

**A descriptive study of an adult non- trauma emergency centre at a Cape Town
central referral hospital**

By

Vuyiswa Boitumelo Kubeka

MBCHB (UCT), DipPEC SA

KBKBOI001

1292632

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Supervisors: Assoc/Prof Peter Hodkinson

Dr Derrick Evans

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PART A: MANUSCRIPT IN ARTICLE FORMAT

A descriptive study of an adult non- trauma emergency centre at a Cape Town central referral hospital

Vuyiswa Boitumelo Kubeka*; Derrick Evans; Peter Hodgkinson.

*Corresponding Author Tel +2778 121 0216 Email kbkboi001@myuct.ac.za

Division of Emergency Medicine, University of Cape Town

F51, Old Main Building, Groote Schuur Hospital, Main Road, Observatory, Cape Town, 7935

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Abstract

Objective: The study evaluated the demographics and acuity of patients at a South African central referral hospital. The triage acuity, diagnosis and disposition from the Emergency Centre (EC) were assessed, and the impact of COVID19 initial lockdown on presentations as a secondary outcome.

Methods: Data were collected retrospectively from 1 March 2019 to 31 May 2020, including the first 2-month COVID 19 lockdown period. Data was entered electronically by EC staff for routine healthcare management processes, including final ICD 10 code diagnosis on leaving the EC.

Results: A total of 38477 patients were included, 20 excluded, with a mean of 2565 seen per month prior to the COVID lockdown when there were 1619 monthly. Lower acuity patients were largely either referred by a general practitioner or self-referred. Of the discharged patients, 64% were lower acuity. Some 57% of specialist referrals were high acuity. The top four disease categories were cardiovascular 15%, gastrointestinal and hepatobiliary 14%, neurology 13 % and respiratory 12%. Disposition for referral to an inpatient specialist was 42%. Patients discharged from the EC amounted to 35%. Total time in the EC for patients referred to an inpatient specialist were a median of 561 minutes and 23 minutes for discharged patients.

Conclusion: Central referral hospitals offer specialty and subspecialty services for emergency and outpatient presentations. A good deal of the patient load on the EC was relatively low acuity patients that might be more efficiently seen elsewhere such as subspecialty outpatient clinics to alleviate the burden on the EC, and to free it up for high acuity patients. This study can serve as a foundation for reflection on the use of a specialised central referral hospital EC as a resource in the healthcare system. We observed a global trend of decreased EC presentations during COVID19 lockdown period.

KEYWORDS: emergency centre, caseload, referral hospital, disposition, triage

African relevance

- Provides data on an African central referral hospital patient acuity, referral source, disease burden and length of stay in the EC for future quality improvement studies.
- The results of the study serve as a foundation for reflection on the use of central referral hospital EC as a resource in healthcare delivery.
- The study informs how an African central referral hospital was affected by the initial COVID 19 hard lockdown period.

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Introduction

There is an observed trend across the world of increased Emergency Centre (EC) usage and a dramatic rise in patient volume[1]. Emergency Medicine has been established for almost two decades in South Africa and research in the speciality is growing, including several studies to assess burden of disease and patient acuity presenting to ECs, [2-4] yet few describe a central referral hospital[5]. Central hospitals are the fourth and highest level of care and provides highly specialised referral units and multi-speciality clinical services [6]. The South African publicly funded healthcare system serves the low and middle income population, and operates in parallel to a privately funded healthcare system for those with medical insurance[7]. It has three components comprising Emergency Medical Services (patient transport), District Health Services (primary health care, (PHC) services), and Hospital Services (which include Regional Hospitals, Tertiary Hospitals, and Central Hospitals[8]. A hierarchy of referral allows for efficiency in healthcare delivery by reducing the burden that large volumes of low acuity patients could exert on the resources of a central referral hospital[9].

Emergency care systems evaluation and improvement depend on a detailed understanding of the proportion of disease burden that requires emergency care. With this knowledge, equitable allocation of resources can be planned to achieve the United Nations sustainable development goal of Good Health and Wellbeing [10].

The aim of the study was to evaluate the demographics and the acuity of patients presenting to a South African central referral hospital and to describe the final diagnosis and disposition.

During the various COVID-19 lockdowns, hospitals around the world have reported a decrease in attendance to the EC because of the COVID-19 lockdown regulations [11-13]. As a secondary outcome, this study assessed the impact of the initial SA COVID19 lockdown on EC presentations.

¹ EC- Emergency Centre, GSH-Groote Schuur Hospital, HECTIS-Hospital and Emergency Centre Tracking Information System, HREC-Human Research Ethics Committee, PHC- Primary Health Care, SA-South Africa, SATS- South African Triage Scale

Methodology

A descriptive, retrospective study was conducted at Groote Schuur Hospital's non-trauma emergency centre. Groote Schuur Hospital (GSH), in Cape Town, South Africa, is an 893 bed, central teaching hospital [14]. Services offered at the hospital include Emergency Medicine, General Medicine including Medical Subspecialties, Psychiatry, General Surgery including Surgical Subspecialties, Paediatrics and Obstetrics and Gynaecology. Patients under 13 years of age and obstetric patients (>28 weeks) present elsewhere. The EC is divided, with one section dedicated for trauma (injuries of less than 1 month duration); and the second, which the study was based on, offering services to all other medical and surgical emergencies. Although the hospital and the EC primarily function to provide tertiary care to patients referred from secondary hospitals around the Cape Town Metropole, the EC also offers secondary level care to patients referred from nearby community health centres (CHC). Patients that arrive at the EC are assessed using the South African Triage Scale (SATS) to determine their acuity[15]. According to SATS, patients are prioritized according to the urgency with which they should ideally be seen in, as red (immediately), orange (less than ten minutes), followed by yellow (less than 60 minutes), green (within four hours) and blue if a patient arrives deceased[15].

South Africa had one of the tightest “lockdown” states in the world prior to the first wave of COVID 19 infections. The public of SA were bound to their properties and only allowed out for essential (including medical purposes), from 27 March 2020 to 30 April 2020[16]. The study was conducted from 1 March 2019–31 March 2020; and 1 April 2020-31May 2020 for the initial COVID 19 lockdown period. All patients presenting to the EC were included in the study except those with incomplete data entries, referrals from inpatient wards, and patients triaged and “down referred” to PHC or other facilities before consultation by a doctor in the EC.

Data was extracted from an existing digital data capture system in use at the EC, known as the Hospital & Emergency Centre Tracking Information System (HECTIS). The investigator who is trained to use HECTIS was given access by the administrator of the system to download the data on an excel document. Patient identifiers and those with incomplete data were removed and the data was sent to the statistician. Operators (nursing staff, doctors and clerks) actively

enter patient data into the HECTIS system at various points throughout the patient's journey through the EC, culminating in the final diagnosis and disposition being entered by the doctor completing the discharge or admission. The final diagnosis, according to ICD10 code classification was further grouped into broader physiological system categories. Ethical approval from the University of Cape Town Human Research Ethics Committee (HREC) was obtained HREC reference 598/2020, as well as the Provincial and Hospital approval to conduct the study. De-identified data was exported into Microsoft Excel and then analysed using Stata version 14.

Results

A total of 38477 patients were included, 20 patients excluded. with results divided into pre lockdown data (1 March 2019 -31 March 2020) and lockdown data (1 April 2019 to May 2020). (Table 1)

Table 1 Patient and arrival characteristics, presented as n (%)

Variable	Total study period	March 2019 to March 2020	April to May 2020
Total number of patients	38,477	35,240	3,237
Mean number of patients per month	2,565	2,711	1,619
Age: Median [IQR]	51 [35, 64]	50 [34, 64]	51 [36, 65]
13-18 years	935 (2%)	850 (2%)	85 (3%)
19-29 years	5,561 (14%)	5,151 (15%)	410 (13%)
30-39 years	6,224 (16%)	5,718 (16%)	506 (16%)
40-49 years	5,866 (15%)	5,327 (15%)	539 (17%)
50-59 years	6,850 (18%)	6,263 (18%)	587 (18%)
60-69 years	6,530 (17%)	5,985 (17%)	545 (17%)
70-79 years	4,450 (12%)	4,037 (11%)	413 (13%)
80 years or older	2,061 (5%)	1,909 (5%)	152 (5%)
Sex (n=38,470)			
Female	19,967 (52%)	18,353 (52%)	1,614 (50%)
Male	18,503 (48%)	16,880 (48%)	1,623 (50%)

Referral source (n=38623)

Self-referral	21,841 (57%)	19,968 (56%)	1,873 (57%)
Direct EMS ¹	3,684 (10%)	3,281 (9%)	403 (12%)
CHC	2,767 (7%)	2,478 (7%)	289 (9%)
General Practitioner	4,297 (11%)	2,992 (11%)	305 (9%)
Referral for Investigations ²	2,944 (8%)	2,753 (8%)	191 (6%)
Direct referral to inpatient discipline	981 (3%)	886 (3%)	95 (3%)
Referrals from within institution ³	1,587 (4%)	1,507 (4%)	80 (2%)
Other ⁴	505(1%)	464(1%)	41(1%)
SATS Category ⁵			
Red	2,566 (7%)	2,274 (6%)	292 (9%)
Orange	16,149 (42%)	14,839 (42%)	1,310 (40%)
Yellow	11,557 (30%)	10,703 (30%)	854 (26%)
Green	8,104 (21%)	7,323 (21%)	781 (24%)
Untriaged	101 (0.3%)	101 (0.3%)	0 (0%)

¹ Direct EMS (Emergency Medical Services) are patients who are transported from home according to EMS personnel discretion. ²Referral for investigation includes patients who came to GSH specifically for radiological services like Computed Tomography.

³Referrals from elsewhere within the institution are patients referred from GSH outpatient department clinics. Other⁴, (includes results of transfers from other hospital which refers to those hospitals which are outside of GSH's drainage area within the Cape Metropole and South African Social Security Agency (SASSA) from patients whose sought assistance for social grants and patients brought to the EC by the South African Police Service). ⁵SATS (South African Triage Scale).

Acuity at presentation showed lower acuity triage in general practitioner and self-referrals (Fig 1). Acuity of presentations through the day, lower acuity (green) presentations seen in the daytime (Fig 2). Comparing the outcome of the visit and acuity, 64% of discharged patients were of lower acuity (green or yellow), and 57% of inpatient specialist referrals were high acuity patients (red and orange).

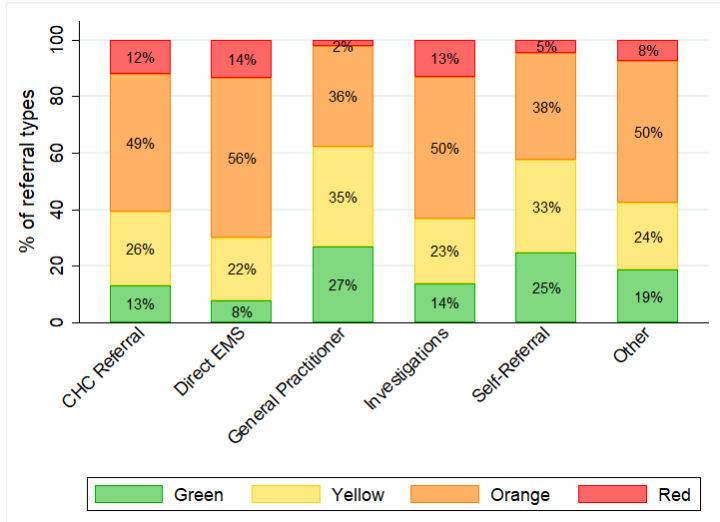


Figure1: Acuity by referral pattern (using SATS categories)

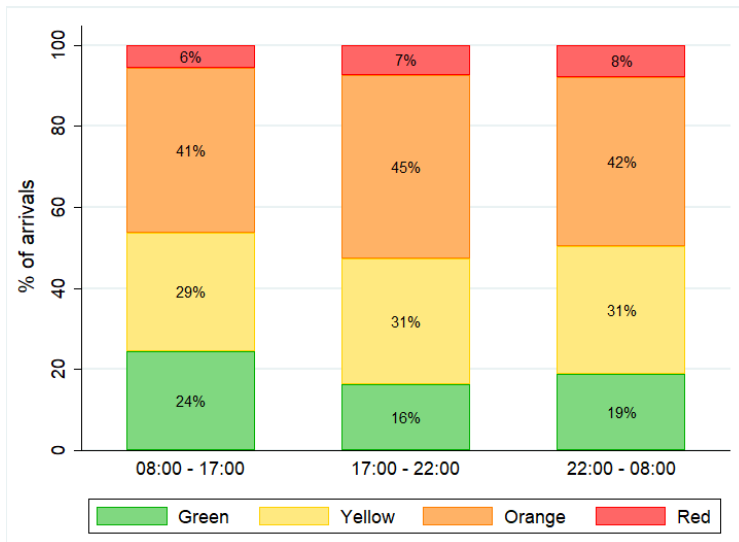


Figure2: Acuity by Time of Arrival

Monday and Tuesday saw the highest patient loads (mean of 90 and 92 a day respectively), and Saturday and Sunday the lowest (76 and 72 per day). An average of 85 patients presented on a Wednesday, Thursday or Friday.

A 2% increase in respiratory cases (from 11% to 13%) is shown in the COVID lockdown period. The top four diagnoses were respiratory, cardiovascular, gastrointestinal, and neurology (Table 2).

Table 2 Diagnostic groups of presenting patients, presented as n (%)

Variable	Total study period	March 2019 to March 2020	April to May 2020
Total number of presenting diseases ¹	39,276	35,671	3,605
Disease classification			
Cardiovascular	5,999 (15%)	5,442 (15%)	557 (15%)
Gastrointestinal & hepatobiliary	5,315 (14%)	4,879 (14%)	436 (12%)
Neurology	5,214 (13%)	4,743 (13%)	471 (13%)
Respiratory	4,534 (12%)	4,075 (11%)	459 (13%)
Communicable disease	2,276 (6%)	2,006 (6%)	270 (7%)
Psychiatric	2,224 (6%)	2,044 (6%)	180 (5%)
Urology	1,932 (5%)	760 (5%)	172 (5%)
Oncology	1,728 (4%)	1,567 (4%)	161 (4%)
Dermatology	1,689 (4%)	1,554 (4%)	135 (4%)
Endocrine	1,201 (3%)	1,041 (3%)	160 (4%)
Renal	1,174 (3%)	1,080 (3%)	94 (3%)
Musculoskeletal	1,016 (3%)	929 (3%)	87 (2%)
Vascular	615 (2%)	581 (2%)	34 (0.9%)
Haematology	524 (1%)	480 (1%)	44 (1%)
General surgery miscellaneous	499 (1%)	448 (1%)	51 (1%)
Rheumatology	464 (1%)	436 (1%)	28 (0.8%)
Social admission	439 (1%)	407 (1%)	32 (0.9%)
Gynaecology	396 (1%)	370 (1%)	26 (0.7%)
Undifferentiated pain	391 (1%)	370 (1%)	21 (0.6%)
Ear, Nose and Throat	341 (0.9%)	320 (0.9%)	21 (0.6%)
Trauma (> 1 month from onset)	266 (0.7%)	247 (0.7%)	19 (0.5%)
Ophthalmology	232 (0.6%)	210 (0.6%)	22 (0.6%)
Radiology	225 (0.6%)	164 (0.5%)	61 (2%)
Undifferentiated fatigue	118 (0.3%)	112 (0.3%)	6 (0.2%)
Metabolic	111 (0.3%)	99 (0.3%)	12 (0.3%)
Clinical governance cases ²	107 (0.3%)	98 (0.3%)	9 (0.2%)
Immunology	92 (0.2%)	71 (0.2%)	21 (0.6%)

Maxillofacial/dental	90 (0.2%)	77 (0.2%)	13 (0.4%)
Poison/toxin	57 (0.1%)	54 (0.2%)	3 (0.1%)
Environmental	5 (<0.1%)	5 (<0.1%)	0 (0%)
Unclassified congenital	2 (<0.1%)	2 (<0.1%)	0 (0%)

¹ Some patients had more than 1 presenting diagnosis recorded

² Clinical Governance are taken from HECTIS as non-disclosure clinical information, adverse effects not elsewhere classified.

Over the study period's total patient population, patients' disposition was either referral to a speciality (n=16230;42%), discharge home (n= 13519;35%), or (n=4038;10%) admission to the short stay unit (a unit attached to the EC for less than 48 hour stay). The remaining 13% included patients who absconded, were transferred back to secondary hospitals after imaging, and those who refused further hospital treatment. The top three speciality referrals during the study period were to medicine (n=6419;39%), surgery (n= 5554;34%) and psychiatry (n=1735;11%).

Arrival time to triage was consistently a median of eight minutes. Patients triaged red were appropriately seen faster, but notably, as with other higher acuities, took longer to diagnose, manage and refer (Fig 3).

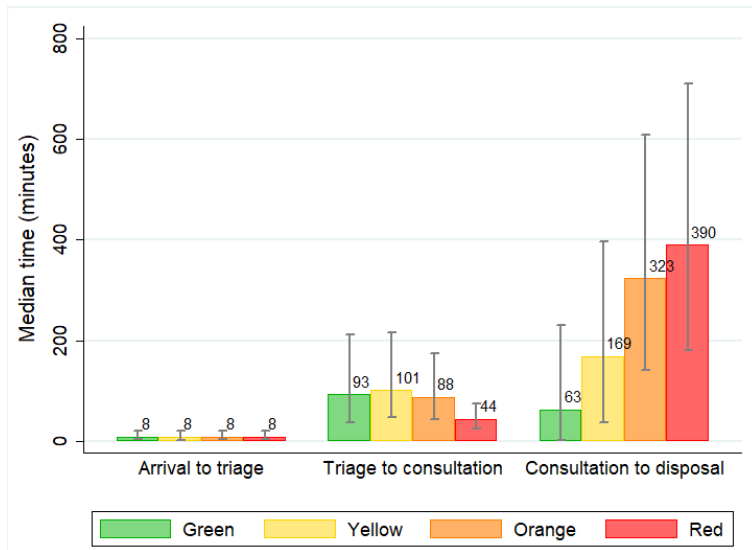


Figure 3: Median time for triage, consultation, disposal by SATS score

The median exit time for patients referred to a specialist was 561 minutes throughout the study period, while discharged patients' median exit time was 23 minutes. Exit time is calculated from the time the disposition is selected on HECTIS to the time the patient leaves the EC. Patients who were admitted to the short stay unit spent 217 minutes before exit and those transferred back to secondary hospitals has a median of 277 minutes.

Discussion

Our findings reflect the picture that this hospital EC (and thus the hospital overall) serves a dual purpose, as a tertiary, specialist referral centre, as well as a district hospital function for the surrounding suburbs. Whilst this is a not uncommon scenario for any referral hospital either through unnecessary referrals or patients' perceived urgency [17-19]. This places an additional burden on staff dealing not only with relatively minor but also undifferentiated patients, while dealing with complex referrals requiring specific integrated management and referral with other specialities. We found that referral patterns and acuity were fairly evenly spread throughout each 24-hour period (unlike prior and earlier studies in other nearby ECs, which showed higher

acuity after hours) [2-4]. During the early phases of the COVID lockdown, we found little change in the source and acuity of patients, but just the volume of patients overall markedly reduced, which mirrors the findings elsewhere[20, 21] . Although indicators for initial reception, triage and assessment suggest a well-functioning EC, there is a clear reflection of patients destined for admission spending an excess of time in the EC after referral to the inpatient teams. This is a clear reflection of access block in the hospital which hampers EC functioning in this hospital, along with many others in Cape Town and internationally [22-25].

A central referral hospital functions as a tertiary hospital to provide specialist and sub-specialist care and to use specialised technologies to provide patient centred care according to the complexity of presentations[26]. Besides that, it is characterised by the important academic roles of teaching and research[26]. Meeting the balance of patient focused care and exposing learners to an environment conducive to learning, places an additional cognitive demand on the EC staff, yet should be protected for good quality teaching and the benefit to the health system at large.

In a hierarchical referral pathway, the health facilities do not work in silos. The ideal pathway is for patients to first present to a PHC. If needed, will be referred to a secondary level hospital, which has limited specialist disciplines. Only a small subset that require a central referral hospital will be sent for urgent care [9]. Alternatively, directly to subspecialty outpatient clinics from the lower levels of care to alleviate the burden on the EC for non-urgent presentations.

The adequate functioning of the referral pathway to Groote Schuur Hospital has been hampered by several factors over the last few years. In 2013, the district hospital that serviced one of the busy surrounding areas was closed, and plans to build a new facility have not yet materialised. In 2016, the only 24-hour community health centre in this area was forced to close at night because of recurrent violence within the direct vicinity[27]. This has resulted in many patients seeking care at a central hospital for conditions that could have been potentially managed at primary or district level.

We found that a large proportion of patients were self-referred, although most of them were high acuity orange patients. Which is in contrast to past findings at a SA secondary hospital EC where many of the patients were self-referred, however, those patients were of lower acuity yellow and green patients [2].Patients that have been seen at various specialist clinics at GSH (including oncology) are often advised to present directly to Groote Schuur rather than their local facility should they have a medical issue. These patients would usually have more complex

medical conditions and this may be a factor that has contributed to the higher acuity triage of the self-presenting patients.

Interestingly, Mondays and Tuesdays are the busiest days of the week, Saturday and Sundays have lower patient numbers similar to two studies done at secondary level hospitals in the Western Cape[2, 28] We suspect that this is a historical health seeking behaviour pattern, as well as related to lack of transportation over weekends that influences this pattern, although this will require further investigation. GPs generally close their practice over weekends; therefore, patients wait to consult them on a Monday or Tuesday. During the day 53% are low acuity patients and in the evening, there is a slight reversal, higher acuity patients are over 50%. It will be useful for management to reference the statistics for staff allocation.

In contribution to data that describes the burden of disease at a tertiary hospital in South Africa, we found that the most common disease categories are similar to those observed in Paarl and George EC which are secondary level hospitals in Western Cape South Africa[2, 4]. A detailed study could offer information on public health surveillance and primary prevention strategies.

Access block is defined as a situation where patients cannot access a hospital bed within a reasonable time after EC management, with eight hours a standard in most international literature [29-31]. Overcrowding contributes to increased EC length of stay, which has a negative impact of increased morbidity and mortality on EC and admitted patients[32]. The time related metrics of our study show that discharged patients take an average of 23 minutes to exit the EC, markedly lower than patients who were referred to a speciality. Compared to a study done at a tertiary hospital in Pretoria SA, the mean consultation to disposition time of our study was 390 minutes for all patients, which is less than half of their finding of 808 min[5]. We also found that the time that contributes the longest to EC length of stay is the time spent post disposition decision, and it was longest for patients who were referred to another specialty. The median EC exit time post consultation in our study was 561 min compared to over 54 hours at a tertiary hospital in the same country[5]. There are context related factors that lead to these findings; however, both hospitals have challenges with output processes from the EC i.e., access block. Overcrowding has been shown to result in compromised medical care and decreased morale for health providers[29]. This is an EC which has a higher proportion of high acuity patients who

exert a higher cognitive and physical care burden on staff. An intervention that makes theoretical sense is to down refer low acuity patients, implying that they are inappropriately using a central referral hospital EC. However, even though multiple studies, have disproved association of EC inappropriate use with overcrowding[33-36], we need studies that look at the effect in EC with a high burden of high acuity patients in South Africa.

Other proposed interventions for our context are to address the availability of primary care after hours, including patient education to promote first contact at a primary care facility. Secondly, communication with private healthcare providers to adhere to the public hospital hierarchy of referral could make a meaningful difference. Last, expansion of after-hours radiological services to hospitals that refer to Groote Schuur Hospital is a need. Many high acuity patients were referred for urgent radiological investigations. Better access to the needed radiological service could improve patient outcomes.

During the COVID19 hard lockdown, a sharp decline in patient numbers was observed in the local and international literature[11, 13, 37]. A local district hospital observed a decline of EC presentations by 15%, we observed a 55% decline, likely because of the same reason of the fear of contracting COVID19 from the hospital[11]. Interestingly, they observed a higher increase of high acuity patients by 6%; we observed only a 2% increase at a hospital with ICU services. Also, mental health presentations declined, as seen in international literature[12]. However, the overall difference between the pre-lockdown and lockdown period for all study variables was marginal in absolute numbers. The data was collected during the first lockdown period, well before the first peak of COVID19, and the influx of critically ill COVID patients.

Limitations

In a system where live data is entered by busy clinicians, data entry errors are likely. There is a high turnover of medical staff at a teaching hospital, and many staff members were unfamiliar with the electronic record system, which was introduced in June 2018. During the period of study, one of the EC consultants monitored the correct use of HECTIS. We were limited by the data that was available on the HECTIS platform and thus could only make a rudimentary analysis, yet this data shows the research potentials of the platform.

Conclusion

Central referral hospitals offer specialty and subspecialty services for emergency and outpatient presentations. A good deal of the patient load on the EC was relatively low acuity patients that might be more efficiently seen elsewhere in the healthcare system to alleviate the burden on the EC, and to free it up for high acuity patients. This study can serve as a foundation for reflection on the use of a specialised central referral hospital EC as a resource in the healthcare system. This data for an African central referral hospital EC can be used for further quality improvement studies.

Dissemination of Results

The results of the study were shared with the staff at Groote Schuur Hospital through an informal presentation.

Authors' contribution

Authors contributed as follows to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising critically for important intellectual content:

VBK contributed 60%; PH 20%; DE 20%.

All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declared no conflicts of interest.

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PART B: APPENDICES

APPENDICES

Appendix B: Relevant journal instructions to Authors

Available at: <https://www.elsevier.com/journals/24ffrican-journal-of-emergency-medicine/2211-419X/guide-for-authors>

Appendix C: STROBE CHECKLIST

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	6	An observational study
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	6	Abstract
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	8	Introduction- Aim
Objectives	3	State specific objectives, including any prespecified hypotheses	8	Introduction
Methods				

Study design	4	Present key elements of study design early in the paper	9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	<p><i>(a) Cohort study</i>—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up.</p> <p><i>Case-control study</i>—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls.</p> <p><i>Cross-sectional study</i>—Give the eligibility criteria, and the sources and methods of selection of participants</p> <hr/> <p><i>(b) Cohort study</i>—For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i>—For matched studies, give matching criteria and the number of controls per case</p>	9 Inclusion Criteria
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	9 Methods Data collection
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group.	9 Methods
Bias	9	Describe any efforts to address potential sources of bias	9 All participants included except for

exclusion
criteria

Study size	10	Explain how the study size was arrived at	0
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Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why.	9	Methods
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9	Methods
		(b) Describe any methods used to examine subgroups and interactions		
		(c) Explain how missing data were addressed	9	Data excluded
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy		
		(e) Describe any sensitivity analyses		
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10-15	
		(b) Give reasons for non-participation at each stage		
		(c) Consider use of a flow diagram		
Descriptive data	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders	10-15	Tables/figures
		(b) Indicate number of participants with missing data for each variable of interest		

		(c) <i>Cohort study</i> —Summarise follow-up time (e.g., average and total amount)		
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	10-15	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure		
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-15	In text, tables, figures
		(b) Report category boundaries when continuous variables were categorized		
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		

Continued on next page

Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses		
Discussion				
Key results	18	Summarise key results with reference to study objectives	15-19	
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18	Limitation noted
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-19	
Generalisability	21	Discuss the generalisability (external validity) of the study results	15-19	
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	0	No funding

Appendix D: Research Proposal

A descriptive study of an adult non- trauma emergency centre at a Cape Town central referral hospital

by

Vuyiswa Boitumelo Kubeka

MBChB; DipPEC (SA)

KBKBOI001

This proposal is submitted in partial fulfilment of the requirements for the degree Masters of Medicine in the Faculty of Health Sciences at the University of Cape Town

Supervisors

Assoc. Prof Peter Hodkinson UCT

Dr Derrick Evans UCT

March 2020

A descriptive study of an adult non- trauma emergency centre at a Cape Town central referral hospital

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Declaration

I, Vuyiswa Boitumelo Kubeka, declare that the work on which this thesis is based is my original work (except where acknowledgements show otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university. I allow the University to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever. I further declare the following:

8. I know that plagiarism is a serious form of academic dishonesty.
9. I have read the document about avoiding plagiarism, am familiar with its contents and have avoided all forms of plagiarism mentioned there.
10. Where I have used the words of others, I have showed this by the use of quotation marks.
11. I have referenced all quotations, and I properly acknowledged other ideas borrowed from others.
12. I have not and shall not allow others to plagiarise my work.
13. I declare that this is my own work.
14. I am attaching the summary of the Turnitin match overview.

Signature.....VB Kubeka..... Date...March 2020.....

Abbreviations

CHC- Community Health Centre

GSH- Groote Schuur Hospital

HECTIS – Hospital & Emergency Centre Tracking Information System

EC- Emergency Centre

SATS- South African Triage Scale

Background

Although Emergency Medicine has been established in South Africa for almost two decades, there is a lack of literature describing the patients and their presentations to Emergency Centres (EC) in Sub-Saharan Africa[38]. Several studies have been conducted in Cape Town ECs, yet there are none describing a central referral hospital in South Africa[2, 28, 39, 40].

Adult medical (i.e., non- trauma) emergencies are managed at a dedicated EC at Groote Schuur Hospital, the central referral hospital for specialist and subspecialist care for a large area of the Cape Town Metropole and the Western Cape Province. The dual function of this EC is also to serve as a secondary level of care for several nearby Community Health care Centres. This gives the EC unique demands on its resources and affects the time to deliver services.

ECs face the challenge of an overwhelmed healthcare system and overcrowding daily. Overcrowding is a significant factor that influences patient care in the EC[41]. It has been shown that prolonged length of stay is associated with overcrowding and adverse outcomes, which result in decreased patient satisfaction[41]. Therefore, it is important to better understand the presentations, and the timing thereof, of conditions managed at an EC. The outcomes of a descriptive study of an EC could serve as a valuable resource for stakeholders to address factors that affect the efficiency of an EC.

Hospitals around the world have reported a decrease in attendance to the EC because of the COVID19 lockdown regulations[37]. As expected, presentations of minor conditions reduced. However, a decline in presentations of priority medical conditions such as stroke and acute myocardial infarction is harder to explain. Research could provide useful information to understand not only the lockdown impact but also factors around access to emergency care[37, 42]. The importance of understanding the effect of the lockdown is further highlighted by the concerning evidence that a reduction in presentations of acute myocardial infarction has contributed towards an increase of out-of-hospital cardiac arrests in Italy[43].

Motivation

The EC of a central referral hospital is a resource that requires efficient utilization as the highest health facility in the referral's hierarchy system. It is important to know the patient population demographics, burden of disease and time taken from triage to disposition while they manage patients in the EC. That information will help justify the use of the EC's resources.

Research question

What are the characteristics of patient presentations and their disposition in an adult non-trauma emergency centre of a central hospital in Cape Town?

AIM:

To evaluate patients presenting to a central referral hospital and to assess their journey from triage to disposition.

Objectives

1. To evaluate the acuity of patients who present to an emergency centre in a central hospital.
2. To determine the patient diagnosis that leads to disposition to the relevant speciality and sub specialities.
3. To assess the various time elements as a factor in service delivery.
4. To analyse the referral pattern of patients presenting to the EC.
5. To assess the effects of the COVID 19 lockdown on patient presentation.

Rationale

Study design and Setting

The study will be a descriptive study conducted at Groote Schuur Hospital's non-trauma EC analysing data collected retrospectively. The period chosen for the study is from 1 March 2019 - 29 February 2020 to account for seasonal variability; and 1 March 2020 - 31 May 2020 to include three months of the COVID 19 lockdown period.

Research procedures and data collection methods

Data will be collected from a digital data capture system at use at the emergency centre, Hospital & Emergency Centre Tracking Information System (HECTIS) (Appendix 1).

Operators (nursing staff, doctors and clerks) actively enter patient data into the HECTIS system at various points throughout the patient's journey through the EC. Following ethical and facility approval, a technician that operates HECTIS will provide data. The variables that will be requested for the study will include:

- Demographics: Age and Gender
- Acuity by SATS score
- Time to triage
- ICD10 Codes for Primary diagnosis
- Disposition of patients
- Average length of stay after disposition
- Patient referral facility

Inclusion Criteria

- Adult patients (>13 years of age) who present to the EC during the study period (1 March 2019 to 31 May 2020).

Exclusion Criteria

- Incomplete patient demographics and incomplete clinical diagnosis entries.
- Patients dead on arrival to the EC.
- Referrals from inpatient wards.
- Patient redirected to a Primary Health Care or other facilities (and not seen beyond triage at GSH EC).

Data management

Data will be collated onto Microsoft Excel and other statistical software for analysis and data stored on a password operated laptop (Appendix 2 Data Collection Variables). Data will be securely deleted after ultimate submission and feedback of the study.

Data analysis

The data collected will be nominal categorical data and continuous (time). The statistical analysis will include the use of frequency tables and percentages to present that data, and where appropriate graphical presentation of the data using histograms, line charts and pie charts to facilitate interpretation of the data set.

The variable assessing time to triage, time to consultation and time to exit will be assessed per month, using a descriptive data calculator to calculate the mean time over a month and present the findings of each month on an appropriate graph.

Where necessary with the assistance of the statistician, I will seek associations between categorical variables, using standard processes and a significant p value of $p < 0.05$.

Description of risks and benefits

The study is a descriptive study. The data collected will be de-identified before export and will not contain any direct reference to any individual patient or healthcare providers. This study is a retrospective observational study with no intervention, and it will have no impact on patient care.

The overall risk is related to legal processes concerning access to electronic data, including authorization for use and storage of data. Access to data and the storage of collected data is through a password-protected access, therefore the risk of breach of patient confidentiality is minimal.

The benefit of this study will come from serving as a document for stakeholders to plan an efficient Emergency Centre for public use.

Informed consent process

This research project involves only minimal risk to the participants and we therefore request a waiver of informed consent. As this will be a retrospective analysis of routinely collected data, taking individual consent will be impractical. There is no interest in individual patients, nor individual healthcare personnel.

An application for ethical approval for from the University of Cape Town Human Research Ethics Committee (HREC), followed by NHRD application for the research to take place at GSH, and to use the data from the HECTIS database will be made.

Privacy and confidentiality

The data used in the study will be entirely de-identified and anonymous with no direct link to a patient's folder number, name or address. No personal or identifying information will be reported on, and individual records will be identified only by a unique study number. As this is a retrospective study, there will be no influence on patient care.

Reimbursement for participation.

The design of this study is non experimental. There are no added costs or benefits for patient participation.

Strengths and limitations

The digital method of data collection offers the benefit of a complete dataset, likely having few cases with minimal or incomplete information that may result in exclusion of some data. There are gatekeepers in place on HECTIS e.g., a patient cannot be disposed from the system unless there is triage information, and an ICD 10 code or an entrance of time of disposal is recorded. These gatekeepers ensure good data, including rejecting the recording of duplicated data from the system.

During the process of ICD10 code recording, selection biases create a challenge. Clinicians using HECTIS may choose to not document multiple comorbidities by only entering the presenting primary diagnosis. Thus, limiting the exact representation of the burden of disease in the EC. This will be minimized by the use of the documented primary diagnosis as a reflection of the disease that needed medical attention at the time of presentation to the EC.

The retrospective use of manual record charts instead of the digital system during load shedding creates a limitation of incomplete documentation. This process will then be vulnerable to the mistakes during transfer of information from the paper-based register to the computer.

Dissemination of findings

Findings of the study will be presented to the stakeholders of C15 non-trauma emergency unit in the form of a document or a presentation upon invitation for resource planning and allocation, and written up for conference presentations and peer reviewed journals.

Timeline

	Months of 2020 and 2021									
	9	10	11	12	1	2	3	4	5	
Ethics Submission	x	x								
Provincial Approval			x	x						
Data collection					x	x				
Data management						x				
Statistical analysis							x			

Reporting of results							x	X	
Writing up					x	x	x	X	X
Preparation for submission and publication								X	X

Budget

RESEARCH ESSENTIAL	ESTIMATED COST
Statistician	R 2000
Stationery and Printing	R500
Data for literature review	R500

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Appendix 1: HECTIS DATABASE screenshots

HECTIS software operates through a password approved by an administrator.

Welcome to HECTIS

HECTIS

Hospital & Emergency Centre Tracking Information System

<https://www.westerncape.gov.za/department-of-health/coronavirus>

Login to HECTIS

Username

Password

They organise collated reports under a single tab

Emergency Centre Admissions Administration

User Management Reports Locked Records Episode Search Referral Search Manage PC Location Notification

- Patient Process Times
- Summary Reports
- Workload Reports
- Continued Quality Improvement (CQI)
- Other
- Clerk Reports
- Boarding Detail
- EC Status
- Documents Issued

Summarized reports on variables can be accessed.

Patient Process Times

- Waiting Times All Patients
- Waiting Times Non Psych Patients
- Waiting Times Psych Patients

Summary Reports

- Additional Nursing Tasks
- Triage Results
- Boarding
- Diagnoses by Category
- Paed Surge
- Nursing Management Report Latest
- EC Status on the Hour

Workload Reports

Continued Quality Improvement (CQI)

Other

- Absconder Detail
- Admissions
- Arrivals
- Disposals
- Cases for Review
- ICD Code Research Tool by Diagnosis
- ICD Code Research Tool by Diagnosis Group
- ICD Code Research EC Psych Codes
- Current Patient Population
- All EC Populations
- Patients with Temp or No Folder
- TB Screening
- Transfers
- Downtime Backup Status

Colours	Time To Triage	Time To Consult	Time To Disposal	Time To Exit	Total Stay	With Triage Time	With Consultant Time	With Disposal Time	With Exit Time	Total Records
Red	00:19	00:48	06:07	03:41	10:55	99	99	99	99	99
Orange	00:14	01:10	06:37	05:01	13:02	452	452	452	452	452
Yellow	00:26	01:05	05:43	05:21	12:32	292	292	292	292	292
Green	00:15	01:07	03:03	03:29	07:54	236	236	236	236	236
Untriaged	-	-	03:07	00:00	04:53	0	4	4	4	4
Total minus Absconders	00:18	01:06	05:33	04:38	11:33	1079	1083	1083	1083	1083
Absconders	00:06	03:01	05:07	00:00	08:23	6	4	6	6	6

Select a date range of less than 8 days to get a daily breakdown!

Appendix 2: Data Collection Variables

- Time and Date of Presentation
- Age
- Gender
- Acuity (Triage Score)
- Time to triage
- ICD 10 Diagnoses
- Disposition (Admit, Discharge, Refer, Died, etc)
- Time post Disposition
- Referral Facility (Name of referring hospital where applicable)



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



Room G50- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za

Website: www.health.uct.ac.za/fhs/research/humanethics/forms

06 October 2020

HREC REF: 598/2020

A/Prof P Hodkinson

Division of Emergency Medicine

F-51, OMB

Email: peter.hodkinson@uct.ac.za

Student: -kbkboi001@myuct.ac.za

Dear A/Prof Hodkinson

PROJECT TITLE: A DESCRIPTIVE STUDY OF AN ADULT NON-TRAUMA EMERGENCY CENTER AT A CAPE TOWN CENTRAL REFERRAL HOSPITAL -MASTERS CANDIDATE-DR VUYISWA KUBEKA

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.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020 & 06 July 2020.

Approval is granted for one year until the 30 October 2021.

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)

The HREC acknowledge that the student: - Dr Vuyiswa Kubeka will also be involved in this study.

Please quote the HREC REF in all your correspondence.

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

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

HREC/REF:598/2020sa

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice

(ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

APPENDIX F INSTITUTION APPROVAL LETTER



Department of Medicine

Active in clinical service, health education and research

J46.53 (J floor) Old Main Building, Groote Schuur Hospital
Observatory, 7925, Cape Town, South Africa

Tel: +27 21 406 6200 Fax: +27 21 448 6815

Email: Ntobeko.Ntusi@uct.ac.za

Website: www.medicine.uct.ac.za

Ntobeko A. B. Ntusi BSc (Hons) MBChB FCP(SA) MD DPhil Cert Cardiol Phys SA

Professor of Medicine

Chair and Head, Department of Medicine, University of Cape Town and Groote Schuur Hospital

Principal Investigator, Hatter Institute for Cardiovascular Research in Africa, University of Cape Town

Principal Investigator, Cape Universities Body Imaging Center, University of Cape Town

Collaborating Investigator, Wellcome Centre for Infectious Diseases Research in Africa

Director, Cardiovascular Magnetic Resonance Congress of South Africa

Editor-in-Chief, South African Heart Journal

Associate Editor, Circulation



08 October 2020

Mr Lionel Naidoo
GSH Research Committee
Management Suite
Old Main Building
Groote Schuur Hospital

Re: Permission for research to be conducted in GSH Emergency Centre by Emergency Medicine Registrar: Dr Boitumelo Kubeka

Dear Lionel,

I write in my capacity as the Chair and Head of the Department of Medicine, University of Cape Town and Groote Schuur Hospital to approve and support the use of retrospectively collected data from the GSH Emergency Center. Her research project has been approved by the UCT Humane Research Ethics Committee – study title: A descriptive study of an adult non-trauma emergency center at a Cape Town central referral hospital (HREC 598/2020). The project will be supervised by A/Prof Peter Hodkinson and Dr Derrick Evans.

This study is a retrospective review of routinely collected data on patients seen in the Emergency Centre and will have no impact on clinical services and will not require any additional resources or time from any staff member. An extract from the electronic database will be made, and the research team will maintain absolute security of patient details and confidentiality as detailed in the proposal.

It has my full support and will provide useful information for our service going forwards and is in keeping with our clinical governance priorities.

Yours sincerely,

Ntobeko Ntusi
Professor of Medicine and Chair & Head of Department
University of Cape Town & Groote Schuur Hospital