Describing the most common presenting complaints, their priority and corresponding diagnoses at Mitchell's Plain Emergency Centre

by

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Table of contents

Declaration **2**

List of tables and figures **4**

Abbreviations **5**

Part A: LITERATURE REVIEW **6**

Aim of this literature review 6

Literature search strategy, including inclusion and exclusion criteria 6

Quality criteria 7

Summary or interpretation of literature 7

The global perspective 7

The South African perspective 15

The South African Triage Scale in context 18

Identification of gaps or needs for further research 22

References 25

PART B: MANUSCRIPT IN ARTICLE FORMAT **34**

Abstract 35

Main text of article 36

Introduction 36

Methods 37

Results 39

Discussion 46

References 51

PART C: ADDENDA **52**

Instructions for authors 52

A. Questionnaire/ data capture instrument 53

B. Triage and clinical presentations list 54

C. ICD 10 code list 56

Acknowledgements 57

Research Protocol 58

HREC approval letter 66

List of tables and figures

PART A

Table 1: Comparison of time targets for each triage scale …… 8

Figure 1: Rankings of years of life lost by province for South Africa…… 17

PART B

Figure 1. Sample collection flow chart..... 39

Figure 2. Frequency of presenting complaints and proportional SATS priority allocation 41

Figure 3. Proportional SATS priority allocation by time and day of presentation, and day of the week..... 45

Table 1. Sample demographics..... 40

Table 2. Most common presenting complaints and diagnoses in total and for each category of the SATS 42

Table 3. Top five diagnoses overall and for each triage category for top 10 presenting complaints..... 44

Abbreviations

ACEM- Australian College of Emergency Medicine

ACSCOT- American College of Surgeons Committee on Trauma

ATS- Australasian Triage Scale

CAS- Computerised Clinical Assessment System

CEDIS- Canadian Emergency Department Information Systems

COPD- Chronic Obstructive Pulmonary Disease

CTAS- Canadian Triage and Acuity Scale

CVA- Cerebrovascular Accident

DVT- Deep Vein Thrombosis

EC- Emergency Centre

ESI- Emergency Severity Index

ETAT- Emergency Triage Assessment and Treatment

HIV- Human Immunodeficiency Virus

ICA- Incomplete Abortion

ICU- Intensive Care Unit

IMCI- Integrated Management of Childhood Illness

IUSS- Infrastructure Unit Support Systems

KPI- Key Performance Indicator

KTS- Kampala Trauma Score

LMIC- Low Middle Income Country

MEWS- Medical Early Warning Score

MTS Manchester Triage System

NTS- National Triage Scale

PATS- PMH A&E Triage Scale

SATS- South African Triage Scale

TEWS- Triage Early Warning Score

UK- United Kingdom

USA- United States of America

Part A: LITERATURE REVIEW

The South African Triage Scale has had an important impact on the delivery of healthcare in South Africa. It has provided emergency care services with an objective assessment tool at the first point of contact and communication between the healthcare system and the community it serves. The ongoing imbalance between needs and resources stimulates the investigation of novel ways to use this tool to extract information and improve patient care.

Aim of this literature review

The aim of this literature review was to describe and discuss the development of triage scales and the incorporation of presenting symptoms and clinical discriminators into emergency department triage, and describe their association with individual acuity categories and diagnoses, globally as well as in low- and middle- income settings.

Literature search strategy, including inclusion and exclusion criteria

The University of Cape Town Health Sciences Library website was used to perform searches and to obtain the original articles reviewed in this study. PubMed and Google Scholar were used to perform searches using the terms: triage, presenting complaints, developed countries, high resource settings, Australasian Triage Scale, ATS, Canadian Triage and Acuity Scale, CTAS, Pediatric CTAS, Manchester Triage System, MTS, Emergency Severity Index, ESI, telephone triage, National Health System, NHS Direct, challenges telephone triage, low middle income country triage, LMIC triage, African triage systems, Brazil triage, India triage, World Health Organisation, Emergency Triage Assessment and Treatment, WHO ETAT, low resource paediatric triage, Kampala Trauma Score, KTS, South African Triage Scale, SATS, Cape Triage Score, CTS, Paediatric South African Triage Scale, PSATS, burden of disease, call centre triage Africa, reliability, validity, challenges SATS, vital signs, predictors of mortality, language barrier, culture healthcare, quality of care, key performance indicator, KPI, case mix emergency centre, case load. A snowball strategy was then used, whereby prominent articles cited in the papers obtained from the index search were also accessed and included in the review.

Inclusion criteria:

- Publication date: January 1994 - December 2018
- Language: English, including studies translated and published

Exclusion criteria:

- Studies outside of the stipulated timeframe
- Language other than English
- Studies focussed on very specific patient groups were also excluded.

Quality criteria

Titles and abstracts were initially screened for relevance to the review and those deemed to have low relevance or poor external validity were excluded. High-quality evidence, including systematic reviews, was sought to address the review aim. Papers were appraised against a checklist from the Oxford Centre for Evidence-Based Medicine(1). A representation in tabular form of appraised papers is not required for the MPhil and therefore was omitted.

Summary or interpretation of literature

The global perspective

Triage has its origins on the battle fields of the Napoleonic wars of the 18th century - since then, it has become a vital process in the provision of emergency medical care. The French surgeon Dominique Jean Larrey was the first to develop a system that assigned priority to the treatment of injured soldiers by sorting them into categories based on the severity of their injuries(2). The concepts and principles of triage were refined in war contexts, including the World Wars of the 20th century. Identifying those who needed immediate treatment by early triage, resuscitation and transfer to definitive care was shown to have significant impact on mortality rates - consequently triage systems were adopted into non-combat, pre-hospital and disaster management settings, and progressed into in-hospital emergency centres in the 1960's(3).

Emergency centre triage scales allow for prioritisation of time-dependant interventions and immediate treatment of the critical ill. This enables appropriate distribution of resources with the aim of decreasing morbidity and mortality in often resource constrained environments(2). Early in-hospital triage scales were derived from pre-hospital systems using a tiered system of acuity levels linked to urgency of treatment(2). Prehospital systems generally sorted patients into colour coded categories- red required immediate care, yellow-urgent care, and green identified those who would wait for delayed care(4). Modern triage scales now have three, four or five tiers (4). Adding in more subtle differentiation between

emergent, very urgent and urgent care or including a category for 'dead on arrival,' increases the level of skill, education and training required to perform triage(3).

Globally, the modern triage systems that have had the most impact on emergency centre triage are the Australasian Triage Scale (ATS), the Canadian emergency department Triage and Acuity Scale (CTAS), the Manchester Triage Scale (MTS) and the Emergency Severity Index (ESI)(6). These five level scales have been developed and used in adult and paediatric medicine in high income settings since the 1990's(6). They are based largely on expert consensus opinion and have been refined through extensive research over the years(3). Table one shows a comparison of the triage acuity and time targets for each scale.

Table 1. Description of time targets for each triage scale(7–10)

ATS					
Category	ATS 1	ATS 2	ATS 3	ATS 4	ATS 5
Time Target	Immediate	10 min	30 min	60 min	120 min
CTAS					
Category	Level 1 Resusc	Level 2-Emergent	Level 3- Urgent	Level 4- Less Urgent	Level 5- Non-urgent
Time Target	Immediate	15 min	30 min	60 min	120 min
MTS					
Category	Red-Immediate	Amber- Very Urgent	Yellow- Urgent	Green- Standard	Blue- Non-urgent
Time Target	Immediate	10min	60min	120min	240min
ESI					
Category	Level 1	Level 2	Level3	Level4-	Level 5
Assessment	Immediate- Life-saving intervention	High Risk	Requires Multiple Resources	Requires 1 Resource	Requires No Resources

The Australian triage system was initially developed by observing the behaviour of triage nurses(11). It was apparent that the initial assessment made by the nurse (by varied means) defined a specific clinical pathway for the management of the patient(11). These pathways were based on the acuity of the patient's illness and included- immediate medical treatment and resuscitation; waiting to see the next practitioner who became available; prioritization of patients to the front of the queue; assigning patients in order of the queue; or deferring care to another institution(11).

The National Triage Scale (NTS) was rolled out by the Australian College of Emergency Medicine (ACEM) in 1994 (12). Physiological parameters (airway, breathing, circulation and disability) in the form of vital signs and clinical symptoms were added to the NTS which was renamed the Australian Triage Scale in 2000. A review of the literature on the ATS was published by ACEM in 2012- it reported that the ATS is valid in determining the urgency with

which patients need assessment but does not provide a valid indication of the complexity, severity, workload or staffing required in the emergency department(13).

The ATS formed the basis for the development of the Canadian Triage and Acuity scale in 1997(14). The CTAS is also a five tier system from category 1- immediate resuscitative care to category 5- non-urgent care within 120mins(11). It does not include a category for dead on arrival(14). The CTAS compensated for deficits in the ATS by including a rural supplement and a separate Pediatric CTAS scale(11). In 2004 the CTAS was modified based on a standardised list of emergency centre presenting complaints released by the Canadian Emergency Department Information Systems (CEDIS) National working group(14). This list was used to create primary modifiers or discriminators considering a patient's vital signs, pain acuity and mechanism of injury. Second order modifiers were created for patients who needed more urgent attention but were not identified by vital sign parameters- such as mental health users(14). The CEDIS complaint list, adult and paediatric CTAS were revised in 2008, 2012 and again in 2016- taking into consideration further health related concerns such as global warming and a growing geriatric population(14).

Historically the United States of America have used a range of predominantly three or four tiered triage systems(3). The five level Emergency Severity Index was developed in 1999 and has gained popularity due to stronger evidence on reliability and validity of the tool(10). Clinical algorithms and vital signs are used to initially identify patients with an immediate life or limb threatening injury- these patients are prioritised as level 1 or 2 for emergency treatment(10). In contrast to other triage scales the ESI does not allocate a fixed time within which lower acuity patients should be seen, but it does require estimation of the medical resources that may be needed to treat each patient to disposition- placing emphasis on acuity as well as patient flow(15). The ESI relies on a well-trained triage nurse who makes decisions based on their experience in evaluating patients, and their resource needs. Emergency department resource use, length of stay, hospitalisation and six month mortality have been determined with high inter-rater reliability and validity using the ESI in both adult and paediatric populations(16).

In Europe and the United Kingdom, the Manchester Triage Scale is widely accepted. Similar to the ATS it is a five tier scale, which was developed by emergency doctors and nurses in Manchester in 1994(17). Colour codes indicate the acuity levels- Red- requires immediate attention, Orange- very urgent, Yellow- urgent, Green for standard care, and a Blue category for non-urgent care (11). The MTS is a reductionist algorithm-based system that uses the patients presenting symptoms and history of illness and relies less on physiological

measurements. It consists of 52 flow charts, 49 of which are applicable to paediatrics (12). Once the main presenting symptom is identified and the appropriate flow chart chosen, six discriminators (life threatening, pain, level of consciousness, temperature and acuteness) and the use of vital signs further direct the assessment(18). Guiding questions direct a triage nurse to determine how urgently the patient needs to consult a physician(18). The MTS has been studied extensively in both adult and paediatric populations and has been applied successfully in other European countries.

Most in-hospital triage scales have safety nets to minimise under-triage, the use of vital signs and other visual clues may alter the clinician's initial opinion of the acuity of the patient's illness as described symptoms alone. Triage using clinical symptoms alone relies on flow charts that were developed through expert reviews of common emergency complaints- these are particularly relevant in telephone triage and consultation where assessments are made without physical contact (12,13). Mobile phone use is approaching 63% across the world, and 98% in developed countries, and large numbers of patients access emergency services by calling publicised emergency call centres(19).

Call centre operators in developed countries may range from laypersons, to trained nurses or emergency physicians. A considerable evidence base relating to telephonic advice systems exists, systematic reviews show high accuracy and appropriateness of assessments, with minimal safety risk and good patient compliance and satisfaction with advice in many contexts(20).

The largest telephone triage system in the world is the NHS Direct, a nurse-led telephone triage system used in the UK(21). The system allows the public to access health information and advice over the phone, and directs the patient to the appropriate level of care- such as a GP appointment within a certain time frame, or transfer to ambulance services if urgent care is needed(21). The NHS have implemented the CAS, or computerised clinical assessment system, to structure the call format and interaction between the triage nurse and caller(21). The computer algorithms are based on patient symptoms and not their medical diagnoses. Guiding questions are aimed at providing a uniform service, reducing personal variations in advice and decision making by operators(21). Descriptive studies have reported that despite the computerised algorithms nurses individualise patient care and frequently over- or under-ride the system in line with their own clinical judgement as they prefer a patient-centred approach that considers the circumstances of each patient over a uniform response(21). In most instances the decision to deviate from the system were not fully documented making

it difficult to assess any effects on clinical outcomes(21). Similar computer assisted systems are used in the USA, Australia, New Zealand and other parts of Europe.

Despite technological advances in telephonic triage numerous challenges still exist. High call volumes and limited resources for dispatch place pressure call centre operators to quickly identify the callers' problem and decide on the severity of the condition. Problems encountered range from technical aspects such as poor telephone signal, environmental distractions and background noise at the incident site, to interpersonal factors such as language and cultural barriers, the emotional state of the caller and the communication skills or experience of the operator(22). Assessing the urgency of the complaint is further compromised when the caller provides conflicting information or a vague history without focus on one particular problem, or when the operator asks too many questions and distracts the caller from their immediate problem(23). In the absence of visual clues the receiver has to rely on intuition and auditory information such as the quality of the voice and breath sounds to aid the estimation of priority(24).

The low- and middle-income country perspective

Low- and middle-income countries face the exact challenges that triage aims to address - the appropriate allocation of resources in overburdened, resource-poor circumstances. The speed of development and research on triage systems in these countries however, has not followed the trends in developed countries.

Existing triage scales developed in high income countries are often inappropriate for use in LMICs Factors such discrepancies in level of education, resources available for prioritisation of treatment, basic burden of disease as well as socio-cultural factors that influence patient profile and presentation hamper their effectiveness(25). In Africa the use of international triage systems is primarily confined to the disaster management or trauma context, in many countries emergency centre triage is fragmented and often non-existent(26). In some parts of Brazil a modified version of the MTS (with additional flow charts for context specific conditions, such as snake bites) is used, in other areas the ESI is used with variable success(27,28). In 2018, the Directorate of Health Services in India committed to rolling out a new three-tiered triage system developed in India, in the hope of streamlining the delivery of emergency care (21). Until now India's use of triage has been sporadic and based on subjective assessments or time of arrival- the new triage system remains to be validated(29).

The World Health Organization (WHO) has recognised emergency care as a global health priority and acknowledges the need to improve and impact outcomes in this area(30). In 1999

the WHO developed the Emergency Triage, Assessment and Treatment (ETAT) guidelines with the focus of reducing high paediatric mortality rates in resource poor settings through early detection and treatment of serious illness. These guidelines use clinical signs to identify severely ill children and provide guidelines for urgent treatment. Initial validity testing was done in Brazil and Malawi, despite significant variation, the ETAT has appeared to select out high acuity patients effectively(31,32).

In 2017 a systematic review of evidence relating to paediatric triage and the Integrated Management of childhood Illness (IMCI) in LMICs assessed 5 triage tools from 7 studies done between 2000 and 2013- of these the ETAT was the only tool that was tested in LMIC settings(33). Other tools being used included the IMCI which is not a triage tool but a treatment guideline, Paediatric Early Warning Scores (PEWS) which is based on vital signs and Paediatric South African Triage Scale (PSATS) which uses both clinical signs and physiological parameters(33). The results highlighted the variation in study design and the limited amount of data from LMIC's- this made comparison and validation of a single paediatric tool in this context impossible(33).

While triage in the under 5 age group has received some attention there has been a lack of research into appropriate triage scales for adults and older children in LMIC's. In 2018 a systematic review on the '*Reliability and validity of emergency department triage tools in low- and middle-income countries,'* done by Jenson et al was published in the European Journal of Emergency medicine, it confirmed the paucity of data in this area(34). The review included 18 studies done between 2000-2015, 3 of these countries were from LMICs, none of which were from rural settings(34). These 18 studies evaluated 6 different triage tools for reliability and validity, of these- the ATS and the South African Triage Scale(SATS) were the only studies that had any significant evidence on reliability(34). The SATS showed the highest quality of evidence, however the final conclusion made was that, '*The quality of evidence supporting any triage tool's reliability and validity in LMICs is moderate at best*(34).'

The South African Triage Scale was developed out of needs in the South African context. The only other triage scales to arise from Sub-Saharan Africa are the Kampala Trauma Score (KTS) from Uganda and the PMH A&E Triage scale (PATS) which is a version of the SATS modified for use in Botswana(35,36). The KTS is an injury severity score designed for use in low resource areas(35,36). It has been shown to be an effective predictor of mortality in trauma, but reliability remains to be established(35,37). The KTS is of limited use in emergency centre settings with a varied burden of disease not related to injury(35). A small study done by

Mulindwa in 2015 showed that the SATS may in fact be an effective and acceptable tool for emergency centre triage at International Hospital Kampala(38).

In South Africa, the second national burden of disease study, analysed mortality trends from 1997 to 2012, and reflected the ongoing burden of HIV/AIDS and other communicable diseases, non-communicable disease and injuries, and high mortality rates despite economic improvements in the country(39). The need for a unified triage system to manage patient flow, address the complex, quadruple burden of disease and high caseloads facing emergency medical services was already apparent in the late 1990's. In 2004 a multi-disciplinary team of various emergency care workers came together to develop a such a triage tool with the support of the joint division of emergency medicine of the University of Cape Town and the University of Stellenbosch(40). This group, called the Cape Triage Group, designed the Cape Triage Score which was initially implemented in the Western Cape. The CTS was subsequently revised and rolled out nationally as the South African Triage Scale, by the South African Triage Group, in 2006(41).

Existing international triage tools such as the ATS, CTAS or MTS were not entirely suitable for the South African context as they required extensive training, a high level of expertise and used complex algorithms which were time consuming(42). The ideal instrument had to be easy to use by staff with minimal training, efficient and effective in identifying patient acuity using limited resources, and perform with high sensitivity and specificity when tested in all patient groups (42).

The SATS was thus designed to be used by Enrolled Nursing Assistants (ENAs) who have a one year training certificate(43). It is a four-tier system using objective colour coded categories minimising misinterpretation across prehospital and emergency centre settings(40). As with the ATS, MTS and CTAS, the colour tiers are linked to time targets for treatment - Red indicates immediate priority requiring emergency care on arrival, Orange - very urgent care within 10 minutes, Yellow - urgent care within 60 minutes and Green for delayed or routine care within 4 hours(25). The colour Blue is used for patients declared dead on arrival- this not regarded as triage tier(25).

A patient is assigned to a particular acuity or colour category using a combination of discriminators related to the presenting complaint and measured physiological parameters. The physiological score used in the SATS is called the TEWS or Triage Early Warning Score- which is based on the MEWS or Medical Early Warning Score (26). The MEWS successfully identified high risk medical patients in international ICU settings, and had an impact on

patient flow and mortality when used in the initial Cape Triage Score, but appears inferior to the SATS when used alone(44,45). The MEWS measures respiratory rate, heart rate, systolic blood pressure, temperature and level of consciousness on a AVPU scale- these parameters may be recorded with minimal training, using simple, low cost equipment that is widely available in emergency centres(44).

Considering the historically high prevalence of injuries in South Africa, the TEWS includes the additional modifiers of mobility status and history of trauma to compensate for the medical bias of the MEWS (40). The Paediatric SATS differentiates TEWS scoring scales for younger children under 3yrs of age or 95cm in length, and older children of 3 to 12yrs or a height of 95 to 120cm(25). The use of a physiological scoring system is valuable as it allows for objective escalation of patient priority in cases of clinical deterioration- this is a risk in the setting of prolonged waiting times due to high patient numbers and a lack of human resources. Furthermore abnormal vital signs such as an elevated respiratory rate prompt the triage nurse to do additional relevant tests such as oxygen saturation measurement or glucose tests in diabetic patients(25).

The starting point of the SATS, similar to the MTS, is the use of presenting symptoms to rapidly identify patients in need of emergency, very urgent or urgent care. In contrast to the 52 algorithms of the MTS- a list of less than 40 discriminators and a single algorithm is used to direct patient evaluation in the SATS. Immediate recognition of patients with emergencies or time-sensitive conditions prioritise them for resuscitation, monitoring and treatment. Patients requiring decontamination or isolation are also identified early. The presenting complaint and the TEWS score are often assessed simultaneously in patients not requiring immediate resuscitation- early detection of very urgent signs directs flow of patients to the appropriate treatment area for further management. Life or limb threatening injury may present with minimal physiological derangement in some cases, this may be due to prehospital treatment, high physiological reserves, medication or comorbidities. (46).

Discriminators in the SATS consider common, high risk presentations in South Africa, these were decided by expert consensus and include: mechanism of injury- of which high energy mechanism was included; specific presentations with increased morbidity or mortality across a wide diagnostic spectrum such as ‘shortness of breath;’ as well as the patients subjective report of the severity of their pain(40). A junior staff member may use the clinical discriminators or seek the opinion of an experienced healthcare provider to increase the patient priority suggested by the TEWS, the aim of this safety net is to reduce under-triage(25).

The use of discriminators and patient reported symptoms becomes vital in the pre-hospital setting, specifically ambulance control centres that take calls from patients in need of emergency care. No literature relating to the use of telephone triage or remote use of presenting symptoms to evaluate patient priority in LMIC's, including South Africa, were found. In 2016 a study used the assessment by a qualified emergency physician and a computer calculated TEWS as the gold standard and compared this to triage done by trained pre-hospital emergency medical service providers(47). This study showed high rates (5 to 10 times reference standard) of under-triage by EMS personnel due to variations in training and partly attributed to the poor use of clinical discriminators in this context(47).

Since implementation in 2006 the SATS was revised in 2008 and modified again in 2012. In-hospital studies following its inception have shown that the SATS is able to detect high risk patients accurately, and has had an impact on waiting times for high acuity patients in particular(44,48). In 2011 the SATS showed acceptable rates of over- and under-triage on the ASCOT scale, making it a valid tool for adults when used by doctors and nurses in the South African context(41). In 2013 following revisions to include elements from the ETAT, the modified paediatric SATS was validated as 'a robust tool for triage in children.' (49,50). More recently the SATS has been implemented with success in LMIC's such as Sierra Leone, Somaliland, Pakistan, Afghanistan and Haiti(43,51–53).

The South African perspective

The development of a context appropriate triage tool has been a triumph for South African emergency services and healthcare at large. In this diverse setting sustaining a high-quality system comes with ongoing challenges that need to be addressed with evidence-based solutions in order to provide healthcare that increases the likelihood of positive outcomes.

Emergency medicine stands at the interface between the dynamic socioeconomic determinants of health and the provision of healthcare services to the population. In 2017 the World Bank described South Africa as one of the countries with the highest inequality in the world - reporting that the wealthiest 20% of the population consume more than 65% of total expenditure, compared to the poorest 20% who consume less than 3%(54).

The overall disease profile of the country is directly related to poverty as 55% of people still live below the upper limit of the poverty line(54). The 2011 census recorded a total population of 52 million people(55). Demographic distribution defines 79% of people as Black South Africans, 8.9% Coloured or Mixed race, 8.8% White and a further 2.5% Indian or Asian(55). 47% of Black people may be defined as poor compared to 23% coloured, and less

than 1% of the white population(54). Other factors associated with poverty include high unemployment rates (27.7% in 2017), lower levels of education, female lead households, the number of children and family members in a home as well as geographical location(54). The poorest of the 9 provinces in the country are the Eastern Cape, KwaZulu Natal and Limpopo, 65% of people living in rural areas live below the poverty line(54).

In 2017 the Health Systems Trust released the 20th edition of the South African Health Review since 1995(56). This review stated that the South African healthcare system had performed poorly when compared countries such as Brazil which has similar economic status and health care expenditure- this had occurred despite the country having maintained a health care budget of 13.5%(56). Poor leadership, deficits in the District Heath system for provision of primary health care, and the healthcare human resource crisis are cited as possible causes for the country experiencing similar difficulties since 1995(56).

HIV/TB rates in South Africa are still amongst the highest in the world, however a marked decline in mortality can be attributed to the success of anti-retroviral treatment programmes since 2005(39). Deaths from other infectious diseases such as pneumonia, gastrointestinal disease and sepsis have remained largely unchanged, and infant and maternal mortality rates which reflect communicable disease and nutritional status have only shown slight reductions(39). Non-communicable diseases such as diabetes, cardiovascular disease and COPD have trended downward- possibly due to preventative interventions, health promotion and legislation on tobacco products (32).

Inequality and poverty contribute to high levels of violence, gang-related activity, alcoholism and substance abuse in South Africa. A reduction in interpersonal violence has led to drop in the national mortality rates for injuries, these gains are attributed to increasing political stability and changes in firearm laws (32). Figure 1 shows the rankings of years of life lost in South Africa by province from the second national burden of disease study in 2014 (32). It shows Human Immunocompromise Virus (HIV) as the predominant cause of mortality in the country and across all provinces the remainder of causes are divided between infections, injury and chronic disease which vary in rank in each region. The numbers in parentheses represent the proportions of years of life lost from each disease in that region(39).

Rank	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpumalanga	Limpopo	South Africa
1	HIV/AIDS (20·0%)	HIV/AIDS (29·8%)	HIV/AIDS (31·9%)	HIV/AIDS (36·0%)	HIV/AIDS (41·2%)	HIV/AIDS (42·7%)	HIV/AIDS (34·9%)	HIV/AIDS (40·2%)	HIV/AIDS (35·5%)	HIV/AIDS (35·7%)
2	Interpersonal violence (7·3%)	Tuberculosis (9·7%)	Tuberculosis (7·7%)	Lower respiratory infections (6·5%)	Cerebrovascular disease (5·0%)	Cerebrovascular disease (4·7%)	Interpersonal violence (5·8%)	Road injuries (5·7%)	Lower respiratory infections (7·6%)	Cerebrovascular disease (4·8%)
3	Ischaemic heart disease (7·2%)	Interpersonal violence (5·5%)	Interpersonal violence (5·1%)	Cerebrovascular disease (4·9%)	Interpersonal violence (4·6%)	Lower respiratory infections (4·3%)	Road injuries (5·3%)	Diarrhoeal diseases (5·7%)	Diarrhoeal diseases (6·5%)	Lower respiratory infections (4·6%)
4	Cerebrovascular disease (5·8%)	Lower respiratory infections (5·4%)	Cerebrovascular disease (5·1%)	Tuberculosis (4·8%)	Diarrhoeal diseases (4·2%)	Road injuries (4·1%)	Cerebrovascular disease (4·3%)	Lower respiratory infections (5·5%)	Road injuries (5·4%)	Tuberculosis (4·6%)
5	Road injuries (4·6%)	Cerebrovascular disease (4·7%)	Lower respiratory infections (4·7%)	Road injuries (4·6%)	Tuberculosis (4·1%)	Hypertensive heart disease (3·4%)	Lower respiratory infections (3·6%)	Cerebrovascular disease (5·0%)	Tuberculosis (4·4%)	Interpersonal violence (4·6%)
6	Tuberculosis (4·4%)	Diarrhoeal diseases (4·3%)	Ischaemic heart disease (3·8%)	Interpersonal violence (3·8%)	Lower respiratory infections (3·9%)	Diarrhoeal diseases (3·1%)	Ischaemic heart disease (3·5%)	Tuberculosis (3·6%)	Cerebrovascular disease (3·9%)	Road injuries (4·2%)
7	Trachea/bronchi/ lung cancer (3·7%)	Road injuries (3·3%)	Road injuries (3·6%)	Ischaemic heart disease (3·3%)	Road injuries (2·8%)	Tuberculosis (3·0%)	Diabetes (2·4%)	Diabetes (2·7%)	Diabetes (3·3%)	Diarrhoeal diseases (3·7%)
8	COPD (3·5%)	Diabetes (2·4%)	COPD (2·7%)	Diarrhoeal diseases (3·1%)	Ischaemic heart disease (2·8%)	Interpersonal violence (2·5%)	Renal disease (2·4%)	Ischaemic heart disease (2·5%)	Meningitis/ encephalitis (2·6%)	Ischaemic heart disease (3·1%)
9	Diabetes (2·7%)	Ischaemic heart disease (2·1%)	Diarrhoeal diseases (2·3%)	Hypertensive heart disease (2·6%)	Diabetes (2·6%)	Diabetes (2·3%)	Tuberculosis (2·2%)	Hypertensive heart disease (2·3%)	Interpersonal violence (2·4%)	Diabetes (2·5%)
10	Lower respiratory infections (2·6%)	Hypertensive heart disease (2·0%)	Preterm birth complications (2·2%)	Diabetes (2·1%)	Renal disease (2·1%)	Ischaemic heart disease (2·2%)	Self-inflicted injuries (2·2%)	Interpersonal violence (1·9%)	Hypertensive heart disease (2·2%)	Hypertensive heart disease (2·1%)

Figure 1: Rankings of years of life lost by province for South Africa(57)

Understanding the socioeconomic status and disease profile in the country places the triage system in context as a communication tool between the patients who receive healthcare, and the staff who deliver it. At the point of triage, factors such as healthcare worker to patient ratios, training and experience as well as staff attitudes toward duties interplay with patient load, overcrowding, access to services, individual patient demographics, and patient experience of the health system. These are some of the dynamics that influence the application and outcomes of triage and its ability to predict and appropriately allocate resources.

The public health sector is responsible for the healthcare of more than 44 million South Africans as only 17.4% of people can afford medical aid and private health care(58). The misdistribution of the workforce is reflected by the pressures on staff in the state health system- high patient loads, poor compensation, rural working conditions, long working hours and staff burnout all contribute to the fact that the majority of doctors, dentists and pharmacists seek work in the private sector(56). The nursing profession is described as being in a state of 'crisis,' nurses make up the majority of the health work-force however there is a growing aversion to the career due to multiple administrative, ethical and job satisfaction related factors(56).

Emergency centre triage requires the appropriate system and infrastructure such a designated triage area with the necessary equipment, easy access to patients and designated

staff. The triage process should improve patient flow and not become a point for delay or congestion. If the principles are not well understood allocating space, resources, introducing additional tasks and interrupting more senior staff for input may seem counter-intuitive to the untrained personnel.

The South African Triage Scale in context

The SATS was designed to require minimal training and be easy to use in an over-burdened context, a study in KwaZulu Natal in 2011 reported that staff were initially resistant to use the tool as it was 'cumbersome,' and increased workload especially when caseloads were higher(45). When levels of overcrowding are high staff tend to resort to 'eyeball' triage without completing or documenting the triage process. The same study reported that the higher burden of disease in KZN in comparison to the Western Cape lead to higher rates of over-triage of chronically ill medical patients in the orange category, they felt these patients did not require care as urgently as the triage scale suggested- in these cases the opinion of a senior health care provider was used to adjust acceptable waiting times (45). Barriers to accessing healthcare such as long distances, poor public transport, finances, or initial trial of traditional medicine in more rural areas may result in patients presenting later, with more advanced complications and a higher acuity on arrival.

When training and infrastructure are in place, insight into the benefits and implications of accurate triage become essential. In 2017 a study was done in Gauteng identified reasons for mis-triage in the emergency centre of a tertiary hospital(59). Numerical inaccuracy in calculating the TEWS score, or selecting the wrong range of vital parameters lead to incorrect triage of patient. Inaccurate documentation occurred in cases were the addition was done correctly and the appropriate discriminator chosen but the wrong acuity was written down, this impacts the urgency with which a patient is seen. In rural areas Community Health Workers are seen as an intermediate level solution to staff shortages- these findings highlight potential areas for inaccuracies in triage, which may be compounded when done by staff with minimal levels of education and training.

Challenges with the use of clinical discriminators appeared to be the main barrier to accurate triage in the Gauteng Study(59). In some cases presenting symptoms such as 'abdominal pain, chest pain or shortness of breath,' which appear on the discriminator lists were not used to apply the correct triage category, in other cases the correct acuity was given but the discriminator was not documented(59). The study suggested that more complete guidelines for certain discriminators such as pain- as personal biases may influence assessment; or

psychosis- which refers to acute psychosis and not merely a history of mental illness (51). Interestingly the use of 'non-existent' discriminators affected the final triage category a patient was placed in- this occurred when nurses were concerned about physiological findings such as hypoxia, hypotension, or certain conditions such as head injuries(59). The healthcare providers background exposure and local experience may also have an impact their assessment of symptom severity- for example a nurse with significant trauma experience may have a different frame of reference for severe haemorrhage from someone who rarely assesses trauma patients.

The SATS uses a combination of the TEWS physiological parameters and clinical discriminators to determine patient acuity. Abnormal vital signs provide and objective indication of severity of illness amongst patients, and may serve as predictors of in-hospital mortality in patients with significant physiological derangement(60). Clinical discriminators allow for detection of time-dependant presentations such as hypoglycaemia or focal neurology which may be underrepresented in the TEWS(40). These discriminators however, may not detect the subtle differences in linguistic and cultural elements that affect a patient's description of their symptoms or the receivers understanding of this information. South Africa is country with 11 official languages, each with varied dialects and accents that differ over geographical locations. English, the fourth most commonly spoken language, is the predominant language of healthcare(61). The SATS itself was designed in English and implemented in the Western Cape where more than 41% of the population speak Afrikaans(40). It is not uncommon for the patient and the person performing triage to come from different language and cultural backgrounds, the senior clinician may be from a third culture or language group.

History taking in the emergency centre sometimes relies on a few commonly understood words and mimed actions- a hand on the chest for example may mean severe chest pain, shortness of breath or a blow to the chest depending on the perception of those involved. Hospital employed professional translators are uncommon- as a result clinical consultation is frequently performed using auxiliary staff such as porters or cleaning staff to relay information. These third parties typically have a limited vocabulary in one of the two the languages they are communicating (33). In the rare presence of an interpreter- translation of symptoms by a non-medical person further complicates the accurate transfer of information(61).

South African nationals are a diverse mix of people however the healthcare system also caters to a large number of migrants from neighbouring African countries. Culture and

ethnicity impact learned behaviour, coping mechanisms and perception of disease and pain(62). The impact of these differences on clinical presentation may not translate in a hurried triage waiting area. Culture and level of education also impact on health seeking patterns and definitions of disease, western medical definitions of urgency and severity of illness may not always align with patient beliefs and desires. The patients' understanding of the healthcare structure and the triage process positively impacts their interaction with the system(63). In 2015 a study was done to assess patient views of triage at Gugulethu Community Health centre, it revealed that patients had a poor understanding of the system and their expectations were frequently not met(64). Green acuity patients reported harsh, judgemental treatment by staff, and waiting times were in excess of targets for patients in all categories(65).

Globally emergency medicine and time are intimately related- triage relates to urgency and defines times to treatment. Meeting these targets affects patient outcomes, flow and satisfaction, reduces length of hospital stay, impacts overcrowding, allocation of resources and empowers staff(25). The National Core Standards include waiting times as an indicator of quality service delivery in healthcare(56). In 2012 the Western Cape department of health developed waiting time audit templates to capture data on time-based key performance indicators (56). In the emergency centre the patient pathway is tracked from time of arrival, to time to triage, time to healthcare provider, time to disposition, and time from disposition to exit from the EC(66). Evaluating quality in a healthcare system involves assessing the of structure of the system, the processes involved in it, and the eventual outcomes(67). Improving quality in a time-based system requires attention to the individual tasks in each process and the number of times the process is performed. Core tasks and processes may then be targeted and optimised in relation to the available resources.

In South Africa the burden of disease is well described, and the pathways for patient flow through the District Health System, and its' individual emergency centres is also well defined in the IUSS facility guidelines(68). The size and demographics of the emergency centre case load differs between emergency centres, and characteristically varies with time of day/week/year in a single EC(69). The emergency centre population is allocated to process pathways based on their presenting symptoms and acuity determined by the SATS. Resource requirements, time targets and outcomes are determined by this 'burden of clinical presentations and acuities,' however data describing presenting symptoms, their frequency and relationship to diagnosis and disease profile is currently limited.

One of the early studies on 'Workload and casemix in Cape Town emergency centres,' was published in the SAMJ in 2007(70). An audit of four 24hr Community Health Centres (Khayelitsha, Mitchells Plain, Gugulethu, Elsie's River) was done- the Cape Triage System was in use at that time(70). The results showed that a quarter of paediatric cases presented as emergencies, while the acuity mix that was divided fairly equally between emergency, urgent and non-urgent cases in adults. The most common presenting complaint was trauma(27.9%) mostly related to assault or motor vehicle accidents, or shortness of breath in medical patients(9.2%) and paediatrics. Peak attendance was on Mondays and after hours(70). Another study using the CTS to assess acuity was done in George in 2010, this study focussed on the number of patients seen after normal working hours and reported that 65% of these patients were triaged green(71).

A cross sectional survey of patients presenting to New Somerset Hospital in Cape Town by Hodkinson and Wallis was published in 2009(69). The study described presenting symptoms in adults as trauma(25.8%) and non-trauma related (14.9%); the non-trauma category was sub-divided by systems of which abdominal(14.2%), neurological symptoms (8.6%) and sepsis(6.1%) were the most common. Cardiac conditions were the fifth most common presentation but had the highest number of red cases, followed by respiratory and neurological conditions, while ENT and eye problems had the lowest acuity. The case load acuity as measured by the SATS was described as- 2% Red; 27% Orange; 48% Yellow and 23% Green. Head injury, Abdominal Pain, Pulmonary TB, Dyspnoea and Stabbed chest were the most common diagnoses/presentations reported on exit in adults, and Gastroenteritis, Lower and Upper respiratory tract infections were the most common in children. No correlation was made between presenting symptoms and final diagnoses. In terms of temporal patterns Mondays, Tuesdays and Fridays were the busiest, and the fewest patients were seen on Thursdays.

A similar description of the EC population and case load at Paarl Hospital in the Western Cape was published in 2010. This study also found a predominance of trauma presentations in adults (36%), followed by abdominal (21.9%), respiratory (12.4%), nervous (8.3%) and musculoskeletal conditions(72). In terms of acuity, 4.9% of cases were triaged Red, 14.3% Orange, 66.9% Yellow and 13.9% Green, these figures were similar for adults and paediatric cases(72). Further descriptions of diagnoses were given- the most common trauma conditions were lacerations and soft tissue injuries to the head, the next most common diagnostic category was respiratory (pneumonia and upper respiratory tract infections), followed by gastrointestinal (gastroenteritis and gastritis) and neurological conditions

(cerebrovascular accidents and epilepsy). The EC saw most patients between 8h00 and 24h00, with significantly fewer cases overnight, this may have been related to the fact that the majority(88.2%) of patients were self-referred.

A prospective study focussing on patients seen in the resuscitation area of the emergency centre at Khayelitsha District Hospital was done between November 2014 and April 2015(73). In this period 27.6% of patients treated in the resuscitation area were triaged Red for immediate care, and 42.4% required very urgent care. In this high acuity group 50.8% of admissions were medical, with a high co morbidity of HIV (22.8%), hypertension (11.4%) and diabetes (11.3%), a further 39.9% of admissions were trauma related. These figures reflect the national mortality data and quadruple burden of disease in an area with low socioeconomic status.

Outside the Western Cape one study assessed patient numbers and triage acuity during after-hours service at GJ Crookes hospital in KwaZulu Natal(74). It found that 59.7% of the cases seen outside normal working hours were triaged green, a further 19.9% yellow while 17.8% were very urgent and 2.6% red or emergency cases. This study did not look at caseload during normal working hours, or review presenting symptoms or final diagnoses. No other significant studies from outside the Western Cape were found.

Identification of gaps or needs for further research

An analysis of the literature shows the success of the SATG in developing the SATS as a reliable tool with successful application in adult and paediatric populations in South Africa and other LMICs. The first priority of triage is to accurately and reproducibly identify the most severely ill so that they may be treated first- the evidence confirms that the SATS is able to do this successfully.

Simply put, triage is the first point of direct communication between the healthcare worker and the patient. The process allows healthcare workers to determine *how sick* patients are but also provides a wealth of other data. Demographic information defines *who* the patients are, time records show *when* they seek treatment, and clinical discriminators or presenting symptoms record *why* they come to the emergency centre. The responsibility of investigating *what* caused these symptoms and treating them appropriately then falls to the healthcare system. The answers to the who, when, why and what questions have yet to be described adequately in South African literature.

In a resource constrained environment, with high levels of overcrowding and staff shortages streamlining the pathway between presenting complaint and diagnosis or disposition impacts the entire health system. The presenting complaint determines the initial triage acuity and therefore determines the resources that will be allocated the management of that patient.

Understanding and quantifying these presenting complaints allows direct anticipation and planning for the needs of the system. The final diagnosis is made once the allocated resources have been used and has greater implications for management and requirements beyond the EC setting. The presenting compliant is therefore, at least, as important as the final diagnosis in the process of moving a patient from triage to disposition in emergency care.

The SATS provides short lists of clinical discriminators that were added considering symptoms that were underrepresented by the TEWS in the original evaluation of the CTS, and early follow up studies of the SATS. These lists do not cover the full spectrum of possible presentations or give any reliable representation the incidence of each. Collecting data on the frequency and acuity of presenting complaints, and their eventual diagnosis will give insight into how certain conditions present as emergencies, as well as how they present in less severe cases. It will also allow context specific assessment of the differential diagnosis for common presenting conditions in each acuity category.

A diagnosis of pneumonia, myocardial infarction or pneumothorax could be made in a patient presenting with shortness of breath and the same diagnoses may apply to a patient presenting with chest pain or cough. It would be clinically useful to know the expected proportional frequency of the differential diagnoses for each symptom, and the relative of acuity in each case. This also allows for assessment of the frequency with which patients triaged in a high acuity category on TEWS present with other symptoms such as cough – which by itself, does not prioritise treatment according to the SATS discriminators at present.

This type of information may be used to create symptom-based diagnostic algorithms, and outline patient treatment pathways that are appropriate for the level of care and resources available. These tools may facilitate the tasks and processes that could be completed in the waiting time before the formal physician consultation. This would improve patient flow and reduce the time spent waiting for disposition - for example patients with a suspected ankle fracture could have the Ottawa rules applied, and be sent for X-rays while waiting to be seen.

Electronic record systems are being rapidly integrated into clinical settings with great benefits for efficiency and effectiveness, this also applies to the triage process. Inevitably

there will be variation in the data that is collected pre- and post-introduction of electronic databases. Data that has been manually extracted prior to the introduction of electronic systems may be used to validate computerised records as they become more common in South African ECs in the future.

A small body literature describes the difficulties with the use and documentation of clinical discriminators in triage in a diverse context, but it is difficult to assess the quality of communication between patient and health care provider and evaluate the accuracy with which the primary reason for the patient seeking healthcare is captured. This information is important as clinical symptoms affect priority, direct additional investigations and impact resources use as described. Describing the correlation between the presenting complaint documented at triage and the presenting compliant reported at the first clinician encounter will give a basic indication of the reliability of the symptom history.

Most studies on emergency centre caseload focus on overall numbers and acuities or specifically on the after-hours setting. An assessment of relationship between seasons and presentations has not been done, and would be valuable as differences will again direct provision of appropriate services at different times. Similarly describing the acuity caseload on different days of the week may inform operational decisions such as ensuring adequate staffing and increasing supplies over busier periods.

Success in emergency medicine both on an organisational and a clinical level is related to anticipation, preparation and timing. The SATS provides a robust tool that can be used to extract invaluable information on the needs of patients and the expected requirements of a system that can meet those needs. These requirements may vary greatly from one region, and even one emergency centre to another. Starting by collecting data on presenting symptoms and their correlating diagnoses emergency centres may use evidence to advocate for staff and the most appropriate allocation of limited resources in order to optimise outcomes in their area. This information can be used to guide research in emergency care in other LMIC's as the SATS becomes more widely used.

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PART B: MANUSCRIPT IN ARTICLE FORMAT

Describing the most common presenting complaints, their priority and corresponding diagnoses at Mitchell's Plain Emergency Centre

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Abstract

Describing the most common presenting complaints, their priority and corresponding diagnoses at Mitchell's plain Emergency Centre

Introduction

Triage allows prioritisation of the most severely ill in emergency centres that face a complex and growing burden of disease. The presenting symptom is an independent variable that informs acuity and directs resource allocation. This study describes the most common presenting complaints and linked diagnoses, in total and for each category of the South African Triage Scale (SATS) at Mitchell's Plain Emergency Centre

Methods

A retrospective, cross-sectional, chart review was used. The sample consisted of patients who presented to Mitchell's Plain EC in January and June 2015. Charts were reviewed via the Electronic Content Management system. Data were collected on demographic profile, triage priority, presenting symptoms at triage, and ICD-10 diagnosis on EC disposition.

Results

3434 of 4335 charts that were reviewed were suitable for inclusion. Triage acuity was 13.8% (n=475) green, 41.0% (n=1409) yellow, 32.5% (n=1116) orange and 4.3% (n=148) red. Trauma (9.7%) and abdominal pain (8.6%) were the most common presenting complaints- the majority of these were triaged as yellow cases. The most common diagnosis made was pneumonia (3.4%) – most frequently presenting as shortness of breath (14.4%). High acuity complaints were predominantly medical. Triage and clinicians' report of the main complaint correlated in 74.3% of cases (r=0.7). The majority of patients and highest proportion of high priority patients presented on Mondays and Saturdays.

Conclusion

Mitchell's Plain EC has a complex caseload with significant burden of trauma presentations related to interpersonal violence and penetrating assault. Respiratory and gastrointestinal symptoms due to infections were common across triage acuities, and cardiac or neuropsychiatric complications of chronic diseases presented frequently in high priority categories. Describing these presentations and their linked characteristic diagnoses will allow for further research into clinical flow pathways between arrival and disposition. Staffing requirements may be determined by linking these pathways to reality-based time frames.

Main text of article

Describing the most common presenting complaints, their priority and corresponding diagnoses at Mitchell's plain Emergency Centre

Introduction

South African Emergency Centres form the interface between the Healthcare system and the population it serves. A complex and growing burden of disease in this context places a high demand on emergency medical services(1). Emergency centres have to be equipped to provide high-quality care to a number of undifferentiated patients with varying acuity of illness.

The South African Triage Scale (SATS) is a validated tool that enables rapid prioritisation of emergencies and the severely ill in both adult and paediatric cases (2). The patient's presenting complaint is an independent variable in emergency centre triage, it is regarded as at least as important as the eventual diagnosis. Being that the presenting symptom determines the initial triage prioritisation it, therefore, determines resource allocation. The final diagnosis is typically only made once outcomes of the allocated resources have been negotiated further down the patient journey. In fact, many common presentations may lead to different, but important diagnoses (e.g.: a 'Shortness of Breath' triage presentation may eventually turn out to be asthma, pneumonia, tuberculosis, heart failure, influenza, or hyperventilation and so on).

It remains the presentation that determines the initial priority, and as such should be considered the starting point in emergency centre care. Yet fairly little is known about exactly what presentations are seen in local emergency centres. Studies concentrating on presentations have not been done within the local context since the original and subsequent follow-up studies of the SATS (3,4). These studies considered the presenting complaints that were underrepresented in priority by the Triage Early Warning Scores and therefore do not reflect all possible presentations, or give a reliable representation of the incidence of each(4).

Collecting data from patient triage charts will allow assessment of complaints which present commonly; their relative severity or priority and the diagnoses frequently associated with these presentations -as recorded by nurses and clinicians. This will allow us to determine the frequency of these symptoms, and give insight into how certain conditions present as emergencies. Furthermore, understanding the specific presentations, timing and seasonal

variations, and how these interact with priority and eventual diagnosis will guide future research by providing baseline information for the delineation of standard management pathways, and eventual time in motion models which may be used to calculate staffing requirements.

The main aim of this study is to identify the most common presenting complaints and corresponding linked diagnoses, in total and for each category of the SATS, at Mitchell's plain Emergency Centre (EC).

Methods

A retrospective, cross-sectional, chart review was used to describe the aim. The sample consisted of all patients (adults and children) who presented to Mitchell's plain EC in a convenience sample collected for the months of January and June 2015. The months selected for the original study were specifically chosen to include data from both summer and winter months. Mitchell's Plain EC sees approximately 2500 patient encounters each month. Twenty percent of these patients are children. The EC is part of a 270-bed district hospital which serves a population of 430 000 people from the Mitchells Plain, Mandalay and Philippi communities. As a district hospital it offers emergency services, basic surgical and obstetric services at a high turnover. Patients requiring prolonged inpatient or specialist level care are referred to Groote Schuur Hospital. Information obtained from this study may be used to guide resource allocation and help streamline the emergency care services relative to the most common presentations in this area.

The bulk of the data were captured by four, second-year medical students who collected data for their Special Study Module project. The sample evaluated comprised of 4335 individual patient encounters. A list of all patients seen in the emergency centre for January and June 2015, with no intentional exclusions, was obtained from hospital information management department. All patient charts (adults and children) for each time period were then manually reviewed via the Electronic Content Management System that contains hospital records. The presenting complaint at triage as described in free text by the triage nurse and the first attending clinician, SATS priority, and final diagnosis was captured from the emergency centre triage and clerking notes. The Electronic Management System captures approximately 90% of all EC records as scanned documents, which may be accessed via the intranet. A universal data collection spreadsheet was used to capture the data to ensure uniform collection (Appendix A – data supplement. A predetermined presentation list was used to further ensure uniformity in describing the presenting complaint. This list was

adapted from the Manchester Triage Scale list; it contains fifty presentations (called discriminators) each of which initiates a triage decision algorithm(5). Presentations common to the local context, decided by consensus, were added. A free text field was provided where a presentation did not comply with any of those on the predetermined list. This was used for the triage and clinician presentation fields. Similarly, a predetermined diagnosis list was used to guide diagnosis input. The standard emergency centre ICD10 list (Appendix B – data supplement) was used with a free text field provided where a diagnosis did not comply with any of those on the list.

Cases where electronic records are illegible or incomplete, and could not be resolved by consensus, were reported as such and excluded. The quality of the sample was finally cross-checked for accuracy and inconsistencies by scrutinising every 50th data set against the electronic record; where significant errors were found within an individual student's work, the entire set were more closely scrutinised for errors.

We collected the following set of variables for each subject: date and time of arrival, date of birth, gender, triage priority assigned, triage presentation from predetermined list (see Appendix A), free text presentation field (for presentations not included in list), clinician presentation from predetermined list (see Appendix A), free text presentation field [for presentations not included in list], diagnosis from predetermined list (see Appendix B), free text diagnosis field (for diagnoses not included in list).

Data were analysed using Microsoft Excel. Age were expressed as mean and standard deviation. This was described using proportions for triage category and gender in total and for categories above and below the age of 12 years, in accordance with the PSATS age categories and the South African age of capacity to consent to medical treatment(6). The presenting complaint recorded at triage and that reported by the clinician were correlated using the Pearson correlation coefficient (for the purposes of interpretation, r=0.5-0.74 described a strong correlation and r=0.75-1 described a very strong correlation). Frequencies and proportions were provided for categorical data (triage and clinician presentations, priority and diagnoses) and ranked from most to least prevalent for triage and clinician presentations, priority and diagnoses. Triage presentations were ranked and each presentation was described in terms of the proportional SATS priority allocation, as well as the top resulting diagnoses. Frequencies and proportions were also provided for triage presentations and diagnoses for each category of the SATS. The proportional SATS priority allocation for the various days of the week were also calculated. The study was approved

through the University of Cape Town's Human Research Ethics Committee (ref: HREC 678/2017).

Results

The initial sample provided by the hospital information management department comprised 4335 patient encounters for the months of January and June. We excluded 901 cases due to incomplete records and duplication. The eventual sample consisted of 3434 cases.

Figure 1 provides detail regarding the data collection strategy, exclusions and eventual sample used for analysis

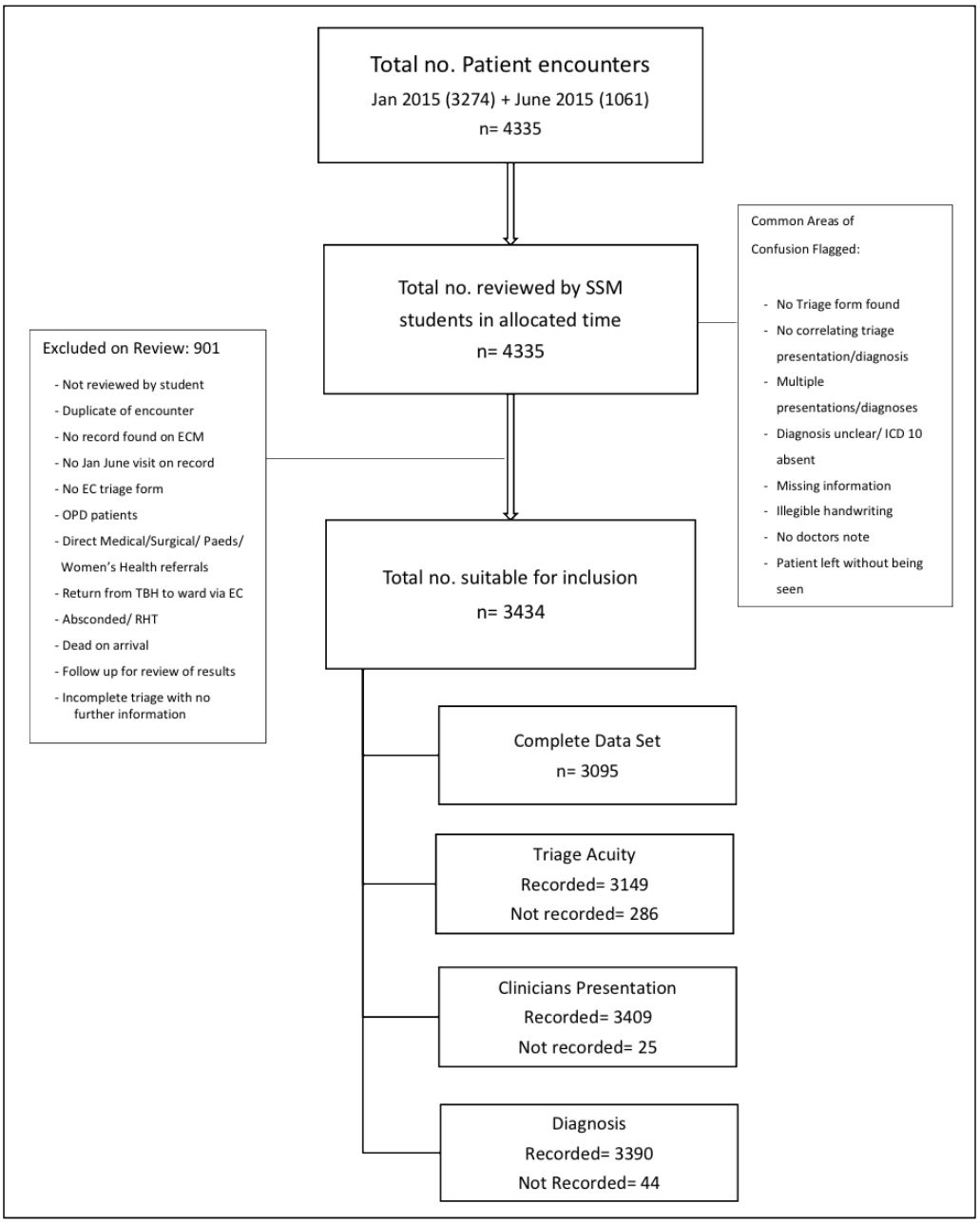


Figure 1. Sample collection flow chart

The sample population comprises 82,2% (n=2824) patients aged 12 years and older resulting in an overall mean age of 36 years (± 22 years). The sample population ranges from 1 month to 97 years of age. Key demographics for the study are provided in Table 1.

Table 1. Sample demographics

Full Sample						
	Female		Male		Total	
Triage Acuity	n (% full sample)	Mean Age (±SD)	n (% full sample)	Mean Age (±SD)	n (% full sample)	Mean Age (±SD)
All Acuity	1698 (49,4)	38 (±22)	1736 (50,6)	34 (±21)	3434 (100)	36 (±22)
Green	233 (6,8)	35 (±22)	242 (7,0)	31 (±22)	475 (13,8)	33 (±22)
Yellow	689 (20,1)	38 (±22)	720 (21,0)	34 (±21)	1409 (41,0)	36 (±22)
Orange	577 (16,8)	38(±23)	539 (15,7)	35 (±21)	1116 (32,5)	36 (±22)
Red	69 (2,0)	39 (±21)	79 (2,3)	34 (±24)	148 (4,3)	37 (±23)
Not Specified	130 (3,8)	38 (±23)	156 (4,5)	33 (±21)	286 (8,3)	35 (±22)
Sample Aged 12 years and older						
All Acuity	1443 (42,0)	43 (±19)	1381(40,2)	41 (±17)	2824 (82,2)	42 (±18)
Green	194 (5,6)	42 (±19)	178 (5,2)	41 (±17)	372 (10,8)	41 (±18)
Yellow	592 (17,2)	43 (±19)	581 (16,9)	41 (±17)	1173 (34,2)	42 (±18)
Orange	488 (14,2)	44 (±19)	438 (12,8)	42 (±17)	926 (27,0)	43 (±18)
Red	60 (1,7)	45 (±17)	61 (1,8)	43 (±19)	121 (3,5)	44 (±18)
Not Specified	109 (3,2)	45 (±18)	123 (3,6)	40 (±17)	232 (6,8)	42 (±18)
Sample Aged less than 12 years						
All Acuity	255 (7,4)	4 (±3)	355 (10,3)	4 (±3)	610 (17,8)	4 (±3)
Green	39 (1,1)	4 (±3)	64 (1,9)	4 (±3)	103 (3,0)	4 (±3)
Yellow	97 (2,8)	5 (±3)	139 (4,0)	5 (±3)	236 (6,9)	5 (±3)
Orange	89 (2,6)	4 (±3)	101 (2,9)	4 (±3)	190 (5,5)	4 (±3)
Red	9 (0,3)	4 (±3)	18 (0,5)	3 (±3)	27 (0,8)	4 (±3)
Not Specified	21 (0,6)	4 (±2)	33 (1,0)	5 (±3)	54 (1,6)	5 (±3)

Figure 2 ranks the frequency of presenting complaints at triage along with its proportional triage allocation. Fifty-nine complaints of the complete list of eighty presenting complaints are represented. The other twenty-one complaints presented less than 5 times over the sample period and are combined as a miscellaneous group. Each of these represented less than 0,1% of the full sample when analysed individually. Presentations that occurred on more than five encounters represent 98,5% (n= 3382) of the total sample. The clinical descriptors in the miscellaneous group were: angioedema, dysuria, post-surgical complications, upper GI bleed, alcohol intoxication, bleeding disorder, burns- facial, haemorrhage- uncontrolled, malnutrition, meningitis, airway obstruction, dislocation- other, fracture- open/compound, inconsolable crying, neonate/tiny baby, palpitations, shock, burns- electrical, hypothermia, stridor, wheezing.

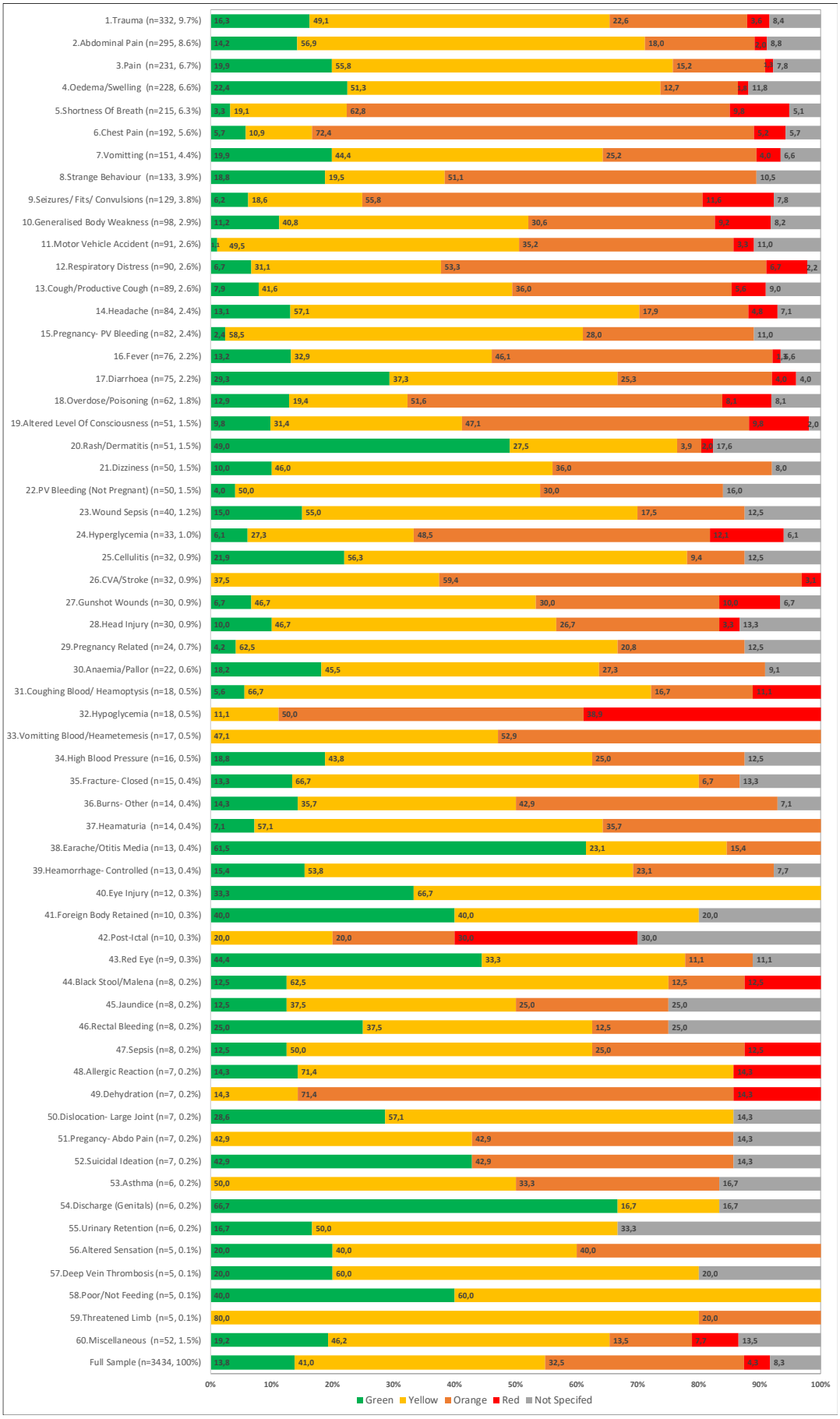


Figure2. Frequency of presenting complaints and proportional SATS priority allocation (%)

Trauma (n=332, 9,7%), as a general descriptor was the number one most common presenting complaint, followed by abdominal pain (n=295, 8,6%) and unspecified pain (n= 231, 6,7%). Combining all specified traumatic/injury presentations (trauma (n=332, 9,7%), motor vehicle accident (n=91, 2,6%), head injury (n=30, 0,9%), gunshot wounds (n=30, 0,9%), fracture-closed (n=15, 0,4%), burns-other (n=14, 0,4%), eye injury (n=12, 0,3%), dislocation-large joint (n=7, 0,2%) burns-facial (n=3, 0,1%), fracture-open (n=2, 0.1%), burns-electrical (n=1, 0,01%) increases the trauma caseload to 15,6% (n=537).

The ten most common presenting complaints represent 58,4% (n=2004) of included patient encounters. Figure 2 shows that the most common complaints are predominantly triaged in the yellow (urgent) category, with the exception of chest pain (72,4%), shortness of breath (62,8%), seizures (55,8%) and strange behaviour (51,1%) which show relatively higher proportions of orange (very urgent) cases. Presentations with hypoglycaemia, post-ictal state, allergic reaction, or dehydration are illustrated to have highest proportions of emergency (red) priority cases although these complaints rank with lower overall frequency. The figure(2) also highlights common primary health care presentations such as genital discharge, earache, and rashes which present to the EC predominantly as non-urgent cases.

Table 2 ranks the presenting complaints by frequency and proportions in each triage category. Triage category was not indicated in 8,3% (n=286) of encounters- clinical discriminators identify 4 very urgent presentations amongst the most common of these unspecified cases. Table 2 also lists the most frequent diagnoses recorded in each triage category. The final list of diagnoses included a broad spectrum of 317 different ICD 10 codes. The twenty most common EC diagnoses account for 40,8% (n=1400) of all encounters. 'No diagnosis provided' (n=15, 3,2%) ranks after gastritis as the second most frequent description in non-urgent (green cases). All cases where no diagnosis was given (n=44, 1,2%) are labelled as such in order that all triage encounters are accounted for.

Table 2. Most common presenting complaints and diagnoses in total and for each category of the SATS

	Most Common Presenting Complaints (n 3434, 100%)	n	%	Green (n=475, 13,8%)	n	%	Yellow (n=1409, 41,0%)	n	%	Orange (n=1116, 32,5%)	n	%	Red (n=148, 4,3%)	n	%	Not Specified (n=286, 8,3%)	n	%
1	Trauma	332	9,7	Trauma	54	11,4	Abdominal Pain	168	11,9	Chest Pain	139	12,5	Shortness of Breath	21	14,2	Trauma	28	9,8
2	Abdominal Pain	295	8,6	Oedema/Swelling	51	10,7	Trauma	163	11,6	Shortness of Breath	135	12,1	Seizures/ Fits/ Convulsions	15	10,1	Oedema/Swelling	27	9,4
3	Pain	231	6,7	Pain	46	9,7	Pain	129	9,2	Trauma	75	6,7	Trauma	12	8,1	Abdominal Pain	26	9,1
4	Oedema/Swelling	228	6,6	Abdominal Pain	42	8,8	Oedema/Swelling	117	8,3	Seizures/ Fits/ Convulsions	72	6,5	Chest Pain	10	6,8	Pain	18	6,3
5	Shortness of Breath	215	6,3	Vomiting	30	6,3	Vomiting	67	4,8	Strange Behaviour	68	6,1	Generalised Body Weakness	9	6,1	Strange Behaviour	14	4,9
6	Chest Pain	192	5,6	Rash/Dermatitis	25	5,3	Headache	48	3,4	Abdominal Pain	53	4,7	Hypoglycemia	7	4,7	Chest Pain	11	3,8
7	Vomiting	151	4,4	Strange Behaviour	25	5,3	Pregnancy- PV Bleeding	48	3,4	Respiratory Distress	48	4,3	Abdominal Pain	6	4,1	Shortness of Breath	11	3,8
8	Strange Behaviour	133	3,9	Diarrhoea	22	4,6	Motor Vehicle Accident	45	3,2	Vomiting	38	3,4	Respiratory Distress	6	4,1	Motor Vehicle Accident	10	3,5
9	Seizures/ Fits/ Convulsions	129	3,8	Chest Pain	11	2,3	Shortness of Breath	41	2,9	Fever	35	3,1	Vomiting	6	4,1	Seizures/ Fits/ Convulsions	10	3,5
10	Generalised Body Weakness	98	2,9	Generalised Body Weakness	11	2,3	Generalised Body Weakness	40	2,8	Pain	35	3,1	Altered LOC	5	3,4	Vomiting	10	3,5
11	Motor Vehicle Accident	91	2,6	Headache	11	2,3	Cough/Productive Cough	37	2,6	Cough/Productive Cough	32	2,9	Cough/Productive Cough	5	3,4	Pregnancy- PV Bleeding	9	3,1
12	Respiratory Distress	90	2,6	Fever	10	2,1	Diarrhoea	28	2,0	Motor Vehicle Accident	32	2,9	Overdose/Poisoning	5	3,4	Rash/Dermatitis	9	3,1
13	Cough/Productive Cough	89	2,6	Earache/Otitis Media	8	1,7	Respiratory Distress	28	2,0	Overdose/Poisoning	32	2,9	Headache	4	2,7	Cough/Productive Cough	8	2,8
14	Headache	84	2,4	Overdose/Poisoning	8	1,7	Strange Behaviour	26	1,8	Generalised Body Weakness	30	2,7	Hyperglycemia	4	2,7	Generalised Body Weakness	8	2,8
15	Pregnancy- PV Bleeding	82	2,4	Seizures/ Fits/ Convulsions	8	1,7	Fever	25	1,8	Oedema/Swelling	29	2,6	Oedema/Swelling	4	2,7	PV Bleeding (Not Pregnant)	8	2,8
16	Fever	76	2,2	Cellulitis	7	1,5	PV Bleeding (Not Pregnant)	25	1,8	Altered LOC	24	2,2	Diarrhoea	3	2,0	Headache	6	2,1
17	Diarrhoea	75	2,2	Cough/Productive Cough	7	1,5	Seizures/ Fits/ Convulsions	24	1,7	Pregnancy- PV Bleeding	23	2,1	Gunshot Wounds	3	2,0	Fever	5	1,7
18	Overdose/Poisoning	62	1,8	Shortness Of Breath	7	1,5	Dizziness	23	1,6	CVA/Stroke	19	1,7	Motor Vehicle Accident	3	2,0	Overdose/Poisoning	5	1,7
19	Altered Level of Consciousness	51	1,5	Respiratory Distress	6	1,3	Wound Sepsis	22	1,6	Diarrhoea	19	1,7	Pain	3	2,0	Wound Sepsis	5	1,7
20	Rash/Dermatitis	51	1,5	Wound Sepsis	6	1,3	Chest Pain	21	1,5	Dizziness	18	1,6	Post-Ictal	3	2,0	Cellulitis	4	1,4
	Other	679	19,8	Other	80	16,8	Other	284	20,2	Other	160	14,3	Other	14	9,5	Other	54	18,9
	Most Common Diagnoses (n=3434, 100%)	**n**	**%**	**Green (n= 475, 13,8%)**	**n**	**%**	**Yellow (n=1409, 41,0%)**	**n**	**%**	**Orange (n=1116, 32,5%)**	**n**	**%**	**Red (n=148, 4,3%)**	**n**	**%**	**Not Specified (n=286, 8,3%)**	**n**	**%**
1	J18.9- Pneumonia	117	3,4	K29.9- Gastritis/Duodenitis	23	4,8	L02.9- Abcess	41	2,9	J18.9- Pneumonia	69	6,2	J18.9- Pneumonia	15	10,1	O20.0- Threatened abortion	12	4,2
2	A09.9- Infective GE	91	2,6	None given	15	3,2	K29.9- Gastritis/Duodenitis	40	2,8	G40.9- Epilepsy	47	4,2	A41.9- Severe sepsis	7	4,7	F29.X- Psychosis	10	3,5
3	K29.9- Gastritis/Duodenitis	88	2,6	S00.9- Superfical head Injury	15	3,2	O20.0- Threatened abortion	40	2,8	F29.X- Psychosis	42	3,8	E16.2- Hypoglycemia	6	4,1	G40.9- Epilepsy	8	2,8
4	A15.9- PTB	87	2,5	A09.9- Infective GE	14	2,9	A09.9- Infective GE	38	2,7	I50.9- Cardiac failure	41	3,7	G40.9- Epilepsy	6	4,1	L02.9- Abcess	8	2,8
5	G40.9- Epilepsy	87	2,5	F29.X- Psychosis	14	2,9	A15.9- PTB	38	2,7	J21.9- Bronchiolitis	39	3,5	J44.9- COPD	6	4,1	K29.9- Gastritis/Duodenitis	7	2,4
6	F29.X- Psychosis	83	2,4	N39.0- UTI	13	2,7	S00.9- Superfical head Injury	37	2,6	A15.9- PTB	37	3,3	A09.9- Infective GE	5	3,4	S00.9- Superfical head Injury	7	2,4
7	S00.9- Superfical head Injury	81	2,4	L03.9- Cellulitis	12	2,5	J06.9- URTI	32	2,3	J06.9- URTI	33	3,0	I50.9- Cardiac failure	4	2,7	A09.9- Infective GE	6	2,1
8	J06.9- URTI	80	2,3	H66.9- Otitis Media	11	2,3	L03.9- Cellulitis	31	2,2	T50.9- Poisoning	29	2,6	I64.X- CVA	4	2,7	A15.9- PTB	6	2,1
9	I50.9- Cardiac failure	77	2,2	K59.0- Constipation	11	2,3	L03.9- Cellulitis	28	2,0	A09.9- Infective GE	28	2,5	J81.X- Pulmonary Oedema	4	2,7	I82.9- DVT	6	2,1
10	J21.9- Bronchiolitis	71	2,1	R52.9- Pain	11	2,3	N39.0- UTI	28	2,0	I64.X- CVA	28	2,5	T50.9- Poisoning	4	2,7	J21.9- Bronchiolitis	6	2,1
11	O20.0- Threatened abortion	69	2,0	J06.9- URTI	9	1,9	S27.11- Pneumohaemo	27	1,9	J44.9- COPD	26	2,3	E10.1- DKA	3	2,0	G41.9- Status Epilepticus	5	1,7
12	L02.9- Abcess	62	1,8	L02.9- Abcess	9	1,9	I50.9- Cardiac failure	26	1,8	S27.11- Pneumohaemo	24	2,2	J06.9- URTI	3	2,0	I20.9- Unstable angina	5	1,7
13	S27.11- Pneumohaemothorax	61	1,8	G40.9- Epilepsy	8	1,7	S82.9- Lower leg injury	25	1,8	I20.9- Unstable angina	19	1,7	R56.8- Convulsions	3	2,0	O03.3- ICA	5	1,7
14	T50.9- Poisoning	55	1,6	L03.9- Cellulitis	7	1,5	J18.9- Pneumonia	24	1,7	J45.9- Asthma	19	1,7	S00.9- Superfical head Injury	3	2,0	X99.99- Assault-sharp object	5	1,7
15	N39.0- UTI	54	1,6	J18.9- Pneumonia	6	1,3	J21.9- Bronchiolitis	23	1,6	S00.9- Superfical head Injury	19	1,7	X95.99- Assault- Gun	3	2,0	I50.9- Cardiac failure	4	1,4
16	I64.X- CVA	53	1,5	R21.X- Rash	6	1,3	I64.X- CVA	19	1,3	D64.9- Anaemia	18	1,6	X99.99- Assault-sharp object	3	2,0	L03.9- Cellulitis	4	1,4
17	None given	44	1,3	S69.9- Hand/wrist Injury	6	1,3	None given	19	1,3	I25.9- Ischemic Heart Disease	18	1,6	A15.9- PTB	2	1,4	None given	4	1,4
18	J44.9- COPD	48	1,4	S99.9- Foot/ankle injury	6	1,3	G40.9- Epilepsy	18	1,3	K29.9- Gastritis/Duodenitis	16	1,4	E11.0- HHS	2	1,4	L03.9- Cellulitis	4	1,4
19	L03.9- Cellulitis	47	1,4	T50.9- Poisoning	6	1,3	S69.9- Hand/wrist Injury	18	1,3	O20.0- Threatened abortion	14	1,3	G03.9- Meningits	2	1,4	F33.9- Major Depressive DO	3	1,0
20	K38.9 Appendicitis	45	1,3	Z00.8- Well patient	6	1,3	S82.9- Ankle Fracture	18	1,3	E10.1- DKA	13	1,2	G41.9- Status Epilepticus	2	1,4	G03.9- Meningits	3	1,0
	Other	2034	59,2	Other	267	56,2	Other	839	59,5	Other	537	41,8	Other	61	41,2	Other	168	58,7

The presenting complaint recorded at triage and that reported by the clinician who consulted the patient correlate in 2550 (74.3%) of the 3434 encounters reviewed (r=0.71). There are 11 triage presentations with 100% correlation- all of these are from the miscellaneous group which presented less than 5 times- followed by gunshot wounds (n=20, 96,7%), vaginal bleeding in pregnancy (n=79, 96,3%), and motor vehicle accidents (n=87, 95,6%).

Strange behaviour (n=123, 92,5%), trauma (n=298, 88,9%) and seizures/ fits/ convulsions (n=108, 83,7%) show the highest correlations of the 10 most common complaints, of these- trauma and seizures are frequent high acuity presentations. Shortness of breath (n=148, 68,8%), vomiting (n=100, 66,2%) and generalised body weakness (n=56, 57,1%) show the lowest correlation of the most common complaints, notably- shortness of breath and generalised body weakness are both high acuity presentations. Chest pain which is also a high acuity condition correlated as the presenting complaint in 75,5% (n=145) of cases .

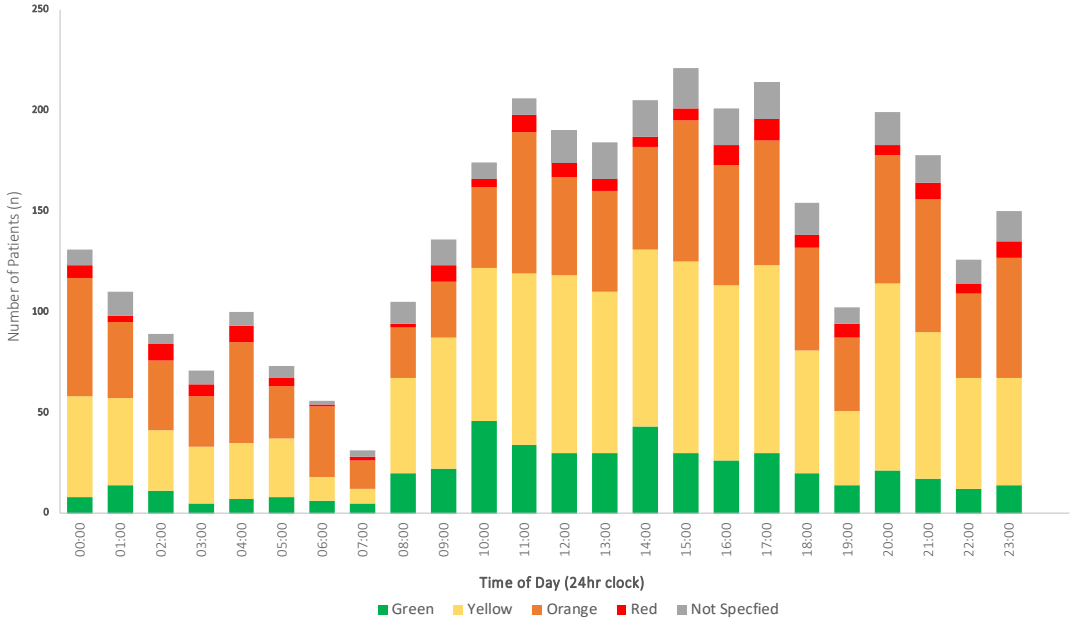
Table 3 provides details of the top five diagnoses associated with each of the top ten most common presenting complaints. It ranks the diagnoses for each presenting complaint in total and for each triage priority, frequency and proportion of the number of triage presentations in each category are shown. Fifty-two percent (n=77) of emergency (red) cases have

diagnoses within the top five diagnosis category, the range of diagnoses decreases with increasing acuity .

Table 3. Top five diagnoses overall and for each triage category for top 10 presenting complaints

Most Common Diagnoses (n= 976 of 3434 Traiged, 28,4%)	n	%	Green (n= 150 of 475, 3,2%)	n	%	Yellow (n= 362 of 1409, 25,7%)	n	%	Orange (n= 395 of 1116, 35,4%)	n	%	Red (n=77 of 148, 52,0%)	n	%	Not Specified (n=96 of 286, 33,6%)	n	%
1. Trauma	**160**	**48,2**		**24**	**44,4**		**73**	**44,8**		**51**	**68,0**		**9**	**33,8**		**17**	**60,7**
1 S27.11- Pneumoheamothorax	54	16,3	S00.9- Superfical Head Injury	8	14,8	S27.11- Pneumoheamothorax	25	15,3	S27.11- Pneumoheamothorax	20	26,7	X99.99- Assault-sharp object	3	9,1	X99.99- Assault-sharp object	4	14,3
2 S00.9- Superfical head Injury	37	11,1	S59.9- Forearm/ Elbow Injury	4	7,4	S00.9- Superfical Head Injury	15	9,2	X99.99- Assault-sharp object	10	13,3	S00.9- Superfical Head Injury	2	3,7	S00.9- Superfical Head Injury	4	14,3
3 X99.99- Assault-sharp object	33	9,9	S27.11- Pneumoheamothorax	4	7,4	S69.9- Hand/wrist Injury	12	7,4	S21.9- Thorax- penetrating injury	9	12,0	S27.11- Pneumoheamothorax	2	5,4	S59.9- Forearm/ Elbow Injury	4	14,3
4 S21.9- Thorax- penetrating injury	18	5,4	X99.99- Assault-sharp object	4	7,4	X99.99- Assault-sharp object	12	7,4	S00.9- Superfical Head Injury	8	10,7	S31.8- Abdomen- penetrating	1	5,6	S27.11- Pneumoheamothorax	3	10,7
5 S69.9- Hand/wrist Injury	18	5,4	S99.9- Foot/ankle injury	4	7,4	S31.8- Abdomen- penetrating	9	5,5	T07.X- Multiple injuries	4	5,3	S49.9-Shoulder/arm injury	1	10,0	S21.9- Thorax- penetrating injury	2	7,1
2. Abdominal Pain	**102**	**34,6**		**20**	**47,6**		**60**	**35,7**		**19**	**35,8**		**6**	**100**		**11**	**42,3**
1 K38.9 Appendicitis	34	11,5	K59.0- Constipation	6	14.3	K38.9 Appendicitis	22	15,3	K38.9 Appendicitis	5	9,4	O00.9- Ectopic Pregnancy	2	33,3	K38.9 Appendicitis	3	11,5
2 K29.9- Gastritis/Duodenitis	18	6,1	N39.0- UTI	5	11.9	K29.9- Gastritis/Duodenitis	11	9,2	K56.6- Bowel Obstruction	4	7,5	G03.9- Meningits	1	16,7	K29.9- Gastritis/Duodenitis	3	11,5
3 K59.0- Constipation	17	5,8	None	4	9.5	R10.4- Abdominal pain	10	7,4	R10.4- Abdominal pain	4	7,5	I71.8- Aortic Aneurysm	1	16,7	O03.3- ICA	2	7,7
4 R10.4- Abdominal pain	17	5,8	K38.9 Appendicitis	3	7.1	N20.9- Renal Colic	9	7,4	K59.0- Constipation	3	5,7	O85- Pueperal Sepsis	1	16,7	K27.9- PUD	2	7,7
5 N39.0- UTI	16	5,4	K85.9- Pancreatitis	2	4.8	K27.9- PUD	8	5,5	N10.X- Pyleonephritis	3	5,7	K38.9- Appendicitis	1	16,7	K43.2- Incisional hernia	1	3,8
3. Pain	**63**	**27,3**		**23**	**50,0**		**41**	**31,8**		**14**	**40,0**		**3**	**100**		**9**	**50,0**
1 M54.5- Back pain	18	7.8	R52.9- Pain	7	15,2	M54.5- Back pain	14	10,9	N20.9- Renal Colic	2	5,7	R42.X- Dizziness	1	33,3	N50.8- Testicular pain/swelling	2	11,1
2 R52.9- Pain	12	5.2	M54.5- Back pain	2	4,3	J03.9- Tonsillitis	6	4,7	J21.9- Bronchiolitis	2	5,7	I25.9- Ischemic Heart Disease	1	33,3	X99.99- Assault-sharp object	1	5,6
3 N39.0- UTI	9	3.9	I82.9- DVT	2	4,3	N39.0- UTI	6	4,7	M54.5- Back pain	2	5,7	R10.4- Abdominal pain	1	33,3	I51.7- Cardiomegaly	1	5,6
4 S72.9- Femur Fracture	8	3.5	M19.99- Osteoarthritis	2	4,3	L03.9- Cellulitis	5	3,9	S72.9- Femur Fracture	2	5,7				K56.6- Bowel Obstruction	1	5,6
5 J03.9- Tonsillitis	8	3.5	L03.9- Cellulitis	2	4,3	L02.9- Abcess	5	3,9	R52.9- Pain	2	5,7				S99.9- Foot/Ankle Injury	1	5,6
L03.9- Cellulitis	8	3.5	R07.4- Chest Pain	2	4,3	S72.9- Femur Fracture	5	3,9	A15.9- PTB	2	5,7				A41.9- Severe sepsis	1	5,6
			R56.01- Post traumatic epilepsy	2	4,3				I27.9- Cor pulmonale	1	2,9				S52.9- Forearm fracture	1	5,6
			N39.0- UTI	2	4,3				J45.9- Asthma	1	2,9				L02.9- Abcess	1	5,6
			Z00.8- Well patient	2	4,3												
4. Oedema/Swelling	**106**	**46,5**		**17**	**33,3**		**61**	**52,1**		**17**	**58,6**		**4**	**100**		**5**	**18,5**
1 L02.9- Abcess	42	18,4	L02.9- Abcess	7	13,7	L02.9- Abcess	30	25,6	I50.9- Cardiac failure	9	31,0	I21.3- STEMI	1	25.0	S92.90- Foot fracture	1	3,7
2 I50.9- Cardiac failure	23	10,1	None	3	5,9	L03.9- Cellulitis	13	11,1	I27.9- Cor Pulmonale	4	13,8	I50.9- Cardiac failure	1	25.1	S72.9- Femur Fracture	1	3,7
3 L03.9- Cellulitis	17	7,5	L04.0- Lymphadenitis	3	5,9	I50.9- Cardiac failure	9	7,7	L02.9- Abcess	2	6,9	L03.9- Cellulitis	1	25.2	S69.9- Hand/wrist injury	1	3,7
4 I82.9- DVT	10	4,4	T78.4- Allergy	2	3,9	S82.9- Lower leg injury	5	4,3	K40.3- Inguinal hernia	1	3,4	L72.3- Sebaceous cyst	1	25.3	R60.9- Oedema	1	3,7
5 R22.9- Lump	7	3,1	I82.9- DVT	2	3,9	R22.9- Lump	4	3,4	I21.4- NSTEMI	1	3,4				R22.9- Lump	1	3,7
N50.8- Testicular pain/swelling	7	3,1															
5. Shortness of Breath	**122**	**56,7**		**7**	**100**		**22**	**53,7**		**83**	**61,5**		**18**	**85,7**		**8**	**72,7**
1 J18.9- Pneumonia	31	14,4	J45.9- Asthma	2	28,6	I50.9- Cardiac failure	8	19,5	J18.9- Pneumonia	23	17,0	J44.9- COPD	6	28,6	J44.9- COPD	3	27,3
2 J44.9- COPD	29	13,5	I27.9- Cor Pulmonale	1	14,3	J06.9- URTI	4	9,8	I50.9- Cardiac failure	19	14,1	J81.X- Pulmonary Oedema	4	19,0	J21.9- Bronchiolitis	2	18,2
3 I50.9- Cardiac failure	29	13,5	J18.9- Pneumonia	1	14,3	J45.9- Asthma	4	9,8	J44.9- COPD	17	12,6	J18.9- Pneumonia	4	19,0	I42.9- Cardiomyopathy	1	9,1
4 J44.9- COPD	18	8,4	G40.9- Epilepsy	1	14,3	J90.X- Pleural Effusion	3	7,3	A15.9- PTB	15	11,1	J45.9- Asthma	2	9,5	J18.9- Pneumonia	1	9,1
5 J45.9- Asthma	15	7,0	R21.X- Rash	1	14,3	J21.9- Bronchiolitis	3	7,3	J21.9- Bronchiolitis	9	6,7	I50.9- Cardiac failure	2	9,5	I20.9- Unstable angina	1	9,1
			J44.9- COPD	1	14,3												
6. Chest Pain	**96**	**50,0**		**6**	**54,5**		**10**	**47,6**		**55**	**40**		**7**	**70**		**9**	**81,8**
1 I20.9- Unstable angina	23	12,0	J18.9- Pneumonia	2	18,2	I50.9- Cardiac failure	3	14,3	I20.9- Unstable angina	18	12,9	J18.9- Pneumonia	2	20,0	J44.9- COPD	4	36,4
2 I25.9- Ischemic Heart Disease	19	9,9	I25.9- Ischemic Heart Disease	1	9,1	A15.9- PTB	2	9,5	I25.9- Ischemic Heart Disease	15	10,8	I25.9- Ischemic Heart Disease	2	20,0	R07.4- Chest Pain	2	18,2
3 J18.9- Pneumonia	15	7,8	I21.4- NSTEMI	1	9,1	J21.9- Bronchiolitis	2	9,5	J18.9- Pneumonia	9	6,5	I21.4- NSTEMI	1	10,0	R52.9- Pain	1	9,1
4 I21.4- NSTEMI	10	5,2	A15.9- PTB	1	9,1	J18.9- Pneumonia	2	9,5	I21.4- NSTEMI	7	5,0	A09.9- Infective GE	1	10,0	I25.9- Ischemic Heart Disease	1	9,1
5 I50.9- Cardiac failure	8	4,2	None	1	9,1	I25.9- Ischemic Heart Disease	1	4,8	J44.9- COPD	6	4,3	I20.9- Unstable angina	1	10,0	I21.4- NSTEMI	1	9,1
R07.4- Chest Pain	7	3,6															
J44.9- COPD	7	3,6															
A15.9- PTB	7	3,6															
7. Vomiting	**75**	**49,7**		**18**	**60,0**		**37**	**55,2**		**23**	**61,0**		**6**	**100**		**7**	**70,0**
1 A09.9- Infective GE	29	19,2	K29.9- Gastritis/Duodenitis	9	30,0	A09.9- Infective GE	12	17,9	A09.9- Infective GE	10	26,3	E16.2- Hypoglycemia	1	16,7	A09.9- Infective GE	2	20,0
2 K29.9- Gastritis/Duodenitis	27	17,9	A09.9- Infective GE	4	13,3	K29.9- Gastritis/Duodenitis	12	17,9	E10.1- DKA	5	13,2	A09.9- Infective GE	1	16,7	K59.0- Constipation	2	20,0
3 J03.9- Tonsillitis	7	4,6	None given	2	6,7	J03.9- Tonsillitis	5	7,5	K29.9- Gastritis/Duodenitis	4	10,5	A41.9- Severe sepsis	1	16,7	K29.9- Gastritis/Duodenitis	1	10,0
4 E10.1- DKA	6	4,0	J93.9- Spontaneous Pneumothorax	1	3,3	A15.9- PTB	4	6,0	K92.2- Melena	2	5,3	K29.9- Gastritis/Duodenitis	1	16,7	R57.9- Shock unspecifed	1	10,0
5 J06.9- URTI	6	4,0	T63.9- Animal Bite	1	3,3	R11.X- Nausea+ Vomiting	4	6,0	A41.9- Severe sepsis	2	5,3	K92.1- Haemetemsis	1	16,7	E10.1- DKA	1	10,0
			R11.X- Nausea+ Vomiting	1	3,3							J18.9- Pneumonia	1	16,7			
8. Strange Behaviour	**115**	**86,5**		**22**	**88,0**		**22**	**84,6**		**58**	**85,3**					**14**	**100**
1 F29.X- Psychosis	73	54.9	F29.X- Psychosis	12	48,0	F29.X- Psychosis	14	53,8	F29.X- Psychosis	38	28,6				F29.X- Psychosis	9	64,3
2 F20.9- Schizophrenia	17	12.8	F20.9- Schizophrenia	3	12,0	F20.9- Schizophrenia	3	11,5	F20.9- Schizophrenia	9	6,8				F20.9- Schizophrenia	2	14,3
3 F31.9- Bipolar Disorder	10	7.5	F31.9- Bipolar Disorder	3	12,0	F19.9- Substance intoxication	2	7,7	F31.9- Bipolar Disorder	5	3,8				J18.9- Pneumonia	1	7,1
4 F30.9- Manic episode	4	3.0	R41.8- Confusion/delirium	2	8,0	F31.9- Bipolar Disorder	2	7,7	A19.9- Miliary TB	2	1,5				G40.9- Epilepsy	1	7,1
5 R41.8- Confusion/delirium	4	3.0	A52.1- Neurosyphilis	1	4,0	A17.0 TB meningitis	1	3,8	F30.9- Manic episode	2	1,5				F30.9- Manic episode	1	7,1
F19.9- Substance intoxication	4	3.0	G03.9- Meningits	1	4,0				J18.9- Pneumonia	2	1,5						
J18.9- Pneumonia	3	2.3															
9. Seizures/ Fits/ Convulsions	**109**	**84,5**		**8**	**100**		**21**	**87,5**		**61**	**84,7**		**15**	**100**		**10**	**100**
1 G40.9- Epilepsy	69	53,5	R56.8- Convulsions	6	75,0	G40.9- Epilepsy	12	50,0	F30.9- Manic episode	41	56,9	G40.9- Epilepsy	5	33,3	G40.9- Epilepsy	5	50,0
2 R56.8- Convulsions	18	14,0	Z00.8- Well patient	1	12,5	R56.8- Convulsions	4	16,7	R56.8- Convulsions	9	12,5	R56.8- Convulsions	3	20,0	R56.8- Convulsions	2	20,0
3 J06.9- URTI	8	6,2	N39.0- UTI	1	12,5	J06.9- URTI	2	8,3	I64.X- CVA	4	5,6	G41.9- Status Epilepticus	2	13,3	J06.9- URTI	1	10,0
4 I64.X- CVA	5	3,9				G45.9- TIA	2	8,3	J06.9- URTI	3	4,2	J06.9- URTI	2	13,3	R50.9- Fever	1	10,0
5 G41.9- Status Epilepticus	3	2,3				G03.9- Meningits	1	4,2	J18.9- Pneumonia	2	2,8	T65.4- Poisoning	1	6,7	J18.9- Pneumonia	1	10,0
G03.9- Meningits	3	2,3							G03.9- Meningits	2	2,8	A41.9- Severe sepsis	1	6,7			
J18.9- Pneumonia	3	2,3										I60.9- SAH	1	6,7			
10. Generalised Body Weakness	**28**	**28,6**		**5**	**45,5**		**15**	**37,5**		**14**	**47,0**		**9**	**100**		**6**	**75,0**
1 A15.9- PTB	8	8,2	F41.9- Anxiety disorder	1	9,1	A15.9- PTB	4	10,0	D64.9- Anaemia	4	13,3	I64.X- CVA	2	22,2	F33.9- Major Depressive DO	2	25,0
2 I64.X- CVA	4	4.1	R51.X- Headache	1	9,1	I64.X- CVA	4	10,0	A15.9- PTB	4	13,3	A41.9- Severe sepsis	2	22,2	F29.X- Psychosis	1	12,5
3 D64.9- Anaemia	4	4.1	E13.X- Diabetes Mellitus	1	9,1	T50.9- Poisoning	3	7,5	I64.X- CVA	2	6,7	J18.9- Pneumonia	2	22,2	A15.9- PTB	1	12,5
4 J18.9- Pneumonia	3	3.1	M54.5- Back pain	1	9,1	R26.8- Gait disturbance	2	5,0	N18.9- CKD	2	6,7	A18.3- TB Abdo	1	11,1	E13.X- Diabetes Mellitus	1	12,5
5 E13.X	3	3.1	I31.3- Percardial Effusion	1	9,1	S00.9- Superfical Head Injury	2	5,0	J18.9- Pneumonia	2	6,7	A15.9- PTB	1	11,1	G45.9- TIA	1	12,5
T50.9- Poisoning	3	3.1										B24.X	1	11,1			
B24.X- HIV	3	3.1															

Figure 3 shows the variation in the case load and proportional number of triage acuities presenting during each hour of the day. Time of presentation was recorded in 3406 of 3434 encounters (99,2%). The increasing trend in numbers is shown from the typical start of a day shift at 7h00. In addition, Figure 3 tables the case load and proportional triage acuities for each day of the week.



	Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		All	
Triage Acuity	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
All	285	8.3	559	16,3	560	16.3	465	13.5	523	15.2	526	15.3	516	15.0	3434	100.0
Green	26	5.5	90	18,9	154	16.9	78	16.4	61	12.8	76	16.0	64	13.5	475	13.8
Yellow	112	8.0	214	15,2	157	15.5	188	13.3	246	17.5	218	15.5	213	15.1	1409	41.0
Orange	101	9.1	189	16,9	153	16.8	140	12.5	152	13.6	166	14.9	180	16.1	1116	3.5
Red	21	14.2	29	19,6	10	12.2	23	15.5	17	11.5	23	15.5	17	11.5	148	4.3
Not Specified	25	8.4	37	12,9	46	19.6	36	12.6	47	16.4	43	15.0	42	14.7	286	8.3

Figure 3. Proportional SATS priority allocation by time and day of presentation, and day of the week

Discussion

The emergency centre at Mitchells Plain hospital is a high acuity environment. In accordance with the South African Triage Scale (SATS) eighty percent of the patients who presented to this unit were prioritised for intervention within 1hour (yellow); half of those cases were high priority time dependent conditions which required immediate (red) intervention, or attention within 10 minutes (orange). The ten most common presenting complaints represented more than half of the caseload, there was some distinction between high and low acuity presentations and diagnoses amongst these.

The most frequent presenting complaint overall was trauma. Half of unspecified trauma patients were triaged into the yellow(urgent) category, a further quarter were high acuity cases (red/orange). Penetrating chest injuries and superficial head injuries were the most common diagnoses in trauma patients, across all priority categories. Abdominal pain, unspecified pain and oedema followed trauma presentations in frequency. Complaints of abdominal pain were most often yellow/orange in priority. Appendicitis was a common cause of abdominal pain in all triage categories, while gastritis or constipation were diagnosed in low priority cases, and ectopic pregnancy, puerperal sepsis or meningitis only diagnosed in emergency cases. The majority of unspecified pain or oedema presentations were green (non-urgent)/yellow cases. and Pain was caused by non-specific or musculoskeletal conditions in non-urgent cases whereas renal colic, ischemic heart disease or PTB occurred only in the higher acuity categories. Similarly swelling was due to soft tissue conditions (abscess/cellulitis/deep vein thrombosis) in green cases, while cardiac failure was included in the differential at higher priorities. High frequency, high acuity, presentations were due to shortness of breath, seizures due to uncontrolled epilepsy, trauma and chest pain. Shortness of breath was the most common emergency presentation, frequently was caused by cardiac failure or respiratory diseases, including pneumonia, asthma and Chronic Obstructive Pulmonary Disease (COPD). Chest pain was the most frequent presenting symptom in the very urgent (orange) acuity- the majority of which was due to ischemic heart disease. Interestingly, cases of ischemic heart disease may have been diagnosed frequently but did not feature amongst the overall most common diagnoses in the EC population. Infective pathologies such as pneumonia, gastroenteritis and pulmonary tuberculosis (PTB), or medical conditions such epilepsy were more prevalent when all acuities were combined. This observation may relate to the fact that ischemic heart disease is should be characterised specifically as unstable angina, Non-ST segment Elevation Myocardial Infarction (NSTEMI) or ST Segment Elevation Myocardial Infarct(STEMI) in acute cases, whereas pneumonia covers

a broad spectrum of undifferentiated aetiologies. It is also important to note that HIV, which is the top cause of mortality across the country, did not feature prominently in presenting complaints or diagnoses- this is likely due to HIV being listed as a comorbidity and HIV-related diagnoses being reported with systemic symptoms such as shortness of breath related due pneumonia or PTB for example(7). Presenting complaints with lower frequencies but higher proportions of patients requiring very urgent or emergency intervention- such as hypoglycaemia, post-ictal state, allergic reactions, dehydration or features of visceral bleeding such as haemoptysis or melena stools- were also highlighted in this study, it may be interesting to explore the specific diagnoses in uncommon conditions which require high resource interventions.

Presenting complaints add a specific level of detail to generic acuity categories, and once described may anticipate diagnoses consistent with the context. The range of clinical descriptors used by staff to describe patients' presenting complaints is broad. Undifferentiated terms such as pain may be used for certain presentations but specific descriptions of abdominal pain, chest pain and headache, for example, are also used frequently and correlated closely with the relevant anatomical diagnoses. The presenting complaint noted at triage and the primary problem identified by the consulting doctor agreed in nearly three-quarters of cases resulting in a strong correlation coefficient. This is important in an overburdened EC as presenting complaints can determine the patients priority and under-triage places patients at risk of deterioration while waiting to be seen. High agreement suggests that staff are familiar with the patient population and diagnostic differential, and the description of complaints are acceptably accurate and precise, and this is consistent across multiple shift changes and combinations of nursing staff and doctors. The resulting diagnostic spectrum in this sample population reflected this varied burden of disease in the public health care system. Infections and communicable diseases associated with low socioeconomic status (pneumonia, gastroenteritis, PTB) and injury-related diagnoses (head injuries and pneumo/heamothoraces) were prevalent across all acuity categories. Cardiac failure, ischemic heart disease, and COPD were most frequently diagnosed in very urgent and emergency triage categories, these conditions related to the medical complications of chronic, lifestyle diseases such as diabetes, hypertension, smoking and obesity, placed a further burden on emergency care. Poorly controlled chronic conditions such as epilepsy and psychiatric disease presented as uncontrolled seizures and psychosis and increased the load of high acuity cases, this highlights a need for attention to lifestyle modification and compliance support in patients with chronic diseases who frequent the EC for complications.

In temporal analyses- Monday, Tuesdays and Fridays were the days of the week with the largest caseloads . Acute cases were seen in greater numbers on Mondays and Saturdays, followed Fridays, this is possibly due to a higher load of injuries around the weekend, and could be confirmed by exploring presenting symptoms by day of the week. Half the number of patients presented on Sundays as compared to the rest of the week, with the greatest reduction in numbers in the low acuity categories. The proportions of urgent and very urgent cases remained constant throughout each day, although absolute numbers were highest between 11h00 and 21h00, this would be when the most resources (human/facility) will be needed. A notable drop in the number of presentations at 07h00 is likely due to delays in time to triage as this is the usual time of staff shift changeover. Concrete descriptive data that so clearly defines the needs of the EC population are more valuable for planning the operation of unit than simply knowing that high numbers of acute cases can be expected. The range of human resources, facilities, equipment, investigations and time essential to manage each presentation differs from one condition to another. In order to calculate the clinical time required for the emergency centre management of each patient that arrives- the flow from triage to diagnosis/disposition should to be mapped out for frequent presenting complaints, time taken to perform individual tasks should be measured, and related to the frequency with which they have to occur. The burden of providing evidence for staffing models and advocating for the resources needed to improve patient care, rests in the clinical environment and begins with exploring these presenting problems.

This study had a number of limitations. The electronic record only captures 90% of patient encounters- causes for absent data include: paper-based records being used by the other administrative departments, clinicians using them for teaching/morbidity and mortality reports/adverse incidents, or simply being misplaced due to human error. Seasonal analysis of data were not possible as data from part of the winter month were not supplied when the records were initially released by the hospital records department, this was first discovered during the original SSM study after the time allocated for data collection was complete. Data collection period was limited to two months of the year and may have shown different trends and variations if longer collection periods with complete data were possible. In some instances scanned copies of handwritten notes on the Electronic Content Management system were illegible, missing pages or did not correspond to the correct patient. Encounters were audited systematically throughout the data collection process to ensure a robust collection, however, given the incomplete source folders and that every file was not rechecked, it is likely that some cases were incorrectly coded. Overlap and ambiguity between descriptions for presenting symptoms and diagnoses (eg: pain, abdominal pain,

headache) may have introduced inconsistences between data collectors despite briefing. Analysis of temporal patterns of individual presenting complaints was not performed and could add further value to determining resource requirements. Triage acuity was not recorded in a number of cases- this likely has an impact on patient safety, however it is representative of the real life situation in a busy EC. A single ICD 10 code on disposition from the EC was captured, in many cases the secondary code was either used by the clinician or the only code recorded by SSM students. Secondary ICD 10 codes relate to mechanism of injury or symptoms, these are not always accurate representation of the final diagnosis. Gynaecological conditions may be under-reported as they are redirected to the Women's health clinic during office hours. As the first study to describe presenting complaints and related diagnoses at Mitchells Plain hospital this study a provides data consistent with the national burden of disease in similar socioeconomic circumstances across the country- vital descriptions of presenting symptoms may be applied to these settings or may provide further information on the contrasting presentations of similar diagnoses in different regions if the study is repeated in other locations.

Conclusion

This study showed that Mitchell's Plain EC has complex caseload with a significant burden of trauma presentations related to interpersonal violence and penetrating assault. Respiratory and gastrointestinal symptoms, most often caused by infections were common in all triage categories, and cardiac or neuropsychiatric complications of chronic medical illnesses frequently presented with high priority. Presentations showed characteristic variations and differential diagnoses across acuities. Describing these presentations and their linked diagnoses will allow for further research into clinical flow pathways between arrival and disposition. Staffing requirements may be determined by linking these pathways to reality based time frames. This study serves as the first step in that process.

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Competing interests

There are no conflicts of interest to declare.

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None.

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PART C: ADDENDA

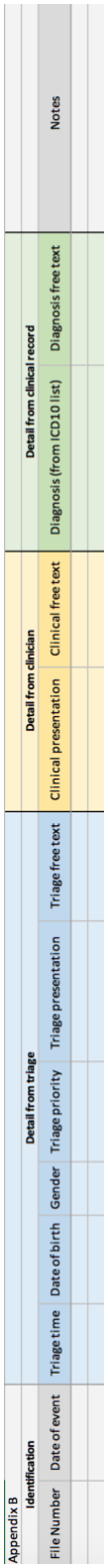
Instructions for authors

Instructions for authors can be found at the following url:

http://www.samj.org.za/index.php/samj/about/submissions#authorguidelines

A. Questionnaire/ data capture instrument

Appendix A from manuscript



Appendix B

Identification		Detail from triage						Detail from clinician		Detail from clinical record		
File Number	Date of event	Triage time	Date of birth	Gender	Triage priority	Triage presentation	Triage free text	Clinical presentation	Clinical free text	Diagnosis (from ICD10 list)	Diagnosis free text	Notes

B. Triage and clinical presentations list

Appendix B from manuscript

DISCRIMINATOR	DEFINTION/CONTEXT	DISCRIMINATOR	DEFINTION/CONTEXT
ABDOMINAL PAIN	Any pain below the costal margin/substernal area down to the pelvis	FRACTURE- OPEN/COMPOUND	Broken bone with overlying break in the skin ((specify site or multiple if >3)
ABNORMAL PULSE	Any subjective or objective conditions relating to pulse, not covered by palpitations	GENERALISED BODY WEAKNESS	Usually multiple complaints associated with an inability to perform usual tasks
AIRWAY OBSTRUCTION	An airway that cannot be kept open (obstruction/injury/swelling etc)	GUNSHOT WOUNDS	Specify site or multiple if >3
ALCOHOL INTOXICATION	Symptoms directly related to the recent consumption of alcohol	HEAD INJURY	Traumatic event involving the head
ALLERGIC REACTION	Used for any symptoms (itch/rash/wheeze etc) related to a known or unknown allergy	HEADACHE	Pain around the head not related to a particular anatomical structure
ALTERED LEVEL OF CONSCIOUSNESS	Not fully alert. Responding to voice/pain or unresponsive	HEAMATURIA	Blood in the urine
ALTERED SENSATION	Change in the sensory perception (usually related to skin)	HEAMORRHAGE- CONTROLLED	Bleeding wounds, usually controlled by pressure dressing
ANAEMIA/PALLOR	Pt with low HB, often requiring transfusion	HEAMORRHAGE- UNCONTROLLED	Active arterial bleeding not related to bleeding disorder
ANGIODEMA (tongue swelling)	Sudden onset swelling of the soft tissues of the tongue/oropharynx/lips/ lower face	HIGH BLOOD PRESSURE	History of or raised blood pressure on examination
ASTHMA	Known Asthmatic with respiratory symptoms	HOT JOINT/SEPTIC ARTHRITIS	Any warmth around a joint
BLACK STOOL/MALENA	Change in stool colour to a dark colour usually with offensive smell	HYPERGLYCEMIA	Glucose greater than 7mmol/l when fasted or random glucose > 11.1mmol/l
BLEEDING DISORDER	Congenital or Acquired Bleeding problem, not related to trauma	HYPOGLYCEMIA	Glucose less than 3.0mmol/l
BURN- CIRCUMFERENTIAL	Burns extending around a tissue compartment	HYPOTHERMIA	Exposure to cold with Core Temperature less than 35deg resulted in clinical condition
BURNS- >20%	Used if face/inhalational burn not specified but more than 20% BSA involved	INCONSOLABLE CRYING	Unable to soothe and comfort child - continuous crying
BURNS- ELECTRICAL	Burn caused by electric current or natural sources	JAUNDICE	Yellow discolouration of the skin/ sclera/
BURNS- FACIAL	Any burn to the face	LOSS OF VISION	Unable to see in one or both eyes and has not returned to normal
BURNS- OTHER	Burns not covered by facial/inhalational/electrical(specific site and %if noted)	MALNUTRITION	usually in children
BURNS-INHALATIONAL	History of being confined in a smoked filled space with or without evidence of carbon deposits around nose/mouth	MENINGITIS	Usually? Meningitis used for combinations of headache/fever/vomiting
CARDIAC ARREST	Requiring CPR, no pulse	MOTOR VEHICLE ACCIDENT	Pt involved in MVA details of injuries not given
CELLULITIS	Infection of the skin (specify site)	NEONATE/TINY BABY	Infant less than 2months if other conditions not specified
CHEST PAIN	Any pain between the clavicles and costal margin	OEDEMA/SWELLING (specify free text)	Swelling of an area of the body (specify)
COUGH/PRODUCTIVE COUGH	Cough with or without sputum	OVERDOSE/POISONING	Ingestion of poisons or medication overdose
COUGHING BLOOD/ HEAMOPTYSIS	Frank Blood- or blood-stained sputum	PAIN (specify free text)	If not covered elsewhere (specify site)
CVA/STROKE	Usually ?CVA used for new neurological weakness/change in speech/cognition	PALPITATIONS	Awareness of abnormally fast heart beat
DEHYDRATION	Evidence of dehydration(lethargy/sunken/decreased skin turgor eyes etc) of any cause	POOR/NOT FEEDING	Usually children refusing solids/liquids by mouth
DIARRHOEA	Passing loose stools frequently	POST SURGICAL COMPLICATIONS	Pt returning with complaint related to recent surgery
DISCHARGE (genitals)	Any abnormal secretions from penis/ vagina- usually related to STI	POST-ICTAL	State of decreased LOC or delirium occurring immediate after a generalised seizure
DISLOCATION- LARGE JOINT	Dislocated Knee/Hip/Shoulder/Ankle/Elbow	PREGANCY- ABDO PAIN	All abdominal pain in pregnant patients
DISLOCATION- OTHER	Dislocation of other jts Fingers/Toes	PREGNANCY- PV BLEEDING	All PV bleeding in pregnant patients
DIZZINESS	Used for a variety of sensations of instability/presyncope/nausea etc	PREGNANCY RELATED	May relate to initial diagnosis or symptoms of trauma (specify)
DVT (Deep vein thrombosis)	Blood clot, usually in the legs (specify if another site)	PREGNANCY- TRAUMA	Specify site/mechanism
DYSURIA	Pain or burning on passing urine	PV BLEEDING (not pregnant)	Loss of blood from the vagina in non-pregnant patients
EARACHE/OTITIS MEDIA	Pain/discharge/infection of the ear not related to trauma	RASH/DERMATITIS	Skin lesions not related to infection
EYE INJURY	Any substance/chemical splashed or entering the eye or trauma to the eye	RECTAL BLEEDING	Passing fresh blood per anus
FEVER	Subjective or objective report of elevated core temperature (>38.3)	RED EYE	Any redness of the eye, may or may not be painful, may be entire eye or part

FLOPPY	Generalised reduced muscle tone	RESPIRATORY DISTRESS	Often related to SOB/ Tachypnoea/Difficulty breathing, not airway related
FOREIGN BODY RETAINED	Foreign body lodged in an organ (eg: eye/nose)	SEIZURES/ FITS/ CONVULSIONS	Generalised or partial tonic-clonic episodes
FRACTURE- CLOSED	Broken bone with no break in skin (specify site or multiple if >3)	SEPSIS	Usually used for patient with signs of infection and tachycardia/hypotension/tachypnoea
FRACTURE- OPEN/COMPOUND	Broken bone with overlying break in the skin ((specify site or multiple if >3)	SHOCK	Inadequate tissue perfusion usually accompanied by skin changes/hypotension/decreased loc/
GENERALISED BODY WEAKNESS	Usually multiple complaints associated with an inability to perform usual tasks	PREGNANCY- PV BLEEDING	All PV bleeding in pregnant patients
GUNSHOT WOUNDS	Specify site or multiple if >3	PREGNANCY RELATED	May relate to initial diagnosis or symptoms of trauma (specify)
HEAD INJURY	Traumatic event involving the head	PREGNANCY- TRAUMA	Specify site/mechanism
HEADACHE	Pain around the head not related to a particular anatomical structure	PV BLEEDING (not pregnant)	Loss of blood from the vagina in non-pregnant patients
HEAMATURIA	Blood in the urine	RASH/DERMATITIS	Skin lesions not related to infection
HEAMORRHAGE- CONTROLLED	Bleeding wounds, usually controlled by pressure dressing	RECTAL BLEEDING	Passing fresh blood per anus
HEAMORRHAGE- UNCONTROLLED	Active arterial bleeding not related to bleeding disorder	RED EYE	Any redness of the eye, may or may not be painful, may be entire eye or part
HIGH BLOOD PRESSURE	History of or raised blood pressure on examination	RESPIRATORY DISTRESS	Often related to SOB/ Tachypnoea/Difficulty breathing, not airway related
HOT JOINT/SEPTIC ARTHRITIS	Any warmth around a joint	SEIZURES/ FITS/ CONVULSIONS	Generalised or partial tonic-clonic episodes
HYPERGLYCEMIA	Glucose greater than 7mmol/l when fasted or random glucose > 11.1mmol/l	SEPSIS	Usually used for patient with signs of infection and tachycardia/ hypotension/tachypnoea
HYPOGLYCEMIA	Glucose less than 3.0mmol/l	SHOCK	Inadequate tissue perfusion usually accompanied by skin changes/hypotension/decreased loc
HYPOTHERMIA	Exposure to cold with Core Temperature less than 35deg resulted in clinical condition	SHORTNESS OF BREATH	Acute or chronic difficulty breathing or shortness of breath
INCONSOLABLE CRYING	Unable to soothe and comfort child - continuous crying	STAB WOUNDS (specify site free text)	Specify site or multiple if >3
JAUNDICE	Yellow discolouration of the skin/ sclera/	STRANGE BEHAVIOUR	Change in patients actions, responses or unusual reactions to circumstance. May include psychosis/ hearing voices/aggression/ and in some cases delirium
LOSS OF VISION	Unable to see in one or both eyes and has not returned to normal	STRIDOR	Sound associated with upper airway obstruction
MALNUTRITION	usually in children	SUICIDAL IDEATION	Thoughts of self-harm/taking one's life
MENINGITIS	Usually ?Meningitis used for combinations of headache/fever/vomiting	THREATENED LIMB (specify free text)	Neurovascular compromise of an extremity
MOTOR VEHICLE ACCIDENT	Pt involved in MVA details of injuries not given	TRAUMA	Injury that does not fit into another category, include traumatic pain (specify site)
NEONATE/TINY BABY	Infant less than 2months if other conditions not specified	UPPER GI BLEED	May relate to melena or haematemesis or both
OEDEMA/SWELLING (specify free text)	Swelling of an area of the body (specify)	URINARY RETENTION	Unable to empty bladder
OVERDOSE/POISONING	Ingestion of poisons or medication overdose	VOMITTING	Vomiting
PAIN (specify free text)	If not covered elsewhere (specify site)	VOMITTING BLOOD/HEAMETEMESIS	Blood or coffee ground vomitus
PALPITATIONS	Awareness of abnormally fast heart beat	WHEEZING	Musical sound when breathing, related to bronchospasm
POOR/NOT FEEDING	Usually children refusing solids/liquids by mouth	WOUND SEPSIS	Infected wounds
POST SURGICAL COMPLICATIONS	Pt returning with complaint related to recent surgery		
POST-ICTAL	State of decreased LOC or delirium occurring immediate after a generalised seizure		
PREGANCY- ABDO PAIN	All abdominal pain in pregnant patients		
PREGNANCY- PV BLEEDING	All PV bleeding in pregnant patients		
PREGNANCY RELATED	May relate to initial diagnosis or symptoms of trauma (specify)		
PREGNANCY- TRAUMA	Specify site/mechanism		
PV BLEEDING (not pregnant)	Loss of blood from the vagina in non-pregnant patients		
RASH/DERMATITIS	Skin lesions not related to infection		
RECTAL BLEEDING	Passing fresh blood per anus		
RED EYE	Any redness of the eye, may or may not be painful, may be entire eye or part		

C. ICD 10 code list

Appendix C from manuscript

PRESENTATIONS	
Well patient – Gen Exam	Z00.8
Cardiac Arrest	I46.9
Respiratory Arrest	R09.2
Shock	R57.9
Severe Sepsis	A41.9
Anaphylaxis	T78.2
Allergy	T78.4
Palpitations	R00.2
Cough	R05.X
Chest Pain	R07.4
SOB	R06.8
Haemoptysis	R04.2
Abdominal Pain	R10.4
Diarrhoea	K52.9
Nausea + Vomiting	R11.X
Heartburn	R12.X
Jaundice	R17.X
Ascites	R18.X
Haematemesis	K92.0
Melena	K92.1
Gait Disturbance	R26.8
Abnormal Movements	R25.8
Headache	R51.X
Reduced LOC	R40.2
Confusion/Delirium	R41.8
Dizziness	R42.X
(Pre)- Syncope	R55.X
Convulsions	R56.8
Rash	R21.X
Urinary Retention	N32.9
Dysuria	R30.9
Haematuria	R31.X
Back Pain	M54.5
Fever	R50.9
Pain	R52.9
Malaise	R53.X
Oedema	R60.9
Cachexia	R64.X
Emotional abn	R45.X
Hallucinations	R44.3
Social Problem	Z60.9
NEUROLOGY	
Vascular Dementia	F01.9
Alzheimers Dementia	G30.9
CNS Degenerat. 2° Alcohol	G31.2
Unspecified Dementia	F03.X
Intellectual Disability	F79.X
Meningitis	G03.9
Bacterial Meningitis	G00.9
Epilepsy	G40.9
Status Epilepticus	G41.9
TIA	G45.9
CVA (Infarct/Haem)	I64.X
Non Traumatic SAH	I60.9
CARDIOLOGY	
HTN	I10.X
Cardiomyopathy	I42.9
Cardiac Failure	I50.9
Cor Pulmonale	I27.9
Atherosclerosis	I70.9
STEMI	I21.3
NSTEMI	I21.4
UAP	I20.9
IHD	I25.9
Pericarditis - Acute	I30.9
Pericarditis – Chronic	I31.9
Pericardial Effusion	I31.3
AV Block	I44.3
LBBB	I44.7
AF & A Flutter	I48.9
SVT	I47.1
VT	I47.2
VF	I49.0
Valve Disease	I08.9
Aortic Aneurysm – leak	I71.8
PVD	I73.9
DVT	I82.9
Pulmonary Embolism	I26.9
RESPIRATORY	
URTI	J06.9
Croup	J05.X
Pneumonia	J18.9
Bronchitis	J20.9
Bronchiolitis	J21.9
COPD	J44.9

Asthma	J45.9
ARDS	J80.X
Pulmonary Oedema	J81.X
Pleural Effusion	J90.X
Spont. Pneumothorax	J93.9
Respiratory Failure	J96.90
GIT	
GERD	K21.0
Gastritis/Duodenitis	K29.9
PUD	K27.9
PUD with haemorrhage	K27.0
PUD with Perforation	K27.1
Appendicitis	K38.9
Ileus	K56.7
Bowel Obstruction	K56.6
Constipation	K59.0
Haemorrhoids	K64.9
Peritonitis	K65.9
Alcoholic Liver Disease	K70.9
Hepatic Failure	K72.9
Cirrhosis	K74.6
Cholelithiasis	K80.5
Cholecystitis	K80.4
Pancreatitis	K85.9
Chronic Pancreatitis	K86.9
METABOLIC	
Anaemia, Fe deficiency	D50.9
Anaemia	D64.9
DM	E13.X
DKA	E10.1
HHS	E11.0
Hypoglycaemia	E16.2
RENAL	
Nephritic Syndrome	N05.9
Nephrotic Syndrome	N04.9
Hydronephrosis	N13.3
Acute Renal Failure	N17.9
Chronic Renal Failure	N18.9
UTI	N39.0
Pyelonephritis	N10.X
Renal Calculi	N20.9
RHEUMATOLOGY	
Septic Arthritis	M00.99
Reactive Arthropathy	M02.99
Rheumatoid Arthritis	M05.99
Osteoarthritis	M19.99
Arthritis	M13.99
Gout	M10.99
Connective Tissue Disease	M35.9
Pain in limb	M79.60
URO-GENITAL	
Urethral Stricture	N35.9
BPH	N40.X
Epididymo-Orchitis	N45.9
Torsion of Testis	N44.X
Testicular Pain/Swelling	N50.8
STD	A64.X
Bartholin's Abscess	N75.9
PID	N73.9
Ovarian Cysts	N83.2
Amenorrhea	N91.2
Dysfx Uterine Bleeding	N92.5
Vaginal Bleed	N93.9
SOFT TISSUE	
Abscess	L02.9
Cellulitis	L03.9
Dermatitis	L30.9
Lump	R22.9
Pressure Ulcer	L89.90
Ulcer Lower Limb	L97.X
Gangrene	R02.X
Breast Infection - lactating	O91.1
INFECTIOUS DISEASES	
Infective gastroenteritis	A09.9
Pulmonary TB	A15.9
TB Pleura	A15.6
TB Meningitis	A17.0
Tuberculoma	A17.8
TB Spine	A18.0
TB Peripheral LN	A18.2
TB Abdo	A18.3
TB Heart (pericarditis)	A18.8
Millary TB	A19.9
Meningococcal Meningitis	A39.0
Meningococ Sepsis	A39.4
Sepsis -procedure: SAureus	A41.0

Gas gangrene	A48.0
Symptomatic neurosyphilis	A52.1
Asymptom neurosyphilis	A52.2
Unspecified STI	A64.X
Viral meiningitis	A87.9
Herpes Zoster	B02.9
Occular H Zoster	B02.3
Measles	B05.9
Acute Hepatitis A	B15.9
Acute Hepatitis B	B16.9
Chronic viral hepatits	B18.9
HIV	B24.X
Viraemia	B34.9
Cerebral Cryptococcosis	B45.1
P. falciparum Malaria	B50.9
Unspecified Malaria	B54.X
Toxoplasma encephalitis	B58.2
Pneumocystosis (PJP)	B59.X
PSYCHIATRIC	
Overdose	T50.9
Substance Intoxication	F19.9
Alcohol Abuse	F10.1
Suicidal/homicidal	R45.8
Psychosis	F29.X
Schizophrenia	F20.9
Manic Episode	F30.9
Bipolar Disorder	F31.9
Major Depressive Disorder	F33.9
EYE	
Conjunctivitis	H10.9
Unspecified Eye Pathology	H57.9
Visual Disturbance	H53.9
Eye Pain	H57.1
Eye Foreign Body	T15.9
Eye Trauma	S05.9
ENT	
Otitis Externa	H60.9
Otitis Media	H66.9
Vestibular dysfunction	H81.9
Hearing Loss	H91.9
Foreign Body Ear	T16.X
Epistaxis	R04.9
Foreign Body Nose	T17.1
Pharyngitis	J02.9
Tonsillitis	J03.9
Dental Abscess	K04.9
OBSTETRICS/NEONATES	
Ectopic	O00.9
ICA	O03.3
Threatened Abortion	O20.0
Hyperemesis Gravidarum	O21.9
Pre-eclampsia	O14.9
Eclampsia	O15.9
PROM	O42.9
PTL	O.60.0
PTL with Delivery	O60.1
Abruptio Placentae	O45.9
APH	O46.9
PPH	O72.1
Foetal Distress	O68.9
Preterm Newborn	P07.3
Resp Distress of Newborn	P22.0
Meconium Aspiration	P24.0
NEOPLASMS	
Oesophageal Cancer	C15.9
Stomach Cancer	C16.9
Colon Cancer	C18.9
Liver Cancer	C22.9
Pancreas Cancer	C25.9
Lung Cancer	C34.9
Karposi sarcoma	C46.9
Breast Cancer	C50.9
Cervix Caner	C53.9
Uterine Cancer	C55.X
Ovarian Cancer	C56.X
Prostate Cancer	C61.X
Metastatic Disease	C79.9
TRAUMA	
Head - Superficial Injury	S00.9
Head – Penetrating Injury	S01.9
Facial / Skull #	S02.92
Intracranial Injury	S06.90
Neck – Penetrating Injury	S11.9
C-Spine #	S12.90
Cervical Spinal Cord Injury	S14.6
Neck Blood Vessel Injury	S15.9

Neck Injury	S19.9
Thorax - Superficial Injury	S20.8
Thorax - Penetrating Injury	S21.9
Thorax – Blunt Injury	S28.0
Thorax – Fracture	S22.90
Haemopericardium	S26.01
Pneumohaemothorax	S27.11
Abdo – Superficial Injury	S30.9
Abdo Trauma: Penetrating	S31.8
Abdo Trauma: Blunt	S39.9
Abdo Organ Injury - Pene	S36.90
Abdo Organ Injury - Blunt	S36.91
Lumbar #	S32.00
Pelvic #	S32.X
Femur #	S72.9-
Dislocation Hip	S73.X
Hip Injury	S79.9
Lower Leg #	S82.9-
Dislocation Knee	S83.1
Lower Leg injury	S89.9
Ankle #	S82.9-
Dislocation Ankle	S93.0
Sprain Ankle	S93.4
Foot #	S92.9-
Foot or Ankle Injury	S99.9
Humerus/Shoulder #	S42.9-
Dislocation Shoulder	S43.0
Shoulder / Arm Injury	S49.9
Forearm #	S52.9-
Forearm / Elbow Injury	S59.9
Wrist or Hand #	S62.X
Hand/ wrist Injury	S69.9
Multiple Injuries	T07.X
Injury Unspecified	T14.8
Burn	T30.X
Chemical Burn	T30.4
Poisoning: Medication	T50.9
Poisoning: OrganoPO4	T60.0
Animal Bite/Sting	T63.9
Poisoning: Substances	T65.9
Heatstroke	T67.9
Hypothermia	T68
Asphyxiation	T71.X
Neglect	T74.0
Physical Abuse	T74.1
Sexual Abuse / Assault	T74.2
Psychological Abuse	T74.3
Pedestrian Accident	V09.X
Cyclist Accident	V19.X
Motorcyclist Accident	V29.X
MVA Driver	V49.49
MVA Passenger	V49.59
Fall – same level	W01.11
Fall – Stairs	W10.99
Fall – 1 level to another	W17.99
Fall	W19
Hit by object (accidental)	W20.88
Cut – Glass	W25.X
Cut – Blade	W26.X
Machinery Accident	W31.99
Explosion	W40.99
Needlestick Injury	W46.X
Drowning	W74.X
Electrocution	W86.X
Fire – Building	X00.88
Hot fluid Burns	X12.X
Contact Burns	X19.X
Self-harm - Hanging	X70.X
Self-harm – gun	X74.99
Self-harm – sharp object	X78.99
Assault – Gun	X95.99
Assault – Sharp Object	X99.99
Assault – Fire / smoke	X97.X
Assault – Blunt Object	Y00.99
Assault – Bodily Force	Y04.99
Intentional Self-harm	Y87.0
Accident	Y86.X
Open # last digit =1	
Closed # last digit = 0	

Acknowledgements

To my supervisor Prof Stevan Bruijns- it's a privilege to be able thank you twice. I finally believe you when you say, 'it's almost done-' but I certainly could not have done it without you. It has been an honour to learn from you, thank you for your patience and compassion. A word of appreciation to Dr Tyson Welzel and Dr Peter Hodkinson for your help with the administration that made this possible.

Thank you to my family and friends for your faith and support, and to Nicholas Elston for your spreadsheet magic. A special thank you to my mother- your belief in education, healthcare and making the impossible possible is the heart of this.

Research Protocol

Describing the most common presenting complaints, their priority and corresponding diagnoses at Mitchells Plain Emergency Centre

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* Principal investigator and supervisor

Introduction/ Background

South African Emergency Centres form the interface between the Healthcare system and the population it serves. A complex and growing burden of disease in this context places a high demand on emergency medical services. Emergency centres have to be equipped to provide high-quality care to a number of undifferentiated patients with varying acuity of illness.

The South African Triage System is a validated tool that enables rapid prioritisation of emergencies and the severely ill in both adult and paediatric cases[1]. The patients presenting complaint is an independent variable in emergency centre triage, it is regarded as at least as important as the eventual diagnosis. Being that the presenting symptom determines the initial triage prioritisation it, therefore, determines resource allocation. The final diagnosis is typically only made once outcomes of the allocated resources have been negotiated further down the patient journey. In fact, many common presentations may lead to different, but important diagnoses (eg: a 'Shortness of Breath' triage presentation may eventually turn out as Asthma, Pneumonia, Tuberculosis, Heart failure, Influenza, or Hyperventilation and so on).

It remains the presentation that determines the initial priority, and as such should be considered the starting point in emergency centre care. Yet fairly little is known about exactly what presentations are seen in local emergency centres. Studies concentrating on presentations have not been done within the local context since the original and subsequent follow-up studies of the South African Triage Scale (SATS)[1,2]. These studies considered the presenting complaints that were underrepresented in priority by the Triage Early Warning Scores and therefore do not reflect all possible presentations, or give a reliable representation of the incidence of each.

Collecting data from patient triage charts will allow assessment of complaints which present commonly; their relative severity or priority and the diagnoses frequently associated with this presentation -as recorded by nurses and clinicians. This will allow us to determine the frequency of these symptoms, and give insight into how certain conditions present as emergencies.

Furthermore, understanding the specific presentations, timing and seasonal variations, and how these interact with priority and eventual diagnosis will guide future research by providing baseline information for the delineation of standard management pathways, and eventual time in motion models which may be used to calculate staffing requirements.

Mitchells Plain Hospital is a 270-bed district hospital which serves a population of 430000 people from the Mitchells Plain, Mandalay and Philippi communities. As a district hospital it offers emergency services, and basic surgical and obstetric services at a high turnover. Patients requiring prolonged inpatient or a specialist level of care are referred to Groote Schuur Hospital. Information obtained from this study may be used to guide resource allocation and help streamline the emergency care services relative to the most common presentations in this area.

This is one of two similar studies by the same investigators, following on a study done by UCT second year medical students as part of their Special Study Module this year. The second study will be conducted at Khayelitsha Hospital emergency centre. These emergency centres were recently opened and are similar in size (approximately 3000 patients per month), but see a different spectrum of acute illness and injury: with Khayelitsha leaning more towards injury and infectious disease and Mitchell's Plain trending more towards non-communicable disease.

Aim

The main aim of this study is to identify the most common presenting complaints and corresponding linked diagnoses, in total and for each category of the SATS, at Mitchells Plain Emergency Centre (EC)

Objectives

- To rank the presenting complaints at triage and describe the relationship of each with the proportional SATS priority allocation, as well as the eventual diagnoses
- To rank the presenting complaints at triage for each of the four categories of the SATS

- (Sub-objective) to describe and correlate the relationship between the presentation described at triage and at first clinician encounter
- (Sub-objective) to describe and correlate the relationship between the presentations seen in winter and summer
- (Sub-objective) to rank the diagnoses for each of the four categories of the SATS
- (Sub-objective) to describe the proportional SATS priority allocation for the various days of the week and time of day (weekday and weekend)

Methods

- *Study design:*

Retrospective, cross-sectional, chart review. This study is a follow-on study, on a Special Study Module project, which has previously been approved through the UCT HREC (358/2016; Appendix A). Dr's. Naidoo and Bruijns were supervisors on the Special Study Module project.

- *Characteristics of the study population:*

All patients (adults and children) who presented to Mitchells Plain EC in a convenience sample collected for the months of July 2015 and January 2016. The months selected for the original study were specifically chosen to accommodate for seasonal differences between summer and winter. Mitchells Plain EC sees approximately 2500 new patients each month. About 20% of the patients are children.

- *Recruitment, research procedures and data collection methods:*

The data was captured by four, second-year medical students who were collecting data for their Special Study Module project. The sample evaluated comprised of 4335 individual patient encounters. A list of all patients seen in the emergency centre for January and June 2015, with no exclusions, was obtained from hospital information management department. For the Special Study Module project, the sample was divided into four parts and each student collected the data for their part of the study. For this project, the data collected by the four students will be merged for further, in-depth analysis.

The process of data collection employed by the students:

A list of patients' folder numbers for the required study periods was obtained from the hospital records department. All patient charts (adults and children) for each time period were then manually reviewed via the Electronic Content Management System and the

presenting complaint at triage and as described by the first attending clinician, SATS priority, and final diagnosis were captured from the emergency centre triage and clerking notes.

The Electronic Management System captures approximately 90% of all EC records as scanned documents, which may be accessed via the intranet. A universal data collection spreadsheet was used to capture the data to ensure uniform collection (Table 1- summary and Appendix B- data collection sheet).

A predetermined presentation list was used to further ensure uniformity. This list was adapted from the Manchester Triage Scale list, the gold standard for emergency centre triage; it contains fifty presentations or discriminators, each of which initiates a triage decision algorithm. Presentations common to the local context (by consensus) were added. A free text field was provided where a presentation did not comply with any of those on the predetermined list. This was used for the triage and clinician presentation fields. Similarly, a predetermined diagnosis list was used to guide diagnosis input. The standard emergency centre ICD10 list (Appendix C) was used with a free text field provided where a diagnosis did not comply with any of those on the list.

Students flagged data areas where there was confusion as to what to input in the database. Areas where free text was used, missing fields or flagged fields were not included in their subsequent data analysis or study reports. Facility permission was obtained for the Special Study Module from the head of Mitchells Plain Hospital EC, Dr M Kalla, as well as the records department.

For this study, the four datasets will be merged and then cleaned. The students were able to analyse all patient encounters. In terms of cleaning, areas where the students made use of free text or highlighted missing fields (1386 patient encounters) will be cross-checked with the electronic chart for completion in order to improve the sample prior to data analysis. Cases where electronic records are illegible or incomplete, and cannot be resolved by consensus, will be reported as such and excluded. The quality of the sample will finally be cross-checked for accuracy and inconsistencies by scrutinising every 50th data set against the electronic record; if significant errors are found within an individual student's work, the entire set will be more closely scrutinised for errors.

Table 1: Variables included in data collection

1. File number [to allow duplication management]

2. Date and time of arrival [to allow duplication management]
3. Date of birth
4. Male/ female
5. Triage priority assigned
6. Triage presentation from predetermined list (See Appendix B)
7. Free text presentation field [for presentations not included in list]
8. Clinician presentation from predetermined list (See Appendix B)
9. Free text presentation field [for presentations not included in list]
10. Diagnosis from predetermined list (see Appendix C)
11. Free text diagnosis field [for diagnoses not included in list]

- *Data safety and monitoring:*

A Western Cape Government computer within Mitchells Plain Hospital EC, with a unique password, protected account was used for data capture and storage with permission from the head of the department, we will continue to use this station. Data transfer to external data drives (hard drives, smartphones, tablets and USB devices) was not and will not be allowed. Following the completion of the data merging, cleaning and collection, and after checking and removing duplicates and incomplete sets, file numbers will be removed and any hard copies containing patient identifiers will be destroyed. This will precede data analysis and will be performed by the study investigators.

- *Data analysis:*

Data will be analysed using Microsoft Excel and SPSS statistical package. Age will be expressed as mean, standard deviation and range. Frequencies and proportions will be provided for categorical data (gender, triage and clinician presentations, priority and diagnoses) and ranked from most to least prevalent for triage and clinician presentations, priority and diagnoses.

Triage presentation will be ranked (top 10) and each presentation will be described in terms of the proportional SATS priority allocation, as well as the top five eventual diagnoses. Frequencies and proportions will also be provided for triage presentations and diagnoses for

each category of the SATS. The proportional SATS priority allocation for the various days of the week will also be calculated.

Coding of triage and clinician presentations, priority and diagnoses will allow exploration of the assumptions presented in the study objectives using Chi^2 or Fisher's Exact test. It is likely that only the top ranked triage and clinician presentations, and diagnoses will be included in such a calculation as the inclusion of more categories will not be practical in terms of running the actual test. It will not be clear whether the latter will be necessary until the data has been collected, coded and reviewed.

Given the descriptive nature and lack of a power calculation in the study, the 95% confidence interval will be included to describe precision. With this proviso, and given the expected large sample size, p-values will be provided for statistical tests and a value less than 0.05 will be assumed to be statistically significant.

Ethical considerations

This study has in part received HREC approval for through application for the Special Study Module. This study will be used as the dissertation component for Dr Naidoo (MPhil student), who is also a co-investigator named on the Special Study Module's HREC application. Dr Naidoo provided coordination and oversight of the students in conjunction with the EC lead. Dr Naidoo will also provide input on datasets where the students either failed to provide a complete data set, flagged and data collection issue or used the free text option. The data analysis plan approved by HREC for the Special Study Module is much less complex than what is provided in this expanded proposal. The additional objectives appropriately reflect the difference between the undergraduate and postgraduate project.

- *Description of risks and benefits:*

As this study will not involve direct or indirect patient care, the risk to both adult and child patients are likely minimal. It is unlikely that the data required for this study can be collected without access to the file number. This does pose a risk, as loss of even this information would constitute a breach of confidentiality. It is for this reason that data will be collected on site. The data safety measures already include restricted use of any external storage devices. The study team feels that this risk is small and that the intended benefits of the study are likely to overshadow any of the potential risks.

- *Informed consent process:*

Data is retrospective and therefore obtaining individual consent would be impractical.

- *Privacy and confidentiality:*

As stated above data safety will be protected through on location data collection and removal of identifiers once duplicates and incomplete sets have been removed. This will commence prior to analyses starting.

Dissemination of findings plan

As per the undergraduate curriculum, a report of the findings was generated for the Special Study Module. As stakeholders, findings from this project will be provided to the hospital and EC management teams. It is also anticipated that findings will be presented at a national conference and publication will also be sought. A STROBE checklist will be used to structure the final report.

Finally, it is hoped that the findings from this project could be merged with that of the similar study conducted at Khayelitsha Hospital EC to create an even larger sample. The Khayelitsha project will also follow-on from another similar Special Study Module project, supervised by both Drs. Naidoo and Bruijns. Dr Naidoo will compile the findings of that project for her MMed master's dissertation.

Project timeline

EMDRC	Ethics	Data collection	Data analysis	Write up
1 month	1 month	3 weeks	2 month	2 months

Resources utilisation

Resources used will be mainly non-clinical. This will include the use of an existing Western Cape Government account and computers. As most patient information will be electronically available, Mitchells Plain hospital clerks will not be utilised to access hard copy folders. Resources required will thus include the use of a computer with an active Internet connection. Both are accessible through the EC offices at Mitchells Plain hospital where the data collection will take place. Facility permission will be sought through the National Health Research Database.

Budget

Item	**Budget**
Stationary: paper, pens, etc	R100
Printing	R100
Travel (UCT to Mitchell's Plain: 28km for 15 days @ R1.13/km- SARS rate)	R950.88
Total	**R1150.88**

All budgeted item costs will be recovered by the researchers.

References

1. Bruijns SR, Burch VC, Wallis LA. A prospective evaluation of the Cape triage score in the emergency department of an urban public hospital in South Africa. Emerg Med J. 2008;25:398-402
2. Twomey M, Cheema B, Buys H, et al. Vital signs for children at triage: a multicentre validation of the revised South African Triage Scale (SATS) for children. S Afr Med J. 2013 May;103(5):304-8

HREC approval letter

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E53-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6626
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Website: www.health.uct.ac.za/fhs/research/humanethics/forms

31 October 2017

HREC REF: 678/2017

Dr SR Bruijns
Emergency Medicine
F51, Old Main Building

Dear Dr Bruijns

PROJECT TITLE: DESCRIBING THE MOST COMMON PRESENTING COMPLAINTS, THEIR PRIORITY AND CORRESPONDING DIAGNOSES AT MITCHELLS PLAIN EMERGENCY CENTRE (MMED CANDIDATE - DR A V NAIDOO) SUB-STUDY LINKED TO 358/2016

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee.

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

Approval is granted for one year until the 31 October 2018.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

Please quote the HREC REF in all your correspondence.

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

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

The HREC acknowledge that the student, Dr Antoinette Vanessa Naidoo will also be involved in this study.

Yours sincerely

Signature Removed

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938