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A National Trauma Capacity Assessment of Haiti

By

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Master of Public Health

Global Health

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B.Sc
University of Victoria
2006

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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in Global Health
2015

Abstract

A National Trauma Capacity Assessment of Haiti

By Chelsea McCullough

Background:

Trauma systems in high-income countries have been shown to reduce trauma-related morbidity and mortality, however these systems are infrequently implemented in LMICs. Haiti currently lacks a well-resourced and structured trauma system and in turn loses an estimated 800,000 years of healthy life to injuries annually. In the current study, we perform a nation-wide trauma capacity assessment, and using the World Health Organization's Guidelines for Essential Trauma Care as a framework, we attempt to identify achievable steps that can be taken towards improving trauma care in Haiti.

Materials and Methods:

This cross-sectional study was performed at 12 facilities nationally using a survey tool assessing the areas of infrastructure, supplies and equipment, personnel and training, and procedural capabilities. Additionally, the total number of trauma cases presenting to each facility was tabulated from emergency room logbooks.

Results:

A total of 6 secondary and 6 tertiary facilities were surveyed. Secondary facilities received an average of 35 trauma cases per week, while tertiary facilities received an average of 65 cases per week. Survey results demonstrated a shortage of airway, breathing and circulation equipment and supplies in both facility levels, particularly in emergency rooms. All facilities lacked access to essential surgical personnel and trauma training.

Conclusions:

This study makes recommendations for improvements in trauma care in Haiti in the areas of infrastructure & administration, physical resources, and training & human resources. These recommendations represent feasible steps that can be taken towards the construction of a national trauma system in Haiti.

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Chapter 1: Introduction

Haiti is the third largest and second most populous country in the Caribbean (1). Sharing the Island of Hispaniola with the Dominican Republic, Haiti covers a landmass approximately the size of Hawaii. Haiti is the poorest country in the Western Hemisphere (1). With a population of 10.3 million and a gross domestic product (GDP) of 8.5 billion USD it has the lowest GDP per capita in the Caribbean by more than 8,000 USD at 1,315 USD per capita (1). Its neighboring country, the Dominican Republic (DR), has a similar population of 10.4 million, however it is considered an upper middle-income country with a GDP per capita of 9,911 USD (1). The United Nations (UN) Human Development Index ranked Haiti 168 out of 187 member nations, compared to a ranking of 102 for the DR (2). Overall, Haiti has a life expectancy of 63 years with an infant mortality rate of 57 per 1000 live births and an under five mortality rate of 76 per 1000 live births (3). Sixty two percent of Haiti's population has access to improved drinking water while only 24% has access to improved sanitation (3). The UN Food and Agriculture Organization states that from 2011-2013, 49.8% of the population was undernourished. Haiti still struggles with many other health indicators including an HIV prevalence of 1435 per 100,000 and only 58% of infants receiving the measles vaccination (3). Currently, Haiti spends approximately 62 USD per capita on health care every year, compared to 293 USD per capita in the DR and 8,467 USD per capita in the United States (3).

Traumatic injuries are a growing source of morbidity and mortality worldwide. In 2012 road injuries alone were the eighth leading cause of years of life lost (3). Haiti has an overall trauma-related mortality rate of 83 per 100,000 and loses over 800,000 disability-adjusted life years every year to injuries (4, 5). Haiti, like most low- and middle-income countries (LMICs), lacks a cohesive trauma system. This fact was highlighted after the devastating 7.0 earthquake that occurred in January 2010 just outside of Port-au-Prince that left over 200,000 dead and 300,000 injured, many of which requiring emergent life-saving surgery (6). In an effort to assess the state

of trauma care in Haiti, a team from Emory University School of Medicine in collaboration with Haiti's Ministère de la Santé Publique et de la Population (MSPP), and Project Medishare for Haiti, a non-governmental organization based in Haiti, performed a regional trauma capacity assessment in Haiti's Central Plateau in 2013 (7). This regional assessment revealed an under-resourced and unstructured trauma system that is burdened by a high incidence of trauma.

A nation-wide trauma capacity assessment is required as a first step towards establishing a national trauma system in Haiti. Continuing the collaboration between Emory University, Haiti's MSPP and Project Medishare for Haiti, the current study aims to perform a national trauma capacity assessment by expanding our initial study to twelve facilities including the MSPP department referral center in each of Haiti's ten department (Figure 1). By adapting the World Health Organization's (WHO) Tool for Situational Analysis to Assess Emergency and Essential Surgical Care, we created a survey tool focusing on trauma and evaluating facilities in the areas of infrastructure, supplies and equipment, personnel and training, and surgical capabilities (Appendix 1). Utilizing the WHO *Guidelines for Essential Trauma Care* as a framework, we attempt to identify feasible steps that can be taken towards improving trauma care in Haiti (8).

Figure 1. Map showing the location of the twelve surveyed facilities

Chapter 2: Comprehensive Review of the Literature

2.1 Trauma in Developing Countries

Trauma consisting of both intentional and unintentional injuries has recently been coined as a neglected epidemic (9). The World Health Organization's (WHO) Global Burden of Disease (GBD) Study has estimated that injuries are responsible for 5.8 million fatalities every year, representing 32% more than the lives lost to tuberculosis, malaria and HIV/AIDS combined (10). The GBD Study estimated that over 200 million years of life were lost to injuries in 2013 (11). The top three causes of death from injuries are motor vehicle accidents (MVAs), homicide and suicide. By 2030 it is estimated that these causes of death will rise to the fifth, twelfth and eighteenth leading causes of death worldwide, respectively (10). Young people in particular suffer greatly from injuries, with MVAs, homicide and suicide all within the top six leading causes of death for people between the ages of 15 and 44. The nearly 6 millions injury-related deaths each year represent only the tip of the iceberg with an additional tens of millions suffering injuries that lead to hospitalizations and emergency department visits. Even still there is a substantial number of injured people that do not present for any formal medical care (12). These non-fatal injuries leave an estimated 20-50 million people each year with long-term disabilities (13).

The worldwide injury burden falls disproportionately on LMICs with 90% of injury-related deaths occurring in developing countries (14). The 2013 GBD study noted that while the numbers of injuries resulting from MVAs and occupational injuries continue to fall in high-income countries (HICs), the incidence of these injuries in LMICs is rapidly increasing (11). This is largely attributed to the progressive industrialization and increasing use of motorized transport without a parallel increase in infrastructure and safety legislation (15). The death and disability associated with injuries can have large socioeconomic consequences for families in LMICs. With trauma's predilection for young people in the most productive years of life, injuries

can greatly reduce the earning potential of a family (15). One study in Ghana sought to identify strategies employed by the families of injury persons to pay for medical expenses and compensate for lost income (16). The study showed that families will resort to selling belongings, borrowing money and intra-family labor reallocation; and in spite of these strategies up to 30% of families reported decreased food consumption as a direct consequence of an injured family member.

While HICs have developed trauma and emergency care systems to handle a growing trauma burden, currently LMICs lack these systems (17). One study found that mortality rates for severely injured patients increased as a country's economic level decreased with observed mortality rates of 35%, 55% and 63% for the United States, Mexico and Ghana, respectively (18). Outcomes for severely injured persons in HICs have greatly benefited from the formation of trauma systems, and as a result those with life-threatening but salvageable injuries are more than 6 times more likely to survive in HICs than LMICs (15). Additionally, it has been estimated that between 1,730,000 and 1,965,000 lives could be saved if fatality rates in LMICs could be reduced to those in HICs (19).

2.2 Trauma Systems in High-Income Countries

In the United States, the concept of trauma systems emerged largely from war and the need to care for massive numbers of injured soldiers (20). In particular, the Korean and Vietnam wars produced systems that were capable of rapidly transporting wounded soldiers to well-resourced facilities for definitive injury care. Upon recognizing that the standards of civilian care were beneath those achieved by the military and drawing from experience gained in wartime, the American College of Surgeons (ACS) set forth to improve trauma care in the US (20). The ACS

Committee on Trauma (COT) published the first edition of *Optimal Hospital Resources for Care of the Seriously Injured Patient* in 1976 (21). These guidelines focused on the development of specialized trauma centers for optimal care of trauma patients. A subsequent study in Orange County, California showed a reduction in medically-preventable deaths from 73% to 9% after trauma centers were established in the county. This same study also showed an increase in the percentage of patients receiving appropriate surgical intervention from 14% up to 89% in newly designated trauma centers (22).

The emphasis on trauma centers was soon expanded to regionalized trauma systems. This transition was prompted by two essential factors: (1) an all-encompassing approach must be taken towards preventing and treating injured patients in order to optimize outcomes; and (2) not all injured patients require care at the highest level available (20, 23). To reflect this paradigm shift, the ACS COT renamed their trauma care guidelines *Resources for the Optimal Care of the Injured Patient* in 1990 (23). The COT described the ideal "inclusive" trauma system to include components of prevention, access, pre-hospital care and transportation, acute hospital care, rehabilitation and research activities (23). These guidelines also defined criteria for Level I through Level IV trauma centers as well as the processes for center designation and verification.

In terms of facilities, trauma systems are composed of a hierarchical structure of trauma centers arranged in increasing order of trauma care capacity. Trauma centers of all levels are vital components of a functional trauma system in which patients are triaged to centers capable of handling their level of injury severity. In fact, only the most severely injured 5-10% of patients require transport to Level 1 care, and this system of triage leaves higher level centers free to treat the most severely injured (23). According to the ACS COT, Level I and Level II centers provide the same level of clinical care for injured patients; however, Level I centers must also participate

in community education and outreach, and conduct trauma research (23). Level I centers serve as a regional resource for the system and must admit a minimum number of severely injured patients each year. Level II centers can serve the purpose of either aiding a Level I center in a large population-dense area with a high injury burden or serving as the lead trauma center in a low population density rural area. Level III centers must be capable of treating the majority of injured patients and stabilizing severely injured patients. These centers will have transfer agreements in place with a Level I or Level II center for seriously injured patients requiring more intensive care than can be provided at a Level III facility. Level IV trauma centers provide initial injury evaluation and assessment in rural medically-underserved areas. Unlike all Level I, II and III trauma centers that must have immediate access to a general surgeon 24 hours a day, Level IV centers do not have surgical capabilities and may only be staffed by a midlevel non-physician provider (23).

Regionalized trauma systems have been proven to reduce mortality rates and improve functional outcomes for injured patients (24). For example, prior to the implementation of a trauma system in Quebec, Canada, the mortality rate for severely injured patients was 52%. Ten years after system implementation this mortality rate had been reduced to 9 % (25). Population-based studies in North Carolina showed a 20% reduction in trauma-related mortality in counties with designated trauma centers (26). Additional studies have attempted to identify the critical components of effective trauma systems. One study highlighted tertiary trauma centers and reduced pre-hospital times (27). Another study found that pre-hospital notification protocols and performance improvement programs were associated with a reduction in risk-adjusted odds of death (28).

2.3 Developing Trauma Systems in Low- and Middle-Income Countries

There is an obvious need for trauma system implementation in LMICs, however the majority of injured persons worldwide are not able to afford the provisions for trauma care outlined in the ACS COT trauma care guidelines (29). Despite the financial barriers experienced by LMICS, it has been noted that improvements in trauma-related outcomes could be made with modifications to the organization and planning for trauma care in these countries (29, 30). In an effort to develop a set of guidelines for trauma care in LMICs, the Essential Trauma Care Project was formed through a collaborative partnership between the International Association for the Surgery of Trauma and Surgical Critical Care (IATSIC) and the Injuries and Violence Prevention Department of the WHO (31). The Trauma Care Project, along with a panel of trauma care experts representing every continent, created the Guidelines for Essential Trauma Care (Guidelines for EsTC) in 2004 (8). The overriding theme of these guidelines is that great improvements in trauma care can be made through feasible and affordable modifications in organization and planning with minimal increase in cost. The guidelines identify eleven trauma care services that represent the minimum standard of care that should be available to every trauma patient worldwide. These “rights of the trauma patient” are laid out in terms of the supplies, equipment and skills required to provide these services. The 260 individual items of human and physical resources required by the guidelines cover the full scope of trauma care from initial resuscitation to long-term rehabilitation. This resource list is further categorized according to facility level with all items deemed either essential, desirable or irrelevant for each facility level.

The Guidelines for EsTC were developed with the intention of creating both a flexible template to serve as a planning guide for low-resource trauma care and an advocacy tool for promoting an

acceptable minimum standard of trauma care (29). Since their development, the guidelines have been used as a needs assessment framework in several LMICs including Mexico, Vietnam and Ghana (32-34). Following these assessments, several stakeholder meetings have been held in each country allowing for the identification of priorities stemming from the needs assessments, adaptation of essential resource lists and development of implementation plans (31). Additionally, utilization of the Guidelines for EsTC have already lead to improvements in trauma care delivery. In Vietnam, organizational deficiencies pointed out by a needs assessment resulted in improvements in trauma care capabilities when the assessment was repeated a year later (32).

Chapter 3: Manuscript

A National Trauma Capacity Assessment of Haiti

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To be submitted to: The Journal of Surgical Research

3.2 Contribution of the Student

My contribution to this project began during the initial phases of project inception and execution including the regional trauma capacity assessment of Haiti's Central Plateau in 2013. Since then my involvement continued in the current national trauma capacity assessment of Haiti in the form of project conception, design and planning, as well as data collection, analysis, table development and manuscript writing.

3.3 Abstract

Background:

Trauma systems in high-income countries have been shown to reduce trauma-related morbidity and mortality, however these systems are infrequently implemented in LMICs. Haiti currently lacks a well-resourced and structured trauma system and in turn loses an estimated 800,000 years of healthy life to injuries annually. In the current study, we perform a nation-wide trauma capacity assessment, and using the World Health Organization's Guidelines for Essential Trauma Care as a framework, we attempt to identify achievable steps that can be taken towards improving trauma care in Haiti.

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Conclusions:

This study makes recommendations for improvements in trauma care in Haiti in the areas of infrastructure & administration, physical resources, and training & human resources. These recommendations represent feasible steps that can be taken towards the construction of a national trauma system in Haiti.

3.4 Introduction

The burden of traumatic injury in low- and middle-income countries (LMICs) has received growing attention from the international community as a matter requiring urgent action (1-3). The 2004 Global Burden of Disease study estimated that over 5.8 million lives were lost worldwide to traumatic injuries, representing 32% more than the lives lost to tuberculosis, malaria and HIV/AIDS combined (4). Ninety percent of this burden falls on LMICs with enormous socioeconomic consequences for families in developing countries (5). Trauma systems in high-income countries (HICs) have been shown to reduce morbidity and mortality resulting from injuries, however these systems are infrequently implemented in LMICs due to financial, logistical and human resource barriers (6). Multiple studies from the developing world tell a story of medically-preventable deaths due to the lack of an organized system of trauma care delivery (7-10). One such study found that those with life-threatening but salvageable injuries are six times more likely to die in LMICs than in HICs with functional trauma systems (10).

Several international organizations have developed tools and guidelines in an effort to assess and improve trauma care in LMICs (11-13). The World Health Organization (WHO) and the International Association for the Surgery of Trauma and Surgical Intensive Care (IASTSIC) have collaborated to develop the *Guidelines for Essential Trauma Care* (Guidelines for EsTC). These guidelines provide a minimum standard of care that should be available to every injured person worldwide regardless of setting (6). The major theme of these guidelines is that large improvements in the outcomes for injured persons can be made through affordable interventions in organization and planning. To this end the Guidelines for EsTC set forth a list of essential

trauma services including the physical resources and corresponding knowledge and skills that should be available to every injured person globally.

Haiti, the poorest country in the Western Hemisphere, is affected by a growing trauma burden with an estimated 800,000 years of healthy life lost to injuries in 2012 alone (14). In 2013 our group performed a trauma capacity assessment of Haiti's Central Plateau and found an under-resourced and unstructured regional trauma system (15). Apart from this regional assessment, little was known of the state of trauma care in Haiti. With the support of Haiti's Ministère de la Santé Publique et de la Population (MSPP), we have expanded our regional study to a nation-wide trauma capacity assessment. Through this assessment and using the Guidelines for EsTC as a framework, we attempt to identify achievable steps that can be taken towards improving trauma care in Haiti.

3.5 Methods

This cross-sectional study of trauma capacity in Haiti was performed as part of a collaboration between Haiti's MSPP, the non-governmental organization Project Medishare for Haiti, and Emory University School of Medicine and the Rollins School of Public Health. As previously reported, a survey tool focused on trauma capacity was adapted based on the WHO's Tool for Situational Analysis to Assess Emergency and Essential Surgical Care covering the areas of infrastructure, supplies and equipment, personnel and training, and procedural capabilities (15). Following observations made during this initial study, we adapted our survey tool to better capture the current state of trauma care in Haiti. These adaptations included gathering data on:

(1) the percentage of time select items of equipment were available; (2) the location of select items within the facility (i.e. emergency room versus operating room); (2) the 24-hours per day/7 days a week (24/7) availability of essential services (e.g. blood bank, radiology); and (3) the availability of essential personnel (e.g. surgeon availability in-house versus on-call).

Haiti is divided into ten geographic departments. Surveyed facilities were selected if they either represented the MSPP departmental referral facility or had substantial surgical capacity and acted as a regional surgical subspecialty referral facility. Site visits were conducted and surveys were administered at eleven facilities from June 2014 – July 2014. A twelfth facility was visited for survey administration in February 2015. With the assistance of Haitian interpreters, two Emory University medical students administered the survey at each facility. Surveys were completed by a combination of administrators, medical directors, clinicians and technicians at each facility. Most survey items were directly observed during facility tours. The majority of survey questions were answered during these in-person visits and missing information was gathered via phone or during additional site visits during the period of July 2014 to February 2015. Facilities were categorized as secondary or tertiary based on either the population size that they served or by the infrastructure and surgical capabilities of the facility. Estimated 2009 department populations were used for populations served by MSPP departmental facilities (16). Facilities serving a population greater than 700,000 people, or possessing an intensive care unit (ICU) and serving as a surgical subspecialty referral center were classified as tertiary care facilities.

The percentage of time each survey item was available in each location was recorded. Open-ended sections were also included in the survey to allow for facility-specific notes in each

section. The quantity of each case type performed per month as reported by medical directors and clinicians was recorded as a range: 1-10, 11-25, 26-50, 51-75, 76-100 and 101+. A value of 0 indicates that the procedure is not performed at the facility, while a value of less than 1 indicates that the procedure is performed less than once a month. Procedure counts include both emergent and non-emergent cases. The total number of adult and pediatric trauma cases presenting to each facility were tabulated from government-mandated emergency room (ER) logbooks that record every patient presenting to the ER. When reported in the ER logbook, the total number of motor vehicle accidents (MVAs) and injuries due to violence reported in the ER logbooks were also tabulated. Surveys were initially completed on paper and then loaded into Adobe Forms Central. Aggregate data was exported to Microsoft Excel for analysis. Approval of this study was granted by Emory University's Internal Review Board and Haiti's National Bioethics Committee.

3.6 Results

A total of twelve facilities were visited for survey administration including six secondary and six tertiary facilities (Table 1). None of the surveyed facilities utilized a trauma registry and so epidemiologic data was gathered from ER logbooks (Table 2). Secondary hospitals experienced an average of 35 trauma cases per week, while tertiary facilities had an average of 59 trauma cases per week. A high degree of variability existed in the amount of information recorded in ER logbooks. The only patient information consistently recorded among all twelve facilities was name, age, sex and hometown. Mechanism of injury, injury description and severity, diagnosis and ER course were all inconsistently recorded with only 5 secondary and 4 tertiary facilities reporting the number of MVAs and injuries due to violence. Details regarding the circumstance

of MVAs (i.e. pedestrian, motorcycle, car) and injuries due to violence (i.e. weapon) were infrequently recorded.

Secondary facilities had a median of 67 beds and 2 operating rooms, while tertiary facilities had a median of 112 beds and 3.5 operating rooms (Table 3). All facilities had a 24/7 ER while only three tertiary facilities had an ICU, defined in this case as access to mechanical ventilation and continuous monitoring. Four facilities had consistent 24/7 access to blood products within 15 minutes. Additionally, only one secondary and one tertiary facility had access to fresh frozen plasma. The majority of facilities had 24/7 access to radiology services. Among surveyed facilities there was only one computed tomography (CT) scanner, which represented one of four CT scanners available in the country. None of the twelve facilities currently utilize a trauma registry and only two facilities were engaged in trauma-related quality improvement programs. One tertiary facility was in the midst of implementing emergency care guidelines and building a new ER, while another secondary hospital was in the midst of developing protocols for natural disasters.

The availability and location of resuscitation equipment is shown in Table 4. Although not an exhaustive list of surveyed items, the items reported were selected based on Guidelines for EsTC determination of “essential” and “desirable” equipment and supplies for trauma care. The table highlights a deficiency of resuscitation equipment located in the ER in both secondary and tertiary facilities. Hemoglobin determination is widely available, however arterial blood gas (ABG) and lactic acid determination were universally unavailable with the exception of ABGs available in one tertiary facility.

Two facilities reported the availability of attending level physicians to staff the ER. Emergency rooms in all surveyed facilities were primarily staffed by Haitian physicians in their mandatory year of social service immediately following graduation from medical school and not Emergency Medicine (EM) or Internal Medicine-trained physicians. Two tertiary facilities and no secondary facilities had a general surgeon in-house 24/7, but eleven facilities reported access to a general surgeon on-call. All tertiary facilities reported an orthopedic surgeon on-call 24/7 compared to only one secondary facility. No facility reported 24/7 in-house availability of a neurosurgeon and only two facilities reported access to a neurosurgeon on-call. It should be noted that the timeliness of physician availability was not assessed and anecdotally was noted to be quite variable. All twelve facilities had anesthesia staff consisting of either an anesthesiologist or nurse anesthetist available 24/7.

Four of the twelve surveyed facilities reported the presence of physicians with any trauma training consisting of ATLS or an ATLS-equivalent. One of the three tertiary facilities was dependent on rotating foreign physicians for this training and thus was not included in the calculations shown in Table 6. The one secondary facility with trauma-trained physicians reported that 50% of their emergency physicians and surgeons had received ATLS from a visiting group of foreign physicians. Likewise, one of the tertiary facilities reported that a visiting group of physicians had provided an ATLS course. One tertiary facility reported the existence of an ongoing trauma-training course for all surgical residents.

Table 7 shows the most frequently reported range of procedures performed per month. The majority of facilities reported performing over 101 laceration repairs each month and treating 1-10 burns per month with no facility treating over 25 burns in one month. All facilities were capable of treating closed fractures with most facilities treating 1-10 per month. Four facilities, including two secondary and two tertiary, reported treating 26-50 closed fractures per month. Five out of seven secondary facilities reported an inability to treat open fractures. A slight majority of tertiary facilities (4/6) reported having sufficient quantities of internal and external fixation equipment, however less than 50% of secondary facilities reported sufficient quantities of these materials. Both emergent and non-emergent chest tube insertions, laparotomies, thoracotomies and cases of general anesthesia are included in case counts. Only one tertiary facility reported the consistent use of chest tubes in emergent situations with most facilities reporting none or less than one a month. Nine out of 12 facilities were incapable of performing thoracotomies and only one tertiary facility reported performing thoracotomies for emergent cases.

3.7 Discussion

The current study offers a comprehensive description of trauma capacity in Haiti covering the areas of infrastructure, supplies and equipment, personnel and training, and procedural capabilities. These data reveal a trauma system lacking structure and resources. This study also provides basic epidemiologic trauma data not found elsewhere that further validate the need for a cohesive trauma system in Haiti. Using our survey results and the Guidelines for EsTC as a framework, we have constructed a list of feasible steps that can be taken to improve trauma care

in Haiti in the areas of infrastructure & administration, physical resources, and training & human resources (Table 8).

A key step towards establishing a trauma system within Haiti is determining the level of care to be provided at each facility. This is essential to defining the physical and human resources necessary at each facility. Currently no surveyed facilities in Haiti use a trauma registry and one must be initiated. A trauma registry or injury surveillance system can aid in trauma system design and resource allocation by identifying the areas of highest injury burden (17, 18). The data gathered in trauma registries can also be used to inform injury prevention strategies, to identify gaps in care, and to monitor the effectiveness of future trauma care interventions (19). Indeed, the effectiveness of trauma systems in HICs could not be shown without the utilization of trauma registries (19). Currently, ER logbooks register all trauma patients but the information recorded is quite variable. With minimal resource input, ER logbooks in Haiti could be standardized to collect a minimum set of epidemiologic data on trauma patients. This information could greatly aid trauma system design and development in Haiti. Additionally, we suggest the formation of a national trauma committee consisting of Haitian clinicians, hospital administrators and government officials that can inform the initiative to improve trauma care in Haiti and provide strategies to achieve these goals.

Only two facilities surveyed had trauma quality improvement (QI) programs dealing with trauma-related projects. Trauma QI programs are essential to the success of trauma systems in HICs, and have been consistently shown to improve the process of care, decrease mortality and decrease costs in HICs (20). As such, all trauma centers in the United States are mandated to

have quality improvement programs in place (21). To support the development of a functional trauma system, Haitian facilities must implement trauma QI programs. In an effort to increase the use of trauma QI programs in LMICs, the WHO and IATSIC have developed the *Guidelines for Trauma Quality Improvement Programmes* (22). The document promotes two trauma QI methodologies that are inexpensive and feasible to implement in low-resource settings: morbidity & mortality conferences and preventable death panels. Both of these strategies could be useful in Haiti.

There is a stark shortage of critical care capabilities in Haiti with only three facilities possessing ICUs. Increasing critical care infrastructure may not be feasible for many LMICs and as such the Guidelines for EsTC have deemed items such as mechanical ventilation and invasive monitoring as “desirable” as opposed to “essential”. In addition to being prohibitively expensive, these items come with the need for personnel training, consumable resources (e.g. oxygen) and machine repair capabilities that may make them unfeasible for many LMICs. Therefore, we have listed the recommendation of increasing capacity for critical care as a secondary recommendation that should take less priority than more feasible, higher impact recommendations. Conversely, there is growing momentum for the use of mechanical ventilation in developing countries (23). Mechanical ventilation can benefit a wide spectrum of patients with the four most common indications for ventilation in developing countries being trauma, infectious disease, postsurgical treatment and peripartum maternal and neonatal complications (24). Because these patients frequently require only short-term ventilation, basic low-cost ventilators are being developed for use in LMICs (23).

This study identified several items essential for adequate trauma care that are in short supply in both secondary and tertiary facilities such as airway equipment, oxygen, cervical collars, chest tubes and pulse oximetry. By defining the necessary equipment and supplies at each level of care, the MSPP can take action to prioritize procurement and supply chains for these items. Additionally, we found that many of these essential items are not located in ERs where they are needed for emergent use. This finding is consistent with similar studies performed in other LMICs (25). This problem can easily be solved with improved organization and planning including the establishment of formal resuscitation areas (21, 25). Other physical resource needs include improved laboratory capabilities for arterial blood gas and lactic acid determinations. Despite aiding considerably in the management of trauma patients, both of these tests are deemed "desirable" by the Guidelines for EsTC due to cost. Pending funding, these capabilities may be considered for tertiary facilities and as such are listed as a secondary recommendation in Table 8. Lastly, only four surveyed facilities had consistent immediate access to blood products within fifteen minutes as required by the American College of Surgeons (ACS) Committee on Trauma at all national trauma centers. This was either due to a shortage of blood products or their untimely availability. The MSPP and the Haitian Red Cross can work together towards ensuring the consistent availability of blood products. By implementing transfusion protocols, the MSPP can promote timely access to available blood products.

The epidemiologic data reveal that ERs across the country see large volumes of trauma. This is further supported by the large numbers of monthly laceration repairs and fracture splintings reported. This volume however is not accompanied by the large numbers of resuscitative procedures such as chest tube insertions and ER intubations that one would expect with a large

trauma volume. Additionally, there is a significant lack of essential resuscitation equipment in the ER. Of particular note was the absence of airway equipment (suction, endotracheal tubes and oxygen) as well as chest tubes in emergency rooms. This is similar to studies in other LMICs that revealed low numbers of emergency resuscitative procedures and a dearth of resuscitative supplies and equipment in the ER (25-27). Further, our survey revealed that the majority of ERs are staffed by Haitian physicians in their mandatory social service year immediately following medical school. These physicians receive no formal EM or trauma-specific training in medical school. Based on the large volume of trauma seen in ERs, we suggest establishing a trauma-based curriculum in medical school to better prepare these physicians for their ER rotations.

Many physicians in HICs are required to take the Advanced Trauma Life Support (ATLS) course developed by the ACS (28). Unfortunately the start-up costs of ATLS are considerable and often prohibitive for LMICs and thus many low-resource adaptations of ATLS have been developed (29-32). However, one study of ATLS implementation in a low-resource setting that specifically targeted inexperienced physicians prior to their ER rotation showed improved mortality rates for all injury severities and better functional outcomes as a result of the course (33). An indirect result of the course was improved distribution of essential resuscitative equipment and supplies from the OR to the ER and the establishment of a resuscitation room. As an additional benefit of ATLS, the group noted an increased frequency of resuscitative procedures in the ER such as chest tube insertions and intubations (27). Currently, the only EM training program in Haiti is a three-year program recently started by Partners in Health (34). This program plans to graduate their first class of six EM physicians in 2017 (34). Previously unavailable and with small class sizes, physicians in their social service year will infrequently continue to staff ERs in their future

careers making implementation of ATLS for these physicians impractical. However, the ACS has developed the Trauma Evaluation and Management (TEAM) course for medical students to introduce the concepts of ATLS without the financial and resource commitment of ATLS (35). The TEAM course may be of great value in the medical schools of Haiti. Additionally, Haiti lacks any continuing trauma education for health care practitioners. ATLS courses are commonly provided in developing counties by visiting foreign medical doctors on a one-time basis. This is undoubtedly beneficial for local staff, however ATLS certification is meant to be renewed every four years. Without the certification of Haitian ATLS or equivalent instructors this will not become a locally sustainable program. To this end we suggest the establishment of a continuing trauma education course lead by trained Haitian instructors for all relevant medical personnel including physicians and nurses. Due to the high start-up costs of ATLS, another low-resource trauma training course may be better adapted to Haiti's needs.

Haiti is in need of more trained surgeons, particularly in surgical specialties such as orthopedics, cardiothoracics and neurosurgery. Many developing countries have a large burden of orthopedic and neurologic injuries, many of which are due to the high incidence of MVAs in these settings, thus necessitating the need for these surgical subspecialties (10, 26, 36, 37). In the United States both a Level 1 and Level 2 trauma center are expected to have 24/7 access to orthopedics and neurosurgical capabilities (21). We found that many secondary facilities in Haiti do not have 24/7 access to an orthopedic surgeon and the vast majority of all surveyed facilities do not have access to neurosurgical care. Our survey also revealed a wide-spread inability to perform thoracotomies, a vital life-saving procedure in many circumstances. Currently Haiti does have an orthopedic surgery training program but lacks a neurosurgical and cardiothoracic residency

program. To fill this gap in care, we recommend that the training capacity in these areas be increased. A possible strategy to accomplish this is to develop systems that utilize Haitian physicians that have received specialty training and reside in foreign countries as instructors for in-country Haitian training programs (38).

Lastly, we must acknowledge the limitations of our study. First, although our study included the major public facility in each of Haiti's ten departments, we did not expand our study to smaller district facilities due to time and financial constraints. These district facilities may represent important parts of a future trauma system, especially in more rural areas where they are likely to be the location of initial presentation for injured persons. Other limitations pertain to the subjective nature of our study. We sought to have questions answered by the most appropriate staff member but this was not always possible leading to potential under- or over-reporting of resource availability. Additionally, procedure counts were reported as subjective ranges and not verified by operating room logbooks. A third limitation of this study is that we did not assess processes of care. Other studies in similar settings have identified aspects of trauma care such as the use of blood transfusions and the time to emergency surgery as feasible, low-cost targets to improve trauma outcomes (26).

Despite these limitations we feel that this study provides a comprehensive description of current trauma care capacity in Haiti. Using the Guidelines for EsTC as a framework we have developed a list of feasible recommendations in the areas of infrastructure & administration, physical resources, and training & human resources. These recommendations represent a starting point for the improvement of trauma care in Haiti and the establishment of a national trauma system. In

addition to these hospital-based interventions, improvements in injury prevention, pre-hospital care, rehabilitation and research are needed to establish a fully functional trauma system in Haiti. Through the continued efforts of this collaborative group we aim to facilitate the MSPP's efforts in implementing these improvements and others in the future.

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3.9 Tables

Table 1. Surveyed Facilities

Hospital	City	Population Served^	Private/Public	Classification
Hopital de l'Universite d'Etat d'Haiti	Port-au-Prince	3.664.620	Public	Tertiary
Hospital Bernard Mevs	Port-au-Prince	250,000*	Mixed	Tertiary
Hopital Sacre Coeur	Milot	29,094*	Mixed	Tertiary
Hopital Universitaire Justinien	Cap Haitien	970,495	Public	Tertiary
Hopital Immaculee Conception des Cayes	Les Cayes	704,760	Public	Tertiary
Hopital de la Providence	Gonaives	1,571,020	Public	Tertiary
Hopital Ste.-Antoine de Jeremie	Jeremie	425,878	Mixed	Secondary
Hopital Immaculee Conception	Port-de-Paix	662,777	Public	Secondary
Hopital Ste. Michel de Jacmel	Jacmel	575,293	Public	Secondary
Hopital Ste. Therese de Hinche	Hinche	678,626	Mixed	Secondary
Hopital de Fort-Liberte	Fort Liberte	358,277	Mixed	Secondary
Hopital Ste. Therese de Miragoane	Miragoane	311,497	Public	Secondary

^Populations served are estimated 2009 populations based on 2003 national census results
Secondary = Population served <700,000; Tertiary = Population served >700,000 or extensive infrastructure and surgical capabilities
Mixed = Public hospitals with significant financial contributions from private donors
*Populations represent surrounding local populations however these facilities serve a broader population as national surgical referral centers

Table 2. Trauma cases presenting to surveyed Emergency Rooms during a one week period

	Secondary	Tertiary
Trauma cases per week^, mean ± sd	35 ± 21	59 ± 35
% Adult trauma, mean ± sd	68 ± 19	74 ± 15
% Pediatric trauma, mean ± sd	31 ± 16	21 ± 12
% Motor Vehicle Accident*, mean ± sd	26 ± 9	20 ± 11
% Violence*, mean ± sd	17 ± 11	9 ± 3

^Data obtained from six secondary and five tertiary hospitals.
*Information regarding mechanism of injury was only recorded at 5 secondary and 4 tertiary facilities

Table 3. Hospital Infrastructure at surveyed facilities

	Secondary	**Tertiary**
N	6	6
Total Beds per facility, median (range)	67 (40-157)	112 (45-500)
Operating Rooms per facility, median (range)	2.0 (1-3)	3.5 (2-12)
Number of facilities with ICU, n (%)	0 (0%)	3 (50%)
Facilities with immediate blood products^, n (%)	2 (33%)	2 (33%)
Facilities with 24/7 Radiology Services*, n (%)	5 (83%)	6 (100%)
Facilities with Computed Tomography, n (%)	0 (0%)	1 (17%)
Trauma Registry, n (%)	0 (0%)	0 (0%)
Trauma Quality Improvement Program, n (%)	1 (17%)	1 (17%)

*24/7 = 24-hours per day, 7 days a week

^Availability of blood products within 15 minutes in accordance with the American College of Surgeons' Committee on Trauma

Table 4. Average percentage of time essential supplies are available in the Emergency Room (ER) and Operating Room (OR)

		Secondary		Tertiary	
		ER Mean % ± SD	OR Mean % ± SD	ER Mean % ± SD	OR Mean % ± SD
Airway	Suction	17 ± 41	100 ± 0	17 ± 41	98 ± 4
	Laryngoscope	17 ± 41	100 ± 0	17 ± 41	100 ± 0
	Endotrachial tube	17 ± 41	94 ± 9	17 ± 41	100 ± 0
	Cricothyroidotomy Equipment	0 ± 0	50 ± 55	0 ± 0	83 ± 41
	Cervical Collar	25 ± 42	40 ± 55	69 ± 45	40 ± 55
Breathing	Oxygen	74 ± 43	100 ± 0	46 ± 51	98 ± 4
	Chest tubes	0 ± 0	51 ± 54	17 ± 41	92 ± 20
	Pulse Oximetry*	50 ± 55	100 ± 0	79 ± 33	100 ± 0
	Arterial Blood Gas*	0 ± 0		17 ± 41	
	Bag Valve Mask	67 ± 52	100 ± 0	79 ± 33	100 ± 0
	Mechanical Ventilators*	0 ± 0	-	50 ± 55	-
Circulation	Blood Pressure Cuff	100 ± 0	100 ± 0	100 ± 0	100 ± 0
	Gauze/Bandages	43 ± 47	88 ± 27	67 ± 37	98 ± 4
	IV infusion sets	75 ± 42	100 ± 0	83 ± 41	92 ± 20
	Crystalloid fluid	92 ± 20	70 ± 45	82 ± 34	90 ± 24
	Urinary Catheter	37 ± 50	60 ± 55	57 ± 50	83 ± 41
	Hemoglobin determination	100 ± 0		98 ± 4	
	Lactic Acid Determination*	0 ± 0		0 ± 0	
	Central line equipment	0 ± 0	20 ± 45	35 ± 49	60 ± 55

*Supplies or equipment deemed “desirable” by the WHO Guidelines for Essential Trauma Care

Table 5. Availability of trained staff at secondary and tertiary facilities

	Secondary	Tertiary
ED staffed by attending level physicians, n (%)	0 (0%)	2 (33%)
General Surgeon In-House 24/7, n (%)	0 (0%)	2 (33%)
General Surgeon On-Call 24/7, n (%)	5 (83%)	6 (100%)
Orthopedic Surgeon In-House 24/7, n (%)	0 (0%)	2 (33%)
Orthopedic Surgeon On-Call 24/7, n (%)	1 (17%)	6 (100%)
Neurosurgeon Surgeon In-House 24/7, n (%)	0 (0%)	0 (0%)
Neurosurgeon Surgeon On-Call 24/7, n (%)	0 (0%)	2 (33%)
Anesthesia Provider In-House 24/7, n (%)	3 (50%)	2 (33%)
Anesthesia Provider On-Call 24/7, n (%)	6 (100%)	6 (100%)

^Anesthesia provider = anesthesiologist or nurse anesthetist

Table 6. Average percentage of physicians with formal trauma training at secondary and tertiary facilities

	Secondary (n=1)	Tertiary (n=2)
% Emergency Physicians with trauma training, mean	50%	15%
% Surgeons with trauma training, mean	50%	75%

Table 7. The most frequently reported number of cases performed per month at surveyed facilities

	Secondary **mode** (range)	Tertiary **mode** (range)
Laceration repairs	**101+** (1-101+)	**101+** (51-101+)
Acute burn management	**1-10** (<1-25)	**1-10** (<1-10)
Chest tube insertion*	**<1** (0-10)	**<1** (<1-75)
Splinting fracture	**11-25** (0-25)	**101+** (11-101+)
Procedural treatment of closed fracture	**1-10** (0-50)	**1-10** (1-50)
Procedural treatment of an open fracture	**0** (0-25)	**1-10** (1-101+)
Laparotomy*	**1-10** (0-50)	**1-10** (1-75)
Thoracotomy	**0** (0-<1)	**0** (0-10)
General anesthesia*	**1-10** (0-50)	**26-50** (1-100)

Data was collected as follows: 0 = procedure is not available; < 1 = procedure is performed less than once a month; and the following ranges: 1-10, 11-25, 26-50, 51-75, 76-100, 101+

*These numbers represent both emergent and non-emergent procedures performed

Table 8. Recommendations for improving trauma care in Haiti

Infrastructure & Administrative

- Determine the level of care to be delivered at each facility to facilitate adequate human and physical resource distribution
- Initiate a trauma registry at all facilities to gather epidemiological data and to monitor quality improvement efforts
- Assemble a National Trauma Committee consisting of government officials, administrators and clinicians
- Initiate trauma quality improvement programs
- Increase capacity for care of critically ill patients*

Physical Resources

- Define equipment and supplies that are deemed essential at each level of care
- Improve procurement and supply chains for supplies and equipment
- Improve distribution of resources within each healthcare facility (i.e. ED vs OR)
- Increase laboratory capabilities (arterial blood gases, lactate levels)*
- Increase access to blood products and protocols for their use (packed RBCs, FFP, platelets, etc)

Training & Human Resources

- Increase trauma training in medical schools to ensure that physicians staffing EDs in their social services year have basic trauma training
- Increase access to continuing trauma education for all medical personnel including physicians and nurses using resource-appropriate training modules
- Increase training capacity of essential emergent surgical procedures including general, cardiothroacic and neurosurgical procedures

*secondary recommendation

Chapter 4: Recommendations, Implications and Future Directions

This study successfully completed a trauma capacity assessment of twelve healthcare facilities across Haiti including the MSPP departmental referral center in each of Haiti's ten departments. The capacity survey utilized in this study was adapted from the WHO's Tool for Situational Analysis to Assess Emergency and Essential Surgical Care and assessed the areas of infrastructure, supplies, equipment, personnel, training and procedural capabilities. Based on these findings, and using the WHOs Guidelines for EsTC as a framework for the development of trauma systems in LMICs, recommendations towards improving trauma care in Haiti were provided spanning the areas of infrastructure & administration, physical resources, and training & human resources. These recommendations represent a set of feasible, evidence-based interventions that collectively can contribute to the formation of a cohesive national trauma system in Haiti. The recommendation to create a National Trauma Committee strives to establish in-country governance and ownership of the larger initiative to impact trauma care in Haiti. With minimal resource input, the initiation of a trauma aims to better inform trauma system design and structure. The establishment of inexpensive facility-based trauma quality improvement programs will aid in the identification of gaps in care delivery as well as monitor the success of implemented interventions. Several recommendations such as determining the level of care to be delivered at each facility, defining the equipment and supplies that are to be deemed essential at each level of care, and improving the distribution of essential supplies and equipment within facilities involve low-cost improvements in organization that will improve trauma care delivery. Recommendations in the area of training & human resources requires slightly more resource input to establish sustainable trauma and surgical education capacity. Lastly, two recommendations to increase critical care and laboratory capacity require significant resource input and may be of lesser priority when compared to more feasible, higher impact interventions.

This study is the product of a collaboration between Emory University School of Medicine and the Rollins School of Public Health, Haiti's MSPP and Project Medishare for Haiti. This partnership has the potential to greatly impact trauma care in Haiti through the continued dedication of the MSPP and the guidance of outside academic and non-governmental institutions. Currently, a study is in the planning stages to pilot an injury surveillance tool in five ERs across Haiti. This study will provide valuable information towards the formation of a national trauma registry as well as providing epidemiologic data that can begin to inform the design of a national trauma system. In addition to aiding in future system design, a trauma registry can help bring about comprehensive trauma care by identifying targets for injury prevention and providing an inherent monitoring and evaluation system for the implemented system improvements.

Trauma systems in LMICs must be individualized to each country's needs, financial capabilities and infrastructural capacity. Our group must remain flexible and resourceful to overcome the barriers that will be encountered while attempting to improve trauma care in Haiti. The recommendations made in this study address the hospital-based element of trauma care. Work is still needed to address the other elements a comprehensive trauma system including injury prevention, pre-hospital care, rehabilitation and trauma-related research.

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Appendix 1: Survey Tool

Hospital

City

Facility Level

Medical Director

Phone Number

Email address

Number of Beds

Number of Operating Rooms

EPIDEMIOLOGIC DATA (Survey Questions)

Trauma cases per month (subjective)

◯ 1-5 ◯ 6-10 ◯ 11-25 ◯ 26-50 ◯ 51-75 ◯ 76-100
◯ 100-200 ◯ 201-300 ◯ 301-400 ◯ 401-500 ◯ <1

Adult Trauma cases per month (subjective)

◯ 1-5 ◯ 6-10 ◯ 11-25 ◯ 26-50 ◯ 51-75 ◯ 76-100
◯ 100-200 ◯ 201-300 ◯ 301-400 ◯ 401-500 ◯ <1

Pediatric Trauma cases per month (subjective)

◯ 1-5 ◯ 6-10 ◯ 11-25 ◯ 26-50 ◯ 51-75 ◯ 76-100
◯ 100-200 ◯ 201-300 ◯ 301-400 ◯ 401-500 ◯ <1

MVCs per month (subjective)

◯ 1-5 ◯ 6-10 ◯ 11-25 ◯ 26-50 ◯ 51-75 ◯ 76-100
◯ 100-200 ◯ 201-300 ◯ 301-400 ◯ 401-500 ◯ <1

Burns per month (subjective)

◯ 1-5 ◯ 6-10 ◯ 11-25 ◯ 26-50 ◯ 51-75 ◯ 76-100
◯ 100-200 ◯ 201-300 ◯ 301-400 ◯ 401-500 ◯ <1

Are all patients that come to the ED recorded in the log book?

◯ Yes ◯ No ◯ Don't know

Are all in-coming transfer patients recorded in the log book?

◯ Yes ◯ No ◯ Don't know

Are all out-going transfer patients recorded in the log book?

◯ Yes ◯ No ◯ Don't know

Explanation of Log Book entries

How do patients arrive to the Emergency Room (check all that apply)

☐ foot ☐ Motorcycle ☐ Taxi ☐ Private Vehicle
☐ Ambulance

How do patients most often arrive to the Emergency Room (select one)

◯ foot ◯ Motorcycle ◯ Taxi ◯ Private Vehicle
◯ Ambulance

INFRASTRUCTURE

What percent of the time do you have electricity?

Is the primary source city grid or generator?

What percent of the time is running water available?

What type of internet access is available? Percent of time operational?

Is this facility capable of patient transfers? ◯ Yes ◯ No

How are patients transferred? (check all that apply)

☐ foot ☐ car
☐ motorcycle ☐ private vehicle
☐ taxi ☐ ambulance

How are patients transferred most often? (check all that apply)

◯ foot ◯ car
◯ motorcycle ◯ private vehicle
◯ taxi ◯ ambulance

How many ambulances does the facility have?

What percentage of time is an ambulance available? (if available, get picture)

Are the ambulances shared?

What activities is the ambulance available for?

- ☐ pre-hospital care
- ☐ patient transfers
- ☐ Other

Who drives the ambulance?

What training do they have?

Does the ambulance have the following items?

Oxygen	◯ Yes	◯ No
IV equipment	◯ Yes	◯ No
Spine board	◯ Yes	◯ No
Ambu bag	◯ Yes	◯ No
Cervical collar	◯ Yes	◯ No
Fire extinguisher	◯ Yes	◯ No
Power inverter	◯ Yes	◯ No

Does the facility have a helicopter landing pad? ◯ Yes ◯ No

Is there somewhere nearby for a helicopter to land? How far away is it from the hospital?

Ambulance Notes

Are the following guidelines written and available on-site? Can we see them? (picture)

trauma guidelines	◯ Yes	◯ No
surgery guidelines	◯ Yes	◯ No
anesthesia guidelines	◯ Yes	◯ No

Explanation of Guidelines

QI Program

Are there QI mechanisms in place? ◯ Yes ◯ No

If yes, please explain:

Trauma Registry

Does this facility use a trauma registry? ◯ Yes ◯ No

If yes, does this information go to the MOH? ◯ Yes ◯ No

What parameters are in the trauma registry? (e.g. injury severity scale, GCS, mechanism of injury, location of injury)

In-Service Training

Does this facility offer in-service training? ◯ Yes ◯ No

If yes, who provides this training?

What topics have been covered?

How frequent are these trainings?

ATLS Training

Does this facility offer ATLS or equivalent trauma training? ◯ Yes ◯ No

If yes, who provides this training?

What topics have been covered?

How frequent are these trainings?

Does the facility have a dedicated area for trauma care? (If yes, picture) ◯ Yes ◯ No

Intensive Care Unit

Does this facility have an intensive care unit? (If yes, can we see it) ◯ Yes ◯ No

Who staffs the ICU and what is their training?

Is it staffed 24 hours a day? ◯ Yes ◯ No

Is it staffed 24 hours by a physician ◯ Yes ◯ No

If no, what hours is it staffed?

Is a physician available IN-HOUSE 24 hours? ◯ Yes ◯ No

If no, what hours is a doctor IN-HOUSE?

Is a physician available ON-CALL 24 hours? ◯ Yes ◯ No

If no, what hours is a doctor ON-CALL?

Answer the following questions with percent available, available but broken or not available:

Ventilators

Continuous cardiac monitoring

CVP monitoring

ICP monitoring

Compartment pressure monitoring

Blood Bank

Are blood products available? ◯ Yes ◯ No

Are blood products stored on-site? ◯ Yes ◯ No

Are they accessible 24/7? ◯ Yes ◯ No

Are they accessible immediately or is someone on-call? How long does it take to get them?

What percentage of time does the blood bank have blood?

What blood products are regularly available? (Check all that apply)

- ☐ packed RBCs
- ☐ platelets
- ☐ cryoprecipitate
- ☐ FFP

LABS

What percentage of time are the following labs available?

CBC	
Electrolytes	
Urinalysis	
Lactate	
Gram stain	
Bacterial culture	
Arterial blood gas	

Lab Notes

Are labs available nights and weekends ◯ Yes ◯ No

PERSONNEL

Is your ED open 24/7? ◯ Yes ◯ No

Is there an ED physician IN-HOUSE 24/7? ◯ Yes ◯ No

If no, what hours/days is one IN-HOUSE?

Is there an ED physician ON-CALL 24/7? ◯ Yes ◯ No

If no, what hours/days is one ON-CALL?

What training does this physician have? (e.g. internal medicine, family, EM)

What percentage of these physicians have ATLS or equivalent training?

What hours of the day is the ED staffed by a nurse?

Is there a wards physician IN-HOUSE 24/7? ◯ Yes ◯ No

If no, what hours is one IN-HOUSE?

Is there a wards physician ON-CALL 24/7? ◯ Yes ◯ No

If no, what hours is one ON-CALL?

Is there a general surgeon IN-HOUSE 24/7? ◯ Yes ◯ No

If no, what hours/days is one IN-HOUSE?

Is there a general surgeon ON-CALL 24/7? ◯ Yes ◯ No

If no, what hours/days is one ON-CALL?

What percentage of these physicians have ATLS or equivalent trauma training?

Is there an orthopedic surgeon IN-HOUSE 24/7? ◯ Yes ◯ No

If no, what hours/days is one IN-HOUSE?

Is there an orthopedic surgeon ON-CALL 24/7? ◯ Yes ◯ No

If no, what hours/days is one ON-CALL?

What percentage of these physicians have ATLS or equivalent trauma training?

Is there a neurological surgeon IN-HOUSE 24/7? ◯ Yes ◯ No

If no, what hours/days is one IN-HOUSE?

Is there a neurological surgeon ON-CALL 24/7? ◯ Yes ◯ No

If no, what hours/days is one ON-CALL?

What percentage of these physicians have ATLS or equivalent trauma training?

Is there an anesthesiologist IN-HOUSE 24/7? ◯ Yes ◯ No

If no, what hours/days is one IN-HOUSE?

Is there an anesthesiologist ON-CALL 24/7? ◯ Yes ◯ No

If no, what hours/days is one ON-CALL?

What percentage of these physicians have ATLS or equivalent trauma training?

Is there a nurse anesthetist IN-HOUSE 24/7? ◯ Yes ◯ No

If no, what hours/days is one IN-HOUSE?

Is there a nurse anesthetist ON-CALL 24/7? ◯ Yes ◯ No

If no, what hours/days is one ON-CALL?

What percentage of these physicians have ATLS or equivalent trauma training?

Are there OR staff IN-HOUSE 24/7? ◯ Yes ◯ No

If no, what hours/days is one IN-HOUSE?

Are there OR staff ON-CALL 24/7? ◯ Yes ◯ No

If no, what hours/days is one ON-CALL?

Is there physical therapy at this facility? ◯ Yes ◯ No

What percentage of time is PT available?

MACHINERY

What percentage of time are the following things available? (%, available but broken, not available)

Anesthesia machine

OR lights

Generator

Incinerator

Autoclave

EKG

Machinery Notes

SUPPLIES
What percentage of time are the following supplies available and where are they located in the hospital?

Vitals Equipment: percent of time available and location

Stethescope ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

BP cuff and sphyngmomanometer ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Pulse Oximeter ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Thermometer ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Airway/Breathing Equipment: percent of time available and location

Oxygen cylinder ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Portable Oxygen Source ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Oxygen concentrator ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Oxygen mask and tubing (nasal cannula, non-re-breather, etc) ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Suction (including pump, tubing, tip) ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Bag valve mask (adult) ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Bag valve mask (peds) ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

ET tubes (adult and peds) ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Laryngoscope (handle and blades) ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Ventilators ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Chest tube equipment ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Chest tube water seal suction equipment ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Cricothyrotomy equipment ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Circulatory Equipment: percent of time available and location

IV infusion equipment (including IV cannula various sizes, tubing) ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Butterfly needles ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

IO infusion equipment ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Central line equipment ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Crystalline fluids ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Colloid fluids (albumin, dextran, hetastarch) ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Fluid warmers ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Tourniquet ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Pelvic binder ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Head/Spine Equipment: percent of time available and location

Cervical collar ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Spine back board ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Burr hole drill ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Wheeled gurney ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Surgical Equipment: percent of time available and location

Scalpel ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Hemostat ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Needle driver ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Suture ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Straight scissors ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Retractor ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Laparotomy Equipment ◯ Yes ◯ No

OR (% time available)

Other (specify, % time available)

Thoracotomy equipment ◯ Yes ◯ No

OR (% time available)

Other (specify, % time available)

Vascular Equipment ◯ Yes ◯ No

OR (% time available)

Other (specify, % time available)

Neurosurgery Equipment ◯ Yes ◯ No

OR (% time available)

Other (specify, % time available)

External Fixation Equipment ◯ Yes ◯ No

OR (% time available)

Other (specify, % time available)

Internal Fixation Equipment ◯ Yes ◯ No

OR (% time available)

Other (specify, % time available)

C-section equipment ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Electrocautery ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Sterile drapes ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Face masks ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Eye protection ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Nail scrub brush ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Sterile patient preparation (iodine, chlohexidine) ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Sterile gloves ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Wound Care Supplies: percent of time available and location

Alcohol-based solution ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Non-sterile gloves ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Sterile dressing ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Clean non-sterile dressing ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Tape ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Miscellaneous Supplies: percent of time available and location

Splints ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Casting materials ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Vaginal speculum ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

NG tube ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Foley catheter ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Sharps container ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Flashlight ◯ Yes ◯ No

ED (% time available)

OR (% time available)

ICU (% time available)

Other (specify, % time available)

Medications: Percent of time available

Local anesthetics

General anesthetics	
Anxiolytics	
Opiates	
Vasopressors	
Anti-Hypertensives	
Anti-pyretics	
Anti-convulsants	
Anti-coagulants	
Paralytics	
Naloxone	
Diuretics	
Insulin	
Penicillin	
Cephalosporin	
Macrolides	
Fluoroquinolones	
Aminoglycosides	
Topical antibiotic ointment	
Normal saline	
Ringer's Lactate	
Glucose	
Albumin	
Sulfadiazine	
Magnesium	
Anti-fungals	
Topical anti-fungals	

Tetanus vaccine

Hepatits B Vaccine

Medication Notes

PROCEDURES
Number of procedures performed per month

Acute burn management

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

General Anesthesia

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Ketamine Anesthesia

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Spinal Anesthesia

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Resuscitation

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Cricothyrotomy

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Tracheotomy

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Foreign Body removal

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Laceration Repair

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Incision & Drainage of an abscess

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Wound debridement

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Chest tube insertion

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Splinting

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Casting

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Procedural treatment of a closed fracture

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Procedural treatment of an open fracture

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Amputation

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Skin grafting

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Laparotomy

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Thoracotomy

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

C-section

◯ 1-10 ◯ 11-25 ◯ 26-50 ◯ 51-75
◯ 76-100 ◯ 101+ ◯ Not available ◯ <1

Procedure Notes

IMAGING EQUIPMENT: Percentage of time available

CT Scanner

Portable X-Ray

Standing X-Ray

Ultrasound

Endoscopy

Angiography

Imaging Notes

Submit