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

by

Antoinette Vanessa Naidoo

MBChB (UCT) DA(SA)

NDXANT004

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Supervisor(s): Ass. Prof. Stevan Bruijns

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PART B

Abbreviations

ACEM- Australian College of Emergency Medicine

ATS- Australasian Triage Scale

CEDIS- Canadian Emergency Department Information Systems

COPD- Chronic Obstructive Pulmonary Disease

CTAS- Canadian Triage and Acuity Scale

DKA- Diabetic Ketoacidosis

DVT- Deep Vein Thrombosis

EC- Emergency Centre

ESI- Emergency Severity Index

ETAT- Emergency Triage Assessment and Treatment

GI- Gastrointestinal

ICA- Incomplete Abortion

IMCI- Integrated Management of childhood Illness

KTS- Kampala Trauma Score

LMIC- Low Middle Income Country

MEWS- Medical Early Warning Score

MTS- Manchester Triage System

NTS- National Triage Scale

SATS- South African Triage Scale

TEWS- Triage Early Warning Score

UK- United Kingdom

USA- United States of America

PART A: LITERATURE REVIEW

Emergency care services form the interface between healthcare and the socioeconomic climate responsible for profile of wellness and disease in the country. In order to impact the high levels of preventable disease and injury in South Africa attention should be placed on the terms in which our population communicates their illness and how those descriptions relate to the severity and complex spectrum of disease we aim to treat.

Aim of this literature review

The aim of this review was to address and discuss the association between presenting complaints and diagnoses, and individual triage acuity categories as used in emergency centres (EC) 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, 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 Services, NHS Direct, challenges telephone triage, Low Middle Income Country triage, LMIC triage, African triage, 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, reliability, validity, challenges SATS, 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 2000 - December 2017
- 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 MMed and therefore was omitted. Very little data were available that directly addressed some parts of the aim and objectives and thus criteria were applied less stringently here.

Summary or interpretation of literature

The global perspective

Triage systems were first introduced into hospital emergency centres in the 1960's(2). The military surgeon Dominique Jean Larrey first used the process of identifying and prioritising treatment of the most severely injured in the army of Napoleon Bonaparte, as early as 1792(3). This approach has since been shown to decrease morbidity and mortality in all patient groups(3).

In-hospital triage systems have been developed from pre-hospital and disaster management systems(3). Pre-hospital systems were adapted for civilians from those practises that were first used in war contexts(2). The nature of pre-hospital medicine and disaster management, in particular, are such that these tools remain simple and require minimal equipment(4). Patients are typically categorised into three colour coded groups indicating the order or time frame in which they should be seen- red denotes immediate attention, yellow for urgent care and green for delayed treatment(4).

Emergency centre triage scales may have three, four or five tiers(5). Additional tiers subdivide 'very urgent' cases from less severe- 'urgent' cases, and may add a category for 'non-urgent' or 'dead on arrival(4).' The addition of tiers to a triage tool allows higher sensitivity and improved detection of time-dependant conditions(6). This comes at the cost of higher levels of training, and increases time required to perform it(2).

The Australian College of Emergency Physicians (ACEM) developed the Australasian Triage Scale (ATS) as one of the first modern triage systems in high income countries(5). It was originally structured on the Ipswich Triage Scale(IPS) which was revised to the National Triage

Scale(NTS) in 1994, and further modified into the ATS by 2000(7). The IPS was based on the practices of nurses who identified the patients who were most to likely deteriorate if they had to wait for treatment, and decided the order in which they would consult the next available physician(7).

The ATS uses clinical descriptors and the appearance of the patient to assign them to a triage category(8). Vital signs are measured in cases were the clinical discriminator does not clearly indicate the urgency, or if time allows for it(8). The scale consists of categories 1 to 5, each linked to an estimation of the time-frame within which the patient should be seen(8,9). Clinical descriptors and time targets are based on expert consensus(7).

ATS category 1(red) refers to life threatening conditions requiring simultaneous resuscitation and triage, category 2(orange) may be at risk of rapid deterioration or organ failure if treatment is not initiated within 10 minutes(8). Patients in categories 3(green), 4(blue) and 5(white) may be treated within 30, 60 and 120 minutes respectively as acuity, severity of pain the potential for adverse outcomes decreases from one level to the next(8). This system has been proven highly reliable and valid in its ability to in identify critically ill patients and time sensitive cases in categories 1 and 2, with lower reliability for categories 3, 4 and 5 and time to treatment targets(7).

The Canadian Triage and Acuity Scale was formally adopted in 1997(10). Derived from the ATS- it is a validated 5 tiered system arranged in decreasing order of acuity with a maximum time to treatment of 120 minutes for level 5(10). The CTAS has undergone multiple revisions and outlines conventions for special populations such as mental health users, paediatrics, geriatrics and those who live in more rural areas(11).

The CTAS is a nurse-led process starting with a rapid visual assessment to identify level 1 cases who require resuscitation or life-saving interventions(12). If immediate resuscitation is not required the first step is directed at the detection of potential communicable diseases so that these cases may be managed in an appropriate area for the safety of staff and other patients(11). The history of the presenting complaint is then recorded- if there are multiple complaints the symptom assigning the highest acuity is selected(12).

Presenting complaints are chosen from a list of clinical discriminators drawn from emergency department research, and consensus by the Canadian Emergency Department Information Systems (CEDIS) National working group(11). Vital signs, mechanism of injury, severity of pain or the presence of bleeding disorders act as first order modifiers of acuity, followed by second order modifiers related to the nature of the presenting complaint(10). These second

order modifiers aim to select out patients who may need treatment more urgently than suggested by their presenting complaint or vital signs alone, for example cases of extremity injury with *deformity* or stridor with *drooling*(12).

In 1999 the Emergency Severity Index (ESI) was implemented in the United States of America, since then it has shown strong performance in both adult and paediatric patient populations(13). This 5-tier scale is replacing previously used three or four tier systems. Similar to the ATS and CTAS it is a nurse-led system, aiming to rapidly recognise level 1 and 2 cases which need immediate attention(14). The ESI places importance on reducing emergency department overcrowding and improving patient flow from arrival to disposition- it is with this in mind that an assessment of the resources necessary to treat the patient is required, and triage acuity does not place time targets on levels 3, 4 and 5(13). Patients placed on level 3 are estimated to require multiple resources, a single resource on level 4, and no additional resources on level 5(13). A nurse with sufficient experience and training in patient assessment, and knowledge of relevant management strategies is a necessity for the success of such a system(15).

The Manchester Triage Scale(MTS) has been validated in studies of adult and paediatric emergency centre patients in the UK and parts of Europe(16). Initially developed in 1994 by doctors and nurses, it is a 5 tier system in which colour codes also denote acuity and assign patients to time target categories(17).

A triage nurse performs triage using flow charts and algorithms that have been created from patient presenting symptoms- this nurse does not have to make an assessment of resources or possible diagnoses to assign a patient to a level of priority(18). There are 52 general symptom flow charts, 49 of these flow charts may be used in the paediatric MTS(18). The triage process assumes that the patient has presented with an immediate life threatening condition and leads the triage nurse down a reductionist pathway via the set algorithm(17). Additional information is required at each step, discriminators such as severity of pain, level of consciousness, acute history and vital signs are included to ultimately place the patient in the correct category. The colour system uses red for immediate resuscitation, amber for very urgent (within 10min), yellow for urgent (within 60min), green for standard care (within 120min and blue is used for non-urgent care (within 240min)(9).

In Asia, triage scales include the Japanese triage scale which is based on the CTAS and has shown acceptable performance, and the 4 level Taiwanese Triage scale- these have undergone less rigorous testing than those used in the North America and Europe.

Triage is an area of ongoing research in high income countries and the performance of these triage scales, and adherence to time targets are often used as indicators in assessment of the health system at large. Research into improved triage training programmes, revision of triage tools and protocols are continuously balanced against the need to minimise the time and level of expertise required to perform the task.

The low- and middle-income perspective

Low and middle income countries (LMIC) face a deficit in research and design of triage systems for this context(19). These countries routinely face significant disparities between high acuity caseloads and available health resources, making triage increasingly crucial in the delivery of emergency care.

Paediatric triage in LMIC's drew attention when the Emergency Triage, Assessment and Treatment(ETAT) guidelines were issued by the World Health Organisation(WHO) in 1999(19). The aim of the ETAT was to decrease the high number of child deaths from serious illness by providing early treatment(20). Studies done in Malawi and Brazil confirmed that the tool was able to reliably sift out the patients needing admission in the under 5 age group(21). The Paediatric Early Warning Score (PEWS), Paediatric South African Triage scale (PSATS) and Integrated Management of Childhood Illness(IMCI) treatment guidelines are examples of other tools used in LMIC paediatric care (20). The paucity of data and heterogeneity in the studies of these tools limits evidence based comparison, as was demonstrated in a systematic review of the available literature in 2017(20).

Research into triage scales in adult emergency care in LMIC's has also been limited. Adapted versions of the MTS and ESI are used in areas of Brazil, however these high income country scales are not always suitable for use in countries with far few resources, varied disease patterns and higher numbers of cases due to communicable diseases, violence and natural disasters (22,23). A new three tiered scale designed by healthcare professionals in India was implemented in 2018, while this triage scale has not yet been validated, it is an improvement on previous systems that were largely subjective or non-existent(24).

Historically international triage scales have been used in prehospital medicine, mass casualty situations, epidemics or trauma care in Africa(25). In many parts of the continent, in-hospital triage in adult healthcare remains sporadic or is not used at all(25). The Kampala Trauma score (KTS) is an example of a triage tool developed in Africa, it was implemented in various Ugandan facilities in 2000(26). The KTS appears better suited to trauma care as it was derived

from injury severity indexes and trauma scores used in high income countries(26). The KTS could not be validated in emergency centres receiving a mixed case load of both medical and trauma related pathology(26).

A systematic review published in 2018 assessed the reliability and validity of triage tools used across 18 LMIC's(27). It found that the number of published studies, research methodology, representation and quality of information was not sufficient to recommend one triage system that could be used as an evidence based solution in LMIC's(27). The study reported that of the 6 triage tools studied the South African Triage Scale(SATS) was the only scale developed in LMIC's that had high quality evidence on reliability and validity in its context(27).

The increasing incidence of medical illness and injury facing South Africa in the early post-apartheid period prompted the development of a triage tool in emergency care(28). The SATS was adapted from the Cape Triage Score (CTS) which was first developed in the Western Cape province in 2004(28). The CTS was designed to be easy for use by staff with limited training, and reliably sort high acuity patients across a wide spectrum of disease and prioritise them for treatment in a resource constrained environment. Revised by a team of emergency care workers, now known as the South African Triage Group(SATG), the SATS has been in use nationally since 2006(29).

The SATS is a four tier system which uses a composite of clinical discriminators and physiological parameters to assign patients to a colour-coded level of acuity and treatment priority(30). Those patients requiring immediate resuscitation are coded red, orange for 'very urgent' care within 10min, yellow for 'urgent' care within 60min and green for those who can wait up to 4hours for routine care(31).The SATS shows strong performance in accurately detecting and reducing waiting times for patients who need immediate or very urgent treatment(32,33).

The triage process begins by taking a history of the problem that caused the patient to present to hospital(31). If the presenting complaint or sign is found on the list of clinical discriminators detailed on the triage flow chart the patient automatically falls into the corresponding acuity category(emergency/very urgent/urgent) (31). In this case, the vital signs do not need to be recorded before the patient is assigned a triage colour(31). The use of these clinical discriminators allows for immediate recognition and treatment of life-threatening conditions, thus reduces mortality(2).

The team of South African emergency care experts who compiled the list of clinical discriminators had to consider the quadruple burden of disease, as well as the knowledge and experience of the staff who would perform triage(34). High risk clinical signs and symptoms related to- HIV/TB and other infectious diseases, trauma as well as non-communicable conditions such as diabetes and hypertension- had to be included without increasing the complexity beyond the level of a junior staff member(30,35). Unlike the ATS, CTAS or MTS only one algorithm is used and the number of discriminators are limited(36). This initial process is ideal in face of resource limitations as it requires no equipment, and may be easily performed by an Enrolled Nursing Assistant (ENA) with one year of clinical training. Objective evidence that the combination of clinical discriminators and vital signs as calculated in the SATS provide 'reliable acuity ratings' when performed by ENA's and doctors was provided in study by Twomey et al in 2011 (30).

The Triage Early Warning Score (TEWS) is calculated once presenting symptoms have been filtered through the algorithm of clinical discriminators(31). A study done at GF Jooste hospital in 2008 showed that the patients who required admission, or were at high risk of in-hospital mortality were successfully identified using the Modified Early Warning Score (MEWS) (37). The MEWS was incorporated into the initial CTS, recording heart rate, respiratory rate, systolic blood pressure, temperature and level of consciousness (37,38). When the CTS was revised to the SATS a history of trauma and mobility status were added as parameters creating the Triage Early Warning Score, this was deemed necessary due to the high incidence of trauma in addition to medical conditions(38). The TEWS may be used to up-triage a patient into a higher acuity category(31). A TEWS of more than seven places the patient in the emergency category where triage and resuscitation should occur at the same time. Age-based TEWS charts for children less than 95cm (<3years) and children between 95cm and 120cm (3-12years) in the PSATS(31). The use of a single validated system for adults and paediatrics is preferable as it reduces the time required for training and minimises errors(39).

The context specific benefits of the SATS include efficiency and cost effectiveness as it may be performed easily in a small area by a trained junior nurse using basic vital signs equipment(31). The triage flow chart suggests additional side room investigations (ECGs, oxygen saturation monitoring glucose checks, urine tests) when needed, therefore triage may be performed without extensive knowledge of diagnoses or management(31). It aids patient safety, patient flow and decreases overcrowding by allowing for rapid redistribution of patients to designated treatment areas(31). The tool includes both presenting complaints

and vital signs and also allows for the opinion of a senior clinician to reduce under-triage.(31). It is suitable for repeat triage, as strained resources in LMIC's result in long waiting times in which a patient's clinical condition and vital signs may deteriorate. These benefits and the deficit of other validated triage tools in LMIC's has suggested the SATS as feasible starting point for the research and development of triage in similar settings.

The South African perspective

The number of published studies with robust data on the reliability and validity of the SATS in both adult and paediatric populations is encouraging. The success and sustainability of the triage system also depends on willingness and flexibility to address and revise the system based on clinical experiences, challenges and data from staff and patient experiences on the floor.

The history of racial segregation, exploitation and inequality have been cited as reasons for the poor performance of the South African health care system(40). The unique quadruple burden of disease in the country was described in the first national burden of disease study in 2000(41). Since then mortality from non-communicable diseases and interpersonal violence have decreased slightly due changes in political stability, improved legislation on tobacco, sugar and firearm use(34). Premature deaths due to HIV/AIDS and TB have decreased as a result of a comprehensive anti-retroviral treatment program(34). Health indicators of poverty, overcrowding, nutritional status and inequality such as infant and maternal rates and deaths due to communicable/infectious disease however, have shown only modest reductions and overall disease prevalence remains high(34).

The public health sector provides services to more than 82% of the population with a workforce that represents less than 65% of health care human resources in the country(40). The cost of private health care makes it inaccessible to the bulk of the population. Many doctors and allied health staff chose to emigrate or work in the private sector due to better financial incentives but also as a result of poor working conditions, lack of strong leadership and resource limitations in the public health care system(40).

Areas with large rural populations often bear the brunt of the misdistribution of the workforce and face additional barriers to accessing healthcare such as- poor housing, lack of adequate water and sanitation services, long geographical distances to facilities, lack of funding and sporadic public transport(40). KwaZulu Natal, Limpopo province, the Eastern Cape are among the poorest areas in the country(40). Staff shortages and high caseloads

were reported to impact the willingness of staff to use the SATS in a rural emergency centre in KwaZulu Natal 2011(33). The triage process was thought to increase the workload as a brief visual assessment could be performed as a substitute(33).

Triage in South Africa is nurse-led, however the most severe human resource deficits and challenges exist in the nursing profession, which is also the backbone of the District health care system(40). Nurses report that poor levels of job satisfaction in relation to high demands, political, administrative, financial and ethical factors all play a role in the growing disinterest in the career(40). In 2013 the Nurses Qualification Framework revisited nursing education, qualification and registration in South Africa(42). Historically nurses have been trained by a combination of universities, colleges, government and private hospitals and NPO's while registration has been overseen by the South African Nursing Council (SANC)(42). Currently clinical nursing staff are employed with various levels of experience on 4 different levels of education- an enrolled nurse auxiliary holds a higher certificate in education, a staff nurse holds a diploma in nursing, a registered nurse has a minimum of 4 years of training and holds a bachelor's degree in nursing, and specialist nurses hold further post-graduate or research qualifications(42). While ENA's are more numerous and economical to employ, the ideal skills mix and nurse to patient ratios are not well established(43). Some studies have suggested that employing a workforce composed of a minimum of 20% registered nurses with bachelor's degrees may reduce inpatient mortality by up to 8% (43).

Staff education and training was one of the many concerns highlighted in a study done at a tertiary hospital in Gauteng in 2017(44). The study reviewed the reasons for mis-triage and described whether patients were placed in higher or lower acuity categories(44). It was found that 68.3% of patients were triaged appropriately, of those who were mis-triaged patients with injuries were more likely to be placed in higher triage category while those with non-trauma related injuries were most often demoted(44). It appeared that patients in the 'very urgent' or orange category were most likely to be mis-triaged into a lower acuity group(44). In an environment with long waiting times assigning patients to lower priority categories places them at risk of deterioration from time dependant illnesses, whereas incorrect escalation of triage priority places further strain on doctor to patient ratios for those patients who need more urgent attention.

The study reported errors in TEWS calculations which ranged from incorrect mathematical addition to selecting the wrong numerical score category, even when vital signs were recorded correctly(44). There were cases in which the appropriate discriminator was selected and TEWS calculated correctly however the patient was assigned to the wrong triage

category(44). These inaccuracies are compounded by poor documentation(44). These mistakes may reflect simple human error which is exacerbated by time pressure on staff, tiredness, overcrowding as well as the quality and level of education and training of the staff responsible for triage(44).

Assessment of a patients presenting complaint or clinical discriminator was another area of concern, most often the discriminator was not documented or not used to assign the appropriate triage category(44). More specifically clinical discriminators such as pain or psychosis were identified as an areas of ambiguity where guidelines may need refinement or clarification (44). Staff biases around the severity of pain, or use clinical signs which are not in the TEWS or on the list of discriminators (such as low oxygen saturation) were sometimes used to patients assign a triage code that the junior nurse found appropriate(44).

Misinterpretation or miscommunication around presenting symptoms is a vital area to address, as the correct use of these discriminators in a triage scoring system makes it superior to the use of the physiological score alone(33,38). South Africans and foreigners accessing the health system come from a diverse mix of racial, ethnic and cultural backgrounds. These non-clinical factors are well known to influence health seeking behaviour and the patient's perception of their illness, they are frequently considered from public health point of view but also impact the development of an objective list of clinical discriminators which are relevant, and translate well across the varied groups of the population.

History taking in emergency centres is often suboptimal due to time constraints, lack of privacy, overcrowding, high noise levels, and significant language barriers in a country with 11 official languages. Many of clinical discriminators listed in the SATS are symptoms or signs that are visible without verbal description. Frequently doctors, nurses and patients have different first language preferences and more subjective information is transferred in a few words and gestures. Translators are uncommon in the clinical environment, using clinical staff as translators places an extra burden on their workload and untrained non-medical staff may not interpret clinical information correctly(45).

Reviewing the triage process in the South African health setting provides useful information on the staff perceptions, attitudes and practical problems that may arise. Implementation of a standardised triage tool has also provided an additional resource for collecting data on the spectrum of the workload and health profile of the patient populations seen in different emergency centres.

An audit of the casemix across Khayelitsha, Mitchells Plain, Gugulethu and Elsies River community health centres was done using the Cape Triage System in 2007(29). It showed that these EC's saw an average 300 patients a day with peaks after 16h00, on Mondays and weekends(29). On average high acuity patients comprised 30 to 45% of the workload, 5.3% which were triaged red(29). 27.9% of patients presented with trauma which was the most frequent complaint overall, while shortness of breath(9.2%) was the most common non-trauma symptom(29). A quarter of all children seen presented as emergencies, most often with shortness of breath(29). The CTS was also used to determine that 65% of patients who presented to the EC after 16h00 in a George hospital presented with non-urgent complaints and triaged green(46).

An observational study of data collected over a one month period at New Somerset Hospital was done in 2007(47). Patient demographics, referral patterns and dispositions were gathered from questionnaires completed by the doctors who saw the patients(47). The majority(48%) of the patients seen in the EC were between 20 and 40 years of age, and 18% of the population were below the age of 18(47). Numbers of males and females were not significantly different(47). The overall most common reason for presentation was trauma related (25.8%), followed by respiratory (14.9%), abdominal (14.2%), neurological (8.6%), sepsis (6.1%), and gynaecological (5.4%) complaints. In keeping with the national disease profile the most common corresponding diagnoses in adults was head injuries, followed by abdominal pain, TB, dyspnoea and stab chest(47). Applying the SATS the most frequent triage acuity in adults was yellow(48%), followed by orange(27%), green (23%) and red(2%)(47). The majority of children were triaged as 'very urgent' or orange cases and were frequently diagnosed with gastroenteritis, lower an upper respiratory tract infections(47). The highest number of patients were seen on Mondays, Tuesdays and Fridays(47). Patients were transported to hospital by ambulance in 39% of cases(47).

Paarl hospital EC conducted a similar cross-sectional study over a 5 month period in 2008(48). The caseload acuity and presentations described were similar to those at NSH. In adults-trauma(36%), abdominal(21.9%), respiratory (12.4%), and nervous (8.3%) complaints were most frequent(48). The most frequent corresponding diagnoses were head injuries, upper and lower respiratory tract infection, gastroenteritis and cerebrovascular accidents. (48). Triage acuity rates were red(4.9%), orange(14.3%), yellow (66.9%) and green(13.9%), this was similar in adults and children(48).

More recently Khayelitsha District hospital EC reviewed data collected specifically from the resuscitation area between November 2014 and April 2015(49). The majority of the patients

fell into the red(27.6%)and orange (42.4%) high acuity categories(49). Trauma(39.9%) did form a significant portion of the case load, but was not the most common presentation in this area, medical admissions (50.0%) with a high prevalence of HIV, hypertension and diabetes were more frequent(49).

Identification of gaps or needs for further research

Triage is traditionally focused on high acuity conditions and reducing the waiting times for initiation of treatment. Outcomes such as impact on morbidity and mortality, waiting time and time to disposition are recorded as performance indicators in the health system. The growing demand on emergency care services requires improved data collection on factors that influence management and distribution of resources across the entire emergency centre population. Few studies have been done using the SATS in this way.

The demographic profile of the patient population in terms of total number of patients, age and gender in relation to presenting complaint and triage category varies between ECs in different regions. This is especially significant in South Africa where access to resources and disease profiles may differ significantly from one EC to another. This variation occurs between individual centres in the same province, and is more extreme across different provincial areas. Variations may also occur across seasons, days of the week or even time of day. There are no studies that have been done using standardised data collection methods to systematically compare patient populations in different ECs.

The first step in applying the SATS is taking a history of the reason the patient came to hospital. These presenting complaints may allocate a patient to a triage priority category, but they also determine the management pathway and investigations that the patient requires to disposition. A patient with a stabbed chest for example, triages orange by clinical discriminator- from the presenting symptom it is already apparent that the patient will need to be seen very urgently, may require ultrasound or chest x-rays as basic investigations, clinical time may be required for procedures such as intercostal chest drains or suturing. This pathway is very different from that of a patient who presents with focal neurology and triages in the same category. While the triage category defines the urgency with which both patients should be seen, the specific presenting complaint determines the resources and time requirements thereafter, detailed data on these complaints is currently limited as most studies focus on triage acuity or broad categories of symptoms.

Studies on the SATS have shown that it is a reliable and valid tool for assigning a patient to a triage category based on the combination of clinical discriminators and the TEWS. While vital signs may be recorded objectively it is more difficult to assess the accuracy of the history taken from the patient. This becomes crucial when considering that there are significant challenges in communication between patients and healthcare workers and the influence of presenting history the subsequent resource needs. Observing the frequency with which the person performing triage and the evaluating clinician agree on the main complaint may provide further insights on the accuracy of this history.

Describing presenting complaints and correlating these to triage category allows for evaluation of the appropriateness of the clinical discriminators used in the SATS. These lists of discriminators were compiled on expert opinion as a safety net for serious conditions that may not be apparent by recording vital signs alone. This list may need to be refined and additional discriminators may be necessary if informed by evidence.

Relating presenting complaints to diagnoses completes the pathway of the patient from arrival to disposition. Data captured from presenting complaints and diagnoses may be used to delineate clinical decision-making pathways relative to the most likely differential diagnoses. Additional investigations and side room tests may be indicated and performed based on these diagnostic algorithms, with the aim of reducing waiting times and improving patient flow.

Providing high quality health care in an overburdened system is a challenge that requires collaboration on multiple levels. In order for healthcare workers to advocate for the needs of their patients it is necessary to provide accurate descriptions of the profile of patients who are seen, and data on the nature and cause of their complaints, this data is currently lacking in the South African context.

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PART B: MANUSCRIPT IN ARTICLE FORMAT

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

Antoinette Vanessa Naidoo[1]*

Stevan Raynier Bruijns[1]

1. Division of Emergency Medicine, University of Cape Town, Cape Town, South Africa

* Corresponding author

Corresponding author details

Email: ven704@gmail.com

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Abstract

Introduction

Emergency centres have to be equipped to provide high-quality care to a number of undifferentiated patients with varying acuity of illness. This study aimed to identify the most common presenting complaints and corresponding linked diagnoses, in total and for each category of the South African Triage Scale (SATS) at Khayelitsha Emergency Centre (EC).

Methods

A retrospective, cross-sectional, chart review was used. The sample consisted of patients who presented to Khayelitsha 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.

Results

4006 of 4928 charts that were reviewed were suitable for inclusion. Triage acuity was 28.0% (n=1123) green, 34.2% (n=1372) yellow, 25.7% (n=1030) orange and 3.5% (n=141) red. The most common presenting complaints were trauma (10.3%) and pain (10.1%); the majority of these patients presented in the yellow and green triage categories. The most common diagnosis made in the EC was pneumonia (7.0%) – most frequently presenting as shortness of breath (8.7%) and cough (5.6%). Medical conditions presented with a higher acuity at triage. Presenting complaints documented at triage and those reported by clinicians correlated an acceptable 70.1% of cases (r=0.71). Diarrhoea and vomiting were the predominant symptoms in summer whereas shortness of breath and cough were more frequent in winter. Triage acuity was similar for both months.

Conclusion

Individual symptoms presented with varying priority and resulted in a variety of eventual diagnoses which showed differences across categories. Presenting complaints provide granularity to otherwise undifferentiated triage priorities. Future research should focus on time-in-motion work to determine the mean clinical care time each of these complaints require. This should allow a calculation of the mean clinical care time for each triage priority. In turn this can be turned into a calculation for optimal staffing.

Main text of article

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. 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.(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 (e.g.: 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. However 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.(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 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 Khayelitsha 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 Khayelitsha 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 accommodate for seasonal differences between summer and winter. Khayelitsha district hospital forms part of a decentralised primary health care system, the EC receives referrals from general doctors and nurses at local clinics, community health centres and private GP practices; patients who require intensive care, specialised services or prolonged care are stabilised and referred from Khayelitsha hospital to Tygerberg tertiary hospital for further management. Khayelitsha EC sees approximately 3000 new patients each month. About 20% of these patients are children. The total bed capacity of the hospital is 230 beds and requires high turnover in order to continuously provide services. 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 Khayelitsha informal settlement in the Cape Town metropolitan is the largest and most rapidly growing township in the country. An estimated 500 000 people of low socioeconomic status are served by Khayelitsha hospital.

The bulk of the data were captured by four, second-year medical students who collected the data for their Special Study Module project. The sample evaluated comprised of 6233 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. All patient charts (adults and children) for each time period were then manually reviewed via the Electronic Content Management System that contains scanned hospital records. Internal audits report that the Electronic Management System captures approximately 90% of all EC records as scanned documents which may be accessed via the intranet, uncaptured data results from paper-based records being used by the other departments such as medicolegal administration, being held by clinicians for teaching/morbidity and mortality reports/adverse incidents, or being mislaid due to human error. The presenting complaint at triage as described by the triage nurse and the first attending clinician, SATS priority, and final diagnosis was captured from the scanned emergency centre triage and clerking notes. A universal data collection spreadsheet was used

to capture the data to ensure uniform collection (Appendix A – data supplement). A predetermined presentation list (Appendix B) 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. 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 – 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 (Appendix B): date and time of arrival, date of birth, gender, triage priority assigned, triage presentation from predetermined list, free text presentation field (for presentations not included in list), clinician presentation from predetermined list, free text presentation field [for presentations not included in list], diagnosis from predetermined list, 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. 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. We used Pearson's correlation coefficient (r) to compare nurse and doctor presentation descriptions, and the seasonal variation of triage allocation. The study was approved through the University of Cape Town's Human Research Ethics Committee (ref: HREC 673/2016).

Results

The initial sample provided by the hospital information management department comprised 6251 patient encounters for the months of January and June. We excluded 2245 cases due to incomplete records and duplication. The eventual sample consisted of 4006 cases. Figure 1 provides detail regarding the data collection strategy, exclusions and eventual sample used for analysis.

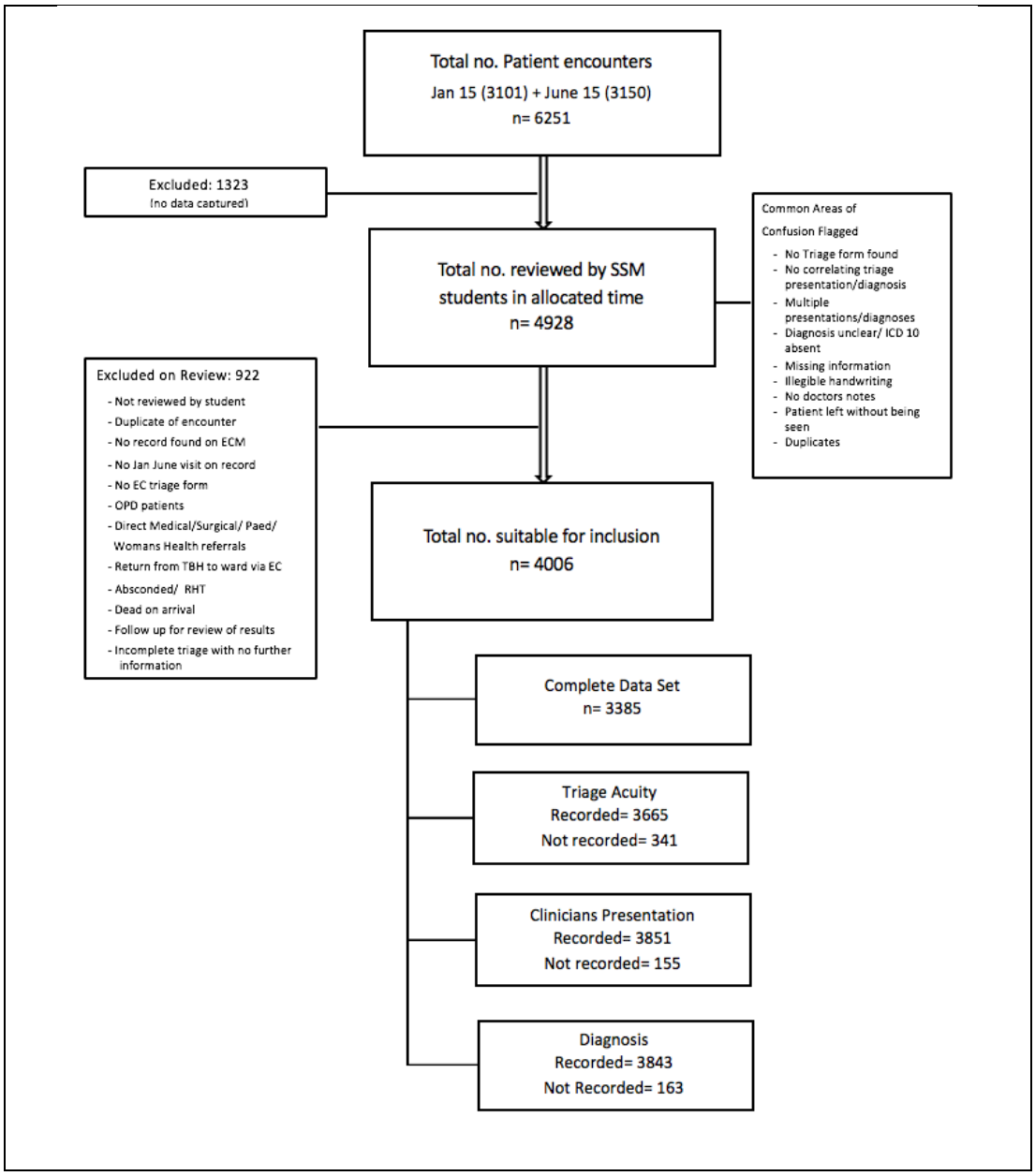


Figure 1. Sample collection flow chart

The sample population ranged from birth to 104 years of age. 21.1% of the cases were under 12 years of age. Key demographics for the study are provided in Table 1.

Table 1. Sample demographics

Full sample												
Triage Acuity	Female				Male				Total			
	n	%	Mean age (±SD)		n	%	Mean age (±SD)		n	%	Mean age (±SD)	
All	1968	49.1	32	(±20)	2038	50.9	31	(±20)	4006	100.0	32	(±20)
Green	541	48.2	31	(±20)	582	51.8	29	(±19)	1123	28.0	30	(±19)
Yellow	731	53.3	32	(±20)	641	46.7	32	(±20)	1372	34.2	32	(±20)
Orange	459	44.6	32	(±21)	571	55.4	33	(±21)	1030	25.7	33	(±21)
Red	56	39.7	31	(±23)	85	60.3	26	(±21)	141	3.5	28	(±22)
Not Specified	181	53.2	34	(±18)	159	46.8	33	(±18)	340	8.5	34	(±18)
Sample aged 12years and older												
Triage Acuity	Female				Male				Total			
	n	%	Mean age (±SD)		n	%	Mean age (±SD)		n	%	Mean age (±SD)	
All	1573	49, 8	39	(±15)	1587	50.2	39	(±15)	3160	78.9	42	(±15)
Green	420	48.2	39	(±15)	442	51.3	38	(±13)	862	21.5	41	(±14)
Yellow	596	54.0	39	(±15)	507	45.9	39	(±15)	1103	27.5	42	(±15)
Orange	360	44.4	40	(±16)	450	55.6	41	(±15)	810	20.2	43	(±16)
Red	40	42.1	42	(±17)	55	58.0	39	(±14)	95	2.4	43	(±15)
Not Specified	157	54.1	39	(±14)	133	60.0	39	(±14)	290	7.2	41	(±14)
Sample aged less than 12 years												
Triage Acuity	Female				Male				Total			
	n	%	Mean age (±SD)		n	%	Mean age (±SD)		n	%	Mean age (±SD)	
All Acuity	395	46.7	3	(±5)	451	53.5	3	(±3)	846	21.1	3	(±3)
Green	121	46.4	3	(±3)	140	53.6	4	(±3)	261	6.5	4	(±3)
Yellow	135	50.2	3	(±2)	134	49.8	3	(±2)	269	6.7	3	(±2)
Orange	99	45.0	3	(±2)	121	55.0	3	(±3)	220	5.5	3	(±3)
Red	16	34.8	3	(±2)	30	65.2	2	(±2)	46	1.1	3	(±2)
Not Specified	24	48.0	4	(±4)	26	52.0	3	(±2)	50	1.2	4	(±3)

Figure 2 ranks the frequency of presenting complaints at triage along with its proportional triage allocation. Presenting complaints that presented more than five times represents 98.4% (n= 3941) of the total sample population. Complaints that presented less than five times are made of 27 clinical descriptors: airway obstruction, alcohol intoxication, allergic reaction, anaemia/ pallor, black stool/ melena, bleeding disorder, burns- electrical, burns-facial, burns-inhalational, dehydration, dislocation- large joint, DVT (deep vein thrombosis), dysuria, earache/otitis media, eye injury, floppy, haemorrhage- uncontrolled, hypothermia, inconsolable crying, malnutrition, poor/not feeding, pregnancy related, pregnancy- trauma, rectal bleeding, red eye, shock, suicidal ideation, threatened limb, upper GI bleed and wheezing- these are represented as miscellaneous. The ten most common presenting complaints represent 64.9% (n= 2601) of the total sample. Unspecified trauma is the most common complaint (n=411, 10.3%). The combined trauma case load made up 15.7% (n= 659)

of the sample. Figure 2 also illustrates presenting complaints which may occur less frequently but with increased severity, these include seizures/fits/convulsions, postictal state, altered level of consciousness, respiratory distress and hyperglycaemia.

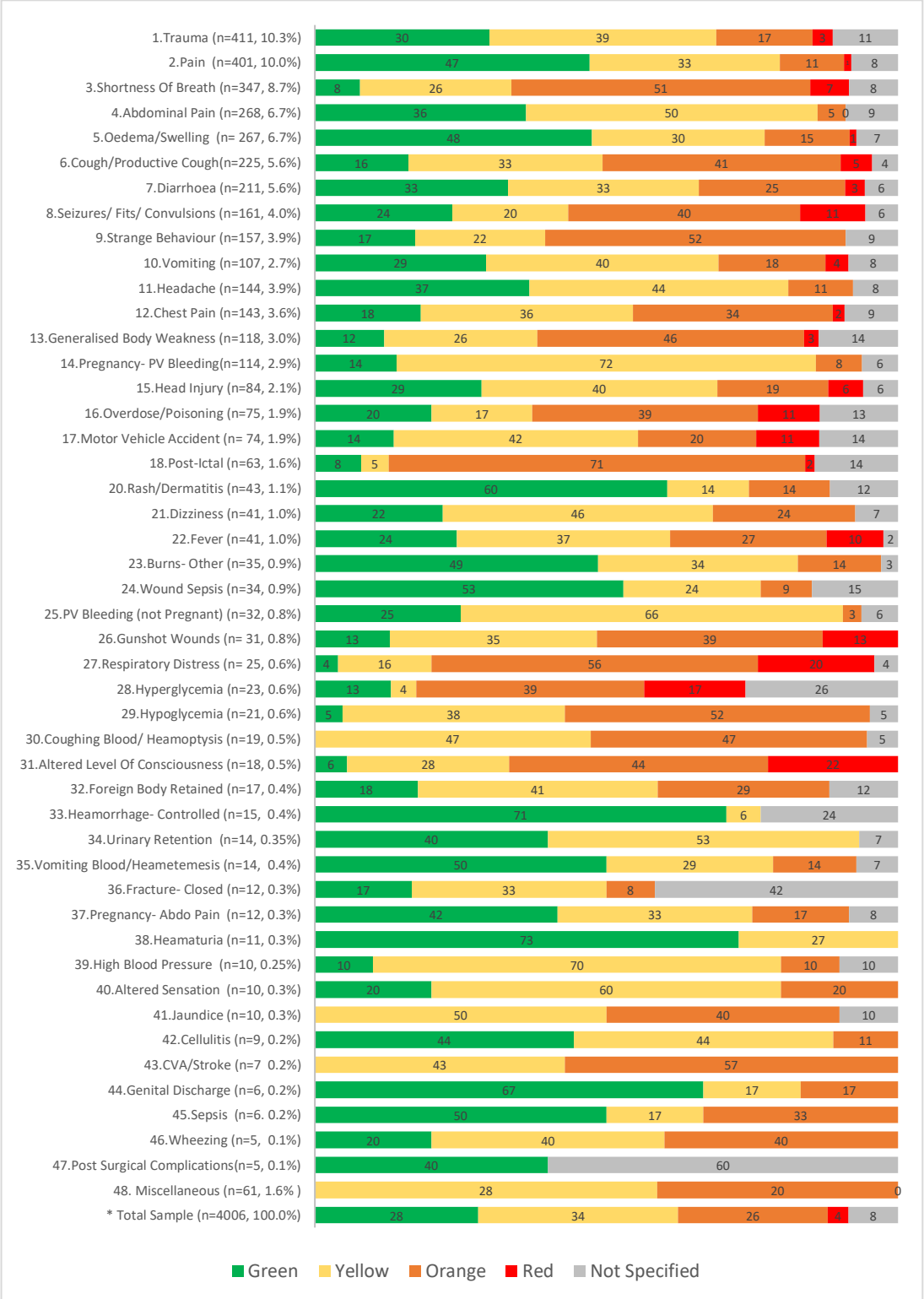


Figure 2.Frequency of presenting complaints at triage along with its proportional triage allocation (%)

Table 2 presents the presenting complaints that were most frequently associated with each triage category. Table 2 also lists the most common diagnoses associated with each triage category. The final list included 317 different ICD 10 codes. The 20 most common diagnoses account for 50.9% (n=2027) of cases.

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

Most Common Presenting Complaints (n=4006, 100%)			Green (n=1123, 28.0%)			Yellow (n=1372, 32.2%)			Orange (n=1030, 25.7%)			Red (n=141, 3.5%)			Not Specified (n=340, 8.5%)		
	n	%		n	%		n	%		n	%		n	%		n	%
Trauma	411	10.3	Pain	189	16.8	Trauma	160	11.7	Shortness of Breath	178	17.3	Shortness of Breath	23	16.3	Trauma	46	13.5
Pain	401	10.0	Oedema/Swelling	127	11.3	Abdominal Pain	134	9.8	Cough/Productive Cough	92	8.9	Seizures/ Fits/ Convulsions	18	12.8	Pain	32	9.4
Shortness of Breath	347	8.7	Trauma	123	11.0	Pain	131	9.5	Strange Behaviour	81	7.9	Trauma	14	9.9	Shortness of Breath	29	8.5
Abdominal Pain	268	6.7	Abdominal Pain	97	8.6	Shortness of Breath	90	6.6	Trauma	68	6.6	Cough/Productive Cough	12	8.5	Abdominal Pain	24	7.1
Oedema/Swelling	267	6.7	Diarrhoea	70	6.2	Pregnancy- PV Bleeding	82	6.0	Seizures/ Fits/ Convulsions	64	6.2	Overdose/Poisoning	8	5.7	Oedema/Swelling	19	5.6
Cough/Productive Cough	225	5.6	Headache	53	4.7	Oedema/Swelling	79	5.8	Generalised Body Weakness	54	5.2	Motor Vehicle Accident	8	5.7	Generalised Body Weakness	16	4.7
Diarrhoea	211	5.3	Vomiting	45	4.0	Cough/Productive Cough	75	5.5	Diarrhoea	53	5.1	Diarrhoea	7	5.0	Strange Behaviour	14	4.1
Seizures/ Fits/ Convulsions	161	4.0	Seizures/ Fits/ Convulsions	38	3.4	Diarrhoea	69	5.0	Chest Pain	49	4.8	Vomiting	6	4.3	Vomiting	13	3.8
Strange Behaviour	157	3.9	Cough/Productive Cough	36	3.2	Headache	64	4.7	Post-Ictal	45	4.4	Pain	5	3.5	Chest Pain	13	3.8
Vomiting	153	3.8	Shortness of Breath	27	2.4	Vomiting	61	4.4	Pain	44	4.3	Head Injury	5	3.5	Diarrhoea	12	3.5
Headache	144	3.6	Strange Behaviour	27	2.4	Chest Pain	52	3.8	Oedema/Swelling	39	3.8	Respiratory Distress	5	3.5	Headache	11	3.2
Chest Pain	143	3.6	Chest Pain	26	2.3	Strange Behaviour	35	2.6	Overdose/Poisoning	29	2.8	Fever	4	2.8	Cough/Productive Cough	10	2.9
Generalised Body Weakness	118	2.9	Rash/Dermatitis	26	2.3	Head Injury	34	2.5	Vomiting	28	2.7	Gunshot Wounds	4	2.8	Overdose/Poisoning	10	2.9
Pregnancy- PV Bleeding	114	2.8	Head Injury	24	2.1	Seizures/ Fits/ Convulsions	32	2.3	Headache	16	1.6	Hyperglycaemia	4	2.8	Motor Vehicle Accident	10	2.9
Head Injury	84	2.1	Wound Sepsis	18	1.6	Generalised Body Weakness	31	2.3	Head Injury	16	1.6	Altered Level of Consciousness	4	2.8	Seizures/ Fits/ Convulsions	9	2.6
Overdose/Poisoning	75	1.9	Burns- Other	17	1.5	Motor Vehicle Accident	31	2.3	Motor Vehicle Accident	15	1.5	Oedema/Swelling	3	2.1	Post-Ictal	9	2.6
Motor Vehicle Accident	74	1.8	Pregnancy- PV Bleeding	16	1.4	PV Bleeding (Not Pregnant)	21	1.5	Respiratory Distress	14	1.4	Chest Pain	3	2.1	Pregnancy- PV Bleeding	7	2.1
Post-Ictal	63	1.6	Overdose/Poisoning	15	1.3	Dizziness	19	1.4	Abdominal Pain	13	1.3	Generalised Body Weakness	3	2.1	Hyperglycaemia	6	1.8
Rash/Dermatitis	43	1.1	Generalised Body Weakness	14	1.2	Fever	15	1.1	Gunshot Wounds	12	1.2	Post-Ictal	1	0.7	Head Injury	5	1.5
Fever	41	1.0	Foreign Body Retained	12	1.1	Overdose/Poisoning	13	0.9	Fever	11	1.1	Dislocation- Large Joint	1	0.7	Rash/Dermatitis	5	1.5
Dizziness	41	1.0	Motor Vehicle Accident	10	0.9	Burns- Other	12	0.9	Hypoglycaemia	11	1.1	Poor/Not Feeding	1	0.7	Wound Sepsis	5	1.5
Most Common Diagnoses (n=4006, 100%)			**Green (n=1123, 28.0%)**			**Yellow (n=1372, 32.2%)**			**Orange (n=1030, 25.7%)**			**Red (n=141, 3.5%)**			**Not Specified (n=340, 8.5%)**		
	n	%		n	%		n	%		n	%		n	%		n	%
J18.9- Pneumonia	281	7.0	None given	82	7.3	J18.9- Pneumonia	79	5.8	J18.9- Pneumonia	128	12.4	J18.9- Pneumonia	25	17.7	None given	15	4.4
None given	163	4.1	K52.9- Diarrhoea	52	4.6	K52.9- Diarrhoea	51	3.7	F29.X- Psychosis	66	6.4	R56.8- Convulsions	7	5.0	J18.9- Pneumonia	14	4.1
K52.9- Diarrhoea	139	3.5	L02.9- Abscess	50	4.5	S00.9-Superfical Head Injury	49	3.6	G40.9- Epilepsy	66	6.4	G40.9- Epilepsy	6	4.3	X99.99- Assault-sharp object	13	3.8
F29.X- Psychosis	130	3.2	S00.9-Superfical Head Injury	41	3.7	O03.3- ICA	46	3.4	A15.9- PTB	51	5.0	I50.9- Cardiac Failure	5	3.5	A15.9- PTB	11	3.2
S00.9-Superfical Head Injury	115	2.9	J18.9- Pneumonia	35	3.1	None given	43	3.1	J21.9- Bronchiolitis	31	3.0	X95.99- Assault-Gun	5	3.5	F29.X- Psychosis	10	2.9
A15.9- PTB	110	2.7	L03. 9- Cellulitis	33	2.9	X99.99- Assault-sharp object	43	3.1	K52.9- Diarrhoea	26	2.5	E10.1- DKA	5	3.5	S00.9-Superfical Head Injury	9	2.6
G40.9- Epilepsy	108	2.7	K29.9- Gastritis/Duodenitis	31	2.8	A09.9- Infective GE	41	3.0	R56.8- Convulsions	25	2.4	T50.9- Poisoning	4	2.8	G40.9- Epilepsy	9	2.6
X99.99- Assault-sharp object	97	2.4	R56.8- Convulsions	28	2.5	A15.9- PTB	37	2.7	J44.9- COPD	24	2.3	S27.11- Pneumo/haemothorax	4	2.8	T50.9- Poisoning	9	2.6
A09.9- Infective GE	86	2.1	F29.X- Psychosis- Psychosis	25	2.2	O20.0- Threatened Abortion	32	2.3	T50.9- Poisoning	23	2.2	A41.9-Severe Sepsis	4	2.8	A09.9- Infective GE	8	2.4
L02.9- Abscess	82	2.0	X99.99- Assault-sharp object	21	1.9	J21.9- Bronchiolitis	31	2.3	None given	21	2.0	K52.9- Diarrhoea	3	2.1	I64.X- -CVA	8	2.4
J21.9- Bronchiolitis	76	1.9	I82.9- DVT	19	1.7	F29.X- Psychosis	29	2.1	I64.X- -CVA	21	2.0	S00.9-Superfical Head Injury	3	2.1	R10.4- Abdominal Pain	8	2.4
L03. 9- Cellulitis	71	1.8	A09.9- Infective GE	18	1.6	L03. 9- Cellulitis	24	1.7	I50.9- Cardiac Failure	20	1.9	A15.9- PTB	3	2.1	K52.9- Diarrhoea	7	2.1
J21.9- Bronchiolitis	71	1.8	J06.9- URTI	17	1.5	K29.9- Gastritis/Duodenitis	24	1.7	X99.99- Assault-sharp object	19	1.8	K29.9- Gastritis/Duodenitis	3	2.1	I50.9- Cardiac Failure	7	2.1
K29.9- Gastritis/Duodenitis	70	1.7	N39.0- UTI	17	1.5	J06.9- URTI	24	1.7	A09.9- Infective GE	19	1.8	G03.9- Meningitis	3	2.1	S82.9- Ankle fracture	7	2.1
O03.3- ICA	65	1.6	M54.5- Back Pain	17	1.5	S82.9- Ankle fracture	24	1.7	J06.9- URTI	18	1.7	S06.90- Intracranial Injury	3	2.1	O03.3- ICA	6	1.8
J06.9- URTI	62	1.5	R52.9- Pain	16	1.4	S89.9- Lower leg injury	24	1.7	J45.9- Asthma	17	1.7	R41.8- Confusion/delirium	3	2.1	S27.11- Pneumo/ haemothorax	6	1.8
T50.9- Poisoning	60	1.5	T50.9- Poisoning	14	1.2	L02.9- Abscess	23	1.7	E16.2- Hypoglycaemia	16	1.6	J81.X- Pulmonary Oedema	3	2.1	L02.9- Abscess	5	1.5
I50.9- Cardiac Failure	59	1.5	S69.9- Hand/wrist Injury	14	1.2	I50.9- Cardiac Failure	20	1.5	A41.9-Severe Sepsis	14	1.4	None given	2	1.4	O20.0- Threatened Abortion	5	1.5
I64.X- CVA	51	1.3	R51.X- Headache	14	1.2	G03.9- Meningitis	19	1.4	S00.9-Superfical Head Injury	13	1.3	S02.92- Facial/Skull injury	2	1.4	T07.X- Multiple injuries	5	1.5
O20.0- Threatened Abortion	49	1.2	T30.X- Burn	13	1.2	N73.9- PID	19	1.4	L03. 9- Cellulitis	11	1.1	T07.X- Multiple injuries	2	1.4	D64.9- Anaemia	5	1.5

Table 3 provides the top five diagnoses associated with top ten presenting complaints. It also breaks down the diagnoses for each presenting complaint by triage priority. The presenting complaint recorded at triage and that reported by the clinician who consulted the patient correlate in 2830 (70.6%) of the 4006 encounters reviewed (r=0.71). There are 15 triage presentations with 100% correlation, all of these are from the miscellaneous group which presented less than 5 times. Strange behaviour (n=145, 92.4%), seizures/ fits/ convulsions (n=143, 88.8%), trauma (n=392, 83.2%) and cough/ productive cough (n=187, 83.1%) had the highest correlations of the 10 most common complaints. Correlations for oedema/swelling (n=174, 65.2%), shortness of breath (n=219, 63.2%) and pain (n=241, 60.1%) were lower. Overdose/poisoning and diarrhoea are other complaints that frequently present in the very

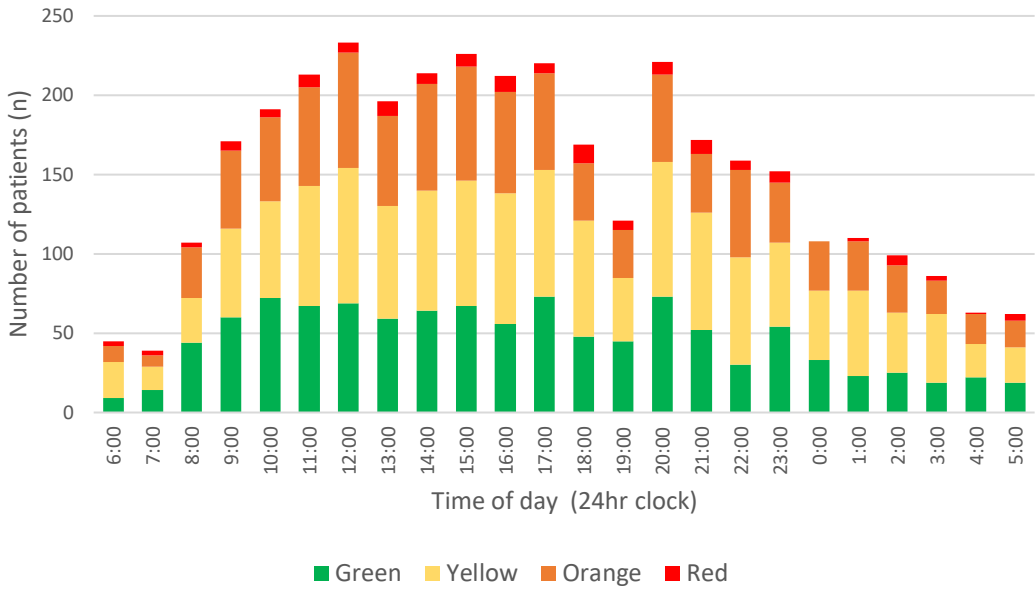
urgent or emergency triage categories- agreement was 82.7% (n=67) and 73.9% (n=153) for these respectively, whereas for generalised body weakness agreement was only 50.8%(n=60).

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

Most Common Diagnoses (n=4006, 100%)			Green (n=1123, 28.0%)			Yellow (n=1372, 32.2%)			Orange (n=1030, 25.7%)			Red (n=141, 3.5%)			Not Specified (n=340, 8.5%)		
	n	%		n	%		n	%		n	%		n	%		n	%
Trauma	**411**	**10.3**		**123**	**29.9**		**160**	**38.9**		**68**	**16.6**		**14**	**3.4**		**46**	**11.2**
X99.99- Assault-sharp object	92	22.4	X99.99- Assault-sharp object	19	15.4	X99.99- Assault-sharp object	40	25,0	X99.99- Assault-sharp object	19	27.9	S27.11- Pneumo/ haemothorax	3	21.4	X99.99- Assault-sharp object	13	28.3
S00.9- Superficial head Injury	41	10.0	S00.9- Superficial head Injury	16	13.0	S00.9- Superficial head Injury	18	11.3	S11.9- Neck injury- penetrating	6	8.8	S02.92- Facial/Skull injury	2	14.3	S27.11- Pneumo/ haemothorax	5	10.9
S27.11- Pneumo/ haemothorax	28	6.8	None given	15	12.2	S21.9- Thorax- penetrating injury	12	7.5	S27.11- Pneumo/ haemothorax	6	8.8	S21.9- Thorax- penetrating injury	2	14.3	S01.9- Head Injury- penetrating	3	6.5
S21.9- Thorax- penetrating injury	24	5.8	S69.9- Hand/wrist Injury	7	5.7	S27.11- Pneumo/ haemothorax	10	6.3	T07.X- Multiple injuries	5	7.4	None given	1	7.1	S05.9- Eye Injury	2	4.3
None given	24	5.8	S49.9-Shoulder/arm injury	6	4.9	None given	6	3.8	S00.9- Superficial head Injury	4	5.9	X95.99- Assault-Gun	1	7.1	S00.9- Superficial head Injury	2	4.3
Pain	**401**	**10**		**189**	**47.1**		**130**	**32, 7**		**44**	**11**		**5**	**1.2**		**32**	**8**
M54.5- Back pain	23	5.7	None given	25	13.2	S82.9- Ankle fracture	13	9.9	M54.5- Back pain	3	21.4	L02.9- Abscess	1	7.1	S82.9- Ankle fracture	4	8.7
S82.9- Ankle fracture	19	4.7	M54.5- Back pain	13	6.9	S89.9- Lower leg injury	8	6.1	J18.9- Pneumonia	3	21.4	J18.9- Pneumonia	1	7.1	None given	3	6.5
S89.9- Lower leg injury	15	3.7	I82.9- DVT	10	5.3	None given	6	4.6	N10.X- Pyelonephritis	2	14.3	A41.9- Severe sepsis	1	7.1	S62.X- Wrist/ Hand Fracture	2	4.3
L02.9- Abscess	14	3.5	L02.9- Abscess	8	4.2	M54.5- Back pain	6	4.6	M13.99- Arthritis	2	14.3	M72.6- Necrotising Fasciitis	1	7.1	R10.4- Abdominal pain	2	4.3
I82.9- DVT	14	3.5	R52.9- Pain	7	3.7	J18.9- Pneumonia	5	3.8	T07.X	2	14.3	E10.1- DKA	1	7.1	T50.9- Poisoning	2	4.3
Shortness of Breath	**347**	**8.7**		**27**	**7.8**		**90**	**25.9**		**178**	**51.3**		**23**	**6.6**		**29**	**8.4**
J18.9- Pneumonia	100	28.8	J18.9- Pneumonia	7	25.9	J18.9- Pneumonia	29	32.2	J18.9- Pneumonia	50	28.1	J18.9- Pneumonia	8	34.8	J18.9- Pneumonia	6	20.7
I50.9- Cardiac Failure	32	9.2	I50.9- Cardiac Failure	4	14.8	A15.9- PTB	9	10,0	A15.9- PTB	21	11.8	I50.9- Cardiac Failure	4	17.4	I50.9- Cardiac Failure	5	17.2
A15.9- PTB	32	9.2	J45.9- Asthma	3	11.1	I50.9- Cardiac Failure	8	8.9	J44.9- COPD	20	11.2	J81.X- Pulmonary Oedema	2	8.7	A15.9- PTB	2	6.9
J44.9- COPD	28	8.1	I10.X Hypertension	2	7.4	J45.9- Asthma	6	6.7	J45.9- Asthma	14	7.9	E10.1- DKA	2	8.7	R06.8- SOB	2	6.9
J45.9- Asthma	25	7.2	J44.9- COPD	2	7.4	J44.9- COPD	4	4.4	I50.9- Cardiac Failure	11	6.2	I44.3- AV Block	1	4.4	J20.9- Bronchitis	2	6.9
Abdominal Pain	**268**	**6.7**		**97**	**36.2**		**134**	**50**		**14**	**48.5**					**24**	**9**
R10.4- Abdominal pain	23	8.6	R10.4- Abdominal pain	10	10.3	N73.9- PID	12	9	K59.0- Constipation	1	7.7				K38.9- Appendicitis	3	12.5
K29.9- Gastritis/ Duodenitis	22	8.2	None given	9	9.3	K29.9- Gastritis/ Duodenitis	12	9	A41.9- Severe sepsis	1	7.7				R10.4- Abdominal pain	3	12.5
N73.9- PID	22	8.2	K29.9- Gastritis/ Duodenitis	8	8.2	None given	9	6.7	K27.9- PUD	1	7.7				K29.9- Gastritis/ Duodenitis	2	8.3
None given	20	7.5	N73.9- PID	7	7.2	R10.4- Abdominal pain	9	6.7	O21.9- Hyperemesis gravidarum	1	7.7				O20.0- Threatened Abortion	2	8.3
K38.9- Appendicitis	14	5.2	K38.9- Appendicitis	5	5.2	N39.0- UTI	8	6	R10.4- Abdominal pain	1	7.7				N73.9- PID	2	8.3
Oedema/Swelling	**267**	**6.7**		**127**	**45.6**		**79**	**25.6**		**39**	**14.6**		**3**	**1.1**		**19**	**7.1**
L02.9- Abscess	49	18.4	L02.9- Abscess	33	26,0	L03. 9- Cellulitis	12	15.2	L03. 9- Cellulitis	6	15.4	T78.4- Allergy	1	33.3	L02.9- Abscess	4	21.1
L03. 9- Cellulitis	38	14.2	L03. 9- Cellulitis	18	14.2	L02.9- Abscess	11	13.9	I82.9- DVT	3	15.4	I50.9- Cardiac Failure	1	33.3	R60.9- Oedema	3	15.8
I82.9- DVT	16	6.0	None given	10	7.9	I82.9- DVT	4	5.1	I50.9- Cardiac Failure	3	15.4	N17.9- Acute Renal Failure	1	33.3	L03. 9- Cellulitis	2	10.5
None given	13	4.9	I82.9- DVT	8	6.3	I50.9- Cardiac Failure	4	5.1	None given	2	15.4				I27.9- Cor Pulmonale	1	5.3
R60.9- Oedema	12	4.5	R60.9- Oedema	6	4.7	S00.9- Superficial head Injury	4	5.1	Y04.99- Assault- Bodily force	2	15.4				I64.X- -CVA	1	5.3
Cough/ Productive Cough	**225**	**5.5**		**36**	**16**		**69**	**32.7**		**92**	**40.9**		**12**	**5.3**		**10**	**4.4**
J18.9- Pneumonia	82	36.4	J18.9- Pneumonia	14	38.9	J21.9- Bronchiolitis	21	28.0	J18.9- Pneumonia	40	43.5	J18.9- Pneumonia	8	66.7	A15.9- PTB	4	40.0
J21.9- Bronchiolitis	44	19.6	J21.9- Bronchiolitis	5	13.9	J18.9- Pneumonia	17	22.7	J21.9- Bronchiolitis	17	18.5	A15.9- PTB	1	8.3	J18.9- Pneumonia	3	30.0
A15.9- PTB	27	12,0	A15.9- PTB	4	11.1	A15.9- PTB	10	13.3	J06.9- URTI	11	12.0	A39.4- Meningococcal Sepsis	1	8.3	I30.0 -Acute Pericarditis	1	10.0
J06.9- URTI	25	11.1	J06.9- URTI	4	11.1	J06.9- URTI	9	12.0	A15.9- PTB	8	8.7	J21.9- Bronchiolitis	1	8.3	None given	1	10.0
None given	6	2.7	A19.9- MTB	2	5.6	J05.X- Croup	3	4.0	A18.3- TB Abdo	2	2.2	R41.8- Confusion/delirium	1	8.3	J06.9- URTI	1	10.0
Diarrhoea	**211**	**5.3**		**70**	**33.2**		**32**	**20**		**53**	**25.1**		**7**	**3.3**		**12**	**5.7**
K52.9- Diarrhoea	90	42.7	K52.9- Diarrhoea	37	52.9	K52.9- Diarrhoea	29	42.0	K52.9- Diarrhoea	18	34.0	R57.9- Shock unspecified	2	28.6	K52.9- Diarrhoea	5	41.7
A09.9- Infective GE	39	18.5	A09.9- Infective GE	10	14.3	A09.9- Infective GE	21	30.4	Z00.8- Well patient	6	11.3	J18.9- Pneumonia	1	14.3	A09.9- Infective GE	4	33.3
K29.9- Gastritis/ Duodenitis	20	9.5	K29.9- Gastritis/Duodenitis	9	12.9	K29.9- Gastritis/ Duodenitis	5	7.2	K29.9- Gastritis/ Duodenitis	5	9.4	K29.9- Gastritis/ Duodenitis	1	14.3	A18.3- TB Abdo	1	8.3
K59.0- Constipation	8	3.8	K59.0- Constipation	4	5.7	K59.0- Constipation	2	2.9	A09.9- Infective GE	4	7.5	R41.8- Confusion/ delirium	1	14.3	K59.0- Constipation	1	8.3
Z00.8- Well patient	8	3.8	None given	3	4.3	A15.9- PTB	2	2.9	J18.9- Pneumonia	3	5.7	A41.9- Severe sepsis	1	14.3	J18.9- Pneumonia	1	8.3
Seizures/ Fits/ Convulsions	**161**	**4**		**38**	**23.6**		**35**	**22.3**		**64**	**39.8**		**18**	**11.2**		**9**	**5.6**
R56.8- Convulsions	59	36.6	R56.8- Convulsions	25	65.8	G40.9- Epilepsy	11	34.4	G40.9- Epilepsy	29	45.3	R56.8- Convulsions	7	38.9	G40.9- Epilepsy	4	44.4
G40.9- Epilepsy	56	34.8	G40.9- Epilepsy	7	18.4	R56.8- Convulsions	8	25.0	R56.8- Convulsions	16	25.0	G40.9- Epilepsy	5	27.8	R56.8- Convulsions	3	33.3
G03.9- Meningitis	5	3.1	H66.9- Otitis Media	2	5.3	F29.X- Psychosis	2	6.3	G03.9- Meningitis	3	4.7	G41.9- Status Epilepticus	2	11.1	A17.0- TB Meningitis	2	22.2
G40.0- Idiopathic Seizures	4	2.5	Z00.8- Well patient	1	2.6	G40.9- Epilepsy	2	6.3	None given	3	4.7	G03.9- Meningitis	1	5.6			
R41.8- Confusion/ delirium	3	1.9	G40.0- Idiopathic Seizures	1	2.6	K52.9- Diarrhoea	2	6.3	I64.X- CVA	2	3.1	G00.9- Bacterial Meningitis	1	5.6			
Strange Behaviour	**157**	**3.9**		**27**	**17.2**		**35**	**22.3**		**81**	**51.6**					**14**	**8.9**
F29.X Psychosis	118	75.2	F29.X- Psychosis	25	92.6	F29.X- Psychosis	25	71.4	F29.X- Psychosis	57	70.4				F29.X- Psychosis	10	71.4
F20.9- Schizophrenia	6	3.8	F30.9- Manic episode	2	7.4	F19.9- Substance intoxication	2	5.7	F20.9- Schizophrenia	5	6.2				Z00.8- Well patient	1	7.1
R41.8- Confusion/ delirium	5	3.2				R41.8- Confusion/ delirium	2	5.7	G40.9- Epilepsy	3	3.7				F20.9- Schizophrenia	1	7.1
G40.9- Epilepsy	3	1.9				F10.1- Alcohol abuse	1	2.9	R41.8- Confusion/ delirium	2	2.5				R41.8- Confusion/ delirium	1	7.1
F31.9- Bipolar Disorder	3	1.9				R44.3- Hallucinations	1	2.9	I64.X- CVA	2	2.5				F31.9- Bipolar Disorder	1	7.1
Vomiting	**153**	**3.9**		**45**	**29.4**		**61**	**39.9**		**28**	**18.3**		**6**	**3.9**		**11**	**7.6**
K52.9- Diarrhoea	24	15.7	K29.9- Gastritis/Duodenitis	10	22.2	K52.9- Diarrhoea	11	18.0	K52.9- Diarrhoea	4	14.3	K52.9- Diarrhoea	2	33.3	R11.X- Nausea/Vomiting	2	15.4
A09.9- Infective GE	16	10.5	A09.9- Infective GE	5	11.1	A09.9- Infective GE	8	13.1	J18.9- Pneumonia	3	10.7	A41.9- Severe sepsis	1	16.7	I64.X- CVA	2	15.4
K29.9- Gastritis/ Duodenitis	15	9.8	K52.9- Diarrhoea	5	11.1	K29.9- Gastritis/ Duodenitis	5	8.2	E10.1- DKA	2	7.1	A15.9- PTB	1	16.7	K52.9- Diarrhoea	2	15.4
R11.X- Nausea/Vomiting	13	8.5	R11.X- Nausea/Vomiting	4	8.9	R11.X- Nausea/Vomiting	5	8.2	R11.X- Nausea/Vomiting	2	7.1	J18.9- Pneumonia	1	16.7	K85.9- Pancreatitis	1	7.7
J18.9- Pneumonia	9	5.9	J06.9- URTI	2	4.4	O21.9- Hyperemesis gravidarum	5	8.2	None given	2	7.1	J06.9- URTI	1	16.7	C18.9- Colon Ca	1	7.7

The case load was higher in January (n=2161, 53.9%) compared to June (n=1845, 46.1%). There is little variation in triage acuity between summer and winter for all categories of the SATS(r=0.99). The predominant triage acuity in both months is yellow (urgent care), 608 cases (33.6%) in January and 562 cases (30.5%) in June. Presenting complaints show seasonal variation- 72.8% (n=153) of diarrhoea and 66.0% (n=101) of vomiting presents in the summer whereas 59% (n=153) of shortness of breath and 66.7% (n=150) of cough/productive cough cases are seen in winter. Trauma (n=231, 56.2%) and pain (n=225, 56.1%) related conditions are also more frequent in the summer month.

Figure 3 shows the variation in the case load and proportional triage acuities over 24 hours and 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	552	13.8	653	16.3	520	13.0	506	12.6	611	15.3	611	15.3	553	13.8	4006	100.0
Green	156	13.9	184	16.4	154	13.7	150	13.4	143	12.7	168	15.0	168	15.0	1123	28.0
Yellow	202	14.7	206	15.0	157	11.4	161	11.7	229	16.7	221	16.1	196	14.3	1372	34.2
Orange	136	13.2	170	16.5	153	14.9	125	12.1	168	16.3	151	14.7	127	12.3	1030	25.7
Red	19	13.5	28	19.9	10	7.1	20	14.2	26	18.4	16	11.3	22	15.6	141	3.5
Not Specified	39	11.5	65	19.1	46	13.5	50	14.7	45	13.2	55	16.2	40	11.8	340	8.5

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

Discussion

Presenting complaints at Khayelitsha EC resulted in a wide distribution across all categories of acuity. Intertwined with the varied acuity allocations were the eventual diagnoses, which were also fairly varied. In essence the specific presentations did not imply a specific acuity, nor a did they result in a common or uniform diagnosis. Although this may seem quite matter of fact, it is a valuable observation. Triage acuity on its own is one dimensional and lacks granularity; it only tells us the urgency that should be applied to treatment at initial presentation. It does not provide any information about the duration of an encounter or the resources required to manage it. For this more information is required. The presenting complaint relates acuity on arrival at the front door of the EC, whilst the diagnosis brings that acuity closer to disposition. In doing so it adds two additional dimensions to acuity that could provide information on resource requirements. This study is the first to define these aspects of the SATS using a large sample. Its findings can now be used to direct time in motion studies that can add another dimension to specific presenting complaint/ acuity/ diagnostic complexes. This will allow calculation of mean time requirements for different acuity groups which can in turn be used to direct staffing, quality and efficiency measures.

The case load acuity at Khayelitsha EC can be described as predominantly urgent (yellow) cases, with equal numbers of very urgent(orange) and non-urgent (green) cases. In keeping with the trends shown in previous studies in Western Cape, trauma was the most common presenting complaint in KDH(29,47). The prevalent mechanism was penetrating assault, most patients were low acuity cases with superficial injuries and in more severe cases the predominant diagnosis was pneumothorax or haemothorax. Common undifferentiated symptoms such as pain was due to back pain, trauma or deep vein thrombosis at low acuity and caused by pneumonia, severe sepsis, and diabetic ketoacidosis in more severe cases. Non-urgent cases presented with oedema from soft tissue problems such as cellulitis, whereas swelling was due to cardiac or renal failure in emergencies. Resource limitations and low staff to patient ratios result in average waiting time to consultation in excess of two hours in many emergency centres in the Western Cape(50,51). To advocate for appropriate resources in this setting, we need to describe the presentations that are seen and define the tasks and services required to diagnose and treat them. The MTS uses symptom based algorithms to assess acuity, and the ESI estimates individual resources in low acuity cases- these concepts and the individual needs of the South African EC remain to be described(9). Correctly identifying the chief complaint is crucial as it begins a sequence of events in which errors may impact patient care, patient flow and resource usage. Triage and clinician

presentations correlated in a high number of cases in this EC. This level of accuracy is encouraging in an overburdened, high acuity environment with time and communication restraints.

Describing the proportional frequency of presenting complaints in each triage acuity drew to attention the conditions that presented less frequently but with higher acuity. Research done specifically in the resuscitation area of Khayelitsha EC reported that the majority of acutely ill patients had medical complaints, it also described a high burden of HIV co-infection(49). Those findings were also reflected here: the most common high acuity symptom was shortness of breath (most often diagnosed as pneumonia or cardiac failure). Other common emergency presentations included seizures, postictal state, and strange behaviour. Pneumonia covers a broad range of infective pathologies including TB which may be under-represented here as EC patients may be awaiting confirmatory results, or simply documented as pneumonia. Comorbid conditions such as HIV, hypertension and diabetes were not reported with the primary diagnosis which was the focus of this study. Altered level of consciousness, respiratory distress, overdose and fever were symptoms reported in a small number of cases however a high proportion of these cases triaged as emergencies on the TEWS, these may be context specific presentations to be aware of.

Seasonal differences reflected outbreaks of pneumonia presenting with shortness of breath and cough in winter, and gastroenteritis presenting with diarrhoea and vomiting in January, although there was no difference in triage acuity between the months. Trauma presentations were more common in the summer months than in winter. Although higher numbers of patients were expected on the weekends, Monday was found to be the busiest day of the week with the highest proportion of emergency cases – possibly due to delayed presentation.

The study had a number of limitations. Twenty percent of patient encounters for January and June were not captured due to the time constraints of the SSM. Duplication of electronic folders and incomplete records resulted in a large number of encounters which were reviewed in the SSM being excluded. Scanned copies of handwritten notes on the Electronic Content Management system were illegible, missing pages or did not correspond to the correct patient in some cases. A single ICD 10 code was captured. In many cases the secondary code was used. These codes relate to mechanism of injury or symptoms and not the final diagnosis. Gynaecological conditions may be under-reported due to women's health referrals. It is likely that there were some coding errors in the data collection. These were audited by independently, manually cross-checking the data collection sheets with the

scanned triage forms repeated intervals to ensure a robust collection. However, given the incomplete source files, it is likely that some cases were incorrectly coded.

Conclusion

Presenting symptoms at Khayelitsha EC reflect the national burden of disease overall. Individual symptoms presented with varying priority and resulted in a variety of eventual diagnoses which showed differences across categories. Presenting complaints provide granularity to these otherwise undifferentiated triage priorities. Future research should focus on time-in-motion work to determine the mean clinical care time each of these complaints requires in order to reach a final disposition. This should allow a calculation of the mean clinical care time for each triage priority. In turn this can be turned into a calculation for optimal staffing and other resource requirements.

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Competing interests

There are no conflicts of interest to declare.

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PART C: ADDENDA

Relevant journal Instructions to Authors

The 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/clinical presentation 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/tachypnoe
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 malena 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		
RESPIRATORY DISTRESS	Often related to SOB/ Tachypnoea/Difficulty breathing, not airway related		

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- my verbosity notwithstanding there are not words to sufficiently thank you for your patience, and guidance at every step of this project. Thank you for running with my overzealous ideas in the beginning and for helping me complete something I feel proud of.

Thank you to my family and friends for your faith and support, and to Nicholas Elston for your spreadsheet magic. Finally, to my Mother- who is the definition of strength and determination, thank for always digging deep, aiming high, and never giving up- and pushing me to do the same.

Research Protocol

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

Vanessa Naidoo (MMed)[1], Michael McCaul[2], Stevan Bruijns[1]*

1. Division of Emergency Medicine, University of Cape Town
2. Biostatistics Unit, Stellenbosch University

* 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 (e.g.: 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 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 Khayelitsha informal settlement in the Cape Town metropolitan is the largest and most rapidly growing 'township' in the country. An estimated 500 000 people of low socioeconomic status are served by Khayelitsha hospital. The total bed capacity of the hospital is 230beds and requires high turnover in order to continuously provide services. Patients requiring a higher-level or prolonged care are referred to Tygerberg 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 Mitchell's Plain 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 Khayelitsha 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 (357/2016; 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 Khayelitsha 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. Khayelitsha EC sees approximately 3000 new patients each month. About 20% of the patients are children.

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

The bulk of the data were captured by four, second-year medical students who were collecting data for their Special Study Module project. The sample evaluated comprised of 6233 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.

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 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 (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 (called 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 Khayelitsha Hospital EC, Dr Sa'ad Lahri as well as the records department.

For this study, the four datasets will be merged and then cleaned. The students were unable to analyse 1328 patient encounters. These un-analysed encounters will now be analysed. In terms of cleaning, areas where the students made use of free text or highlighted missing fields (1354 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 50^{th} 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 Khayelitsha 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 (MMed 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 is 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 Mitchells Plain Hospital EC to create an even larger sample. The Mitchells Plain 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 MPhil masters dissertation.

Project timeline

EMDRC	Ethics	Facility approval	Additional data collection and data cleaning	Data analysis	Write up
1 month	1 month	1 month	3 weeks	2 months	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, Khayelitsha 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 Khayelitsha 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 Khayelitsha: 28km for 15 days @ R1.13/km- SARS rate)	R950.88
Total	**R1150.88**

The researchers will recover all budgeted item costs.

References

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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 6492
Email: sumayah.ariefdien@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

19 September 2016

HREC REF: 673/2016

Dr S Bruijns
Division of Emergency Medicine
c/o Ms Aileen Maas
E52.27
OMB

Dear Dr Bruijns

PROJECT TITLE: DESCRIBING THE MOST COMMON PRESENTING COMPLAINTS, THEIR PRIORITY AND CORRESPONDING DIAGNOSIS AT KHAYELITSHA EMERGENCY CENTRE (MMeD-candidate- Dr A Naidoo)

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

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 30 September 2017.

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.

We acknowledge that the student; Dr A Naidoo will also be involved in this study.

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 before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE