COMPARATIVE ANALYSIS OF DIAGNOSTIC AND PROCEDURE CODING SYSTEMS FOR USE IN DISTRICT AND REGIONAL HOSPITALS IN THE WESTERN CAPE.

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KEYWORDS

International Classification of Primary Care (ICPC-2), International Classification of Diseases (ICD-10), International Classification of Diseases Condensed Morbidity List,

Current Procedure Terminology for South Africa (CCSA), International Classification of Diseases Clinical Modification (ICD-9-CM), Health information systems, Diagnostic coding systems, Procedure coding systems, Decision Support, Data standardisation.

DEDICATION

This research project is dedicated with love and honour to God for his unshakable Love and Guidance during a challenging period while completing this project, more so for his unconditional expression of love and support in the form of Dr Thabi Maitin.

To my boys,

Katlego, Kutlwano and Khumo who continue to inspire me to want to do the right thing.

To Mrs. Limukani Dlodlo

Without whose commitment, love, support and dedication I would not have had time to focus on this project.

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- Dr Samuel Manda and Dr Carl Lombard for their statistical analysis

DECLARATION

I declare that *Comparative analysis of diagnostic and procedure coding systems for use in district and regional hospitals in the Western Cape* is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Lebogang Gloria Montewa

March 2012

Signed: . . . . . .

ABSTRACT

Background: The Provincial Government Western Cape (PGWC) Department of Health identified a lack of data on inpatient diagnoses and procedures in a form suitable to use for operational, strategic as well as financial health care planning. The only format in which diagnostic and procedure data was available was a paper based one encompassing individual patient notes in folders and discharge summaries. Making the data available in a coded format within an electronic database would facilitate storage, analysis and utilisation of that data for health service planning.

Recognising the lack of availability of such coded data, this study was undertaken to evaluate different coding systems for their ability to code data in order to assist in deciding which coding systems best fit the need to facilitate easy and accurate recording of data on diagnoses and procedures from patient records. The identification of the most appropriate coding system for the context in which the PGWC Department of health functions should facilitate the easy recording, storage and retrieval of data that is accurate, reliable and useful for management decision making and would support optimal patient care.

Aim: The aim of the study was to evaluate a selection of potentially suitable coding systems in order to determine which would be best able to code public sector district and regional hospital diagnostic and procedure data in the Western Cape Province.

Method: A cross sectional analytical study design was used. Discharge diagnosis and procedure data were extracted from 342 patient folders from 3 district and 3 regional public hospitals in the Western Cape. This yielded 221 different diagnostic concepts and 126 different procedure concepts. The diagnostic concepts were further grouped into "all" diagnostic concepts recorded, diagnostic concepts recorded as "symptoms only" and diagnostic concepts recorded as "proper diagnoses". The diagnostic coding systems evaluated were ICD-10 (International Classification of Diseases), ICPC-2 (International Classification of Primary Care 2nd edition) and ICD-10 Condensed Morbidity List. The procedure coding systems evaluated were CCSA-2001 (Current Procedure Terminology for South Africa) ICD-9-CM (International Classification of Diseases Clinical Modification 9th revision) and ICPC-2. The diagnoses and procedures were then coded in all of the coding systems being

evaluated. Each diagnosis and procedure concept was matched with its representing concept in the coding system and scored according to the ability of the coding system to provide an "exact" match which was scored as (3) or a "partial" match scored as (2) or a "poor" match scored as (1) or "no" match scored as (0).

Results: ICD-10 was better able to code diagnoses obtained from district and regional hospitals in the Western Cape compared to ICPC-2 and ICD-10 Condensed Morbidity list. For all recorded diagnostic concepts, ICD-10 was able to score 82% of the concepts as either an "exact" or a "partial" match compared to 79% in ICPC-2 and 30% in ICD-10-CL. ICD-10 consistently performed best across different stratification of diagnostic concepts namely concepts recorded as "proper diagnoses", concepts recorded from regional hospitals only, concepts recorded from district hospitals only, concepts designated as "common diagnoses" and for concepts designated as "very common diagnoses". In addition ICD-10 had zero diagnostic concepts for which "no match" could be found. CCSA -2001 proved to be the best coding system for coding procedures across all hospitals with an overall percentage of "exact" and "partial" matches of 83% compared to 65% for ICD-9-CM and 39% for ICPC-2 and also proved to be best across all strata.

Conclusion: There were striking differences between the evaluated coding systems with regard to their ability to code diagnoses and procedures in the evaluated district and regional hospitals in the Western Cape Province. ICD-10 covers the scope of clinical diagnoses in more accurate and specific detail than ICPC-2 and ICD-10 CL. Though ICPC-2 is simpler and easier to use than ICD-10, it is not as detailed and specific as the latter but it proved ideal for symptoms rather than for specific diagnoses. ICD-10 Condensed Morbidity List was shown to be inadequate for coding diagnoses. However the difference between the two, although statistically significant were not very large and given the ease of use of ICPC-2, it could be recommended for use. As for procedures CCSA-2001 was assessed as being the most appropriate for coding procedures recorded in this setting compared to the other coding systems. ICPC-2 performed poorest for coding procedures across all evaluated settings and thus would be inappropriate to use. ICD-10 in most comparisons performed second best to ICPC-2 in terms of coding ability for diagnoses and could be considered for recommendation as a diagnostic coding tool.

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CHAPTER 1

1. INTRODUCTION

In 1994, the newly installed democratic government implemented a new health care system that would cater for the needs of all South Africans. A strategic approach used to develop this vision was that of Comprehensive Primary Health Care, which was believed to be the best vehicle for the transformation of the health sector in the country (Department of Health, 1995). Priority was given to the development of a new national health information system aimed at contributing towards the promotion of an information culture in South Africa. The National Health Information System for South Africa Committee[1] (NHIS/SA) was formed to facilitate improved health planning and management as a priority of the National Department of Health and viewed as the overall parent of the national health information system of South Africa, comprising of various component systems or sub-systems that would individually and collectively cater for the various needs for information support (Department of Health, 1997). Based on the analysis of the health information systems then, tremendous efforts were made to improve the collection and use of data for effective management, by implementing streamlined health information systems based on national guidelines, followed by the standardisation of health data using coding systems as a major element to achieve this.

The standardised coding of diagnoses and procedures was viewed as an important component of an effective health information system, because it allows for the efficient summarization of the clinical content of a patient's medical record, including the reason for admission, other conditions identified during the hospital stay, and the treatments provided. As a result of this, the International Classification of Diseases 10th Revision (ICD-10) Diagnostic coding system and the CCSA-2001 procedure coding systems which was adopted from the Current

[1] Committee mandated to guide and co-ordinate Health Information Systems development in the public health sector

Procedure Terminology 4th version (CPT-4) were adopted as the national diagnostic and procedure coding standards for South Africa under the auspice of the National ICD-10 Implementation Task Team which is a joint task team between the National Department of Health and the Council for Medical Schemes. This was accepted by all role-players in the health care industry as the coding standard of choice in the public as well as private sector in July 2005 (National Task Team, 2007).

So what are coding systems, what is their value and importance in relation to the South African context? How do they form part of the priority given to the development of health information systems in South Africa? Below is a brief discussion of coding systems including their value and importance in the South African Hospital information systems model.

1.2 CODING SYSTEMS, WHAT ARE THEY?

Coding systems are alpha-numeric codes which are used to provide summary information which classifies, standardises and transforms large volumes of data into summary information. Data coding refers to a systematic way in which to condense extensive datasets into smaller analyzable units through the creation of categories and concepts derived from the data. The American Health Information Management Association website (2012) defines a coding system process as "The transformation of narrative descriptions of diseases, injuries, and healthcare procedures into numeric or alphanumeric designations (that is, code numbers). The code numbers are detailed in order to accurately describe the diagnoses (that is, what is wrong with the patient) and the procedures performed to test or correct those diagnoses".

The coding of patient information has always been directed at simplifying the data and converting it to a general form, which is easier to manipulate and yet able to provide full

records of patient encounters, which are used to reflect episodes of health care of the patients, as accurately and completely as possible (Cimino, 1996). Coding systems typically summarises information on medical diagnoses, procedures and surgical operations, signs and symptoms of diseases, poisoning and adverse effects of drugs and complications of surgical and medical care. They are used in all health care settings including hospitals, physician's rooms, nursing homes, home health agencies and other health service provider settings. They serve several important functions, typically being used for physician reimbursement, hospital payments, quality reviews, benchmarking measurements and the collection of general medical statistical data.

1.3 ROLE AND USE OF CODING SYSTEMS IN SOUTH AFRICA.

History has proven that over periods of time, diseases change, new diseases emerge and treatments and intervention procedures improve. With all these developments and expansions of new conditions, improved health care and new health technologies, the demand on information management for health care evaluation and decision making has increased dramatically and as a result the utilization of clinical information has become one of the most critical strategies for improving the quality of health care in South Africa. This strategy has become aligned with the rationale for the implementation of coding systems for the standardisation of data collection and reporting (The National ICD10 Task Team, 2007).

The adoption and implementation of data coding for diagnoses and procedures was deemed important for the South African health care industry in that it lends itself well to improvement of efficiency of health care through easy storage, retrieval and analysis of information for patient care, research, performance improvement, health care planning and facility management. More so standardisation of reporting enabled reliable communication about

health care data among many participants in the health care industry. While this adoption also enabled South Africa as a member of the World Health Organisation (WHO) to submit health data as required by the WHO standards, it further allowed for communication in a predictable, consistent and reproducible manner. However the most important part was the fact that the implementation of standardised coding in South Africa was used as a vehicle towards addressing the development of a new national health information system which was used towards the promotion of an information culture in South Africa (National Task Team 2007).

1.4 CODING SYSTEMS AS AN IMPORTANT PART OF HOSPITAL INFORMATION SYSTEMS

Hospital Information Systems are defined by Ismail *et al*., (2010) as a comprehensive, integrated information system designed to manage the administrative, financial and clinical aspects of a hospital which encompasses paper-based information processing as well as computerised data processing. It can be composed of one or a few components with specialty-specific extensions, as well as a large variety of sub-systems in medical specialties e.g. laboratory information system, radiology information system or inpatient clinical information system, which forms part of the focus point for this research study.

Whether manually driven or electronic, hospital information systems are aimed at achieving the best possible information support for management purposes, as well as individual patient care through the recording of episodes of health care. Coding systems allows for such recording of episodes of health care to be recorded in a standardised manner with international recognition. The standardisation of diagnoses and procedures is thus an important component of an effective hospital information system because it summarises the

clinical content of a patient's medical record, including the reason for admission, other conditions identified during the hospital stay, and treatments provided.

1.5 RESEARCH SETTING

Medical records maintained by hospitals in the Western Cape provide useful sources of information on morbidity within the province. The data contained in the records are generated from interactions between patients and various healthcare providers and include data on administration records for, demography of, diagnoses made on, procedures undergone by and investigations conducted on the patients. According to the information systems manager at a large tertiary hospital in the Western Cape (Mc Gregor, 2009), it is required by the South African government that all hospitals produce a patient discharge report with summary data on the above data categories. Since December 2001, more than 20 hospitals in the Western Cape have been using a database system that allows for computerized record keeping of individual patient data including discharge summaries and particularly the diagnoses made and the procedures they received while in hospital, however the system was made operational only in tertiary academic hospitals.

The Provincial Government of the Western Cape (PGWC) Department of Health encountered problems in relation to reliable and accurate reporting of the burden of disease in the province. Lack of data accessible to health managers on inpatient case mix, morbidity, mortality and interventions in public district and regional hospitals in a form suitable for use for health care planning, resource allocation and financial planning contributed hugely to the problem of 'inability to determine the burden of disease'. Though there was reasonably good inpatient data on diagnoses made and procedures undergone to be found in patients' folders, it remained unprocessed in the folders which rendered it useless for management purposes. It

was envisioned that the inpatient data once coded and available using appropriate diagnostic and procedure coding systems, would facilitate easy collection, storage and utilisation of data for health service planning and address the concerns of morbidity measurement and disease burden assessment.

However the uncertainty around which coding system to use for electronic capture of both diagnoses and procedures and indeed whether one coding system could capture both of these categories of data was a concern. The identification of an appropriate coding system/s that would facilitate easy recording, storage and retrieval of data that is accurate, reliable and useful for management decision making and that would support patient care was therefore required for district and regional public hospitals. Tertiary institutions had been conducting inpatient data coding for many years with ICD-10 as the chosen diagnostic coding system and CCSA-2001 as the chosen procedure coding system. However it was still uncertain if these coding systems used in tertiary hospitals would be applicable for diagnoses and procedures commonly encountered at public district and regional hospital settings, as it was presumed that these hospitals might have a different case mix to that of tertiary hospitals.

Recognising the need for information from district and regional hospitals in a format that would facilitate easy collection, storage and utilisation for healthcare management and planning, the department of health requested a pilot project to investigate potential diagnoses and procedure coding systems to be used in district and regional public hospitals in the Province. This study was therefore initiated out of the need to assist in deciding which coding systems would best facilitate accurate recording of data on diagnoses and procedures from inpatient records at hospitals of this type.

This initiative required the assessment of several candidate coding systems likely to accommodate the accurate collection of inpatient morbidity and interventions in order to determine the most appropriate one/s. The potential candidate coding systems to serve this function are listed below and more background information on each coding system is elaborated on in page 51.

- Diagnoses could be coded in ICPC-2 (International Classification of Primary Care, version 2), or ICD-10 (International Classification of Diseases, 10th revision) or ICD-10-CL (International Classification of Diseases Condensed Morbidity list).
- Procedures could be coded in ICPC-2 (International Classification of Primary Care, version 2) or ICD-9-CM (International Classification of Diseases, 9th revision, Clinical Modification) or CCSA (Current Procedure Terminology for SA).

1.6 RESEARCH PROBLEM

Though the Provincial Government of the Western Cape (PGWC) Department of Health had reasonably good inpatient data on diagnoses made and procedures undergone in inpatients' folders at district and regional hospitals, this data remained unprocessed in the folders, which rendered it unhelpful for management purposes. It was presumed that coded inpatient data would allow for the compilation of summary information on inpatients at district and regional hospitals and make this easily accessible to health managers. Even though coding systems had been in place for a while at tertiary hospitals, there was still considerable uncertainty around which coding systems to use to facilitate reliable and accurate reporting at district and regional hospitals as it was assumed that tertiary hospitals had a different inpatient case mix to that of district and regional hospitals, and hence the coding system used at tertiary hospitals might not be ideal for district and regional hospitals. This called for a need to

assess potential candidate coding systems to assess whether they would be appropriate for the purpose of coding diagnoses and procedures encountered within the context of these district and regional hospitals.

1.7 PURPOSE OF THE STUDY

With the assessment of the selected coding system's ability to code diagnoses and procedures in this study it is anticipated that decisions about the most appropriate coding system to be used in District and Regional Hospitals in the province will be facilitated. The reports of the study will be submitted to the Provincial Government Western Cape Department of Health. The outputs of the study could also be used to support the development of an inpatient morbidity and burden of disease assessment for the Western Cape Province which should in turn provide useful information for strategic and operational management purposes.

CHAPTER 2

2. LITERATURE REVIEW

The purpose of this literature review is to provide a summary of the existing literature on coding systems used for coding inpatient diagnostic morbidity and procedure data, and to give the reader a background on other evaluation studies done on a variety of coding systems.

The chapter will begin with a brief definition of inpatient data and will then proceed to expand sources used to extract the data for this study. These being, medical records, discharge summaries and administrative files. Potential problems associated with inpatient data will be discussed and a brief summary on the role and use of coding systems for inpatient diagnostic and procedure data will also be elaborated on. The chapter will further focus on the types of coding systems suitable for inpatient data, as well as existing potential problems associated with the use of coding systems for inpatient data. The chapter will conclude with a discussion on evaluation studies done on coding systems.

2. 1 INPATIENT DATA

Inpatient data is data recorded on an inpatient's medical record to reflect the care and medical treatment that is provided in a hospital or other facility, and requires at least one overnight stay. Inpatient morbidity and procedure data is generated as a result of an encounter with a health care provider (Damberg, Kerr and Mc Glynn, 1998). The National Health Service (2011) defines inpatient data as the records of a patient admitted for a planned sequence of treatments, procedures, investigations and or observations.

There are several types of inpatient data that yield different types of data. Though medical records also referred to as patient folders or patient records are the most common sources of inpatient diagnostic and procedure data and the process of care, there are other sources that can be used to obtain inpatient data. While there are several sources of inpatient data such as

laboratory reports, radiographic reports, surgical reports and pharmacy scripts. This literature review only focus on medical records, discharge summaries and administrative files as the above reports are usually contained within medical records. Below is a brief discussion thereof.

2.1.1 Medical Records

According to Reddy and Basha (2010), a medical record is a systematic documentation of a patient's medical history and care, which is compiled and stored by the health care providers. Medical records produce information on a patient's medical history, primary complaints, presenting symptoms, physical examination, clinical assessment, diagnoses, diagnostic test results, subsequent diagnoses and procedures performed or interventions undergone (Damberg, Kerr and Mc Glynn, 1998). Medical records are able to provide information on most of the technical aspects of care, are a good source for prescription drugs data and are useful for identifying individuals with specific conditions and evaluating the cost of treatment. However medical records may lack sufficient details on outcomes of care with interpersonal aspects of care rarely recorded and symptoms may only reflect the doctor's assessment of importance of symptoms described by the patient.

2.1.2 Discharge Summaries

Segen (2002) defines a discharge summary as a document that is prepared by the attending physician of a hospitalised patient summarising the discharge diagnosis, diagnostic procedures performed, therapy received while hospitalised, clinical course during

hospitalisation, prognosis, and plan of action upon the patient's discharge with stated time to follow up and attending physician's signature.

Derived from medical records, discharge summaries transfers important clinical information from inpatient to outpatient settings and between hospital admissions and is important in maintaining the continuity of care and to serve as a valid documentation of a patient's medical history. The doctor's details, especially signature, is important in a discharge summary as it aids doctor to doctor communication and serves as documented proof in case of any legal issues regarding the quality of treatment or suggestion of negligence arises (Reddy and Basha 2010).

These discharge summaries form valid and easily accessible data sources for health policy and programme planning (Reddy and Basha 2010).

2.1.3 Administrative Files

Administrative files are generated from an interaction between a health care provider and a patient in a healthcare delivery system that includes outpatient care, hospital inpatient service and pharmaceutical service. This source can provide useful information about access to health care services, cost of health care and quality of care as well as the monitoring of changes in the healthcare system. Though administrative files are regarded as the best source to provide information on the use of services, the cost of services are not necessarily reflected.

Administrative files are also good source of tests done, even though they may lack the test results. Patient socio economic, demographic and domiciliary data are usually contained within the administrative files (Damberg, Kerr and Mc Glynn, 1998).

2.2 POTENTIAL PROBLEMS WITH INPATIENT DATA

Although inpatient diagnostic data may be more reliable than outpatient data sources, there are limitations to these data. Damberg, Kerr and Mc Glynn (1998) identified the following characteristics as contributing towards potential problems with inpatient data.

- Variation in the data provided from different providers, may limit the ability to draw reliable conclusions and thus contribute to lack of standard reporting on medical records.
- Lack of unique identifiers for patients and therefore making it impossible to track the course of patient's care.
- Multiple records: Patients may have multiple records because a new medical record may be established for a visit to a different hospital or for a visit to the same hospital but on a different occasion.
- Difficulty in extracting data from a record, since when there is a need to extract data from a medical record, there has to be a manual extraction of data from hard copies. The potential problem is that due to the fact that data mainly exist in hard copies, the process can be costly and time consuming.
- Inconsistencies with recorded clinical data, meaning that the information reflected on the medical records of patients is based on a subjective evaluation of the doctor and different doctors may differ on a diagnosis.
- Lack of important pieces of information e.g. lack of test results information. Test results have the ability to provide critical information regarding the diagnosis or even the procedure which is useful for the evaluation of the quality of care. However test results are not always available or included in patient records.

These problems of unreliable information have a tendency to produce undesirable and sometimes unintended consequences such as a distorted image of what is going on in health

service provision and an inability to properly evaluate diagnoses made and procedures undergone.

2.3 ROLE AND USE OF CODING SYSTEMS FOR INPATIENT DIAGNOSES AND PROCEDURE DATA

One of the greatest advantages of coding systems is that they serve the function of summarising clinical data that can then be used to capture patient encounters and gather health statistics, which leads to improved validity of epidemiological and statistical analyses (Ireland, 1995) and facilitates decision making. WHO identified the major purpose of a diagnostic coding system as allowing health care practitioners, chiefly physicians to indicate the conditions responsible for a patient encounter with the health system and/or cause of death (Health Technology Research Group, 1995).

Al-Ghamdi (2003) identified two main values of coding schemes: The first one is the "abstraction of patient data". Because the coding represents only a simplified synopsis of information extracted from the record, this kind of coding is referred to as abstraction. ICD-10 is an example of a coding system that facilitates abstraction of patient data.

The second value identified by Al-Ghamdi (2003) is the "provision of controlled vocabulary to support coding of detailed patient data". Coding patient information is accomplished through combing terms from multiple axes (post-coordination) to represent complex terms.

Coding systems play a major role in converting large volumes of data into a manageable format (Health Technology Research Group, 1995). When patient encounters are coded, they have better chances of being used for statistical analysis of diseases and procedures to support and facilitate the management of health care services.

While the coding of diagnoses and procedures has become the standard for national and international reporting, this does come with its own limitations. According to McGlynn, Damberg, and Brook (1998) codes tend to group together a broad range of disease severity conditions and therefore may mask important clinical subgroups that differ in their expected responses to treatment. Shortliffe & Perreault cited by Al-Ghamdi (2003) state that coded data has the disadvantage of limiting the user to a predefined vocabulary which might not meet his or her goal. Secondly, data coding can be time-consuming and tedious.

The completeness and accuracy of patient information is extremely important as health information needs to be of sufficiently high quality for it to be used. Quality assurance that arises from the coding of data contributes a valuable aspect in eliminating misinterpretation of the data, while simultaneous ensuring standardisation. However initial data recording by health care workers has the potential to introduce many inaccuracies, and therefore for data quality recording to be practical, it must be integrated with the routine provision of care, and whenever possible, should be done within a formal information systems infrastructure (Bates *et al*., 1998).

2.4 TYPES OF CODING SYSTEMS SUITABLE FOR INPATIENT DATA

Duisterhout and van der Maas (1997) define codes as" the process of assigning an individual object or case to a class or set of classes. They further assert that codes may be formed by numbers, alphabetic characters, or even both. They identified the following types of coding systems: number codes, mnemonic codes, hierarchical codes, juxtaposition codes, combination codes, as well as value addition codes.

Below is a brief summary of the different types of codes.

2.5.1 Number Codes

In the case of number codes, the assigning may be issued sequentially, meaning that each new class is given the next unused number. These numbers are issued with a fixed set of classes when no expansion of the set of classes is expected. ICD-9-CM (International Classification of Diseases Clinical Modifications 9th revision) and CPT are examples of a medical code with numerical representation.

2.5.2 Mnemonic Codes

According to Duisterhout and van der Maas (1997) a mnemonic code is formed from one or more characters of its related class rubric in order to help users to memorise the codes. The first basic rule is that a code is derived from the initial letters of the words in a clinical detail or phrase. The code is made up of up to four letters by taking subsequent letters from the final word if required. In the case of a one word clinical detail, then the code would be the first four letters of the word. Example, acromegaly would be "ACRO". However in cases where the

letter is too short to generate a four letter code, then a shorter code is generated, for example hepatitis A would be coded as “HA”. Mnemonic codes are not limited to coding of diagnoses and procedures, as hospital departments can also be indicated by a mnemonic code as “ENT” for Ear Nose and Throat, or “CAR” for Cardiology.

With mnemonic codes, abbreviations used in clinical details are treated as one word for the purpose of deriving the code. Where abbreviations are less than four characters, the code is the length of the abbreviation. For example Diabetes Mellitus which is typically abbreviated to the code “DM”. However for very common abbreviations which are longer than four characters, the whole abbreviations are used. An example of that is non insulin dependant diabetes mellitus which is coded as “NIDDM”. Another rule of a mnemonic code is that queries are indicated by a Q in the code. Therefore the code for “?” myeloma is QMYEL and for anemia due to unknown cause would be ANAEQ. These codes hold Q as a prefix or Suffix (Bailey *et al.*, 1991).

2.5.3 Hierarchical Codes

Hierarchical codes are created through the extension of an existing code with one or more additional characters for an additional level of detail. A hierarchical code thus bears information on the level of detail of the related class and on the hierarchical relations with its parent class. Medical coding can be broadly classified into two types. They are Diagnostic codes that are assigned to various diseases, and Procedure codes assigned for the treatment/procedures provided (Duisterhout and van der Maas, 1997).

ICD-10 is an example of a hierarchical code for diagnostic coding and CPT is an example of a procedure coding system which is hierachical.

2.5.4 Juxtaposition codes

Juxtaposition codes are composite codes consisting of segments. Each segment provides a characteristic of the associated class. In ICPC, for instance, a diagnostic code is formed by using a code consisting of one letter of the alphabet (a mnemonic code for the tract), followed by a two-digit number. For instance, all codes with the character "D" are related to the digestive tract and all codes starting with an "N" describe disorders of the nervous system. In the example of ICPC, two independent characteristics are coded simultaneously, and each characteristic has its own position in the code (Duisterhout and van der Maas, 1997).

2.5.5 Combination codes

Another example is a classification of medical procedures using ordering principles: action, equipment, aim, and anatomical site. The combination of 100 anatomical sites with 20 different actions, 10 different instruments, and 5 different purposes results in a classification system with a potential of a 100,000 classes and codes. A way to cope with this explosion is the use of a combination code. By using a six-digit combination code consisting of four segments, with segments dedicated to action (two digits), equipment (two digits), aim (one digit), and anatomical site (one digit), respectively, a coding clerk has to distinguish only 135 codes, with which 100,000 combinations can be generated (Duisterhout and van der Maas, 1997).

2.5.6 Value addition codes

In value addition codes only powers of 2 are used as a representation of a data item or class. Just as in a combination code, several characteristics can be coded. In this case, however, only one number instead of a segment for each characteristic is used as a code. This is easily illustrated if we code the presence or absence of risk factors, such as:

1 for smoker/0 for non smoker,

2 for overweight/0 for no overweight,

4 for increased cholesterol/0 for not increased cholesterol.

By using the codes 1 to 7 we can sum all the three risk factors mentioned above. A smoker who is overweight but with no increased cholesterol level is coded as 3, and a nonsmoker who is overweight and who has an increased cholesterol level is coded as 6 (Duisterhout and van der Maas 1997).

2.6 POTENTIAL PROBLEMS WITH THE USE OF CODING SYSTEMS SUITABLE FOR INPATIENT DATA.

Although coding tools hold the potential to facilitate standard reporting, easy collection, storage and retrieval of data, potential problems cannot be ignored. Diagnosis codes have a tendency to encompass a broad range of disease severity and have a potential to mask important clinical subgroups that may differ in their response to procedures or interventions.

Several potential problems in diagnostic and procedure coding systems identified by Mc Glynn *et al.*, (1998) are as follows.

2.6.1 Incompleteness.

Coding systems may lack the ability to reflect an illness severity. E.g. while a coding system can code Asthma in detail, it may not be able to reflect the severity of the condition and this can compromise the intervention processes relating to the information required to put those interventions in place. More so it also means that in order to get the details of the severity patient manual records have to be extracted which can be a time consuming effort (Mc Glynn *et al.*, 1998).

2.6.2 Varying reliability and validity of codes

Different diagnosis and procedure codes can be used to describe the same event. e.g. bronchitis and upper respiratory illnesses may be coded using different codes, but may refer to the same condition.

Coding on Procedures may lack precision, meaning that a code may fail to reflect a sufficient level of detail required (Mc Glynn *et al.*, 1998).

2.6.3 Inaccuracies and inconsistencies

There may be an inconsistency with accuracy and completeness of coding among different hospitals which could be due to human error, but also due to the way in which different individual institutions respond to recording and billing procedures (Mc Glynn *et al.*, 1998).

2.6.4 Lack of Human resources

The use of a system may be too difficult due to limited availability of human resources to do the coding. It should be noted that coding requires expertise and knowledge in the use of the system. Therefore even if the system may promise to make the management of data easy, this is dependent on the availability of human resources to perform the coding (Mc Glynn *et al.*, 1998).

2.6.5 Uncertainty with co-morbidities and complications

The code lacks the ability to distinguish between co-morbidities (more than one diagnosis present at admission) and complications (diagnoses that develop as a complication during inpatient care) (Mc Glynn *et al.*, 1998).

2.7 EVALUATION STUDIES DONE ON CODING SYSTEMS USED FOR INPATIENT DATA PROCESSING

Mc Glynn *et al.*, (1998) identified the following elements as most important when evaluating data in relation to coding systems. First, they assert that there needs to be an assessment on what proportion of diagnosis and procedure codes has missing or incomplete data and what strategies can be used to address this missing data.

Secondly there needs to be an assessment on the validity of coded diagnoses and procedure data and what potential biases are likely to occur in cases where validity is low or suspect.

Thirdly, there needs to be an assessment whether data is commonly defined and coded among healthcare providers. Due to geographical variations, health care providers may record or code conditions differently.

Fourthly, there needs to be an assessment on the type of data collected and coded and if there is uniformity among healthcare providers about the type of data collected and the way it is coded.

In preparation for the development of disease surveillance systems, the Medical Research Council (MRC), and University of Cape Town (UCT) Department of Community Health, did a study on primary care coding. The purpose was to identify a suitable coding system for primary health care services. Data was collected for all the outpatient visits that occurred during a two-week period at a district hospital in Cape Town. Secondary analysis of the data provided an opportunity to assess different coding systems for data collected in a primary care setting (Nojilana *et al*., 1997). The aim was to evaluate the effectiveness of diagnostic coding systems using the full ICD-10, the Condensed ICD-10 morbidity list and ICPC-2. Their main objectives were to compare the clinical profile resulting from the different coding systems, and to match the specificity of the coding system with the data, and to assess what proportion of the diagnoses and procedures could not be coded. The conclusion of the study revealed that for that particular setting the full ICD-10 and ICPC-2 were too detailed for the clinical diagnoses recorded. On the basis of data from this study it was suggested that specific codes for “dressing” and “collect” or “repeat medication” be added to the South African version of ICD-10 Condensed Morbidity List to meet local requirements (Nojilana *et al.*, 1997).

A study conducted by Chute *et al.* (1996) focused on clinical classifications using seven standard coding systems to evaluate them for their content coverage. Clinical text for inpatients and outpatients was grouped into concepts which were then later coded into International Classification of Diseases Clinical Modifications 9th revision (ICD-9-CM), ICD-10, CPT, Systematized Nomenclature of Medicine (SNOMED III), READ v2 coding system (The Read code is named after James Read who used to be a General medical practitioner), Unified Medical Language System (UMLS 1.3) and the North American Nursing Diagnosis Association (NANDA). The concepts were scored based on the accuracy and the level of capturing of the data. From this study it was discovered that no classification had the ability to capture all concepts. However SNOMED did the most complete job. ICD-9-CM and CPT failed to capture substantial clinical details. The study concluded that major clinical classification systems in use do not completely cover the clinical content of patient records (Chute *et al.*, 1996).

A paper from the North American World Health Organisation Collaborating Centre for the Classification of Diseases reported on the evaluation of ICD-10 for morbidity applications in the United States. The primary evaluation objectives were to make in-depth analysis and comparison of ICD-10 with ICD-9-CM procedure codes. The study's conclusion reflected many strengths in ICD-10 compared to ICD-9-CM procedure codes. Many of the ICD-10 chapters were found to contain a wealth of useful expansion in detail for which diagnostic information is typically available and it was able to represent important clinical distinctions (WHO Collaborating Centres for the Classification of Diseases, 1996).

Campbell *et al*' s (1997) study on the evaluation of clinical coding schemes for completeness, taxonomy, mapping definitions and clarity was based on READ codes version 3.1, SNOMED and International and Unified Medical Language System. One thousand nine hundred and twenty nine medical and nursing terminology concepts were assembled from a variety of clinical information from 4 medical centres across the United States. The concepts were coded in each system by a researcher and checked by the coding system owner. These were then scored by an independent panel of clinicians for acceptability and the codes were checked for definitions provided with the coding system. These systems were evaluated for completeness and comprehensiveness[2], clarity[3], mapping[4], atomic and compositional character[5], synonyms[6], attributes[7], uncertainty[8], hierarchies[9], context free identifiers[10], unique identifiers[11], definitions[12], language independence[13], syntax and drama[14]. In this study, SNOMED was judged to be significantly more complete in coding the source material than the other coding systems.

The study methods adopted by Nojilana e*t al.,* (1997) to evaluate the effectiveness of diagnostic coding systems for primary health care data were in line with the requirements of this study. The current study incorporated methods by Campbell *et al* (1997) and Chute *et al.,* (1996) especially since their method for the evaluation of clinical coding systems focused on content.

In addition this study further uses the same scoring criteria as that of Chute *et al.,* (1996).

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[2] Should cover the entire clinical spectrum including all component disciplines involved in patient care
[3] A concept should be neither vague nor ambiguous and should not have overlapping meanings within the system.
[4] Must point to related entities
[5] Must have substantial practical advantages by avoiding an explosion of terms
[6] Must support alternate terminology.
[7] Must support the mechanism to modify or qualify meaning of the core term.
[8] Must support a graduated record of certainty for findings and assessment
[9] Must allow a hierarchical organisation of concepts, linking logically more general and specific terms
[10] Must be devoid of meaning to avoid assignment conflicts.
[11] Must not be used when declared obsolete
[12] Concepts should be associated with concise explanations of their meaning.
[13] Should be freely translated across the human languages in use by patients and caregivers.
[14] Must be accompanied by a set of rules that define logical and clinically relevant constructions of the codes.

CHAPTER 3

3. RESEARCH METHODOLOGY

This chapter provides a detailed outline of the processes followed in carrying out the study. The chapter starts with the aim of the study and goes on to list the specific objectives. The study methodology is then described, followed by the study population selected, the sample size used and the sampling procedures followed. The chapter further gives a detailed account of the data collection process. This is followed by the rationale used in the selection of the coding systems that were evaluated and a brief background on those coding systems. The chapter further gives a brief background on coding systems not included in the study and the reasons for exclusion of those coding systems from the study. A detailed description of data coding and scoring, analysis, validity, reliability and generalisability is given. This chapter ends by describing the ethical considerations followed in the study.

3.1 AIM OF THE STUDY

The aim of the study was to evaluate a selection of coding systems in order to determine which are best able to code public sector district and regional hospital diagnostic and procedure data in the Western Cape province of South Africa.

3.2 OBJECTIVES

1. To collect data on diagnoses and procedures recorded from urban and rural public hospitals in the Western Cape.
2. To code the data using appropriate standard diagnostic and procedure codes in each of the coding systems being assessed.
3. To allocate a score for each diagnostic concept and procedure concept in each of the coding systems evaluated.
4. To determine the most appropriate coding system based on scoring of diagnostic and procedure concepts.

3.3 STUDY METHODOLOGY

A cross sectional descriptive study design was deemed appropriate for the study because it allows for the description and comparison of the characteristics of the different coding systems being evaluated which is congruent with the objectives of the research project. Since there is no causal association to be evaluated, case control and cohort study designs would be inappropriate. A randomized control study design would be premature for this specific study, however if actual use of 2 or more coding systems required to be evaluated, then a randomized control study design would become more appropriate.

3.4 STUDY POPULATION

The study population was made up of inpatients from rural district public hospitals and urban and rural regional public hospitals in the Western Cape. At the time of data collection, there were only 2 urban district hospitals, so regional hospitals attended to the bulk of the urban patients. The rural

district hospitals mainly serve patients from surrounding small towns, farms and villages outside Cape Town while the urban regional hospitals mainly serve patients from urban Cape Town.

Inpatients were chosen as the population for the study because since they are assessed during their period of care in the hospital, records are kept and it is therefore much easier to obtain data on their presumed diagnosis. This may not be the case with outpatients as the records typically are less complete and often present the reasons for encounters rather than the presumed diagnoses.

3.5 SAMPLE SIZE

A sample size of 6 hospitals (3 District and 3 Regional) with 50 discharges per hospital giving a total of 300 discharges was selected for the study. The range of diagnoses encountered and procedures performed on an average of 50 cases per hospital was deemed large enough in both urban and rural settings to be able to reflect most health conditions seen and most procedures performed in these settings. The spread of institutions was chosen to take account of potential variations in the range of conditions between similar institutions in various settings. The specific hospitals chosen were selected based on: (1) them having a high level of record keeping as reflected in their manual discharge records, (2) being in close proximity to Cape Town (3) recommended by the Provincial Government Western Cape Department of Health managers as having a diverse and hence appropriate anecdotal case mix as individual hospitals and (4) as a group being likely to cover the full range of diagnostic and procedure case mix in the province. This aspect was considered important for this study so as to ensure that the results of the study regarding the appropriateness of the coding systems being evaluated would be generalisable to all hospitals in the province. The population excluded special institutions such as psychiatric, chronic care and special obstetric care institutions. However where study hospitals treated patients in general departments who would usually be included in these specialties, data for such patients were not excluded.

Other institutions such as private, academic, tertiary, specialised and other hospitals were also deliberately excluded from this sample and in addition the sample excluded patients seen in specialised departments such as, Ear, Nose and Throat (ENT), Eye Care and Radiology, which may form part of the services provided at some of the hospitals chosen for this study.

3.6 SAMPLING PROCEDURES

The initial plan of the study was to collect retrospective data from patient folders stratified by ward/department type. However an MRC Ethics committee ruling required that patient consent be obtained before the collection of data. The implications of this ruling regarding ethics implied that data could only be collected after patients were discharged and had given consent. Each hospital visit for data collection meant that data could only be extracted from patient folders after every patient discharge. Each morning of the hospital visit all wards selected for this study were visited in order to access a list of all patients discharged for the day. Those patients were then individually consulted to obtain study participation consent before extracting the discharge diagnoses and procedures from their patient folders. Though some nurses were very helpful to obtain the consent on behalf of the researcher, it still took longer than anticipated as the researcher had to wait for patients to be discharged. More so this meant that data sampling was restricted to convenient sampling which allowed for bias in the sample. The impact of this was that data ended up being skewed towards medical and surgical diagnoses as these were most of the patients discharged at the time. As a result of this skewed data it is acknowledged that the results of this study may be biased against obstetric, trauma, pediatric and orthopedic diagnoses and procedures.

3.7 DATA COLLECTION

Patient records were retrieved in consultation with hospital staff after obtaining patient consent to extract data from their records. Each morning of the days on which the data was collected, the researcher would visit each ward to identify patients that had been discharged for the day with the help of the nursing sister in charge. While the doctors were busy writing discharge notes, the researcher would request patient consent from all discharged patients. Only after getting patient consent would the researcher gain access to the records. A data collection form was designed for the purpose of recording data from patient files (See appendix **XII**).

The demographic details, diagnoses and interventions data were extracted and recorded on the data collection form. Patient names were not recorded, but it was necessary to capture patient identification data in case queries arose. The sequence number allocated to each patient for the study was used as the patient identification. There was a need to refer back to some patient records, where there were queries about the recorded data which in some cases was not clear to the data collector. Data was collected over a period of 22 months on different days of the week including weekends. The process of only accessing the records for which consent had been obtained introduced some problems to the study because it meant that only those patients that were discharged during the days of visiting the hospital were included in the study. In some instances it became impossible to include patients from certain wards as there were no discharges during those times. However in some instances hospital staff agreed to obtain patient consent on behalf of the researcher for patients discharged when the researcher was not on the premises. This contributed positively to gaining access to a diversity of patient records**.** The consent process effectively prohibited access to the records of those patients who had died thus biasing the results towards conditions where only survival occurred.

The data collection process was greatly facilitated by outstanding support from the ward staff. No problems were encountered for both patient identification and clinical information. Generally the information from the records was clear and in most cases recorded in English. For Regional hospital 2 and District hospital 2 patient records were recorded in Afrikaans, however there was always help available for translations or any queries.

3.8 SELECTION OF CODING SYSTEMS FOR THE STUDY

The selection of coding systems to be evaluated was done in consultation with experienced experts in the field of health informatics and information systems who have also participated in a range of professional and statutory bodies in the research and implementation of health information systems in South Africa. The coding systems selected for evaluation in this study were based on extensive anecdotal knowledge of their perceived potential usefulness within the context of public sector district and regional hospitals in the Western Cape. This was required to exclude coding systems which were clearly inappropriate as there is a plethora of coding systems available.

3.9 CODING SYSTEMS SELECTED FOR THE STUDY.

Three diagnostic and three procedure coding systems were selected for evaluation in this study and below is a brief rationale on why these coding systems were selected for evaluation.

3.9.1 *Diagnostic* Coding systems selected for the study

ICPC-2 (International Classification of Diseases 2nd revision) was selected for evaluation because it allows for the classification of both diagnoses and procedures in one coding system and is used by a wide range of institutions in South Africa.

ICD-10 (International Classification of Diseases 10th revision) was selected for evaluation in this study because it is the current official standard for diagnosis coding in South Africa and is widely used in the public and private health care sector.

ICD-10 Condensed Morbidity List was selected for evaluation based on its condensed list for morbidity and ease of use.

3.9.2 *Procedure* Coding Systems selected for the study

ICD-9-CM Procedure Coding system (International Classification of Diseases 9th revision Clinical Modifications) was selected for evaluation because it is widely used in the South African public and private sectors.

CCSA-2001 (Current Procedure Terminology for South Africa) was selected for evaluation because it is widely used for reporting procedures in South Africa in the private sector.

ICPC-2 was selected for the reasons outlined above.

3.10 BACKGROUND INFORMATION ON THE CODING SYSTEMS EVALUATED

Below is a brief background sketch on each of the coding systems included in the study.

3.10.1 International Classification of Diseases - 10th Revision (ICD-10)

ICD-10 is used to classify, process and present morbidity and mortality data to promote international comparability in the collection, classification, processing and presentation of health statistics. It was originally developed to classify causes of mortality as recorded through the registration of deaths. It was further developed to include codes for morbidity and reasons for

encountering health services. ICD-10 is used to translate diagnoses of diseases and other health problems from words into alphanumeric codes to allow easy storage, retrieval and the analysis of data. It also provides for a wide variety of signs, symptoms and abnormal findings, complaints and social circumstances. ICD-10 extends well beyond the traditional causes of death and hospital admission and allows for the capturing of risk factors to health such as lifestyle, life management, psychosocial circumstances as well as the occupational and physical environment. ICD-10 also enables detailed coding of aspects of the patient encounter (WHO, 1993). ICD-10 is the current South African standard for diagnosis coding.

3.10.2 ICD-10 Condensed Morbidity List

The ICD-10 Condensed Morbidity list is a condensed list from the full list of ICD-10 and has 298 categories of which each is included only once and totals for groups of diseases and ICD-10 chapters. This list can be constructed by either condensing or expanding the core classification as appropriate. All signs and symptoms for which no specific diagnosis can be made, even after all facts bearing on cases have been investigated are placed under the same category. These categories also include cases whose causes could not be determined and patients who failed to return for further investigation. The condensed list also put together those conditions and symptoms that point equally to 2 or more diseases or to 2 or more systems of the body. Also included in these are the diseases with unknown causes and manifestation cases for which no specific diagnosis can be made or cases in which a more precise diagnosis was not available for any reasons. A good example of this category is the 270 code where all “other symptoms signs” and “abnormal clinical and laboratory findings”, not elsewhere classified were grouped together. In cases of more precise and specific conditions and diagnoses e.g. asthma that condition will have its own code. However

diseases that fall under the same category with a range of manifestations can also be coded together, e.g. “diseases of appendix” (WHO, 1992).

3.10.3International Classification of Primary Care 2nd Edition (ICPC-2)

ICPC was developed in 1987 by the World Organisation of National Colleges, Academic Associations of general practitioners/family physicians, now known briefly as the World Organisation of Family Doctors (WONCA 1998). It allows health care providers to classify, using a single classification, three important elements of the health care encounters being:

1. Reason for encounter

2. Diagnoses or problems

3. Process of care

ICPC was based on an earlier Reason for Encounter Classification (RFE’s) developed by WONCA to describe agreed statements of the reason(s) why a patient enters the health care system, thus representing the demand for care by that person. According to Lamberts, *et al.*, (1993) classification with ICPC-2 permits detailed characterisation of what the patient has expressed whether a complaint or symptom, already known diagnosis, request for prescription, referral, physical examination or any problems to discuss.

3.10.4 International Classification of Diseases 9th Revision Clinical Modification (ICD-9-CM Procedure Codes)

ICD-9-CM Procedure Coding system is designed for the classification of mortality and morbidity information for statistical purposes, indexing of hospital records by disease and operation and for the storage and retrieval of data. ICD-9-CM Procedure Codes describes not only the clinical management of individual patient problems, but also can be used to generate indicators of health status and health statistics. It was also designed to report national morbidity and mortality data and is used as a basis for Diagnostic Related Groups for hospital reimbursement. In the USA ICD-9-CM Procedure Codes has also been used to report and compile health data for evaluation and planning of the health care delivery system as well as to conduct epidemiological and clinical research (Commission on Professional and Hospital Activities, 1978).

3.10.5 Complete CPT for South Africa (CCSA –2001)

Complete CPT (Current Procedure Terminology) for South Africa 2001, derived from CPT-99, was developed to list descriptive terms and to identify codes for reporting medical services and procedures performed by physicians in South Africa. The purpose of this tool is to provide a standard method to accurately describe medical, surgical and diagnostic services and to facilitate effective and reliable means of reporting among patients, doctors and third parties. The system was also developed for doctors to set parameters for practice and benchmarks for reimbursement (SAMA, 1999).

The South African version of CPT was developed after extensive negotiation between the South African Medical Association and the American Medical Association. This was developed out of the need to develop a system designed for South African conditions. CCSA –2001 allows the capturing

of information required for the management of cost in line with international developments. The system includes more than 7000 descriptions and units based on the Harvard model. It provides a complete set of codes applicable to medical services rendered by doctors in South Africa and simplifies the reporting of services and defines the procedures and services rendered accurately (SAMA, 2001).

3.11 CODING SYSTEMS NOT SELECTED FOR THIS STUDY

Other coding systems that are widely used for the classification of patient records include SNOMED (Systematised Nomenclature of Medicine), READ (Read Clinical Classification), DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) HCPCS (Healthcare common Procedure Coding System Codes) and UMLS (Unified Medical Language System). Although these coding systems are recognized internationally for the classification of diseases, they were excluded from this study because they are not popular within the South African health care environment and their use in district and regional hospital settings has not yet been demonstrated on a large scale.

Although SNOMED covers a very broad spectrum of healthcare knowledge, concepts, and terminology and is inarguably the largest healthcare terminology system in the world, it was not selected for evaluation, because its area of greatest strength and strongest coverage has been in the area of pathology, and the study assessed clinical diagnoses rather than pathology based diagnoses (Moore and Berman, 1994). A number of SNOMED observers claim that SNOMED may be somewhat biased toward this particular type of healthcare provider and that SNOMED is specifically lacking in the areas of: nursing terminology; terminology for other healthcare professionals; terminology relating to the theories, practice, and supplies of alternative medicine (Chute *et al*, 1996). Moore and Berman (1994) also identified SNOMED coding system as one of

the most time consuming systems for pathology coding. For instance a single diagnostic report can give rise to a large list of coded items.

READ codes were deliberately left out of the study for evaluation because there appears to be little knowledge about their structure in South Africa and their complexity has discouraged many users from using them (Parr, 2001).

DSM-IV codes were not included in the study because their use is clearly defined for use only in mental health service provision.

Healthcare Common Procedure Coding System Codes (HCPCS) were excluded from the study because they are used mainly for health insurance programs. It is a uniform coding system consisting of descriptive terms and identifying codes that are used primarily to identify medical services and procedures furnished by physicians and other health care professionals, for which they bill public or private health insurance programs. It is also used to identify products, supplies, and services such as ambulance services and durable medical equipment, prosthetics, orthodontics, and supplies when used outside a physician's office.

UMLS codes were excluded from this study because their focus is more on the collection of different source vocabularies, designed for the development of computer systems rather than the coding of diagnostic and procedure concepts (US National Library of Medicine, 2011).

3.12 DATA CODING AND SCORING

Diagnoses and Procedures were coded using the selected diagnostic and procedure coding systems. Each diagnostic and procedure concept being coded was matched with the associated code that describes that concept. Those concepts were then compared with the text description of the associated code for representation of the concept in the code. This method of scoring was also used by Chute *et al* (1996) in their study on content coverage of clinical classifications.

Each diagnosis and procedure was assigned a score in each of the coding systems based on the summary below:

Table 1

Score	Score Criteria	Explanation	Example
0	No Match	Concepts from records do not match concepts from codes at all.	Pain = other symptoms
1	Poor Match	Concepts from records are poorly reflected on coding system	Lack of Appetite= Anorexia
2	Partial Match	Concepts from records are captured as inclusion criteria	e.g. Dyspnoea= Shortness of breath Incl. dyspnoea
3	Complete/exact Match including synonyms	Words from records are the same or similar to those in the coding system	e.g. back pain = back pain or backache

3.13 DATA ANALYSIS

The coding systems were analysed on their ability to correctly code diagnostic and procedure concepts. For the purposes of the study, a score of 2 (partial match) and a score of 3 (exact match) were considered an "appropriate match". The analysis involved describing the data using simple counts and percentages of the scores that each diagnosis and procedure obtained in each of the coding systems. Overall scores were then grouped by diagnostic and procedure concepts recorded from "all" hospitals and thereafter stratified by hospital types (regional and district), by diagnostic concepts recorded as "symptoms only" or "proper diagnoses" and finally by "commonly occuring" as well as "very commonly occuring" concepts. The cut off for "commonly occuring" and "very commonly occuring" were chosen because they appeared in at least 4 records and 10 records respectively therefore were deemed reasonable to reflect widely prevalent conditions because they are important for management reporting purposes to assess the coding system coding ability.

This provided an overall pattern and trends in the scores across these different strata for each coding system. In order to assess whether the observed difference in scoring patterns between the three coding systems were statistically significant or whether they might have risen by chance, a Friedman's test was done across all three coding systems as well as pair-wise, by matching up each combination of pairs from which the Chi-Squared Statistic and the associated p-value was derived.

3.14 STUDY VALIDITY

A standard method for score allocation was introduced for each of the coding systems as a means of ensuring validity. A similar method for evaluating the different coding systems was used and tested in a study by Chute et al (1996) and Nojilana *et al.,* (1997) for similar settings to this one. This method was also used by the researcher in a previous comparative study of diagnosis codes

Ten percent of the data was sent to external coders for coding and scoring with the purpose of ensuring standardised coding and scoring, so as to reduce or eliminate bias in the coding and scoring process. When comparing the coding and the scoring from the external coder and the researcher for diagnoses, it was noted that only 10% of the cases were coded one category different from the researcher. The co-supervisor of this study also reviewed some of the coded data for diagnoses and procedures and no disagreements arose from the review.

For procedures the external coder reported less than 10% minor discrepancies between her coding and that of the researcher. The low sample size, the introduction of sampling bias, the lack of uniform seasons and the use of proxy diagnoses all had an effect on validity but they are discussed in detail in the section 5.5 on limitations.

3.15 RELIABILITY

The data collection instrument designed for the study yielded consistent results as the same kind of data was collected for all institutions. Since the researcher carried out all data collection, there was likely to be minimal or no inconsistencies introduced in the data collection process. The researcher who is an experienced coder did all of the coding and hence again there are unlikely to be inconsistencies in the coding.

3.16 GENERALISABILITY

Since the study hospitals were specifically chosen to be reasonably representative of district and regional hospital in the province it is likely that the results can be generalisable to all district and regional hospitals in the Western Cape province. It is assumed that Western Cape hospitals are similar to those in provinces of South Africa with a similar urban rural mix and therefore the study results could possibly be generalised to other settings in South Africa covering the same spectrum of diseases and services in South Africa. It is acknowledged that due to regional disease patterns some diagnoses that are common in some parts of the country may not be reflected in this study, e.g. malaria.

3.17 ETHICAL CONSIDERATIONS

The Medical Research Council (MRC) of South Africa was a stakeholder in this study therefore the project proposal was submitted for review to the MRC ethics committee. When the study was initiated, it was not expected by the supervisors that patient consent might be required since it was proposed that retrospective records data would be collected.

However the MRC Ethics committee surprisingly and inexplicably required that individual patient consent be obtained prior to accessing the records, and this decision had a major impact on sample selection and data collection. Patient information sheets and consent forms were developed and were approved by the committee and the protocol had to be changed to incorporate the process of obtaining informed patient consent. This process added a few months of elapsed time to the project and the need to obtain consent added some bias to the collection of data, because the samples had to be limited to those patients from whom patient

consent could be obtained. However no refusal for consent was experienced except for one patient who was in pain at the time of requesting the consent.

The UWC ethics committee did not require individual consent from patients, but did require consent from hospital managers to access patient records and required that confidentiality be maintained. An undertaking by all researchers to preserve the confidentiality of the patient record was included in the protocol and only limited patient demographic information (excluding folder numbers and names) was recorded on the project database.

CHAPTER 4

RESULTS

4. INTRODUCTION

A descriptive summary of data analysed for regional and district hospitals as well as an analytical comparison of the scoring ability differences among the evaluated coding systems for diagnoses and procedures at all hospitals combined as well as stratified into regional and district hospitals is provided. A further breakdown of diagnoses by "proper diagnoses" and "symptoms only" was done to assess how each coding system performed in its ability to definitively score diagnoses. Finally the section presents further analysis of results by looking at the most commonly recorded diagnoses and procedures for all hospitals as well as for district and regional hospitals.

4.1 Sample Realised

In the planning phase of the study data was to be extracted from 50 patient files per hospital proportionally spread across all wards. The proportional percentage breakdown aimed for was that each ward would provide 15% of the sample for the hospital as there are 6 common types of wards in each hospital. Seasonal variations as well as unusual events like disease outbreaks were known to adversely affect convenience sampling (selecting patients as they get discharged). However to limit this bias it was ensured that there was a balance in terms of type of patients selected from each ward. For every 10 to 15 patients selected from each department or division, the selection was stopped for that ward in order to balance the number of patients from other wards.

However following a preliminary analysis it was noted that at "urban regional hospital 1", 44 records (88% of the data collected from that hospital) was exclusively from medical patients. This introduced a high degree of medical patients' bias. To correct the error for Regional Hospital 1, a further sample of records was collected from non medical wards which brought the sample size for that hospital to 97 patient records. Regional hospitals 2 and 3 also had more than 40% of the records from medical records and except for district hospital 1, the other 2 district hospitals had more than 60% of the records from medical wards. Altogether 342 patient folders were extracted instead of the planned 300.

The profile of data collected is shown in table 2 below.

Table 2: The number and proportions of discharged patient records sampled per hospital stratified by wards.

	Regional Hospitals							District Hospitals						All Hospitals		
Wards	**Region 1**		**Region 2**		**Region 3**		**All Regional Total %**	**District 1**		**District 2**		**District 3**		**All Dist Total %**	**All # Total sample**	**All Total %**
	No	%	**No**	**%**	**No**	**%**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**%**	No	%
Medical	44	45%	20	40%	20	43%	**43%**	8	15%	27	61.4%	32	61.5%	**45.2%**	151	44.2%
Surgical	17	18%	19	38%	22	47%	**30%**	20	39%	12	27.3%	4	7.7%	**24.3%**	94	27.5%
Obstetric	9	9%	3	6%	0	0%	**6%**	8	15%	4	9%	10	19.2%	**15%**	34	10%
Trauma	13	14%	1	2%	3	6%	**9%**	5	10%	0	0%	3	5.8%	**5.4%**	25	7.3%
Paediatric	8	8%	1	2%	0	0%	**5%**	9	17%	1	2.3%	2	3.8%	**8.1%**	21	6%
Orthopaedic	6	6%	6	12%	2	4%	**7%**	2	4%	0	0%	1	2%	**2%**	17	5%
Total	**97**	**100%**	**50**	**100%**	**47**	**100%**	**100%**	**52**	**100%**	**44**	**100%**	**52**	**100%**	**100%**	**342**	**100%**
Total # and % of records for regional & district hospitals	**194 (57%)**							**148 (43%)**							**342**	

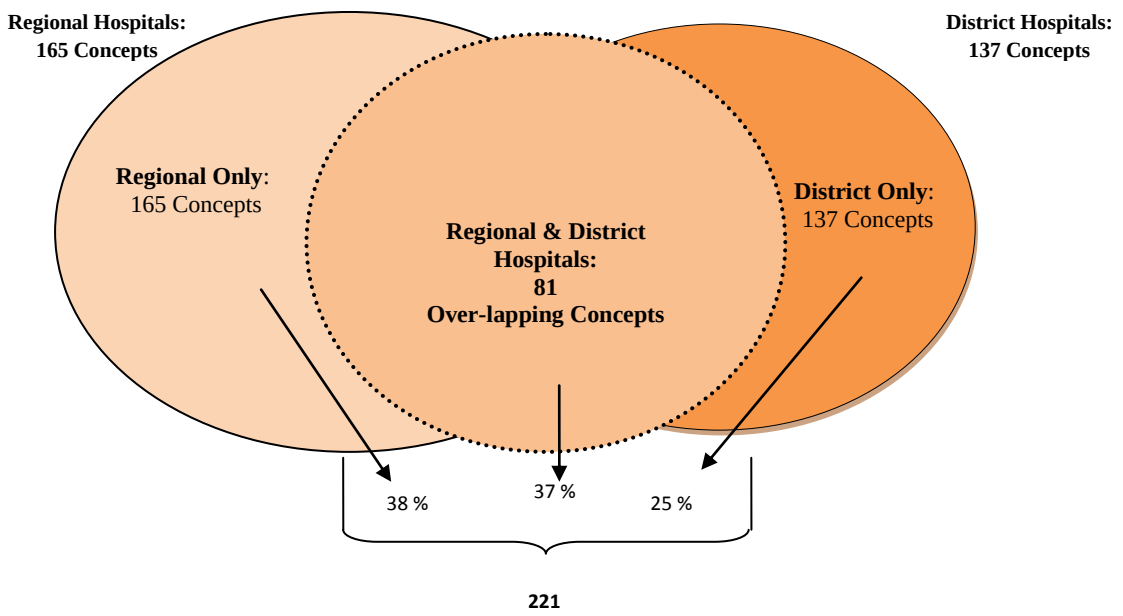
4.2 OVERVIEW OF DIAGNOSTIC AND PROCEDURE CONCEPTS

The results of this study provide a descriptive analysis of the type of recorded diagnoses and procedures as well as the most common diagnoses and procedures. Diagnoses are further grouped into diagnoses recorded as "symptoms only" and those recorded as "proper diagnoses".

4.2.1 Diagnostic Concepts by proportional breakdown

Figure 1 below illustrates the number of diagnostic concepts recorded from "a*ll*" hospitals. Eighty-one of the recorded diagnostic concepts in the centre of the diagram show the proportion of diagnoses that were recorded in both district and regional hospitals while those which occurred in only regional or district hospitals are shown on the periphery.

Fig 1: Number of "*All*" Diagnostic Concepts for all Hospitals: 221 Concepts



4.2.2 Scoring of individual Diagnostic Concepts

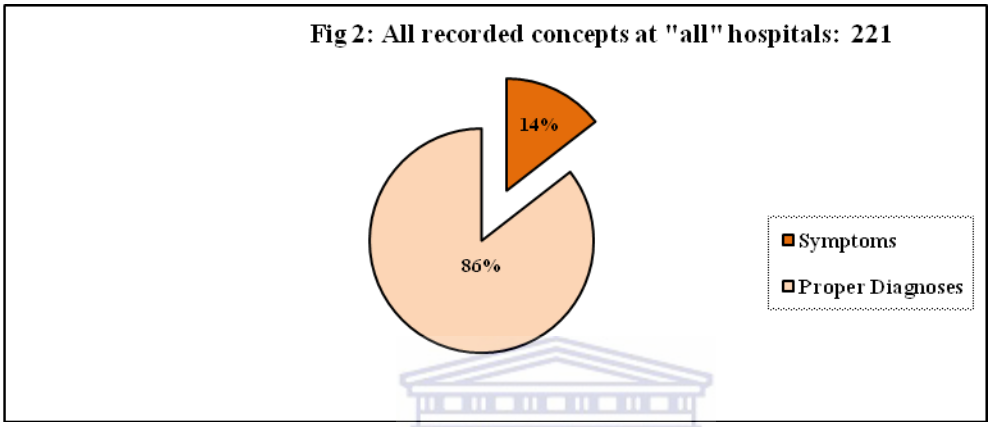
The manner in which the results of this study are interpreted are based on a scoring system used by Chute *et al.*, (1996) to evaluate ICD-9-CM, ICD-10, SNOMED 3, READ V2.UMLS 1.3 and NANDA coding systems for content coverage in capturing clinical data for inpatient and outpatient diagnoses and procedures data. The scoring was from 0 to 3. (0= no match between codes and concepts, 1=poor match between codes and concepts, 2= partial match between codes and concepts and 3= complete/exact match between codes and concepts). See the methodology section for a more detailed explanation. The ability of the three coding systems namely ICPC-2, ICD-10 and ICD-10CL to code the most common individual diagnoses is shown in table 3. ICD-10 was better able to code the diagnoses with 8 out of 10 diagnostic concepts scoring a 3 compared to 7 for ICPC-2. ICD-10CL did not do so well with only 4 of the top 10 recorded diagnostic concepts scoring a 3 as can be seen in table 3. Scoring for "all" the individual concepts are shown in appendix vii.

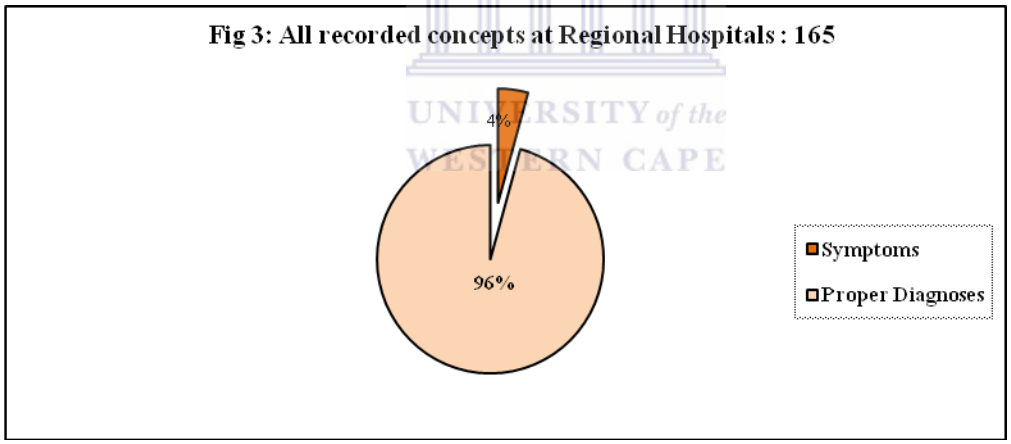
Table 3: Top 10 Diagnoses recorded and coded from patient files for all hospitals.

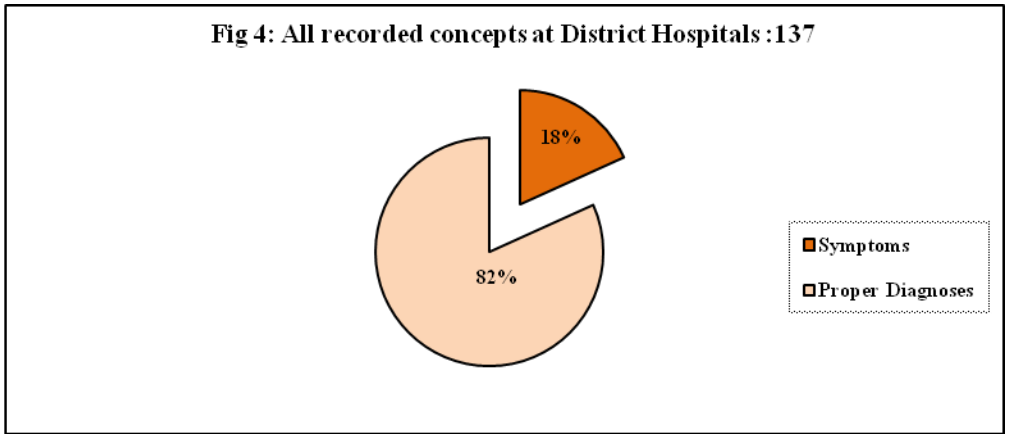
Recorded diagnoses	Number of atients with the diagnosis.	ICPC-2				ICD-10				ICD-10CL			
		Score 0	**Score 1**	**Score 2**	**Score 3**	**Score 0**	**Score 1**	**Score 2**	**Score 3**	**Score 0**	**Score 1**	**Score 2**	**Score 3**
Single Stab	47		**X**					**X**			**X**		
Pain	31			**X**					**X**	**X**			
Dyspnoea/Shortness of breath	30				**X**				**X**	**X**			
Cough	28				**X**				**X**	**X**			
Hypertension	24				**X**				**X**				**X**
Pneumonia	24				**X**				**X**				**X**
Pulmonary TB	24			**X**					**X**				**X**
Vomiting	23				**X**			**X**		**X**			
HIV+	21				**X**				**X**				**X**
Pregnancy	19				**X**				**X**	**X**			

4.2.3 Diagnostic Concepts: breakdown by "proper diagnoses" and "symptoms only".

The graphs below are a breakdown of all recorded diagnostic concepts grouped by "proper diagnoses" and "symptoms only" for "a*ll*" hospitals. Figure 2 presents a breakdown for all recorded concepts for "a*ll*" hospitals whilst figure 3 presents such a breakdown by regional hospitals and figure 4 is a breakdown for district hospitals only.







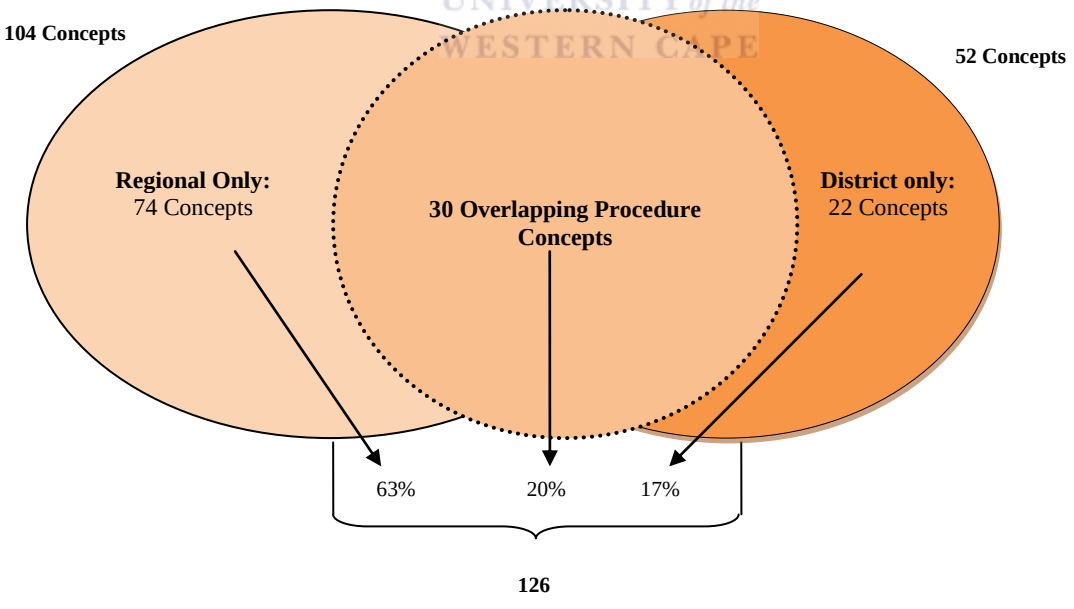
4.3 SCORING OF INDIVIDUAL PROCEDURE CONCEPTS

A breakdown and descriptive analysis of recorded procedures for the 3 district and 3 regional public hospitals in this study is covered in this section.

4.3.1 Procedure Concepts by proportional breakdown

Figure 5 illustrates the number of procedure concepts recorded from all hospitals. Thirty of these were recorded in both district and regional hospitals while 74 were recorded only in regional hospitals and 22 were recorded only in district hospitals.

Fig 5: Number of "*all*" procedure concepts for all hospitals: 126 Concepts



4.4 TOP 10 PROCEDURE CONCEPTS BY SCORING

Please refer to the table below for a list of the ten most commonly recorded procedures encountered at all hospitals.

Table 4: Most common recorded procedures for all hospitals

Procedures	Patients who received that procedure	ICPC-2				ICD-9-CM PROCEDURE CODES				CCSA-2001			
		Score 0	Score 1	Score 2	Score 3	Score 0	Score 1	Score 2	Score 3	Score 0	Score 1	Score 2	Score 3
1. Discharge Medication	62				X	X							X
2. Chest X-ray	37			X					X				X
3. Incision & drainage	20				X		X						X
4. ECG	19		X						X				X
5. Dressing	16			*X*					X				X
6. Sputum Examination	9		X						X				X
7. Pregnancy termination	9				3				X				X
8. Laparatomy	8			X					X			X	
9. Vacuum Aspiration	7		X						X			X	
10. Neuro Observation	6				X				X			X	

4.5 SCORING OF DIAGNOSTIC CONCEPTS

The discussion below presents the results of the coding ability and scoring for each diagnostic coding system evaluated, using a comparative tabular presentation. The section illustrates and compares the three coding systems for their ability to definitively score all diagnostic concepts, diagnostic concepts recorded as "symptoms only" and diagnostic concepts recorded as "proper diagnoses". Table 5 presents the results arising from such a comparison using frequencies and percentages for each score within a coding system. For example of the 221 diagnostic concepts, ICPC-2 scored 4 of them into category "0", 42 into category "1", 108 into category "2" and 67 into category "3". Also shown is the combined percentage of concepts scored as either category "2" or category "3". These scores were combined as a score of "2" or "3" since they indicate a partial or exact match respectively and in most circumstances it is sufficient although not ideal to have a partial match.

A Friedman test was used to statistically assess differences in the scores between the three coding systems and all pair wise comparisons of groups of 2 coding systems, and a p-value was calculated for each of the comparisons to test if the differences in their coding ability were statistically significant.

4.5.1 Comparison of coding systems scores for all diagnostic concepts recorded in folders of "all" hospitals, regional and district hospitals.

The table below gives a tabular presentation of the results arising from the evaluation of all (221) diagnostic concepts recorded from "all" hospitals. The highlighted sections are the scoring results of concepts that scored "partial" and "exact" matches.

Table 5: Comparison of Coding Systems Scores for "all"diagnostic concepts recorded in folders of ALL Hospitals.

		CODING SYSTEMS											
		ICPC-2				**ICD-10**				**ICD 10- CL**			
All Diagnostic concepts: 221	**Scores**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	4	42	108	67	0	40	79	102	49	105	49	18
	% of concepts	2%	19%	49%	30%	0%	18%	36%	46%	22%	48%	22%	8%
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **79%**				***Overall of 2 & 3 Scores*** **82%**				***Overall of 2 & 3 Scores*** **30%**			
	Statistical Tests	Comparing all 3 coding systems = Friedman Chi² 521.31, p value 0.00001 Comparing ICPC-2 & ICD-10 = Friedman Chi² 344.02, p value=0.000001 Comparing ICPC-2 & ICD-10 CL = Friedman Chi² 374.00, p value=0.0001 Comparing ICD-10 & ICD-1O CL = Friedman Chi² 346.54, p value 0. 0001											

4.5.2 Comparison of coding systems scores for all diagnostic concepts recorded in folders of "all" hospitals, regional only.

Tables 6 below represent the results in a similar fashion as the tables above for "all" diagnostic concepts for comparisons of data from regional hospitals only.

Table 6: Comparison of Coding Systems Scores for Scoring of all Diagnostic concepts recorded in folders for Regional Hospitals.

All recorded concepts : 165	Coding Systems	ICPC-2				ICD-10				ICD 10- CL			
	Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	2	33	77	53	0	32	62	71	46	54	51	14
	% of concepts	1%	20%	**47%**	**32%**	0%	18%	**38%**	**44%**	29%	35%	**28%**	**8%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **79%**				***Overall of 2 & 3 Scores*** **82%**				***Overall of 2 & 3 Scores*** **36%**			
	Statistical Tests	Comparing all 3 coding systems= Friedman Chi² 401.01, p value= 0.00001 Comparing ICPC-2 & ICD10= Friedman Chi² 265.45, p value 0.00001 Comparing ICPC-2 & ICD-10 CL = Friedman Chi²274.12, p value 0.000001 Comparing ICD-10 & ICD-1O CL = Friedman Chi² 277.63p value 0.00001											

4.5.3 Comparison of coding systems scores for all diagnostic concepts recorded in folders of "all" district hospitals only.

Tables 7 below represent the results in a similar fashion as tables above for "all" diagnostic concepts for comparison of data from district hospitals only.

Table 7: Comparison of Coding Systems Scores for Scoring of all Diagnostic concepts recorded in folders for District Hospitals.

All recorded concepts: 137													
	Coding Systems	**ICPC-2**				**ICD-10**				**ICD 10- CL**			
	Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	4	20	57	56	0	17	47	73	34	69	23	11
	% of concepts	3%	14%	**42%**	**41%**	0%	13%	**34%**	**53%**	24%	50%	**17%**	**8%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **83%**				***Overall of 2 & 3 Scores*** **87%**				***Overall of 2 & 3 Scores*** **25%**			
Statistical Tests		Comparing all 3 coding systems = Friedman Chi² 297.23, p value 0.0001 Comparing ICPC-2 & ICD-10 Friedman Chi² 208.89, p value 0.001 Comparing ICPC-2 & ICD-1O CL= Friedman Chi² 210.73, p value= 0.00001 Comparing ICD-10 & ICD-1O CL = Friedman Chi² 197.22, P value 0.0001											

4.5.4 The scoring of "all" diagnostic concepts and diagnostic concepts stratified by "symptoms only" and "proper diagnoses" for "all" hospitals

Tables 8 and 9 below provide the results arising from the analysis of diagnostic concepts stratified by "symptoms only" and "proper diagnoses" for "all" hospitals.

Table 8: Comparison of Coding Systems Scores for Scoring of Diagnostic concepts recorded as "Proper Diagnoses" in folders for "ALL" Hospitals

Proper Diagnostic Concepts: 189	Coding Systems	**ICPC-2**				**ICD-10**				**ICD 10- CL**			
	Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	3	41	103	41	0	37	73	79	32	99	46	12
	% of concepts	2%	22%	**54%**	**22%**	0%	19%	**39%**	**42%**	17%	52%	**24%**	**7%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **76%**				***Overall of 2 & 3 Scores*** **81%**				***Overall of 2 & 3 Scores*** **30%**			
	Statistical Tests	Comparing all 3 coding systems = Friedman Chi² 424.90, p value = 0.00001 Comparing ICPC-2 & ICD-10 = Friedman Chi² 286.82, p value = 0.00001 Comparing ICPC-2 & ICD-10CL = Friedman Chi² 290.35, p value = 0.0001 Comparing ICD 10 & ICD-10CL= Friedman Chi² 296.69, p value = 0.00001											

Table 9: Comparison of Coding Systems Scores for Scoring of Diagnostic concepts recorded as "symptoms only" in folders for ALL Hospitals.

"Symptom only" Concepts: 32		**ICPC-2**				**ICD-10**				**ICD 10- CL**			
	Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	1	1	5	25	0	3	6	23	17	6	3	6
	% of concepts	3%	3%	**16%**	**78%**	0%	9%	**19%**	**72%**	53%	19%	**9%**	**19%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **94%**				***Overall of 2 & 3 Scores*** **91%**				***Overall of 2 & 3 Scores*** **28%**			
	Statistical Tests	Comparing all 3 coding systems = Friedman Chi² 45.24, p value=0.04 Comparing ICPC-2 & ICPC-10= Friedman Chi² 33.08 p value 0.36 Comparing ICPC-2 & ICD-10 CL= Friedman Chi² 30.57, p value 0.48 Comparing ICD-10 & ICD-1O CL= Friedman Chi² 34.88 , p value 0.28											

4.5.5 The scoring of "all" diagnostic concepts and diagnostic concepts stratified by "proper diagnoses" and "symptoms only" for "all" regional hospitals only.

Tables 10 and 11 below provide the results arising from the analysis of diagnostic concepts stratified by "proper diagnoses" and "symptoms only" for regional hospitals only.

Table 10: Comparison of Coding Systems Scores for Scoring of all Diagnostic concepts recorded as proper diagnoses in folders for Regional Hospitals.

"Proper Diagnostic" concepts: 158													
	Coding Systems	**ICPC-2**				**ICD-10**				**ICD 10- CL**			
	Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	2	33	75	48	0	30	62	66	40	53	51	14
	% of concepts	1%	21%	**48%**	**30%**	0%	19%	**39%**	**42%**	25%	34%	**32%**	**9%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **78%**				***Overall of 2 & 3 Scores*** **81%**				***Overall of 2 & 3 Scores*** **41%**			
	Statistical Tests	Comparing all 3 coding systems= Friedman Chi² 385.51, p value = 0.001 Comparing ICPC-2 & ICD-10= Friedman Chi²252.47, p value = 0.0001 Comparing ICPC-2 & ICD-10CL= Friedman Chi²262.07, p value = 0.0001 Comparing ICD 10 & ICD-10CL = Friedman Chi²269.98, p value = 0.0001											

Table 11 Comparison of Coding Systems Scores for Scoring of all Diagnostic concepts recorded as symptoms in folders for Regional Hospitals.

"Symptoms only": 7													
	Coding Systems	**ICPC-2**				**ICD-10**				**ICD 10- CL**			
	Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	0	0	**2**	**5**	0	0	**0**	**7**	5	2	0	0
	% of concepts	0%	0%	**29%**	**71%**	0%	0%	**0%**	**100%**	71%	29%	**0%**	**0%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **100%**				***Overall of 2 & 3 Scores*** **100%**				***Overall of 2 & 3 Scores*** **0%**			
	Statistical Tests	Due to the small sample size and many of the scoring categories having zero score it was not viable to do a statistical significance test											

4.5.6 The scoring of "all" diagnostic concepts and diagnostic concepts stratified by "proper diagnoses" and "symptoms only" for "all" district hospitals only.

Tables 12 and 13 below provide the results arising from the analysis of diagnostic concepts stratified by "proper diagnoses" and "symptoms only" for regional hospitals only.

Table 12: Comparison of Coding Systems Scores for Scoring of all Diagnostic concepts recorded as "proper diagnoses" in folders for District Hospitals.

	Coding Systems	ICPC-2				ICD-10				ICD 10- CL			
"Proper Diagnostic" concepts 112	**Scores**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	4	33	16	59	0	9	16	87	33	41	15	23
	% of concepts	4%	29%	**14%**	**53%**	0%	8%	**14%**	**78%**	29%	37%	**13%**	**21%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **67%**				***Overall of 2 & 3 Scores*** **92%**				***Overall of 2 & 3 Scores*** **34%**			
	Statistical Tests	Comparing all 3 coding systems = Friedman Chi² 207.54 p-value 0.0001 Comparing ICPC-2 & ICD-10 = Friedman Chi ² 126.71, p value 0.14 Comparing ICPC-2 & ICD-10-CL = Friedman Chi² 177.96, p value 0.0001 Comparing ICD-10 & ICD-10-CL = Friedman Chi²132.47, p value 0.08											

Table 13: Comparison of Coding Systems Scores for Scoring of all Diagnostic concepts recorded as "symptoms only" in folders for District Hospitals.

Symptom Concepts: 25												
Coding Systems	**ICPC-2**				**ICD-10**				**ICD 10- CL**			
Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
No of concepts	2	3	8	12	3	9	6	7	16	2	3	4
% of concepts	8%	12%	**32%**	**48%**	12%	48%	**24%**	**28%**	64%	8%	**12%**	**16%**
Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **80%**				***Overall of 2 & 3 Scores*** **52%**				***Overall of 2 & 3 Scores*** **28%**			
Statistical Tests	Comparing all 3 coding systems = Friedman Chi² 52.94, p value = 0.0000 Comparing ICPC-2 & ICD-10= Friedman Chi²= 40.59, p value = 0.01 Comparing ICPC-2 & ICD-10CL= Friedman Chi² =32.56, p value = 0.11 Comparing ICD 10 & ICD-10CL= Friedman Chi² 36.33, p value = 0.05											

4.6 COMMONLY OCCURRING DIAGNOSTIC CONCEPTS RECORDED.

The discussion below represents the results in a similar fashion as the previous tables but compares only commonly occurring diagnostic concepts for all hospitals as well as those stratified by type of hospital.

4.6.1 Commonly occurring diagnostic concepts for all hospitals

Table 14 below illustrates commonly occurring concepts which are defined as those concepts occurring four times or more. Commonly occurring diagnostic concepts in this case refers to those diagnostic concepts that occurred amongst 4 patients or more. It is assumed that selecting diagnostic concepts that occurred at least 4 times is a low enough threshold to filter out infrequent diagnoses, but high enough to select in common conditions seen at these hospitals. Note that there were 221 individual unique diagnostic concepts and several of these unique concepts would have been present in either one or more of the patient's records. The cutoff of a unique diagnostic concept appearing in at least 4 records was chosen as an expression for "commonly occurring" because the sample size was not very large and hence what constituted commonly occuring had to be a very relatively low number. It was deemed reasonable to reflect "commonly occurring" conditions because they are important for management reporting purposes to assess the coding system coding ability as it would be desirable for the coding system to be able to at least code these reasonably well. . The table below illustrates 56 commonly occuring conditions that occurred 4 times or more in a patient record.

Table 14: Comparison of Coding Systems Scores for "common" Diagnostic Concepts occurring 4 or more times for "all" hospitals													
Common Diagnostic concepts: 56	Coding Systems	**ICPC-2**				**ICD-10**				**ICD 10- CL**			
	Scores	0	1	2	3	0	1	2	3	0	1	2	3
	No of concepts	0	9	23	24	1	5	18	32	14	19	14	9
	% of concepts	0%	16%	**41%**	**43%**	2%	9%	**32%**	**57%**	25%	34%	**25%**	**16%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **84%**				***Overall of 2 & 3 Scores*** **89%**				***Overall of 2 & 3 Scores*** **41%**			
STATISTICAL TESTS		Comparing all 3 coding systems =Friedman Chi² 126.05, p value 0.00 Comparing ICPC-2 & ICD-10= Friedman Chi² 81.57, p value 0.01 Comparing ICPC-2 & ICD-10CL= Friedman Chi² 93.28, p value 0.00 Comparing ICD 10 & ICD-10CL= Friedman Chi² 85.77, p value 0.00											

4.6.2 Commonly occurring diagnostic concepts for regional hospitals

The table below illustrates the commonly recorded concepts occurring 4 times or more at regional hospitals.

Table 15: Comparison of Coding Systems Scores for 31 Diagnoses occurring 4 times or more for Regional Hospitals													
Common Diagnostic Concepts: 31	Coding Systems	**ICPC-2**				**ICD-10**				**ICD 10- CL**			
	Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	0	10	9	12	0	6	7	18	10	9	8	4
	% of concepts	0%	32%	**29%**	**39%**	0%	19%	**23%**	**58%**	32%	29%	**26%**	**13%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **68%**				***Overall of 2 & 3 Scores*** **81%**				***Overall of 2 & 3 Scores*** **39%**			
STATISTICAL TEST		Comparing all 3 coding systems =Friedman Chi² 72.02, p value 0.00 Comparing ICPC-2 & ICD-10= Friedman Chi² 46.35, p value 0.02 Comparing ICPC-2 & ICD-10CL= Friedman Chi² 53.67, p value 0.00 Comparing ICD 10 & ICD-10CL= Friedman Chi² 46.93, p value 0.02											

4.6.3 Commonly occurring diagnostic concepts for district hospitals

The table below illustrates the commonly recorded concepts occurring 10 times or more at District Hospitals.

Table 16: Comparison of Coding Systems Scores for 20 Diagnoses occurring 10 times or more for District Hospitals

Common diagnostic concepts : 25												
Coding Systems	**ICPC-2**				**ICD-10**				**ICD 10- CL**			
Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
No of concepts	0	3	9	13	0	4	7	14	11	6	3	**5**
% of concepts	0%	15%	**36%**	**52%**	0%	20%	**28%**	**56%**	44%	24%	**12%**	**20%**
Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **88%**				***Overall of 2 & 3 Scores*** **84%**				***Overall of 2 & 3 Scores*** **32%**			
STATISTICAL TEST	Comparing all 3 coding systems =Friedman Chi² 43.85 p value 0.0001 Comparing ICPC-2 & ICD-10 = Friedman Chi² 29.33 p value 0.06 Comparing ICPC-2 & ICD-10CL= Friedman Chi² 30.32, p value 0.04 Comparing ICD 10 & ICD-10CL= Friedman Chi² 30.27, p value 0.04											

4.6.4 "Very commonly" occurring diagnostic concepts for "all" hospitals

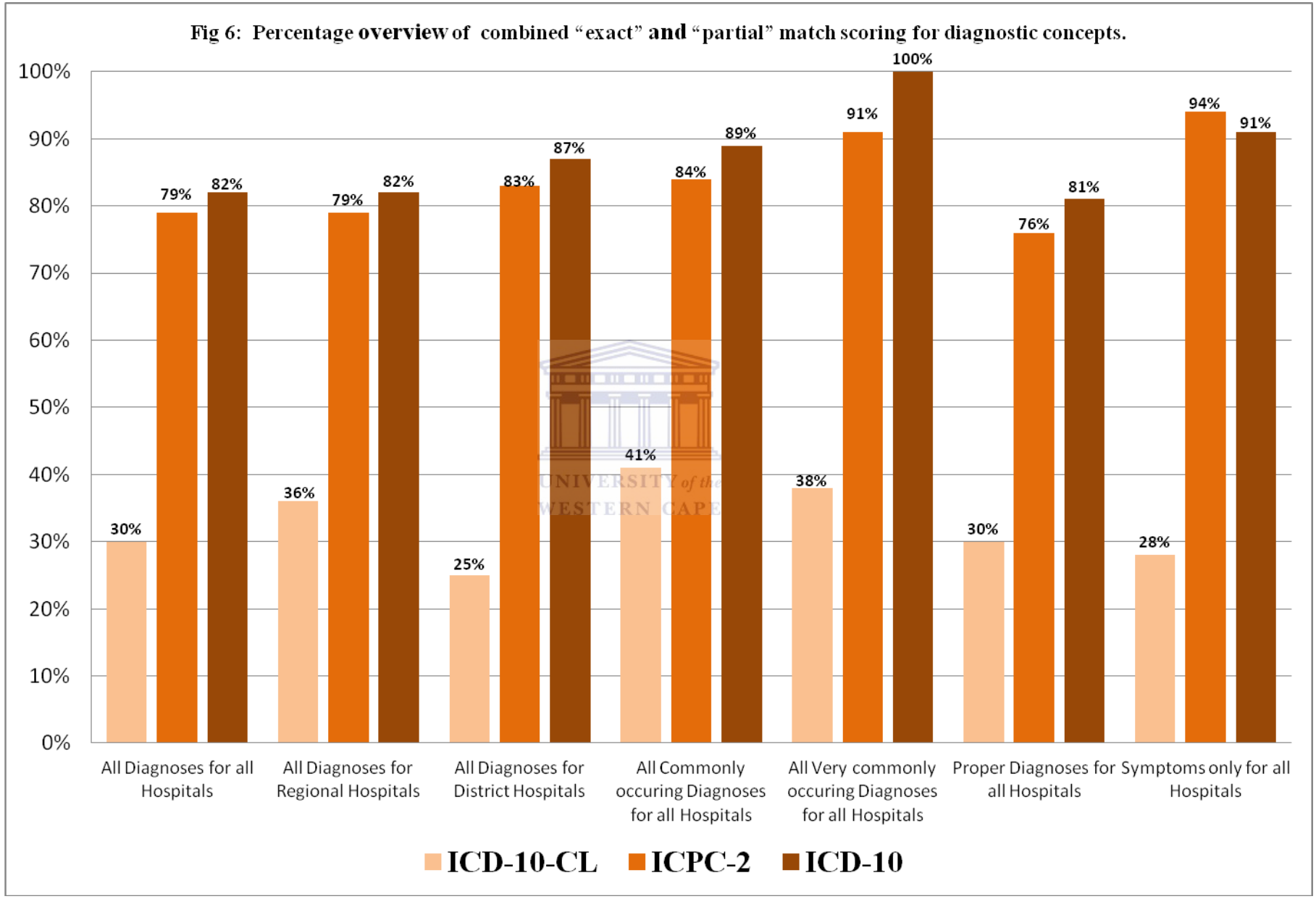
Table 17 below illustrates "very commonly" occurring concepts defined as those concepts occurring ten times or more. The table below illustrates 21 "very commonly" occuring conditions.

Table 17: Comparison of Coding Systems Scores for "very common" Diagnostic Concepts occurring 10 times or more for "*All*" hospitals

	Coding Systems	ICPC-2				ICD-10				ICD 10- CL			
"Very common" Diagnostic Concepts 21	**Scores**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	0	2	10	9	0	0	7	14	9	4	4	4
	% of concepts	0%	9%	**48%**	**43%**	0%	0%	**33%**	**67%**	43%	19%	**19%**	**19%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **91%**				***Overall of 2 & 3 Scores*** **100%**				***Overall of 2 & 3 Scores*** **38%**			
STATISTICAL TEST		Comparing all 3 coding systems =Friedman Chi² 40.05, p value 0.00001 Comparing ICPC-2 & ICD-10= Friedman Chi² 24.77, p value 0.21 Comparing ICPC-2 & ICD-10CL= Friedman Chi² 31.99, p value 0.04 Comparing ICD 10 & ICD-10CL= Friedman Chi² 27.16, p value 0.13											

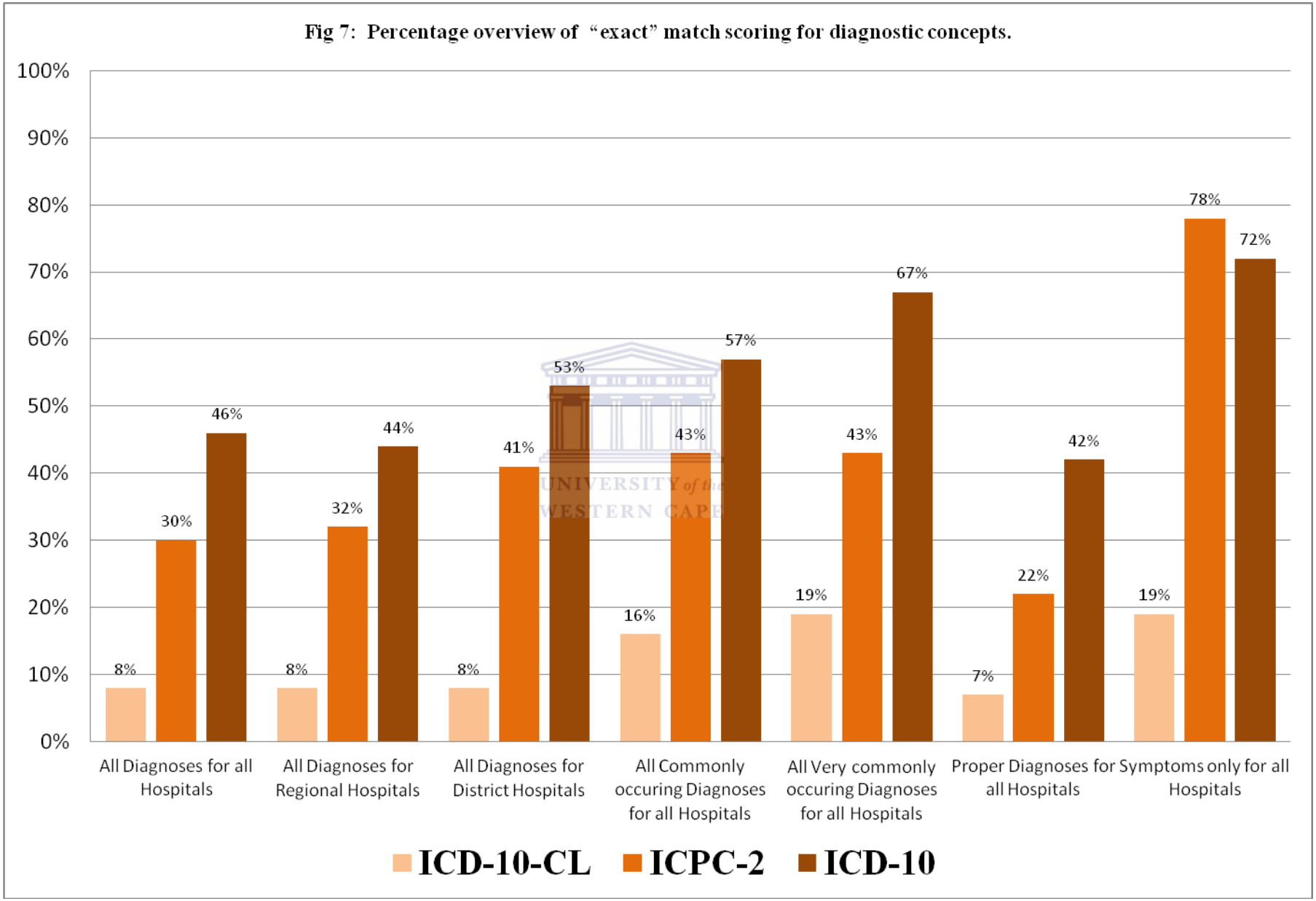
4.7 GRAPHIC PRESENTATION OF COMBINED "EXACT" AND "PARTIAL" MATCH SCORES FOR DIAGNOSTIC CONCEPTS.

Figure 6 below is a graphic illustration of the scoring ability of the diagnostic coding systems based on the combined “partial” and “exact” match scores for all diagnostic concepts, diagnostic concepts by regional hospitals, diagnostic concepts by district hospitals, “commonly” occuring diagnostic concepts, “very commonly” occuring diagnostic concepts, diagnostic concepts by “proper diagnoses” and diagnostic concepts by “symptoms only”.



4.7.1 Graphic presentation of "exact" match scores for diagnostic concepts.

While the discussion and figure above is based on illustrating the percentage overview on the scoring ability of the evaluated diagnostic coding systems using “partial’ and “exact’ match scores, figure 7 below will look at the same analysis based on only the “exact” match scores for all diagnostic concepts, diagnostic concepts by regional hospitals, diagnostic concepts by district hospitals, commonly occuring diagnostic concepts, very commonly occuring diagnostic concepts, diagnostic concepts by “proper diagnoses” and diagnostic concepts by “symptoms only”.



4.8. COMPARISON FOR PROCEDURE SCORING

While the previous discussions have focused mainly on the results of the coding ability and scoring for each diagnostic coding system evaluated, the following discussion will focus on procedure coding systems evaluated using a comparative tabular presentation of the results. This section illustrates the comparison of the three coding systems for their ability to definitively score recorded procedures from all hospitals procedures recorded from regional hospitals, and procedures recorded from district hospitals. These are also stratified by "commonly occuring" procedures at regional hospitals as well as "commonly occuring" procedures at district hospitals. As with the analysis for diagnoses, this section will focus on the results arising from a comparison of procedure concepts using frequencies and percentages for each score within a coding system.

A Friedman test was used to statistically assess differences in the scores between all three coding systems and for pair wise comparisons of combinations of groups of 2 coding systems, and a p-value was calculated for each of the comparisons to test if the differences in their coding ability were statistically significant.

4.8.1 All recorded procedures

Table 18 below gives a tabular presentation of the results arising from the evaluation of all (126) procedure concepts recorded from all hospitals. The highlighted sections are the scoring results of concepts that scored "partial" and "exact" matches.

Table 18: Comparison of Coding Systems Scores for All Recorded Procedures for "All" hospitals

	Coding Systems	ICPC-2				ICD-9-CM				CCSA-2001			
All Procedure Concepts 126	**Scores**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	3	74	37	12	21	23	39	43	1	20	39	66
	% of concepts	2%	59%	**29%**	**10%**	17%	18%	**31%**	**34%**	1%	16%	**31%**	**52%**
	Combined 2 & 3 Scores	***Overall of 2 & 3 Scores*** **39%**				***Overall of 2 & 3 Scores*** **65%**				***Overall of 2 & 3 Scores*** **83%**			
	Statistical tests	Comparing all 3 coding systems = Friedman Chi² 275.55, p value 0.00001 Comparing ICPC-2 & ICD 9CM = Friedman Chi² 193.79, p value 0.00001 Comparing ICPC-2 & CCSA 2001= Friedman Chi² 172.22, p value 0.0001 Comparing ICD 9CM & CCSA 2001= Friedman Chi² 204.42, p value 0.00001											

4.8.2 All recorded procedures for regional hospitals

Table 19 below represents the results in a similar fashion as previous tables but for regional hospitals only.

Table 19: Comparison of coding systems Scores for All recorded procedures for regional hospitals

	Coding Systems	ICPC-2				ICD-9-CM				CCSA-2001			
All Procedures 81	**Scores**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	3	47	25	6	6	17	19	39	0	10	28	43
	% of concepts	4%	58%	**31%**	**7%**	8%	21%	**23%**	**48%**	0%	12%	**35%**	**53%**
	Combined *2 & 3 Scores*	***Overall of 2 & 3 Scores*** ***38%***				***Overall of 2 & 3 Scores*** ***71%***				***Overall of 2 & 3 Scores*** ***88%***			
Statistical tests		Comparing all 3 coding systems = Friedman Chi² 175.05, p value 0.0001 Comparing ICPC-2 & ICD 9CM =Friedman Chi² 125.66, p value 0.0001 Comparing ICPC-2 & CCSA 2001= Friedman Chi² 109.60, p value 0.01 Comparing ICD 9CM & CCSA 2001= Friedman Chi² 126.92, p value 0.001											

4.8.3 All recorded procedures for district hospitals

Table 20 below represents the results in a similar fashion as previous tables but for district hospitals only.

Table 20: Comparison of Coding Systems Scores for All Recorded Procedures for District Hospitals

	Coding Systems	ICPC-2				ICD-9-CM				CCSA-2001			
	Scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
All Procedures 75	No of concepts	0	38	27	10	15	6	26	31	0	18	20	37
	% of concepts	0%	51%	36%	13%	20%	8%	**32%**	**38%**	0%	24%	26%	49%
	Combined *2 & 3 Scores*	***Overall of 2 & 3 Scores*** *49%*				***Overall of 2 & 3 Scores*** *52%*				***Overall of 2 & 3 Scores*** *75%*			
	Statistical tests	Comparing all 3 coding systems = Friedman Chi² 179.19, p value 0.00001 Comparing ICPC-2 & ICD 9CM = Friedman Chi² 123.81, p value 0.000001 Comparing ICPC-2 & CCSA 2001= Friedman Chi² 117.30, p value 0.00001 Comparing ICD 9CM & CCSA 2001= Friedman Chi² 124.86, p value 0.00001											

4.9 COMMONLY OCCURRING PROCEDURE CONCEPTS RECORDED.

The discussion below represents the results in a similar fashion as above tables arising from comparison of commonly occurring procedure concepts by all hospitals as well as by hospital type.

4.9.1 Commonly occurring procedures for "all" hospitals

Table 21 below illustrates the scoring results of commonly occurring procedure concepts recorded four times and more from all Hospitals. This relatively low number for commonly occuring concepts was deemed appropriate due to the small sample size for the study.

Table 21: Comparison of Coding Systems Scores for commonly occurring Procedures for all Hospitals

	Coding Systems	ICPC-2				ICD-9-CM				CCSA-2001			
Common procedures 17	**Scores**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	0	5	5	7	0	2	3	12	0	1	7	9
	% of concepts	0%	29%	29%	42%	0%	12%	18%	70%	0%	6%	42%	52%
	Combined *2 & 3 Scores*	***Overall of 2 & 3 Scores*** *71%*				***Overall of 2 & 3 Scores*** *88%*				***Overall of 2 & 3 Scores*** *94%*			
Statistical tests		Comparing all 3 coding systems = Friedman Chi² 32.0065, p value 0.01 Comparing ICPC-2 & ICD 9CM = Friedman Chi² 22.2059, p value 0.13 Comparing ICPC-2 & CCSA 2001= Friedman Chi² 24.6275, p value 0.07 Comparing ICD 9CM & CCSA 2001= Friedman Chi² 19.6569, p value 0.23											

4.9.2 Commonly occurring procedures for Regional hospitals

Table 22 below illustrates the scoring results of commonly occurring procedures concepts recorded from Regional Hospitals. These were procedures occurring 4 times and more.

Table 22: Comparison of Coding Systems Scores for commonly occurring Procedures for Regional Hospitals

	Coding Systems	ICPC-2				ICD-9-CM				CCSA-2001			
Common Procedures : 13	**Scores**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	0	5	3	5	2	1	3	7	0	1	6	6
	% of concepts	0%	38%	23%	38%	15%	8%	23	54%	0%	8%	46%	46%
	Combined *2 & 3 Scores*	***Overall of 2 & 3 Scores*** *61%*				***Overall of 2 & 3 Scores*** *77%*				***Overall of 2 & 3 Scores*** *92%*			
Statistical tests		Comparing all 3 coding systems = Friedman Chi² 39.3737, p value 0.001 Comparing ICPC-2 & ICD 9CM = Friedman Chi² 27.6868, p value 0.06 Comparing ICPC-2 & CCSA 2001= Friedman Chi² 27.0237, p value 0.07 Comparing ICD 9CM & CCSA 2001= Friedman Chi² 25.8711, p value 0.10											

4.9.3 "Commonly occurring" procedures for district hospitals

Table 23 below illustrates the scoring results of commonly occurring procedures concepts recorded from district Hospitals occurring 4 times and more.

Table 23: Comparison of Coding Systems Scores for commonly occurring Procedures for District Hospitals

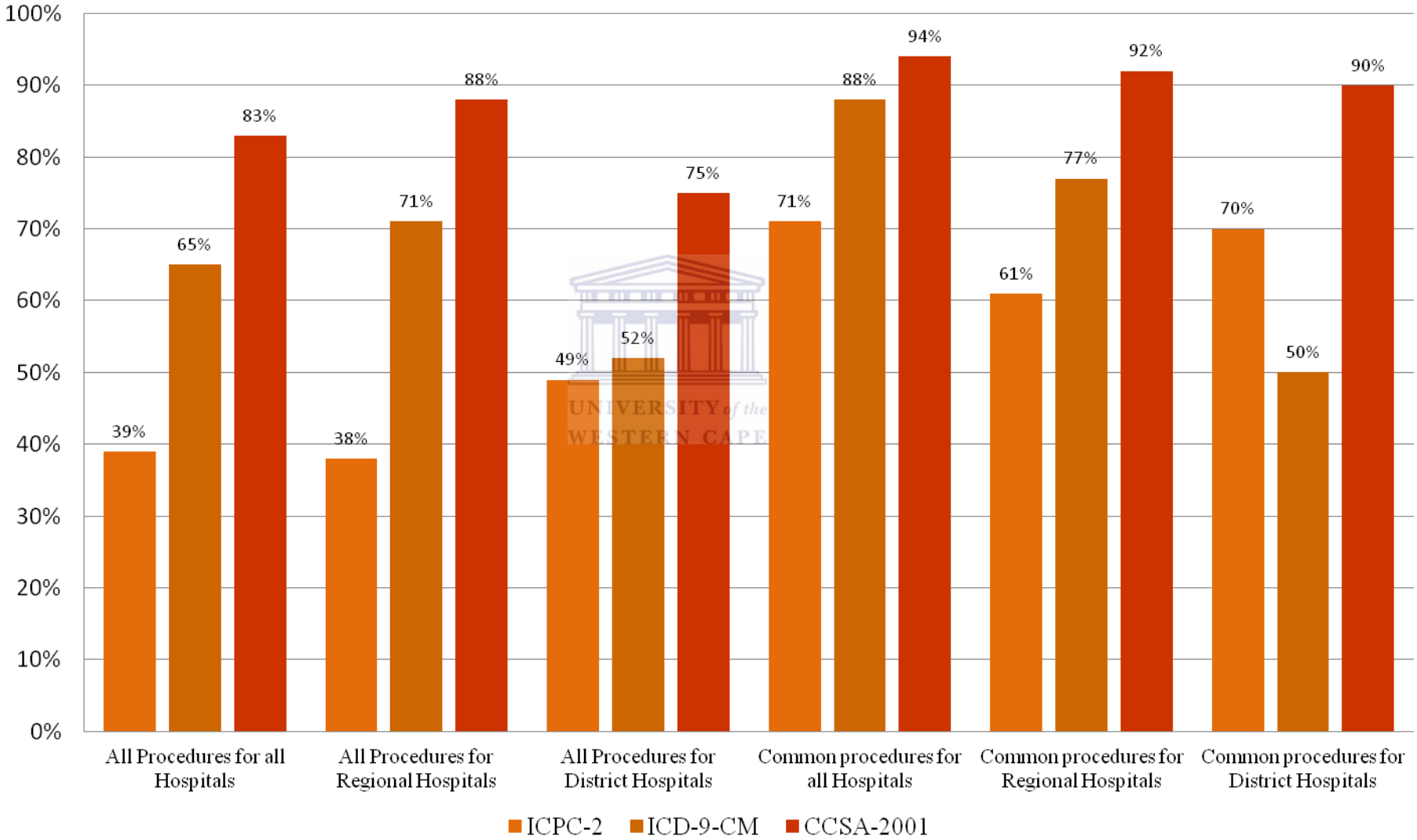
	Coding Systems	ICPC-2				ICD-9-CM				CCSA-2001			
Common Procedures: 10	**Scores**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	No of concepts	0	3	5	2	2	3	1	4	0	1	2	7
	% of concepts	0%	30%	**50%**	**20%**	20%	30%	**10%**	**40%**	0%	10%	**20%**	**70%**
	Combined *2 & 3 Scores*	***Overall of 2 & 3 Scores*** *70%*				***Overall of 2 & 3 Scores*** *50%*				***Overall of 2 & 3 Scores*** *90%*			
Statistical tests		Comparing all 3 coding systems = Friedman Chi² 18.8909, p value 0.02 Comparing ICPC-2 & ICD 9CM = Friedman Chi² 14.3455, p value 0.11 Comparing ICPC-2 & CCSA 2001= Friedman Chi² 12.4909, p value 0.18 Comparing ICD 9CM & CCSA 2001= Friedman Chi² 12.3545, p value 0.19											

Due to a significantly low number of concepts for procedures, analysis for the category of "very commonly occuring" concepts was not viable.

4.10 GRAPHIC PRESENTATION OF COMBINED "EXACT" AND "PARTIAL" MATCH SCORES FOR PROCEDURE CONCEPTS.

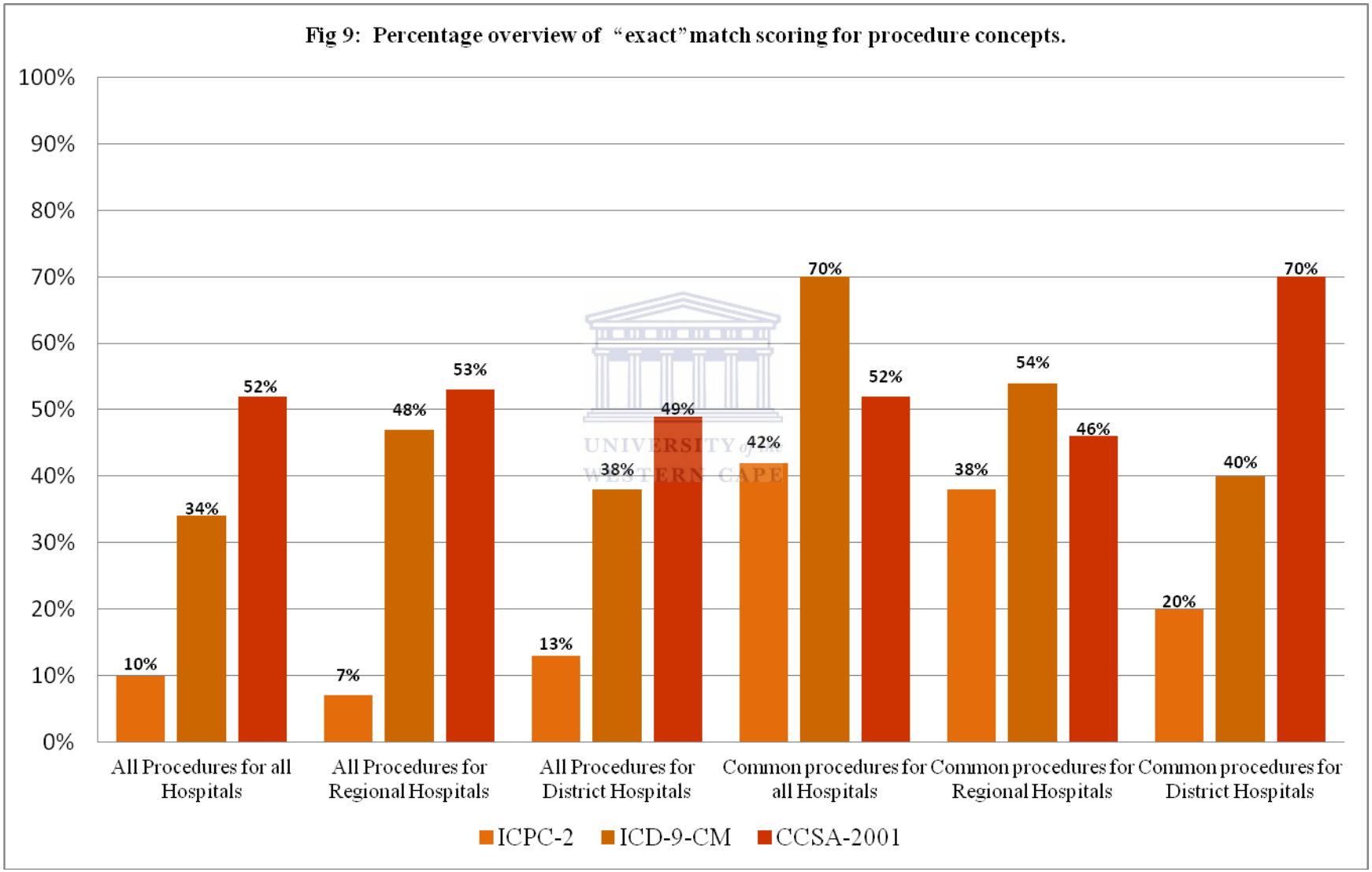
Figure 8 below is a graphic illustration on a percentage overview of the scoring ability of the evaluated procedure coding systems based on the “partial” and “exact” match scores for all procedures, procedures by regional hospitals, procedures by district hospitals, commonly occuring procedures for all hospitals, regional and district hospitals.

Fig 8: Percentage overview of combined "exact" and "Partial" match scoring for procedure concepts.



4.10.1 Graphic presentation of "exact" match scores for procedure concepts.

As with the previous discussion, the following presentation provides a graphic illustration of the percentage overview of the scoring ability of the evaluated procedure coding systems based on the “exact” match scores for all procedure concepts, procedure concepts by regional hospitals, procedure concepts by district hospitals, commonly occuring procedures concepts as well as very commonly occuring procedure concepts stratified by regional and district hospitals.



CHAPTER 5

DISCUSSION

The purpose of this chapter is to discuss comparative analysis of the results that arose from this study. Due to the tentative nature of the results produced in this pilot study, the discussion chapter will extensively utilise corroborating and refuting findings derived from different studies that are similar to this study, with the purpose of portraying the similarities or contrasting the differences that arose. Hence a greater reliance on published literature will be utilised in this discussion section than is usually the case in a thesis.

5.1 COMPARISON OF DIAGNOSTIC CONCEPT CODING ABILITY

The following discussion is based on a comparative analysis of the ability of ICPC-2, ICD-10 and ICD-10 Condensed Morbidity List to code diagnoses recorded from district and regional hospitals in the Western Cape. The discussion will cover the findings on their ability to code data for "*all"* diagnostic concepts, diagnostic concepts recorded as "*proper diagnoses*" and diagnostic concepts recorded as "*symptoms only*". The discussion will further look at the results of the comparison of the three coding systems stratified by "*commonly occurring*" diagnoses and by type of hospital. The hospitals are stratified into 3 groups which are (i) District hospitals and (ii) Regional hospitals and with the two groups combined being referred to as (iii) "*all*" hospitals. The discussion below commences with an assessment of the three systems' coding ability for "*all*" diagnostic concepts at "*all*" hospitals and then moves on to assess the strata noted above.

The major criterion used to qualify a coding system as the most suitable coding system is that it should be able to code most elements and especially common important elements, of all health problems in a

particular setting. The system should there be able to capture most of the concepts recorded in the patient record. The overall analysis of the scores was on the basis that there will be a single coding standard for both district and regional hospitals as a requirement for a national diagnosis coding standard.

5.1.1 Coding Ability for "*all*" diagnostic concepts at all hospitals.

A reasonably large number of diagnostic concepts (221) were recorded from the sample of "*all*" hospitals (see table 5 in the results section). A significant difference was noted across all three evaluated coding systems with ICD-10 performing better than ICPC-2 and ICD-10 Condensed Morbidity List in terms of its ability to capture the scope of all recorded diagnostic concepts for the setting in the Western Cape (see table 5). With its detailed specification of diagnoses, ICD-10 was able to reflect specific diagnoses in more accurate detail than the other coding systems.

Though ICD-10 was reasonably close to ICPC-2 in terms of its ability to code all diagnostic concepts, a statistically significant difference between the two was noted. However although their ability to score recorded diagnostic concepts as either a "2" (partial match between a recorded concept and a code) or a "3" (complete/exact match between a recorded concept and a code) differed only slightly, ICD-10 did much better than ICPC-2 at scoring diagnostic concepts as "exact" match ("3"). It is also worth noting that no diagnostic concepts were scored as "0" in ICD-10 (concepts from records do not match concepts from codes at all). There were by contrast a small number of diagnostic concepts that scored "0" in ICPC-2. The greater coding specificity of ICD-10 could result in substantial benefits such as (i) greater assistance with managerial decision making which would flow from the higher quality data produced, and (ii) increased

efficiency in the exchange of patient profile information between health facilities (Deloitte, 2010).

Comparable results were yielded in a cross national assessment of the ability of ICD-10 to code diagnostic concepts in Australia, Canada, Switzerland and Japan in a study done by Sundararajan *et al.*, (2007). In that study, ICD-10 was able to code 82% of the recorded diagnostic concepts for the above countries as "exact" matches.

It is worth noting that ICD-10 is a direct descendant of clinical and research diagnostic classifications developed in the US and Western Europe, thus it is based upon a Western conceptual framework and therefore may not necessarily represent all conditions prevalent in other settings or parts of the world. Evidence by Pastore *et al.*, (2009) in a Mozambique setting confirms that 1CD-10 lacked codes fitting diagnoses particular to the Mozambique setting such as "complications caused by the use of traditional medicine". In the same vein it might be that common diagnoses used in the Western Cape setting, where the current study is based, might be different and/or differently expressed in the patients' clinical folders than those in Europe. This could explain why only 46% of the diagnoses in this study could be exactly matched to a code. However an alternative and probably more likely explanation is that the diagnoses were not properly elaborated in the patient folders (e.g. a diagnosis which should have been recorded as "pulmonary tuberculosis" was instead recorded as "TB"; or a diagnosis which should have been recorded as "diabetes mellitus type 2" was instead recorded as "diabetes") and hence since the diagnoses lacked specificity the coding in turn could not be "exactly" "matched".

In countries like Mozambique where patients are often attended to solely by medical technicians and other personnel with limited diagnostic capacity, improperly elaborated diagnoses could explain the lower coding ability experienced. In the current study however, all patients were seen by a doctor, and since it is unlikely (though not impossible) that doctors lack diagnostic capacity it implies that doctors do not fully appreciate the need for accurately recording patients diagnoses, since "short hand" diagnoses would be easily understood by their colleagues (Pastore *et al.*, 2009).

The above factors illustrate that ICD-10, by virtue of its ability to code a high number of concepts as "exact" ("3") matches across different international barriers gives it a higher credibility, and although it is a universally comparable system designed to promote international compatibility in the classification and presentation of health diagnoses, it may better reflect diagnostic terms from the developed world context in which it was formulated (Chinniah and Muttan, 2009). However even though the success in achieving high credibility may vary from country to region or setting context, ICD-10 still has credibility across different international settings.

According to Farhan *et al.*, (2005) the core of the health information system in the hospital lies in the medical records which also serves as the primary means of communication between health care workers, and therefore a properly documented medical record is essential to good clinical care, and they further argue that accurate diagnostic and procedural coding cannot be attained without clear and complete documentation. In their study to review the relationship between completeness of documentation and coding accuracy, Farhan *et al.*, (2005) found that of the 300

medical records reviewed, 83% were accurately documented, 4% were inaccurately documented, and 13% were not documented. Those records that were accurately documented were coded correctly by 71% compared to inaccurately documented records with only 50% correct coding. From these findings Farhan *et al.,* (2005) concluded a positive correlation between accurate documentation and correct coding, which supports the conclusion that high quality documentation enhances coding accuracy.

Though ICPC-2 did not score as high in this category as ICD-10, it fared comparatively well considering that there was a difference of only 3%. A study on a clinical audit on ICPC-2 in Hong Kong proved that the coding of health problems and diagnoses of patients using ICPC-2 helps the primary care physicians to improve the quality of their work through clinical audits, administrative monitoring and other continuous improvement processes. The quality of the coding database is important to achieve these goals. In this study, findings revealed that clinical audit are very useful tools to monitor the standard of care for chronic illnesses. Although using ICPC-2 effectively involves training and practice, it is well compensated by its potential to improve quality of work through clinical audits, administrative monitoring and other continuous improvement processes and the process involved in the training to code is not as complex as ICD-10 (Lam *et al.,* 2005).

ICD-10 Condensed Morbidity List proved to be unequivocally the most unsuitable coding system for coding diagnostic concepts for the current study setting, with only 30% of the

diagnostic concepts being scored as either "partial" or "exact" matches ("2" or "3", see table 5). These poor performance results for ICD-10 Condensed Morbidity list are not surprising as it was not designed to give an in depth analysis of diagnoses, but rather was designed to provide a panoramic view of the health situation and to identify the broad categories of health problems to assist health policy development and health intervention prioritization (Becker and Whyte, 2006).

5.1.2 Coding ability for diagnostic concepts recorded as "proper diagnoses" at all hospitals

For the purpose of this study "proper diagnoses" are those diagnoses which extend beyond the presenting complaints (symptoms) of the patients and identify the presumed causes of the symptoms. A reasonably large number of "proper diagnostic" concepts (189) were analysed (see table 6). Although both ICPC-2 and ICD-10 coding systems performed worse for "proper diagnoses" compared to "*all*" diagnoses, ICD-10 performed comparatively better than ICPC-2 in assessing "proper diagnoses". ICD-10 in particular performed slightly lower in exact match scores for "proper diagnoses", compared to "*all*" diagnostic concepts.

This unexpected lower result for exact matches for "proper diagnoses" reinforces the view that although clear diagnoses are made, they are often not fully described or elaborated with 189 proper diagnoses being fully described in this study. However there are specific codes for primary or secondary hypertension. This lack of elaboration of the diagnosis in the patient folders led to partial matches between a code and a "proper diagnostic" concept. This doesn't

mean that ICD-10 is poorly able to code “proper diagnoses” as exact matches, it simply means that the way the diagnoses were recorded, does not allow for an exact match with ICD-10 codes.

The results above supports the evidence by George and Woodford (2008) that lack of elaboration of diagnostic concepts or lack of proper recording of diagnoses may compromise the coding ability of ICD-10. Their review of 2005-2006 data in England suggested that more than 10% of the concepts coded as unexplained symptoms were due to inaccurate recording which led to inaccurate coding.

Similarly in a German and Swedish setting, a study by Stausberg *et al.*, (2008) showed weak ability of ICD-10 to code “proper diagnoses” as an exact match, with only 59% of diagnoses being coded as an “exact” (“3”) match. Yet again it seems that although ICD-10 may promise clinical credibility for its ability to code “proper diagnoses” and was designed mainly for secondary and tertiary care settings, where there are likely to be more “proper diagnoses” than symptoms recorded as the formal diagnosis, coding ability varies according to the contextual setting and culture of data recording.

It is not surprising that ICPC-2 performed lower for this category as it is designed for primary health care setting where mainly it would cover reason for encounter or symptoms rather than diagnoses. Again ICD-10 Condensed Morbidity list proved to be the most inappropriate for the setting.

5.1.3 Coding ability for diagnostic concepts recorded as "symptoms only" at "all" hospitals

For the purpose of this study "symptoms only" are those diagnostic concepts recorded on the patient's folders which are identical or very similar to the patient's presenting complaint, or reason for visiting a health facility, and do not identify the presumed causes of the complaint. Both ICD-10 and ICPC-2 did extremely well at coding "symptoms only" compared to coding "proper diagnoses", with both coding systems achieving 100% for scoring the "symptoms only" diagnoses as either a "2" or a "3". This finding is not surprising for ICPC-2 as it was designed for primary care settings in which it is assumed that many diagnoses would be recorded as "symptoms only", but the high coding ability of ICD-10 with regard to "symptoms only" is quite unexpected. As in previous comparisons, a slight though statistically significant difference was noted between ICD-10 and ICPC-2, but with the latter now, as expected, performing better for this analysis. Not only did ICPC-2 perform better than ICD-10 for overall comparison for the coding of "symptoms only", it also fared the best for highest number of exact match scores, achieving (78%) compared to 72% exact matches for ICD-10. Petersen *et al.*,(2000) explored how terminology used in patient records in a Swedish primary care setting related to codes represented in ICPC-2, by examining whether a textual description of the problem/diagnosis is explicit in the text, and whether the coding system has the ability to code it as is. Their results show that 57% of the diagnostic concepts were an exact match with the coding system, which were reasonably low compared to the results of the current study, suggesting that though ICPC-2 is designed for coding "symptoms only", results may vary according to the environment in which it is used.

Though as noted above it was not surprising for ICPC-2 to perform well for “symptoms only” as it was designed for such data, it was rather unexpected for ICD-10 to perform so well for “symptoms only”. This unexpected finding is paradoxically in line with the finding that proper diagnoses are not clearly elaborated. This is so as symptoms are seldom expressed in short hand as they are already a form of short hand diagnosis. Hence they are recorded in the patient folders in the same or similar way to what they are listed in the coding system, resulting in a good match between the listed codes and the “symptom only” diagnosis. However “proper diagnoses” are listed as fully described “proper diagnoses” in the coding systems and therefore if the tendency of doctors is towards using short hand when recording “proper diagnoses”, then there would be a poor match between those diagnoses and the listed “proper diagnoses” in the coding systems.

Though ICPC-2 performed well for “symptoms only” in this analysis, it is not really helpful, as the most important thing required from a coding system is the recording of “proper diagnoses”. Information on “proper diagnoses” is required for efficient clinical management of individual patients, for assessing the population burden of disease, for managerial operational decision making, for formulating appropriate policies and for equitable resource allocation. Information on symptoms is only really useful for elaboration of a patient case over a period of hospital stay in order to track progress on clinical intervention.

These results on “symptoms only” should however be treated with caution as only a small number of “symptom only” diagnostic concepts (32) were recorded at discharge, hence generalisation of these findings are doubtful.

As in previous analyses, ICD-10 Condensed Morbidity List proved not to be suitable for coding "symptoms only". Fifty three percent of all diagnostic concepts recorded as "symptoms only" did not have any match with the codes in ICD-10 Condensed Morbidity List and hence scored "no match" (0).

5.1.4 Coding ability for "*all*" diagnostic concepts at regional hospitals.

The same analysis as above was repeated for 165 diagnostic concepts recorded from Regional hospitals alone. (See table 8 in the results section). Again ICD-10 was reasonably close to ICPC-2 in terms of its ability to code all diagnostic concepts, with a statistically significant difference noted across both coding systems. A comparative analysis of the two coding systems in terms of their ability to score either a "partial" or "exact" match indicated that ICD-10 did slightly better (82%) than ICPC-2 (79%) but ICD-10 did much better for scoring "exact" matches compared to ICPC-2 (See table 8). It is not surprising that ICD-10 performs better in a regional hospital setting as it was primarily designed for diagnoses in secondary level care settings.

Other positive results for ICD-10 were noted for Regional hospital settings in Canada. A report by the Healthcare Information and Management Systems Society (2009) suggested that the increased level of specificity derived from diagnoses coded in ICD-10 for clinical case costing and decision support reporting, provided relevant data for epidemiological research and other secondary uses of data for population health management. More so ICD-10 allowed for opportunities for clinical data comparisons (diagnoses, outcomes) to advance service delivery and system efficiencies and effectiveness.

While ICD-10 performed well for the settings in this study, ICPC-2 also performed reasonably better with only a difference of 3% lower compared to ICD-10. Considering that this is a regional hospitals setting, it can be argued that ICPC-2 performed reasonably well under the conditions as it was designed for primary health care. However of noting is that as in the previous analyses, ICD-10 Condensed Morbidity list proved to be the most inappropriate for the setting.

5.1.5 Coding Ability for "proper diagnoses" versus "symptoms only" at Regional hospitals

As with the results of the previous comparative analyses, ICD-10 performed better than ICPC-2 in terms of its coding ability for "proper diagnoses" versus "symptoms" at Regional hospitals settings. For this analysis combined scoring for both "partial" and "exact" match of "proper diagnoses" scored 81% in ICD-10 compared to 78% in ICPC-2. Again ICD-10 performed better for "exact" match scores alone compared to ICPC-2.

As for diagnostic concepts recorded as "symptoms only" there was no significant difference between ICD-10 and ICPC-2 for combined matches of "partial" and "exact" match. However ICD-10 was still the best as it provided an "exact" match for all (100%) recorded symptoms compared to ICPC-2 which had 71% scoring an "exact" match. However a large degree of caution is advised for this part of the analysis as only 7 "symptoms only" concepts were analysed for regional hospitals. An interesting element to these findings is that ICD-10 performed better

for symptoms compared to ICPC-2. A rather surprising outcome as ICPC-2 would be expected to perform better as it was designed to enable coding of symptoms.

However a study by Lorentzen (1996) done in Denmark found ICPC-2 to be extremely useful with a high rate of accurate coding. Its ability to code vague diagnoses and general symptoms gave ICPC-2 a high credibility and in some instances, ICD-10 was deemed to be highly inappropriate because it was not as precise in its formulation of general practice problems as ICPC-2. ICD-10 was found to produce a high percentage of faulty codes due to its coding difficulty. However in the same vein, ICPC-2 although being able to code symptoms well, as would be expected, failed to distinguish between common diagnoses. E.g. IDDM (insulin dependent diabetes mellitus) and NIDD (non insulin dependent diabetes).

As before ICD-10 Condensed Morbidity List performed least satisfactorily compared to the other coding systems evaluated in this study.

5.1.6 Coding ability for "*all*" diagnostic concepts at district hospitals.

For District hospitals settings, 137 diagnostic concepts analysed yielded similar results as above in terms of the coding ability of the evaluated coding systems. Again there was a statistically significant difference between the two with ICD-10 again performing slightly better than ICPC-2, with more than half of the analysed concepts scoring an "exact" match and with none of the concepts scoring "no match" ("0").

In their comparison of the ability of the existing coding systems to code data in a primary care setting, Gask *et al.*, (2008) suggest that with the exception of ICPC-2, most coding systems are

unsatisfactory for the primary care setting. This is a consequence of coding systems having been adapted for, rather than developed in primary care settings. In general, coding systems are not considered suitable to capture the complexity of primary care settings, with its associated physical illness and social problems. Specifically, most coding systems do not address in a satisfactory way the problems of co-morbidity and cross-cultural morbidity specifications. Despite the evidence given by Gask *et al.*, (2008), ICPC-2 as with previous comparisons, did not perform better than ICD-10 and neither did it perform better at scoring "exact" matches, hence adding corroborating evidence that ICD-10 is surprisingly more appropriate for this particular primary care setting.

ICD-10 Condensed Morbidity List performed much more poorly than the other two, again confirming it as the least appropriate coding system of the three.

5.1.7 Coding ability for "proper diagnoses" versus "symptoms only" at district hospitals

A significant difference was noted for the ability of the coding systems to code "proper diagnoses" data from district hospitals. ICD-10 managed to score 92% compared to ICPC-2 scoring 67% for their ability to code as "partial" or "exact" match, and in ICD-10 all the concepts could at least be coded to some degree. Because ICD-10 is designed to capture diseases and injuries in detail the results of this analysis were not surprising. However the fact that it performed well in a district hospital setting which is expected to have more "symptoms" than diagnoses were unexpected for this setting.

The same analysis as above elicited different results for 'symptoms only" with ICPC-2 performing significantly better. ICPC-2 performed better for the overall analysis of this sub-set

with as almost half of the concepts scoring an “exact” match (“3”) compared to ICD-10 (28% “exact” match). The results of this sub-set of the study showing that ICPC-2 performed better at coding “symptoms only” found in a district hospital setting is not surprising as ICPC-2 was designed for the primary care setting. One should be cautious though, as the results of this sub section are based on a small sample of 25 “symptom only” concepts. Despite the caution these findings are consistent with the findings by Sampaio *et al.*, (2008) suggesting that ICPC-2 is more than adequate for coding symptoms which is primarily what it was designed for.

Published experience with ICPC-2 confirmed the validity of its key elements and its utility in coding episodes of care for primary care problems. Its ability to code the three essential elements of each clinical encounter namely: the patient's reason for visiting a healthcare service, the clinician's diagnosis, and the resultant procedure, usually permits coding of 95% or more of primary care visits (Gask *et al.*, 2008).

A report by the Research and Development Division of the Newfoundland and Labrador centre for health information (2006) indicates that although ICD-10 has the advantage of international recognition, allowing comparability of data between different settings, the disadvantage is that many symptoms and non-disease conditions presented in primary care are difficult to code with ICD-10. This is primarily due to the fact that ICD-10 was originally designed based on a disease-based structure for mortality statistics. In primary care, many of the conditions treated are vague and ill-defined and can only be classed under symptomatic headings, supporting the finding of this part of the analysis where ICD-10 performed more poorly for “symptom only” diagnostic

concepts in district hospitals settings. However the overall results of this study suggest that ICD-10 performed much better at "symptoms only" in general for this study.

As in previous analyses ICD-10 Condensed Morbidity List performed very badly scoring 64% of the concepts as "0".

5.1.8 Coding ability for "*all commonly*" recorded diagnostic concepts.

The results of this section are based on a comparative analysis of the evaluated coding system's ability to code frequently occurring diagnostic concepts by all hospitals as well as by hospital type as it's clearly important that a coding system is able to code conditions which frequently occur in the setting in which it is being used. As in the previous analyses, ICD-10 was the best (89%) at overall coding for "partial" and 'exact" match scores compared to ICPC-2 (84%). As illustrated in table 14 ICD-10 also performed significantly better than ICPC-2 in terms of "exact" match scores with the latter scoring 43% compared to 57% for ICD-10.

So far ICD-10 has demonstrated consistent results in terms of its coding ability and to support this view a Canadian study by Myers *et al.*, (2007) was compared to these findings. In their validation study to ascertain the coding accuracy of ICD-10 for the most common causes of acute liver failure, Myers *et al.*, (2007) study supports the evidence that ICD-10 is more appropriate and accurate for coding of the common conditions. For the setting evaluated in their study they found that 90% of the common conditions associated with causes of acute liver failure including codes for hepatic necrosis, toxic hepatitis and encephalopathy were accurately coded in ICD-10. Though the above findings are limited to conditions associated with acute liver failure,

these results can be compared with the finding in the current study to ascertain the coding ability of ICD-10 for common conditions.

Though still the least in performance for "exact" match scoring, a significant improvement was noted for ICD-10 Condensed Morbidity List with it doing better with commonly occurring diagnostic concepts compared to its performance in previous analyses.

5.1.9 Coding ability for "*all commonly*" recorded diagnostic concepts at regional hospitals.

For the "commonly" recorded diagnostic concepts in regional hospital settings, once more ICD-10 performed better compared to ICPC-2. Though 1% lower compared to the overall analysis a significant difference was noted for "exact" match scores when comparing with the overall analysis results. Though ICPC-2 had a significant drop in overall scoring ability compared to the overall analysis there was a slight increase in "exact" match scores for "commonly" occurring diagnostic concepts in regional hospitals. These results are supported by Farzandipour (2010)'s cross-sectional study performed in the city of Kashan in Iran with ICD-10 yielding 89% for "exact" match of common conditions.

Cited by Farzandipour (2010) an Australian study by, Henderson, Shepheard, and Sundararajan (2006) reported 85% "exact" match coding in ICD-10 and principal diagnoses coding at the three-digit and four-digit level respectively during 1998–1999, and 87% during 2000–2001, respectively. A systematic analysis in the UK reported an average 84% coding accuracy in their target hospitals.

However some limitations should be considered in interpreting or comparing the above findings to the current study findings since, the variety of diseases prevalent at different hospital types is likely to influence its coding ability.

5.1.10 Coding ability for "*all commonly*" recorded diagnostic concepts at district hospitals.

The following results were yielded for the ability of the coding systems to code "commonly" recorded diagnostic concepts at district hospitals (see table 16). Consistent with previous results for district hospitals, ICPC-2 performed better than ICD-10 for this subset of data with a significant difference noted when compared to the results of "*all*" hospitals as well as regional hospitals. Though ICPC-2 performed better than ICD-10 the latter still performed better at "exact" match ("3") scores. ICPC-2's performance is not surprising as indeed it was designed for a primary health care setting and as such a high score would be expected. As confirmed by Gask *et al.*, (2008), people present to primary care with a wide variety of symptoms, concerns, worries and problems which in this case would pose as a bias for ICPC-2. The results of this analysis highlight the significant differences regarding the nature of conditions found at regional hospitals and those found at district hospitals because service utilization differs between levels of care as well as between urban and rural populations (Mariolis, 2008).

ICPC-2 performed well in the district hospital setting because it has been constructed on the principles of symptoms, complaints and reasons for encounter which are recorded as diagnoses commonly found in such a setting. With ICD-10 not being the most appropriate tool for a primary care classification such findings again would not be surprising.

However the use of ICPC-2 in a primary care setting with low resources can pose a problem. An assessment of such a setting in Cameroon revealed that though ICPC-2 has great flexibility and the ability to keep track of symptoms and diagnosis in an environment where, very often due to poor availability of investigation techniques, the patient diagnoses are labelled at a symptom level. (Research and Development Division of the Newfoundland and Labrador centre for health information 2006).

5.1.11 Coding ability for "*very commonly*" recorded diagnostic concepts

Coding systems should be able to accurately code "very commonly" occurring diagnostic concepts as these would constitute a large proportion of diagnoses recorded in a particular setting. The results of the coding ability of the evaluated coding systems for very common conditions are illustrated in table 15 of the results section. As with previous findings, it was not surprising that again ICD-10 performed exceptionally well by scoring 100% for overall scoring of "exact" and "partial" match scores. Though not statistically different from ICPC-2 in overall coding ability, it is worth noting that whilst ICD-10 had a 0% score for "no match" and "poor" match scores, ICPC-2 had 9% "poor" match scores. Though only 21 concepts were analysed; the results of this important stratum of diagnoses increases one's confidence that ICD-10 is still the most appropriate coding system for this setting.

No comparable findings on "very commonly" occuring diagnoses could be found in the literature. However a study by Galeazzi *et al.,* (2004)'s on the assessment of the reliability of ICD-10 to code diagnoses relating to psychosomatic disorders showed that 75% of the patient diagnoses had "exact" matches. Since psychosomatic disorders are very common in this study,

they can serve as a proxy comparison for all "very common" disorders in their setting. Hence ICD-10's ability to code psychosomatic disorders as exact matches suggest that arguably it is likely to be able to do so for other common disorders as well.

ICD-10 Condensed Morbidity List again proved to be inappropriate to use.

5.2 COMPARISON OF PROCEDURE CONCEPTS CODING ABILITY

The same discussion as for diagnoses is shown below for the results arising from comparing the ability of ICPC-2, ICD-9-CM procedure codes and CCSA-2001 to code procedures found at "*all"* hospitals, procedures found at regional hospitals alone and procedures found at district hospitals alone. Further analysis will be based on "commonly" recorded procedures for "*all"* hospitals, commonly occurring procedures for regional hospitals and commonly occurring procedures for district hospitals.

5.2.1 Coding ability for all procedures concepts.

One hundred and twenty six procedure concepts recorded from district and regional hospitals were analysed to assess the coding ability of ICPC-2, ICD-9-CM and CCSA 2001 (See Table 18 in the results section). The results of this analysis show that CCSA-2001had the best (83%) coding ability for overall ("partial" and "exact" match) scoring compared to ICD-9-CM (65%) and ICPC-2 (39%). CCSA-2001 also performed well for "exact" match scoring (52%) compared to ICD-9-CM (34%) and ICPC-2 (2%). These differences were confirmed as significant via a statistical significance test.

CCSA-2001 is a South African coding system developed from the modification and customization of CPT (Current Procedure Terminology) by the South African Medical Association licensed by the America Medical Association. It was designed to provide a complete set of codes applicable to medical procedures specifically rendered by doctors in South Africa and to allow the capturing of information required for the management of costs in line with international developments (SAMA, 2001, Ferreira 2010). Based on the above, it is therefore not surprising that CCSA-2001 would perform well for the current setting. It would of course be easier to recommend the selection of a procedure coding system for South Africa with CCSA already as the de facto standard in some environments in the country.

ICD-9-CM is designed to describe not only the clinical management of individual patient problems, but can also be used to generate indicators of health care procedures for Diagnostic Related Groups for hospital reimbursement. In the United States of America ICD-9-CM Procedure Codes have been used to report and compile health data for evaluation and planning of the health care delivery system as well as to conduct epidemiological and clinical research (Commission on Professional and Hospital Activities, 1978).

Some study findings have highlighted the significant relationship between the ability of the coding system to code the diagnoses or procedures and proper documentation and elaboration of those diagnoses and procedures in patient folders. In Holt *et al.*, (2010)'s assessment of the coding ability of CPT using 351 randomly selected visit notes from North East Tennessee region, the results showed a significant inability to code some procedures based on the following 2 factors: (i) approximately 33% of patient visits were "partially" coded based on deficiencies in

the written documentation. (ii) Approximately 80% of the visits were "partially" coded based on the total number of problems which the patient presented during the visit. According to Holt *et al.,* (2010) these problems can be associated with "lack of exploring problems mentioned by the patient and not documenting additional work that was performed". Hence modification of CPT and by implication CCSA-2001 to cover problems mentioned by the patient and additional work likely to be performed in a particular setting would be useful.

The view above is evident also in Farzandipour and Sheiktaheri (2009)'s evaluation study on the accuracy of procedural coding and the factors that influence it. They found that documentation of procedures by the clinician positively affected coding accuracy and moreover, that records with no abbreviations had fewer coding errors. Therefore not using abbreviations, ensuring more readable documentation, and paying more attention to recording available information, increases coding ability and the quality of information available in procedure databases. The above view illustrates the importance of elaboration when recording patient discharges which is also supported by Farhan *et al.,* (2005) in their evaluation of diagnostic coding systems.

CCSA-2001 was developed primarily to provide a standard method to accurately describe medical, surgical and diagnostic procedures, in an effective and reliable manner within the South African context. However a seemingly contradictory view was found by Chute *et al.,* (1996). In their assessment of the coding ability of several systems, their results show that CPT (international version of CCSA-2001) yielded a significantly lower score (0.90) compared to ICD-9-CM (1.61) for the ability to code procedures. This is however not necessarily contradictory but perhaps confirms that in order for CPT to be effective in the South African setting it required modification. This suggests that CCSA-

2001 which was adapted for the South African setting is certainly likely to be more appropriate than CPT and could be expected to compete favourably with other coding systems. It should therefore be no surprise that in this setting it performed better than ICD-9 CM.

Also noteworthy is that although ICD-9-CM performed much better than ICPC-2, it also had the highest number of cases that could not be coded. It could therefore be argued that although ICPC-2 is comparatively lower in overall scores compared to ICD-9-CM, it may well be that ICPC-2 is more appropriate to use as only 2% of procedures could not be coded compared to 17% in ICD-9-CM.

5.2.2 Coding ability for procedure concepts at regional hospitals

When comparing the coding system's ability to code procedures at regional hospitals using 81 concepts (see table 19 in the results section), the results were not very different compared to the previous analysis using "all" hospitals. The gap between CCSA-2001 (88%) and ICD-9-CM (71%) was not much different compared to the analysis above for all procedure concepts. Again CCSA-2001 performed comparatively better than both other coding systems with ICPC-2 again performing worst for this analysis. Though ICPC-2 performed comparatively worse (38%) than ICD-9-CM (71%) for overall scoring ability of "partial" and "exact" match scores, of note is that the latter again had a higher number of concepts that could not be coded at all (8%) compared to (4%) for ICPC-2.

These differences were assessed via a Friedman Chi square statistical test that showed a significant difference between the evaluated coding systems. Again a huge gap was noted between CCSA-2001 and ICD-9-CM in terms of their ability to score "exact" match with the latter performing worse. Though these results suggest that ICD-9-CM is comparatively not as good as CCSA-2001contradicting results were yielded in a study by Fisher *et al.,* (1992) in regional hospital setting with 78% of the ICD-9-CM procedures concepts being coded with "exact" match for ICD-9-CM .

5.2.3 Coding ability for procedure concepts at district hospitals

Though a significant drop was noted compared to the results of the previous analysis CCSA-2001 still performed better than the rest of the coding systems evaluated with almost half (49%) of the procedure concepts scoring an "exact" match compared to 38% of the procedure concepts scoring an "exact" match for ICD-9-CM. Again ICPC-2 performed worst for procedures at district hospitals but there was slight improvement compared to the analysis for regional hospitals. However, for district hospitals, 20% of the procedures could not be coded in ICD-9-CM at all (scored '0') which is a clinically significantly high number of concepts that could not be coded. With this in mind, it could be argued that even if ICPC-2 performed worst for overall "partial" and "exact" scoring, comparatively it performed better than ICD-9-CM as none of the concepts scored "no match" in ICPC-2. CCSA-2001 performed well for this setting with 75% of the procedure concepts scoring "partial" and "exact" matches.

A similar study by Murray *et al.,* (1994) on the coding ability of CCSA in rural hospitals settings showed that on average 61% of the procedures at district hospitals are accurately coded.

Although this is a reasonably high number, the study further concludes that the reason why this number is not higher is because of two factors, namely the nature of health conditions and their associated interventions found in these settings. Despite the decreased ability of CCSA-2001 to code rural and district hospital procedures as well as regional hospital procedures it was still substantially better at doing so than the other two coding systems.

5.2.4 Coding ability for "commonly occurring" procedures concepts.

The results of this section are based on a comparative analysis of the evaluated coding systems ability to code commonly occurring procedure concepts by all hospitals as well as by hospital type. Common procedures evaluated in this study were deemed important to assess separately in view of the same criteria used for diagnoses in 5.1.8 of this chapter.

Though a significant improvement was noted (see table 21) for ICPC-2 (71%) for its coding ability for common procedures, with a large number of procedure concepts scoring an "exact" match (42%), compared to previous analyses, it still performed worst compared to ICD-9-CM and CCSA-2001. Though the latter performed better for overall "exact" and "partial" match scores, ICD-9-CM was unequivocally the best for this analysis as 70% of the concepts scored 3 ("exact" match).

Important to note is that all the coding systems managed to code the diagnoses to some degree. Again these results should be taken with caution as they are based on only 17 procedure concepts analysed for the frequently occurring concepts for all hospitals. When comparing these results to

that of De Coster *et al.,* (2008), in their study to evaluate the validity of ICD-9-CM in 4 academic hospitals in Alberta, Canada, they found that of the 4008 randomly selected procedure codes evaluated, ICD-9-CM coded the more major or invasive procedures reasonably well, but did not perform so well for less invasive or minor procedures. They still asserted that ICD-9-CM can be used by health services and population health researchers with much confidence.

5.2.5 Coding ability for "commonly occurring" procedures concepts at regional hospitals

For the analysis using commonly occurring concepts at regional hospitals, CCSA-2001 proved again to be the most appropriate. A slight improvement was noted for overall scoring when comparing with the results of the analysis for commonly occurring procedures for all hospitals. More so a significant improvement for "exact" matches were also noted when compared with the previous analysis. However ICD-9-CM dropped significantly compared to the previous analysis for "exact" matches.

Though ICD-9-CM has often been used to code specific procedures, certain procedures may not be accurately reflected by ICD-9-CM codes Benesch *et al.,* (1998). They assessed the accuracy of ICD-9-CM procedure coding for cerebrovascular diseases (commonly found in regional hospitals) by comparing ICD-9-CM codes with procedures from medical records. Results of the medical record review were compared with the ICD-9-CM codes from the administrative database. More than 85% of those procedures did not have an "exact" match. These findings suggest that ICD-9-CM is unequivocally an unsuitable coding system for coding all procedure concepts recorded for this study. However caution should be applied to the above study results as their findings are limited to procedures based on cerebrovascular conditions.

Supporting the above findings is a comparative evaluation of ICD-9-CM and CCSA-2001 for their ability to code spinal procedures in specific detail by Faciszewski *et al.*, (2003). Using data on lumbar spine surgery patient's procedures from six teaching institutions the results of the study indicate that overall, CCSA-2001 codes reflected a greater level of detail than ICD-9-CM codes and that ICD-9-CM codes tend to under represent the complexity of the surgical procedures actually performed

Cooper *et al.*, (1999)'s study on the evaluation of coding ability using ICD-9-CM in a regional hospital setting in the USA had contradictory results for ICD-9-CM compared to the current study. Though limited to common endoscopic procedures associated with gastrointestinal conditions, their results showed 98% coding ability for ICD-9-CM. Though limited to endoscopic procedures only and thus to be treated with caution, the results by Romano and Luft cited by Cooper *et al.*, (1999) supports the finding of the current study. In their investigation to examine coding ability for endoscopy procedures using ICD-9-CM in a cohort of California hospital discharges, of the 87 procedure cases that were analysed, 99.9% were "exactly" matched in ICD-9-CM.

5.2.6 Coding Ability for "commonly occurring" procedure concepts at District hospitals

Though ICPC-2 performed better than ICD-9-CM for combined scoring of "partial" and "exact" matches and was second best to CCSA-2001, it still came out as the worst of the three. Again ICD-9-CM came second best to CCSA-2001 with 40% exact matches compared to 70% for CCSA-2001. In support of this view are O'Malley *et al.*, (2005) who argue that coding accuracy is likely to be influenced by clear recording of disease with a clear definition on observable signs

and symptoms. Alexander *et al.*, (2003) proposes that complete and concise physician documentation is paramount, in accurate documentation for appropriate coding and reimbursement.

5.3 PROFILE OF DIAGNOSES AND PROCEDURES ANALYSED

In relation to the above findings this part of the discussion chapter will provide further elaboration of the context of the study setting, so as to describe the variety of diagnoses and procedures data collected in this setting, in view of the potential impact of case mix on each of the coding systems. The section will particularly address the degree of precision with which the diagnostic data was recorded at district and regional hospitals. i.e. contrasting "proper diagnoses" against "symptoms" diagnostic concepts. Seasonal and geographical variations of when and where the data was collected will be discussed as well to assess their effect on the evaluation of the coding systems.

5.3.1 Range of diagnostic concepts

When looking at the implications of the different hospital settings where the data was collected although there was a considerable overlap, there were also mutually exclusive diagnostic concepts recorded between regional hospitals and district hospitals. If only regional hospitals diagnostic concepts were used, then 25% of the total diagnostic concepts (See fig 1) would have been missed. Conversely if only district hospitals diagnostic concepts were used, then 38% of the total diagnostic concepts would have been missed. Hence it was fortuitous to have assessed both district and regional settings as otherwise this evaluation of the coding systems may have applied to only one level of care setting. Note that the key finding that ICD-10 is the most appropriate

coding system for diagnostic concepts may therefore not apply to the other levels of care and types of facilities which were not assessed, such as primary care clinics, tertiary hospitals and specialized hospitals.

5.3.1.1 "Proper diagnoses" versus "Symptoms only" diagnostic concepts.

The diagnostic concepts data extracted from the Regional hospitals setting were mostly "proper diagnosis" specific compared to data from the district hospital settings which had a greater proportion of "symptoms only" diagnoses. The implication of this is that a bias could be introduced giving an erroneous impression that one coding system is performing much better than the others depending on the type of diagnostic data used. For example in this study and generally ICPC-2 performs better than the other coding systems for diagnostic concepts recorded as "symptoms only" since the number of cases recorded as "symptoms only" were relatively small with only 4% being present at regional hospitals and 18% at district hospitals ICPC-2 did not fare as well as ICD-10. With a high proportion of symptoms recorded from district hospitals and a much lower proportion recorded from regional hospitals both of which is also not unusual, confidence can be drawn that the coding systems were tested or evaluated based on conditions that are a true reflection of the settings evaluated.

In comparing the above to a district hospital setting in the Eastern Cape, Brueton *et al.,* (2010)'s cross sectional survey study on primary care morbidity showed that of the total 6 856 symptoms that were recorded across the 3 sites investigated "symptom only" categories made up 47% of recorded diagnostic concepts and "proper diagnoses" were recorded in 53% of the recorded cases. Furthermore their study revealed that 13% of the patients had no symptom and no

diagnosis recorded, which means that in a case like this, where a large proportion of conditions are missing, the data may not be representative enough to reflect conditions seen in that setting.

5.3.2 Range of Procedure concepts

Regarding procedures it was noted that the data collected at district hospitals also varied significantly from data collected from regional hospital settings. This can be attributed to the fact that district hospitals, by nature of the services being rendered, would not be able to cover some of the procedures required by the patients and therefore would have to do a lot of referrals to secondary level hospitals, who have the skills and resources to perform those procedures. It is therefore not surprising that 63% of the procedures seen in this study were from regional hospitals only compared to 17% from district hospitals only. Of these, 20% were over lapping between district and regional hospitals.

5.3.3 Seasonal variations

Data was collected over a period of 22 months on different days of the week including weekends. The purpose of this was to ensure that data collected was representative of any conditions that may appear at certain times of the year, weekdays and weekends. It was thereby hoped to avoid seasonal or week day variation which could introduce a potential bias towards certain conditions occurring or noted at certain times, e.g. if data was collected at times when there was an infectious disease outbreak, the implication would be that most of the diagnostic concepts collected at the time would not be able to give a true reflection of the mix of the cases being seen, as a large proportion of typical of diagnoses and procedures performed could be crowded out by the outbreak admissions.

Similar methods were followed in the Brueton *et al.,* (2010) survey where the study was strengthened through the collection of data during winter and summer months to account for seasonal variations in disease presentation.

5.4. OTHER FACTORS TO CONSIDER WHEN CHOOSING A CODING SYSTEM

While specificity of the code and appropriateness of the settings of the coding systems has been the focus of the study, it is just one of the multiple components of decision making about codes. Other factors include training requirements, the cost of material (such as coding books and software) licensing requirements and the ease of use of the coding system.

The most appropriate coding system was identified on the basis of its ability to score the highest frequencies for accurate and complete scoring and to accurately reflect common diagnoses and procedures in comparison with other coding systems. An overall assessment should also take into consideration coding difficulty, user friendliness, time taken to code, prior experience with and the practicality of the coding system for the setting.

The major criterion used to qualify a coding system as the most appropriate coding system is that it should hold the potential to capture the most important elements of all health problems in a particular setting. The coding system should also be able to capture most of the concepts recorded in the patient records. The overall analyses of the scores were on the basis that there will be a single coding standard for both district and regional hospitals as a pragmatic requirement for a national standard.

Taking all the above into account, it would be reasonable to recommend ICD-10 as the most appropriate coding system for the setting because it managed to score most of the diagnoses in exact score categories.

Similarly it is reasonable to recommend CCSA-2001 as the most appropriate coding system for the setting because of the same reasons stipulated above.

5.5 LIMITATIONS

The scoring of the data was based on an objective standardised ordinal ranking scale. However subjectivity could have infiltrated through the allocation of scores based on the researchers' subjective opinion and therefore the results may have been biased although a strenuous attempt to prevent this was attempted by include other coding experts input on the scoring.

5.5.1 Sample size

Because this was an exploratory study, the sample size selected was small except for conditions and procedures associated with medical wards. E.g. the diagnoses types and procedures stratified by ward type were noticed to range between 2% and 45%.

5.5.2 Sampling Bias

It was envisioned in the study that at least 15% of the data would be collected from each ward to adequately represent each of the ward types stratified for sampling. However for district and regional hospitals, data from trauma, paediatric and orthopedic wards represented less than the 15% each that was envisioned. Most of the diagnoses collected were from medical wards (45%) and surgical wards (28%) with the least from paediatric (6%), trauma (7%) and orthopedic (5%)

wards. The results are therefore more reflective of medical and surgical diagnoses and procedures, and less appropriate for trauma, pediatric, orthopedic diagnoses and procedures as a small number of concepts were analysed for these categories. Also the convenience sampling imposed on the study due to ethical considerations prevented diagnoses on and procedures from deceased patients being included in the study.

5.5.4 Proxy Diagnoses

As proposed by Campbell *et al.,* (1997) a coding system should have a compositional structure, meaning that whether the concept id coded as single or multiple individual concepts, the coding system must be able to combine the description logic and identify them as the same condition. In this study the use of "retroviral disease" as a proxy for HIV was noted and taken into consideration.

Proxy diagnoses in this study applied only to HIV/AIDS. The hospitals where data was collected for this study had different variations of recording HIV. While some hospitals recorded HIV as "HIV+" other hospitals, mainly in the rural areas, used "retroviral disease" as a proxy for HIV+. Because the researcher was aware of such a proxy, all "HIV+" cases and "retroviral disease" cases were coded as the same diagnoses. Potential implications this can have is that, if proxies are not taken into consideration, this would result in under reporting of those diagnoses due to poor matching of proxy diagnosis in the coding system.

5.6 SUMMARY OF MAJOR FINDINGS

The major finding of the study is that there are striking differences between the evaluated coding systems with regard to their ability to code diagnoses and procedures in the evaluated District and Regional hospitals in the Western Cape. For ***diagnoses***, the following observations were noted:

- ICD-10 covers the scope of clinical diagnoses in more accurate and specific detail than ICPC-2 and ICD-10 CL.

- ICD-10 has a high level of specificity and accuracy for reflecting "proper diagnoses" as well as "symptoms only" diagnoses.

- ICD-10 allows for the detailed reflection of clinical details of diagnoses.

- ICD-10 is able to code conditions at regional hospitals better than those at district hospitals.

- Although ICPC-2 is simpler and easier to use, and requires less training than ICD-10, its level of specificity is not as detailed as that of ICD-10

- ICPC-2 has proved ideal for "symptoms only" rather than for "proper diagnoses".

- ICD-10 Condensed Morbidity List (ICD-10-CL) is not designed to capture detailed aspects of patient care and therefore was unequivocally not appropriate for coding conditions in this setting.

For ***procedures*** coding the following findings were noted:

- CCSA-2001 has proved to the most appropriate system to cover accurate and specific clinical patient procedures recorded in this setting compared to other coding systems.

- ICD-9-CM Procedure Codes was less appropriate and did not allow for the classification of referrals, e.g. institution types and services especially as these were very common for district hospitals.

- ICPC-2 was the worst for coding procedures across all stratifications in the evaluated setting.

CHAPTER 6

6.1 CONCLUDING REMARKS AND RECOMMENDATIONS

Below is a brief summary of concluding remarks from the study and recommendations arising from the study findings

6.1.1 Diagnostic Coding Systems

- The results from this study indicate that ICD-10 is an appropriate *diagnostic* coding system in the environment studied namely: district and regional public hospitals in the Western Cape province of South Africa, because it performed well across all analysed data for "exact' match scores as well as combined "partial" and "exact' match scores.

- ICD-10 also performed well for d*iagnostic* concepts recorded as "*proper*" diagnoses. Though not better than ICPC-2 it still performed significantly well for concepts recorded as "*Symptoms*".

- The fact that ICD-10 is the current national standard for diagnostic coding in South Africa makes its recommendation more likely to be accepted.

- ICPC-2 could be a reasonable candidate to be recommended as an appropriate diagnostic coding system due to its advantage of being easy to use and the fact that the coding ability compared to ICD-10 for combined "partial" and "exact" diagnoses is not much different.

- While ICPC-2 performed second best to ICD-10 it performed better for symptoms than any other evaluated coding system in the study. Furthermore ICPC-2 performed well for

conditions found in district hospital settings. If a separate coding system was required for primary health care setting, ICPC-2 could be the recommended first choice coding system. The disadvantage however is that it is currently not commonly used in South Africa.

- Based on the outcome of the study ICD-10 Condensed Morbidity list cannot be recommended for use due to its poor performance in coding ability for diagnoses across all strata.

6.1.2 Procedure Coding Systems

- For *procedures* CCSA- 2001 proved to be the most appropriate coding system for the environment studied compared to other procedure coding systems. Its ability to perform consistently better than the other coding system across both district and regional public hospitals setting studied makes it the first choice coding system for this setting.

- ICD-9-CM is not really suitable for coding *procedures* as it failed to code a significant number of conditions found in the studied environments. While ICD-9-CM managed to code a large proportion of procedure concepts, it still performed poorer than CCSA-2001 in all aspects assessed.

- ICPC-2 cannot be recommended for use as it was unable to code most procedures across all strata in the environment studied.

6.1.3 Incidental Findings

- The expansion or amendment of the 'HIV/AIDS' code to include 'retroviral disease' as a proxy will be of great benefit for statistical purposes as this will minimise the under reporting of HIV due to variation in recording by different institutions and doctors.

6.2 RECOMMENDATIONS

- The results arising from this study supports the recommendation of ICD-10 for *diagnosis* coding and CCSA-2001 for *procedure* coding as the appropriate coding systems for the setting in the Western Cape and it is likely to be appropriate for the rest of South Africa as well.
- Due to its easy usage nature and reasonable overall performance, ICPC-2 is recommended as a possible alternate candidate for use as a diagnostic coding system.

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APPENDIX I

DIAGNOSES CONCEPTS SCORING BY INDIVIDUAL REGIONAL HOSPITALS

DIAGNOSES BY INDIVIDUAL REGIONAL HOSPITALS													
Regional Hospital 1		*ICPC-2 Scores*				*ICD-10 Scores*				*ICD-10-CL Scores*			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	110	1	26	**37**	**46**	1	20	**35**	**53**	34	18	**46**	**12**
		1%	24%	**33%**	**42%**	1%	18%	**33%**	**48%**	31%	16%	**42%**	**11%**
		Overall of 2 & 3 Scores ***75%***				***Overall of 2 & 3 Scores*** ***81%***				***Overall of 2 & 3 Scores*** ***53%***			
Regional Hospital 2		*ICPC-2 Scores*				*ICD-10 Scores*				*ICD-10-CL Scores*			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	59	0	9	**36**	**14**	0	3	**25**	**31**	17	36	**1**	**5**
		0%	15%	**61%**	**24%**	0%	5%	**42%**	**53%**	29%	61%	**2%**	**8%**
		Overall of 2 & 3 Scores ***85%***				***Overall of 2 & 3 Scores*** ***95%***				***Overall of 2 & 3 Scores*** ***10%***			
Regional Hospital 3		*ICPC-2 Scores*				*ICD-10 Scores*				*ICD-10-CL Scores*			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	60	0	10	**35**	**15**	0	10	**22**	**28**	10	32	**10**	**8**
		0%	17%	**58%**	**25%**	0%	17%	**37%**	**46%**	17%	53%	**17%**	**13%**
		Overall of 2 & 3 Scores ***83%***				***Overall of 2 & 3 Scores*** ***83%***				***Overall of 2 & 3 Scores*** ***30%***			

APPENDIX II

DIAGNOSES CONCEPTS SCORING BY INDIVIDUAL DISTRICT HOSPITALS

DIAGNOSES BY INDIVIDUAL DISTRICT HOSPITALS													
Hospital 1	**59**	**ICPC-2 Scores**				***ICD-10 Scores***				***ICD-10-CL Scores***			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
		0	10	**27**	**22**	0	10	**16**	**33**	15	31	**4**	**9**
		0%	17%	**46%**	**37%**	0%	17%	**27%**	**56%**	25%	53%	**7%**	**15%**
		Overall of 2 & 3 Scores ***83%***				***Overall of 2 & 3 Scores*** ***83%***				***Overall of 2 & 3 Scores*** ***22%***			
Hospital 2	**49**	**ICPC-2 Scores**				***ICD-10 Scores***				***ICD-10-CL Scores***			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
		0	1	**21**	**27**	0	4	**18**	**27**	10	14	**18**	**7**
		0%	2%	**43%**	**55%**	0%	8%	**37%**	**55%**	20%	29%	**37%**	**14%**
		Overall of 2 & 3 Scores ***98%***				***Overall of 2 & 3 Scores*** ***92%***				***Overall of 2 & 3 Scores*** ***51%***			
Hospital 3	**58**	**ICPC-2 Scores**				***ICD-10 Scores***				***ICD-10-CL Scores***			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
		1	14	**19**	**21**	0	5	**20**	**30**	15	26	**9**	**5**
		2%	25%	**35%**	**38%**	0%	9%	**36%**	**55%**	28%	47%	**16%**	**9%**
		Overall of 2 & 3 Scores ***73%***				***Overall of 2 & 3 Scores*** ***91%***				***Overall of 2 & 3 Scores*** ***25%***			

APPENDIX 111

PROCEDURES CONCEPTS SCORING BY INDIVIDUAL REGIONAL HOSPITALS

PROCEDURES BY INDIVIDUAL REGIONAL HOSPITALS													
Regional Hospital 1		*ICPC-2 Scores*				*ICD-9-CM Scores*				*CCSA-2001 Scores*			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	35	0	18	**12**	**5**	4	3	**12**	**16**	0	1	**16**	**18**
		0	51%	**35%**	**14%**	11%	9%	**34%**	**46%**	0%	3%	**46%**	**51%**
		Overall of 2 & 3 Scores ***49%***				***Overall of 2 & 3 Scores*** ***80%***				***Overall of 2 & 3 Scores*** ***97%***			
Regional Hospital 2		*ICPC-2 Scores*				*ICD-9-CM Scores*				*CCSA-2001 Scores*			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	38	2	17	**16**	**3**	6	1	**15**	**16**	0	1	**15**	**21**
		5%	45%	**42%**	**8%**	16%	3%	**39%**	**42%**	0%	3%	**39%**	**58%**
		Overall of 2 & 3 Scores ***50%***				***Overall of 2 & 3 Scores*** ***81%***				***Overall of 2 & 3 Scores*** ***97%***			
Regional Hospital 3		*ICPC-2 Scores*				*ICD-9-CM Scores*				*CCSA-2001 Scores*			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	34	0	23	**8**	**3**	4	4	**10**	**16**	1	6	**13**	**14**
		0%	68%	**23%**	**9%**	12%	12%	**29%**	**47%**	3%	18%	**38%**	**41%**
		Overall of 2 & 3 Scores ***32%***				***Overall of 2 & 3 Scores*** ***76%***				***Overall of 2 & 3 Scores*** ***79%***			

APPENDIX IV

PROCEDURES CONCEPTS SCORING BY INDIVIDUAL DISTRICT HOSPITALS

PROCEURES BY INDIVIDUAL DISTRICT HOSPITALS													
District Hospital 1		*ICPC-2 Scores*				*ICD-9-CM Scores*				*CCSA-2001 Scores*			
		0	*1*	*2*	*3*	*0*	*1*	*2*	*3*	*0*	*1*	*2*	*3*
	33	0	22	**4**	**7**	6	14	**3**	**10**	1	13	**6**	**13**
			67%	**12%**	**21%**	18%	43%	**9%**	**30%**	3%	39%	**18%**	**40%**
		Overall of 2 & 3 Scores *33%*				***Overall of 2 & 3 Scores*** *39%*				***Overall of 2 & 3 Scores*** *58%*			
District Hospital 2		*ICPC-2 Scores*				*ICD-9-CM Scores*				*CCSA-2001 Scores*			
		0	*1*	*2*	*3*	*0*	*1*	*2*	*3*	*0*	*1*	*2*	*3*
	31	0	14	**15**	**2**	7	3	13	8	0	5	**9**	**17**
		0%	45%	**49%**	**6%**	22%	10%	42%	26%	0%	16%	**29%**	**55%**
		Overall of 2 & 3 Scores *55%*				***Overall of 2 & 3 Scores*** *68%*				***Overall of 2 & 3 Scores*** *84%*			
District Hospital 3		*ICPC-2 Scores*				*ICD-9-CM Scores*				*CCSA-2001 Scores*			
		0	*1*	*2*	*3*	*0*	*1*	*2*	*3*	*0*	*1*	*2*	*3*
	29	2	9	**16**	**2**	7	2	**10**	**10**	0	0	**10**	**19**
		7%	31%	**55%**	**7%**	24%	7%	**34%**	**34%**	0%	0%	**34%**	**66%**
		Overall of 2 & 3 Scores *62%*				***Overall of 2 & 3 Scores*** *68%*				***Overall of 2 & 3 Scores*** *100%*			

APPENDIX V

ALL RECORDED INDIVIDUAL DIAGNOSTIC CONCEPTS AND ASSOCIATED SCORES BY CODING SYSTEM IN ALPHABETICAL ORDER.

		ICPC-2 SCORES				ICD-10 SCORES				ICD-10CL SCORES			
Diagnoses	**Freq**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
1. Abscess on Jaw	1			2				2			1		
2. Alcohol Gastritis	1			2					3		1		
3. Angina	1			2					3			2	
4. Ankle Injury	1		1					2			1		
5. Arrhythmia	1				3				3		1		
6. Ataxia	1		1						3	0			
7. Atrial fibrillation	1			2				2				2	
8. Bed ridden	1	0					1			0			
9. Blood Stools	1				3			2			1		
10. Blunt Head Trauma	1			2				2			1		
11. Bulimia	1				3				3		1		
12. Burn Wounds	1			2			1			*			
13. Butterfly Rash	1		1				1			0			
14. Cardiomegaly	1			2					3			2	
15. Cardiovascular disease	1				3				3			2	
16. Chest Infection	1			2			1				1		
17. Cholecystitis	1			2					3			2	
18. Chronic Use of Indecit	1	0						2		0			
19. Complicated Hypertension	1				3			2				2	
20. Confusion	1		1				1			0			
21. Constipation	1			2					3		1		
22. Crushing head Injury	1			2					3		1		
23. Deodenal bleeding	1			2				2			1		

		ICPC-2 SCORES				ICD-10 SCORES				ICD-10CL SCORES			
Diagnoses	**Freq**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
24. Depression	1			2					3			2	
25. Dermatitis	1			2					3		1		
26. Difficulty breathing	1				3			2		0			
27. Displaced Ulna	1		1				1					2	
28. Dysphagia	1			2					3	0			
29. Eczema	1			2			1					2	
30. Elevated blood pressure	1				3		1						3
31. Enlarged testes	1			2			1				1		
32. Epigastric cramps	1			2			1					2	
33. Facial Cellulitis	1	0							3		1		
34. Facial paralysis	1				3		1				1		
35. Fear of HIV results	1				3		1			0			
36. Fecal impaction	1			2				2			1		
37. Foot cellulitis	1		1					2			1		
38. Fractured Elbow	1			2				2			1		
39. Fractured metatarsal	1			2					3		1		
40. Fractured Tibia 41. (with distal Tibia)	1			2					3		1		
42. Ganglion	1			2					3		1		
43. Gangrene (With NIDDM)	1			2				2			1		
44. Gastric bleed	1		1				1				1		
45. Gastric cancer	1			2				2			1		
46. Gastroenteritis	1			2				2			1		
47. Gastrointestinal infection	1				3			2					3
48. Gout	1				3				3		1		
49. Gun Shot Wound	1		1					2		0			

		ICPC-2 SCORES				ICD-10 SCORES				ICD-10CL SCORES			
Diagnoses	**Freq**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
50. Haemopneumothorax bleed	1		1						3		1		
51. Head Injury	1				3				3		1		
52. Head Swelling	1			2				2		0			
53. Heart Failure	1				3				3				3
54. Heart valve leakage	1			2				2			1		
55. Heartburn	1				3				3	0			
56. Hemorrhage	1			2					3	0			
57. Hepatic Failure	1			2					3		1		
58. Hepatitis	1			2				2				2	
59. High Blood Pressure	1				3			2			1		
60. Hypoglycemia	1				3				3		1		
61. Hypothyroid	1			2					3		1		
62. Hysteria	1			2			1				1		
63. Ischemic Heart Disease	1			2					3			2	
64. Incontinence	1				3				3	0			
65. Induced abortion	1				3			2				2	
66. Irregular heart beat	1		1						3	0			
67. Joint pain	1			2					3			2	
68. Liver cirrhosis	1			2					3		1		
69. Liver Laceration	1		1					2			1		
70. Loss of Consciousness home Injury	1		1					2		0			
71. Lung Abscess	1			2				2			1		
72. Malaria	1				3				3				3
73. Metastatic Cancer	1			2					3		1		
74. Migraine	1				3				3			2	
75. Miscarriage	1			2					3		1		

		ICPC-2 SCORES				ICD-10 SCORES				ICD-10CL SCORES			
Diagnoses	**Freq**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
76. Monoparesis	1			2				2				2	
77. Muscular pain	1				3		1				1		
78. Myalgia	1			2					3		1		
79. Myocardial Infarction	1			2				2				2	
80. Nappy Rash	1			2				2			1		
81. Neck Stiffness	1		1					2			1		
82. Neglect	1		1						3		1		
83. Neurotic testes	1			2			1				1		
84. Night Sweat	1		1					2		0			
85. Open Wound	1			2					3		1		
86. Oral thrush	1			2			1				1		
87. Organophosphate poisoning	1		1				1			*			
88. Paraffin Ingestion	1		1					2			1		
89. Paralysis	1			2				2				2	
90. Paraplegic	1		1						3		1		
91. Peripheral oedema	1			2				2		0			
92. Plueritic chest pain	1			2			1				1		
93. Pregnancy termination	1				3				3				3
94. Psoriasis	1				3				3			2	
95. Pulmonary Embolism	1			2					3				3
96. Pyoderma	1			2					3			2	
97. Recurrent Bowel obstruction	1			2				2			1		
98. Retinopathy	1				3			2				2	
99. Rheumatic Heart Disease	1				3				3		1		
100. Septic Gout	1			2				2			1		

		ICPC-2 SCORES				ICD-10 SCORES				ICD-10CL SCORES			
Diagnoses	**Freq**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
101. Sharp assault head	1		1					2			1		
102. Shoulder Injury	1		1						3		1		
103. Small Bowel Obstruction	1		1					2				2	
104. Sore throat	1			2					3	0			
105. Speech disorder	1				3			2		0			
106. Spontaneous abortion	1				3				3				3
107. Stomach Cancer	1			2					3		1		
108. Stomach Cancer	1			2					3		1		
109. Stomach Swelling	1		1					2		0			
110. Superior vena cava syndrome	1		1					2			1		
111. Sweat rash	1			2				2		0			
112. Swelling	1				3		1				1		
113. Swollen Ankle	1			2			1				1		
114. Swollen Face	1		1				1			0			
115. Throat Wound	1		1				1				1		
116. Throat Abscess	1		1					2			1		
117. Tiredness	1			2				2		0			
118. Underweight	1			2			1			0			
119. Upper Respiratory Infection	1				3				3		1		
120. Urinary Incontinence	1				3				3	0			
121. Weakness	1			2			1			0			
122. Acute Myocardial Infarction	2				3				3				3
123. Alcohol Abuse	2				3			2				2	
124. Anaemia	2				3				3			2	
125. Breast Abscess	2			2				2				2	

		ICPC-2 SCORES				ICD-10 SCORES				ICD-10CL SCORES			
Diagnoses	**Freq**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
126. Cancer?	2			2							1		
127. Cardio Vascular Accident	2			2				2			1		
128. Convulsions	2				3			2			1		
129. Diabetes Type ii	2			2				2				2	
130. Dizziness	2			2					3	0			
131. Ectopic pregnancy	2				3				3			2	
132. Effusion in Peritonium	2	0					1			0			
133. Fractured Hip	2			2				2			1		
134. Haemoptysis	2				3				3	0			
135. Laceration	2			2				2			1		
136. Loss of consciousness	2		1					2		0			
137. Lumbago	2			2			1				1		
138. Lymphodenopathy	2			2				2		0			
139. Malaise	2			2				2		0			
140. Meningitis	2				3				3		1		
141. Otitis Media	2			2					3		1		
142. Overdose	2			2				2				2	
143. Pill Overdose	2			2			1				1		
144. Pleural effusion	2				3				3			2	
145. Semi Puncture Wound	2		1					2		0			
146. Sinusitis	2			2				2			1		
147. Sub-conjuctival bleed	2		1				1			0			
148. Unconsciousness	2		1					2		0			
149. Urinary tract infection	2		1						3			2	
150. Viral Meningitis	2			2					3		1		
151. Acute lower	3		1						3			2	

respiratory infection													
		ICPC-2 SCORES				**ICD-10 SCORES**				**ICD-10CL SCORES**			
Diagnoses	**Freq**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
152. Arthritis	3			2					3			2	
153. Cerebrovascular accident	3				3		1				1		
154. COAD	3			2				2				2	
155. Emphysema	3			2					3			2	
156. Gangrene	3			2					3	0			
157. Incomplete Abortion (With pelvic bleeding)	3			2					3		1		
158. Pelvic Inflammatory Disease	3				3			2				2	
159. Pelvic/Rectal Bleeding	3				3			2			1		
160. Peptic ulcer	3				3				3			2	
161. Perianal Abscess	3			2				2			1		
162. Peritonitis	3			2					3		1		
163. Septic wound	3	0					1				1		
164. Transient Ischemic Attack	3			2					3		1		
165. Unstable Angina	3			2					3				
166. Assault	4				3				3		1		3
167. Brochospasm	4			2				2					
168. Bronchitis	4			2			1				1		3
169. Bronchospasm	4		1					2			1		
170. Epigastric pain	4			2				2			1		
171. Haematoma	4			2			1				1		
172. Haemetemesis	4				3				3				
173. Hyperglycemia	4			2					3	0	1		
174. Pancreatitis	4			2					3			2	
175. Stomach ache	4			2			1				1		

		ICPC-2 SCORES				ICD-10 SCORES				ICD-10CL SCORES			
Diagnoses	**Freq**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
176. Sub-mandibullar abscess	4		1					2			1		
177. Supra bilateral laceration	4		1				1						
178. Tonsilitis	4			2				2			1	2	
179. Bronchopneumonia	5			2					3				
180. Intra abdominal Abscess	5		1				1					2	
181. Wheezing	5				3				3	0			
182. Gastritis	6			2					3			2	
183. Loss of appetite	6				3		1			0			
184. Loss of Weight	6				3				3	0			
185. Mysistic Abscess	6		1				1			0			
186. Pneumothorax	6			2					3		1		
187. Acute pancreatitis	7		1						3			2	
188. Back Pain	7			2				2			1		
189. Dehydration	7				3			2					
190. Diarrhoea	7				3				3				
191. Fever	7				3				3		1		3
192. Wound (NOS)	7			2				2			1		
193. Appendicitis	8				3				3				
194. Epilepsy	8				3				3		1		3
195. Haemothorax	8		1						3				
196. Headache	8				3			2				2	
197. Ischaemic Heart disease	8				3				3			2	
198. Tight chest	8			2			1			0			
199. Tuberculosis	8				3				3			2	

200. Asthma	9				3				3		1		3
		ICPC-2 SCORES				**ICD-10 SCORES**				**ICD-10CL SCORES**			
Diagnoses	**Freq**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
201. Abdominal Pain	10				3				3			2	
202. Cellulite Left leg	10			2				2			1		
203. Chronic cardiac Failure	10		1					2				2	
204. Diabetes	10			2					3				3
205. Fractured Tibia	10			2					3				3
206. Chest Pain	11				3				3	0			
207. Nausea	12				3			2		0			
208. NIDDM	12				3			2			1	2	
209. Pulmonary Oedema	12			2					3				
210. MVA	13			2					3			2	
211. Shortness of breath	14			2				2		0			
212. Dyspnoea	16			2					3	0			
213. Pregnancy	19				3				3	0			
214 HIV +	21				3				3				3
215. Vomiting	23				3			2		0			
216. Hypertension	24				3				3			3	
217. Pneumonia	24				3				3				3
218. Pulmonary TB	24		1						3			2	
219. Cough	28				3				3	0			
220. Pain	31			2					3	0	1		
221. Single Stab	47		1					2					

APPENDIX VI

ALL RECORDED PROCEDURE CONCEPTS AND SCORES BY CODING SYSTEM IN ALPHABETICAL ORDER

Procedures Recorded	FREQ	ICPC-2				ICD-9CM				CCSA-2001			
BT Shunt	1	1			1		1				1		
Close reduction & Orif	1				0								
Clot Drainage	1	1			1	0						2	
Control BP	1	1			1		1						3
Dillation & Curetage	1		2		2				3				
Family Planning	1		2		2	0							
Gastric Washout	1		2		2								
HIV Counselling	1		2		2			2					
HIV Test	1	1			1			2					3
Knee atroscopy	1	1			1				3				3
Lipase	1				0	0							3
Lipogram	1				0	0							
Microscopy	1		2		2				3				3
Nasal Tube	1	1			1			2				2	
Neurogastric tube	1		2		2				3				
Referral					0								
TB Clinic referral	1	1			1	0						2	
RVD blood test	1	1			1			2					3
Skin Grafting	1	1			1			2					3
Sputum test	1	1			1			2				2	
Sterilisation	1			3	3				3				3
Thyroidectomy	1	1			1				3				3
Urine dipstix	1		2		2	0							3
Urine test Glucose	1		2		2	0							3
White cell count	1	1			1		1					2	
4 hrs evaluation	1		2		2		1						3
Abdominal laparotomy	1	1			1			2				2	
Anal Sphincter Repair	1	1			1				3				3
Biopsy	1		2		2				3				3
Blood culture	1	1			1				3			2	
Blood gas (analysis)	1	1			1			2				2	
Blood transfusion	1	1			1				3				3
Bone transplant (referred)	1				0		1						
BP monitoring	1	1			1				3				3
Breathing exercise	1		2		2				3				3
Bronchoscopy	1	1			1				3				3
Cholesystetomy	1	1			1				3			2	
Colonoscopy	1	1			1				3				3
Contraception	1			3	3		1				1		
Cystotomy	1	1			1				3				3
Dilation & curretage (with pregnancy)	1	1			1				3				3

Procedures Recorded	FREQ	ICPC-2				ICD-9CM				CCSA-2001			
Distal Salpingectomy	1	1			1			2				2	
Drip	1	1			1		1				1		
Evacuation of uterus	1	1			1			2					3
Evaluation	1		2		2			2					3
Facial Neurology	1	1			1			2				2	
Follow up letter	1	1			1	0					1		
Foot x-ray	1	1			1		1						3
Full blood count	1	1			1		1					2	
Ganglionectomy	1	1			1			2				2	
Gastric lavage	1	1			1				3			2	
Glucose test	1	1			1	0							
Hemoglobin	1	1			1		1					2	
Hernia repair	1	1			1				3				3
Hip prostethic	1	1			1				3				3
Hospital care	1	1			1	0							3
Hysterectomy	1		2		2				3				3
Infusion	1	1			1			2			1		
Jaw X-Ray	1		2		2			2					3
Knee x-ray	1	1			1			2					3
Laparoscopy	1	1			1			2				2	
Lung Physiotherapy	1		2		2			2			1		
Malaria Smear	1		2		2		1					2	
Mobilisation	1	1			1				3				
Moore's prestice	1	1			1			2					3
Observation	1		2		2	0					1		
Parasite count	1	1			1		1					2	
Polysomnogram	1	1			1				3				3
POP	1	1			1		1				1		
Psychiatric evaluation	1		2		2			2					3
Pulmonary TB Prophylaxis	1			3	3		1				1		
Rectal lump removal	1	1			1			2			1		
Ref to Diabetes clinic	1		2		2	0							
Ref to neuro-surgical OPD	1	1			1	0						2	
Ref to OPD	1		2		2	0							
Ref to Swellendam Hospital	1			3	3	0							
Referral to Hospice	1		2		2	0						2	
Rehabilitation	1				0	0						2	
Rehydration	1	1			1		1				1		
Removal of uterus	1		2		2				3				3
Ringers Lactate	1	1			1		1				1		
Sonar ECG	1	1			1				3			2	
Spine X-ray	1	1			1				3				3
Stitch removal	1				0								
Stitch	1	1			1						1		
Stool test	1		2		2				3				3
Tonsillectomy	1	1			1				3				3

Procedures Recorded	FREQ	ICPC-2				ICD-9CM				CCSA-2001			
Total hysterectomy	1	1			1			2					3
Urine Microscopy	1	1			1			2				2	
Uterus X-ray	1	1			1		1				1		
Vaginal hysterectomy	1	1			1				3				3
White cell count	1	1			1			2					3
Wound cleaning & Dressing	1			3	3		1						3
Wound stitch	1	1			1			2					3
Debridement	2		2		2			2					3
Intravenous Therapy	2	1			1			2					3
Pelvic X-ray	2		2		2			2					3
Sigmoidoscopy	2	1			1			2					3
Theatre	2	1			1	0				0			
Urinary catheter	2		2		2				3				3
White blood count	2	1			1			2					3
Wound care	2		2		2			2					3
Appendicectomy	3	1			1			2					3
Chest Physiotherapy	3		2		2			2				2	
Crutches	3	1			1		1					2	
Elevate Foot	3		2		2		1					2	
Gastroscopy	3		2		2				3		1		
Inhalation	3	1			1			2					3
Blood tests	4			3	3			2				2	
Intercostal drain	4	1			1			2				2	
Referral to social worker	4		2		2		1						
X-ray	4		2		2			2				2	
Intra-uterine device	5			3	3				3				3
Normal Vaginal Delivery	5			3	3				3			2	
Physiotherapy	5		2		2				3			2	
Neuro observation	6			3	3				3			2	
Vacuum Aspiration	7	1			1				3			2	
Laparatomy	8		2		2				3			2	
Sputum Examination	9	1			1				3				3
Pregnancy Termination	9			3	3				3				3
Dressing	16		2		2				3				3
ECG	19	1			1				3				3
Incision & drainage	20			3	3		1						3
Chest X-ray	37		2		2				3				3
Medication	62			2		2	0						3

APPENDIX VII

MEDICAL RESEARCH COUNCIL
A STUDY TO ASSESS THE QUALITY OF DATA FOR INPATIENT MORBIDITY AND ASSOCIATED DIAGNOSTIC AND PROCEDURE CODING SYSTEMS FOR DISTRICT AND REGIONAL PUBLIC HOSPITALS IN THE WESTERN CAPE.

SUBJECT INFORMATION SHEET

Dear Patient
The Medical Research Council is undertaking a study in conjunction with the Western Cape Provincial Department of Health to measure the scale of health problems in the Province. The purpose is to provide useful information that can be used by the management to make decisions about the diagnoses and treatment based on the data so as to reduce the burden of ill health.

To facilitate this process, we need to obtain information from the medical records of patients chosen for the study. We therefore request your permission to copy information from your medical record for the study.

We will need to record a unique sequence number, the name of the institution where you were treated, admission and discharge date diagnoses and treatments.

All information recorded will be kept confidential and will only be used for this project. Patient names will not be recorded. Your folder number will be recorded along with a sequence number used as a patient identifier on the data collection form. The list of folder numbers and the corresponding patient sequence numbers will be stored by the Hospital Manager and will only be used by the Hospital Manager if it is necessary to refer back to the patient records to answer queries related to the analysis of the data extracted from your medical record.

Please note:

This study will not affect your treatment in anyway.

You have the right to refuse to take part in this study.

If you decide to refuse to take part in this study, you will still receive the same treatment.

For further information about the study please contact:

Ms Gloria Lebo Montewa

Medical Research Council.

Health Informatics Research & Development Division

P.O. Box 19070

Tygerberg

7505

Tel: 021 9380284/Fax 021 9380315

Cell: 0836720714

APPENDIX VIII
PATIENT CONSENT FORM

Medical Research Council

TITLE OF PROJECT: **A STUDY TO ASSESS THE QUALITY OF DATA FOR INPATIENT MORBIDITY AND ASSOCIATED DIAGNOSTIC AND PROCEDURE CODING SYSTEMS FOR DISTRICT AND REGIONAL PUBLIC HOSPITALS IN THE WESTERN CAPE.**

PROJECT LEADER: **Dr LA Hanmer, Medical Research Council, Cape Town**

- The subject should complete the whole of this form himself/herself or have answered all of these questions, if unable to fill in this form.
- If the subject is not able to complete this form, then the research project and its implications must be fully explained in language the subject understands. Witnessing includes this undertaking.
- In the case of a minor, this form must be completed by the parent or guardian.

Please cross out as necessary

Have you read the Subject Information Sheet? YES/NO

Do you understand what it means for you to take part in this study? YES/NO

Have you received satisfactory answers to all your questions? YES/NO

Have you received enough information about this study? YES/NO

Who have you spoken to? Dr/Mr/Ms……

Do you understand that you are free to withdraw from the study:

- At any time
- Without having to give a reason for withdrawing
- And without affecting your future medical care?

YES/NO

Do you agree to take part in this study? YES/NO

Witness (in the case of witnessed consent)

……	……	……..
NAME IN BLOCK LETTERS	SIGNATURE	DATE

Subject

……	……	……..
NAME IN BLOCK LETTERS	SIGNATURE	DATE

Researcher

……	……	……..
NAME IN BLOCK LETTERS	SIGNATURE	DATE

APPENDIX IX

ETHICAL CLEARANCE LETTER

MRC
SOUTH AFRICA

MEDICAL RESEARCH COUNCIL

MEDIESE NAVORSINGSRAAD

UMKHANDLU WOKUCWANINGA NGEZOKWELAPHA

LEKGOTLA LA PHUTSO HO TSA KALAFO

South African Medical Research Council

PO Box 19070, TYGERBERG 7505, Republic of South Africa • Francie van Zijl Drive, Parowvallei, Cape Town
Tel: +27 21 938-0911 • Fax: +27 21 938-0200
~~E-mail: lgething@eagle.mrc.ac.za~~
URL: http://www.mrc.ac.za/

APPENDIX VI

30 July 2001

Ms L Hanmer
Programme Manager
Health Informatics R&D Co-ordination

Dear Ms Hanmer

RE: A study to assess the quality of data for a later inpatient morbidity survey, and associated diagnostic and procedure coding systems for district and regional public hospitals in the Western Cape Province

Thank you for your response to the Ethics Committee, dated 13 July 2001. I am pleased to tell you that approval is now granted for the study.

Wishing you well with your research.

Yours sincerely

PROF PE CLEATON-JONES
CHAIRPERSON: MRC ETHICS COMMITTEE

APPENDIX XII

DATA COLLECTION FORM

MEDICAL RESEARCH COUNCIL

WESTERN CAPE INPATIENT MORBIDITY SURVEY

FACILITY NAME: …….. HOSPITAL

Subject number ……

(This number is used only to identify the record;

it is not the patient folder number or ID number)

Date of birth or Age ……

Postal code or Place of residence ……

Gender ……..

Type of patient ……..

(Medical / Surgical etc.)

Admission date ……

Discharge date ……

Discharge diagnosis(es)

(Diagnosis recorded on discharge.

Indicate reason for encounter if there is no discharge diagnosis available or "no diagnosis" if no diagnosis has been recorded)

1……..… 4……

2…….. 5……

3…….. 6……

Procedure(s)

1……
2……
3……
4……
5……