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## ORIGINAL RESEARCH

### Epidemiology of patients presenting to the emergency centre of Princess Marina Hospital in Gaborone, Botswana

*L'épidémiologie des patients se présentant au service des urgences de l'hôpital Princess Marina à Gaborone, au Botswana*

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**Introduction:** Emergency medicine is a newly recognized specialty in Botswana and the country launched an emergency medicine residency in January 2011. Data regarding the practice of emergency medicine in Botswana are limited. This study reviewed 1 year of patient presentations to the emergency centre of Princess Marina Hospital, the country's main referral hospital located in the capital city, Gaborone.

**Methods:** Epidemiologic data of all patients presenting to the emergency centre between May 2010 and April 2011 were extracted into a database. The diagnoses of a random sample of patient presentations were coded using the categories outlined by the Clinical Classifications Software (CCS) for ICD-10. For ease of analysis, several CCS categories were grouped together for subsequent analysis.

**Results:** 24,905 patient encounters were recorded during the study period. A large proportion of patients were aged between 25 and 50 years old. 20% of patients presented with a traumatic injury. The most common diagnoses across all ages included trauma, pregnancy complications, gastrointestinal disorders, and pneumonia.

**Conclusion:** These results can inform the development of emergency medicine education and acute care systems in Botswana.

**Introduction:** La médecine d'urgence est une spécialité qui n'a été reconnue que récemment au Botswana; le pays a inauguré une résidence en médecine d'urgence en janvier 2011. Les données relatives à la pratique de la médecine d'urgence au Botswana sont limitées. Cette étude s'intéresse aux patients qui se sont présentés au service des urgences de l'hôpital Princess Marina, le principal centre hospitalier du pays situé à Gaborone, la capitale, sur une année.

**Méthodes:** Les données épidémiologiques de tous les patients qui se sont présentés au service des urgences entre mai 2010 et avril 2011 ont été intégrées à une base de données. Les diagnostics d'un échantillon aléatoire de patients se présentant dans le service ont été codés au moyen des catégories du logiciel de classification des maladies pour la CIM-10. Afin de faciliter l'analyse, plusieurs logiciels de classification des maladies ont été regroupés en vue d'une analyse ultérieure.

**Résultats:** 24 905 interactions avec des patients ont été enregistrées au cours de la période concernée par l'étude. Une large proportion de patients se présentant aux urgences était âgée de 25 à 50 ans. Vingt pour cent d'entre eux souffraient d'un traumatisme. Les diagnostics les plus courants, tous âges confondus, étaient les traumatismes, les complications associées à la grossesse, les troubles gastro-intestinaux et les pneumonies.

**Conclusion:** Ces résultats peuvent étayer le développement de l'enseignement de la médecine d'urgence et les systèmes de prise en charge active au Botswana.

#### African relevance

- This study describes the burden of disease presenting to an African emergency centre.
- Understanding these data will help to direct the development of emergency care.

- Acute care epidemiology studies can inform regional referral systems in Africa.
- Trauma is a significant cause of emergency centre visits in Africa.

#### Introduction

In Botswana, epidemiologic data on emergency centre (EC) clinical presentations have rarely been recorded or published. Health reports from Botswana's Central Statistics Office report outpatient visits in the aggregate, combining EC and outpatient

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department visits. Regionally, relatively little information has been published on the general epidemiology of EC presentations in Sub-Saharan Africa.<sup>1-4</sup> This paper aims to provide descriptive statistics of EC presentations at the Princess Marina Hospital (PMH) in Gaborone, one of two tertiary referral centres in Botswana and the main teaching hospital for the University of Botswana. This study is intended to benefit policy makers, healthcare providers, and public health officials in Botswana to promote and define the specialty of emergency medicine (EM) and to allocate resources more effectively to address the country's acute care needs. It is also intended for a global audience interested in the development and management of emergency care in lower and middle income countries (LMICs).

To put EC statistics in perspective, it is useful to consider the demographics of Botswana, its health care system, and the history of EM in Southern Africa. Botswana is populated by approximately 2 million people, 61% of whom live in urban areas, and it is designated as a "middle income" country according to the World Bank.<sup>5,6</sup> It is bordered by South Africa, Zimbabwe, Zambia, and Namibia. Botswana has the world's second highest HIV prevalence at 24.8% of adults aged 15-49 years old.<sup>5</sup> The majority of the country's infectious disease burden is HIV-related, although the country also has high mortality and morbidity from trauma, non-communicable diseases, and other non-HIV-related communicable diseases.

PMH, a 525-bed facility in the capital city of Gaborone, sits at the apex of the public sector referral pyramid in Botswana. It offers the most complete range of specialty and subspecialty services available in the country. PMH also serves as the primary and secondary hospital for residents of Gaborone and its surrounding areas. Not surprisingly, the PMH emergency centre receives a broad spectrum of adult and paediatric patient presentations. Patients include those self-referred ("walk-in population"), referred from area clinics, and referred from hospitals in Botswana. Because pre-hospital emergency medical services consist of private ambulance companies and government ambulances generally used for inter-facility transfer, very few patients arrive to EC via ambulance directly from the field.

The specialty of EM is still in its infancy in southern Africa. South Africa has served as a regional leader in the field, having achieved specialty recognition in 2003 and initiating EM training in 2004. The Botswana Health Professions Council recognized the specialty of emergency medicine in 2009. In 2011, 2 years after inaugurating the country's first medical school, the University of Botswana launched an EM residency program, with a curriculum tailored to the country's resources and prevalent diseases.<sup>7</sup> Also in 2011, a national organization, the Botswana Society for Emergency Care, was founded to enhance collaboration, research, and capacity building within the country. With the continued development of EM as a specialty, significant improvement is expected to occur in emergency care, pre-hospital care, and disaster management and preparedness.

## Methods

Since 2006, the EC medical record has been completed on a standardized triage form with a carbon copy. Nurses trained in triage procedures enter patient demographics and triage information on the upper third of the form, and doctors write

their notes on the lower two-thirds. The original page stays with the patient's personal records when they leave the EC (after discharge or admission), while the carbon copy remains in the emergency centre. The content and format of the form has been updated several times in recent years to reflect evolving triage processes, most significantly in early 2010 when a modified version of the South African Triage Scale was implemented.<sup>8</sup> Health auxiliaries enter the selected data from the EC copy into a Microsoft Access database, including the patient's name, medical record number, age, sex, vital signs, triage category, referral source, presence of trauma, final diagnosis, and disposition.

For the purposes of this retrospective study, 1 year of data from 01 May 2010 to 30 April 2011 were selected for analysis. Extraction de-identified data prior to analysis by removing names and medical record numbers, storing it in an encrypted, password-protected Microsoft Excel file. Analysis categorized data by age groups: under 5, between 5 and <14, 14 to <25, 25 to <50, and over 50 years. For each group we randomly selected a sample of 10% of all presentations in each age range, and categorized diagnoses according to codes outlined by the Clinical Classifications Software (CCS) for ICD-10. Patients with multiple diagnoses listed were assigned multiple codes. CCS is a tool developed in the United States by the Agency for Healthcare Research and Quality (AHRQ) that codes diagnoses according to 285 unique categories.<sup>9</sup> To simplify reporting, some CCS codes were grouped together for subsequent analysis. Data analysis employed STATA version 12.0 and assessed statistical significance at the 95% confidence level.<sup>10</sup> We used chi-square goodness of fit test to compare the hypothesized population distribution, calculated from the total population, with the distribution in the diagnostic sample population.

Approval for the study was obtained from the University of Botswana, the Ministry of Health of Botswana, and the Princess Marina Hospital.

## Results

Over the 1-year period studied, 24,905 unique patient presentations were recorded in the database. We randomly selected 2417 patients for diagnosis coding using the CCS system. **Table 1** describes the age and sex distribution of the data sample. The largest proportion of patients was in the 25 to <50 year-old age group, and more women presented for care than men. Despite being a referral hospital, 30% of patients came directly to the PMH EC for care (self-referral) rather than going to a local clinic first.

Thirty-nine percent of patients were triaged as Yellow (3rd highest acuity), 36% were triaged as Orange (2nd highest acuity), and 5% were triaged as Red (highest acuity) (**Table 2**). Traumatic injury, as recorded by the triage officer in the presence of assault, fall, road traffic accident, or other injury, was recorded in 20% of patient presentations (**Table 1**).

**Fig. 1** describes diagnosis groupings coded for all age groups, demonstrating a predominance of infections, trauma, OB/Gyn conditions, and non-communicable diseases. **Table 3a** describes top diagnoses by all age groups, **3b through 3f** breaks top diagnoses down by age category (**table 3b through 3f** available as a data supplement). Diarrhoea and pneumonia were the most common diagnoses assigned to patients less than

**Table 1** Description of the study population and study sample.

	Census ( <i>n</i> = 24905)	Diagnoses coded ( <i>n</i> = 2417)	Chi <sup>2</sup> goodness of fit*
	<i>n</i> (%)	<i>n</i> (%)	<i>p</i> -Value
Age (in years)			0.37
Under 5	2883 (11.6)	270 (11.2)	
Between 5 and <14	1437 (5.8)	131 (5.4)	
Between 14 and <25	4696 (18.9)	430 (17.8)	
Between 25 and <50	11,719 (47.0)	1186 (49.1)	
50 and over	4050 (16.3)	400 (16.5)	
Missing	120 (0.4)	0 (0)	
Sex			0.97
Male	11,379 (45.7)	1104 (45.7)	
Female	13,356 (53.6)	1298 (53.7)	
Missing	170 (0.7)	15 (0.6)	
Referrals			0.53
Referred	16,129 (64.8)	1586 (65.6)	
Self-referred	7706 (30.9)	736 (30.4)	
Missing	1070 (4.3)	95 (3.9)	
Presentation of traumatic injury			0.15
None documented	18,761 (75.3)	1814 (75.0)	
Trauma	4885 (19.6)	509 (21.1)	
Missing	1259 (5.1)	94 (3.9)	
Disposition			0.40
Admitted	10,429 (41.9)	1077 (44.6)	
Discharged	11,887 (47.7)	1185 (49.0)	
Died in EC	55 (0.2)	4 (0.2)	
Missing**	2534 (10.2)	151 (6.3)	

EC, Emergency Centre.

^ Includes falls, assaults, road traffic accidents, etc.

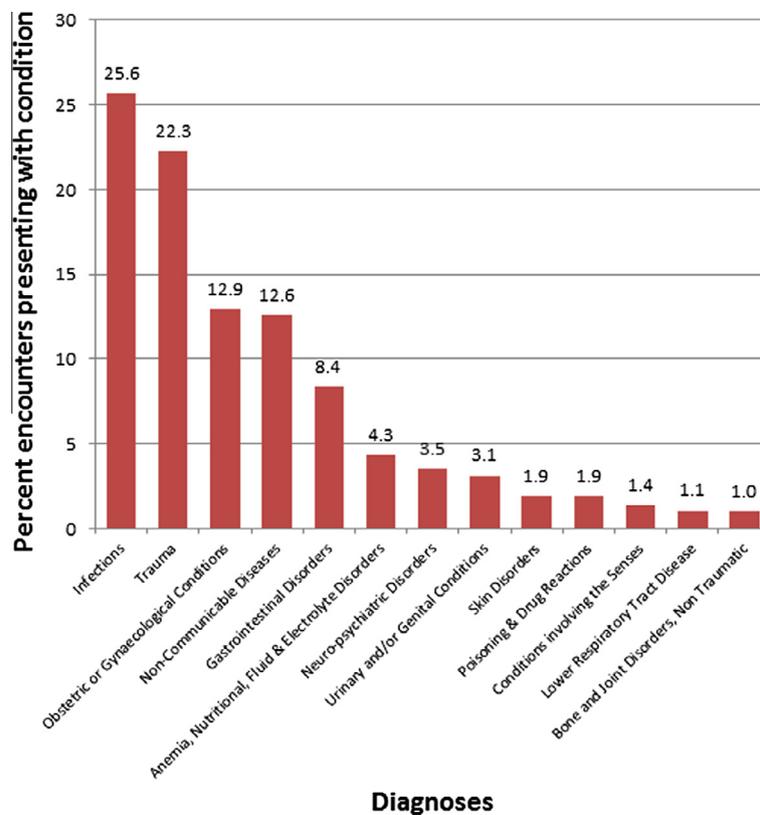
\* Statistical significance suggests a poor goodness of fit unlikely to be due to chance.

\*\* Missing disposition includes left without being seen, brought in dead, and transferred to mortuary.

**Table 2** Triage category by age.

Age (in years)	Triage Category <i>n</i> (%)						Total
	Red	Orange	Yellow	Green	Brought in dead	Missing	
0 to <5	289 (10)	1356 (47)	710 (24.6)	208 (7.2)	100 (3.5)	220 (7.6)	2883 (100)
5 to <14	89 (6.2)	486 (33.8)	597 (41.5)	142 (9.9)	10 (0.7)	113 (7.9)	1437 (100)
14 to <25	152 (3.2)	1544 (32.9)	1994 (42.5)	586 (12.5)	33 (0.7)	387 (8.2)	4696 (100)
25 to <50	570 (4.9)	4198 (35.8)	4856 (41.4)	1057 (9)	148 (1.3)	890 (7.6)	11,719 (100)
50+	264 (6.5)	1368 (33.8)	1578 (39)	407 (10)	121 (3)	312 (7.7)	4050 (100)
Missing	5 (4.2)	49 (40.8)	38 (31.7)	9 (7.5)	4 (3.3)	15 (12.5)	120 (100)
Total	1369 (5.5)	9001 (36.1)	9773 (39.2)	2409 (9.7)	416 (1.7)	1937 (7.8)	24,905 (100)

Red, highest acuity; Orange, second highest acuity; Yellow, third highest acuity; Green, lowest acuity.



**Figure 1** Diagnoses coded for all age groups.

5 years of age. Older children (5 to < 14) commonly presented with injuries, other gastrointestinal disorders (excluding diarrhoea), and pneumonia. Young adults (14 to < 25) presented with pregnancy complications, injuries, and other gastrointestinal disorders. Adults aged 25 to < 50 presented with pregnancy complications, injuries, other gastrointestinal disorders, anaemia, and menstrual and pelvic disorders. Adults over 50 commonly presented with other gastrointestinal disorders, heart disease, and injuries.

Forty-two percent of patients were admitted to the hospital for further care, 48% were discharged home after evaluation and treatment in the EC, and 0.2% died in the department (Table 1). Of the 2409 patients that were triaged Green, 1154 were self-referred, and of these 961 were discharged home.

## Discussion

In our study period, the PMH EC cared for an average of 68 patients per day, many of who were critically ill. The large numbers of self-referred patients and patients presenting with low triage scores (Green) may indicate an opportunity for system wide improvements in health facility referral and utilization practices. Given the high discharge rate of self-referred patients who were triaged Green (83% discharged home), a policy could be considered to redirect these patients to lower level facilities rather than utilizing limited EC resources. The effect of such a policy however, may be limited, since international experience has shown that high acuity patients requiring admission utilize the bulk of EC resources.<sup>11</sup>

One fifth of all patients presented following traumatic injury, although more data are needed to evaluate the severity

and mechanisms involved. This prevalence of traumatic injuries reflects the clinical experience of the authors working at PMH, and is predominantly associated with road traffic accidents. According to the Motor Vehicle Accident Fund of Botswana, a para-statal third party insurer, there were 26.5 fatalities attributable to road traffic accidents per 100,000 people in Botswana in 2011.<sup>12</sup> This high burden of disease highlights the need to improve road safety and the acute management of trauma.

Paediatric conditions managed in the EC reflect a high burden of diarrhoea and pneumonia in the under-5 year age range. With the recent introduction of the *Haemophilus influenzae* and *Streptococcus pneumoniae* vaccines into the national immunization program, the burden of these communicable diseases may decrease with time. Clinical guidelines are currently utilized in the EC for the management of paediatric diarrhoea, dehydration, and pneumonia. The predominance of injuries in older children emphasizes the need to continue to educate the public on preventive interventions such as the usage of seat belts and infant car seats. Miscarriage was a common diagnosis in adults of childbearing age. Given the large number of pregnancy complications managed in the EC, a “vaginal bleeding” protocol could be beneficial to standardize and improve care in this population.

Several hidden diagnoses may not have been recognized by this study, including HIV and sepsis. Doctors working in the EC usually do not describe a patient’s HIV status in the diagnosis, although they often recognize that they are in fact managing a complication of HIV. This may be associated with the pervasive social stigma that continues to be associated with the disease. HIV status (positive, negative, or unknown) has

**Table 3a** Most Common diagnoses coded, all ages.\*

Top diagnosis	Frequency	Percent
Traumatic injury	340	12.45
Fractures and traumatic joint injuries	268	9.82
Pregnancy complications	263	9.63
Gastrointestinal disorders (excluding gastroenteritis)	229	8.39
Pneumonia	130	4.76
Anaemia, nutritional, fluid and electrolyte disorders	118	4.32
Meningitis/encephalitis/other CNS conditions	101	3.7
Menstrual and pelvic inflammatory disorders	90	3.3
Gastroenteritis	86	3.15
Tuberculosis	76	2.78
Cardiac disease (MI, dysrhythmia, CHF)	63	2.31
Cancer	60	2.2
Skin disorders	53	1.94
Poisoning and drug reaction	52	1.9
Epilepsy, convulsions	50	1.83
Hypertension	48	1.76
Mental conditions (grouped)	46	1.68
Urinary tract conditions	44	1.61
Renal conditions (grouped)	44	1.61
Upper respiratory infection	44	1.61
Asthma and COPD	44	1.61
Cerebral-vascular disease/TBI (grouped)	33	1.21
Diabetes mellitus and other endocrine disorders	30	1.1
Lower respiratory tract disease	29	1.06
Male genital disorders	29	1.06
Bone and joint disorders, non-traumatic	27	0.99
Eye disorders	22	0.81
Peripheral vascular/lymphatic disease	21	0.77
Ear and sense organ disorders	15	0.55
Female genital disorders	12	0.44
Other infections or conditions	263	9.63
Total	2730	100

\* As investigators could code up to a maximum of three diagnoses for the same patient, the total exceeds the number of patients sampled for the study.

recently been integrated into the triage form but is not currently recorded in the database. Reports from the PMH adult medical wards indicate that the prevalence of HIV among admitted adult patient is between 50% and 66% (Haas personal communication). Similarly, sepsis is not commonly recorded on the diagnosis line of the triage form. Many septic patients have their diagnosis recorded as: fever, pneumonia, hypotension, or other related categories. An internal audit conducted in 2010 showed that 3.3% of all adult admissions from the EC had fever and tachycardia suggestive of sepsis.

Limitations of this retrospective study are mainly a result of the data collection methods. Omissions occurred in cases where an EC nurse or doctor left relevant sections of the triage form blank. Further data loss occurred when health auxiliaries entered the data incompletely or incorrectly into the computerized database. Additional limitations were related to the analysis of the diagnoses of individual patients. Multiple diagnoses were often coded for individual patient presentations when a single CCS code could not reflect the database text. For example, a single patient with multiple traumatic injuries could have been assigned codes for “head injury” and “extremity fracture,” and a single patient with pneumonia could have been assigned codes for “HIV” and “pneumonia” and “sepsis”. It was decided to allow for multiple diagnosis codes in these situations rather than to introduce additional biases associated

with the subjective determination of which diagnosis was “primary”. Also, the diagnosis recorded on the EC triage form may not always accurately reflect the patient’s final diagnosis, especially in the case of admitted patients. Delays in obtaining results from the laboratory and the inherent delays associated with microbiologic classification of common diseases like tuberculosis and cryptococcal meningitis both lead to refinement of admitted patients’ diagnoses over time. Unless a manual search of ward admission and discharge logs were to be performed, it is not currently possible to match the EC diagnoses, recorded in the EC database, to patients’ subsequent diagnoses at the time of discharge or outpatient follow up. Lastly, each patient was coded into the various CCS diagnoses by one of three authors and the inter-rater reliability of the categorization was not measured; however, given the brevity of the diagnoses listed in the EC database, we do not believe that categorization by multiple coders significantly altered our findings.

This study provides the first description of patients presenting to a referral hospital emergency department in Botswana. It provides valuable data on the demographics and epidemiology of these patients. The data can, in turn, inform and guide the allocation of national resources towards emergency care, pre-hospital care, injury prevention campaigns, emergency medicine education, and clinical guideline development.

The Botswana Ministry of Health has recently begun to implement a national electronic medical record system. If successful, it will allow for the real-time tracking of patient demographics, diagnoses, disease epidemiology, laboratory results, and seasonal trends.

#### Conflict of interest

We have no conflict of interest to declare.

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#### Supplementary files

Supplementary files associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.afjem.2013.12.004>.

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