

ORIGINAL ARTICLE

Needs assessment for a formal emergency medicine residency program in southern Madagascar



Gretchen Mockler^{a,*}, Rivo Andry Rakotoarivelo^b, Jaona Ranaivo^c, Rolando Valenzuela^d, Katherine Pierson^e, Dalia Calix^e, William Mallon^f

^a Department of Family, Population and Preventive Medicine, Stony Brook University Hospital, United States of America

^b Université de Fianarantsoa, Fianarantsoa, Madagascar

^c Centre Hospitalier Universitaire de Fianarantsoa Tambohobe, Fianarantsoa, Madagascar

^d Stony Brook University School of Medicine, United States of America

^e International Emergency Medicine, Department of Emergency Medicine, Stony Brook University Hospital, United States of America

^f Division of International Emergency Medicine, Department of Emergency Medicine, Stony Brook University Hospital, United States of America

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ABSTRACT

Introduction: World Health Organization data for Madagascar reveal that the nation's under age five mortality rate is 56/1000, and that its maternal mortality rate is 440/100,000. Malaria, leprosy, plague, and tuberculosis remain significant communicable disease threats. Malnutrition rates are improving but continue to impact negatively on the general health of the Malagasy population, especially in the southern region with its 1.9 million inhabitants. There are no emergency medicine (EM) training programs to serve the southern half of Madagascar, which has a large urban population in Fianarantsoa. This study aimed to assess the need for and potential feasibility of an emergency medicine training program in southern Madagascar.

Methods: We met with the institutional leadership on site at the university hospital in Fianarantsoa. A needs assessment was performed on multiple domains. Domain 1: existing hospital infrastructure and its physical plant and emergency centre (EC) space allotment. Domain 2: existing clinical and technological resources. Domain 3: educational resources and the existing curriculum for EM. Domain 4: medical student educational program and availability of prospective residency candidates. Domain 5: pre-hospital care and emergency medical services. **Results:** The size of the EC is adequate for the current census. Clinical resources are typical of many developing countries, with significant need for technological advancement and support, which we delineate in the body of our paper. There is an existing curriculum in Antananarivo and in Majanga, as well as one available through the African Federation for Emergency Medicine. The medical school in the area is relatively new, with graduating classes numbering approximately 30. There is no organised pre-hospital care system, no 9-1-1 equivalent, and no pre-hospital treatment from within metropolitan Fianarantsoa.

Conclusions: While the needs assessment indicates substantial need for emergency medicine development in southern Madagascar, the yield (particularly for the metropolitan Fianarantsoa area) would serve the population well.

African relevance

- There is a demand for needs assessments like this throughout low- and middle-income countries.
- This needs assessment was completed in Madagascar but could be carried-out elsewhere in Africa.
- The proposed curriculum was derived in part from that of the African Federation for Emergency Medicine.
- Medical conditions discussed in this paper are prevalent across multiple regions of Africa.

Introduction

World Health Organization data in the statistical profile for Madagascar reveal that the nation's under age five mortality rate was 56/1000 in 2013, and that its maternal mortality rate was 440/100,000. Malaria, leprosy, plague, and tuberculosis remain as significant communicable disease threats today, with a plague outbreak having occurred as recently as this past year. Gross national income is \$1340 [1] per capita with as many as nine out of ten Malagasy living on \$2 per day in some areas [2]. Less than 14 U.S. dollars were spent

* Corresponding author.

E-mail address: gretchen.mockler@stonybrookmedicine.edu (G. Mockler).

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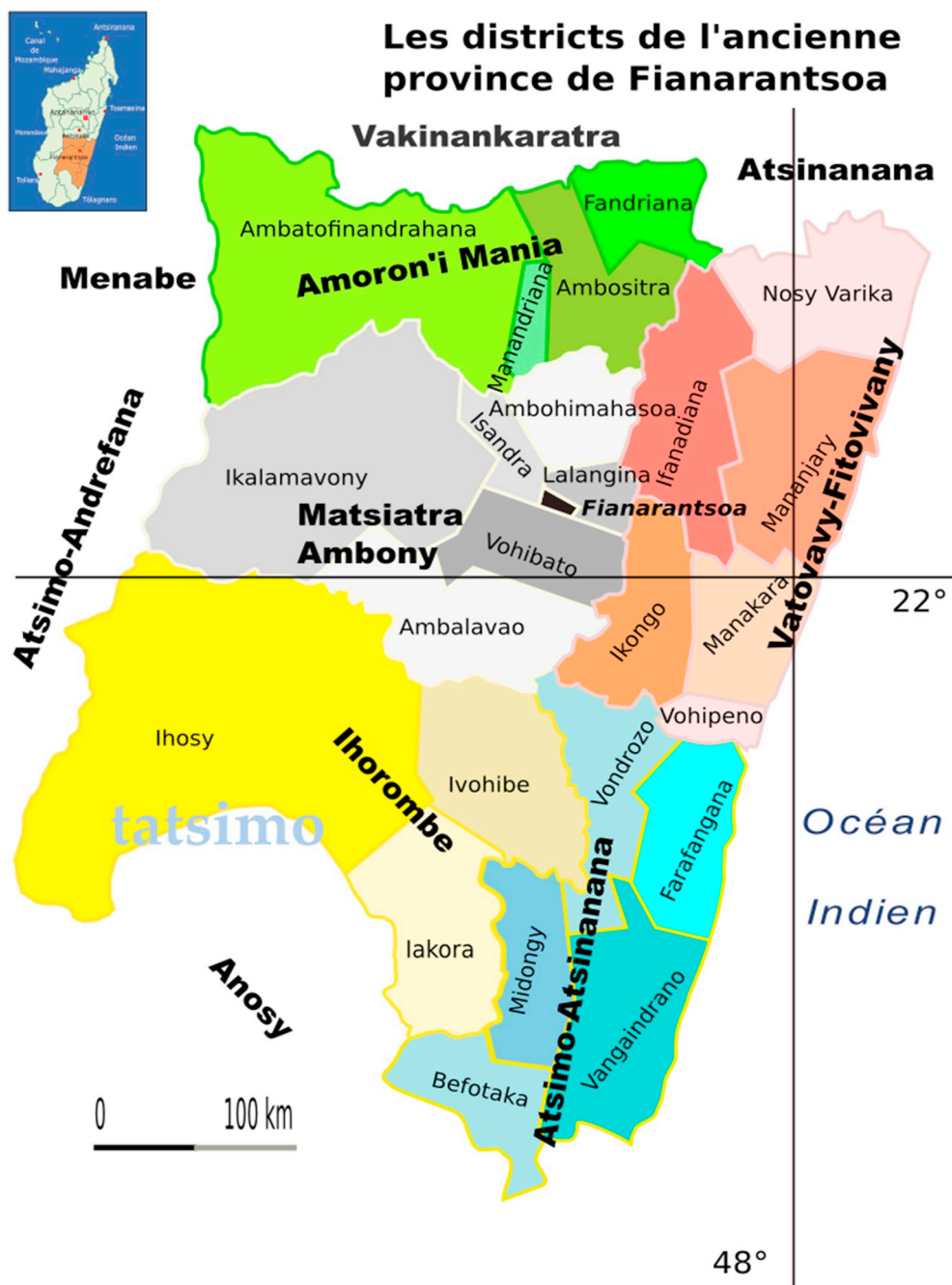


Fig. 1. Districts of Fianarantsoa Province, Madagascar.

annually per capita on health in Madagascar as of 2014 [3]. 33% of the general population is undernourished [4] with more than half of children suffering from chronic malnutrition [5]. Food insecurity and malnutrition (the latter at the fourth highest rate in the world for children under the age of five) are improving but continue to impact negatively on the general health and welfare of the Malagasy population, especially in the country's southern region with its 1.9 million inhabitants [6]. Non-communicable diseases (NCDs) are on the rise in Madagascar. Road traffic accidents claim 6,506 out of every 100,000 lives (3% of total deaths) and are increasing in number and frequency [7]. The main southern city of Fianarantsoa (Fig. 1) has a population of over 200,000 with a regional population of 1.1 million [8]. The city has no pre-hospital care system, no standardised trauma care or formal emergency medicine training programs in place at present. The WHO has recently emphasised the impact of NCDs on disability-adjusted life

years (DALYs), and recognised the importance of health initiatives that mitigate the negative effects of NCDs and trauma [9].

Despite demonstrable need, Madagascar receives little international aid when compared to other economically comparable countries. Aid money from international sources declined precipitously after a government coup in 2009 [10]. Sustainable development and healthcare initiatives are needed across the country and particularly in the most underserved southern region.

Emergency medicine (EM) is in the early stages of development in Madagascar with existing programs in the capital city of Antananarivo and in the northeastern coastal region of Mahajanga. As a result of these two programs, Madagascar is recognised by the African Federation for Emergency Medicine (AFEM) as an associate member and has a specialty society known as AMUM (Association Medecine d'Urgence Madagascar). Despite these advances, there are as yet no EM training

programs to serve the southern half of Madagascar, which has a large underserved urban population in and around Fianarantsoa.

This study aimed to assess the need for and potential feasibility of developing an EM training program in southern Madagascar with external academic support from Stony Brook University in New York. “The eighth continent”, as Madagascar has been described, is ripe for capacity building. A successful EM training program in the south would bolster NCD and trauma care, while creating a central academic hub based at the Centre Hospitalier Universitaire de Fianarantsoa Tambohobe (CHU), which serves a population of 380,000 people over two districts. For this reason, we undertook a needs assessment within the context of an existing memorandum of understanding between Stony Brook University in New York and University de Fianarantsoa. Approval of this exploratory needs assessment was obtained from Madagascar's Ministries of Health and Education, Madagascar's U.S. ambassador in New York City and key stakeholders at CHU.

Methods

On review of the existing literature, we found that only four studies in peer reviewed journals have used a standardised health facility needs assessment tool specifically for use in low- and middle-income countries (LMIC). Three of these studies employed the “Service Provision Assessment” while one used the “Health Facility Census”. However, there are ten health facility assessment tools in total available when the International Health Facilities Assessment Network, The World Bank and the World Health Organization are also included. There has been shown to be great variability in format and length of these assessments with no overall standardisation, which by definition limits the comparability of data collection across countries and leaves large gaps in information critical to public health planning. However, a thematic analysis of assessment domains across all ten available health facility needs assessment tools has been performed, unifying the themes common to all the tools in use to the present day [11].

These assessment domains are summarised by Nickerson et al. into six health systems building blocks, which we have used to organise our needs assessment in Madagascar: 1) leadership/governance; 2) health-care financing; 3) health workforce; 4) medical products, technologies; 5) information and research; and 6) service delivery.

In light of the limited scope of the project at hand, however, we modified these six domains in order to better address the mandate for this particular, preliminary feasibility outreach project. Furthermore, by necessity, much of the data we included in these domains was based on anecdotal information and expert estimates from on the ground physicians and administrators at the hospital we surveyed. Going forward, data would need to be collected prospectively in order to complete the six standardised health systems building block domains if a full health facility assessment across all specialties were to be carried out.

The current assessment began with a review of existing Stony Brook University programs in the region. These include a tuberculosis eradication program run by Stony Brook's Global Health Institute (GHI) in collaboration with the Institut Pasteur de Madagascar and with Centre ValBio, a Stony Brook tropical forest research centre and lemur preserve with a level II laboratory. Stony Brook is also affiliated with PIVOTworks, a non-governmental organisation that operates primary care clinics and works with a regional hospital known as CHRD that refers patients to CHU in Fianarantsoa.

We met with the institutional leadership of Madagascar's Ministry of Health, GHI, Centre ValBio and PIVOTworks in their respective locales in Madagascar. We then met with hospital leadership and faculty on site at CHU in Fianarantsoa, including two hospital deans, two department heads (the emergency centre director and director of laboratories), two faculty members and two internal medicine residency trainees. Per these interviews, hospital care in Fianarantsoa was described as being financed in part by the national government and in part by individual

patients' families. Food, supplies and medications during inpatient stays were reported to be largely provided by patients' families, who remain with patients during the duration of their care.

As described earlier, we devised modified domains for the specific needs assessment project at hand. Domain 1 consisted of a physical survey of the existing hospital infrastructure and plant, and of emergency centre (EC) space allotment in particular. Domain 2 consisted of an interview survey of hospital leadership regarding existing clinical and technological resources and the most common clinical presentations to the hospital. As a follow up to this, we asked interviewees for their own assessment of what technological resources were most necessary in order to meet any gap between the available resources and the common clinical presentations that they had identified.

Domain 3 consisted of quantification of educational resources and interview questions regarding any existing curriculum for EM. Domain 4 consisted of descriptors of the medical student educational program and availability of prospective residency candidates. Domain 5 consisted of questions to the director of the EC about existing pre-hospital emergency care and inpatient emergency medical services.

Lastly, in designing our preliminary proposal for a collaborative emergency medicine residency program at CHU, we used the framework of the “Seven Cs” for international emergency medicine development (William Mallon, MD, verbal communication). This approach includes the initiation of CONTACT, maintaining CULTURAL awareness and CONTEXT, identifying local CHAMPIONS with a long term plan to remain locally, beginning CURRICULUM development and exchange, teaching COURSES (“training the trainer”), and maintaining longitudinal CONTINUITY with permanent faculty.

Results

Domain 1: CHU's physical plant is situated in the hilltop city of Fianarantsoa, whose population numbers approximately 1.1 million including close-in outskirts. The hospital setting includes a combination of historical buildings that originally served as a military barracks and a mid-20th century building.

The size of the EC is adequate for the current census as per CHU's EC director [13]. In our opinion, the multidisciplinary reanimation suite has the potential to become a centre of excellence for teaching emergency medicine and critical care with the addition of specific infrastructure needs (Table 1).

Domain 2: The hospital has a basic laboratory; internal medicine, paediatrics, surgery and maternity services; an EC and reanimation suite; ophthalmology, neurosurgery and radiology services; and equipment for non-portable X-rays and echocardiogram without Doppler.

Per the current EC staff, the top three causes of immediate death (some preventable) in EC are sepsis, cardiovascular pathology and trauma, including both acute and delayed presentations. According to

Table 1
Centre Hospitalier Universitaire de Fianarantsoa Tambohobe's (CHU's) medical equipment needs.

CHU's medical equipment needs
BiPAP machine
Portable cardiac monitor/defibrillator
Cardiac monitor
EKG machine
Bedside ultrasound
EC-stocked medications
EC-stocked blood products
Intraosseous lines
Bedside stat labs machine
Portable CT scanner

BiPAP, bilevel positive airway pressure; EKG, electrocardiogram; EC, emergency centre; CT, computed tomography

Table 2

Leading medical causes for referral to Centre Hospitalier Universitaire de Fianarantsoa Tambohobe (CHU).

Leading medical causes for referral to CHU	
Medical diagnoses	Cardiovascular pathology Neuropsychiatric illness Malaria
Oncologic diagnoses	Medical & surgical oncologic pathology
Surgical diagnoses	Traumatic brain injury Neurosurgical pathology Motor vehicle trauma Abdominal surgical emergency ENT pathology Ophthalmologic pathology Cerebrovascular accident

ENT; ear, nose and throat.

these interviews, many patients live remotely from the city and do not arrive at the hospital until initial trauma symptoms have failed to resolve and have become complicated by infection, etc.

Per the hospital administration, the top indications for medical referral to CHU from outlying hospitals fall broadly into the categories of medical, oncologic and surgical diagnoses (Table 2).

The resources listed in Table 1 would address the clinical realities on the ground in the CHU EC, while resources necessary for management of non-emergent diagnoses causing transfer to CHU would have to be assessed separately.

Domain 3: There is an existing curriculum in Antananarivo and in Majanga, as well as one available through AFEM. Because no training program exists at CHU, these curricula are not implemented in full at their site. There are currently two dedicated EM faculty at CHU who could lead the implementation of a new, more complete curriculum. There are three additional internal medicine faculty who were identified as potential contributors to an EM educational program.

Domain 4: The medical school at CHU is relatively new, and while expanding, remains small at present. It includes a medical student training track as well as a paramedical track that is comprised of midwifery, nursing and laboratory and EKG technician students. Graduating classes of medical students range from 20 to 40 in number. Therefore, if a target of three new graduates was set for the annual number of EM residents, this would represent approximately 10% of the graduating class. This likely dictates that EM residency classes at CHU would remain small (perhaps 2 to 4 trainees per year) for the initial future. Ideally, potential candidates could also be recruited from the capital city of Antananarivo or other sites, with efforts to incentivise them to remain in the southern region after graduation (Table 3).

Domain 5: CHU has two ambulances based at the medical centre. These are used primarily to transfer patients out of Fianarantsoa for

Table 3

Allocation of students currently enrolled at University de Fianarantsoa.

All health students, year	Number of students
1	268
Medical, year	Number of students
2	70
3	73
4	70
5	40
6	41
7	40
8	18
Paramedical – midwifery track, year	Number of students
2	11
3	33
Paramedical – nursing track, year	Number of students
2	15
3	39

Table 4

Prehospital system needs for Fianarantsoa.

Pre-hospital system needs
9-1-1 equivalent telephone system
Emergency medical technician training for pre-hospital care
Ambulances to transport patients to CHU from pre-hospital setting
Designation of regional trauma care centre
Referral coordination from villages/primary care centres to CHU

CHU, Centre Hospitalier Universitaire de Fianarantsoa Tambohobe.

Table 5

Health facilities that refer medical patients to Centre Hospitalier Universitaire de Fianarantsoa Tambohobe (CHU).

Region	District	Facility type	2015 population
Haute Matsiatra	Ambohimasasoa	CHRD I	220,525
	Ambalavao & Vohibato	CHRD II	215,094 & 193,343
Amoron'i Mania	Ikalamavony	CHRD I	89,374
	Ambositra	CHRR	262,353
	Fandriana	CHRD I	201,611
	Manandriana	CHRD I	95,594
Ihorombe	Ambatofinandrahana	CHRD II	155,470
	Ihoso	CHRR	203,373
	Iakora	CHRD I	50,409
Vatovavy Fitovinany	Ivohibe	CHRD I	58,525
	Ifanadiana	CHRD II	54,272
	Mananjary	CHRD II	316,930
	Nosy Varika	CHRD I	241,438
Atsimo-Atsinanana	Ikongo	CHRD I	186,055
	Manakara-Atsimo	CHRR	365,427
	Vohipeno	CHRD I	157,337
	Farafangana	CHRR	341,843
	Vondrozo	CHRD I	127,99
	Vangaindrano	CHRD II	329,596
	Midongy-Atsimo	CHRD II	45,817

CHRD I, Level 1 referring district hospital located in a district centre, with inpatient medicine services but no surgical service/operating suite; CHRD II, Level 2 referring district hospital located in a district centre, with inpatient medicine and surgical services, including operating suites; CHRR, regional referring hospital located in a regional centre, with inpatient specialty medicine services, surgical services including operating suites and paediatric services; CHU Tambohobe = population of Fianarantsoa + Lalangiana = 211,750 + 168,420 [18].

specialty care or imaging not available at CHU. Currently, no ambulances bring patients to CHU from the pre-hospital care setting. There is no organised pre-hospital care system, 9-1-1 equivalent, nor pre-hospital treatment from within metropolitan Fianarantsoa. Only one of the district hospitals (e.g. CHRD) has ambulances to send higher level of care transfers to Fianarantsoa. Future needs for the city would include the development of an emergency medicine technician (EMT) basic service for the over 1 million residents of the larger metropolitan area. These initiatives could lead to a formalised regionalisation of trauma care and the first trauma centre designation in the southern half of Madagascar for CHU (Table 4 and Table 5).

Using the “Seven Cs” theoretical framework for the establishment of international emergency medicine training programs, the first five “Cs” were undertaken as follows: Contact was initiated. Cultural awareness and Context were considered during our on-site meetings with physician leaders in Fianarantsoa, where we began to obtain information about local needs and medical utilisation patterns. We identified several potential local Champions who are likely to remain as emergency medicine physicians in Fianarantsoa indefinitely. And finally, we identified and discussed a preliminary basis for Curriculum content based on preexisting curricula in Antananarivo and through AFEM.

Discussion

Strengths of our study include the close cooperation of the CHU faculty, who met with us at length to provide anecdotal data based on their extensive personal experience caring for the hospital patient population. Weaknesses include the lack of extensive reliable public health data in the region. Furthermore, going forward, community stakeholders would need to be included in an analysis of community health care needs, which time and resources precluded during this initial fact finding/feasibility assessment mission.

Financial/economic challenges continue to be an obstacle to the basic goal of providing affordable medical care to the patients that present to CHU. Funding and foundations to support basic medical care, with IV fluids and antibiotics, will likely need to be established in order for CHU to fulfill its mission. Increased governmental support would help but may or may not be available. Non-governmental organisation (NGO) sources will need to be explored.

Primary care resources at the district hospital level, if improved, would select patients for transfer into CHU with greater accuracy and increase the CHU census. Ultimately CHU could become an academic hub, with regional/district hospitals and clinics identifying critically ill patients for coordinated referral to the University hospital in Fianarantsoa.

The needs assessment confirmed a substantial need for emergency medicine development in southern Madagascar. The potential yield of a sustainable EM training program hosted at CHU with SBU support would be considerable, particularly for the metropolitan Fianarantsoa area, and would serve the population well. Emergency medical services (EMS) development for urban Fianarantsoa could be incorporated into the project with the long term goal of creating the infrastructure for a regional trauma response system. The immediate goal of the training program would be to create emergency medicine physicians who would remain in the region and contribute to long term local care needs.

Dissemination of results

The results of this study were shared with the Dean of the faculty of the hospital described.

Authors' contributions

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 it critically for important intellectual content: GM contributed 50%; WM 25%; and JR, RAR, RV, KP and DC contributed 5% each. 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 have no conflicts of interest to declare.

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