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## ORIGINAL ARTICLE

## Case mix of patients managed in the resuscitation area of a district-level public hospital in Cape Town



## Eventail des patients traités dans le service de réanimation d'un hôpital public de district au Cap, en Afrique du Sud

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## ABSTRACT

**Introduction:** At the core of the district health system is the emergency centre, for many the entry point into the healthcare system. Limited data is available on the patient population served by district-level emergency centres in South Africa. The objective of this study is to describe the case mix of adult patients managed in the resuscitation unit of a district-level hospital in the Western Cape.

**Methods:** A six-month prospective observational study was conducted in the resuscitation unit of Khayelitsha Hospital. Data were collected by clinicians in the unit by means of a Smartphone application on their own devices. Variables collected included patient demographics, patient acuity, patient comorbidities, diagnosis made in the unit, interventions received, length of stay, and disposition. Summary statistics were used to describe all variables.

**Results:** A total of 2324 patient admissions were analysed. The mean age was 36.9 years with a male predominance (n = 1367, 58.8%). Most patients were triaged into high-acuity categories (n = 1626, 70%). HIV infection was the most common comorbidity (n = 530, 22.8%). Acute medical (n = 1181, 50.8%) and trauma-related patients (n = 928, 39.9%) dominated the cohort. The median length of stay was 195 min and 502 (21.6%) patients were transferred to higher levels of care. There were 74 (3.2%) deaths.

**Conclusion:** This study yields novel epidemiological data of emergency care in a district-level emergency centre. It highlights the burden of trauma and acute medical emergencies at the district level and can be used as a foundation for further research to provide targeted and effective healthcare to all citizens.

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## ABSTRACT

**Introduction:** Le service des urgences se trouve au coeur du système de santé de district, constituant pour nombre de personnes le niveau d'entrée dans le système de santé. Des données limitées sont disponibles sur la population de patients desservie par les services des urgences de district en Afrique du Sud. L'objectif de cette étude est de décrire l'éventail des patients adultes pris en charge au sein du service de réanimation d'un hôpital de district dans la province du Cap occidental.

**Méthodes:** Une étude d'observation prospective de six mois a été réalisée au sein du service de réanimation de l'hôpital de Khayelitsha. Des données ont été recueillies par les médecins du service à l'aide d'une application pour mobiles utilisée sur leurs propres smartphones. Les variables recueillies étaient les informations démographiques sur les patients, la gravité de l'état des patients, les comorbidités des patients, le diagnostic établi dans le service, les interventions réalisées, la durée de séjour et la disposition. Des statistiques sommaires ont été utilisées pour décrire toutes les variables.

**Résultats:** Au total, 2324 admissions de patients ont été analysées. L'âge moyen était de 39,6 ans, avec une prédominance d'hommes (n = 1367, 58,8%). La plupart des patients étaient triés dans des catégories

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de fort degré de gravité (n = 1626, 70%). L'infection par le VIH constituait la comorbidité la plus fréquente (n = 530, 22,8%). Les patients souffrant de troubles médicaux graves (n = 1181, 50,8%) et victimes de traumatismes (n = 928, 39,9%) dominaient la cohorte. La durée moyenne de séjour était de 195 min et 502 (21,6%) patients ont été transférés vers un niveau de soins supérieur. 74 (3,2%) décès ont été enregistrés. *Conclusion:* Cette étude produit de nouvelles données épidémiologiques sur les soins d'urgence dans un services des urgences de district. Elle souligne l'importance des traumatismes et des urgences médicales graves au niveau du district et peut être utilisée comme base pour une étude supplémentaire afin de fournir des soins ciblés et efficaces à tous les citoyens.

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## African relevance

- This article provides novel epidemiological data of emergency care of a previously poorly described community.
- It highlights the burden of trauma and acute medical emergencies experienced at district level, where specialists are not always available.
- It can be used as a foundation for further research to provide targeted and effective healthcare to all citizens.

## Introduction

South Africa's health system faces a quadruple burden of disease: HIV/AIDS and tuberculosis; maternal and child morbidity and mortality; non-communicable diseases; and violence, injuries and trauma [1]. The health system consists of a large public (government funded) sector and a smaller private sector [2]. The public health sector has been decentralised and divided into health districts to ensure that citizens in every part of the country have access to a primary health care and district hospital services [3]. Primary-level health services are provided through local clinics and 24 h community health centres. Higher-level services are generally provided at hospitals categorised as district (level 1), regional, (level 2), or tertiary/central (level 3) hospitals [3]. The definition of and services offered at a district hospital often varies, but essentially consist of outpatient and inpatient services, a 24-h emergency service and an operating theatre [3]. District hospitals have less than 200 beds and provide basic diagnostic and therapeutic services [3]. Specialist services are not always available [3].

The district health system was identified in the National Development Plan 2030 as the vehicle of change for the re-engineering of health care at a primary level [4]. The Western Cape Department of Health subsequently aligned itself with the National Development Plan [5]. At the core of the district health system is the emergency centre, for many the entry level into the healthcare system.

Limited data is available of the patient population served by emergency centres on a district level in South Africa. Previous descriptive studies have been performed in the Western Cape, but focused on facilities at either a lower or higher level than district-level facilities [6–9]. Suitable data is necessary to allow adequate planning to ensure a health system that provides accessible, efficient and quality care to all citizens.

The aim of this study was to describe the case mix of adult patients managed in the resuscitation unit of Khayelitsha Hospital – a district level hospital in the Western Cape.

## Methods

A prospective descriptive study was conducted from 1 November 2014 to 30 April 2015. The study was approved by the Stellenbosch University Health Research Ethics Committee (Ref: N14/08/102) and included a waiver of informed consent.

Khayelitsha Hospital is a 240-bed district-level hospital situated in the sprawling township of Khayelitsha, Cape Town. It serves a

health district with a population of ±400,000, which is predominantly Black African (99%) with high levels of unemployment (38%) [10]. The geo-spatial legacy of apartheid and the tremendous burden of disease related to HIV, tuberculosis and interpersonal violence are major challenges that the hospital and its staff face on a day-to-day basis [11].

Khayelitsha Hospital provides surgical, medical, psychiatric, paediatric and obstetric inpatient services. It houses a large emergency centre, which is 30% larger than that of a standard district-level hospital emergency centre [12]. The emergency centre manages about 30,000 patients per annum with a 30% admission rate. The resuscitation unit consists of four beds and a paediatric cot. Each bed is equipped with its own monitor with blood pressure measurement, pulse oximetry, and capnography capabilities. A stocked emergency airway trolley, a defibrillator and ventilators are also available. The admission criteria to the resuscitation unit are either a high acuity score according to the South African Triage Scale (SATS) or at a senior practitioner's discretion [13].

All adult patients (≥ 13 years) managed in the resuscitation unit of Khayelitsha Hospital during the study period were eligible for inclusion. Patients with missing information were only excluded on the section pertaining to that particular variable.

The data were collected by means of a Smartphone application (app). This tailor-made app was made possible through a philanthropic gesture of JourneyApps, a South African-born international company based in California and South Africa (<http://journeyapps.com/>). The app was first tested in a pilot study in the unit. All doctors (n = 18) working in the resuscitation unit used their own Smartphone devices to download the app and collect data. The data collection was an additional step to the regular note keeping on the patients. The app proved to be a powerful paperless prospective data capturing tool with a high data capture rate and enjoyed a positive response from the clinicians. Quality control of the data involved retrospective cross-checking of all entered data points using the resuscitation unit's nursing register, the electronic patient administration system and the electronic clinical record system of Khayelitsha Hospital. Variables collected include patient demographics (age and gender), patient acuity, patient comorbidities, diagnosis made while in the unit, interventions received, time spent in the unit, and disposition from the resuscitation unit. The data on each physician's Smartphone was password protected as the application required that a user provides a unique personal password prior to use. The only traceable data point linking the patient to the captured data is the unique hospital number that each patient was allocated during admission to the hospital. The data captured via the app was immediately coded and stored directly onto a password protected server. JourneyApps manage highly personalised data (e.g. banking details) and run a powerful encrypted platform to prevent unauthorised access.

Captured data were crosschecked weekly against the nursing register and the hospital's electronic administration system. Patients not initially captured were retrospectively captured by means of a chart review.

Statistical analysis was performed using Microsoft Excel® and summary statistics were used to describe all variables.

## Results

A total of 2747 patients were managed in the resuscitation unit over the six-month period of which 423 were excluded (less than 13 years of age  $n = 342$ , patient's admission notes missing  $n = 81$ ). The final sample analysed was 2324 patients (mean per month 387.3; mean per day 12.9).

The mean age of patients was 36.9 years (standard deviation 16.2 years). A male predominance was noted ( $n = 1367$ , 58.8%), except in those over 50 years of age ( $n = 217$ , 45.5%) (Table 1).

The majority of patients were triaged into a high acuity triage category: 641 (27.6%) as emergency cases requiring immediate care (triage category: red) and 985 (42.4%) as very urgent cases (triage category: orange) (Fig. 1).

HIV infection was the most prevalent co-morbidity ( $n = 530$ , 22.8%), while hypertension ( $n = 382$ , 16.4%) and diabetes ( $n = 264$ , 11.3%) were also frequently present (Table 2).

Most admissions were either acute medical ( $n = 1181$ , 50.8%) or trauma-related ( $n = 928$ , 39.9%); a small percentage of cases related to obstetrics or gynaecology ( $n = 102$ , 4.4%), surgery ( $n = 97$ , 4.2%) or other ( $n = 16$ , 0.7%). Trauma-related admissions featured predominantly in all the age groups less than 50 years of age; penetrating assault being the most prevailing reason. Medical admissions were more frequently encountered in the over 50 age group, while overdoses accounted for 14.6% (152/1043) in patients 30 years of age or younger (Table 3). The majority of emergency cases (triaged red) had medical diagnosis, whilst patients with a trauma related diagnosis dominated the rest of the triage categories (Table 4).

Mobile X-rays were performed in 1562 (67.2%) patients, blood gas measurements in 1093 (47%) patients, and point of care ultrasound in 852 (36.6%) patients. Antibiotics were given to 1167 (50.2%) patients and 130 (5.5%) patients were intubated.

The median length of stay in the unit was 195 min (interquartile range 100–380 min, maximum 4020 min). Sixty-one (2.3%) patients were in the unit for 24 h or longer, 228 (8.5%) for 12 h or longer and 623 (23.4%) for six hours or longer.

A total of 1027 (44.1%) patients were referred to in-hospital disciplines, 511 (21.9%) patients were transferred to facilities where a higher level of care could be rendered, and 148 (6.3%) patients were discharged home. There were 74 (3.2%) deaths recorded; most in the patients older than 50 years ( $n = 26$ , 5.5%). The remaining patients ( $n = 564$ , 24.2%) were managed by the emergency centre staff.

## Discussion

This study describes the case mix of adult patients treated in a resuscitation unit in a district-level hospital in the Western Cape. It reveals a unit managing a large proportion of critically ill patients that require immediate resuscitation, stabilization and often referral to a tertiary facility. The patient population also mirrors the quadruple burden of disease experienced in South Africa [1]. To

the best of the authors' knowledge, this is the first published data of the case load managed by a district-level hospital in the Western Cape. Previous descriptive studies have been performed in community health care centres and regional healthcare facilities [6–9]. However, comparisons between datasets remain unsatisfactory due to differences in cohort size, study duration, study population and facilities' level of care.

On average, 13 patients were managed in the resuscitation unit per day. Notably, almost 30% of the patients were triaged into lower acuity categories (green and yellow) and the exact reason for this is likely multifactorial. A few contributory factors have been speculated. Firstly, an incorrectly applied triage score could have underestimated the severity of presentations. Secondly, the resuscitation unit is the area in the emergency centre with the highest level of care and therefore is used for patients who warrant procedural sedation. This leads onto the last point which is that Khayelitsha Hospital does not have a high care unit and the resuscitation unit is often used for this purpose. For example, a patient in acute renal failure might be categorised as non-urgent (green) according to the South African Triage Scale but would require careful fluid management that can only be accomplished in the resuscitation unit.

The patient profile in the study also reflects the quadruple burden of disease experienced in South Africa [1]. One in four patients in the database (23%) had documented HIV-infection; the most frequent comorbidity experienced (Table 2). This is considerably less than the 50% prevalence reported in medical patients attending the emergency centre of an urban district-level hospital in KwaZulu-Natal [14]. However, our cohort included all patient presentations and not only medical patients, this might explain the lower prevalence in our study since trauma patients aren't routinely tested.

The trauma burden (40%) is 4–14% higher than experienced at regional hospitals within the Western Cape, taking into account that the comparative numbers are outdated [7,9]. Although our numbers might be overinflated (only patients managed in the resuscitation unit and not the entire emergency centre), it still illustrates the need for continuous presence of a surgical team experienced in trauma – a service currently not available.

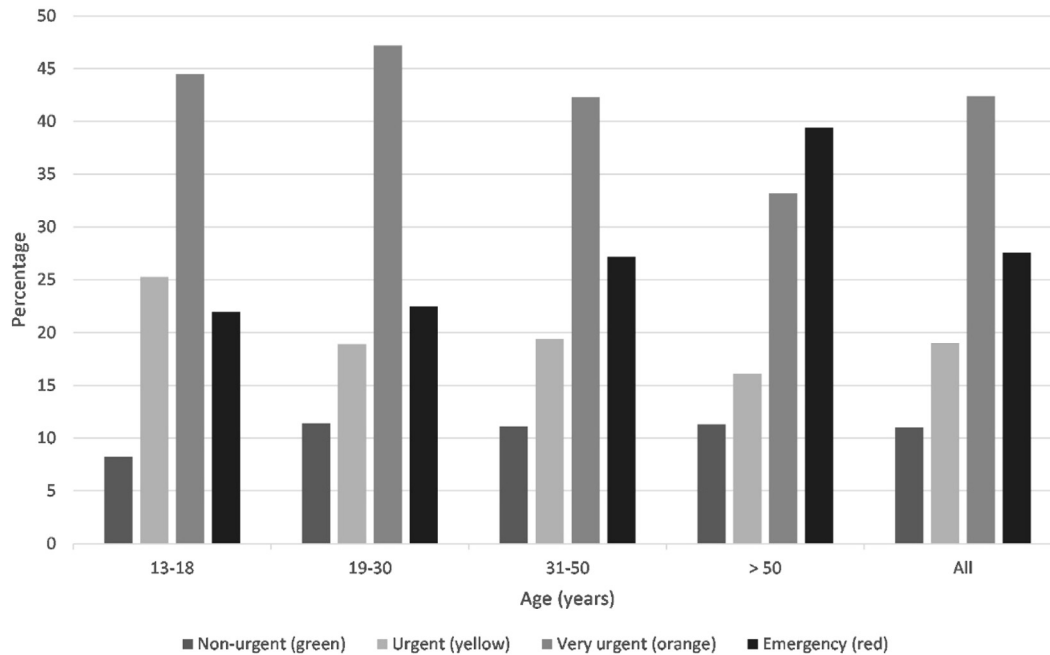
Non-communicable diseases were also frequently experienced. The prevalence of hypertension (16%) and diabetes (11%) reflects the burden of non-communicable diseases in the urban black population of Cape Town. Both these comorbidities still feature in the top 10 causes of death by non-communicable diseases [15], and suggests that current interventions need to be re-evaluated to reduce non-communicable diseases within the health district.

A third of patients (36.6%) had point-of-care ultrasound examinations. This is relatively low, considering that most of the diagnoses were amenable to ultrasound examination. Ultrasound could have aided clinical diagnoses or decisions made in patients with trauma (EFAST: Extended Focused Assessment with Sonography for Trauma), HIV/TB (FASH: Focused Assessment with Sonography for HIV/TB) and pneumonia (lung scan), to name a few. The most probable reason for this is the lack of training in the use of point-of-care ultrasound. Less than 20% of local healthcare professionals attending a point-of-care ultrasound course ultimately become accredited point-of-care ultrasound providers [16].

**Table 1**

Age and gender distribution of patients managed in the resuscitation area of Khayelitsha Hospital over a six-month period.

Age (years)	13–18	19–30	31–50	>50	All
	n (%)				
Male	103 (56.6)	552 (64.1)	495 (61.6)	217 (45.5)	1367 (58.8)
Female	79 (43.4)	309 (35.9)	309 (38.4)	260 (54.5)	957 (41.2)
Total	182 (7.8)	861 (37)	804 (34.6)	477 (20.5)	2324 (100)



**Fig. 1.** Triage categories of patients managed in the resuscitation area of Khayelitsha Hospital over a six-month period, overall and according to age.

**Table 2**

Comorbidities of patients managed in the resuscitation area of Khayelitsha Hospital over a six-month period, overall and according to age.

13–18 years	n (%)	19–30 years	n (%)
Nil	146 (80.2)	Nil	605 (70.3)
Pregnant	10 (5.5)	HIV	135 (15.7)
Epilepsy	10 (5.5)	Pregnant	66 (7.7)
HIV	6 (3.3)	Active TB	35 (4.1)
		Diabetes	17 (2.0)
31–50 years	n (%)	>50 years	n (%)
Nil	358 (44.5)	Hypertension	295 (61.8)
HIV	338 (42.0)	Diabetes	184 (38.6)
Hypertension	93 (11.6)	HIV	70 (14.7)
Active TB	80 (10.0)	Cardiac failure	52 (10.9)
Diabetes	66 (8.2)	Chronic kidney disease	39 (8.2)
All	n (%)		
Nil	1179 (50.7)		
HIV	530 (22.8)		
Hypertension	382 (16.4)		
Diabetes	264 (11.3)		
Active TB	142 (6.1)		

TB, tuberculosis.

**Table 3**

Diagnoses made in patients while managed in the resuscitation area of Khayelitsha Hospital over a six-month period.

13–18 years	n (%)	19–30 years	n (%)
Penetrating assault	57 (31.3)	Penetrating assault	332 (38.6)
Overdose	42 (23.1)	Blunt assault	110 (12.8)
Polytrauma	13 (7.1)	Overdose	101 (11.7)
O&G	8 (4.4)	Polytrauma	69 (8.0)
		O&G	59 (6.9)
31–50 years	n (%)	>50 years	n (%)
Penetrating assault	172 (21.4)	Pneumonia	93 (19.5)
Acute kidney injury	118 (14.7)	Delirium	88 (18.4)
Pneumonia	113 (14.1)	Acute pulmonary oedema	73 (15.3)
Delirium	91 (11.3)	Hyperglycaemia	45 (9.4)
Polytrauma	74 (9.2)	Hypoglycaemia	39 (8.2)
All	n (%)		
Penetrating assault	574 (25.0)		
Delirium	265 (11.4)		
Pneumonia	257 (11.0)		
Acute kidney injury	237 (10.1)		
Overdose	201 (8.6)		

O&G, Obstetrics & gynaecology.

Almost a quarter of patients experienced a prolonged length of stay ( $\geq 6$  h) in the resuscitation unit. Prolonged emergency centre length of stay should ideally be avoided as it is associated with adverse outcomes, decreased patient satisfaction, and emergency centre overcrowding [17]. Increased length of stay is often the result of a combination of factors (e.g. patient acuity, mechanical ventilation, diagnostic tests, etc.) and may be a symptom of bigger systematic problems hindering the delivery of efficient and high quality emergency care (e.g. access block). However, it is difficult to put the results from this study into context since only patients managed in a certain area within the bigger emergency centre were analysed. Further research is indicated since length of stay has become a surrogate or indicator of quality of care.

Several limitations affect the extrapolation of this study's findings. Firstly, the exclusive focus on the resuscitation unit and not the entire emergency centre could have resulted in over-

underestimation of some of the findings. Secondly, the study period (November–April) did not include traditionally colder months and one can hypothesize that more medical cases (e.g. pneumonia) would present if winter months were included. Lastly, the database was mainly populated by clinicians working in the resuscitation unit and some patients might not have been entered. Measures to ensure a high capture rate were in place and we are confident that missed patients were limited, and that their omission would not have influenced the outcome of the study significantly.

This study has brought to light common trends experienced at the district healthcare level. The evaluation of patients managed in the resuscitation unit at Khayelitsha Hospital provides novel epidemiological data of a previously poorly described community. Our study has highlighted the huge burden that trauma and acute medical emergencies have on the unit. There is scope for further research to provide a foundation for targeted, effective, and

**Table 4**

Top five diagnoses according to triage category in patients managed in the resuscitation area of Khayelitsha Hospital over a six-month period.

Non-urgent (Green)	n (%)	Urgent (Yellow)	n (%)
Penetrating assault	81 (32.6)	Penetrating assault	211 (47.7)
Fractured/dislocated limb	31 (12.1)	Fractured/dislocated limb	46 (10.4)
Blunt assault	22 (8.5)	Blunt assault	43 (9.7)
Acute kidney injury	20 (7.8)	Head injury	32 (7.2)
Head injury	20 (7.8)	Pneumonia	32 (7.2)
Very urgent (Orange)	n (%)	Emergency (Red)	n (%)
Overdose	180 (18.2)	Delirium	176 (27.4)
Penetrating assault	170 (17.2)	Pneumonia	122 (19.0)
Head injury	103 (10.4)	Penetrating assault	112 (17.4)
Pneumonia	94 (9.5)	Acute kidney injury	106 (16.5)
Delirium	89 (9.0)	Seizures	92 (14.3)

appropriate healthcare interventions, specifically aimed at district-level healthcare facilities.

#### Authors' contributions

LH had the original idea and wrote the first draft. All authors contributed to the acquisition of the data, analysis and interpretation of the data and contributed to the final paper. LH is the guarantor.

#### Conflicts of interest

The authors declare no conflicts of interest.

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