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**Correlating Emergency Centre Referral Diagnoses With Final
Discharge Diagnoses**

By

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CS-42-01-22

SUBMITTED TO THE UNIVERSITY OF CAPE TOWN

In partial fulfilment of the requirements for the degree

M.Med (Emergency Medicine)

Faculty of Health Sciences

UNIVERSITY OF CAPE TOWN

Date of Submission:

Supervisor:

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DECLARATION

I, Almero H. Oosthuizen, hereby declare that all the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole nor any part of it has been, is being, or is to be submitted for another degree to this or any other university.

I empower the university to reproduce for the purpose of research either the whole or any portion of the contents in a manner whatsoever.

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University of Cape Town

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INTRODUCTION

Background

Healthcare systems exist to provide quality care to those who need it. Accurate patient assessment is the essential first step towards appropriate management. It is simply not possible to properly address a problem if you do not know that it exists.

To make a complete and accurate assessment, a clinician requires skill, information and time. Clinicians assessing acutely ill patients in an EC usually do not have as much time or information available to them as their colleagues to whom they refer patients for admission. It seems intuitive that the accuracy and completeness of EC assessments should be less than those made by the receiving departments, particularly with regard to the final discharge diagnosis.

There may be many reasons for this such as special investigation results that become available only after referral of the patient, the evolution of clinical features on the ward of the receiving department or simply the fact that the patient spends more time with the definitive care team. The existence of this 'diagnostic gap' seems intuitive but very few studies have investigated or attempted to measure it.

Importance

Assessments that are incorrect or incomplete may lead to poor patient management, adverse events and poor outcomes. Incorrect assessments and poor patient management can cause conflict between a health system and its users, including litigation against doctors and/or facilities. Good assessments protect patients, doctors and the healthcare system as a whole. This is especially true in the emergency centre (EC) – usually the first point of care for acutely unwell patients. EC doctors and systems are often under pressure to balance the need for good quality acute care for multiple patients and the system's ability to provide it.

Many studies have asked specific, focussed questions relating to diagnostic accuracy. Examples include the development and validation of a clinical decision rule to identify patients at high risk for adverse events after syncope, evaluating the

ability of FAST (focussed assessment by sonar in trauma) to accurately determine the presence of abdominal free fluid and emergency medicine and surgical registrars' ability to correctly diagnose acute appendicitis in adults presenting to an EC with abdominal pain.

These studies evaluate specific investigations, decision rules, doctors or diagnoses; none measure or attempt to describe EC diagnostic accuracy in the broad sense.

Goals of This Investigation

Very few studies have evaluated EC staff's global performance and accuracy as it relates to assessment and diagnosis. We could find only one study investigating how closely initial assessment correlates with final disposition diagnosis for all patients attending an EC. No such studies have been conducted in South Africa.

This study aims to measure the degree of correlation between EC referral diagnoses and final discharge diagnoses for patients admitted to three urban hospitals in Cape Town, South Africa. Some factors influencing the degree of correlation are investigated and considered.

AIM

The aim of this study is to investigate how closely EC referral diagnoses correlate with final discharge diagnoses.

In order to achieve this aim, the study has the following objectives:

1. To compare EC referral diagnoses with final discharge diagnoses for at least 1500 patients admitted to three metropolitan hospitals after initial assessment in their respective ECs.
2. To compare the degree of correlation for:
 - a. Emergency medicine registrars vs. Emergency centre medical officers.
 - b. Different EC shifts.
 - c. Different diagnostic groups: internal medicine vs. trauma vs. the surgical disciplines
3. To gather some basic survey information, namely: age, gender and the EC the patient was referred from and investigate if these influence diagnostic correlation.

PART A:

RESEARCH PROTOCOL

University of Cape Town

**Correlating Emergency Centre Referral Diagnoses With Final
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INTRODUCTION

Healthcare systems exist to provide quality care to those who need it. Accurate patient assessment is the essential first step towards appropriate management. It is simply not possible to properly address a problem if you do not know that it exists.

To make a complete and accurate assessment, a clinician requires skill, information and time. Clinicians assessing acutely ill patients in an EC usually do not have as much time or information available to them as their colleagues to whom they refer patients for admission. It seems intuitive, therefore, that the accuracy and completeness of EC assessments will be less than those made by the receiving departments, particularly with regard to the final discharge diagnosis.

Emergency Medicine (EM) as a formal speciality in South Africa is still in its infancy: our registrar training programs are continuously evolving in order to provide the best possible training. Understanding where we are now is essential if we are to chart a course towards quality emergency care for all South Africans.

Internationally, very little has been done to explore how closely emergency centre diagnoses correlate with the final discharge diagnoses made by definitive care departments. There are no published articles reporting diagnostic correlation in the South African context.

I therefore propose a study to determine the degree of correlation between EC referral diagnosis and final discharge diagnosis in admitted patients.

BACKGROUND AND LITERATURE REVIEW

Very little information exists on the correlation between EC and final discharge diagnoses. There is no research addressing this question in the South African context.

An internet-based literature search was performed using the following Boolean search string:

(diagnosis OR diagnostic OR assessment) AND [emergency AND (centre OR department OR unit OR room)] AND (accuracy OR accurate OR correlation OR correlate)

Search portals used included Pub Med, Google and TD Net. A search of Sabinet and the African Journal Archive returned no directly relevant articles. Only English language articles were considered. All retrieved articles were scanned for relevance; relevant articles had their reference lists checked for any papers not retrieved by the search.

There were thousands of hits relating to diagnostic accuracy or correlation as it relates to specific diagnostic tests (i.e. point of care d-dimer analyses), clinical decision rules (i.e. the Canadian cervical spine injury rule), specific symptom based presenting problems (i.e. chest pain) and specific known diagnoses (i.e. pulmonary embolism). All of these papers ask narrow, focused questions pertaining to specific tests or diseases and, while contributing to the overall body of knowledge regarding the abilities of EM practitioners, they bear little relevance to this proposed study.

The initial literature search revealed three relevant papers. One study [1] evaluated the diagnostic accuracy of 14 surgical registrars admitting patients from the EC to their service (in the United States of America). However, while the methodology is helpful, it differs fundamentally from this study in that it compares initial receiving department diagnosis with the same department's final discharge diagnosis. The emergency physician's assessment was not considered.

Cheng [2] selected those cases admitted by the receiving department but discharged after less than 24 hours in hospital for his study. Rather than evaluating diagnostic accuracy, he attempted to evaluate and judge the appropriateness of these referrals. Again, while providing methodological support to this proposed study, Cheng's focus was on appropriateness and types of diagnoses, rather than the accuracy thereof.

The final useful article [3] provided very helpful data on the study question, but on the situation in Hong Kong which therefore limits its external validity to our setting. Additionally, although Chiu *et al* also used three categories of diagnostic correlation,

they defined the 'incomplete' category differently from this proposal (see 'methods' and 'definition of terms'). They included children whereas we excluded paediatric patients from our study. They excluded obstetric and gynaecological cases; we included these cases. Additionally, they gathered much more specific information about diagnosis, whereas this study will only categorise diagnosis by receiving specialty.

**Please refer to the 'Literature Review' section for a more complete review or relevant articles.*

AIMS AND OBJECTIVES

The aim of this study is to investigate how closely EC referral diagnoses correlate with final discharge diagnoses.

In order to achieve this aim, the study has the following objectives:

1. To compare EC referral diagnoses with final discharge diagnoses for 1500 patients admitted to hospital from three metropolitan ECs in Cape Town, South Africa.
2. To compare the degree of correlation for:
 - a. Emergency medicine registrars vs. EC medical officers.
 - b. Different EC shifts.
 - c. Different diagnostic groups: internal medicine vs. trauma vs. the surgical disciplines
3. To gather some basic survey information, namely: age, gender and the EC the patient was referred from and investigate if these influence diagnostic correlation.

METHODS

This will be a retrospective case review.

Study setting

The study will take place in three level two metropolitan hospitals in Cape Town, South Africa: GF Jooste, New Somerset and Victoria.

These hospitals have general ECs and on site general specialist services, namely internal medicine, general surgery, orthopaedic surgery, paediatrics (excluding GF Jooste), gynaecology and obstetrics (excluding GF Jooste and Victoria). None of the hospital have full time on site subspecialists (i.e. cardiology or colorectal surgery). All three hospitals have 24 hour access to basic radiology services, in-hours ultrasound services and a laboratory service. At the time of the study none of the units employed full time emergency medicine specialists. The units were staffed partly by emergency medicine registrars and partly by EC medical officers.

Sample size

250 medical and 250 surgical (traumatic and non-traumatic cases) records will be collected for each of the three sites, producing a total sample size of at least 1500. Data collection will start on 1 Feb 2010. Records will be collected consecutively.

Data extraction

The written admission ledger of each unit will be used to recruit the required records. The data recruitment initiation date is the same for all three hospitals. Data recruitment will continue until the required number of records is recruited for each unit. If a record is missing it will be captured as such, but data recruitment will continue until the pre-determined number of records have been recruited. All recruitment and data capture will be performed by the author.

Inclusion and exclusion

Admissions from 1 Feb 2010 onwards will be accepted.

Records will be excluded from recruitment if they:

- pertain to children (12 years or younger)
- are elective admissions

- are direct inter-facility transfers of patients for definitive care where a diagnosis has already been made.
- have no clear referral or discharge diagnosis recorded.

After folders have been retrieved, each will be manually checked and data entered onto the data collection sheet (appendix). The data will then be transferred onto an EpiData (Open source: EpiData® Foringenen, Denmark) database.

Data analysis

Data will be analysed using Stata 10 (©StataCorp, Texas, USA)

Basic descriptive statistics will be used as appropriate; correlation will initially be assessed with kappa analysis. Statistical significance will be judged using variants of the chi-squared test. Where trends are analyzed, sigma restricted parameterization and effective hypothesis decomposition will be used.

Definition of terms

- Primary Diagnosis:
 - The condition that gave rise to the presenting complaint, justified the admission and was the focus of the patient's treatment.
- Diagnosis – Complete correlation:
 - The referral diagnosis and the discharge diagnosis is the same.
- Diagnosis – Incomplete correlation:
 - The referral diagnosis only partially correlates with the final diagnosis, but the primary diagnosis is appropriate. This lack of correlation did not give rise to critical management error. A component of the diagnosis was missed or incorrect relative to the final diagnosis. This component has management implications during this admission, but not during the acute phase in the EC. (Example: A patient is referred as 'persisting hypoglycaemia caused by oral anti-diabetic medication'. No mention is made of the fact that the patient has renal dysfunction. This does not change the acute management

or the need for admission, but has implications for management on the ward.)

- Diagnosis – No correlation:
 - The referral diagnosis does not correlate at all with the final diagnosis.
- Surgical referral:
 - Includes referral to all surgical disciplines, including general surgery, orthopaedics, obstetrics and gynaecology etc. Where a patient is cared for by a multi disciplinary team of doctors, such as in ICU, the final primary diagnosis on discharge and the final definitive care team will be used as correlates. This category will be sub-divided into two main sub-categories:
 - Trauma, including traumatic orthopaedics
 - Surgery: non-trauma
- Medical referral
 - Three main categories will be used:
 - HIV, TB and related. This includes cases of confirmed TB and/or HIV disease, as well as their complications (opportunistic infections, HIV associated malignancies and recognised primary HIV complications such as HIV associated nephropathy).
 - The insulin resistance syndrome and its complications. This includes hypertension, type 2 diabetes mellitus and dyslipidaemia, as well as recognized complication arising from these conditions (recognised micro and macro vascular complications and end organ damage, i.e. coronary artery disease and acute coronary syndromes).
 - Other. This includes all diagnoses not mentioned above.

- This sub-division is somewhat arbitrary, but aims to compare diagnostic correlation for two very important groups of patients in South African healthcare. HIV, TB and their related complications represent a massive disease burden in this country. Similarly, South Africa has not been spared the international pandemic of obesity, the insulin resistance syndrome and its complications. The author hopes comparing these two important patient groups may reveal interesting descriptive data and identify areas for possible future study.
- Time/Shift
 - Most Western Cape emergency centres operate a three-shift system, and time will be identified using this system in this study: 08h00 to 16h00; 16h00 to 00h00; 00h00 to 08h00.
 - The time the patient was first seen will be used. Referral times are rarely recorded, and time first seen more closely represents the conditions under which the patient was evaluated by EC staff.
- Category of assessing doctor
 - Two categories will be used
 - Emergency medicine registrar. These are doctors currently training to be emergency medicine specialists
 - EC Medical officers. These are doctors working in the emergency centre, but not currently involved in a formal emergency medicine training program. This represents a heterogeneous group i.t.o. experience and training.
 - At the time of this study none of these units employed a full time emergency medicine specialist. When more than one EC doctor assessed a patient the final EC referral diagnosis and the doctor who made that assessment are used as correlates.
- Demographics

- Gender
- Age
 - Patients age 13 and older will be included. To aid comparison with other studies, age 65 will be used to divide the patients into two groups: 13 to 65 years (64y364d) and 65 years and older.

ETHICAL CONSIDERATIONS

This study is a retrospective chart review. Permission to access records will be obtained from the managers of the involved hospitals. Patients and doctors are not identified in any way. The study does not require any patient or doctor intervention or participation.

All records will be assigned a unique study identifier. No patient details will be kept on the paperwork or database. All paperwork will be kept in a locked cupboard in a work office. All data will be stored on a password protected work computer.

WORK PLAN AND BUDGET

This study requires no funding.

DISSEMINATION OF FINDINGS

The findings of this study will be made available to the managers of the involved hospitals and units. The thesis will be formatted as an article and submitted for publication in a peer reviewed journal.

REFERENCES

1. Raz E, Cohen S, Benbassat J: Evaluation of diagnostic accuracy in the clinical setting. *Isr J Med Sci* 1987;23(12):1177-80
2. Cheng S, Chung CH: A retrospective study of patients discharged within 24 hours after emergency admission in a public general hospital. *Hong Kong J Emerg Med* 2002;9:139-144
3. Chiu HS et al: A comparison of emergency department diagnoses and discharge diagnoses: a retrospective study. *Hong Kong J Emerg Med* 2003;10:70-75
4. Lo CM, Yau HH. Appropriateness of emergency admissions in a regional hospital. *Hong Kong J Emerg Med* 1995;2(1):15-18

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PART B:

LITERATURE REVIEW

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EMERGENCY MEDICINE IN SOUTH AFRICA:

Globally, Emergency Medicine (EM) is a relatively new speciality. Emergency care evolved into a structured, formal discipline in the United States of America during the 1970's and 1980's. This development was motivated in part by the rapidly growing body of knowledge and skills required to practice good emergency care.

EM was established as an official speciality in South Africa on 13 Dec 2004. The first training program was established in Cape Town with fewer than 10 registrars. Today there are more than forty registrars nationally, including a number of supernumerary registrars. Supernumerary registrars are doctors from countries who do not offer an emergency medicine program who come to South Africa to study. They complete the training to the same standards as South African registrars. Upon completion they return to their country of origin to practice emergency medicine there.

Numbers of graduates and registrars continue to grow and emergency medicine remains an important part of South Africa's healthcare.

Patients present to emergency centres (EC) with a very wide range of conditions. Many of these patients are acutely and/or severely ill; sometimes not obviously so. Poor quality assessments and inadequate treatment during this vulnerable phase of care can result in poor patient outcomes.[1,2] Correct emergency management has a positive impact on subsequent care and improves patient outcomes.[1]

The division of emergency medicine in Cape Town (the study setting) currently trains the largest number of emergency doctors of any South African program. Registrar training takes four years. Training combines clinical work and training in a variety of contexts, formal lectures, self-directed learning, prescribed short courses periodic assessment of registrar progress. One of the intentions of this training programme is to produce emergency physicians who can correctly assess and manage patients presenting to an EC, especially those that are acutely and severely ill.

Accurate assessment is the cornerstone of correct patient management.[3] Patient assessment is not the same as patient diagnosis. A patient may present in cardiac

arrest due to a cardiac dysrhythmia caused by an acute coronary event. The initial assessment is simply 'cardiac arrest', prompting resuscitation. As more data becomes available the assessment and management can be refined and until a provisional or final diagnosis can be made and a good quality management plan formulated.

It is simply not possible to properly manage patients that have been assessed incorrectly. Incorrect or incomplete assessments may result in and poor outcomes for patients and litigation against doctors and healthcare facilities.[1] It follows that good assessment protects the patient, the doctor and the healthcare system and is therefore important.

Accurate assessment of a patient requires information, time and skill.[3] Doctors assessing patients in ECs usually have less time and a limited amount of information compared to their colleagues in the receiving specialities. This may be because special investigation results become available only after referral of the patient, or evolution of clinical features on the ward of the receiving department making the diagnosis more obvious among other factors. It seems intuitive that there should be a trend towards more complete assessments by definitive care departments by the time of final discharge or disposition as compared to the initial assessment made in the emergency centre.

Variations in the correlation between initial and final assessment may for example be influenced by the skill of the referring and receiving doctor, the complexity of the diagnosis and the amount of time spent in the care of either service. Though some factors influencing the presence and size of this diagnostic gap may seem obvious, they have not been studied in detail in the EC context. The large number of variables involved makes accurately measuring diagnostic accuracy and the factors that influence it very difficult. This task is further complicated by the fact that often no gold standard exists with which to compare a given assessment. The final assessment by the receiving department may be incorrect or incomplete. Rather than judging the accuracy of the assessment during any given phase of management, it may be more appropriate to compare the assessments made in each phase and see how closely they correlate.

STUDY AIMS:

The aim of this study is to investigate how closely EC referral diagnoses correlate with final discharge diagnoses. This study does attempt to judge the correctness of the assessments per se.

In order to achieve this aim, the study has the following objectives:

1. To compare EC referral diagnoses with final discharge diagnoses for at least 1500 patients admitted to hospital from three metropolitan ECs in Cape Town, South Africa.
2. To compare the degree of correlation for:
 - a. Emergency medicine registrars vs. EC medical officers.
 - b. Different EC shifts.
 - c. Different diagnostic groups: internal medicine vs. trauma vs. the surgical disciplines
3. To gather some basic survey information, namely: age, gender and the EC the patient was referred from and investigate if these influence diagnostic correlation.

LITERATURE SEARCH DETAILS:

Pub Med, Medline, Google Scholar and Google were searched for relevant English language articles. The following Boolean search string was used:

(diagnosis OR diagnostic OR assessment) AND [emergency AND (centre OR department OR unit OR room)] AND (accuracy OR accurate OR correlation OR correlate)

All retrieved articles were scanned for relevance; relevant articles had their reference lists checked for any papers not retrieved by the search. Unpublished articles were not included.

There are no directly relevant articles in the South African context. A search of the African Journal Archive and Sabinet revealed no directly relevant articles.

Only one relevant article addressing this issue in broad terms was found.[4] There were thousands of hits relating to diagnostic accuracy of specific diagnostic tests (i.e. EFAST in trauma), clinical decision rules (i.e. the San Francisco syncope rule), specific symptom based presenting problems (i.e. chest pain) and specific known diagnoses (i.e. acute appendicitis).[5-11] All of these papers ask narrow, focused questions pertaining to specific tests or diseases and, while contributing to the overall body of knowledge regarding the abilities of EM practitioners, they bear no relevance to this study.

DIRECTLY RELEVANT ARTICLES:

Only one study by Chiu et al asked the same core question, however, the setting was Hong Kong and therefore the external validity is limited.[4] The study is similar in many respects as it compares initial EC to final discharge diagnosis. As with this South African study it also defines three degrees of correlation.

There are a few important differences to consider, however. In the proposed study the 'incomplete diagnosis' category is defined in terms of implied management implications. The same category is more loosely defined in the Hong Kong study. This is an important difference considering the earlier statement that the value of accurate assessment is that it should result in better management. Specificity of diagnosis was assessed in addition to accuracy, something not considered in the South African study.

The Hong Kong study included children while the South African study excluded them. Conversely, the Hong Kong study excluded obstetric and gynaecological cases while the South African study included these patients. No distinction was made among different classes of doctor evaluating the patient. The South African study compares EM registrars with EC medical officers. The time of day when the patient was assessed was not considered. Chiu and colleagues did not sub-divide medical diagnoses but did gather specific information about special investigations and its

influence on diagnostic accuracy. Their study attempts to find reasons for poor diagnostic correlation and attempts to judge the appropriateness of the assessments made. The proposed South African study limits itself to only describing the diagnostic gap without investigating the reasons it exists.

INTERNATIONAL PAPERS:

A recent study by Blavais et al evaluated whether emergency physicians could rapidly and accurately diagnose deep venous thrombosis (DVT) by using lower extremity compression and colour Doppler ultrasound.[5] Their performance was compared to formal lower extremity evaluation by experienced ultrasound providers in the study hospital's vascular laboratory. The study found that EC doctors could accurately diagnose DVT, and that the time to diagnosis was significantly shorter than sending the patient to the vascular laboratory.

This study compares performance of emergency doctors performing a test in the EC with final diagnosis made by vascular lab staff. The scope of this American study is very narrow and the findings may not be applicable to the South African context. The study evaluates performance as it relates to a single special investigation rather than general diagnostic correlation and is therefore not directly relevant.

Another American study by Hwan Yo et al compared EM registrars, surgical registrars, CT scanning and a clinical decision rule to investigate how closely each group's ability to diagnose acute appendicitis correlated with findings at laparotomy in a tertiary EC in New York.[6]. They concluded that EM registrars, surgical registrars and the clinical decision rule had similar rates of diagnostic correlation, but that both underperformed relative to CT.

This study compares initial assessment with final, objective diagnosis. It specifically looks at the assessments made by EM registrars and compares their performance with that of the in-hospital team. While this comparison is methodologically relevant, the fact that it deals with the diagnosis of a single condition limits relevance to the proposed study that aims to include the full scope of diagnoses and patients admitted via the EC. The American context again limits external validity.

The San Francisco syncope rule (SFSR) was derived and validated as a tool to identify patients at low risk for adverse events after syncope.[7] Patients presenting with syncope to a large university EC in San Francisco were evaluated using the rule, and followed up for 30 days for adverse events. The study concluded that application of the SFSR in this EC had a high sensitivity to detect those patients at risk for an adverse event.

This American study investigates the performance of a clinical decision rule and compares it with current gold standard special investigations. It also evaluates the ability of the rule to correctly assess risk, rather than make a diagnosis. It is therefore not directly relevant to a study evaluating doctors making clinical diagnoses in a South African EC.

A subsequent study by Quin et al compared the performance of the SFSR with physician judgment and decisions.[8] All patients presenting to the EC with syncope were evaluated by an emergency doctor. The doctor made a judgment on risk and decided which patients to admit. The SFSR was then applied to each patient, and all patients were followed for 7 days for adverse events. Doctors' judgment and decisions were compared to the risk assessment of the SFSR. The study concluded that doctors assessments correlated relatively well when identifying high risk patients, but less so when assessing low risk patients. The SFSR could have prevented some of these admissions.

This study evaluates the ability of a doctor to make a risk assessment, and compares their performance with that of a clinical decision rule. Though conceptually useful, it is not directly relevant to a study evaluating and comparing the ability of emergency and receiving service physicians to make an accurate patient assessment. The fact that the study was done in the USA limits it's applicability to South Africa.

SOUTH AFRICAN PAPERS:

A recent South African study by Smith et al investigated the ability of EC staff to correctly identify free fluid in the abdominal cavity of trauma patients using focussed assessment by sonography in trauma (FAST).[10] Three trained doctors

performed FAST when indicated on patients attending a busy EC in Kwa-Zulu Natal, a province of South Africa. This was a prospective study over a period of 12 months. They compared the initial FAST findings with confirmation by CT, laparotomy or a second FAST scan. They concluded that FAST in this South African unit had similar sensitivity and specificity for detecting free fluid than those reported in international studies, and was therefore a useful adjunct in trauma care in SA ECs with the necessary equipment and trained staff.

The study is useful in that it evaluates the accuracy of a test performed by doctors in a typical, high volume South African EC. It is not directly relevant to a study about broad diagnostic correlation, however, as it investigates a single test.

A prospective cross sectional study at the Red Cross War Memorial Children's Hospital in Cape Town, South Africa evaluated the ability of doctors to accurately diagnose mediastinal lymphadenopathy when assessing a chest x-ray.[11] Three primary care clinicians and three paediatricians with a special interest in tuberculosis (TB) interpreted the x-rays of children admitted to a short stay ward with the suspected diagnosis of pulmonary TB. The reference standard was spiral chest CT. Doctors interpreting chest x-ray had a relatively poor sensitivity and specificity with respect to the detection of lymphadenopathy, and the authors suggest caution when interpreting x-rays in this context.

The study assesses the ability of doctors who do not work in an EC to accurately assess a special investigation in a very specific context. The narrow scope of this study and the clinicians evaluated do not bear direct relevance to the proposed study. The fact that a specialist group of clinicians are compared with a non-specialist group, and that this study was conducted in a South African hospital allows useful comparison of setting and methodology.

CONCLUSION:

Only one published study seeks to evaluate the accuracy of EC diagnoses in general terms.[3] No such articles have been published in South Africa.

The proposed study does not aim to draw any conclusion i.t.o. cost, morbidity or mortality as it relates to different degrees of diagnostic correlation, but merely to describe it. This and the paucity of directly relevant English language studies make finding relevant literature to support our study challenging.

Relating degrees of diagnostic correlation to objective outcome measures could be a theme for future studies.

University of Cape Town

BIBLIOGRAPHY:

1. Guly HR. Diagnostic errors in an accident and emergency department. *Emerg Med J* 2001;18:263-269.
2. Pope JH, Aufderheide TP, Ruthazer R et al. Missed diagnoses of acute cardiac ischemia in the emergency department. *N Engl J Med* 2000;342:1163-1170.
3. Talley NJ, O'Connor S. *Clinical Examination*. 3rd ed. Oxford: Blackwell science ltd, Oxford, 2000.
4. Chiu HS, Chan KF, Chung CH et al. A comparison of emergency department admission diagnoses and discharge diagnoses: retrospective study. *Hong Kong J Emerg Med* 2003;10:70-75.
5. Blavais M, Lambert MJ, Harwood RA et al. Lower extremity Doppler for deep venous thrombosis – can emergency physicians be accurate and fast? *Acad Emerg Med* 2000;7:120-126.
6. Hwan Jo Y, Kim K, Rhee JE et al. The accuracy of emergency medicine and surgical residents in the diagnosis of acute appendicitis. *AJEM* 2010;28:766-770.
7. Quinn J, McDermott D, Stiell I et al. Prospective validation of the San Francisco syncope rule to predict patients with serious outcomes. *Ann Emerg Med* 2006;47:448–454.
8. Quinn J, Stiell I, McDermott D et al. The San Francisco syncope rule vs. physician judgment and decision making. *AJEM* 2005;23:782-786.
9. Serrano LA, Hess EP, Bellolio MF et al. Accuracy and quality of clinical decision rules for syncope in the emergency department: A systematic review and meta-analysis. *Ann Emerg Med* 2010;56:362-373.
10. Smith ZA, Postma N, Wood D. FAST scanning in the developing world emergency department. *S Afr Med J* 2010;100:105-108.
11. Swingler GH, Du Toit G, Andronikou S et al. Diagnostic accuracy of chest radiography in detecting mediastinal lymphadenopathy in suspected pulmonary tuberculosis. *Arch Dis Child* 2005;90:1153–1156.

PART C:

(i) ARTICLE FOR SUBMISSION

(ii) INSTRUCTIONS FOR AUTHORS

University of Cape Town

Title:

Correlating emergency centre referral diagnoses with final discharge diagnoses

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2516

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ABSTRACT

Objective: To investigate the degree of correlation between emergency centre (EC) and final discharge diagnoses for patients admitted to hospital after presenting acutely to the EC. **Methods:** A retrospective review of 1768 consecutive admissions to three urban level two hospitals in Cape Town, South Africa. The primary outcome measure was degree of correlation, reported as complete, incomplete or no-correlation. The influence of age, gender, diagnostic type, category of assessing doctor and time of assessment was also considered. **Results:** Of all admission diagnoses, 57.5% correlated completely with the final discharge diagnosis, 28.3% were incomplete and 14.2% did not correlate. Diagnostic correlation was best for trauma cases, men and younger patients. Correlation for medical diagnoses was relatively poor, particularly for patients presenting with HIV/TB and related conditions. For patients presenting with medical diagnoses, HIV/TB and related conditions were significantly more common than those relating to the insulin resistance syndrome and its complications. **Conclusion:** Our study confirms the existence of a diagnostic gap between initial EC assessment and final diagnosis for over one third of patients admitted to hospital via the EC. HIV/TB and related conditions are common and assessed poorly. More specific training pertaining to this group may be warranted.

INTRODUCTION

Background

Healthcare systems exist to provide quality care to those who need it. Accurate patient assessment is the essential first step towards appropriate management.[1] It is simply not possible to address a problem if you do not know that it exists.

To make a complete and accurate diagnosis, a doctor needs information, skill and time.[1] Doctors working in an emergency centre (EC) usually have less time and information on which to base their assessments than their colleagues in the receiving services. It seems intuitive that for most admissions, the final discharge diagnosis should be more accurate and complete than the initial EC assessment. There may be many reasons for this such as special investigation results that become available only after referral of the patient, or evolution of clinical features on the ward of the receiving department that makes the diagnosis more obvious. Very few studies have investigated the existence of this 'diagnostic gap' as it relates to global EC assessments or attempted to measure it.[2]

Importance

Assessments that are incorrect or incomplete may lead to poor patient management, adverse events and poor outcomes.[3,4] Incorrect assessments and poor patient management can cause conflict between a health system and its users, including litigation against doctors and/or facilities. Good assessments protect patients, doctors and the healthcare system as a whole. This is especially true in the EC – usually the first point of care for acutely unwell patients. EC doctors and systems are often under pressure to balance the need for good quality acute care for multiple patients and the system's ability to provide it.

Many studies have asked specific, focussed questions relating to diagnostic accuracy. Examples include the development and validation of a clinical decision rule to identify patients at high risk for adverse events after syncope, evaluating the ability of FAST (focussed assessment by sonar in trauma) to accurately determine the presence of abdominal free fluid and emergency medicine and surgical

registrars' ability to correctly diagnose acute appendicitis in adults presenting to an EC with abdominal pain.[5-11]

These studies evaluate specific investigations, decision rules, doctors or diagnoses; none measure how closely EC assessments correlate with final discharge diagnoses in the broad sense.

Goals Of This Investigation

Very few studies have evaluated EC staff's global performance and accuracy as it relates to assessment and diagnosis. We could find only one study investigating how closely initial assessment correlates with final discharge diagnosis for all patients attending an EC.[2] No such studies have been conducted in South Africa.

This study aims to measure the degree of correlation between EC referral diagnoses and final discharge diagnoses for patients admitted to three urban hospitals in Cape Town, South Africa. Some factors influencing the degree of correlation are investigated and considered. This study aims to describe the degree of diagnostic correlation but does not attempt to infer reasons for the existence of a diagnostic gap, neither does it attempt to judge the objective correctness of any given diagnosis.

METHODS

Study Design And Setting

We undertook a retrospective chart review of consecutive adult (13 years or older) admissions to three metropolitan hospitals in Cape Town, South Africa, starting in February 2010. Initial consultation indicated that 1500 records were required to reach statistical significance. Each hospital contributed a minimum of 250 medical and 250 surgical (including traumatic and non-traumatic cases) admission records.

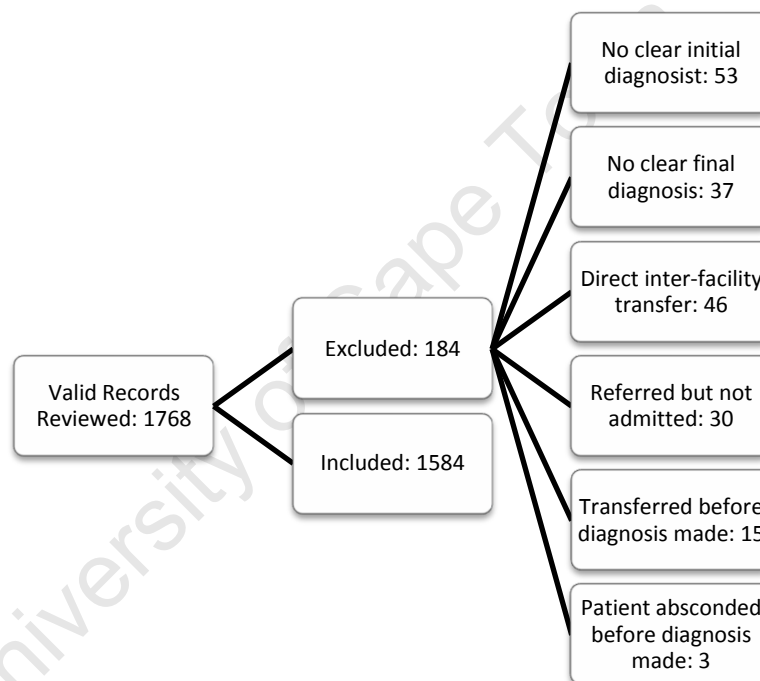
Selection Of Participants

Admission ledgers were used to identify consecutive patients admitted to each hospital via the EC, starting on 1st February 2010. Folders were retrieved from each hospital's medical records department and manually reviewed on site by a single

trained reviewer. Folders that could not be found were excluded, and retrieval continued until the required number of records for each hospital was found. When more than one EC doctor assessed a patient the final EC referral diagnosis and the doctor who made that assessment are used as correlates.

Admissions were excluded if no clear initial or final diagnosis was recorded. Elective admissions and direct admissions to a receiving service from another hospital in cases where a diagnosis had already been made were also excluded. Figure 1 outlines these and other exclusions.

Figure 1: Excluded records



Data Collection And Analysis

All data were initially collected on paper data sheets, and then captured electronically using EpiData®3.1 (Foringen, Denmark). Data were analysed using Stata 10 (©StataCorp, Texas, U.S.A.).

Basic descriptive statistics were used as appropriate; correlation was assessed with kappa analysis.

Outcome Measures And Methods Of Measurement

The final primary discharge diagnosis was identified and then compared to the initial EC assessment at time of referral to the inpatient team. The primary diagnosis is defined as the condition that gave rise to the presenting complaint, justified admission and was the focus of treatment.

Assessment correlation was judged to be complete, incomplete or no-correlation. An EC assessment is complete if it is the same as the final primary diagnosis, and no-correlation if the EC diagnosis was completely different from the discharge diagnosis. Incomplete correlation is defined as an initial EC assessment that missed a component of the final diagnosis that had management implications for the patient during his or her admission, but that would not have affected management in the EC.

Additional information gathered included age, gender, diagnostic category, time of assessment and category of doctor making the initial assessment. Three diagnostic categories were initially defined: trauma, general (non-traumatic) surgery and medical conditions. Medical conditions were then arbitrarily further subdivided into three groups: HIV/TB and related, the insulin resistance syndrome (IRS) and its complications, and other. The initial assessor was either an EM registrar or a non-registrar EC medical officer. Time of assessment was divided into three periods to reflect the three shifts generally operated in these units, namely 08:00 – 16:00, 16:00 – 24:00, and 24:00 – 08:00.

RESULTS

A total of 1584 records were analysed. Of these, 51.1% were male. Age ranged from 13 to 97 years (mean 42.4; 95% CI 41.5 – 43.3). Seventeen records had no age recorded, but data pertaining to the primary outcomes were included for analysis.

Of the 1584 included patients, 806(50.9%) were admitted for medical conditions, 532(33.6%) surgical and 246(15.5%) trauma. Of the medical cases, 248(30.8%) presented with HIV/TB and related disorders, 154(19.1%) with the IRS and its complications and 404(50.1%) with other medical conditions. The majority of patients, 1117(70.5%), were evaluated by EC medical officers.

Of all EC assessments 911(57.5%) correlated completely, 448(28.3%) correlated incompletely and 225(14.2%) did not correlate with the final discharge diagnosis.

The following variables had a statistically significant effect on diagnostic correlation: diagnosis type (table 1), medical diagnosis sub-type (table 2), patient gender (table 3) and assessing doctor (table 4).

Table 1: Assessment by diagnostic type (p = 0.00000)

	SURGICAL	TRAUMA	MEDICAL	TOTALS
COMPLETE	310(58.3%)	183(74.4%)	418(51.9%)	911(57.5%)
INCOMPLETE	134(25.2%)	53(21.5%)	261(32.4%)	448(28.3%)
NO CORRELATION	88(16.5%)	10(4.1%)	127(15.8%)	225(14.2%)
TOTALS	532(33.6%)	246(15.5%)	806(50.9%)	1584

Table 2: Assessment by medical sub-types, total 806 (p = 0.00000)

	HIV/TB	IRS*	OTHER	TOTALS
COMPLETE	92(37.1%)	93(60.4%)	233(57.7%)	418(51.9%)
INCOMPLETE	99(39.9%)	49(31.8%)	113(28.0%)	261(32.4%)
NO CORRELATION	57(23.0)	12(7.8%)	58(14.4%)	127(15.7%)
TOTALS	248(30.8%)	154(19.1%)	404(50.1%)	806

* - Insulin Resistance Syndrome

Table 3: Assessment by patient gender (p=0.0008)

	MALE	FEMALE	TOTAL
COMPLETE	481(59.4%)	430(55.6%)	911(57.5%)
INCOMPLETE	240(29.6%)	208(26.9%)	448(28.3%)
NO CORRELATION	89(11.0%)	136(17.6%)	225(14.2%)
TOTALS	810(51.1%)	774(48.9%)	1584

Table 4: Assessment by category of assessing doctor (p = 0.0019)

	EM REGISTRAR ⁺	MEDICAL OFFICER	TOTALS
COMPLETE	287(61.5%)	624(55.9%)	911(57.5%)
INCOMPLETE	130(27.8%)	318(28.5%)	448(28.3%)
NO CORRELATION	50(10.7%)	175(15.7%)	225(14.2%)
TOTALS	467(29.5%)	1117(70.5%)	1584

+ Emergency medicine registrar

We used 65 years as an arbitrary point around which to assign patients to one of two age groups (younger than 65 years, 65 years or older) to allow for comparison with previous studies. Of all patients included in the study, 1320(84.2%) were younger than 65 years. Using this cut off, we could find no statistically significant

difference in diagnostic correlation between the age groups. When using univariate tests of significance for age (sigma restricted parameterization and effective hypothesis decomposition) the trend is toward decreasing correlation with increasing age. This effect is most pronounced for incomplete assessments.

The shift on which the patient was assessed had no statistically significant effect on diagnostic correlation.

LIMITATIONS

Only three hospitals were included in this study, from a total of 11 in Cape Town. Data from these hospitals may not accurately represent the situation for all levels of health facilities in Cape Town, and cannot be generalised to the very heterogeneous national healthcare system of South Africa. These ECs are, however, representative of typical district level hospitals in the Western Cape Province, are all staffed in part by EM registrars and deal with the full spectrum of patients and conditions an EC is equipped to handle.

The retrospective nature of this study and the fact that only a single investigator interpreted the data may result in bias. To attempt to counter this, we strictly defined and applied terms and end-points, and used standardised methods for a retrospective review.

This study merely describes diagnostic correlation and does not attempt to investigate or explain relative diagnostic correctness. The assumption that final discharge diagnoses are more likely to be correct has not been investigated and may be an area for future study.

Comparing EM registrars with a very heterogeneous group of non-registrar EC medical officers makes drawing conclusions on relative performance difficult. The group of EC medical officers are representative of the way Cape Town ECs have traditionally been staffed. Comparing this group with EM registrars at a time when EM trained staff are becoming more prevalent may offer an indication of future trends in diagnostic correlation.

DISCUSSION

This is the first study of its kind in South Africa. Only one similar study has been published internationally.[2]

When comparing correlation across all diagnostic types, we found relatively few no-correlation assessments (14%). This is especially true for trauma cases, where only 4% of assessments did not correlate at all with the final assessment. Many patients were assessed incompletely in the EC relative to their final assessment - almost a third. This means that less than 60% of patients were admitted to the hospital via the EC with an assessment that correlated fully with their final discharge assessment.

Our study found significantly fewer no-correlation assessments than a previous study, although the ratios for correlation across different diagnostic types are similar.[2] The reasons for this difference are unclear but may include the inclusion of paediatric cases, or differences in defining and interpreting diagnostic correlation. The study setting is also very different.

Patients presenting with medical conditions were least likely to be assigned completely correlating assessments. They were also most likely to be admitted with an incomplete assessment. This is of concern as the majority of patients admitted via the EC presented with medical conditions. HIV/TB and related conditions are very common in patients presenting to the three EC's studied. In this study, 31% of all medical admissions (16% of all admissions) were for HIV and related conditions, and only 19% of medical admissions related to the IRS and its complications. In most developed countries, relatively few medical admissions relate to HIV.

Only 37% of patients presenting with HIV/TB and related conditions had a completely correlating initial assessment and in 24% of cases there was no correlation to final discharge assessment. In contrast, 60% of patients presenting with conditions relating to the IRS had a complete-correlation assessment, and only about 8% a no-correlation assessment. The reasons for this contrast are not clear. Patients with HIV/TB tend to present with multiple conditions or infections.[12,13] They are also more likely to present with unusual diseases or atypical presentations of typical conditions, especially as the illness becomes more advanced.[12,13] Better training and education relating to the emergency care of patients with complications of the IRS may also be a contributing factor. Most textbooks and

web-based resources used by emergency medicine registrars in Cape Town are compiled in the developed world and reflect that specific patient profile. There are very few teaching resources relating to aspects of emergency care that are specifically relevant to the South African context, and even fewer to the emergency care of acutely ill patients with HIV/TB.[14,15]

The ECs included in this study see many HIV/TB patients and these patients are assessed relatively poorly. More specific training in the emergency care of acutely ill patients with HIV/TB is needed.

Gender had a significant effect on diagnostic accuracy. Women were almost twice as likely to have a no-correlation assessment. This trend was also found in the previous study. It may be appropriate for doctors in EC's to regard female patients as a group at higher risk for diagnostic errors.

EM registrars were more likely to make assessments that correlated completely with final discharge diagnoses. This may indicate that specific EM training improves assessment accuracy. This study did not intend to investigate this issue in detail, and further study on the effect of EM specific training on assessment accuracy is needed.

Although it seems intuitive that correct assessments are important, this premise has not been studied formally in a broad sense in the EC. We need a study that investigates if accurate assessment results in better patient management. Studies to further define the factors influencing diagnostic accuracy, and how to improve it, would be the next logical step.

CONCLUSION

Our study confirms the existence of a diagnostic gap between initial EC assessment and final diagnosis for over one third of patients admitted to hospital via the EC. Patients presenting with medical conditions, especially those suffering from HIV/TB, are most likely to have incomplete or no-correlation assessments. Better and more relevant training relating to the assessment and management of acutely ill patients with HIV/TB may be needed.

Increasing age as well as female gender increases the risk of no-correlation assessment, and extra care should be taken by doctors assessing these patients in the EC.

More studies investigating the importance of correct assessments and factors influencing EC diagnostic accuracy need to be done.

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BIBLIOGRAPHY

1. Talley NJ, O'Connor S. Clinical Examination. 3rd ed. Oxford: Blackwell science ltd, 2000: 1.
2. Chiu HS, Chan KF, Chung CH et al. A comparison of emergency department admission diagnoses and discharge diagnoses: retrospective study. Hong Kong j.emerg.med 2003; 10: 70-75
3. Guly HR. Diagnostic errors in an accident and emergency department. Emerg Med J 2001; 18; 263-269
4. Pope JH, Aufderheide TP, Ruthazer R et al. Missed diagnoses of acute cardiac ischemia in the emergency department. N Engl J Med 2000; 342; 1163-1170
5. Smith ZA, Postma N, Wood D. FAST scanning in the developing world emergency department. S Afr Med J 2010; 100; 105-108
6. Quinn J, McDermott D, Stiell I et al. Prospective validation of the San Francisco syncope rule to predict patients with serious outcomes. Ann Emerg Med 2006; 47; 448 – 454
7. Quinn J, Stiell I, McDermott D et al. The San Francisco syncope rule vs. physician judgment and decision making. AJEM 2005; 23; 782-786
8. Serrano LA, Hess EP, Bellolio MF et al. Accuracy and quality of clinical decision rules for syncope in the emergency department: A systematic review and meta-analysis. Ann Emerg Med 2010; 56; 362-373
9. Hwan Jo Y, Kim K, Rhee JE et al. The accuracy of emergency medicine and surgical residents in the diagnosis of acute appendicitis. AJEM 2010; 28; 766-770
10. Blavais M, Lambert MJ, Harwood RA et al. Lower extremity Doppler for deep venous thrombosis – can emergency physicians be accurate and fast? Academic Emergency Medicine 2000; 7; 120-126
11. Swingler GH, Du Toit G, Andronikou S et al. Diagnostic accuracy of chest radiography in detecting mediastinal lymphadenopathy in suspected pulmonary tuberculosis. Arch Dis Child 2005; 90; 1153 – 1156

12. Onen CL. Clinical diagnosis of AIDS and HIV-related diseases. In: Essex M, Mboup S, Kanki PJ, eds. AIDS in Africa 2nd ed. New York, NY: Kluwer academic/plenium publishers 2002:297-316
13. Fischl MA. Introduction to the clinical spectrum of AIDS. In: Merigan TC, Bartlett JG, Bolognesi D, eds. Textbook of AIDS medicine 2nd ed. Baltimore, MA: Williams & Wilkins 1999:139-150
14. Nicol A, Steyn E. Handbook of Trauma for Southern Africa. Oxford University Press South Africa, 2004
15. Kramer EB, Graziano F. The Retroviral Emergency Department Support (REDS©) Course

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INSTRUCTIONS FOR AUTHORS (ANNALS OF EMERGENCY MEDICINE)

INSTRUCTIONS FOR AUTHORS

Scope and Stature of the Journal

Annals of Emergency Medicine, the official journal of the American College of Emergency Physicians, is an international, peer-reviewed journal dedicated to improving the quality of care by publishing the highest quality science for emergency medicine and related medical specialties. *Annals* publishes original research, clinical reports, opinion, and educational information related to the practice, teaching, and research of emergency medicine. In addition to general emergency medicine topics, *Annals* regularly publishes articles on out-of-hospital emergency medical services, paediatric emergency medicine, injury and disease prevention, health policy and ethics, disaster management, toxicology, and related topics. The journal welcomes submissions from international contributors and researchers of all specialties.

Annals continues to be the largest circulation peer review journal in emergency medicine (over 28,000 subscribers, several times its nearest competitor). It is also one of the most accessible to non-subscribing readers, since 5,365 institutions include *Annals* in their online licenses for ScienceDirect (the world's largest electronic collection of science, technology and medicine full text and bibliographic information). ScienceDirect was utilized for access to *Annals* articles approximately 562,000 times last year, a 24% increase from the prior year. *Annals* is also available on the Web (with full text of all articles dating back to its inception), where it received an average of 55,000 page views per month. More than 145,000 reprints were ordered last year.

Annals is the emergency medicine journal most frequently cited by authors and has the highest impact factor of all 19 journals in the emergency medicine category of the SCI (Science Citation Index). The impact factor (the average number of citations per published article) is the commonest measure of journal influence; the 2009 impact factor for *Annals* rose 13% to 4.23, representing 8,293 citations and putting it in the top 8.5% of all 7,300 science and medical journals tracked by the SCI. Not only is *Annals* most frequently cited, but it is cited promptly (52% more promptly

than its nearest competitor). Also its articles are cited longer than any other EM journal (8.4 years, 83% longer than its nearest competitor). In the past 5 years, 1,224 different journals in the ISI science journal database cited an article in *Annals*, and in a typical year, *Annals* articles are cited by over 400 different scientific journals, most of them from a broad range of specialties outside of emergency medicine.

Annals articles also generate considerable interest in the lay media. From October 2008 through September 2009 there were 554 hits in print and television, which reflects the changing media environment in which many newspapers and television stations are consolidating or closing. Radio coverage grew from 13,092 to 14,800 hits. An emerging area for coverage of *Annals* articles is blogs, which posted stories 3,040 times during that period. Major outlets included the *New York Times*, the *Wall Street Journal*, *National Public Radio*, the *Washington Post*, the *Los Angeles Times*, *USA Today*, *Reuters*, *Associated Press*, *MSNBC*, *NBC Nightly News*, *ABC News* and *CNN*, as well as many trade publications.

Annals is an international journal; half of the full text articles accessed via ScienceDirect were downloaded by readers in 79 countries outside the U.S. Our contributors are also international in scope; in 2009 submissions came to us from 43 different countries, with 36% of submissions originating outside the United States, and 14% originating outside North America and Western Europe. The largest volume other than the U.S. was submitted from Canada, Taiwan, China, Turkey, France, Korea, Australia, Netherlands, Italy, and Japan, in descending order. But the list also includes Brazil, Thailand, Tunisia, Georgia, India, Iran, Nigeria, and Serbia.

We strongly believe we have an obligation to make our journal available to international audiences regardless of their financial resources, and therefore have participated for many years in the HINARI initiative sponsored by large journal publishers (<http://www.healthinternetwork.org/src/eligibility.php>), which makes *Annals* available free or at greatly reduced cost in low-income countries. In 2007, *Annals* ranked 141st out of 1,423 Elsevier journal titles in full-text downloads of articles in HINARI countries.

In 2009 *Annals* was chosen one of the 100 most influential scientific journals of the past 100 years by the Special Libraries Association (www.sla.org). The Special

Libraries Association is one of the most respected and largest (11,000 members) library organizations. The entire list is at (<http://www.sla.org/content/Events/centennial/dbio100.cfm>). Some of the high profile medical journals on the list were *Cell*, *Circulation*, *JAMA*, *The Lancet*, *Nature*, *NEJM*, and *Science*. *Annals* is flattered to have received this recognition, which is testimony to the hard work, talent, and dedication of its editorial board, its staff, and all the authors who contribute to it.

Overview of these Instructions

These Instructions for Authors are divided into 4 equally important sections. Section I describes our overall philosophy and expectations regarding how original science should be conducted and reported. Section II describes the types of submissions that the journal accepts. Section III contains specific technical and formatting instructions to help authors prepare their manuscripts for submission with appropriate font, page margins, and so on. Section IV explains what you may expect from our review process.

Section I: Writing your manuscript

We understand that each journal has its own requirements and that there is little uniformity among journals. Our requirements reflect the preferences of our editors and readers, but they also are tailored to reflect what is known from research about best publication practices and the clearest communication of information. Most of these instructions should be familiar to you and not unique. Those that do not fit this description were not chosen arbitrarily, but instead represent the direction toward which we believe scientific publishing is evolving. We do not expect every manuscript to comply in every regard, but the more consistent a manuscript is with these guidelines, the more likely is publication.

Style and Content

General: We seek forthright, detailed reports of scientific investigations; review and educational articles; and scientific, ethical, social, political, and economic commentary on topics of importance to emergency medicine. We value reports of original science that accurately and clearly describe what was done and why it was done. Much of the medical literature is written as if studies were perfectly conducted, but we know this is not possible. We fully expect that some part of

every clinical study will deviate from the ideal. The candid disclosure of such deviations and the reasons they occurred is encouraged because it enhances the scientific process.

Writing Style: A well-written paper is more likely to be accepted for publication, and subsequently read and cited by others. We prefer a straightforward, unpretentious style whose chief purpose is to efficiently convey information. Use the active voice. Sentences should be simple and short. Never use a lengthy scientific term when a clear simpler one is available. In general, brevity conveys more genuine information than loquacity, and leads you and the reader to think more carefully about your message. The [British Medical Journal](#) is a good example of concise and effective writing that communicates a good deal of information with a modest number of words. We discourage the use of any but the most necessary of abbreviations; they may be a convenience for an author but are generally an impediment to easy comprehension for the reader. Most papers should have few or none of them. We particularly discourage the use of newly coined (and quickly forgotten) abbreviations to describe simple terms that most people say in English. Examples include BU for bedside ultrasound, UD for usual dose, CorrCrCl for corrected creatinine clearance, PEP for pediatric emergency physicians, ACE for adverse cardiac events, and VCPRCE for very confusing patients requiring a comprehensive evaluation (we invented none of these abbreviations except the last, but ones like it are occasionally also used). We appreciate the desire to save trees, but the need is not that great. For grammar, style, and punctuation, *Annals* uses the American Medical Association's *Manual of Style* for editorial style.^[2]

Word count limits for each type of submission are described later. Although we do not specify limits for each section of a paper, for original research papers, we strongly suggest that the number of pages devoted to the Introduction and Discussion sections not exceed those devoted to Methods and Results sections.

The importance of language editing continues to increase as journals strive to be truly global. Some articles need more than a style and grammar correction, and authors whose primary language is not English may wish to contact medical editors and writers to assist them in preparing their manuscripts in standard scientific English, which will increase their chance of acceptance. Such editing should always

be done before submission to the journal. Although authors will have to pay for these services, the pricing is not prohibitive in most cases. *Annals* has identified several outside Language Editing Support services that can be used for this purpose. Links to their Web sites are available on Elsevier's Author Gateway at: http://authors.elsevier.com/getting_published.html?dc=LE.

Organizing Reports of Original Research

Guidance for Specific Sections of Reports on Original Research

Abstract: Your abstract will be universally available for free online and will be read far more often than the entire paper. The abstract should be terse yet clear, accurate, and complete. Divide your 250-word abstract into the subheadings: Study hypothesis or Objective, Methods (include information on design, setting, participants, interventions, and main outcomes measured; it is not mandatory to include the subject headings), Results, and Conclusions. Present the magnitude of findings rather than the magnitude of test statistics or P values and keep the amount of numerical reporting consistent with readability. Do not draw conclusions stronger or more expansive than those in the body of the paper. Take care to include all important study limitations and caveats.

Introduction: The introduction to most papers should be less than 1.5 double-spaced manuscript pages (about 450 words); certainly no more than 2 pages. A 3-paragraph structure works well to convince the reader that your topic is new, scientifically important, and clinically relevant. In the first paragraph, under the subheading **Background**, succinctly describe the circumstances that set the stage for your investigation. Explain the historical context that led you to investigate the issue. Under **Importance**, describe why your investigation is consequential. What are its potential implications? How does it relate to issues raised in the first paragraph? Why is this specific investigation the next logical step? Conclude with a third paragraph, **Goals of This Investigation**, in which you state the specific research objective in a detailed manner. Include your primary outcome measure (eg, "We considered a 1-hour median decrease in length of stay important. . .) and the desired precision of the measurement (. . .and wished to enroll sufficient subjects that we could be 95% certain that our estimate was within 20 minutes of the true value.")

Methods: Readers will use your Methods section to determine the validity of your study. Provide enough detail so that a knowledgeable reader could, in principle, replicate all aspects of your study. A statement of institutional review board (IRB) approval or exemption from full review is required.

The Methods section should be organized in a logical and sequential order. Help readers by using the following subheadings to divide the [Methods into meaningful sections](#):

[Theoretical model of the problem](#)

[Study design](#)*

[Setting](#)*

[Selection of participants](#)*

[Interventions](#)

[Methods of measurement](#)*

[Data collection and processing](#)

[Outcome measures](#)

[Primary data analysis](#)*

[Sensitivity analyses](#)

**These subheadings should be included in almost every Original Research paper.*

Authors may note that our preferences regarding analytic methods and presentation of results differ somewhat from other journals. Rest assured that we do not do this to be idiosyncratic or to create annoying roadblocks on the way to publication. Our philosophy is summarized in the editorial[\[32\]](#) that introduced this version of the instructions and is supported by many of the cited references. It represents our attempt to synthesize best practices regarding the conduct and presentation of clinical research. The instructions can be summarized as: show your data at the level of the unit of analysis (using graphics), report estimates of the size of effects (and your confidence in your estimates) instead of the statistical significance of effects, and account for bias when making claims about your results. Because there is no proven best way to do science, we have no absolute rules. Nevertheless, by reading and complying with what follows and having well thought-out reasons when you deviate, you will maximize your chances of getting your work published.

Begin with an explanation of the [theoretical model](#) underlying the investigation. Provide a broad overview of the [study design](#) using [standard terms](#). Describe the [setting](#), [method for selecting participants](#), study protocol (including any [interventions](#)), [methods of measurement](#), and methods for [data collection and processing](#). Identify your primary and secondary [outcome measures](#). We prefer patient-centered outcomes (eg, pain, mood, mortality, days lost from work or school, quality of life) to intermediate outcomes (eg, change in FEV1, number of defibrillations), and previously validated measures to newly invented ones.

Describe the [analytic plan](#) in enough detail that a statistically sophisticated reader with access to the original data could replicate the results. Justify any data manipulations (eg, combining categories, breaking continuous responses into discrete ranges), and other adjustment techniques. Describe the rationale for the analytic strategy for each of the research questions or hypotheses. Do not simply list a series of statistical procedures. We encourage authors to specifically and explicitly describe the assumptions and judgments made in executing their analytic strategy. We also encourage authors to recognize that, when done properly, detailed graphical presentation of the results is a complete analytic method that does not require additional statistical modeling to enhance its validity. Inform the reader of how results will be presented. Document the software used for data management and analysis. Anticipate the likely biases to your study and incorporate [sensitivity analyses](#) exploring how these biases might affect results into your design and analytic plan.[\[33,34\]](#)

If you find that providing this level of detail produces a Methods (or Results) section that is too long, or too complex for the typical reader, consider presenting the details in an appendix. This can be submitted with the manuscript so that the reviewers have access to all of the details. If the paper is accepted, the appendix can be included on *Annals'* Web site instead of in the print journal.

Results: Present the results in a logical, sequential order that parallels the organization of the Methods section. Account for all subjects, beginning with the number of subjects who could have participated in the study. Present as much data as possible at the level of the unit of analysis. *Annals'* preferences for reporting results, from most preferred to least are: graphical depictions of data; summaries of

data (ie, means, medians, ranges); confidence intervals; point estimates; *P* values; and other measures of statistical significance.[\[35\]](#) For example, in a study with 2 groups and a continuous outcome measure, a graph showing the distribution for each group would be best; measures of central tendency and dispersion for each group next best; the sentence "the 95% confidence limits for the difference in means was ____" acceptable; and the statement, "The difference in means was significant," should be avoided. Use tables and figures to empower readers to reach their own conclusions about your work. When describing the dispersion of the data, present standard deviation, not standard error of the mean.

Emphasize the estimation of the size of effects over the determination of whether effects are statistically significant.[\[35-43\]](#) When possible, avoid statistical hypothesis testing. For more information on these issues see the [editorial](#) that accompanied the introduction of this version of the Instructions to Authors. At minimum, restrict estimation and testing procedures to the a priori hypotheses of interest. Statistics, whether descriptive or hypothesis testing, should not be a substitute for the presentation of data. Do not perform multiple statistical tests or adjustments in an exploratory manner to discover "significant" *P* values. When calculating confidence intervals, or other statistics, consider using methods that incorporate uncertainty regarding the validity of assumptions implied by classical statistical techniques.[\[44-48\]](#)

Do not repeat data presented in tables and figures in the text. Use the text to highlight the most important aspects of the figures and tables and to convey unique information. Round numerical results to a level of precision appropriate for the study (eg, the percent response in a study group with 80 subjects should be reported as 35%, not 35.6%). For specific guidance based on [study design](#) and analytic strategy, consider using Lang's guidelines.[\[49\]](#)

When using statistical models, do not restrict your analysis to the "best case" scenario. Include sensitivity analyses that explore how results change when the assumptions of the model are altered.[\[33,34\]](#)

You may use the following subheadings in the Results section:

Characteristics of study subjects

Main results

Sensitivity analyses

Tables and Figures: Make all tables and figures self-explanatory (able to stand alone). Graphics should be used to convey patterns and details that cannot be succinctly conveyed in tables or text. When appropriate, include potentially important covariates in the tables and figures. We prefer graphics that show the distribution of data (eg, scatterplots, 1-way plots, box plots) to those showing summaries of data (eg, pie charts, bar graphs of means). If the data collected are paired (eg, pre and post, or 2 different measures on the same subject), then choose a graphical format that conveys the inherent pairing of the data. Avoid background gridlines and other formatting that do not convey information (eg, superfluous use of 3-dimensional formatting, background shadings).[\[50-54\]](#) Omit internal horizontal and vertical rules.

Arrange tables so that the primary comparisons of interest are horizontal, left-to-right (the standard reading order). Provide the N for each column or row and marginal totals where appropriate. For more details on technical requirements, [please click here](#).

Limitations: Explicitly discuss the limitations of your study. Describe the limitations in the context of the [theoretical model](#) of your research. You can lessen the need for a lengthy limitations section by choosing analytic strategies that account for potential biases. Consider threats to the internal and external validity of your results. Do not simply list potential limitations but examine the magnitude and direction of each bias and how it might affect the interpretation of results. Discuss the implications of any sensitivity analyses.

Discussion: Briefly summarize the results and how they relate to your area of investigation. Do not attempt a literature review. Consider only those published articles directly relevant to interpreting your results and placing them in context. Do not stress statistical significance over clinical importance. Avoid extrapolation to persons or conditions that you have not explicitly studied in your investigation. Avoid claims about cost or economic benefit unless a formal cost-effectiveness analysis was presented in the Methods and Results sections. Do not suggest "more

research is needed" without stating what the specific next step is. You may use the subheading "In Retrospect" to candidly discuss what you would do differently if given the opportunity to repeat the study, so others can learn from your experience. Conclude this section with a brief summary statement. Take care that the conclusion is restricted to that which can be justified by your experimental results.

You may use the following subheading in the Discussion section:

-In retrospect

Section III: Formatting and submitting your manuscript

Manuscript Submission

Annals uses a Web-based peer review system, [Editorial Manager](#) to receive all submissions and no longer accepts submissions by mail. Our Web-based system provides full electronic capabilities not only for submission, but also for peer review and status updates. It also speeds manuscript turnaround and provides global access for authors, reviewers, and editors. Authors, reviewers, and editors will receive automatic e-mail messages from Editorial Manager when significant events occur. Detailed instructions and a help file are provided at the Web site. If you have difficulties uploading your manuscript, please contact the journal office at annemergmed@acep.org.

The submission requirements of *Annals of Emergency Medicine* are in accordance with the ["Uniform Requirements for Manuscripts Submitted to Biomedical Journals"](#) (with the exception of our authorship requirements) and the ["Declaration of Helsinki: Recommendations guiding physicians in biomedical research involving human subjects"](#).^[55] *Annals* uses the American Medical Association's *Manual of Style* for editorial style.^[2]

Required Submission Documents

When submitting your manuscript to *Annals* via our Web-based peer review system, [Editorial Manager](#), each type of submission has its unique items for submission. The following documents are required for most types of manuscripts submitted to *Annals* and should be saved as separate electronic files for uploading to the Web system (**Note:** only the Manuscript Submission Agreement can be submitted offline):

Cover Letter

Manuscript Submission Agreement

Author Contributions Statement (for Original Research and Brief Research Reports only)

Title Page

Abstract, Article, References

We strongly suggest you keep copies of all submission documents in the event of any problem.

Cover Letter: The cover letter should identify and briefly describe the manuscript. In addition, it should:

- list the title of the article
- identify the journal category for which your manuscript is intended
- identify the corresponding author
- indicate whether it is a randomized controlled trial or other standardized study type described below; include trial registration number if applicable
- provide full information about any form of prior publication (see "Prior Publication" above)
- describe any situation that might be perceived as a conflict of interest
- list any copyright constraints

Save the cover letter as a separate electronic file for uploading to Editorial Manager.

Manuscript Submission Agreement: A Manuscript Submission Agreement is printed in every issue of the journal and is available [here](#) in PDF form. In the event you receive a request from the editor asking you to revise your paper, a Manuscript Submission Agreement must be faxed to the editorial office. All authors' signatures are required at the time of final acceptance. Your paper will not be published until the Manuscript Submission Agreement is received.

The sections on IRB/Informed Consent, Conflict of Interest, and Statistical Consultant should be especially noted. Any subsequent changes to the authorship status of individuals listed on this document will require written consent from those authors themselves.

Author Contributions Statement: In all Original Research and Brief Research Reports, the corresponding author must provide information on the contributions each author has made to the article. The purpose of this listing is to give credit where it is due. Additionally, this will serve to clearly identify who is responsible for the quality, accuracy, and ethics of the work, and to whom we may turn for details of the research not included in the manuscript. Listings should be brief and to the point. The details of our reasons for this requirement, and a discussion of the various types of authorship (along with samples) is elaborated elsewhere.[\[56\]](#)

An example of a typical description of a multicenter clinical trial might be:

MBK, BD, and NT conceived the study, designed the trial, and obtained research funding. MBK, BD, ML, and NT supervised the conduct of the trial and data collection. EW, SF, and MG undertook recruitment of participating centers and patients and managed the data, including quality control. NT and BD provided statistical advice on [study design](#) and analyzed the data; ML chaired the data oversight committee. BD drafted the manuscript, and all authors contributed substantially to its revision. MBK takes responsibility for the paper as a whole.

Save the author contributions information as a separate electronic file for uploading to Editorial Manager.

Title Page: On the title page, include the title; the authors' full names, academic degrees (provide no more than 2 per author; do not include honorary affiliations, such as fellow status in an organization), and affiliations (including department, division, institution, city, state, and country) at the time of the study; the name of the meeting, city, state, and date (month and year) if the paper has been presented; acknowledgment of grants (including grant number) or other financial support, including compensation for consulting; trial number, when relevant; the phrase "word count" followed by a numeric word count of the text (excluding abstract and references), and the phrase, "Address for reprints..." followed by the full name, address, telephone number, fax number, and e-mail address of the appropriate author. (If you do not wish reprints, simply write the phrase "Reprints not available from the authors" in this space). The same should be given for the Corresponding Author if it is different. Save the title page as a separate file for uploading to Editorial Manager.

Abstract, Article, and References: The abstract, main text of your manuscript, and the references should be combined into 1 electronic file for uploading to Editorial Manager. Number the pages beginning with the abstract. It is optional whether any tables or figures appear after the references or are uploaded as separate items in Editorial Manager.

Manuscript Preparation

Format: All manuscripts should be double-spaced with standard margins. Number pages consecutively, beginning with the abstract.

Blinded Peer Review: We blind reviewers to the authors' names and institutions as a courtesy to our authors. Although this process has not been shown to affect the quality of reviews, we believe it increases the likelihood of fairness. We encourage authors to maintain such blinding by excluding from the abstract and text any identifying information (eg, names, institution, city) or first-person references to their prior research. Authors who choose to leave this identifying information in their submission anyway effectively waive their right to a blinded review.

Title Page: Follow the guidelines list in Section III. Formatting and Submitting Your Manuscript. [Required Submission Documents](#)

Abstract: For Original Research and Brief Research Reports, follow the instructions for original research listed above. For Concepts, Review Articles, and Case Reports, include a narrative abstract of no more than 250 words summarizing the paper.

Text: For Original Research and Brief Research Reports, divide the text into the sections: Introduction, Methods, Results, Limitations, and Discussion (including a final paragraph that summarizes the conclusion); and [subheadings](#)

Units of Measure: Provide units of measure in common reference values, followed by Systeme International (SI) units in parentheses. [\[54\]](#)

Drugs: Use generic names and, if necessary in the Methods section, list brand names (including the manufacturer's name, city, and state) in parentheses. Please include the International Nonproprietary Name (INN) as well. [\[60\]](#)

References: Do not use the endnote or footnote function of word processing software to generate a list of references. Number references (including references to unpublished information) consecutively in the order of their appearance in the manuscript. Type a list of references in their order of mention in the text, not

alphabetically, at the end of the manuscript.^[61] Abbreviate journal names according to [Index Medicus](#). Indicate abstracts by "abstract" in parentheses. *Annals'* style is to list the first 3 authors, followed by "et al" if there are more than 3. Accuracy of citations is the author's responsibility. Examples of correct referencing forms are as follows:

Journal Article: Raftery KA, Smith-Coggins R, Chen AHM. Gender-associated differences in emergency department pain management. *Ann Emerg Med*. 1995;26:414-421.

Book: Huddy J. *Emergency Department Design: A Practical Guide to Planning for the Future*. Dallas, TX: American College of Emergency Physicians; 2002.

Book Chapter: Mengert TJ, Eisenberg MS. Prehospital and emergency medicine thrombolytic therapy. In: Tintinalli JE, Ruiz E, Krome RL, eds. *Emergency Medicine: A Comprehensive Study Guide*. 4th ed. New York NY: McGraw-Hill; 1996:337-343.

Courses, lectures (unpublished): Sokolove PE. Needlesticks and high-risk exposure. Course lecture presented at: American College of Emergency Physicians, *Scientific Assembly*, October 12, 1998; San Diego, CA.

Internet: Gore L. ACEP hails House passage of the HEALTH Act [press release]. American College of Emergency Physicians Web site. Available at: <http://www.acep.org/1,32181,0.html>. Accessed March 14, 2003.

Tables: Number tables consecutively. Refer to each table consecutively in the text. Each table must be on a separate page after the references.

Figures: Figures (charts, graphs, photographs, etc.) and legends should be self-explanatory and able to stand alone; the data presented in a figure should not be duplicated in the text. Refer to each figure consecutively in the text. If you are reporting a randomized controlled trial, your first figure should be the one described under [Participant Flow in the CONSORT criteria](#).

Submit each figure as a separate file; do not paste them into the word processing document.

PART D:

APPENDIX

University of Cape Town

Appendix A: Data Collection Sheet

DIAGNOSIS

1. 2. 3.

AGE

y

SEX

1. 2.

EMERGENCY CATEGORY

1. 2.
3. 4.
5.

REFERRING STAFF

1. 2.

SHIFT

1. 2. 3.

Appendix B: Study Data

Please note that the terminology used in the data tables (correct, incomplete, incorrect) has been changed in the dissertation and article text to complete correlation, incomplete correlation and no-correlation.

Basic Statistics/Tables (Data in Analysis - 02Mar2011.stw)

Descriptive statistics dialog

Descriptive Statistics (Data in Analysis - 02Mar2011.stw)

Variable	Descriptive Statistics (Data in Analysis - 02Mar2011.stw)								
	Valid N	Mean	Confidence -95.000%	Confidence 95.000%	Median	Minimum	Maximum	Lower Quartile	Upper Quartile
Age	1567	42.3860	41.4552	43.3169	37.0000	13.0000	97.0000	27.0000	56.0000

Basic Statistics/Tables (Data in Analysis - 02Mar2011.stw)

Frequency tables dialog

Frequency table: Diagnosis (Data in Analysis - 02Mar2011.stw)

Category	Frequency table: Diagnosis (Data in Analysis - 02Mar2011.stw)			
	Count	Cumulative Count	Percent	Cumulative Percent
Correct	911	911	57.5126	57.5126
Incorrect	225	1136	14.2045	71.7171
Incomplete	448	1584	28.2828	100.0000
Missing	0	1584	0.0000	100.0000

Frequency table: Age Category (Data in Analysis - 02Mar2011.stw)

Category	Frequency table: Age Category (Data in Analysis - 02Mar2011.stw)			
	Count	Cumulative Count	Percent	Cumulative Percent
Younger than 65	1320	1320	83.3333	83.3333
65 and older	247	1567	15.5934	98.9267
Missing	17	1584	1.0732	100.0000

Frequency table: Gender (Data in Analysis - 02Mar2011.stw)

Category	Frequency table: Gender (Data in Analysis - 02Mar2011.stw)			
	Count	Cumulative Count	Percent	Cumulative Percent
Male	810	810	51.1363	51.1363
Female	774	1584	48.8636	100.0000
Missing	0	1584	0.0000	100.0000

Frequency table: Type (Data in Analysis - 02Mar2011.stw)

Category	Frequency table: Type (Data in Analysis - 02Mar2011.stw)			
	Count	Cumulative Count	Percent	Cumulative Percent
Surgical	532	532	33.5858	33.5858
Trauma	246	778	15.5303	49.1161
Medical - IRS and Complications	154	932	9.7222	58.8383
Medical - Other	404	1336	25.5050	84.3433
Medical - HIV/TB	248	1584	15.6565	100.0000
Missing	0	1584	0.0000	100.0000

Frequency table: Type (Condensed) (Data in Analysis - 02Mar2011.stw)

Category	Frequency table: Type (Condensed) (Data in Analysis - 02Mar2011.stw)			
	Count	Cumulative Count	Percent	Cumulative Percent
Surgical	532	532	33.5858	33.5858
Trauma	246	778	15.5303	49.1161
Medical	806	1584	50.8838	100.0000
Missing	0	1584	0.0000	100.0000

Frequency table: Staff (Data in Analysis - 02Mar2011.stw)

Category	Frequency table: Staff (Data in Analysis - 02Mar2011.stw)			
	Count	Cumulative Count	Percent	Cumulative Percent
EM Registrar	467	467	29.4823	29.4823
Medical Office	1117	1584	70.5176	100.0000
Missing	0	1584	0.0000	100.0000

Frequency table: Shift (Data in Analysis - 02Mar2011.stw)

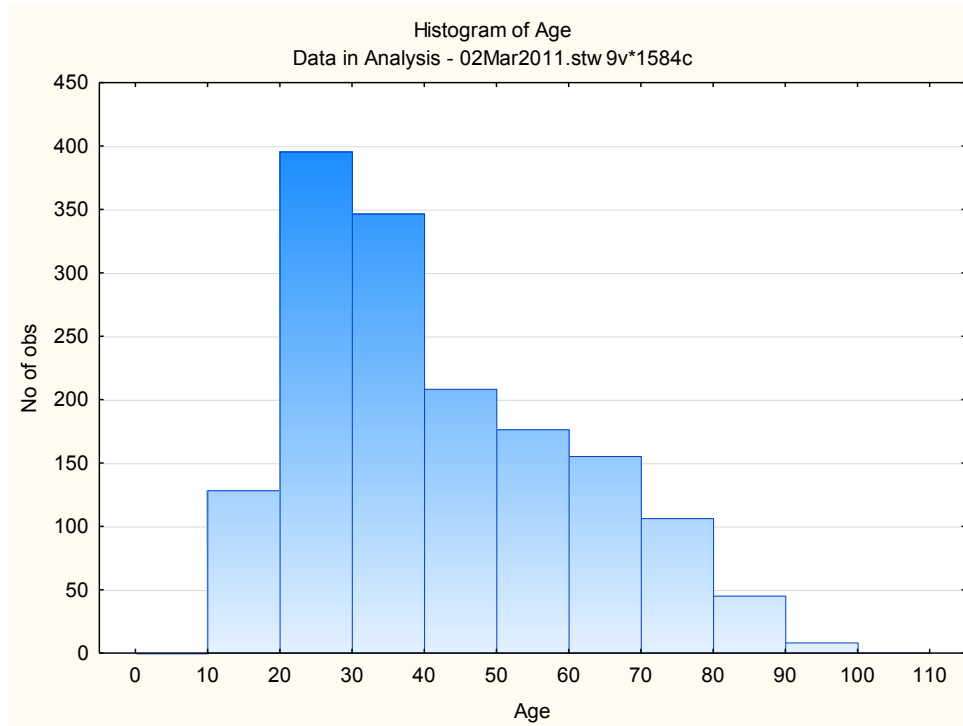
Category	Frequency table: Shift (Data in Analysis - 02Mar2011.stw)			
	Count	Cumulative Count	Percent	Cumulative Percent
16:00 to 24:00	630	630	39.7727	39.7727
08:00 to 16:00	623	1253	39.3308	79.1035
24:00 to 08:00	331	1584	20.8964	100.0000
Missing	0	1584	0.0000	100.0000

Frequency table: Facility (Data in Analysis - 02Mar2011.stw)

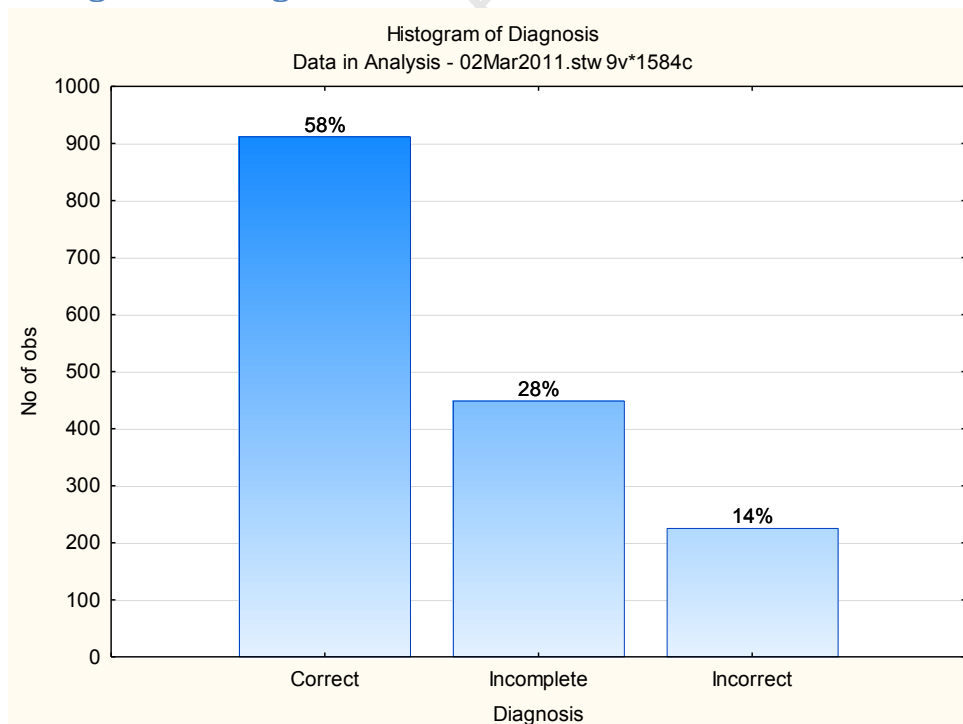
Category	Frequency table: Facility (Data in Analysis - 02Mar2011.stw)			
	Count	Cumulative Count	Percent	Cumulative Percent
Victoria	541	541	34.1540	34.1540
NSH	517	1058	32.6388	66.7928
GF Jooste	526	1584	33.2070	100.0000
Missing	0	1584	0.0000	100.0000

2D Histograms (Data in Analysis - 02Mar2011.stw)

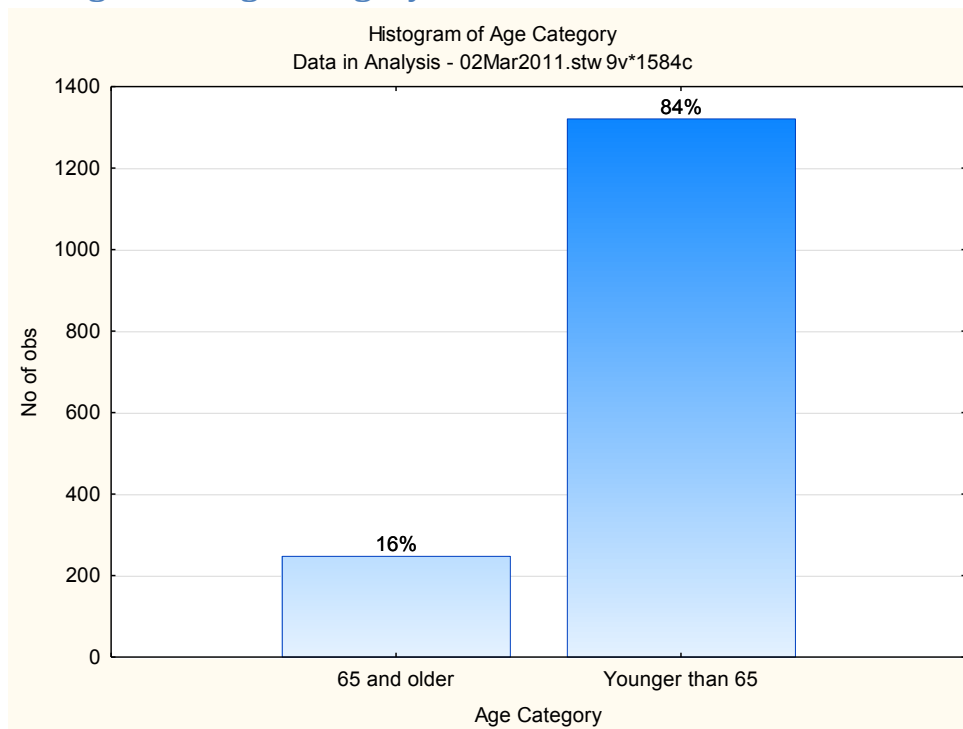
Histogram of Age



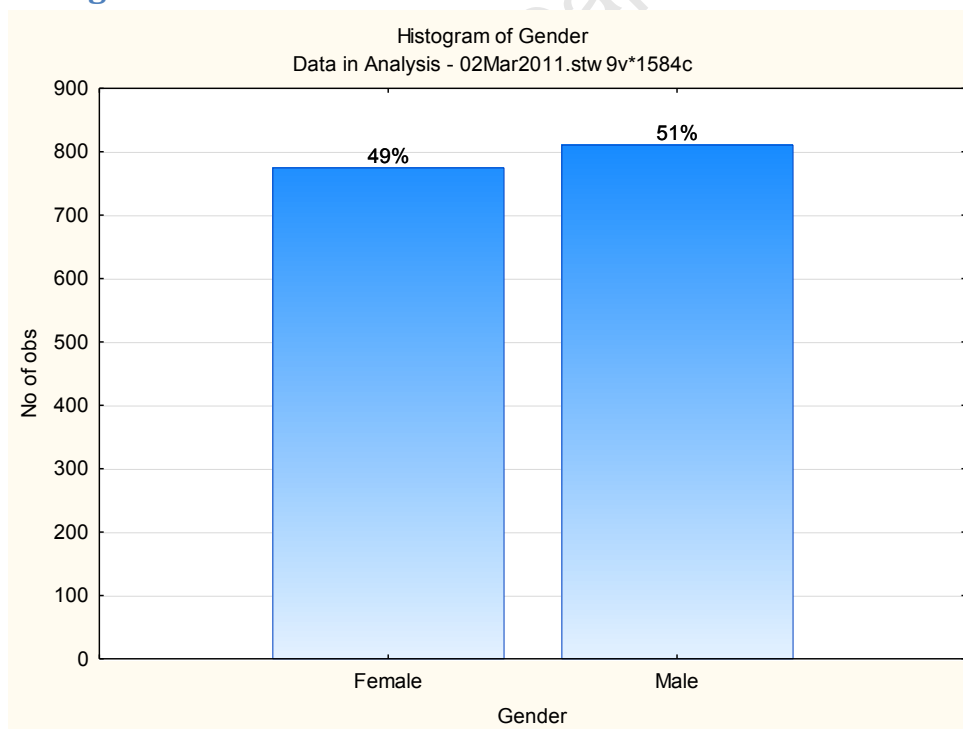
Histogram of Diagnosis



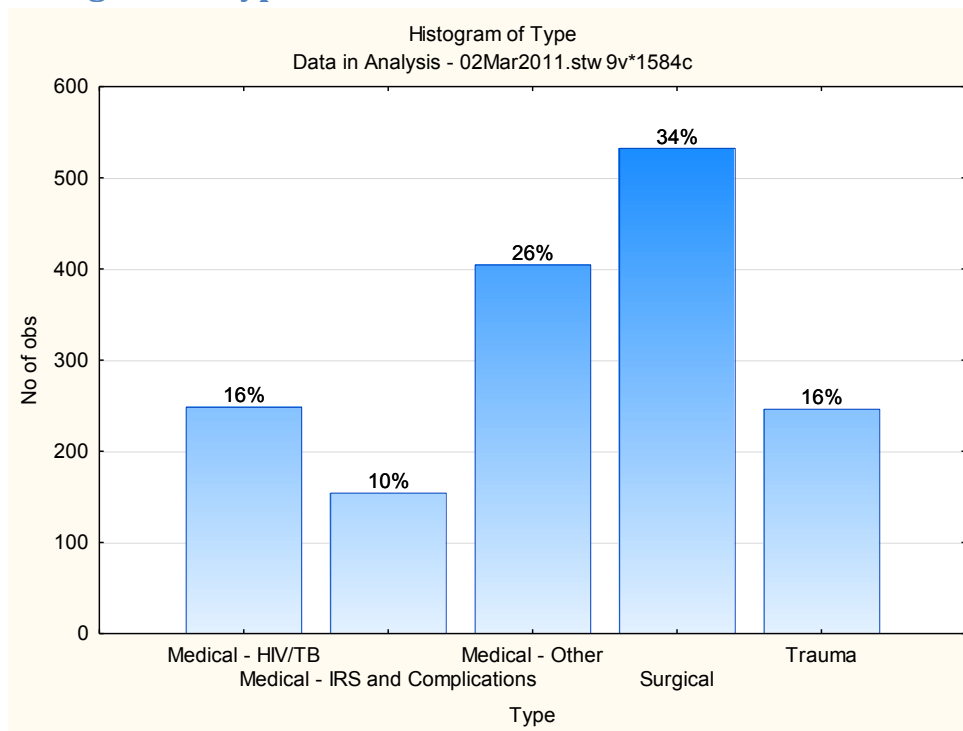
Histogram of Age Category



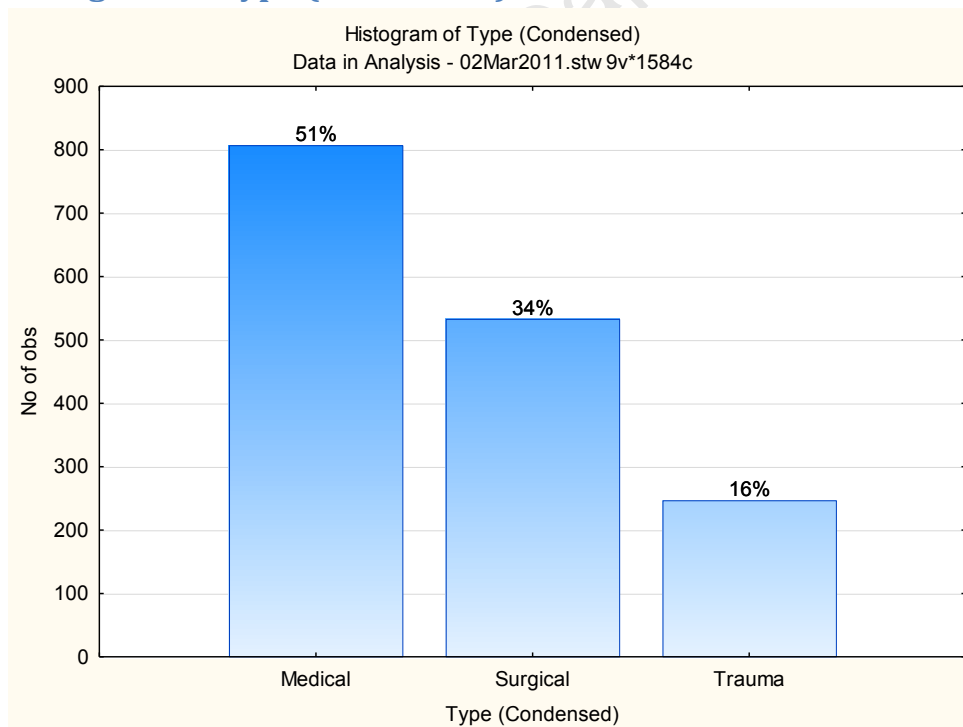
Histogram of Gender



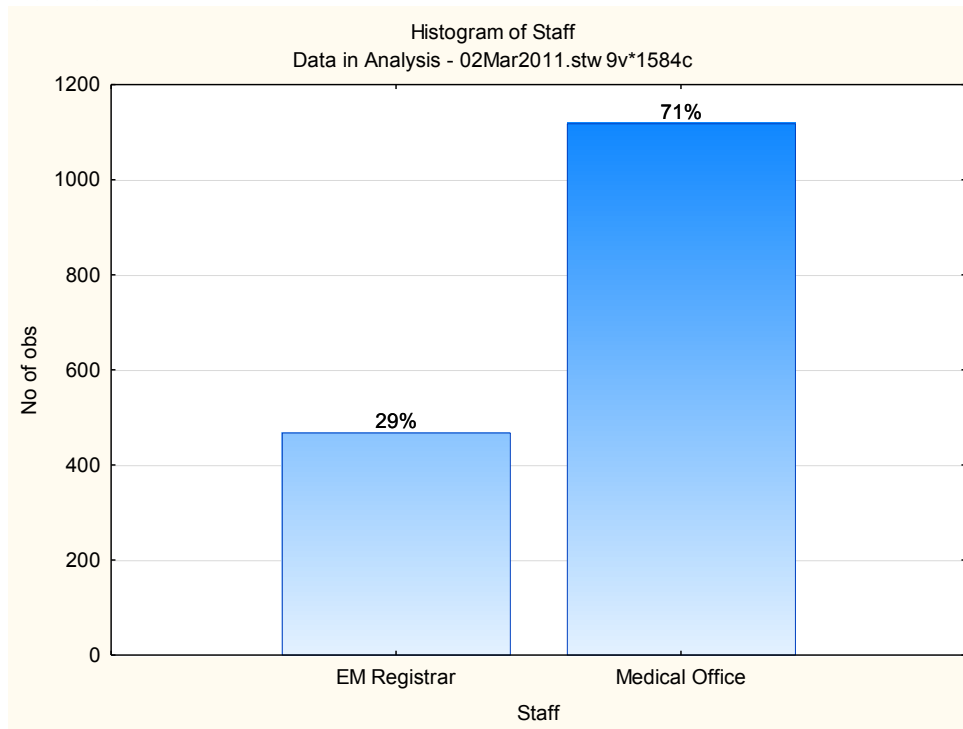
Histogram of Type



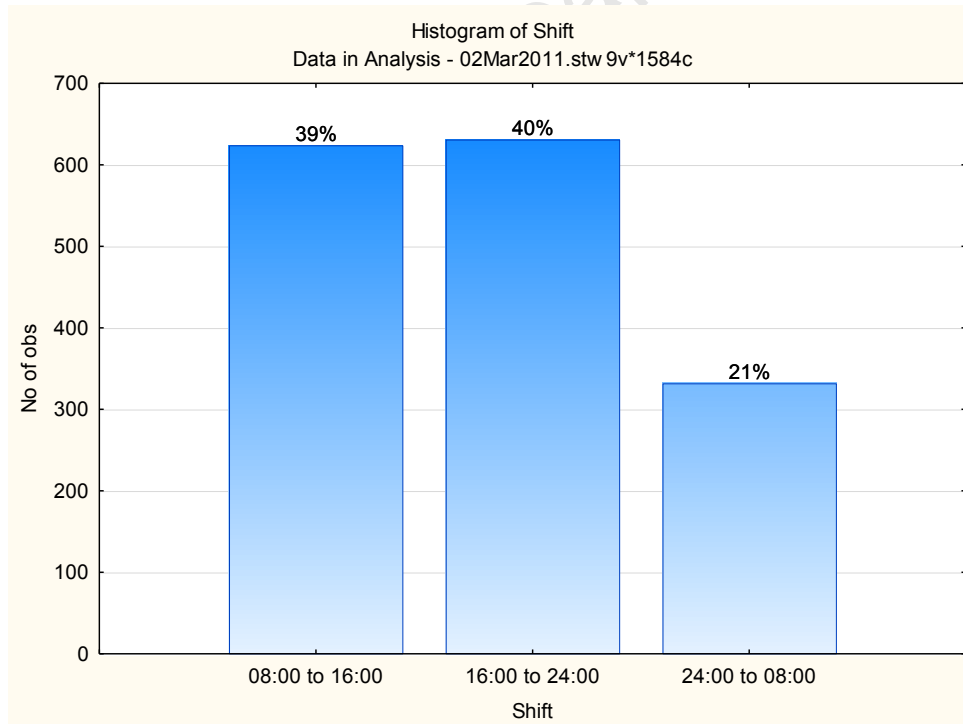
Histogram of Type (Condensed)



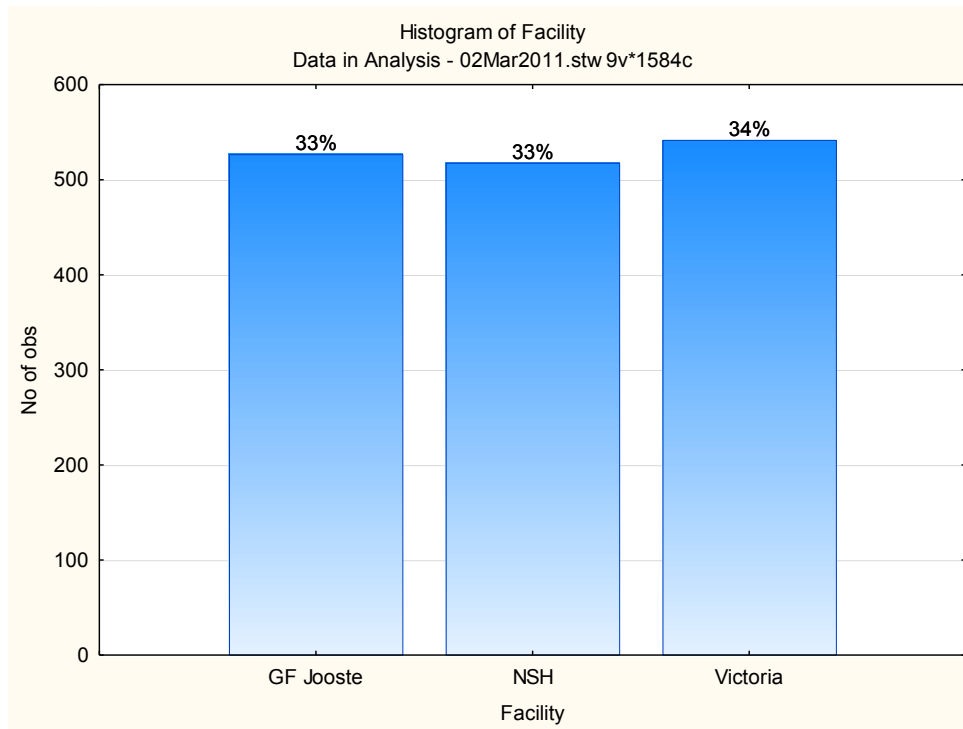
Histogram of Staff



Histogram of Shift



Histogram of Facility



Basic Statistics/Tables (Data in Analysis - 02Mar2011.stw)

Cross tabulation results dialog

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw)

2-Way Summary Table: Observed Frequencies Marked cells have counts > 4			
Diagnosis	Age Category Younger than 65	Age Category 65 and older	Row Totals
Correct	773	131	904
Column %	58.56%	53.04%	
Row %	85.51%	14.49%	
Total %	49.33%	8.36%	57.69%
Incorrect	186	35	221
Column %	14.09%	14.17%	
Row %	84.16%	15.84%	
Total %	11.87%	2.23%	14.10%
Incomplete	361	81	442
Column %	27.35%	32.79%	
Row %	81.67%	18.33%	
Total %	23.04%	5.17%	28.21%
Totals	1320	247	1567
Total %	84.24%	15.76%	100.00%

Statistics: Diagnosis(3) x Age Category(2) (Data in Analysis - 02Mar2011.stw)

Statistic	Statistics: Diagnosis(3) x Age C		
	Chi-square	df	p
Pearson Chi-square	3.28854	df=2	p=.1931
M-L Chi-square	3.22476	df=2	p=.1994

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw)

2-Way Summary Table: Observed Frequencies			
Marked cells have counts > 4			
Diagnosis	Gender Male	Gender Female	Row Totals
Correct	481	430	911
Column %	59.38%	55.56%	
Row %	52.80%	47.20%	
Total %	30.37%	27.15%	57.51%
Incorrect	89	136	225
Column %	10.99%	17.57%	
Row %	39.56%	60.44%	
Total %	5.62%	8.59%	14.20%
Incomplete	240	208	448
Column %	29.63%	26.87%	
Row %	53.57%	46.43%	
Total %	15.15%	13.13%	28.28%
Totals	810	774	1584
Total %	51.14%	48.86%	100.00%

Statistics: Diagnosis(3) x Gender(2) (Data in Analysis - 02Mar2011.stw)

Statistic	Statistics: Diagnosis(3) x Gender		
	Chi-square	df	p
Pearson Chi-square	14.1477	df=2	p=.0008
M-L Chi-square	14.2164	df=2	p=.0008

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw)

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw) Marked cells have counts > 4						
Diagnosis	Type Surgical	Type Trauma	Type Medical - IRS and Complications	Type Medical - Other	Type Medical - HIV/TE	Row Totals
Correct	310	183	93	233	92	911
Column %	58.27%	74.39%	60.39%	57.67%	37.10%	
Row %	34.03%	20.09%	10.21%	25.58%	10.10%	
Total %	19.57%	11.55%	5.87%	14.71%	5.81%	57.51%
Incorrect	88	10	12	58	57	225
Column %	16.54%	4.07%	7.79%	14.36%	22.98%	
Row %	39.11%	4.44%	5.33%	25.78%	25.33%	
Total %	5.56%	0.63%	0.76%	3.66%	3.60%	14.20%
Incomplete	134	53	49	113	99	448
Column %	25.19%	21.54%	31.82%	27.97%	39.92%	
Row %	29.91%	11.83%	10.94%	25.22%	22.10%	
Total %	8.46%	3.35%	3.09%	7.13%	6.25%	28.28%
Totals	532	246	154	404	248	1584
Total %	33.59%	15.53%	9.72%	25.51%	15.66%	100.00%

Statistics: Diagnosis(3) x Type(5) (Data in Analysis - 02Mar2011.stw)

Statistic	Statistics: Diagnosis(3) x Type(5)		
	Chi-square	df	p
Pearson Chi-square	86.5239	df=8	p=.00000
M-L Chi-square	92.8236	df=8	p=.00000

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw)

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw) Marked cells have counts > 4				
Diagnosis	Type (Condensed Surgical)	Type (Condensed Trauma)	Type (Condensed Medical)	Row Totals
Correct	310	183	418	911
Column %	58.27%	74.39%	51.86%	
Row %	34.03%	20.09%	45.88%	
Total %	19.57%	11.55%	26.39%	57.51%
Incorrect	88	10	127	225
Column %	16.54%	4.07%	15.76%	
Row %	39.11%	4.44%	56.44%	
Total %	5.56%	0.63%	8.02%	14.20%
Incomplete	134	53	261	448
Column %	25.19%	21.54%	32.38%	
Row %	29.91%	11.83%	58.26%	
Total %	8.46%	3.35%	16.48%	28.28%
Totals	532	246	806	1584
Total %	33.59%	15.53%	50.88%	100.00%

Statistics: Diagnosis(3) x Type (Condensed)(3) (Data in Analysis - 02Mar2011.stw)

Statistic	Statistics: Diagnosis(3) x Type (
	Chi-square	df	p
Pearson Chi-square	48.4704	df=4	p=.0000
M-L Chi-square	54.7003	df=4	p=.0000

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw)

2-Way Summary Table: Observed Frequencies			
Marked cells have counts > 4			
Diagnosis	Staff EM Registrar	Staff Medical Office	Row Totals
Correct	287	624	911
Column %	61.46%	55.86%	
Row %	31.50%	68.50%	
Total %	18.12%	39.39%	57.51%
Incorrect	50	175	225
Column %	10.71%	15.67%	
Row %	22.22%	77.78%	
Total %	3.16%	11.05%	14.20%
Incomplete	130	318	448
Column %	27.84%	28.47%	
Row %	29.02%	70.98%	
Total %	8.21%	20.08%	28.28%
Totals	467	1117	1584
Total %	29.48%	70.52%	100.00%

Statistics: Diagnosis(3) x Staff(2) (Data in Analysis - 02Mar2011.stw)

Statistic	Statistics: Diagnosis(3) x Staff(2)		
	Chi-square	df	p
Pearson Chi-square	7.54152	df=2	p=.0230
M-L Chi-square	7.84201	df=2	p=.0198

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw)

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw)				
Marked cells have counts > 4				
Diagnosis	Shift 16:00 to 24:00	Shift 08:00 to 16:00	Shift 24:00 to 08:00	Row Totals
Correct	344	371	196	911
Column %	54.60%	59.55%	59.21%	
Row %	37.76%	40.72%	21.51%	
Total %	21.72%	23.42%	12.37%	57.51%
Incorrect	94	90	41	225
Column %	14.92%	14.45%	12.39%	
Row %	41.78%	40.00%	18.22%	
Total %	5.93%	5.68%	2.59%	14.20%
Incomplete	192	162	94	448
Column %	30.48%	26.00%	28.40%	
Row %	42.86%	36.16%	20.98%	
Total %	12.12%	10.23%	5.93%	28.28%
Totals	630	623	331	1584
Total %	39.77%	39.33%	20.90%	100.00%

Statistics: Diagnosis(3) x Shift(3) (Data in Analysis - 02Mar2011.stw)

Statistic	Statistics: Diagnosis(3) x Shift(3)		
	Chi-square	df	p
Pearson Chi-square	4.78480	df=4	p=.31010
M-L Chi-square	4.83064	df=4	p=.30511

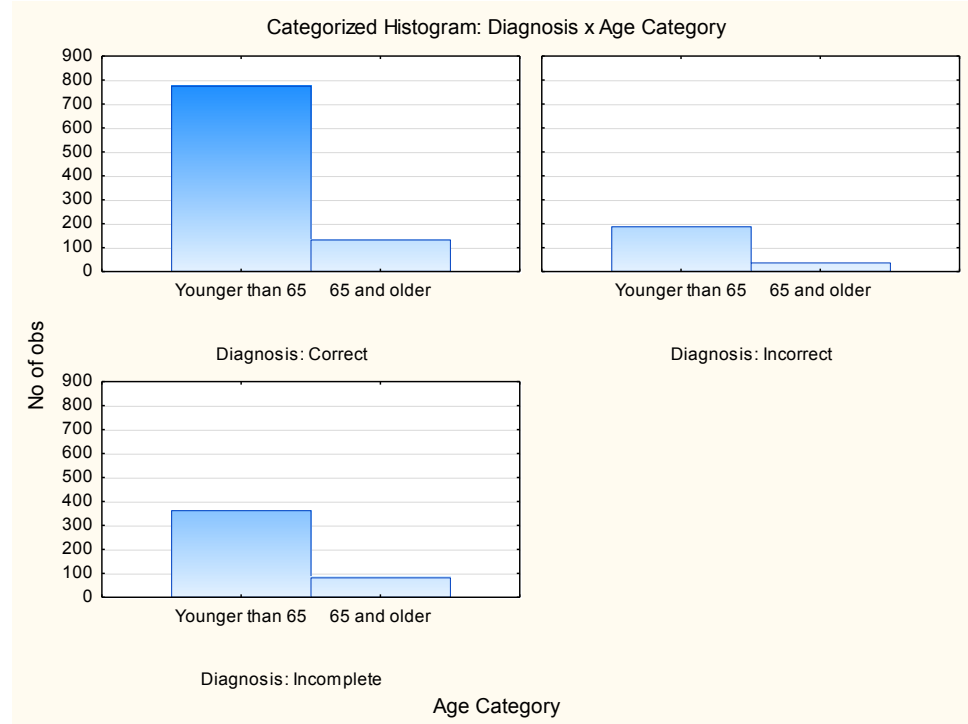
2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw)

2-Way Summary Table: Observed Frequencies (Data in Analysis - 02Mar2011.stw)				
Marked cells have counts > 4				
Diagnosis	Facility Victoria	Facility NSH	Facility GF Jooste	Row Totals
Correct	348	287	276	911
Column %	64.33%	55.51%	52.47%	
Row %	38.20%	31.50%	30.30%	
Total %	21.97%	18.12%	17.42%	57.51%
Incorrect	42	78	105	225
Column %	7.76%	15.09%	19.96%	
Row %	18.67%	34.67%	46.67%	
Total %	2.65%	4.92%	6.63%	14.20%
Incomplete	151	152	145	448
Column %	27.91%	29.40%	27.57%	
Row %	33.71%	33.93%	32.37%	
Total %	9.53%	9.60%	9.15%	28.28%
Totals	541	517	526	1584
Total %	34.15%	32.64%	33.21%	100.00%

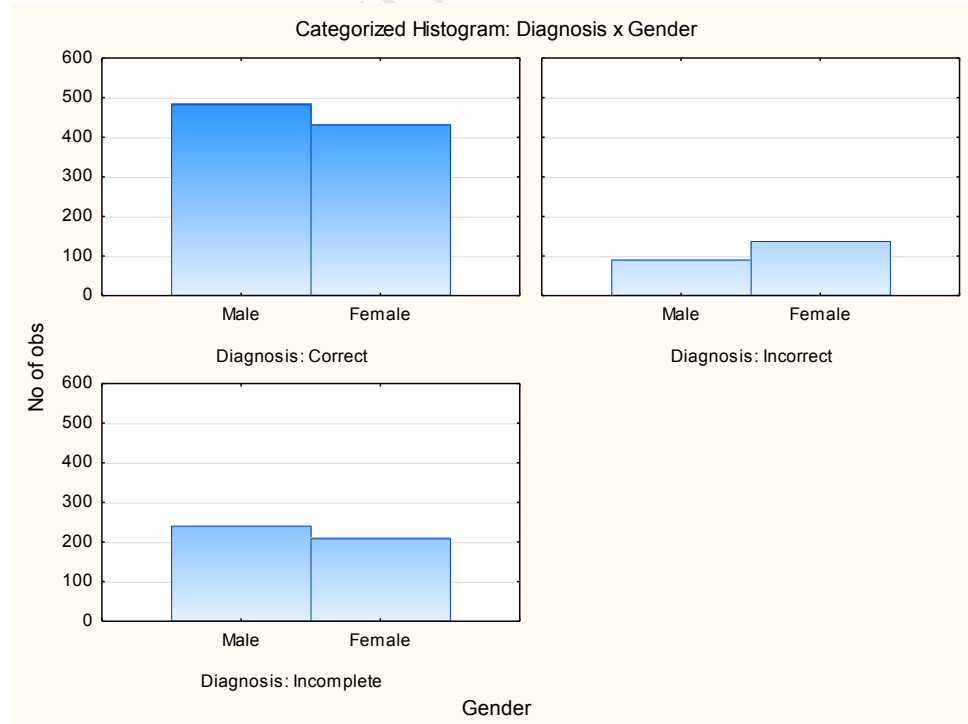
Statistics: Diagnosis(3) x Facility(3) (Data in Analysis - 02Mar2011.stw)

Statistic	Statistics: Diagnosis(3) x Facilit		
	Chi-square	df	p
Pearson Chi-square	35.7595	df=4	p=.0000
M-L Chi-square	37.4212	df=4	p=.0000

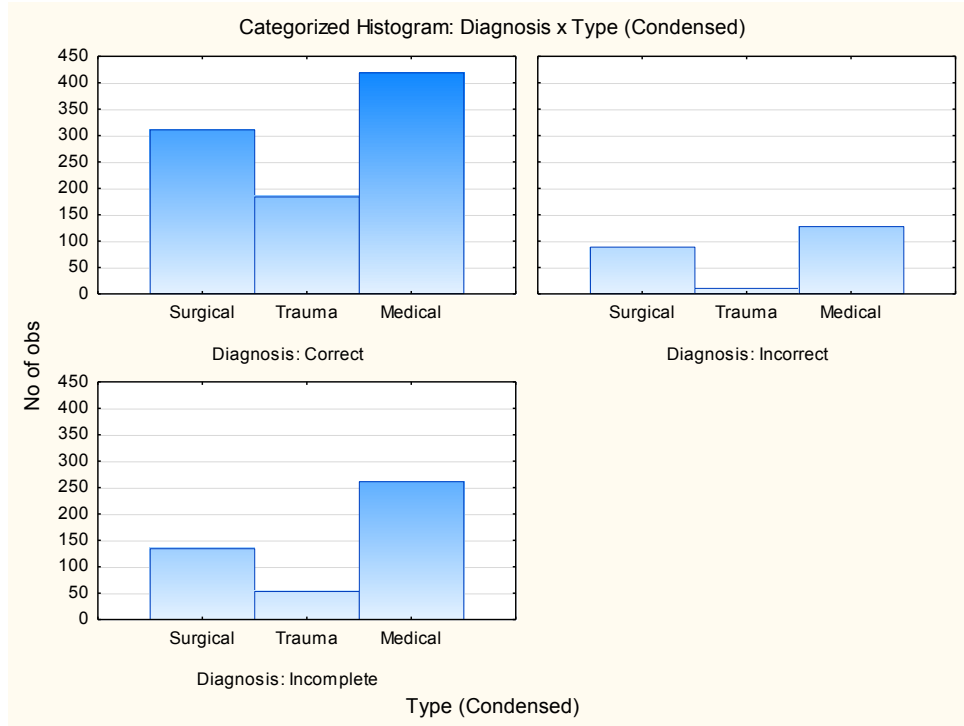
Categorized Histogram: Diagnosis x Age Category



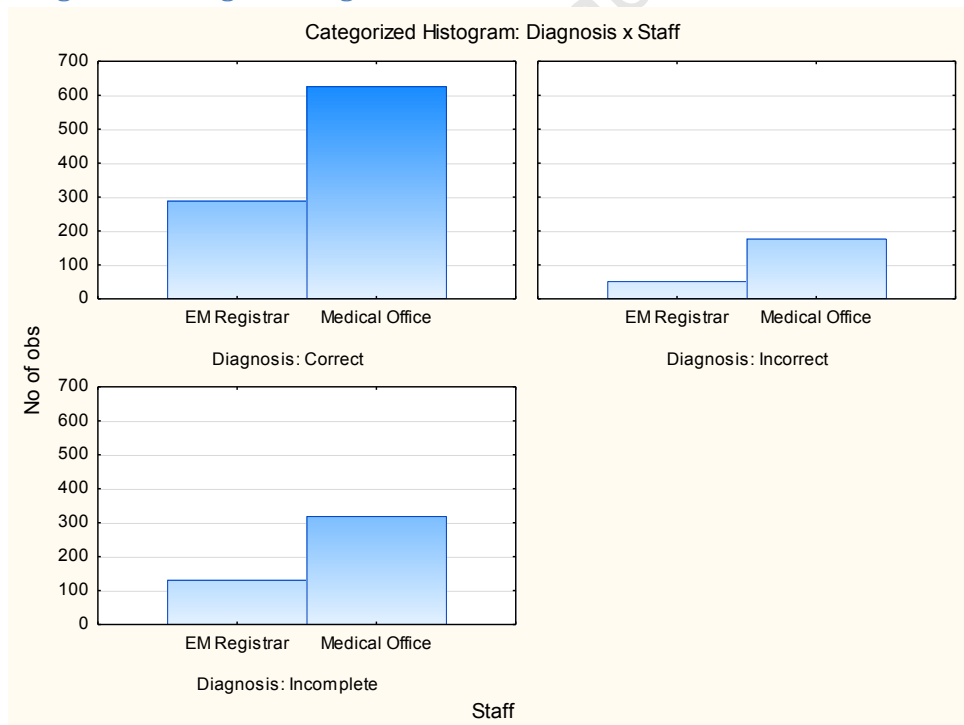
Categorized Histogram: Diagnosis x Gender



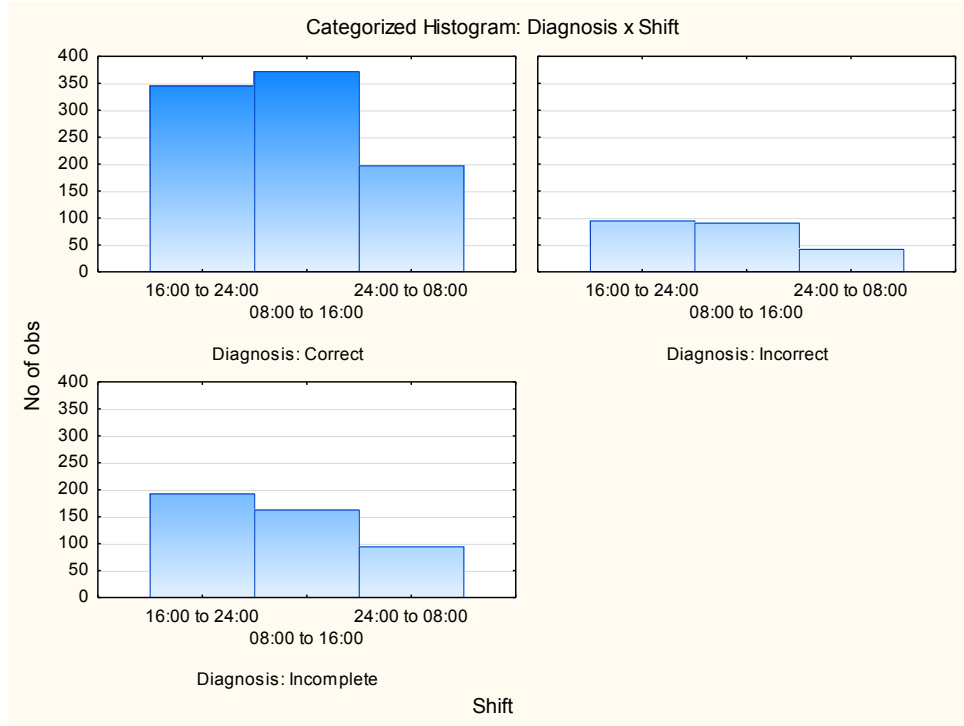
Categorized Histogram: Diagnosis x Type (Condensed)



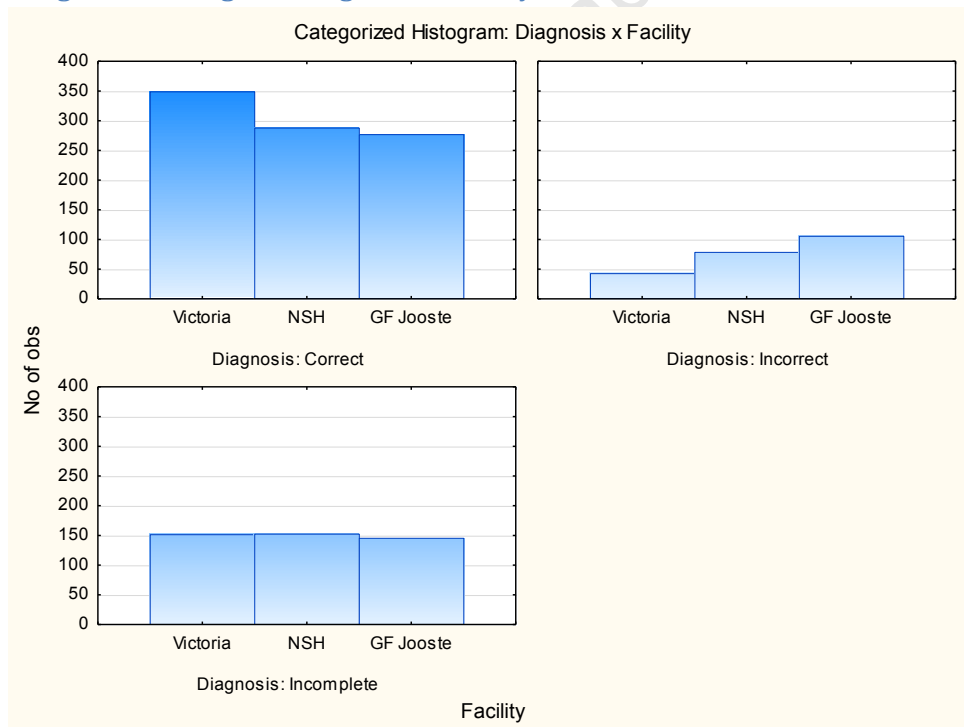
Categorized Histogram: Diagnosis x Staff



Categorized Histogram: Diagnosis x Shift



Categorized Histogram: Diagnosis x Facility



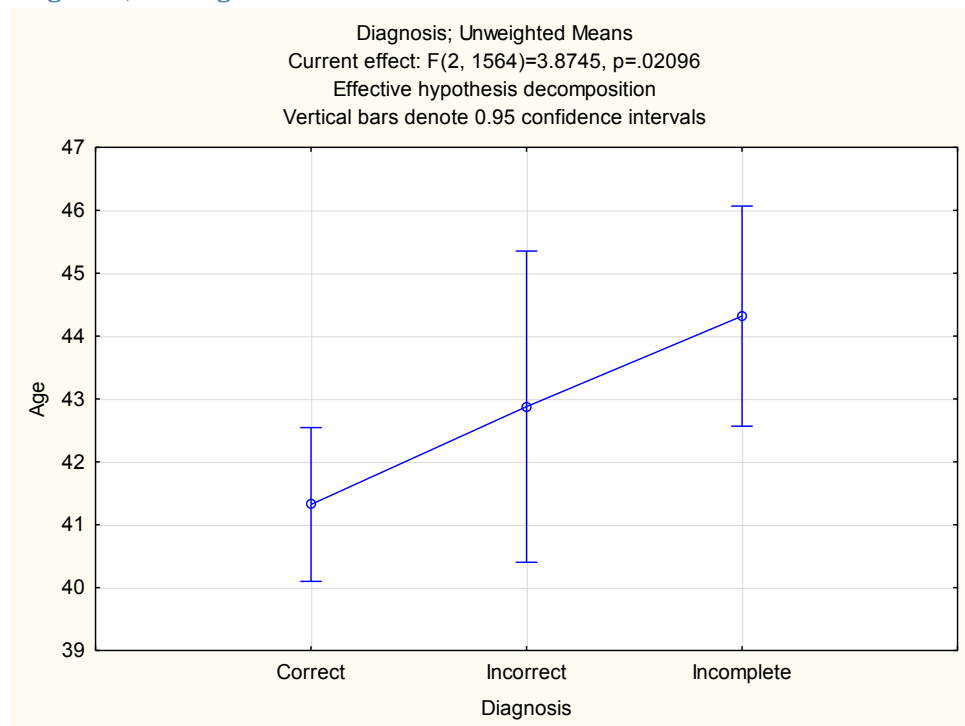
ANOVA (Data in Analysis - 02Mar2011.stw)

ANOVA Results 1: Data in Analysis - 02Mar2011.stw

Univariate Tests of Significance for Age (Data in Analysis - 02Mar2011.stw)

Univariate Tests of Significance for Age (Data in Analysis - 02Mar2011.stw)					
Sigma-restricted parameterization					
Effective hypothesis decomposition					
Effect	SS	Degr. of Freedom	MS	F	p
Intercept	209240.1	1	209240.1	5950.731	0.000001
Diagnosis	2725.1	2	1362.55	3.8745	0.02096
Error	54993.3	1564	352.0		

Diagnosis; Unweighted Means



Diagnosis; Unweighted Means (Data in Analysis - 02Mar2011.stw)

Diagnosis; Unweighted Means (Data in Analysis - 02Mar2011.stw)						
Current effect: $F(2, 1564)=3.8745, p=.02096$						
Effective hypothesis decomposition						
Cell No.	Diagnosis	Age Mean	Age Std. Err.	Age -95.00%	Age +95.00%	N
1	Correct	41.3219	0.62366	40.0985	42.5452	904
2	Incorrect	42.8778	1.26136	40.4036	45.3519	221
3	Incomplete	44.3167	0.89192	42.5672	46.0662	442

Bonferroni test; variable Age (Data in Analysis - 02Mar2011.stw)

Bonferroni test; variable Age (Data in Analysis - 02Mar2011.stw)				
Probabilities for Post Hoc Tests				
Error: Between MS = 351.62, df = 1564.0				
Cell No.	Diagnosis	{1}	{2}	{3}
		41.322	42.878	44.317
1	Correct		0.80702	0.01798
2	Incorrect	0.80702		1.00000
3	Incomplete	0.01798	1.00000	

University of Cape Town



HEALTH

KwaZulu-Natal

Date: 12/8/2011

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Examiners report Dr Almero Oosthuisen thesis:

- a) The initial search via *MeSH* headings was relatively narrow and search engines used few. However, the results appear to have provided an answer to the investigators question. The focus of the search settles on only a few related papers but criteria for the selection of these papers are not described. Despite this, the selected literature has been assessed well and put into context, providing a solid background to the study.
- b) The research methods are well described. Statistical methods used are simple but adequate for a study of this nature. A point of clarity from the sample size (page 11&29) "250 surgical records" – does this include the trauma cases? Since trauma is described in the results and has significance with respect to the primary outcome of the study, this should be clarified. The time line for the study only describes "admissions from 1 Feb 2010"; the date at termination of data collection has not been described fully (Page 11). The reader needs to have idea of how many consecutive days were needed to collect data. The diagnostic categories chosen for the medical patients was subdivided into 3 groups. The investigator should clarify why these categories were chosen(e.g. HIV/TB does seem relevant but I would be interested to know why insulin resistance syndrome was chosen).
- c) The results are simple and portrayed in table format. Of note is that there are no graphs or charts describing the results. Table 2 (page 32) need to be re-checked. The TOTALS percentages don't add up. Line three 127 (45.1%) should be 127 (15.7%). Although the results are Overall the results are well described and to the point.
- d) The results are interpreted very clearly and they are statistically significant. The discussion relating to the results is accurate and insightful. Conclusions drawn are enlightening and interesting. The investigator has understood the aim of the study and presented the results well.
- e) The presentation of the thesis is short and almost a third of the presentation is taken from the Instructions for Authors from the Annals of Emergency Medicine. This is not original and simply implies that the author aims to submit his thesis for publication in the format presented (part C). Consideration should be given to excluding this content. The

study design, aims and methods are repeated 3 times (the Aim, Research protocol, Literature review and Article for submission) using the same format and words to describe them. Overall the thesis is too short but its clarity and to the point presentation is of a high standard.

The thesis is of an above average standard and should stand scrutiny of peer review for publication.



Dr D Wood
(MBBCh, M.Phil., B.Pharm., FCEM (UK), DA, DipPEC)

University of Cape Town



Professor Efraim B. Kramer
Head: Division of Emergency Medicine
Faculty of Health Sciences
University of the Witwatersrand
SOUTH AFRICA



Lorraine McDonald (Ms)
Postgraduate Administrative Officer
Faculty of Health Sciences
University of Cape Town

2nd September, 2011.

Good Afternoon Lorraine,

re: MMed in Emergency Medicine Research Project: Dr Almero Oosthuizen

Thank you for the privilege of marking Dr Oosthuizen's Research Project, submitted in partial fulfilment for the degree of Master of Medicine in Emergency Medicine.

Although I am fully conversant with the traditional method of providing a comprehensive, chapter-orientated written report after marking, my style of marking is to make written comments inside the research report itself for the candidate to see in context and therefore you will notice a rather substantial amount of red coloured written comments. I do not intend to rewrite all of these in a report, but will suffice to provide an explanation of the major issues that prevent me from allowing this research project to pass in its current form and content.

- The research set out to correlate the diagnosis of a patient presenting to the Emergency Centre (EC) with that which was made after admission to the hospital specialty after admission. At no time, did the study attempt to validate which of the diagnoses were in fact the correct one, and consequently the researcher has incorrectly assumed that wherever there is a discrepancy between the two diagnoses, the EC is the incorrect one and as such is a mistake made by the attending doctor, with all analyses based on this premise. As such, the differences in diagnoses have been termed "correct" and "incorrect" which in an assumption that cannot be made ab initio.
- The three hospitals used for the study have been labelled as "level II" hospitals without any explanation as to the level of care at each, the level of skill and knowledge of the doctors in the EC or specialty units, whether there is a specialist daily in all units or staffed by principal medical officers, as is common. Without this information, comparisons become invalid.

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- The literature review is too brief and incomplete and does not describe the true nature of the study, the mortality and morbidity effects that the topic has on patient management and a true description of the South African EC and hospital ward with regards to personnel, equipment, patient load and illness burden that is expected at a Master degree level.
- The references are “sloppy” with no attention to detail, using a consistent reference system, as per the intended journal of publication.
- The publication format of the research project is inconsistent with information in the earlier literature research and introduction, requiring consistency throughout.

In all, it is currently unsatisfactory and will require some major revisions to the intention of the study, methodology, result analysis and discussion. If these are undertaken, I am happy to remark it in the future, either as a revision as is, or in a new format.

Regards



Professor Efraim Kramer
Head: Division of Emergency Medicine
Faculty of Health Sciences
University of the Witwatersrand.
Johannesburg.



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01 August 2010

HREC REF: 350/2010

Dr A Oosthuizen
Emergency Medicine

Dear Dr Oosthuizen

PROJECT TITLE: CORRELATING EMERGENCY CENTRE REFERRAL DIAGNOSIS WITH FINAL DISCHARGE DIAGNOSIS

Thank you for submitting your study to the Health Science Faculty Research Ethics Committee for review

It is a pleasure to inform you that the Ethics Committee has **formally approved** the above-mentioned study.

Approval is granted for one year till the 15th August 2011.

Please submit a progress form, using the standardised Annual Report Form (FHS016), if the study continues beyond the approval period. Please submit a Standard Closure form (FHS010) if the study is completed within the approval period.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the REC. REF in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, HSE HUMAN ETHICS

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

This serves to confirm that the University of Cape Town Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

The Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

University of Cape Town

Professor Efraim Kramer
Head: Division of Emergency Medicine
Faculty of Health Sciences
University of the Witwatersrand
Johannesburg

Dear Prof. Kramer

Response to Prof. Kramer's comments

Thank you. These are all very helpful and I have taken them into account in redrafting the thesis.

Your comments were:

- Relating to the terminology used to describe diagnostic correlation and the validity of drawing conclusions i.t.o. the correctness of diagnoses.
 - Using the terms 'correct', 'incomplete', and 'incorrect' is not appropriate.
 - I have revised the entire text to ensure that the uniform terminology now reads the assessment 'correlates completely', 'correlates incompletely' or 'no-correlation'.
 - Incorrectly assuming no-correlation assessments are incorrect and that I cannot make any conclusions regarding the accuracy of diagnosis as no objective standard exists.
 - I clearly state in the document introduction (p 5) and in the aims section (p 6) that the study aims merely to describe the correlation between referral and discharge diagnoses without judging the accuracy of either. This point is re-iterated on p 9, fully explained on p 20 and mentioned multiple times in the rest of the text.
 - I acknowledge that non-uniform terminology and unclear explanations may have been misleading. I have revised the text accordingly and I hope the aim is now less ambiguous.
- Relating to the level of hospital and type of doctors investigated in the study
 - I do not describe what constitutes a 'level 2 hospital' and the three hospitals sampled in the study are not representative.
 - I have revised the text to describe the hospitals better. I have also revised the text to acknowledge the fact that the sample is not representative of EC's in South Africa in general. I do feel that the units sampled accurately reflect the metropolitan district level hospitals in Cape Town where our division has a presence. The text has been revised to qualify and explain this.
 - The group 'EC medical officers' is a very heterogeneous group. You comment that I cannot compare EM registrars with this heterogeneous group.

- Before Emergency Medicine and EM registrars became involved in the provision of emergency care all our EC's in Cape Town were staffed exclusively by EC medical officers. Even now they still constitute the majority of EC based emergency care providers. I had hoped that comparing EM registrars (representing a new status quo, if you will) and EC medical officers (representing the status quo as it was) may provide interesting data and/or identify areas for future research. I believe that specific EM training results in better emergency care provision. Having said that, this study was not designed or powered to investigate this beyond simple description of the data and I have revised the text to clarify this.
- Relating to the inadequacy of the literature review.
 - The articles discussed in the literature review do not represent the basis for the study. Not enough emphasis was placed on African literature.
 - I have repeated the literature search using the original search string, this time including the African databases you suggested. I could find no relevant English language publications out of Africa. The text has been revised accordingly.
 - Finding literature to support my study was a massive challenge. There simply are no other studies describing general EC diagnostic correlation, apart from the Hong Kong study discussed in the literature review. There are no studies investigating the implications of poor assessment in the broad sense in the EC.
 - I include more articles that speak to the importance of correct assessment and the implication of incorrect assessment on patient outcomes, healthcare costs etc.
 - I have elected not to include these articles for the following reasons:
 - The study aims only to describe relative diagnostic correlation, not to judge the accuracy of diagnosis. This study also does not aim to investigate the reasons for or the implication of poor EC assessment. Including articles that judge diagnostic accuracy or measures outcome effects would not be relevant to a study that clearly states that this is not its aim.
 - Most of the articles included in the literature review are not directly relevant to the study.
 - I have elected to keep the articles reviewed for the following reasons:
 - I keep the Hong Kong article as it is the only directly relevant article I could find
 - I keep the South African articles as they are the only articles that may bear some relevance to our context and because Dr Wood's article involves a South African EC
 - I keep the international articles. Even though they may not be directly relevant, they are methodologically informative. They also serve to illustrate that specific, focussed comparison as it relates to EC assessments have been studied and supports the fact that the question of general diagnostic correlation has not.

- That said I have revised the text to reflect the limited relevance of the included articles. I have removed parts of the text relating to the San Francisco Syncope rule as per your suggestion.
- Relating to 'sloppy' referencing.
 - References used throughout are inconsistent and contains errors.
 - I have revised the text and I hope I caught all the errors.
- Relating inconsistencies of the publication format.
 - UCT requires the bundling of certain components that constitute a MMed dissertation when submitted in an 'article for publication' format. The components (research proposal, literature review, article for publication) are completed and submitted at different stages of the greater project and then combined for the final submission document. Certain inconsistencies are inevitable and represent the evolution of the MMed project over time.
 - I agree that the degree of inconsistency may be unacceptably high. I have revised the text to make sure that terminology, definitions, references and so on are more consistent without changing any one component to the extent that it differs too much from the original submission.

I have also taken into account the very useful comments you made in pen in the original submission document. I have made the changes that I could and hope they are to your satisfaction. I have now also included all the data and statistical analysis as appendix B. The instructions for authors of the intended publication limit the amount of tables and graphs I could include in the article and I hope you find the complete data set interesting.

I thank you for your constructive criticism and I hope the revised document meets with your approval.

Almero Oosthuizen

Fellow: Emergency Medicine education

UCT/US Division of Emergency Medicine

Cape Town