



## Operational implementation and lessons learned from Haiti's first helicopter air ambulance



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### ARTICLE INFO

#### Article history:

Accepted 4 December 2015

#### Keywords:

HEMS

HAA

Helicopter emergency medical service

Helicopter air ambulance

Haiti

Global health

Prehospital care

### ABSTRACT

Critical-care helicopter transport has demonstrated improvements in morbidity and mortality to those patients who utilise the service, but this has largely excluded developing country populations due to set up costs. Haiti Air Ambulance is the first completely publicly-available helicopter ambulance service in a developing country. US standards were adopted for both aviation and aeromedical care in Haiti due to proximity and relationships. In order to implement properly, standards for aviation, critical care, and insurance reimbursement had to be put in place with local authorities. Haiti Air Ambulance worked with the Ministry of Health to author standards for medical procedures, medication usage, and staff training for aeromedical programs in the country.

Utilisation criteria for the helicopter were drafted, edited, and constantly updated to ensure the program adapted to the clinical situation while maintaining US standard of care. During the first year, 76 patients were transferred; 13 of whom were children and 3 pregnant women. Three patients were intubated and two required bi-level mask ventilation. Traumatic injury and non-emergency interfacility transfers were the two most common indications for service. More than half of the transfers (54%) originated at one of six hospitals, mostly as a result of highly-involved staff. The program was limited by weather and the lack of weather reporting, radar, visual flight recognition, thus also causing an inability to fly at night. In partnership with the government and other non-governmental organisations, we seek to implement a more robust pre-hospital system in Haiti over the next 12–24 months, including more scene call capabilities.

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### Introduction

Trauma accounts for 12% of the world's burden of disease and some estimates predict that by 2020, 1 in 10 deaths will be attributable to injuries worldwide [1]. Developing countries fare even worse with five million deaths due to trauma every year [2,3]. If public health systems in developing countries are to meet this demand for pre-hospital emergency services, then HAA must be part of the long-term solution in Haiti. Helicopter air ambulance (HAA) have become part of the accepted standard of care in developed countries. Over the last 40 years, critical-care helicopter transport has demonstrated improvements in morbidity and mortality to those patients who utilise from the service [4–6]. HAA programs have largely been found to be cost-effective in

developed countries, despite the high cost of the intervention [7,8]. The large financial burden of trauma on developing countries, estimated to be \$500 billion annually, may justify the expense in low-resource settings as well [9].

The idea for Haiti Air Ambulance was born out of the ashes of the massive earthquake on January 12, 2010 [10]. What would become the Haiti Air Ambulance team was on the ground days after the earthquake and realised the need for a HAA program. Haiti is a mountainous country with poor roads that make ground ambulance transport over long distances difficult and even dangerous. There are only a few hospitals that offer high quality intensive care and they are not evenly distributed geographically throughout the country, making the utility of the helicopter even greater in this setting than in many developed countries (Map 1). Two other helicopter transport programs existed in the years since the earthquake but they were not true HAA programs. While their impact cannot be diminished, the initial programs merely transported patients from place to place but did not have medical staff on board or have critical care capabilities [11]. The Haiti Air

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Ambulance team started laying the ground work in December 2012 and the program officially launched in October 2013. The base and helipad construction was completed in April 2014 and the first patient was flown in June 2014. In the first year of operation through May 2015, Haiti Air Ambulance has transported 76 patients.

To our knowledge, Haiti Air Ambulance is the first publicly-available HAA program in any low-income country. The middle-income countries with HAA programs all possess either oil industries that justify the cost, large tourist industries and/or GDPs which are significantly higher than Haiti's. A few countries with large poor populations such as Nigeria [12] and Sudan [13] have HAA programs but they are not accessible by the poor local majorities due to high transportation fees. They principally serve the wealthy and expatriates that can afford the fees or have insurance. Several private air ambulance companies purport to serve many developing countries with HAA services, but have no bases or helicopters in the majority of countries listed on their websites [14–16]. Haiti Air Ambulance is based entirely in the country that it serves and is publicly available, regardless of the patients' ability to pay.

## Methods

### Technical aspects

Building a new HAA program from scratch in a country with a few resources as Haiti was no small task. While government entities exist for some aspects of the program, we chose to use the US medical standard for those portions that had no Haitian counterpart. In many instances, we followed both the US and Haitian standards at the same time, forcing us to adopt a higher medical standard or broader applications than if the program was only US-based. On a few occasions, we adopted only the Haitian standard because the US standard was not applicable in the low-resource setting.

Haiti Air Ambulance subcontracted the US-based HAA company Air Methods Corporation, the largest provider of medical helicopters in the world, to supply the Bell 407, single engine helicopters and provide pilots and mechanics. As such, the aviation portion of the program has been entirely based on US Federal Aviation Administration (FAA) protocols and standards for safety. The US-based pilots and mechanics are all certified by their respective US-professional accrediting bodies and observe work hour and personal conduct policies that align with those of US-based HAA programs. On the Haitian aviation side, the National Office for Civil Aviation (Office National de l'Aviation Civile or OFNAC) gave regulatory approval for Haiti Air Ambulance to fly in country. Map 2 shows the OFNAC registered airports used by Haiti Air Ambulance, which represents only a small portion of all landing zones. OFNAC does not permit civilian flights at night due to a lack of radar infrastructure, night vision goggles, and other logistical barriers. In addition, we use visual flight rules when flying. Cold off-loads are the standard operating procedure unless the circumstances dictate otherwise. In the event of hot off-loads, the crew directs and perform the off-loading duties along with chaperoning the external staff. We used Air Methods Corporation's standard seating configuration with the stretcher in the left aft position adjacent to the pilot and their standard medical equipment such as the ReVel ventilator by CareFusion.

Haiti Air Ambulance is capable of transferring to the Dominican Republic where there are significantly better medical facilities. As of the writing of this paper, we are working with Dominican authorities to obtain permission to land directly at hospitals there. Currently, Haiti Air Ambulance has transferred only three patients

to the Dominican Republic, who cleared immigration and customs at both international airports before proceeding to the receiving hospital. We are working towards transferring patients via helicopter directly to the high-acuity hospitals and submitting the immigration and customs documents electronically.

For the medical approval, the patient care guidelines were submitted to the Haitian Ministry of Health and were subsequently adopted as the national standard for HAA programs. Haiti Air Ambulance is currently in the long and arduous process of applying for non-profit status in Haiti.

In order to ensure quality patient care and safety, we established standards for HAA programs in Haiti where there previously was none. While Haiti Air Ambulance is not eligible for the US Commission on Accreditation of Medical Transport Systems (CAMTS) certification because the program has been operational for only twelve months, all the standards for personnel and patient care that CAMTS requires are followed. All clinical personnel have appropriate training and certification in Advanced Cardiac Life Support, Paediatric Advanced Life Support, Neonatal Advanced Life Support, Advanced Trauma Life Support, and critical care experience as their job description demands.

### Medical service delivery

The patient care guidelines (PCG) were adopted from two different sets of similar guidelines from HAA programs in the US, one that offered 450 pages of thorough explanations and training and another 100-page version that was primarily flow-sheet based. Both sets of PCGs came from rural programs covering large areas of territory because of the closer resemblance of the resources available when compared to Haiti. In general, these PCGs tended to be more liberal than urban US programs in which procedures and medications were permitted for use by the medical team in the field. Given Haiti's lack of resources at many hospitals and wide area of territorial coverage, we believed that there would be more scenarios in which high-risk procedures such as chest tubes and cricothyrotomies would be required in the field, although this has not happened in practice yet. Largely, the PCGs were trimmed down from the US version given the limited scope and technology available in Haiti. For example, sections on aortic balloon pumps and left-ventricular assist devices were removed since they are not currently used in Haiti, but so were guidelines about transfusing blood products in air given the inconsistent blood supply available in Haiti. In situations in which Haiti Air Ambulance has a capability the local hospital does not have, such as with Swan-Ganz catheters and intracranial pressure monitors, we chose to eliminate those procedures since we do not wish to start procedures or medications that cannot be continued at receiving hospitals. Directives on Do Not Resuscitate orders, medico-legal language, and other state or local regulations were also removed, as these decisions are made on a strictly clinical basis by the flight crew and Medical Director.

Medication selection, and therefore the PCGs based on them, was a meticulous process involving a multidisciplinary team of doctors, nurses, paramedics, and pharmacists. Wherever possible, the formulary was simplified to include only one medication from each class, even if there were slight variations in the half-life or time of onset, such as stocking only midazolam over both midazolam and diazepam. In other instances, we selected medications based on what was available in most receiving facilities. Since dobutamine and phenylephrine are not utilised regularly at any hospital in Haiti, we elected to use dopamine, epinephrine, and norepinephrine as the principal vasopressors and inotropes for our program. After careful consideration of the local resources, we added streptokinase and tranexamic acid to the formulary because of the lack of catheterisation labs and

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