter. It is possible that a dentist is absent for a quarter, and this would influence the sum of attendances. However, if the average attendance (per quarter) was used in the pivot table a more realistic picture would emerge. But, arithmetically, there is always a danger in calculating a mean of a mean.

4.2 *Z804 report for a clinic or district*

The reports just discussed in paragraphs 4.1.1 and 4.1.2 were based on the operators – the unit of collation was the dentist, oral hygienist or dental therapist. This may be of value in assessing staff performance, but has limitations in that many staff also render services at other satellite clinics, especially in the rural districts. Operator-based reports also cannot account for clinic-based data unless the complexity of the report is increased substantially. This is because the unit of aggregation is either the operator or the clinic.

For this reason, the treatment procedures are also reported on in the PDE system, using the clinic as the aggregation unit, irrespective of which operator worked there.

Basing the report on the clinic has several advantages:

- The degree to which the dentist, therapist and oral hygienist complement each other is reflected in the report. If the clinic has an oral hygienist, the dentist should not be placing fissure sealants – that should be delegated to the oral hygienist. On the other hand, if there is no oral hygienist, the dentist must also do "oral hygienist" procedures to provide preventive services.
- Measuring performance as a team has its own advantages and prevents staff members from working in isolation. It promotes teamwork and mutual support and, indirectly, job satisfaction.
- The work done by more than one operator at a satellite clinic can be assessed. This is important for planning purposes such as reorganisation of the services in the area, equipment upgrades and possible extensions to the service.

The clinic-based report is also a pivot table linking to a back-end database named ZREPCLI.DBF. The layout was described in the previous chapter. An example of such a report is shown in Table 13.

Table 13. A Z804 report for a clinic

DISTRICT	CAPE WINELANDS				
SUBDIST	(All)				
CLINIC	TULBAGH				
QUARTER	(All)				
YEAR	2012				
Sum of ENTRY		TYPE			
ORDER	**PROCEDURE**	**DEPARTMENT**	**SCHOOL**	**UNDER 6**	**Grand Total**
1	ATTENDANCES	152	198	91	441
2	EXAMINATION + CHARTING	8	20	48	76
21	EXTRACTIONS - TEETH	428	340	5	773
29	OTHER (TREATMENT SERVICES)	155	40	1	196
30	ATTENDANCE (PREVENTION)	7	53	7	67
33	ORAL HYGIENE INSTRUCTION	7	17	7	31
35	SCALE & POLISH	7	9		16
36	POLISH ONLY		37	2	39
37	FLUORIDE FULL	1	3	1	5
38	FLUORIDE PARTIAL	4			4
39	FISSURE SEALANTS		6		6
40	POLISH FILLINGS	1			1
43	OTHER (CLINICAL PREVENTION)	1			1
86	MINOR SURGERY	1			1
Grand Total		772	723	162	1657

The Pivot table shown in Table 13 shows a typical clinic-based report in the familiar Z804 format. A satellite clinic was chosen to save space, but also to illustrate the value of such a report for management. This clinic is only visited once every two weeks, or so, by a dentist from a neighbouring town (Ceres) and is also visited by an oral hygienist from Ceres. All their treatment is reflected on this report for the reporting period (2012). This provides management with an idea about clinic utilization and treatment provided irrespective of who or how many operators worked there.

It is also noted that, on this report, that nearly half (44%) of the patients received "Other (Treatment Service)". This is not much help to management as they do not know what these treatments are. This again shows the weakness of the Z804 system due to the pooling of specific treatment codes, as was explained above.

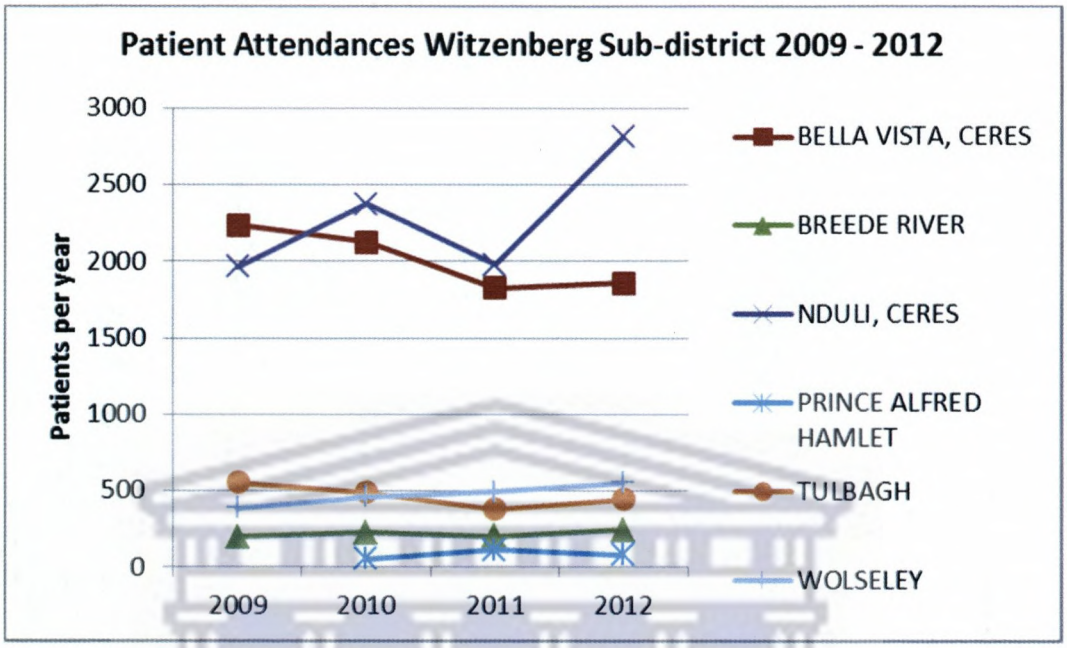
The clinic-based data can also be analysed over a period of time in order to show trends. The clinics can be arranged by district or sub-district to allow managers an overview of the utilization patterns and type of treatment being provided. An example is shown in Table 14.

Table 14. Patient attendances per clinic over a time period

DISTRICT	CAPE WINELANDS						
SUBDIST:	WITZENBERG						
PROCEDURE	ATTENDANCES						
TYPE	(All)						
Sum of ENTRY	CLINIC						
YEAR	**BELLA VISTA, CERES**	**BREEDE RIVER**	**NDULI, CERES**	**PRINCE ALFRED HAMLET**	**TULBAGH**	**WOLSELEY**	**Total**
2009	2234	200	1966		555	388	5343
2010	2126	226	2375	58	490	460	5735
2011	1824	204	1979	114	380	493	4994
2012	1859	246	2811	85	441	554	5996
Grand Total	8043	876	9131	257	1866	1895	22068

Pivot tables allow almost infinite permutations of the aggregated data of the services rendered in the clinics to allow management to make informed decisions about the service. In addition, graphs can be created (either automatically by linkages, or manually) to further facilitate decision-making. The data in Table 14 (above) is displayed in such a graph in Figure 3.

Figure 3. Patient attendances at all clinics in the Witzenberg sub-district for the period 2009 to 2012



An old adage of "A picture is worth a thousand words" is especially true for graphs of data, in general. In this case, one can see in Figure 3 that fewer patients are seen at the satellite clinics than at the two main clinics in Ceres. This comes as no surprise, but this may be disproportionate to the relative sizes of the towns – assuming a similar morbidity rate. This should guide management in their investigations.

Also, trends over time indicate patterns of attendance (in this case). These remain relatively constant, as indicated in Figure 3, except for a spike in attendances at Nduli clinic in 2012.

Any of the treatment procedures can be selected in the Pivot tables. They can even be grouped, which is useful when analysing the number of teeth filled, which needs to include both amalgam and composite restorations.

Preventive services are often neglected in the face of extensive pain and sepsis. Therefore it is useful to observe trends in preventive services. This report is

particularly suited to this in that it can "step back" and provide an overview of such an important, and often neglected, service such as school toothbrushing services.

Figure 4 shows how the number of children on tooth brushing programmes in the province has declined since 1994.

Figure 4. Number of children on a toothbrushing programme per year for the Western Cape 1994 – 2012

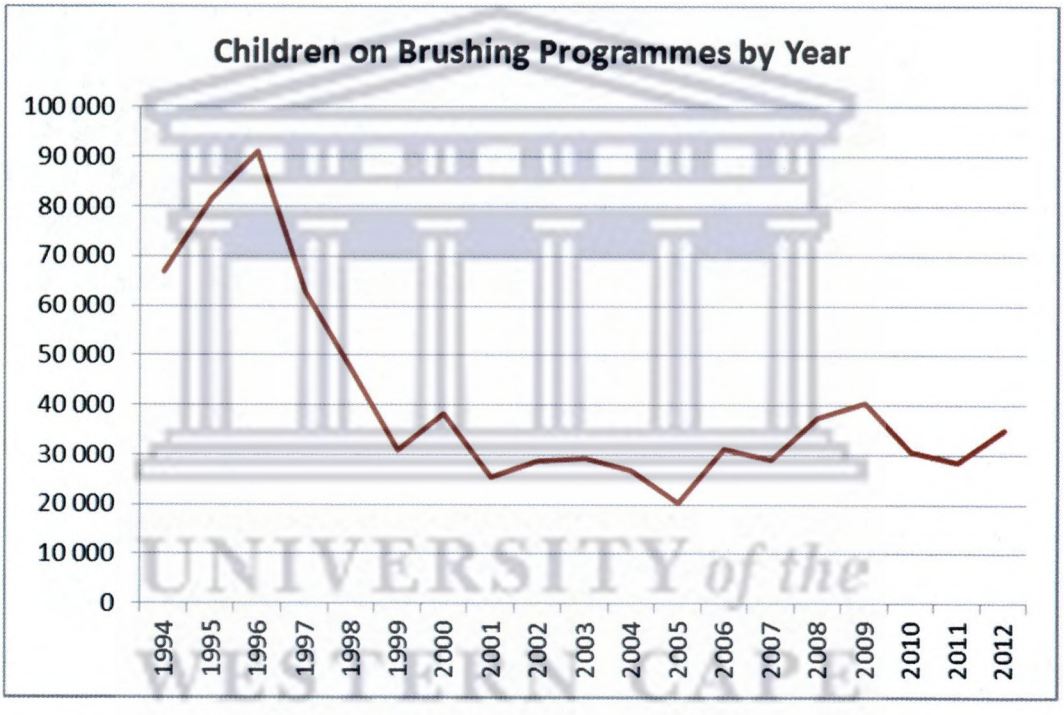


Figure 4 shows a rather substantial decline in brushing programmes since the re-organization of dental services in 1996. Considering that brushing programmes offer the best and most cost effective strategies (apart from water fluoridation) for the prevention of dental caries, this decline is worrying. This information could be used by managers to rectify the situation.

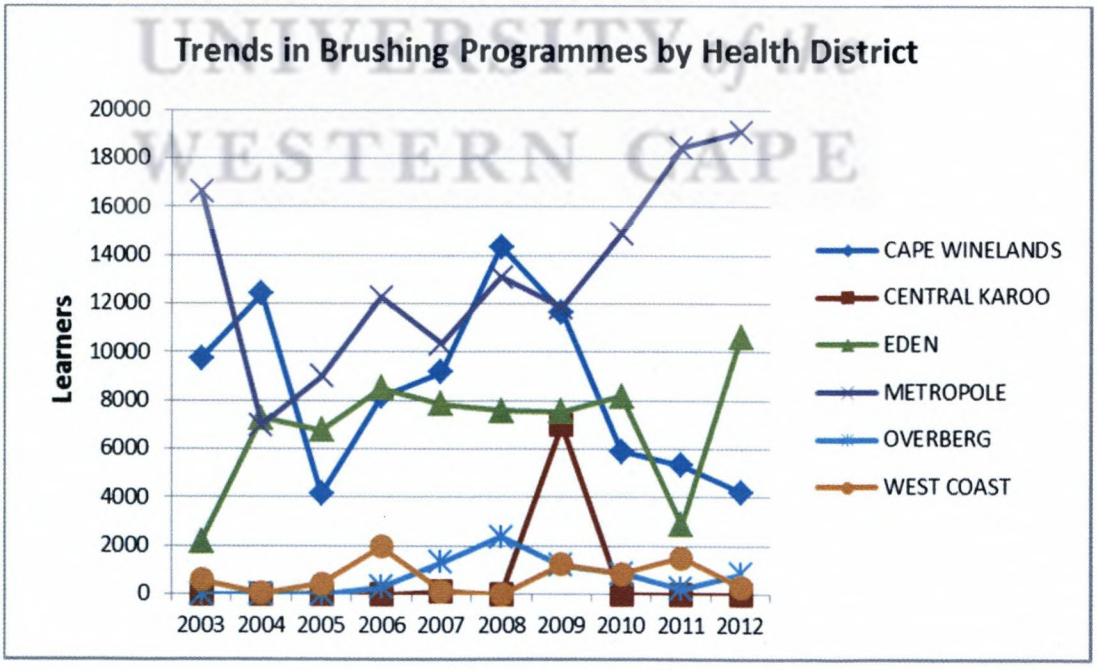
Table 15 shows the brushing services per Health District over the past 10 years.

Table 15. Children on Brushing programmes by Health District 2003 to 2012

PROCEDURE	NEW PROGRAMME – BRUSHING						
TYPE	(All)						
Sum of ENTRY	DISTRICT						
YEAR	**CAPE WINELANDS**	**CENTRAL KAROO**	**EDEN**	**METROPOLE**	**OVERBERG**	**WEST COAST**	**Grand Total**
2003	9745		2189	16631		593	29158
2004	12410		7280	6974		54	26718
2005	4136	27	6765	8977		444	20349
2006	8155		8504	12268	281	1958	31166
2007	9163	120	7838	10351	1297	136	28905
2008	14350		7588	13102	2358		37398
2009	11659	7001	7539	11835	1178	1251	40463
2010	5887		8170	14888	850	871	30666
2011	5317		2879	18426	232	1524	28378
2012	4212		10605	19098	828	331	35074

Table 15 shows some interesting trends in brushing programmes, which become even more apparent when one creates a graph of the same Pivot table (Figure 5).

Figure 5. Trends in Brushing programmes per Health District



The graph of brushing programmes (Figure 5) shows some anomalies, such as a large increase on the Central Karoo District in 2009. The Metropole shows an increasing trend and the Cape Winelands a decreasing trend. Management needs to be aware of this and take corrective action. These types of graphs are useful management tools, and can be easily updated as new treatment data is captured.

The data can also be used to correct organizational problems. For example, the oral hygienists are not under the supervision of the dentists at the clinics – they report to a person who supervises the so called "Professions Allied to Medicine". These are physiotherapists, dieticians, occupational therapists, etc. The question that needs to be asked is (and here is the data to support it), whether the preventive dental services should not be co-ordinated by the clinic dentist or a senior dentist in the health district. This is especially true to the community based preventive services such as brushing programmes.

In this example, the Eden district with two oral hygienists is doing about half as many brushing programmes as the Metro region which has many more oral hygienists. Changing the organisational structure so that dentists supervise the oral hygienists may help in getting them out in the schools doing brushing programmes.

4.3 PDE report

All the reports described thus far have been based on counts of procedures, as one obtains from tally sheets. Most, if not all health information systems, produce such frequency data and they comprise the bulk of reporting in public health systems. This makes sense as various role players have an interest in the number of patients seen, teeth extracted, etc. It is the type of data that is easy to produce and understand.

However, the biggest problem with this frequency data, from a management perspective, is utilising this data to deciding how productive staff are at the clinics. How does one decide that an operator who sees "A" number of patients and does "B" number of extractions and "C" number of fillings is better than another operator who sees "X" number of patients and does "Y" number of extractions and "Z" number of fillings? Then how does one bring the preventive work into the calculation? How can one compare performance of staff who have to travel to distant satellite clinics with staff who do not travel? How does one compare full-time and sessional staff? The answer does not lie in using frequency data. Instead one needs Relative Value Units (RVUs).

The PDE report is designed primarily to make use of RVUs and to use certain measurements in an Objectives Matrix to assess overall job performance. The background theory behind this was explained in the previous chapter. How it functions in reality will now be shown. However, all names of operators will be removed to ensure confidentiality – the object is not to praise or criticize individuals but to demonstrate how these type of reports can be used as a management tool in public dental services.

The database that contains the data for these reports is PDCSUMM.DBF and the structure was shown in Table 10. It must also be noted that the references to the health district, sub-district, etc., are based on the clinic where the operator is based, since these reports are compiled per operator. It is possible that work was included for a satellite clinic in a different sub-district. The administrative areas are merely included to make it easy for managers in these areas to group their staff together.

A further general comment about inter-staff comparisons is also necessary. It is obvious that not all operators function in exactly the same way in the clinic – some are quicker, some are slower, some spend more time making a patient feel at ease, etc. Furthermore, the patient-base varies as well, with some clinics having fewer schools in their area than others. Direct comparisons are therefore

hazardous, and one cannot use any assessment tool without applying one's mind to the reality of the situation on the ground as well as individual, personal differences that exist amongst staff members. But, having said that, staff should be able to provide the required quantity and quality of service for which they are employed.

4.3.1 Z804 (Old) RVUs

A Pivot table has been designed to show the "Old RVUs" which were the RVUs that used to be allocated in the old manual system. Thus there is some comparison with the former system.

Every clinical treatment procedure and every community-based service that was listed on the Z804 report had an associated RVU. The average quarterly total of old RVUs for all the dentists from 1994 to 2012 for each Health Region is shown in Table 16.

Table 16. Average Old RVUs per Quarter and year for all dentists, by Health Region (Overtime services excluded)

TYPE	Dentists				
YEAR	1994 - 2012				
STAFF_NO	(Non-overtime)				
Average of OLDRVU	QUARTERS				
DISTRICT	**1**	**2**	**3**	**4**	**Row Average**
EDEN	2440	2746	2675	2625	2620
KARO	1754	1664	1200	1452	1498
METR	1509	1526	1622	1472	1533
OVER	2502	2513	2580	2573	2542
WEST	1646	1767	1881	1968	1815
WINE	2420	2441	2747	2478	2519
Column Average	**1847**	**1897**	**1997**	**1869**	**1903**

It can be seen that the Metropole Health District has the second lowest average of Old RVUs per quarter. Although the Central Karoo district is very slightly lower,

this district has only one clinic, so variability there may be high and there may be reasons for this. The accepted performance norm for production of a dentist was set at 2000 units. This value is still used today for staff appraisal by means of the Staff Performance Management System (SPMS). By this measure, on average, the staff in the Metropole district are "under-performing".

The problem with the old RVUs is that they allocate an equal value to an extraction and a filling (Appendix 10), and many other procedures had a value that the author did not consider a fair reflection as a measure of production. This means that a dentist doing a large number of extractions will have a high Z804 RVU total. This seems to be rewarding workers for doing the wrong thing – public dental services are not going to make a community healthy by doing mainly extractions. Further analysis of a single health district by quarter, but measured over a five year period is shown in Table 17.

Table 17. Average Old RVUs per dentist (overtime excluded) Eden District 2008 – 2012, sorted in descending order for row average. Some dentists with incomplete data not listed, but included in the average

DISTRICT	EDEN				
TYPE	D				
YEAR	2008 - 2012				
Average of OLDRVU	QUARTERS				
STAFF_NO	**1**	**2**	**3**	**4**	**Row Average**
3025	5052	4567	4531	5188	4835
5013	3313	3528	3920	2569	3274
6002	2743	3051	3258	3513	3141
5044	1978	2714	2597	3029	2580
6016	2192	2568	2667	2137	2391
3020	1989	2926	2595	2002	2378
6018	2180	2060	2479	2548	2317
6040	931	1998	2534	2366	1957
6020	2079	1518	2028	1997	1906
6019	1413	1899	2364	1619	1824
5043	1364	1758	1767	1753	1661
6003	2255	1685	1731	785	1614
6021	679	1588	1939	2195	1600
6001	1451	1626	1876	1444	1599
3194	1257	1556	1651	1912	1594
5045	1151	1818	1457	1324	1438
3107	1053	1724	1440	1572	1368
6039	460	1366	1634	1531	1248
Column Average	**2254**	**2579**	**2451**	**2476**	**2439**

It can be seen in Table 17 that some operators far outperform their colleagues in terms of Old RVUs. So the average for a health district can conceal some significant variability within the district. Whilst it is understood that Community Service dentists will require more time to perform procedures than an experienced clinician, other reasons for good or poor performance should be investigated by the managers.

Managers need to perform an audit, as described above, to investigate whether the data is a true reflection of the services that are rendered. Some clinics complain about delays in patients obtaining their folders prior to attending the dental clinic. This causes the dentist to sit idle for an hour waiting for patients, since a separate queue for dental patients is not allowed. Managers need to have information to support their claim when seeking to address such a problem – anecdotal evidence is not always enough.

4.3.2 PDE RVUs

The PDE RVUs were designed to improve on the old RVUs by more accurately allocating RVUs for the type of services that should be provided in terms of policy and to correct the anomalies that existed in the old RVUs. The derivation of the PDE RVUs was explained in Figure 2.

When the PDE RVUs are used to measure work performance, per district, averages are shown in Table 18.

Table 18. Average PDE RVUs per Quarter per health district for dentists (excluding overtime) for period 2003 – 2012

TYPE	Dentists				
YEAR	2003 - 2012				
Average of PDC_TOT	QUARTERS				
DISTRICT	**1**	**2**	**3**	**4**	**Row Average**
EDEN	1171	1314	1266	1242	1248
KARO	925	896	675	891	838
METR	900	917	980	861	914
OVER	1283	1290	1297	1270	1285
WEST	1050	1077	1141	1207	1118
WINE	1468	1467	1658	1478	1516
Column Average	**1066**	**1092**	**1152**	**1057**	**1092**

The differences between the health districts when measured by PDE RVUs (Table 18) are much smaller than the differences seen in Table 16 when the old RVUs

were used. The main reason for this is a smaller weighting in the PDE RVUs for extractions. The reasoning is that if you are going to measure what staff are doing, the measure used should be focussed on what they are ideally supposed to be doing. This is not to say that extractions are not important (one has to help people who are in pain) and to a certain extent, the dentist does not control who arrives at the clinic for extractions. One is also aware of the state of oral neglect in areas where dentists are few and far between. The PDE RVUs are so designed to monitor the change in the type of service rendered using the carrot rather than the stick approach – rewarding those that prevent caries and provide restorative treatment, rather than just extractions. This way the service can move towards improving oral health.

The PDE RVUs per operator in the Eden district are shown in Table 19.

Table 19. PDE RVUs per dentist (overtime excluded) Eden District 2008 – 2012, sorted in descending order for row average. Some dentists with incomplete data not listed, but included in the average

TYPE	Dentists				
YEAR	2008 - 2012				
DISTRICT	EDEN				
Average of PDC_TOT	QUARTER				
STAFF_NO	**1**	**2**	**3**	**4**	**Row Average**
3025	2146	2135	2202	2414	2224
5013	1277	1674	1973	1199	1498
3020	1254	1479	1523	1298	1388
6002	1198	1313	1288	1429	1307
3107	1290	1493	1219	1083	1272
5044	1048	1352	1258	1407	1266
6016	1024	1141	1253	1046	1116
6018	972	971	1093	1116	1038
5043	808	928	1088	1067	973
6020	921	687	990	1135	933
6040	466	930	1189	1070	914
6019	754	946	1117	724	885
3194	785	764	803	1056	852
6021	315	744	973	1352	846
6001	832	804	935	731	826
6003	1149	809	899	382	810
5045	553	889	663	646	688
6039	284	709	857	763	653
Column Average	**1171**	**1314**	**1266**	**1242**	**1248**

It is immediately apparent from Table 19 that all the staff score lower on the PDE compared to Table 17, and this is understandable as the weighting is biased in favour of prevention. Furthermore, those who were scoring very high on the old system now score nearer to the mean. Three dentists – 3020, 5043 and 3107 – scored higher with the adjusted PDE RVU. Dentist 3107 improved by 12 places – an indication of his/her preventive orientation.

Managers, therefore have a useful tool in the PDE RVUs of measuring focussed performance of the operators – measuring how well they are performing in relation to the desired goals of the department.

An added advantage of the pivot tables is that one can "drill down" in the pivot table and see all the records that contributed to the mean score, increasing its value as a management tool.

The PDCSUMM.DBF database also has the subtotals of PDE units per patient category. So it is possible to analyse the PDE subtotals per patient category to get an idea of which patients are receiving the services. This is useful in helping redirect the service towards the target groups in the community that the policy prioritises – the pre-school and school children. If the PDE sub-totals per patient category are calculated and displayed as a percentage of the total PDE RVUs, an understanding is gained of the relative amount of work that is done by the staff on each patient category (Table 20).

Table 20. Relative contribution (expressed as a Percentage) of each patient category to overall production as measured by PDE RVUs. Data is for 2008 – 2012 for Dentists in Eden district (overtime excluded)

TYPE	Dentists														
YEAR	2008 - 2012														
DISTRICT	EDEN														
	Patient Categories														
STAFF_NO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Row Total**
3020	52	16	0	0	0	0	0	0	1	2	0	30	0	0	100%
3025	18	24	0	0	0	0	0	0	0	2	0	56	0	0	100%
3107	12	23	0	0	1	0	0	0	0	1	1	60	0	0	100%
3171	30	29	0	0	0	0	0	0	0	0	1	40	0	0	100%
3194	48	21	0	0	1	0	0	0	0	0	1	29	0	0	100%
5013	49	22	0	0	0	0	0	0	0	1	0	27	0	0	100%
5028	6	39	0	0	0	0	0	0	0	0	0	55	0	0	100%
5043	16	12	0	0	0	0	0	0	0	1	0	70	0	0	100%
5044	43	18	0	0	1	0	0	0	0	2	0	36	0	0	100%
5045	14	26	0	0	0	0	0	0	0	1	0	59	0	0	100%
6001	13	19	0	0	0	0	0	0	0	2	0	66	0	0	100%
6002	30	23	0	0	0	0	0	0	0	2	0	44	0	0	100%
6003	28	10	0	0	1	0	0	0	0	0	0	62	0	0	100%
6016	26	16	0	0	0	0	0	0	0	0	0	57	0	0	100%
6018	41	19	0	0	0	0	0	0	0	0	0	38	1	0	100%
6019	20	15	0	0	0	0	0	0	0	1	0	63	0	0	100%
6020	49	19	0	0	0	0	0	0	0	1	0	31	0	0	100%
6021	27	16	2	0	0	0	0	0	0	0	0	54	0	0	100%
6039	21	18	0	0	0	0	0	0	0	0	0	60	0	0	100%
6040	17	18	1	0	0	0	0	0	0	3	1	61	0	0	100%
6041	16	29	0	0	0	0	0	0	0	0	0	54	0	0	100%
6042	28	26	0	0	0	0	0	0	0	0	0	46	0	0	100%
6043	24	30	2	0	0	0	0	0	0	5	2	36	0	0	100%
6044	14	18	3	0	2	1	0	0	0	4	4	55	0	0	100%
Column Average	**32**	**21**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**45**	**0**	**0**	**100%**

It is clear that the majority of the work is performed on adults (category 12) followed by pre-school and school children (categories 1 and 2 respectively). This is contrary to policy which lists children as the highest priority. But there may be good reasons for seeing so many adults, like a large backlog in the

treatment services. Managers can use this type of report to identify the potential problem areas and seek ways to address them.

One such area is the amount of time dentists spend at prisons (treating prisoners, that is). Given that (especially in the rural districts) when dentists are busy with this, the rest of the community does not receive a service. The time has possibly come for the Department of Correctional Services to appoint their own dentists.

4.3.3 Measuring production by means of tariffs

Since each treatment code is linked to a tariff that is used in the private sector, a pivot table can display the total cost of rendering the service if it were done in the private sector.

This is very useful for two main reasons:

- Tariffs give one a sense of the size of the variable because it is in Rands and cents. RVUs are a bit abstract, but when expressed as currency, the order of magnitude is seen in a different perspective.
- If the costs incurred by the Department of Health are known for a particular clinic (salary of staff, consumables, equipment, vehicles, etc.), then this tariff calculation will show whether the service could not be more cost effective if performed by a local private practitioner. Privatization of the service is definitely not the intention, as this would bring many other problems, but it does make for a useful comparison nevertheless. However, with the advent of the National Health Insurance (NHI) system in the future, this would be very useful information for managers to have for planning purposes.

However, there is a very big *caveat* regarding the use of tariffs in this way. All community-based prevention programmes do not have an associated tariff as they

are not performed in the private sector. So this underestimation must be borne in mind when analysing the tariffs in this way.

Another *caveat* is the effect of increases in tariffs over time. This can be dealt with by building in a tariff inflation factor. However, for all the tariffs used here, the current (2013) tariffs have been applied retrospectively for all the staff right back to 1994, so all the applicable tariffs are in 2013 terms, guideline tariffs published by the Health Professions Council of SA (HPCSA, 2012).

Using the example of the Eden district for 2008 – 2012, the tariff totals are shown in Table 21.

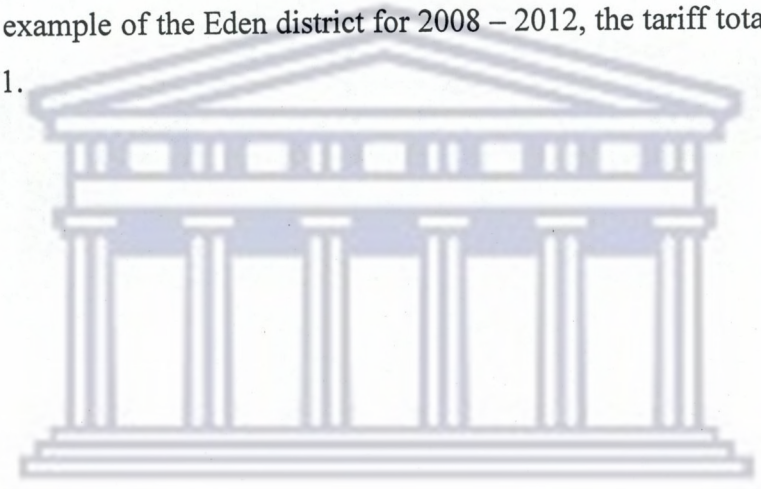


Table 21. Tariff totals per dentist per year in Eden district 2008 - 2012, excluding commuted overtime

DISTRICT	EDEN					
SUBDIST	(All)					
TYPE	Dentists					
Sum of TARIFF_TOT	YEAR					
STAFF_NO	**2008**	**2009**	**2010**	**2011**	**2012**	**Annual Average**
3020	1 245 334	916 139	819 955			993 809
3025	2 299 754	2 493 293	2 277 573	1 975 135	2 606 225	2 330 396
3107	865 449	70 947				468 198
3171		1 001 900			17 068	509 484
3194	743 658	667 117	586 047	702 509	966 527	733 172
5013		257 357	1 048 100	1 697 745	1 578 713	1 145 479
5028		130 112				130 112
5043	794 424					794 424
5044	1 157 699					1 157 699
5045	823 383					823 383
6001		839 067				839 067
6002		1 254 465				1 254 465
6003		698 750				698 750
6016			1 092 443			1 092 443
6018			991 831			991 831
6019				901 030		901 030
6020				861 999		861 999
6021				703 520		703 520
6039					603 186	603 186
6040					992 790	992 790
6041					232 894	232 894
6042					658 859	658 859
6043					107 269	107 269
6044					352 230	352 230
Grand Total	**7 929 701**	**8 329 147**	**6 815 949**	**6 841 938**	**8 115 761**	**7 606 499**

Table 21 is therefore an indication of treatment performed as measured by the private sector tariff for that treatment. If the tariff is less than the costs of running the service, one needs to ask whether the service is cost-effective, unless the dentist is providing many non-tariff services such as community-based preventive programmes. If the service could be provided for less cost by a private practitioner, maybe a public-private partnership could be investigated. This used

to be done in the past by appointing part-time district dentists, but the Department of Health terminated this system from 1999.

It is clear that there is a wide range of values in Table 21. A simple explanation could be that the dentist was not employed for 12 months of the year – these are totals per dentist. It is obvious that some dentists were only employed for a year and the other years are blank – probably community service dentists. However, the table does indicate that some staff are much more productive than others, and managers can use this information as a guide to identifying problems.

4.3.4 Measuring Extraction to Filling ratios

Another measure often used to analyse the type of service being provided in public dental services is to compare the number of teeth filled in comparison with the number of teeth extracted. The Extraction : Filling ratio indicates whether the service is providing more than just extractions. This oversimplifies the situation on the ground as many dentists are forced to perform extractions because a) the tooth is irreparable, or b) they are inundated with patients, or c) they do not have the equipment and/or materials to do restorations.

Despite these shortcomings, this ratio does have some value, and for this reason the fields Extractions, Fillings and Extraction : Filling ratio for the quarter were included in the PDCSUMM.DBF database. However, this information can be obtained from the Z804 reports, as shown above, but have been included here for ease of use.

The arithmetical problem encountered (here and elsewhere) is presenting a mean of several means when looking at the data over a number of quarters. This needs to be borne in mind during the interpretation of the data. However, the data for each quarter is reliable for showing the mean.

The values for the Eden District, chosen purely for convenience and because it is now familiar are shown in Table 22. This is for the period 2008 – 2012 and excluded commuted overtime.

Table 22. Average Extraction : Filling ratio's for the Eden district, 2008 – 2012 for dentists, excluding overtime work

DISTRICT	EDEN		
TYPE	Dentists		
YEAR	2008 - 2012		
	Average per quarter of:		
STAFF_NO	**Extractions**	**Fillings**	**Extraction : Filling Ratio**
3020	2 191	101	25
3025	5 345	212	26
3107	1 641	19	124
3171	2 501	35	62
3194	1 509	33	64
5013	3 195	80	51
5028	441		
5043	1 579	43	38
5044	2 646	56	52
5045	1 173	160	8
6001	1 718	37	48
6002	3 216	108	32
6003	1 205	207	6
6016	2 005	243	8
6018	2 437	43	58
6019	1 883	52	43
6020	1 891	49	43
6021	1 144	170	8
6039	732	175	4
6040	2 095	42	54
6041	2 109	85	25
6042	1 972	57	35
6043	856	40	21
6044	1 419	55	27
Column Average	**2 449**	**100**	**41**

The large differences between the average Extraction : Filling ratios are obvious. Some dentists do a much greater proportion of fillings than others. But this should be interpreted with caution for the reasons just stated.

The Extraction : Filling ratio is of limited value in evaluating the work done by the dentists. A norm for the province has been set at 16, but most of the dentists are nowhere near that. The reasons are probably varied, but a major issue in this Health District is the lack of equipment with which to do fillings. A lot of the procedures performed in Eden are done at satellite clinics, and many do not even have a fixed dental chair. Only an extraction service can be provided. One cannot hold the dentist responsible for this. However, the manager needs to use this to motivate for the purchase of mobile clinics which are fully equipped so that a whole range of services can be provided.

4.3.5 Measuring production by means of The Objectives Matrix

It has already been shown that counts of procedures are very difficult to use to evaluate a dental service. Furthermore, Relative Value Units (RVUs) whether they are the old RVUs which are biased in favour of extractions, tariffs or the more focussed PDE RVUs do not present the whole picture. They are all only able to present a single average value and possibly fail to account for other contributing or even confounding factors.

The Objectives Matrix seeks to combine a number of measurement variables into a matrix based on certain objectives (Critical Success Factors, or Key Performance Areas) set for the service. This has been described in paragraph 3.4, and shown in Appendices 7 and 8. The objectives matrix has the advantage of looking at staff performance in a multi-dimensional fashion and combining a number of measurements to arrive at a single performance score.

The PDCSUMM.DBF database contains, for every staff member in a quarter and year, all the "Actual performance" values, all the "Performance score" values as well as the "Performance index". The Pivot tables can easily present this data in Excel. The "Actual performance" data for the 4th quarter 2012 is shown in Table 23, again using the dentists in the Eden district as an example.

Table 23. Actual performance scores for Objectives Matrix for Eden district 1st quarter 2012 for dentists and oral hygienists

DISTRICT	EDEN							
SUBDIST	(All)							
QUARTER	1							
YEAR	2012							
TYPE	**STAFF**	**1 Prod-uction.**	**2 Pol/ PDE**	**3 Prod/ PDE**	**4. Screen**	**5. Prim/ other prev**	**6 FS/ Rest**	**7. S Prog/ DHE**
Dentists	3025	2430.51	5.96	7.60	0	0.01	0.00	0.00
	3194	732.03	9.24	8.02	0	0.03	6.67	0.00
	5013	3089.78	32.85	26.68	503	0.04	3.35	0.00
	6039	299.11	-5.78	5.24	0	0.13	0.08	0.00
	6040	512.82	-3.98	6.64	0	0.01	0.00	0.00
	6041	885.69	9.15	8.52	0	0.01	0.00	0.00
D Average		**1324.99**	**7.91**	**10.45**	**84**	**0.04**	**1.68**	**0.00**
Oral Hygienist	3315	1121.97	45.27	31.70	0			1.07
	3335	373.45	-16.96	0.00	0			0.00
	3360	575.60	-1.15	0.40	0			0.19
H Average		**690.34**	**9.05**	**10.70**	**0**			**0.42**
All Average		**1113.44**	**8.29**	**10.53**	**55.89**	**0.04**	**1.68**	**0.14**

Table 23 has included the oral hygienists, but they need to be considered separately from the dentists due to the different nature of the work.

What is clear is the large differences within each criterion for both the professional groups. These require further discussion.

Criterion (KPA) 1: PDE Production Units

These vary among the dentists from almost 300 to over 3000 – a ten-fold difference. There is almost a two-fold difference amongst the hygienists. This criterion measures work done, and clearly management needs to investigate these differences.

Criterion (KPA) 2. Policy / PDE units

This criterion is the percentage by which the PDE production units increase as a result of the weighting for patient categories that are defined in policy (which emphasises the importance in work on children). Again large differences are apparent. One dentist increases by 33%, indicating that he/she is working on the targeted patients in terms of policy. On the other hand, one dentist decreases by 6%, indicating that he/she is probably treating mainly adults. A similar picture emerges for the Oral Hygienists, ranging in scores from 45% to -17%. This latter figure is worrying as oral hygienists usually spend most of their time with children and a minus score means she is seeing mainly adults and prisoners. It is therefore clear that further investigation is needed, and once again, this tool has highlighted an area that needs attention.

Criterion (KPA) 3. Production / PDE units

This criterion reflects the percentage increase in the PDE units as a result of the weighting for production. This means that the score will be higher for an operator who sees patients that require more time and effort to treat. This is a way of compensating staff for having to treat the "difficult" patients such as the intellectually challenged – something that requires more time and effort, and thus reduces the number of patients that can be seen.

A fairly large range of values is seen amongst both the dentists and oral hygienists. One reason could be because mainly adult patients are being treated –

it takes much longer to treat children. But children are also the highest policy category. Again, one needs to investigate why this is the case.

Criterion (KPA) 4. Patients screened

In public dental services it is important to screen patients for disease so that teeth can be saved by early intervention. If a patient has to wait for pain to occur it is often too late, especially in the public sector where endodontics is not available. Regular screening of schoolchildren should be part of the routine. This criterion measures the number of children screened. The data shows that only one dentist screened any patients in this quarter – surprising, considering it is the first quarter of the year and there is a whole new cohort in grade 1. The manager, armed with this information, needs to find the reason for this.

Criterion (KPA) 5. Ratio of Primary to Secondary and Tertiary prevention.

This only applies to the dentists as oral hygienists do not provide services that are secondary and tertiary preventive services (mainly restorations and extractions, repectively).

It is clear that very little work, as measured by PDE RVUs, is done in primary preventive services compared to other curative work. This is not a problem if there is an oral hygienist at the same clinic as the dentist. But in the absence of an oral hygienist, the dentist needs to do this work as well. It is possible that the dentist is overloaded with curative work and cannot turn patients away who are in pain, but then the manager should use this as motivation in order to create new posts for oral hygienists. After all, oral health of a community is not going to be improved without the prevention of oral disease.

Criterion (KPA) 6. Ratio of fissure sealants to restorations placed

This also only applies to dentists, since oral hygienists do not place fillings. What is interesting is that one dentist is placing nearly seven times as many fissure sealants as fillings, and another one is placing three times as many. This is most unusual, but may also occur if the denominator (fillings placed) is very small. In addition, as with the previous criterion, the number of fissure sealants placed would also be influenced by whether an oral hygienist is available at the clinic or not. This ratio will be higher in the absence of an oral hygienist.

Criterion (KPA) 7. Special programmes to dental health education ratio

Dental Health Education (DHE) (educational talks to schoolchildren about dental health) is a common practice in the public dental services. However, its effect (if any) is very limited. What is effective are special preventive programmes such as toothbrushing programmes or fluoride rinsing programmes on an organised basis at schools. This ratio is based on dividing the number of learners receiving DHE by the number of learners on special programmes. The numbers for this criterion in Table 23 are low, except for two of the oral hygienists. A possible reason for this may be a lack of funding for toothbushes or a lack of transport to get to the schools. Whatever the reason for the lack of special prevention programmes, armed with this information, the manager can investigate.

The Actual Performance figures for each criterion are then applied to a table of possible values, and a performance score is obtained (out of a possible score of 10). See Appendix 7 and Appendix 8 for the Objective Matrices of dentists and oral hygienists, respectively.

The performance scores for the Eden district for the 1st quarter of 2012 are shown in Table 24.

Table 24. Performance scores for the dentists and oral hygienists in the Eden district for the 1st quarter 2012 (overtime services excluded)

DISTRICT	EDEN							
SUBDIST	(All)							
QUARTER	1							
YEAR	2012							
TYPE	**STAFF**	**1 Prod.**	**2 Pol/ PDE**	**3 Prod/ PDE**	**4. Screen**	**5. Prim/ other prev**	**6 FS/ Rest**	**7. S Prog/ DHE**
Dentists	3025	4	1	2	0	0	0	0
	3194	1	2	2	0	0	10	0
	5013	5	7	5	5	0	10	0
	6039	0	0	1	0	1	0	0
	6040	1	0	1	0	0	0	0
	6041	1	2	2	0	0	0	0
D Average		**2.00**	**2.00**	**2.17**	**0.83**	**0.17**	**3.33**	**0.00**
Oral Hygienist	3315	1	9	5	0			10
	3335	0	0	0	0			0
	3360	1	0	0	0			6
H Average		**0.67**	**3.00**	**1.67**	**0.00**			**5.33**
All Average		**1.56**	**2.33**	**2.00**	**0.56**	**0.17**	**3.33**	**1.78**

The table of possible values in the Objectives Matrix was compiled in such a way that the desired level (norm) yields a performance score of three (out of 10). This leaves much room for improvement in performance. Bearing this in mind, the scores obtained by the staff in Table 24 are somewhat disappointing to say the least. Only one individual (a dentist) manages to meet or exceed the norm for most of the criteria.

This begs the question whether the norm has been set too high. Much thought went into devising the Objective Matrix and choosing the norms and the range of possible values. The norms have, however, never been challenged by the staff or the managers in over 20 years of use. That, in itself, may be a reflection of the lack of use of the Objectives Matrix by the managers.

On the other hand, one also needs to ask why some staff members easily meet and exceed the norm, if the norm is set too high.

No system should be inflexible, and the norms can be changed in the future. But it would be nice for the request to come from the users of the system.

The performance scores for each criterion are then each weighted according to the relative importance of the criterion, and these weighted scores are added to give an overall performance index. This is a score out of a possible 10, the norm being 3. These are shown for all four quarters in 2012 for the Eden district in Table 25.

Table 25. Performance Index Scores for all staff in the Eden district for all quarters in 2012 (excluding commuted overtime)

DISTRICT	EDEN					
YEAR	2012					
PERF. INDEX		QUARTERS				
TYPE	**STAFF_NO**	**1**	**2**	**3**	**4**	**Average**
Dentists	3025	1.2	1.0	1.0	1.2	1.1
	3171			0.8		0.8
	3194	2.1	2.0	2.5	2.3	2.2
	5013	4.8	4.4	3.5	2.4	3.8
	6039	0.3	0.9	1.1	0.8	0.8
	6040	0.3	0.7	0.8	0.8	0.7
	6041	0.8				0.8
	6042		2.2	1.5	1.2	1.6
	6043			1.3		1.3
	6044			0.6	1.8	1.2
D Total		1.6	1.9	1.5	1.5	1.6
Oral Hygienists	3315	4.7	4.3	4.5	4.5	4.5
	3335	0.0	4.0	3.7	1.6	2.3
	3360	1.1	1.1	1.3	1.0	1.1
	3371				1.4	1.4
Hygienist average		1.9	3.1	3.2	2.1	2.6
Overall Average		1.7	2.3	1.9	1.7	1.9

It is clear from Table 25 that very few staff exceed the norm for the Performance Index – those quarters that do so are highlighted in yellow. For all the dentists in the province, just over 20% of them exceeded the norm on average for each

quarter in 2012. This is of concern and raises the question of lowering the standard or managing underperformance. However, 50% of all the oral hygienists in the province reached or exceeded the norm in 2012.

It is interesting to note that the dentist with the largest Z804 and PDE RVU totals as well as the highest tariff total in the health district (staff number 3025) does not feature well on the Performance Index, only obtaining 1.1 out of 10. Since another dentist (5013) who scored less than he did on the RVU and tariff totals, performed much better on the Performance Index, it shows that staff performance cannot be measured using a single variable only. And it shows that one cannot compare a few variables only, but by weighting them and deriving a final overall Performance Index, one can better identify those doing the correct type of work. This situation is neither unique to the Eden district, nor to the year in question. It is seen in all regions and for each year – just to a differing extent.

This is what is needed if one needs to make the public dental services more preventive in approach and yet still meet the demand for services as a result of years of neglect.

Participative management encourages staff to produce their best performance by giving them meaningful feedback. This promotes job satisfaction. The carrot is always better than the stick. If this feedback information can guide the staff in the clinics to do their job more effectively they will appreciate it. Community service dentists are thrown in at the deep end, often working alone in remote clinics. They need guidance based on their overall performance. The Objectives Matrix can provide this guidance.

It does seem such a pity that after having this information available for nearly 20 years, the managers of public dental services have not made much use of it. This may partly be due to the fact that most of the officials making decisions regarding public dental services are not dentally qualified anyway. The need for the

services of a specialist in community dentistry seems to be required – but that sounds like the author beating his own drum.

4.3.6. Comparison of using headcounts to using RVUs to measure production

Despite the obvious advantages of obtaining good quality information from the RVUs and the Performance Index, time and again one hears about headcounts being used as a measure of production in health facilities. In fact, it is recommended that each dentist should treat about 30 patients each day. After 30 patients have been admitted, no further patients are allowed to enter. But in dentistry, different procedures take vastly different lengths of time to perform. An extraction is quick (uncomplicated, about 10 minutes), but a large restoration can take 45 minutes. This means that 30 patients, all requiring an uncomplicated extraction, will be treated in half a day. Managing and planning of the service is important, however, headcounts are not of much value.

To illustrate the point, graphs have been made of all the data from 1994 to 2012, in which the patient attendance total is plotted on the X-axis and the RVUs (either PDE or Old RVUs) plotted on the Y-axis. The data was obtained by comparing the totals of the variables for every operator for each quarter – for the dentists, there are 5872 records (dental therapists have been included) and for the oral hygienists there are 1881 records. The graphs are shown below (Figures 6, 7 8 and 9).

Figure 6. Association between Patient Attendances and Z804 RVUs 1994 – 2012 for all dentists (including dental therapists)

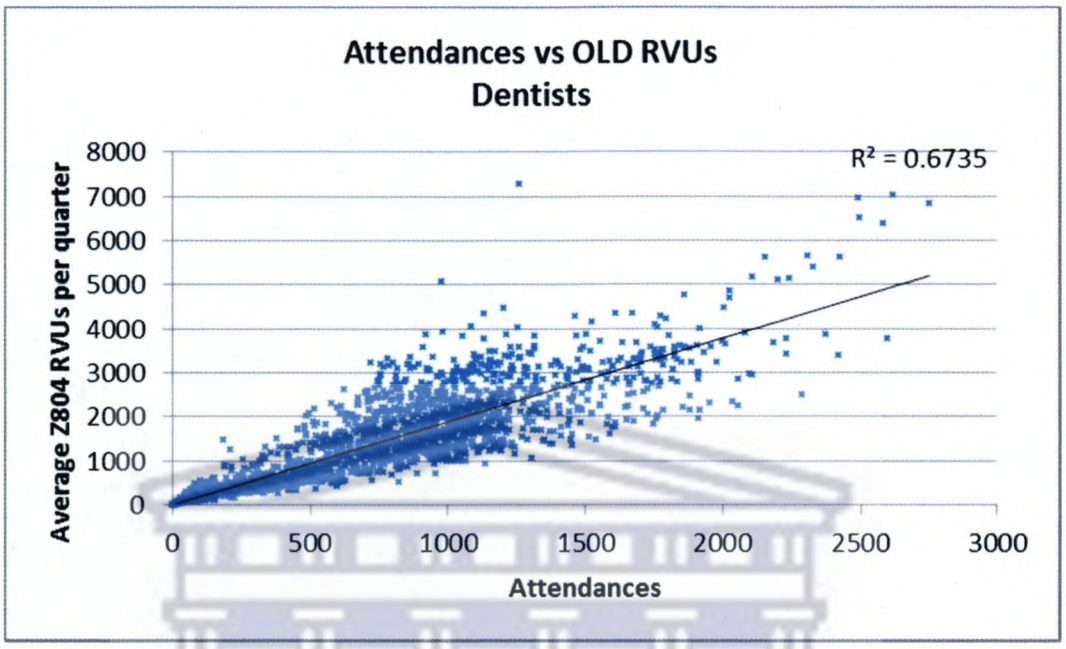


Figure 6 was produced by taking the average Attendance Count and the average Z804RVU for each dentist in the province for the period 1994 – 2012. The annual average was used rather than the quarterly count, because with the latter there were four times as many data points (5872 data points) in the graph and they blurred into one another. It is clear from Figure 6 that there is an association between the number of patients seen (patient attendances or headcounts) and the old (Z804) RVUs. The regression coefficient is 0.67 which means that 67% of the variability in Z804 RVUs can be explained by patient attendances.

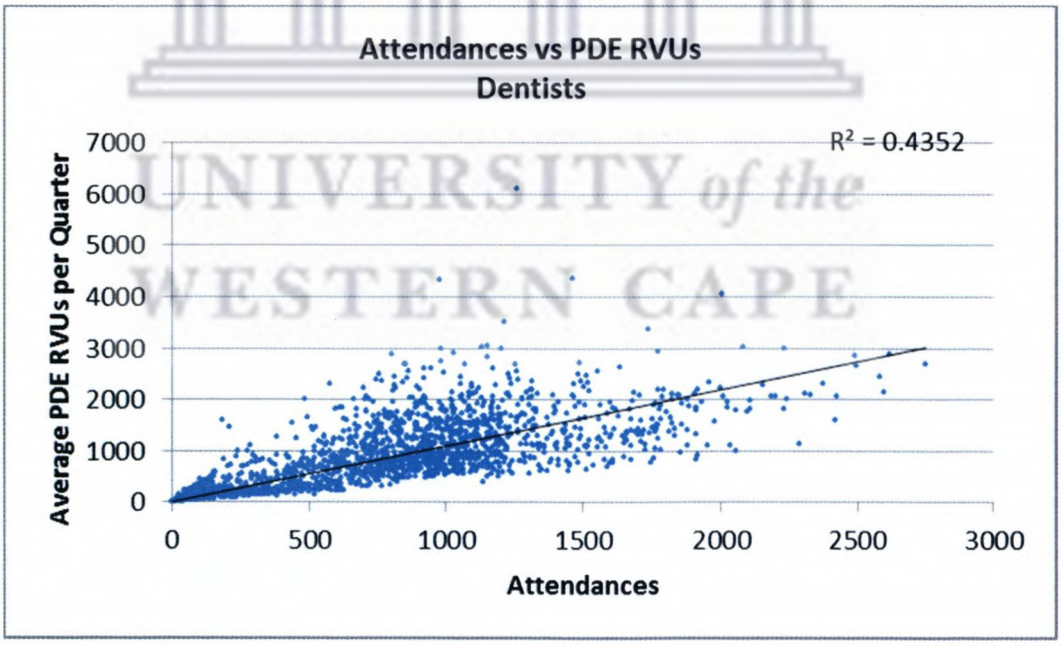
But it has already been shown that the Z804 RVUs are not completely suitable to be used for evaluation of public dental services because, primarily, they are biased in favour of extractions and they are only applicable to the 92 treatment Z804 types which include an "Other" category which could include anything.

If the variability of the data around the least-squares line on the graph is considered, it is clear that there is a substantial range in the data and there are some significant outliers.

It can be safely concluded that headcounts are a rather poor predictor of clinical performance of a dentist when measured by Z804 RVUs.

The PDE RVU was developed to improve on the shortcomings of the Z804 RVU. When a similar graph is constructed to show the association between patient attendances and the PDE RVU subtotals (Figure 7) an even smaller regression co-efficient, 0.44, is obtained. This makes sense as the PDE RVU does not just measure the number of procedures performed on the patients who attend the clinic, as was discussed earlier. If every patient received the same treatment, then the regression co-efficient would be very high. But not all patients need the same treatment and the time per procedure varies, so the smaller regression co-efficient in this case is a good thing. It shows that a variety of services are being provided.

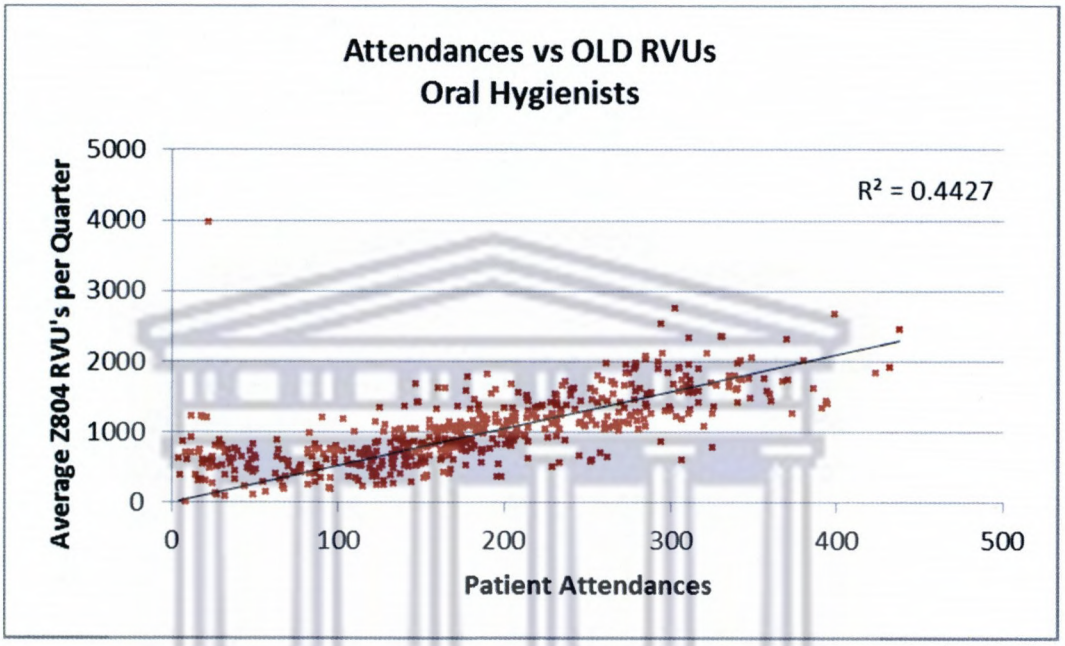
Figure 7. Association between Patient Attendances and PDE RVUs 1994 – 2012 for all dentists (including dental therapists)



Patient attendances only refer to the patients who attend the clinic anyway – and all the community-based prevention programmes are not included in the headcount data.

This can be seen in a similar representation of the data for the oral hygienists in Figure 8.

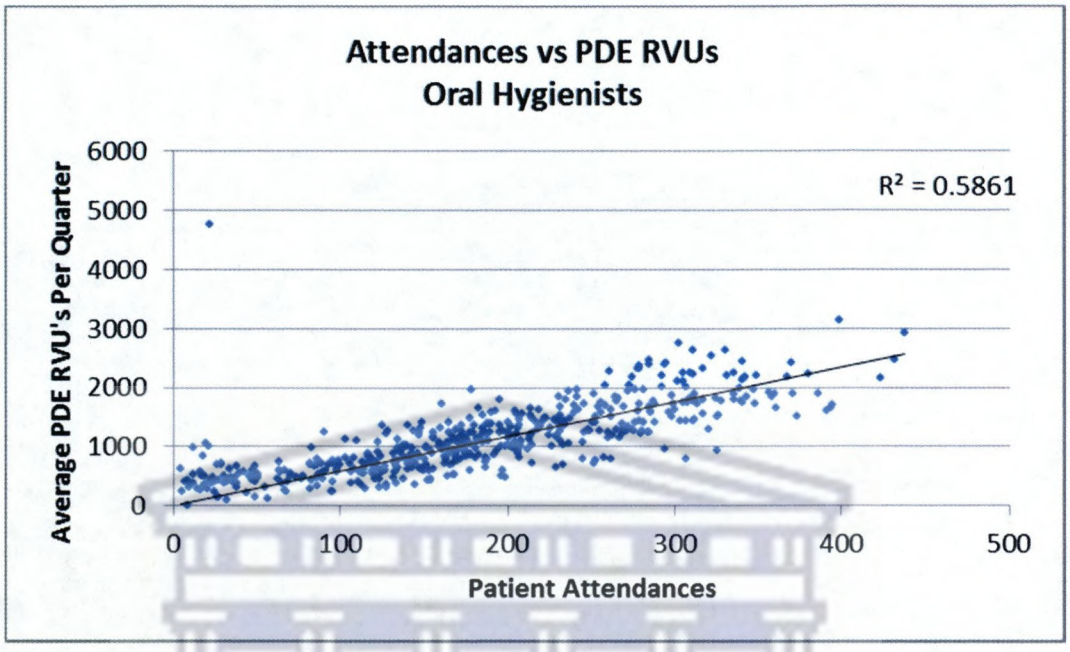
Figure 8. Association between Patient Attendances and Z804 RVUs 1994 – 2012 for all oral hygienists



Oral hygienists spend (or should spend) a significant part of their time out in the community and all this work is excluded from the headcounts. Therefore patient headcounts cannot be used as a predictor of the work that the oral hygienists perform. In Figure 8, the regression co-efficient is 0.44, which is substantially lower than for the dentists.

However, if the PDE RVU is used for the oral hygienists, Figure 9 shows that the regression co-efficient increases to 0.58. The figure 0.58 indicates that the PDE RVUs have a more important effect in showing a more accurate picture of the work done, given the small number of attendances in the case of oral hygienists.

Figure 9. Association between Patient Attendances and PDE RVUs 1994 – 2012 for all oral hygienists



Again this shows that Patient attendances are a poor measure of productivity at a clinic, especially for oral hygienists.

When the headcounts are totalled for a year, the large number is impressive. However, if one excludes 104 days for weekends, 10 public holidays, 30 days annual leave – there are only 221 working days per year. Assuming 60 working days per quarter, and based on the period 2010-2012, the average number of patients seen by the different types of operators, per day, are shown in Table 26.

Table 26. Headcounts per day. Average per operator per quarter for the past three years

	2010	2011	2012	Total
Dentists	16.34	15.54	15.60	15.81
Oral Hygienists	2.90	3.00	2.81	2.90
Dental Therapists	19.90	18.23	18.99	19.00
Total	12.98	12.49	12.26	12.56

This is far short of the targeted 30 patients per day which is the guideline. This is yet another example of headcounts failing to explain the real picture of what is happening in reality.

4.3.7 Incorporating the Leave Factor

When staff travel to a satellite clinic, they can spend a number of hours on the road, and this adds up over time and means that staff could be penalized for not doing as much work as their colleagues who did not need to travel to satellite clinics. To address this, a travelling time code is recorded on the Community Services Statistics Form together with the number of 15 minutes periods that were spent travelling.

In a similar fashion, there is a leave code to be filled in on the community services statistics form together with the number of half-days the person was on "leave". Apart from the normal leave categories, this also includes time spent attending meetings or attending to "non-clinical" administrative duties.

The reason for this is to facilitate comparisons between staff, some of whom are only part-time (sessional), some are on leave, some regularly attend meetings, some travel more than others, etc.

Therefore, by applying the leave factor in PDCSUMM.DBF summary database to the variable one wishes to analyse, one can easily calculate what the total would

be if all the staff worked (doing clinical work) for all the days in the reporting period.

Simply analysing the leave factors shows that for 1994 – 2012, the dentists have a factor of 1.16 (16%) and the Oral Hygienists have a factor of 1.30 (30%). This implies that the oral hygienists travel more and maybe attend more non-clinical duties. It is possible that their involvement in immunisation campaigns, on the instruction of their supervisors at the facilities, could have a greater impact on the amount of time that they are able to spend on dental matters, than one realises.

What is interesting to note is that nearly 15% of the operators (almost exclusively dentists) have a leave factor of 1.00 on average. This means that they are not completing a code for "travelling time" or for "session absent". This needs to be addressed - because one thing is certain - they are certainly taking their leave.

Chapter 5. Conclusions and Recommendations

In order to manage public dental services, information is required about what work is being performed by the staff at the various clinics.

It has been shown that using a tally sheet to record dental procedures performed is not an effective method of recording the amount of work done by staff (production) at public dental clinics. It is inaccurate, open to abuse, and fails to provide the necessary information for managers. Nor is it of any real value for providing feedback to staff on their performance. Feedback is one of the core aspects of job satisfaction. The staff just persevere, doing the same thing and feeling frustrated and lacking guidance from management.

A relative value unit (RVU) has been developed that has been weighted according to policy guidelines and the amount of effort required to do the work.

The Public Dental Evaluation system (PDE) has been developed that captures treatment codes which are saved in a number of back-end databases that are linked to Excel Pivot tables. The data can therefore be easily manipulated by the user to obtain the required information in the form of counts of procedures, but also in the form of tariffs and Relative Value Units. The permutations are almost limitless.

This information is available for the current reporting period as well as for previous periods, allowing a detailed analysis of services rendered and staff performance. The data can be analysed by operator (dentist, dental therapist or oral hygienist) or by clinic. The clinic data can also be aggregated to report on the overall service provided per sub-district or health district.

Use is also made of an Objectives Matrix where the performance of each staff member can be measured according to seven objectives (five in the case of oral hygienists) to produce an overall Performance Index – a score out of ten.

The data for the Western Cape Province has been analysed for the period 1994 to 2012 using this system, and it has been shown that the system is sensitive enough to highlight problems as well as provide a balanced overall view of the service as measured by a number of variables.

Using these databases, containing over 15 million treatment codes, it has been shown that managers can identify problem areas as well as trends in service rendering over a time period.

With the adjustment for time not spent on clinical work (leave taken, travelling time to satellite clinics, etc.) staff comparisons can be made for performance appraisal purposes. Thus a better comparison can be made regarding the productivity of the staff, but with the *caveat* that the situation may vary between the clinics and this is sometimes beyond the control of the staff member.

The system has been running for over 20 years now, and has proven itself. Continuous improvements have been made over the years, and it will continue to improve in the years ahead.

The system is "low tech" in that it does not require a network, but it could easily be applied to an integrated, networked information system provided it contained the treatment codes, and certain other patient, staff and clinic identifiers. It is therefore suitable for developing countries, such as South Africa, that may later develop a comprehensive Health Information System based on an electronic patient record.

The emphasis is not on the information technology, it is the concepts behind the processing of the data into meaningful information that are emphasised.

The database files, the PDE system program (PDE.EXE), are available from the author on request, since the files contain the names of staff members which is confidential.

Recommendations arising from this study:

5.1 Further management consultation to review the performance scales of the Objectives Matrix for dentists as too many dentists do not meet the desired level at present.

5.2 The system needs to be redeveloped in a more suitable database system.

5.3 Expertise in the system needs to be developed within the Department of Health for the on-going support and administration of the system.

5.4 Managers need to use the system for staff performance appraisal in a more meaningful way.

5.5 The system needs to be implemented in all the provinces, not just in the Western Cape.

5.6 The underlying principles could hold great benefit for other health disciplines and this should be investigated and a customised system developed for their managers. This also applies with the proposed National Health Insurance system as the PDE system also estimates costs.

5.7 This thesis needs to be published in a scientific journal so that others can build on what has been developed. This is an aspect of health services management that needs further development.

Bibliography

American Health Information Management Association. (2009). Relative Value Unit (RVU) Data Analysis. [online], Available from: < http://campus.ahima.org/audio/2009/RB012209.pdf> [Accessed: 7 October 2013]

Asisbiz, (2009). Map of Western Cape Municipalities. [online], Available from: <http://asisbiz.com/images/Map-Western-Cape-Municipalities.jpg> [accessed: 8 November 2013].

Booysens, S.W. (ed). (2001). *Introduction to Health Services Management*. Cape Town: Juta.

Charlton, G. (2000). *Human habits of highly effective organisations. The human race*. Cape Town: Van Schaik.

Dervitsiotis, K.N., (1995). The Objectives Matrix as a facilitating framework for quality assessment and improvement in education. *Total Quality Management*; Dec95, Vol. 6 Issue 5, p563-570

Department of Health, (1997). White paper on the transformation of the health services, [online]. Available from: <http://www.info.gov.za/whitepapers/1997/health.htm> [accessed 24 Feb 2012]

Department of Health, (2003a). NHISSA Data Flow Policy. Pretoria: National Department of Health.

Department of Health, (2003b). National Oral Health Policy [online] Available from: <http://www.westerncape.gov.za/Text/2003/national_policy_oral_health_sa.pdf> [accessed: 14 April 2012].

Department of Health, (2010). Negotiated Service Delivery Agreement for for outcome 2: A Long and Healthy Life for All South Africans. Available from: < http://www.info.gov.za/view/DownloadFileAction?id=135747> [accessed: 24 Feb 2012].

Faria, J R. (2000). An Economic Analysis of the Peter and Dilbert Principles. Manuscript. Sydney: Univ. Technology. [online]. Available at: <http://www.jstor.org/stable/10.1086/379943> [Accessed 6 November 2013].

Fejerskov, O., Escobar, M., Jøssing, M. and Baelum, B. (2013). A functional natural dentition for all – and for life? The oral healthcare system needs revision. *Journal of Oral Rehabilitation.* 40; 707 – 722, [online]. Available at: <http://www.onlinelibrary.wiley.com.ezproxy.uwc.ac.za/doi/ 10.1111/joor.12082/pdf > [Accessed 6 November 2013].

Fraser, H., Biondich, P., Moodley, D., Choi, S., Mamlin, B.W. and Szolovits, P. (2005) Implementing electronic medical record systems in developing countries. *Informatics in Primary Care* 13:83–95, [online]. Available from: <http://web.ebscohost.com.ezproxy.uwc.ac.za/ehost/detail?sid=265d3bfe-7320-45ff-b127-77fdda11bc5a%40sessionmgr4&vid=1&hid=13&bdata= JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=mdc&AN=15992493> [Accessed 21 March 2012].

George, G., Gow, J. and Bachoo, S. (2013). Understanding the factors influencing health-worker employment decisions in South Africa. Human Resources for Health 11; 15, [online] Available FROM: <http://www.human-resources- health.comezproxy.uwc.ac.za/content/11/1/15> [Accessed 6 November 2013].

Gilmour, J., Stewardson, D.A., Shugars, D.A., and Burke, F.J.T. (2005). An assessment of career satisfaction among a group of general dental practitioners in Staffordshire. *Brit Dent J* 198: 701-705

Hackman, J.R. and Oldham, G.R. (1975). Development of the Job Diagnostic Survey. *Journal of Applied Psychology*, 60, 159-170.

Hannan, T., Rotich, J., Odero, W., Menya, D., Esamai, F., Einterz, R.M., Sidle, J., Smith, F., and Tierney, W.M. (2000). The Mosoriot medical record system: design and initial implementation of an outpatient electronic record system in rural Kenya. *International Journal of Medical Informatics*, Volume 60, Issue 1 Pages 21–28, [online]. Available from: <http://www.sciencedirect.com.ezproxy .uwc.ac.za/science/article/pii/S138650560000068X> [Accessed 21 March 2012].

Harris, R.V., Ashcroft, A., Burnside, G., Dancer, J.M., Smith, D. and Grieveson, B. (2008). Facets of job satisfaction of dental practitioners working in different organisational settings in England. *Brit Dent J* 204: E1

Health Professions Council of South Africa (HPCSA) (2012). Guideline Tariffs for Dental Practitioners. Gazette Number 35931. [Online]. Available from <www.hpcsa.co.za> [Accessed 7 December 2012].

Jääskeläinen, A. (2010). Identifying a Suitable Approach for Measuring and Managing Public Service Productivity. *Electronic Journal of Knowledge Management Volume 7 Issue 4, (pp447 - 458),* [online]. Available from: <http//:www.ejkm com>. [Accessed 22 March 2012].

Lencioni, P. (2007). *The Three Signs of a Miserable Job.* San Fransisco: Jossey-Bass.

Leyland, D. (2009). If You Can't Measure it, You Can't Manage it. *ITadviser,* Issue 59, Autumn. Online. Available from <http://www.ncc.co.uk/article/ ?articleid=15472> [Accessed 21 March 2012].

Muller, M., Bezuidenhout, M. and Jooste, K. (2009). *Healthcare Service Management*. Cape Town: Juta and Co.

Muschel, J. (1999) District Health Information Systems. In: Crisp N, Ntuli A, (eds) *South African Health Review 1999*. Durban: Health Systems Trust; p 147 – 159 (online) Available from: <http://www.hst.org.za/sites/default/files/chapter12_99.pdf>. [Accessed 14 April 2012].

National Treasury, (1999). *The Public Finance and Management Act* (Act 1 of 1999). (Online) Available from: <http://www.treasury.gov.za/legislation/PFMA/act.pdf> [Accessed 6 November 2013].

Noori, H. and Gillen, D. (1995). A performance measuring matrix for capturing the impact of AMT. *Int J Prod Res* Vol 33 no. 7, 2037 – 2048.

Puriene, A., Aleksejuniene, J., Petrauskiene, J., Balciuniene, I. and Janulyte, V. (2008). Self-perceived mental health and job satisfaction among Lithuanian dentists. *Industrial Health* 46: 247-252

Riggs, J.L. (1984). The objectives matrix for productivity measurement. *Operations Management Review*. 2, No. 4, 15-23.

Rhode, J.E., Shaw, V., Hedberg, C., Stoops, N., Venter, S., Venter, K. and Matshisi, L. (2008) Information for Primary Health Care. *South African Health Review*. Health Systems Trust: Durban.

Rotich, J., Hannan, T., Smith, F., Bii, J., Odero, W.W., Vu, N., Mamlin, B.W., Mamlin, J.J., Einterz, R.M. and Tierney, W.M. (2003). Installing and Implementing a Computer-based Patient Record System in Sub-Saharan Africa: The Mosoriot Medical Record System. *Journal of the American Medical Informatics Association* Volume 10 Number 4 Jul / Aug [Online] Available from:

<http://www.ncbi.nlm.nih.gov.ezproxy.uwc.ac.za/pmc/articles/PMC181978/pdf/295.pdf> [Accessed 21 March 2012].

Shibuya, K., Scheele, S., and Boerma, T. (2005). Health statistics: time to get serious. *Bulletin of the World Health Organization*, 83 (10). [Online]. Available from: <http://www.scielosp.org/pdf/bwho/v83n10/v83n10a02.pdf> [Accessed 24 Feb 2012].

Schleyer, T., Spallek, H. and Hernández, H. (2007). A Qualitative Investigation of the Content of Dental Paper-based and Computer-based Patient Record Formats. *Journal of the American Medical Informatics Association* Volume 14 Number 4. [Online] available from: <http://jamia.bmj.com.ezproxy.uwc.ac.za/content/14/4/ 515.full.pdf+html> [Accessed 21 March 2012].

Stats SA. 2010. *General Household Survey*, (2010). Available from: <http://www.statssa.gov.za/publications/P0318/ P0318June2010.pdf> [Accessed: 14 April 2012]

Stats SA. (2011). *Mid-Year Population Estimates*. Available from: <http://www.statssa.gov.za/publications/P0302/P03022011.pdf> [Accessed: 14 April 2012].

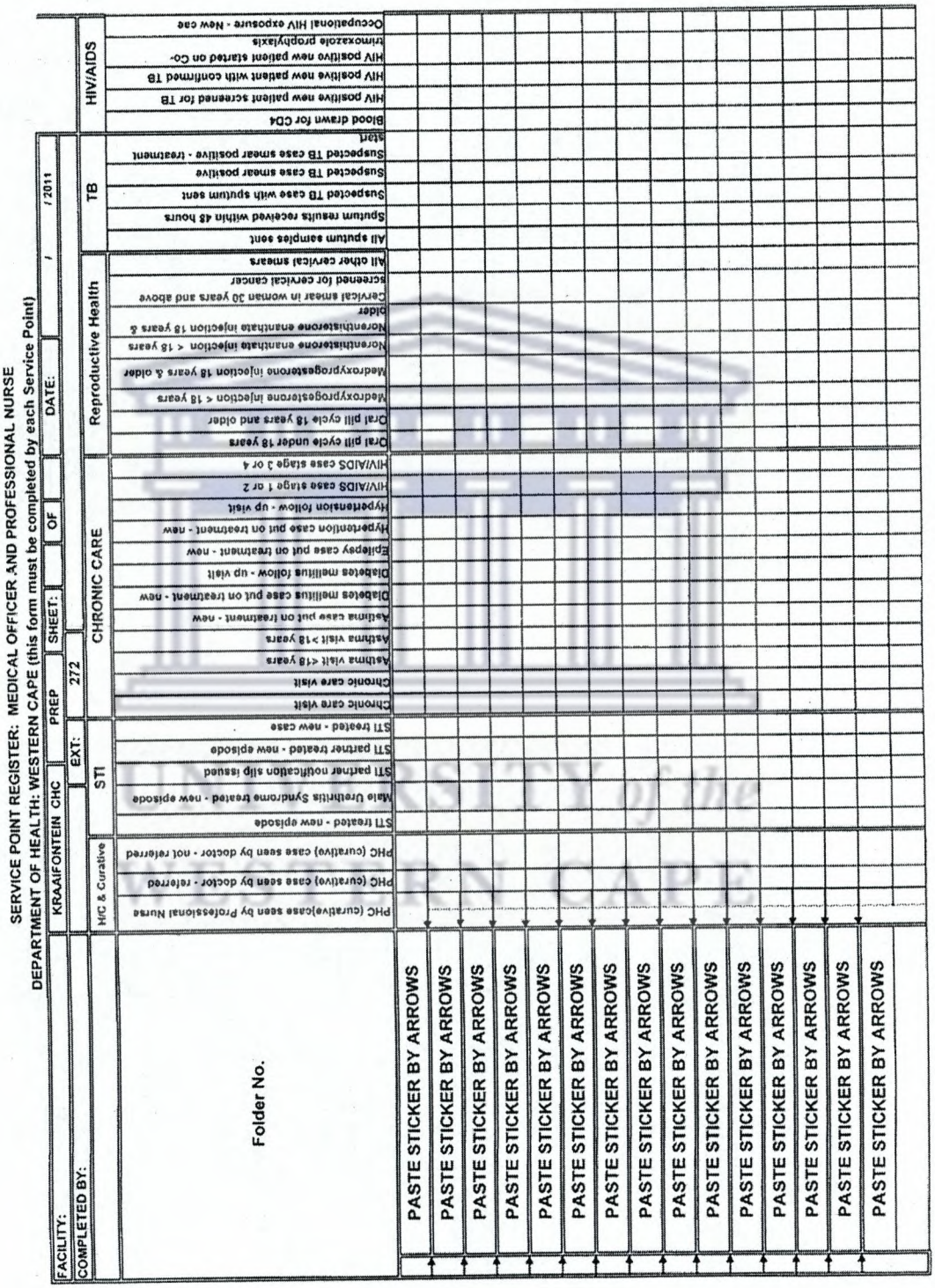
Udhayanan, P. and Nirmal, A. (2011). A revisit on the application of Hackman and Oldham model in organisations. *International journal of research in commerce and management*, Vol 2 no. 2. pp78 – 84.

Williamson, L. and Stoops, N. (2006). Using information for Health. *South African Health Review 2006*. Durban. Health Systems Trust. [Online]. Available from:< http://www.hst.org.za/sites/default/files/chapter12_99.pdf> [Accessed 14 April 2012].

Western Cape Department of Health. (2008). Comprehensive Oral Health Service Plan. [Online] Available from: <http://www.westerncape.gov.za/Text/2008/8/annual_report_2006-07_doh.pdf [Accessed 14 April 2012].

Western Cape Education Department. (2013). SPMDS Procedure Manual. Staff Performance Management and Development System for Public Service Personnel (Levels 1 - 12). [Online]. Available from: <http://wced.pgwc.gov.za/documents/spmds_manual/spmds_index.html> [Accessed 16 October 2013]

Appendix 1. **Routine Monthly Report Tallysheet for primary health care**



Appendix 2. **Routine Monthly Report form for Oral Health (dental) Services**

Oral Health

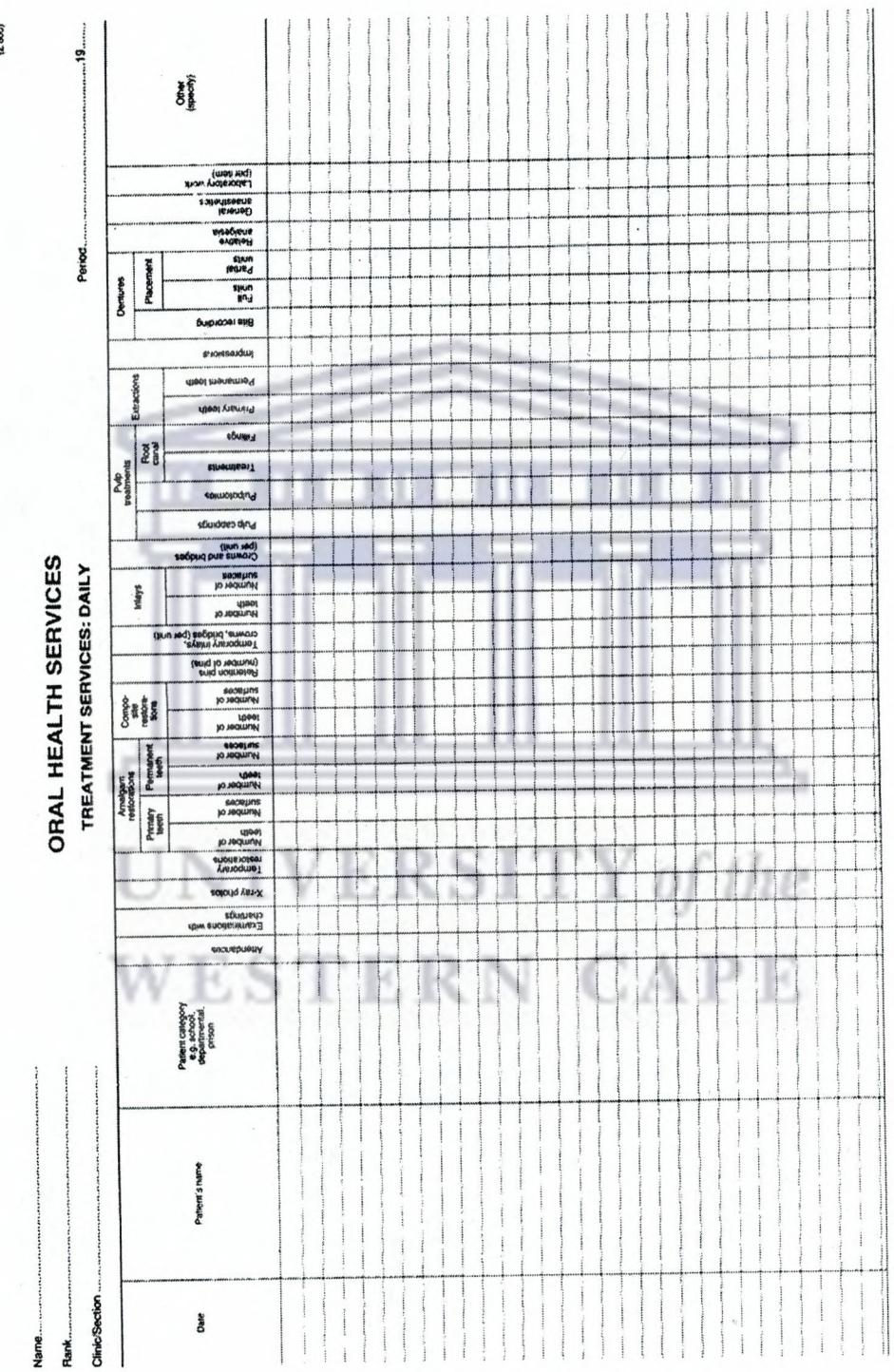
Routine Monthly Report

CHC: KRAAIFONTEIN CHC

Date:

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	TOTAL
PHC Headcount under 5 years							
PHC Headcount 5yrs and older							
Dental Visit							
Extractions All							
Restorations All							
Scaling and Polishing							
Gr.1 Children on which sealants were placed							
Creche Screening for OHS							
Primary School Screening for OHS							

Appendix 3. Z800 Data Collection Tool



Appendix 4. Z804 Summary Data Form

Appendix 5. The PDE Clinical Services Data Capture Form

Western Cape Provincial Department of Health: Oral Health Services PDE 1

CLINICAL SERVICES STATISTICS FORM

DENTIST/THERAPIST/HYGIENIST	CLINIC	QUARTER	PAGE
		/	

DATE	PATIENT	CAT.	CODE	CODE	CODE	CODE	CODE	CODE	CODE	CODE	CODE	CODE

PATIENT CATEGORIES

PRE-SCHOOL CHILD 1
SCHOLAR 2
MENTALLY HANDICAPPED CHILD 3
PHYSICALLY HANDICAPPED CHILD 4
MENTALLY HANDICAPPED ADULT 5
PHYSICALLY HANDICAPPED ADULT ... 6
OLD AGE HOME PATIENT 7
HOSPITALISED CHILD 8
HOSPITALISED ADULT 9
PRISONER 10
AGED PERSON 11
ADULT 12
NOT APPLICABLE 13
PREGNANT WOMAN 14

PDE V 6.6 95-10-17

CERTIFIED CORRECT (SIGN) ....

Appendix 6. The PDE Community Services Data Capture Form

Western Cape Provincial Department of Health: Oral Health Services PDE 2

COMMUNITY SERVICES STATISTICS FORM

DENTIST/THERAPIST/HYGIENIST	CLINIC	QUARTER	PAGE
		/	

DATE	NAME OF SCHOOL/ INSTITUTION	CAT.	COMM. CODE	No. of Indiv.	No of Groups	No. need Treat.	Travel /15 min.	Half Days Absent	Km (PDD)

PATIENT CATEGORIES

PRE-SCHOOL CHILD 1
SCHOLAR 2
MENTALLY HANDICAPPED CHILD 3
PHYSICALLY HANDICAPPED CHILD 4
MENTALLY HANDICAPPED ADULT 5
PHYSICALLY HANDICAPPED ADULT ... 6
OLD AGE HOME PATIENT 7
HOSPITALISED CHILD 8
HOSPITALISED ADULT 9
PRISONER 10
AGED PERSON 11
ADULT 12
NOT APPLICABLE 13
PREGNANT WOMAN 14

PDE V 6.6 95-10-17

CERTIFIED CORRECT (SIGN) ....

Appendix 7. Objectives Matrix: Dentists

Oral Health Services

QUARTERLY OBJECTIVES MATRIX: DENTISTS

Name of Dentist _____ Date _____

Production	Policy / PDE units	Production / PDE units	Patients Screened	1° / 2°&3° prevention	FS / Restorations	Special Progr. /DHE	
1	2	3	4	5	6	7	Criteria
							Actual Performance
							Performance scale
5500	50%	200%	1500	2.0	2.0	1.000	10
5000	45%	165	1300	1.8	1.8	0.900	9
4500	40%	130	1100	1.6	1.6	0.750	8
4000	35%	95	900	1.4	1.4	0.500	7
3500	30%	60	700	1.2	1.2	0.250	6
3000	25%	25	500	1.0	1.0	0.100	5
2500	20%	20	400	0.8	0.8	0.075	4
2000	15%	15	300	0.6	0.6	0.050	3
1500	10%	10	200	0.4	0.4	0.025	2
1000	5%	5	100	0.2	0.2	0.012	1
0	-25%	0	0	0.0	0	0.000	0
							Performance score
0.175	0.166	0.158	0.140	0.132	0.123	0.105	Weighting
							Weighted score
							Performance Index

Revised 3 December 2009

Appendix 8. Objectives Matrix: Oral Hygienists

Oral Health Services

QUARTERLY OBJECTIVES MATRIX: ORAL HYGIENISTS

Name of Oral Hygienist _____ Date _____

Production	Policy / PDE units	Production / PDE units	Patients Screened	Special Progr. /DHE	
1	2	3	4	7	Criteria
					Actual Performance
					Performance scale
5500	50%	200%	2000	1.000	10
5000	45%	165	1800	0.900	9
4500	40%	130	1600	0.750	8
4000	35%	95	1400	0.500	7
3500	30%	60	1200	0.250	6
3000	25%	25	1000	0.100	5
2500	20%	20	800	0.075	4
2000	15%	15	600	0.050	3
1500	10%	10	400	0.025	2
1000	5%	5	200	0.012	1
0	-25%	0	0	0.000	0
					Performance score
0.235	0.224	0.212	0.189	0.141	Weighting
					Weighted score
					Performance Index

Revised 3 December 2009

Appendix 9. List of Z804 Treatments and sequencing

Z804 SEQ	DESCRIPTION OF PROCEDURE
1	ATTENDANCES
2	EXAMINATION + CHARTING
3	X-RAY
4	TEMPORARY FILLING
5	AMALGAM - PRIMARY TEETH (N/A)
6	AMALGAM - PRIM. SURFACES (N/A)
7	AMALGAM - TEETH
8	AMALGAM - SURFACES
9	COMPOSITES - TEETH
10	COMPOSITES - SURFACES
11	PINS
12	TEMP. INLAY, CROWN OR BRIDGE
13	INLAYS - TEETH
14	INLAYS - SURFACES
15	CROWNS & BRIDGES
16	PULP CAPPING
17	PULPOTOMIES
18	ROOT CANAL TREATMENTS
19	ROOT CANAL FILLINGS
20	EXTRACTIONS - PRIM.TEETH (N/A)
21	EXTRACTIONS - TEETH
22	IMPRESSIONS
23	BITE REGISTRATIONS
24	FULL DENTURES
25	PARTIAL DENTURES
26	RELATIVE ANALGESIA
27	GENERAL ANAESTHESIA
28	LABORATORY WORK
29	OTHER (TREATMENT SERVICES)
30	ATTENDANCE (PREVENTION)
31	PRELIMINARY EXAM (O.H.)
32	X-RAY (O.H.)
33	ORAL HYGIENE INSTRUCTION
34	ORAL HYG. INSTRUCTION (GROUPS)
35	SCALE & POLISH
36	POLISH ONLY
37	FLUORIDE FULL
38	FLUORIDE PARTIAL
39	FISSURE SEALANTS

Z804 SEQ	DESCRIPTION OF PROCEDURE
40	POLISH FILLINGS
41	IMPRESSION O/H
42	STUDY MODELS O/H
43	OTHER (CLINICAL PREVENTION)
44	PRE-PRIMARY SCHOOL VISITS
45	PRIMARY SCHOOL VISITS
46	SECONDARY SCHOOL VISITS
47	SPECIAL SCHOOL VISITS
48	INSTITUTION VISITS
49	PUBLIC VENUE VISITS
50	SCREENING EXAM. (PATIENTS)
51	TREATMENT REQUIRED
52	INDEX EVALALUATION (PATIENTS)
53	GROUP EDUCATION (GROUPS)
54	GROUP EDUCATION (PATIENTS)
55	NEW PROGRAMME - BRUSHING
56	NEW PROG. - FLUORIDE RINSING
57	NEW PROG. - FLUORIDE TABLETS
58	NEW PROG. - BRUSH. & FLUORIDE
59	FOLLOW UP VISITS (PREV. PROG.)
60	OTHER (COMMUNITY PREVENTION)
61	ORTHODONTICS - ATTENDANCES
62	ORTHO. INITIAL EXAMINATION
63	ORTHO. FOLLOW UP EXAMINATION
64	ORTHO. X-RAY
65	ORTHO. CEPHALOGRAM
66	ORTHO. STUDY MODELS
67	REMOVABLE APPLIANCE
68	FIXED APPLIANCE - FULL
69	FIXED APPLIANCE - PARTIAL
70	ORTHO. ADJUSTMENTS
71	ORTHO. REPAIR
72	SPACE MAINTAINER
73	ORTHO. TREATMENT DISCONTINUED
74	ORTHO. TREATMENT COMPLETED
75	ORTHO. OTHER
76	MFOS. CONSULTATION
77	MFOS. X-RAYS
78	MFOS. BIOPSIES
79	MFOS. FOLLOW UP
80	SOFT TISSUE TRAUMA - MINOR
81	SOFT TISSUE TRAUMA - MAJOR

Z804 SEQ	DESCRIPTION OF PROCEDURE
82	MANDIBLE FRACTURE - NON-OPERAT
83	MANDIBLE FRACTURE - OPERATIVE
84	MAXILLA FRACTURE
85	GILLIES FRACTURE
86	MINOR SURGERY
87	PERIODONTAL SURGERY
88	INFECTIVE CASES
89	CYSTS
90	TUMORS
91	REFERRALS
92	MFOS. OTHER

Appendix 10. PDE Treatment Codes

PROCEDURE	CODE	PDE RVU	RVU	Z804 RVU	TARIFF	PREV	Z804 SEQ
VISIT PRE-PRIMARY SCHOOL	7000	0.00	0.00	0.00	0.00	2	44
VISIT PRIMARY SCHOOL	7001	0.00	0.00	0.00	0.00	2	45
VISIT SECONDARY SCHOOL	7002	0.00	0.00	0.00	0.00	2	46
VISIT SPECIAL SCHOOL	7003	0.00	0.00	0.00	0.00	2	47
VISIT INSTITUTIONS	7004	0.00	0.00	0.00	0.00	2	48
VISIT PUBLIC VENUE	7005	0.00	0.00	0.00	0.00	2	49
SCREENING EXAM	7100	0.20	0.00	0.20	0.00	2	50
INDEX EVALUATION (O HEALTH SURVEY)	7200	1.88	0.00	1.50	0.00	2	52
GROUP DENTAL HEALTH EDUCATION	7300	4.00	0.00	6.00	0.00	2	53
NEW BRUSHING PROGRAMME	7400	4.00	0.00	4.00	0.00	2	55
NEW FLUORIDE RINSING PROGRAMME	7500	4.00	0.00	4.00	0.00	2	56
NEW FLUORIDE TABLET PROGRAMME	7600	4.00	0.00	4.00	0.00	2	57
NEW BRUSHING & FLUORIDE PROGRAMME	7700	4.00	0.00	4.00	0.00	2	58
PREV. PROGRAMME FOLLOW UP VISIT	7800	1.00	0.00	4.00	0.00	2	59
OTHER COMMUNITY SERVICE	7900	1.00	0.00	0.50	0.00	2	60
EXHIBITION (PER HOUR MANNED)	7950	4.00	0.00	0.50	0.00	2	60
TRAVELLING TIME (PER 15 MIN)	7960	0.00	0.00	0.00	0.00	0	0
SESSION ABSENT (PER 4 HOURS)	7970	0.00	0.00	0.00	0.00	0	0
KM TRAVELLED (FOR PDD'S USE ONLY)	7980	0.00	0.00	0.00	0.00	0	0
ATTENDANCE	8000	0.00	0.67	0.00	73.62	0	1
PRESCRIPTION	8001	0.25	0.00	0.50	0.00	3	29
ATTENDANCE: CLINICAL PREVENTION	8010	0.00	0.00	0.00	0.00	0	30
ATTENDANCE: ORTHODONTICS	8011	0.00	0.00	0.00	0.00	0	61
EXAM (INCLUDING CHARTING)	8101	1.88	0.40	1.00	78.17	2	2
PRELIM. EXAM. (O.HYGIENISTS ONLY)	8102	0.50	0.00	0.50	0.00	2	31
EXAM AT HOSPITAL OR INSTITUTION	8103	2.50	0.96	1.00	0.00	2	2
EXAMINATION FOR SPECIFIC PROBLEM	8104	0.60	0.00	0.50	0.00	2	29
APPOINTMENT NOT KEPT	8105	0.00	0.00	0.00	0.00	0	29
REFER PATIENT TO ORAL HYGIENIST	8106	0.50	0.00	0.00	0.00	2	43
X RAY (INTRA ORAL-PER FILM)(G.P.)	8107	1.25	0.64	1.00	61.45	2	3
X RAY (INTRA ORAL-PER FILM)(O H)	8108	1.25	0.64	1.00	61.45	2	32
USE GLOVES AND MASK	8109	0.25	0.13	0.50	13.65	2	29
X RAY (INTRA ORAL-PER FILM)(MFOS)	8110	1.25	0.64	1.00	61.45	2	77
X RAY (OCCLUSAL)(O.H.)	8111	1.25	0.64	1.00	105.89	2	32
X RAY (OCCLUSAL)(ORTHO)	8112	1.25	1.13	1.00	105.89	2	64
X RAY (OCCLUSAL)(G.P.)	8113	1.25	1.13	1.00	105.89	2	3
X RAY (OCCLUSAL)(MFOS)	8114	1.25	1.13	1.00	105.89	2	77
EXTRA-ORAL RADIOGRAPH (ALL GROUPS)	8115	1.25	2.64	1.00	245.65	2	3
LABORATORY WORK (15 MINUTES)	8116	1.00	0.00	2.50	0.00	0	28

PROCEDURE	CODE	PDE RVU	RVU	Z804 RVU	TARIFF	PREV	Z804 SEQ
STUDY MODELS (INCLUDING DIAGNOSIS)	8117	2.50	0.71	1.00	166.01	2	66
PHOTOGRAPH (DIAGNOSTIC)	8121	0.63	0.71	0.50	66.00	2	29
EMERGENCY (OVERTIME)	8129	3.00	2.47	0.50	228.64	1	29
EMERGENCY FOR PAIN RELIEF	8131	1.50	1.00	0.50	93.27	1	29
EMERGENCY ROOT CANAL TREATMENT	8132	3.00	1.64	0.50	152.52	1	29
RECEMENT INLAY, CROWN OR BRIDGE	8133	0.50	1.00	0.50	93.27	4	29
REMOVE INLAY, CROWN OR BRIDGE ABUT	8135	0.50	2.00	0.50	185.52	4	29
ACCESS THROUGH CROWN FOR RCT	8136	1.00	0.89	0.50	83.01	3	29
EMERGENCY CROWN,BRIDGE, OR INLAY	8137	1.00	3.44	2.00	319.71	4	12
PREFORMED METAL CROWN	8138	1.00	2.04	0.50	190.07	4	29
G.A.	8139	4.00	0.00	4.00	0.00	3	27
TREATMENT AWAY FROM SURGERY	8140	1.50	1.62	0.00	151.35	3	29
R.A./FIRST 15 MINUTES	8141	1.00	0.73	1.00	68.34	3	26
R.A. /ADDITIONAL 15 MINUTES	8143	1.00	0.38	1.00	35.34	3	26
LOCAL ANAESTHETIC, PER VISIT	8145	0.00	0.16	0.50	59.25	3	29
ORAL HYGIENE INSTRUCTION (INDIVID)	8151	1.88	1.00	1.50	93.27	2	33
ORAL HYGIENE INSTRUCTN.(FOLLOW UP)	8153	1.25	0.73	1.50	68.34	2	33
POLISH (ONLY)	8155	1.25	1.00	1.00	93.27	2	36
POLISH RESTORATIONS (WHOLE MOUTH)	8157	1.88	1.00	1.50	93.27	2	40
SCALING (ONLY)	8158	1.25	1.00	0.50	0.00	2	43
SCALE & POLISH	8159	2.50	1.87	2.00	183.17	2	35
TOPICAL FLUORIDE (FULL)	8161	1.25	1.00	1.50	93.27	2	37
TOPICAL FLUORIDE (PARTIAL)	8162	0.63	1.00	0.50	93.27	2	38
FISSURE SEALANT PER TOOTH	8163	1.25	0.64	1.00	61.45	2	39
TREAT HYPERSENSITIVE DENTINE/VISIT	8167	1.25	0.78	0.50	71.71	2	38
BITE PLATE OR OCCLUSAL GUARD	8169	1.88	3.87	0.50	358.28	2	29
MINOR OCCLUSAL ADJUSTMENT	8170	3.00	2.22	0.50	0.00	1	29
MOUTH GUARD	8171	1.88	1.00	0.50	108.38	2	29
SPACE MAINTAINER; FIXED	8173	1.88	1.87	3.00	173.05	2	72
SPACE MAINTAINER; REMOVABLE	8175	1.88	2.40	3.00	223.06	2	72
PERIODONTAL SCREENING	8176	1.50	1.22	0.50	127.88	1	29
EXTRACT 1 TOOTH/QUADRANT	8201	0.31	1.00	0.75	93.27	4	21
EXTRACT 2 TEETH/QUADRANT	8202	0.48	1.40	1.50	130.81	4	21
EXTRACT 3 TEETH/QUADRANT	8203	0.63	1.80	2.25	168.35	4	21
EXTRACT 4 TEETH/QUADRANT	8204	0.79	2.20	3.00	205.89	4	21
EXTRACT 5 TEETH/QUADRANT	8205	0.94	2.60	3.75	243.43	4	21
EXTRACT 6 TEETH/QUADRANT	8206	1.25	3.00	4.50	280.97	4	21
EXTRACT 7 TEETH/QUADRANT	8207	1.40	3.40	5.25	318.51	4	21
EXTRACT 8 TEETH/QUADRANT	8208	1.56	3.80	6.00	356.05	4	21
SURGICAL REMOVAL OF A TOOTH	8209	4.00	3.09	6.00	402.86	4	86
SURGICAL REMOVAL OF RESIDUAL ROOTS	8213	6.00	4.44	6.00	402.86	1	86

PROCEDURE	CODE	PDE RVU	RVU	Z804 RVU	TARIFF	PREV	Z804 SEQ
PLACE SUTURES	8220	0.25	0.67	0.50	0.00	3	29
POST EXTRACTION HAEMORRHAGE	8221	0.25	0.73	0.50	68.34	4	29
DRY/SEPTIC SOCKET	8225	0.75	0.73	0.50	68.34	1	29
FULL UPPER & LOW. DENT.(COMPLETED)	8231	3.75	16.22	10.00	1504.10	4	24
FULL UPP. OR LOW. DENT.(COMPLETED)	8232	2.50	10.00	5.00	927.30	4	24
PARTIAL DENT. 1 TOOTH (COMPLETED)	8233	1.00	4.64	4.00	431.17	4	25
PARTIAL DENT. 2 TEETH (COMPLETED)	8234	1.00	4.64	4.00	431.17	4	25
PARTIAL DENT. 3 TEETH (COMPLETED)	8235	1.00	6.96	4.00	645.14	4	25
PARTIAL DENT. 4 TEETH (COMPLETED)	8236	1.00	6.96	4.00	645.14	4	25
PARTIAL DENT. 5 TEETH (COMPLETED)	8237	1.25	6.96	4.00	645.14	4	25
PARTIAL DENT. 6 TEETH (COMPLETED)	8238	1.25	9.24	4.00	855.59	4	25
PARTIAL DENT. 7 TEETH (COMPLETED)	8239	1.50	9.24	4.00	855.59	4	25
PARTIAL DENT. 8 TEETH (COMPLETED)	8240	1.50	9.24	4.00	855.59	4	25
PARTIAL DENT. 9+ TEETH (COMPLETED)	8241	1.75	9.24	4.00	855.59	4	25
FILL IN DENTURE FORM	8242	0.25	0.00	0.50	0.00	4	29
PRIMARY IMPRESSIONS	8243	0.00	0.00	1.50	0.00	4	22
SECONDARY IMPRESSIONS	8244	0.00	0.00	1.50	0.00	4	22
BITE REGISTRATION	8245	0.00	0.00	5.00	0.00	4	23
TRY-IN DENTURE	8246	0.00	0.00	0.50	0.00	0	29
RE-TRY DENTURE	8247	0.00	0.00	0.50	0.00	0	29
EASE (OF NEW DENTURE)	8248	0.25	0.00	0.50	0.00	0	29
CLASP	8255	0.25	0.96	0.50	89.75	4	29
REBASE DENTURE	8259	1.00	3.80	0.50	351.53	4	29
REMODEL DENTURE	8261	1.00	6.09	0.50	564.33	4	29
RELINE DENTURE	8263	1.00	2.40	0.50	223.06	4	29
TISSUE CONDITIONER	8265	0.50	1.58	0.50	145.63	4	29
SOFT BASE RELINE	8267	1.00	5.53	0.50	513.15	4	29
REPAIR DENTURE OR OTHER APPLIANCE	8269	0.25	1.29	0.50	118.35	4	29
REPAIR DENTURE (INCL. IMPRESSIONS)	8273	0.50	2.02	0.50	68.34	4	29
EASE (DENTURE > 6 MONTHS OLD)	8275	0.50	0.73	0.50	68.34	4	29
DIRECT PULP CAPPING	8301	1.00	0.00	1.00	123.92	3	16
INDIRECT PULP CAPPING	8303	1.00	1.33	1.00	123.92	3	16
APPLIC.OF RUBBER DAM,(ENDO,BLEACH)	8304	0.50	0.80	0.50	72.89	3	29
APEXIFICATION (PER VISIT)	8305	0.50	1.33	0.50	0.00	3	29
PULPOTOMY	8307	1.50	1.31	1.50	121.72	3	17
BLEACHING VITAL TEETH/ARCH	8308	4.00	0.00	0.50	0.00	3	29
SUPPLY & INSTR FOR HOME BLEACHING	8309	2.00	0.00	0.50	0.00	2	29
FOLLOW-UP VISIT, HOME BLEACHING	8311	1.00	0.00	0.50	0.00	2	29
TEMPORARY FILLING	8320	1.00	0.00	1.00	0.00	3	4
ATRAUMATIC REST. TECHNIQUE(1 SURF)	8321	1.00	0.00	0.50	185.52	3	4
ATRAUMATIC REST. TECHNIQUE(2 SURF)	8322	1.20	0.00	0.50	228.64	3	4
BLEACH NON-VITAL TOOTH (PER TOOTH)	8325	1.50	2.38	0.50	220.72	3	29

PROCEDURE	CODE	PDE RVU	RVU	Z804 RVU	TARIFF	PREV	Z804 SEQ
BLEACH (NON-VITAL)ADD.VISIT(MAX.2)	8327	1.50	1.13	0.50	105.89	3	29
RCT FILLING ADD. CANALS (ANT.&PM)	8328	6.00	1.87	6.00	173.05	3	19
RCT PREP & FILL ADD.CANAL (ANT&PM)	8329	2.00	2.33	6.00	216.17	3	19
REMOVAL FRACTURED ENDO INSTRUMENT	8330	1.10	1.31	2.00	121.72	0	18
RCT PREP VISIT ANT.TOOTH(INCL.PM)	8332	1.00	1.00	2.00	93.27	3	18
RCT PREP VISIT MOLARS	8333	1.50	1.40	2.00	130.82	3	18
RCT RE-PREP. OF PREVIOUS RCT	8334	1.30	1.49	2.00	137.71	3	18
RCT FILLING FIRST CANAL EXCL. MOL.	8335	4.00	4.58	6.00	423.25	3	19
RCT FILLING FIRST CANAL MOLARS	8336	5.00	6.29	6.00	582.52	3	19
RCT FILLING ADDIT. CANALS MOLARS	8337	1.50	1.87	6.00	173.05	3	19
RCT PREP AND FILL 1st CANAL ANT	8338	6.00	6.98	6.00	647.34	3	19
RCT PREP AND FILL 1st CANAL MOLAR	8339	8.00	9.60	6.00	889.61	3	19
RCT PREP AND FILL ADD.CANAL MOLARS	8340	2.00	2.33	6.00	216.17	3	19
PLAST.FILL. 1 SURFACE	8341	1.10	1.82	1.50	185.52	3	7
PLAST.FILL. 2 SURFACE	8342	1.50	2.27	3.00	228.64	3	7
PLAST.FILL. 3 SURFACE	8343	2.00	2.73	4.50	278.65	3	7
PLAST.FILL. >3 SURFACES	8344	2.50	3.04	6.00	310.62	3	7
PIN (MAX 2)	8347	0.25	0.98	1.25	92.10	3	11
ACID ETCH 1 SURFACE (ANT. TOOTH)	8351	1.20	2.00	1.50	203.56	3	9
ACID ETCH 2 SURFACE (ANT. TOOTH)	8352	1.60	2.51	3.00	256.06	3	9
ACID ETCH 3 SURFACE (ANT. TOOTH)	8353	2.10	3.00	4.50	306.07	3	9
ACID ETCH >3 SURFACE (ANT. TOOTH)	8354	2.50	3.33	6.00	341.27	3	9
COMPOSITE VENEERS	8355	1.55	3.49	0.50	323.23	4	29
PREFORMED METAL CROWN	8357	0.75	2.04	0.50	190.07	4	29
INLAY 1 SURFACE (POSTERIOR)	8361	0.75	3.07	4.00	283.19	4	13
INLAY 2 SURFACE (POSTERIOR)	8362	1.50	4.47	8.00	414.16	4	13
INLAY 3 SURFACE (POSTERIOR)	8363	2.25	7.47	12.00	690.60	4	13
INLAY 4 OR MORE SURFACES (POSTERIO	8364	3.00	9.02	16.00	835.06	4	13
ACID ETCH 1 SURF.(PRE-M. & MOLARS)	8367	1.20	2.16	1.50	220.72	3	9
ACID ETCH 2 SURF.(PRE-M. & MOLARS)	8368	1.60	2.67	3.00	273.07	3	9
ACID ETCH 3 SURF.(PRE-M. & MOLARS)	8369	2.10	3.22	4.50	329.98	3	9
ACID ETCH >3 SURF(PRE-M. & MOLARS)	8370	2.50	3.49	6.00	354.91	3	9
CERAM/RESIN BOND. INLAY 1 SURF.	8371	1.00	3.67	4.00	341.27	4	13
CERAM/RESIN BOND. INLAY 2 SURF.	8372	1.50	5.42	8.00	503.91	4	13
CERAM/RESIN BOND. INLAY 3 SURF.	8373	2.00	8.96	12.00	830.51	4	13
CERAM/RESIN BOND. INLAY 4 SURF.	8374	2.50	10.84	16.00	1005.91	4	13
CAST CORE WITH SINGLE POST	8391	0.50	2.31	0.50	213.97	4	29
CORE & PINS (CAST)	8397	1.00	3.67	0.50	341.27	4	29
PLASTIC(AG,COMP,GI)CORE FOR CROWN	8398	1.00	4.47	0.50	414.16	4	29
CAST FULL CROWN	8401	3.00	11.49	12.00	1064.87	4	15
CAST 3/4 CROWN	8403	3.00	11.49	12.00	1064.87	4	15

PROCEDURE	CODE	PDE RVU	RVU	Z804 RVU	TARIFF	PREV	Z804 SEQ
ACRYLIC JACKET CROWN	8405	3.00	11.49	12.00	1005.77	4	15
ACRYLIC VENEER CROWN	8407	3.00	11.49	12.00	1064.87	4	15
PORCELAIN JACKET CROWN	8409	3.00	11.49	12.00	1064.87	4	15
PORCELAIN VENEER CROWN	8411	3.00	11.49	12.00	1064.87	4	15
ADDIT. FEE FOR CROWN WITHIN CLASP	8414	0.25	0.64	0.50	61.45	4	29
BRIDGE, SANITARY PONTIC	8420	1.00	5.60	12.00	690.60	4	15
PONTIC, POSTERIOR	8422	1.00	7.47	12.00	869.23	4	15
PONTIC, ANTERIORS & PREMOLARS	8424	1.00	9.38	12.00	869.23	4	15
SPLINTING/SEXTANT EXTRACORON. WIRE	8723	2.00	1.87	0.50	173.05	3	29
SPLINTING/SEXT. EXTRACOR. WIRE+RES	8725	3.00	2.71	0.50	251.07	3	29
SPLINTING INTRACOR. WIRE/PIN+RESIN	8727	1.00	0.86	0.50	78.75	3	29
TREAT PERIODONTAL ABCESS,INCL.FLAP	8731	2.25	1.60	4.00	148.71	1	88
ROOT PLANING / QUADRANT	8737	4.00	3.63	6.00	373.24	3	87
ROOT PLANING / SEXTANT	8739	3.00	2.90	6.00	296.98	3	87
GINGIVECTOMY / QUADRANT	8741	4.00	4.80	6.00	487.04	3	87
GINGIVECTOMY / SEXTANT	8743	4.00	3.82	6.00	389.08	3	87
PERIODONTAL SURGERY / TOOTH	8768	2.00	3.19	6.00	295.80	3	87
ORTHO: CONSULTATION	8801	1.88	1.08	1.50	0.00	2	62
ORTHO: FOLLOW UP EXAM	8803	1.25	0.81	1.00	0.00	2	63
ORTHO: ADJUSTMENTS	8804	0.00	0.00	0.50	0.00	3	70
ORTHO: TREATMENT DISCONTINUED	8806	0.00	0.00	0.00	0.00	3	73
ORTHO: TREATMENT COMPLETED	8807	0.00	0.00	0.00	0.00	3	74
X RAY (INTRA ORAL-PER FILM)(ORTHO)	8810	1.25	0.64	1.00	0.00	2	64
TRACING & ANALYSIS OF E-ORAL FILM	8811	1.50	0.31	2.50	28.45	3	65
ORTHO: DIAGN. & TREATMENT PLANNING	8837	0.92	0.64	1.00	60.00	2	66
ORTHO DIAGNOSTIC SETUP	8839	1.93	1.36	1.00	126.71	2	66
TREAT. PLAN. FOR ORTHOGNATIC SURG.	8840	6.70	4.71	1.00	436.89	2	66
ORTHO: REMOVABLE APPLIANCE: REPAIR	8846	1.04	0.92	0.50	85.65	3	71
ORTHO: REMOVABLE APPL: REPLACEMENT	8847	3.61	3.19	6.00	295.80	3	67
FIXED: REPAIR OR REPLACEMENT/UNIT	8848	1.55	1.36	0.50	126.71	3	71
ORTHO: RETAINER	8849	3.61	3.19	3.00	295.80	3	72
ORTHO: MPDS FIRST CONSULTATION	8850	1.75	1.54	1.50	142.55	3	62
ORTHO: MPDS SUBSEQ. CONSULTATION	8851	0.92	0.81	1.00	75.09	3	63
ORTHO: BITE PLATE	8852	2.52	3.38	6.00	358.28	3	67
ORTHO: MINOR (FIXED)	8861	15.33	13.51	6.00	1253.17	3	69
ORTHO: MINOR REMOVABLE APPLIANCE	8862	12.81	11.29	6.00	1045.95	3	67
ORTHO: REMOVABLE, PER ADDIT. APPL.	8863	6.44	5.67	6.00	525.61	3	67
ORTHO: MAJOR,PRELIM.UPPER OR LOWER	8865	40.94	36.05	12.00	3342.73	3	68
ORTHO: MAJ.PRELIM.UPPER AND LOWER	8866	56.30	49.57	12.00	4597.37	3	68
ORTHO: MAJOR, SINGLE ARCH, MILD	8867	44.00	38.76	12.00	3593.07	3	68
ORTHO: MAJOR, SINGLE ARCH, MOD	8868	54.25	47.79	12.00	4431.94	3	68

PROCEDURE	CODE	PDE RVU	RVU	Z804 RVU	TARIFF	PREV	Z804 SEQ
ORTHO: MAJOR, SINGLE ARCH, SEVERE	8869	63.46	55.91	12.00	5183.70	3	68
ORTHO: MAJOR, CLASS I MILD	8873	80.55	70.92	12.00	6575.46	3	68
ORTHO: MAJOR, CLASS I MODERATE	8875	98.86	87.04	12.00	8072.08	3	68
ORTHO: MAJOR, CLASS I SEVERE	8877	115.24	101.47	12.00	9410.03	3	68
ORTHO: MAJOR, CL I SEVERE + COMP.	8879	129.51	114.04	12.00	10575.21	3	68
ORTHO: MAJOR, CLASS II & 111 MILD	8881	115.24	101.47	12.00	9410.03	3	68
ORTHO: MAJOR, CLASS II & III MOD	8883	129.51	114.04	12.00	10575.21	3	68
ORTHO: MAJOR, CLASS II & III SEV.	8885	145.40	128.02	12.00	11871.50	3	68
ORTHO: MAJ., CL II & III SEV.+COM	8887	161.68	144.26	12.00	13375.45	3	68
MFOS: CONSULTATION	8901	1.54	1.08	1.50	0.00	2	76
REFER TO MFOS OR OTHER SPECIALIST	8902	0.00	0.00	0.00	0.00	0	91
MFOS: CONS AT HOSPITAL	8903	1.74	1.23	1.50	112.98	2	76
MFOS: SUBSEQ. CONS AT ROOMS	8904	1.16	0.81	1.00	75.12	2	79
MFOS: WEEKEND, NIGHT VISITS	8905	3.01	1.78	1.50	165.51	1	76
ASSIST IN THEATRE (PER 15 MINUTES)	8906	1.50	0.00	0.50	0.00	1	92
MFOS: CALD-LUC + ROOT IN ANTRUM	8908	7.54	13.27	15.00	1231.76	4	84
MFOS: CLOSE ANTRO-ORAL FISTULA	8909	5.78	10.18	6.00	944.32	4	86
MFOS: CALDWELL-LUC	8911	2.27	3.99	6.00	369.43	4	86
MFOS: BIOPSY, INTRA-ORAL	8917	3.19	2.56	3.00	235.53	2	78
MFOS: BIOPSY, NEEDLE	8919	5.53	3.90	3.00	362.53	2	78
MFOS: BIOPSY OF BONE, OPEN	8921	9.09	6.40	3.00	593.22	2	78
MFOS: LOC. TREAT. POST-EXTR. HAEM.	8931	0.73	2.93	4.00	68.34	1	80
MFOS: TRT.PT-EXTR.HAEM.(BL.DYSRC.)	8933	17.34	10.18	4.00	944.32	1	80
MFOS: SEPTIC SOCKET	8935	1.32	0.77	4.00	68.34	1	88
MFOS: SURGIC. REMOV. TOOTH	8937	4.00	2.68	6.00	402.86	4	86
MFOS: IMPACTIONS: 1ST TOOTH	8941	4.00	7.20	6.00	667.87	3	86
MFOS: IMPACTIONS: 2ND TOOTH	8943	3.50	3.87	6.00	358.28	3	86
MFOS: IMPACTIONS: 3RD TOOTH	8945	3.00	2.20	6.00	203.56	3	86
MFOS: IMPACTIONS: 4TH AND SUBSQ. T	8947	3.00	2.20	6.00	203.56	3	86
MFOS: SURGICAL REMOVAL OF ROOTS	8953	6.00	4.44	6.00	402.86	1	86
MFOS: ALVEOLOTOMY OR ALVEOLECTOMY	8957	3.03	5.33	6.00	494.52	4	86
MFOS: AUTO-TRANSPLANT. OF TOOTH	8961	4.96	8.74	6.00	810.86	4	86
MFOS: PERIFERAL NEURECTOMY	8965	4.96	8.74	6.00	810.86	4	86
FUNCTIONAL REPAIR ORONASAL FISTULA	8966	13.79	12.16	6.00	1127.93	4	86
MFOS: CYST; INTRA-ORAL APPROACH	8967	13.79	12.15	12.00	1126.46	3	89
MFOS: CYST; EXTRA-ORAL APPROACH	8969	22.08	19.45	12.00	1804.45	3	89
MFOS: NEOPLASMS; SOFT TISSUE TUMR.	8971	4.42	3.90	18.00	362.53	3	90
MFOS: NEOPLASMS; JAW TUMOURS	8973	22.08	19.45	18.00	1804.45	3	90
MFOS: HEMIRESECTION + SPLINT	8975	11.60	20.43	6.00	1895.53	4	86
MFOS: MAJ. REP. UPPER OR LOWER JAW	8977	11.59	20.42	6.00	1894.06	4	86
MFOS: HARVESTING OF BONE GRAFT	8978	4.42	3.87	6.00	342.88	4	86

PROCEDURE	CODE	PDE RVU	RVU	Z804 RVU	TARIFF	PREV	Z804 SEQ
MFOS: EXPOSURE OF IMPACT. FOR ORTH	8981	8.27	7.29	6.00	744.13	3	86
MFOS: CORTICOTOMY; FIRST TOOTH	8983	3.30	5.81	6.00	538.52	4	86
MFOS: CORTICOTOMY; SUBSEQ. TOOTH	8984	1.67	2.93	6.00	273.07	4	86
MFOS: FRENECTOMY	8985	7.57	5.33	6.00	494.52	2	86
MFOS: MYLOHYOID RIDGE REDUCTION	8987	4.96	8.74	6.00	810.86	4	86
MFOS: TORUS REDUCTION	8989	4.96	8.74	6.00	810.86	4	86
MFOS: MAXILLARY TUBEROPLASTY	8991	4.96	8.74	6.00	810.86	4	86
MFOS: RED. OSSEUS TUBEROSITY	8993	2.21	3.90	6.00	362.53	4	86
MFOS: GINGIVECTOMY / JAW	8995	8.83	7.78	6.00	721.40	3	87
MFOS: SULCOPLASTY/VESTIBULOPLASTY	8997	11.38	20.05	6.00	1859.16	4	86
MFOS: REPOSITION MENTAL FORAMEN	9003	6.89	12.15	6.00	1126.46	4	86
MFOS: AUGMENTATION ALV.RIDGE(BONE)	9005	11.60	20.43	6.00	1895.53	4	86
MFOS: AUGMENT. ALV. RIDGE (ALLOPLA	9007	7.29	12.87	6.00	1193.05	4	86
MFOS: SINUS LIFT	9010	7.05	13.21	6.00	1231.76	4	86
MFOS: INCISE AND DRAIN ABCESS	9011	3.53	2.49	4.00	230.69	1	88
MFOS: SEPSIS, EXTRA-ORAL APPROACH	9013	4.81	3.39	4.00	315.46	1	88
MFOS: APICECTOMY - ANTERIOR	9015	2.92	4.37	6.00	459.62	4	86
MFOS: APICECTOMY - POSTERIOR	9016	4.97	8.74	6.00	810.86	4	86
MFOS: OSTEO; DECORT. SAUC. SEQ	9017	10.23	18.02	6.00	1669.38	4	86
MFOS: SEQUESTRECTOMY	9019	6.64	3.90	6.00	362.53	1	86
SOFT TISSUE TRAUMA (MINOR)	9021	2.00	4.37	4.00	459.62	3	80
SOFT TISSUE TRAUMA (MAJOR)	9023	10.00	9.23	8.00	855.59	3	81
DENTO-ALVEOLAR FRACTURE/SEXTANT	9024	2.19	4.37	12.00	406.53	1	82
FRACTURED MAND.(CLOSED REDUCTION)	9025	9.00	9.70	12.00	900.32	1	82
MFOS: MAND. FRACTURE COMPOUND	9027	23.21	13.63	18.00	1264.47	1	83
MFOS: MAND. FRACT GUNNING SPLINT	9029	25.71	15.10	18.00	1400.12	1	83
MFOS: MAND. FRACT OPED RED.+SPLINT	9031	38.10	22.37	18.00	2075.33	1	83
MFOS: LE FORT I FRACTURE	9035	23.27	13.66	15.00	1266.81	1	84
MFOS: LE FORT II FRACTURE	9037	38.10	22.37	15.00	2075.33	1	84
MFOS: LE FORT III FRACTURE	9039	54.68	32.09	15.00	2976.78	1	84
MFOS: GILLIES ELEVATION	9041	16.53	9.70	12.00	900.32	1	85
MFOS: UNSTBLE OR COMMINUTED ZYGOMA	9043	33.12	19.45	12.00	1804.45	1	85
MFOS: ZYGOMA; MULT.INTEROSS.WIRING	9045	49.67	29.16	15.00	2703.31	1	84
MFOS: IMPROVE MASTICATORY FUNCTION	9047	57.93	40.80	6.00	3783.43	4	86
MFOS: ANT. SEG. OSTEOT. MANDIB.	9049	38.61	34.00	6.00	3153.50	4	86
MFOS: TOTAL SUBAPICAL OSTEOTOMY	9050	31.11	62.21	6.00	5767.83	4	86
MFOS: GENIOPLASTY	9051	11.04	19.45	6.00	1804.45	4	86
MFOS: MIDFACIAL EXPOSURE	9052	17.47	30.80	6.00	2856.56	4	86
MFOS: CORONOIDECTOMY (INTRA-ORAL)	9053	6.89	12.13	6.00	1125.58	4	86
MFOS: SCHUKARDT OSTEOTOMY	9055	19.31	34.00	6.00	3153.25	4	86

PROCEDURE	CODE	PDE RVU	RVU	Z804 RVU	TARIFF	PREV	Z804 SEQ
MFOS: WASSMUND OSTEOTOMY	9057	19.31	34.00	6.00	3153.25	4	86
MFOS: LE FORT I OSTEOTOMY(1ST SEG)	9059	36.33	63.99	15.00	5933.11	4	84
MFOS: LE FORT I OSTEOTOMY+REPOSIT	9060	40.74	71.83	15.00	6660.52	4	84
MFOS: PALATAL OSTEOTOMY	9061	12.70	22.37	15.00	2075.33	4	84
MFOS: LE FORT I OSTEOTOMY (>1 SEG)	9062	46.35	81.66	15.00	7573.75	4	84
MFOS: LE FORT II OSTEOTOMY	9063	46.40	81.71	15.00	7577.56	4	84
MFOS: LE FORT III OSTEOTOMY	9065	69.54	122.47	15.00	11356.29	4	84
MFOS: PARTIAL GLOSSECTOMY	9069	8.28	14.58	6.00	1351.58	4	86
MFOS: GENIOHYIODOTOMY	9071	4.96	8.74	6.00	810.86	4	86
MFOS: CLOSE ORO-NAS. FIST. +GRAFT	9072	72.67	63.99	6.00	5933.11	3	86
MFOS: TMJ DIAGNOSTIC ARTHROSCOPY	9074	5.48	9.66	0.50	895.77	3	92
MFOS: CODYLECTOMY ETC (EXTRA-ORAL)	9075	13.79	24.28	6.00	2250.43	4	86
MFOS: ARTHROCENTESIS TMJ	9076	2.67	5.33	6.00	494.52	4	86
MFOS: INTRA-ARTICULAR INJECTION	9077	0.83	1.45	0.50	134.92	4	92
MFOS: TRIGGER POINT INJECTION	9079	0.32	1.13	0.50	105.30	4	92
MFOS: WARD/KOSTECTA OSTEOTOMY	9081	5.51	9.70	6.00	900.32	4	86
MFOS: LE CLERK & TOLLER PROCED.	9083	13.79	24.28	6.00	2250.43	4	86
MFOS: REDUCT. TMJ DISLOCATION	9085	3.29	1.93	6.00	179.07	1	86
MFOS: REDUCT.TMJ DISLOC.(ANAESTH.)	9087	6.64	3.90	6.00	362.53	1	86
MFOS: RED.TMJ DISLOC.(AN.+IMMOB.)	9089	16.53	9.70	6.00	900.32	1	86
MFOS: OPEN REDUCT. TMJ DISLOC.	9091	41.37	24.28	6.00	2250.43	1	86
MFOS: TMJ TOTAL RECONSTRUCTION	9092	36.75	64.80	6.00	6008.20	4	86
MFOS: REMOVE SALIVARY CALCULUS	9093	4.96	4.37	6.00	406.53	3	86
MFOS: REMOVE SALIVARY GLAND	9095	13.25	10.80	6.00	1001.95	3	86
MFOS: REMOVE SALIV. GLAND (EX-OR)	9096	17.50	16.00	6.00	1484.45	3	86
MFOS: SUB-PRIOST. IMPL. PREPARAT.	9180	7.73	13.62	6.00	1227.22	4	86
MFOS: SUB-PRIOST. IMPL. PLACEMENT	9181	7.73	13.62	6.00	1227.22	4	86
MFOS: ENDOSTEAL IMPL. PLACEMENT	9182	3.87	6.82	6.00	614.34	4	86
MFOS: PLACE 1 OSS.INTEG IMPLANT	9183	4.92	8.70	6.00	864.68	4	86
MFOS: PLACE 2nd OSS.INTEG IMPLANT	9184	3.70	6.52	6.00	647.34	4	86
MFOS: PLACE 3rd OSS.INTEG.IMPLANT	9185	3.70	4.36	6.00	433.37	4	86
MFOS: EXPOSE 1 OSS.INTEG IMPLANT	9190	1.83	3.21	6.00	320.74	4	86
MFOS: EXPOSE 2nd OSS.INTEG IMPLANT	9191	1.37	2.41	6.00	241.10	4	86
MFOS: EXPOSE 3rd OSS.INTEG IMPLANT	9192	0.91	1.61	6.00	161.47	4	86
MFOS: CLEFT REPAIR HARD UNILATERAL	9220	17.87	35.74	6.00	3313.84	4	86
MFOS: CLEFT REPAIR HARD BILATERAL	9222	22.68	45.37	6.00	4206.68	4	86
MFOS: CLEFT REPAIR HARD BILATERAL	9224	33.80	67.60	6.00	6268.36	4	86
MFOS: CLEFT REPAIR SOFT NO MUSCLE	9226	14.97	29.94	6.00	2776.93	4	86
MFOS: CLEFT REPAIR SOFT INCL MUSC	9228	21.74	43.48	6.00	4032.16	4	86
MFOS: CLEFT REPAIR SUBMUCOSAL	9230	16.19	32.39	6.00	3002.19	4	86
MFOS: CLEFT VELOPHAR. RECONSTR. UN	9232	16.66	33.32	6.00	3089.45	4	86

PROCEDURE	CODE	PDE RVU	RVU	Z804 RVU	TARIFF	PREV	Z804 SEQ
MFOS: CLEFT VELOPHAR. RECONSTR. CO	9234	17.82	35.63	6.00	3303.42	4	86
MFOS: CLEFT ORONASAL FISTULE 1 PRO	9238	10.19	20.37	6.00	1889.51	4	86
MFOS: CLEFT ORONASAL FISTULE 2 PRO	9240	17.77	35.54	6.00	3296.38	4	86
MFOS: CLEFT PERIOSTEAL SWIVEL FLAP	9246	8.88	17.76	6.00	1647.39	4	86
MFOS: CLEFT LIPADHESION	9248	3.32	6.64	6.00	615.81	4	86
MFOS: CLEFT LIP REPAIR UNILAT NO M	9250	5.85	11.70	6.00	1084.67	4	86
MFOS: CLEFT LIP REPAIR UNILAT INCL	9252	7.93	15.87	6.00	1470.66	4	86
MFOS: CLEFT LIP REPAIR BILAT NO MU	9254	8.17	16.34	6.00	1514.66	4	86
MFOS: CLEFT LIP REPAIR BILAT INCL	9256	12.62	25.25	6.00	2340.04	4	86
MFOS: CLEFT ANT NASAL FLOOR REPAIR	9258	3.19	6.37	6.00	590.88	4	86
MFOS: CLEFT PART REV OF 2ND LIP DE	9260	3.19	6.37	6.00	590.88	4	86
MFOS: CLEFT TOT REV OF 2ND LIP DEF	9262	7.20	14.40	6.00	1335.01	4	86
MFOS: CLEFT ABBE FLAP	9264	8.15	16.30	6.00	1511.73	4	86
MFOS: CLEFT COLLUMELLA RECONSTRUC.	9266	4.82	9.64	6.00	893.57	4	86
MFOS: CLEFT PART. RECONSTR OF NOSE	9268	6.12	12.24	6.00	1135.56	4	86
MFOS: CLEFT COMPL. RECONSTR OF NOS	9270	9.68	19.36	6.00	1794.63	4	86
MFOS: CLEFT PARANASAL AUGMENTATION	9272	4.82	9.64	6.00	893.57	4	86