

The Burden of Acute Disease in Mahajanga, Madagascar and Dar Es Salaam, Tanzania:

A Comparative Study

by

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ABSTRACT

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Background: The burden of acute disease in sub-Saharan Africa is severely under-documented. Efforts to target care within the region are limited by a lack of direction regarding the most appropriate disease patterns on which to focus both research and funding. This is a comparative study of disease prevalence between the countries of Madagascar and Tanzania, intended to accomplish two primary goals. The first is to present the most common diseases afflicting each region in order to reveal the most urgent needs. With this information the international emergency medicine community as well as policy-makers may begin to address the respective needs of each country from an informed perspective. The second goal is to compare this data to better understand the effects of varying geopolitical circumstances on disease patterns. I posit that the approach to the diseases presented here must be in a country-specific, and not region-specific manner (e.g. sub-Saharan).

Objective: To characterize, quantify, and compare the burden of acute disease in Madagascar and Tanzania.

Methods: Clinical patient charts were reviewed from major hospitals in both countries. Diagnoses were coded using international conventions and entered into computer databases. Analyses regarding the frequency of various diseases were performed.

Results: Trauma is the most common acute pathology overall and across all age groups in Madagascar. Similarly, trauma is overall the most common pathology in Tanzania, but infectious disease is more prevalent in patients less than 5 and less than 18 years of age. Given that trauma represents 48% of disease in Madagascar and 25% in Tanzania, it is likely that the disparity amongst pediatric patients is due to a higher risk of traumatic injury in Madagascar, and not a higher risk of pediatric infectious disease in Tanzania.

Conclusion: Madagascar and Tanzania share many of the same patterns and frequencies of acute disease. Traumatic injury should be the main thrust of clinical and public health initiatives in both countries, as it represents the bulk of their acute disease burden. However, infectious disease should be the focus of pediatric emergency research in Tanzania, whereas trauma prevention should have the lion's share of pediatric emergency effort in Madagascar.

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PRIOR PUBLICATIONS AND PRESENTATIONS

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CHAPTER 1

Introduction

The burden of acute disease in sub-Saharan Africa is severely under-documented.[1] Efforts to target care within the region are limited by a lack of direction regarding the most appropriate disease patterns on which to focus both research and funding. This is a comparative study of disease prevalence between the countries of Madagascar and Tanzania, intended to accomplish two primary goals. The first is to present the most common diseases afflicting each region in order to reveal the most urgent needs. With this information the international emergency medicine community as well as policy-makers may begin to address the respective needs of each country from an informed perspective. The second goal is to compare this data to better understand the effects of varying geopolitical circumstances on disease patterns. I posit that the approach to the diseases presented here must be in a country-specific, and not region-specific manner (e.g. sub-Saharan).

Locations

Madagascar

Madagascar is an island in the Indian Ocean off the coast of Mozambique. It spans an area of 587,041 square kilometers, which equates to slightly less than twice the size of the state of Arizona. It is home to the Malagasy people who, after a period of French rule between 1896 and 1960, formed the current Republic of Madagascar now

headed by President Hery Martial Rajaonarimampianina Rakotoarimana. The current population as estimated in July 2013 is 22,599,098.[2]

The healthcare system in Madagascar is organized in hierarchical fashion. Each of the six provinces has a central hospital, and there exist several other local hospitals, dispensaries, maternal centers, and mobile health units. The two largest hospitals in the country are the Centre Hôpitalier Universitaire (CHU) Antananarivo with 1300 beds, and the CHU Mahajanga with 400 beds. These institutions are home to the country's two medical schools. The CHU Antananarivo is home to the country's only emergency medicine residency program, one of only a few in Africa. It is structured as a 3 year specialization after internship.[3]

This portion of the study was performed in the northern province of Mahajanga, at the Centre Hôpitalier de Mahajanga (CHUM). The CHUM is the region's only tertiary care referral center. It is a hospital with a mixed intensive care and emergency medicine unit known as the Unité des Urgences et Soins Intensifs. The unit is staffed by one to two attendings, two residents, and a team of medical students.

Tanzania

Tanzania is also located in sub-Saharan Africa, on the eastern shore bordering the Indian Ocean, with Kenya as its northern border and Mozambique as its southern border. It covers 947,300 square kilometers, which is about twice the size of the state of California. Tanzania was originally split into Tanganyika and Zanzibar, both ruled by Britain until the early 1960's. The two countries merged into modern day Tanzania in

1964, a republic now headed by President Jakaya Kikwete. The current population as estimated in July 2013 is 48,261,942.[4]

The healthcare system in Tanzania is organized in a hierarchical fashion, similar to Madagascar. At the top of this pyramid are the referral/consultant hospitals, followed by regional hospitals, then district hospitals, and below that health centers, then dispensaries, and finally the most basic - village health posts. Tanzania has recently seen the development of emergency medicine as a specialty, with the first residency training program based out of Muhimbili National Referral Hospital.[5]

The second portion of the study was performed at Muhimbili National Referral Hospital (MNRH), a national referral hospital boasting 1,500 beds. It has an independent emergency medicine unit staffed by a cohort of teaching attendings, junior, and senior level residents, interns, and visiting medical students.[6]

CHAPTER 2

Methods

Data Collection

Data from MNRH was collected on all emergency department patients presenting between February 2010 through December 2011. There were a total of 58,887 complete records. Data from the CHUM was collected on all emergency department patients presenting between January 2011 and September 2012. These dates corresponded with the longest contiguous period from which complete CHUM archives were available. There were a total of 5,138 complete records. This information was entered manually into a Microsoft Excel spreadsheet from a handwritten patient registry. Data collected included age, sex, mode of transport, referral status, date and time of service and discharge, entry and exit diagnoses, system-based categorization, and disposition including transfer destination.

Exclusion Criteria

All patients for whom complete data was available were included in analysis. Patients who had no diagnosis available or who were declared “dead on arrival” and not evaluated or treated in the unit were excluded from analysis.

Data Analysis

Diagnoses were manually coded into Clinical Classifications Software (CCS) multi-level categories. All CCS categorizations were reviewed by at least two researchers.

CHAPTER 3

Findings

Table 1. Muhimbili National Hospital – DEMOGRAPHICS

	ALL	M	F	Unknown Sex
Median age	30	30	30	28
Age categories				
<5	7976 (13%)	4624	3321	31
<18	14334 (24%)	8416	5865	53
>=18	40761 (69%)	24841	15744	176
Missing age	3792 (6%)	2346	1365	81
TOTAL	58887	35603	22974	310

Table 2. Centre Hôpitalier de Mahajanga – DEMOGRAPHICS

	ALL	M	F	Unknown Sex
Median age	31	34	31	7
Age categories				
<5	138 (2.7%)	1	2	135
<18	844 (16.4%)	144	195	505
>=18	4263 (83.0%)	2585	1678	0
Missing age	31 (0.6%)	22	9	0
TOTAL	5138	2751	1882	505

Table 3. Muhimbili National Hospital – TOP 25 DIAGNOSES (ALL AGES)

CCS category	Number of patients	As % of group
Mental Illness, unspecified	3516	5.97%
Intracranial injury	3185	5.41%
Anemia	3048	5.18%
Other infections; including parasitic*	2361	4.01%
Other and unspecified fracture	1898	3.22%
Retention of urine	1537	2.61%
Fracture of tibia and fibula	1537	2.61%
Fracture of lower limb	1476	2.51%
HIV infection	1436	2.44%
Other ear and sense organ disorders**	1354	2.30%
Pneumonia (except TB or STD)	1325	2.25%
Tuberculosis	1312	2.23%
Injury and poisoning	1274	2.16%
Acute but ill-defined CVA	1165	1.98%
Congestive heart failure	998	1.69%
Schizophrenia and other psychotic disorders	992	1.68%
Other intestinal obstruction	862	1.46%
Cancer of cervix	826	1.40%
Fracture of upper limb	791	1.34%
Hypertensive heart and/or renal disease	781	1.33%
Burns	780	1.32%
Sickle cell anemia	703	1.19%
Hypertension	668	1.13%
Open wounds	641	1.09%
Intestinal infection	637	1.08%

Table 4. Centre Hôpitalier de Mahajanga – TOP 25 DIAGNOSES (ALL AGES)

CCS category	Number of patients	As % of group
Superficial injury; contusion	670	13.04%
Open wounds of head; neck; and trunk	341	6.64%
Open wounds of extremities	297	5.78%
Intracranial injury	241	4.69%
Injury and poisoning	229	4.46%
Somatoform disorders	157	3.06%
Other gram negative septicemia	120	2.34%
Intestinal infection	114	2.22%
Alcohol-related disorders	100	1.95%
Poisoning by other medications and drugs	92	1.79%
Appendicitis and other appendiceal conditions	87	1.69%
Hypertension with complications and 2° hypertension	85	1.65%
Pneumonia (except that caused by TB or STD)	76	1.48%
Other infections; including parasitic*	75	1.46%
Heart failure	71	1.38%
Infectious and parasitic diseases (unspecified)	65	1.27%
Tuberculosis	63	1.23%
Open wounds	63	1.23%
Convulsions	55	1.07%
Poisoning by nonmedical substances	54	1.05%
Abdominal pain	51	0.99%
Calculus of kidney	48	0.93%
Fracture of radius and ulna	48	0.93%
Intracranial hemorrhage (nontraumatic)	47	0.91%
Fracture of tibia and fibula	46	0.90%

Table 5.

Muhimbili National Hospital – SELECT AGGREGATE DISEASE CATEGORIES

Disease Category	All Ages	<5	<18	≥18
Trauma	25%	15%	23%	25%
Infectious	17%	37%	28%	14%
Mental Health	7%	0%	2%	10%
Neoplasms	5%	1%	2%	7%
Pregnancy-related	2%	0%	0%	2%

Table 6.

Centre Hôpitalier de Mahajanga – SELECT AGGREGATE DISEASE CATEGORIES

Disease Category	All Ages	<5	<18	≥18
Trauma	48%	83%	70%	44%
Infectious	15%	4%	11%	15%
Mental Health	6%	1%	5%	6%
Pregnancy-related	1%	0%	1%	1%
Neoplasms	1%	0%	0%	1%

CHAPTER 4

Discussion

Data Comparison

Tables 1 and 2 report the demographic makeup of each patient population. Both sets have a similar male predominance, 61% in Tanzania and 59% in Madagascar. The median age of both is also similar, 30 years in Tanzania and 31 years in Madagascar. Of note, the median age of unknown gendered patients in Madagascar was 7 years old. This is because gender data was not routinely recorded for pediatric patients.

Tables 3 and 4 display the 25 most common individual disease classifications at Muhimbili National Referral Hospital and at the Centre Hôpitalier Universitaire de Mahajanga, respectively.

Tables 5 and 6 take individual disease classifications (the 25 most common of which are presented in tables 1 and 2), and consolidate them into five broader categories, Trauma, Infectious, Mental Health, Pregnancy-Related, and Neoplasms. These were chosen as representative of key issues affecting many lesser-developed countries.

In comparing the two countries regarding this data, it is evident that trauma is the most common acute pathology overall and across all age groups in Madagascar. Similarly, trauma is overall the most common pathology in Tanzania, but infectious disease is more prevalent in patients less than 5 and less than 18 years of age. Given that trauma represents 48% of disease in Madagascar and 25% in Tanzania, it is likely that the disparity amongst pediatric patients is due to a higher risk of traumatic injury in Madagascar, and not a higher risk of pediatric infectious disease in Tanzania.

Going Forward

This study presents the most prevalent acute disease patterns seen in both countries. This data can be used in regard to the management of these diseases in order to effect pertinent change.

Trauma

It is evident from this study that trauma is the most common acute disease presenting to emergency departments in both Tanzania and Madagascar. What then can be done to improve the management of traumatic injury in these regions? The approach should be two-pronged, one being improved quality of care and the other preventative.

A cross-sectional survey of first-referral health facilities across Tanzania demonstrated that advanced trauma-related life-saving interventions such as chest tube thoracostomy, open fracture management, and caesarean section delivery were not consistently available at these locations.[7] Efforts should be therefore be focused on proper equipment supply and provider training at these facilities. Resources would be well-spent on increasing the number and staffing of trauma bays. Emergency department provider training in trauma protocols would be of particular utility. Advanced trauma life support training, which is not widely accessible at present, would also be useful.

A retrospective analysis of patients presenting to the emergency department at Kilimanjaro Christian Medical Centre in Moshi, Tanzania revealed road traffic injury was the most common traumatic mechanism seen, representing 43.9% of injuries.[8] In fact, road traffic injuries are projected to be the 6th leading cause of death globally by 2020.[9] In a study investigating the causes of road traffic injuries in Tanzania respondents perceived driver recklessness and driver drunkenness as the leading causes of injury.[10] Reported barriers to correcting this issue in Africa are low enforcement levels, frequent corruption of police officers, and low public awareness. However, the installation of rumble strips and speed humps on the Accra-Kumasi highway in Ghana was shown to reduce crashes by 35% and fatalities by 55%.[11] This would be a significant start in preventing the most common cause of the most predominant acute disease presentation in both Madagascar and Tanzania.

Infectious Disease

While infectious disease is the second most common diagnosis in emergency departments in both countries, it is the most common diagnosis the pediatric (<5 years) population of Tanzania. Overall, infectious disease represented 15% of Muhimbili's patients, but in patients less than 5 years of age it represented 37% of cases. Further study is required to determine the precise microbiological etiologies behind these illnesses, but according to one World Health Organization study 21% of all deaths of children under the age of 5 is due to diarrheal illness in developing areas and countries. And while that number is decreasing, the study found that the total morbidity component

of this disease is growing.[12] Interestingly, a study on diarrheal illness in children less than 5 years of age from Ifakara, Tanzania revealed that Shigella species were the only enteropathogen statistically related with diarrhea. E. Coli, Giardia Lamblia, and Salmonella species were not related with diarrhea. Important risk factors were a high number of siblings, birth order, and distance from the home to the water source.[13] Accordingly, it would seem that proper hygiene education and reinforcement as well as improved sanitation will have extremely high yield in reducing pediatric mortality in Tanzania.

The most common specific infectious CCS classification in both countries was “Other infections; including parasitic”. In Madagascar, 85.33% of this category was Malaria. The burden of this disease on the people of sub-Saharan Africa is well documented. The people of Madagascar often resort to using traditional plants to fight Malaria and other infectious diseases due to a lack of wherewithal and/or the remoteness of their location from the nearest hospital.[14] Efforts to bring appropriate antibiotic therapy to the region should be the focus of this problem.

Conclusions

Madagascar and Tanzania share many of the same patterns and frequencies of acute disease. Traumatic injury should be the main thrust of clinical and public health initiatives in both countries, as it represents the bulk of their acute disease burden. However, the unique geopolitical environment of each has created some significant

differences. Infectious disease should be the focus of pediatric emergency research in Tanzania, whereas trauma prevention should have the lion's share of pediatric emergency effort in Madagascar.

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