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Pilot Implementation of a Multi-Site Injury Surveillance Registry in Haiti

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Bachelor of Science and Engineering
Vanderbilt University, 2011

Doctor of Medicine
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Abstract

Background:

Development of a trauma surveillance system has become a national priority for Haiti. In 2014, a trauma needs capacity assessment was conducted in 12 hospitals across 9 departments, as described in the WHO Guidelines for Essential Emergency and Surgical Care. Step two of the guidelines recommends development of standardized data-collection protocols, which allow for monitoring of disease burden and overall health outcomes. In this article, we present our pilot evaluation of implementing a new Injury Surveillance logbook with four Haitian Emergency Departments, specifically looking at the implementation within existing workflow processes and feasibility for tracking patients with trauma or injuries.

Methods:

We designed a provider-based trauma and injury registry utilizing WHO Injury Surveillance Guidelines, existing trauma registries from other Low and Middle Income Countries, and with consideration for existing documentation systems in Haiti. The logbook was tested in four Haitian Emergency Departments for four weeks. Utility of the logbook was evaluated using quantitative indicators from WHO Injury Surveillance Guidelines (injury rate, recording score, completeness score, accuracy score) and post-pilot survey responses from providers. Comparative evaluations of logbook utility at each facility were conducted using Chi-Square tests, determining significance at $p<0.05$. Qualitative data was collected from users and was coded and analyzed using inductive methods.

Findings:

Recording rates by staff ranged from 25% to 58%, and correlated with time of day, week of study, and hospital staffing at sites. Entry completeness rates ranged from 43-80%. The most frequently recorded variables pertained to mechanism (96%), location (95%), and type of injury (92%), as well as procedures performed (90%). Most commonly missed variables included vital signs (60%) and number of severe injuries (65%). Providers reported high agreeability with using the form ($p<0.01$). The most commonly cited barrier to using the form was 'lack of time'.

Interpretation:

This format of an injury surveillance logbook was integrated into the natural workflow of patient care in Haitian Emergency Departments. The feasibility statistics demonstrate that there are areas in the tool that could be improved, but overwhelmingly there is support for the surveillance system to be used nationwide. Future steps include extending the trial period for an additional 6 months, and incorporating more facilities in surveillance of trauma.

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Background

Trauma continues to be an important cause of death and disability, globally. The burden of trauma and injuries is unevenly spread between low and high-income countries, with greater than 90% of global injuries occurring in lower income (LIC) countries (1-4). Injuries are among the top causes of mortality and long-term disability in low-income countries (1, 5). The World Health Organization (WHO) evaluations on injury support the observations that the relative burden of injuries in a country can create a detrimental impact on the nation's socioeconomic and physical health. This is especially true for those countries most constrained in economic growth and national resources (4). Haiti, the poorest country in the western hemisphere, is no exception. Injury mortality rates in Haiti are estimated to be almost four times the rates in the United States (US) (189/100,000 vs 50/100,000), based on models, though the true mortality rates may be even higher (1). To date, it has been impossible to estimate the attributable morbidity associated with trauma and injuries, as the occurrence and outcomes of injuries have not routinely been recorded in the medical records or national data sources. In truth, little is known about the true burden of trauma and injuries in Haiti, due to the lack of standardized registries, and lack of national surveillance data.

Trauma registries in high-income countries (HIC) serve as injury surveillance systems utilized for the quantification and characterization of trauma (6). These registries are also used to enhance performance by trauma centers in delivering care, in developing quality improvement efforts, and in planning and development of national healthcare policies (7, 8). Implementation of trauma registries in high-income countries has been linked to significant decreases in morbidity and mortality secondary to preventable causes of injury, such as road-traffic accidents (9). The US Center for Disease Control and Prevention (CDC) describes the importance of national surveillance systems as "a fundamental part of public health practice used to measure the impact of disease, detect changes in trends, guide immediate and long-term actions, and prioritize the use of public health resources"(9). Trauma registries are infrequently found in low and middle income nations due to financial, logistic, and human resource barriers (7, 10). However, as more and more countries begin to recognize the need for prevention of non-communicable diseases, including injuries, trauma, and surgical diseases, Ministries of Health are becoming more invested in overcoming the barriers to surveillance and setting up documentation systems (11, 12).

Current challenges to creating robust healthcare monitoring in Haiti include irregular reporting by hospitals and clinics to Haiti's Ministère de la Santé Publique et de la Population (MSPP) branches on patient outcomes, variance in medical-record keeping between facilities, and the presence of significant delays in communication between MSPP and regional centers (13). In this report, we present the development and pilot of an injury surveillance tool, aimed at overcoming some of these barriers and collecting valuable information that can be used in the development of a national trauma system for Haiti.

Implementing a National Trauma Surveillance System in Haiti

The implementation of national healthcare innovations in Haiti has historically suffered from absence of relevant and timely research strategies and frequent changes in the sociopolitical infrastructure. Nonetheless, initiatives to address these deficits and encourage evidence-based medical practice in the country have taken off in the past decade (14, 15). The Earthquake in 2005 brought awareness of a need for national epidemiologic surveillance as counts of injury and illness were largely unknown shortly after the quake. The sudden cholera outbreak led to swift establishment of a cholera surveillance network by the CDC in 2006 (14, 15). At this time, injury surveillance was reported indirectly by NGOs providing information on the numbers of people they were treating in makeshift hospitals within and around Port-au-Prince. From 2006-2010, there were attempts to establish injury surveillance tools, but none of these efforts received enough infrastructural support, at that time, to become a national policy (14, 16). In 2012, Dewberry et al conducted an initial Trauma Needs Assessment in the Central Plateau (13). This work was expanded in 2014 by McCullough et al, who conducted a national trauma capacity assessment across 12 Emergency Departments in 9 of the 10 départements of Haiti (17). Following, the group

determined a set of interventions that could be implemented most feasibly and efficiently as next steps in building a national trauma system. Some of the first recommendations made included development and utilization of a standardized trauma registry, and identified the existing system of medical documentation as a potential starting point (17). These recommendations were in keeping with MSPP goals of "improving hospital management with the establishment of a single information system" to "strengthen healthcare institutions"(18).

Financial resource constraints have consistently presented a barrier to healthcare improvement in Haiti, not unlike the rest of the developing world. There is limited funding from the government for public sector healthcare. Many of the healthcare services in the "public sector" are backed by non-governmental organizations or charitable hospitals. A large proportion of public hospitals are staffed by physician-residents and students, with the government mandating that attending physicians or senior nurses donate time to public institutions. Facilities still struggle with reliable access to clean water and electricity, adding significant challenges to adequate provision of healthcare. Given these constraints, there is a need for low-cost interventions which can be easily implemented and yet provide major impact on health. A paper registry, if well-designed, organized, and implemented nationally, is a low-cost intervention that has great potential to assist in capacity-building within and between sectors of public health in Haiti.

Lastly, healthcare workers are busy. The physical, mental, and time constraints they face are particularly marked in developing or remote settings where patient-to-physician ratios are high. Nonetheless, prior studies conducted in middle- and low-income countries have shown that provider-based, hospital registry systems are more effective than those implemented by external stakeholders (4, 6, 8, 10). To be efficient and feasible, it is imperative that an injury surveillance tool be easy to use, take little time to fill out, and, at the very least, not impede health workers from doing their jobs effectively. The ideal tool would thus entail a succinct set of questions that are familiar to providers, or are easily adaptable into the normal routine of history and physical examination at the point of care, while also providing relevant details that could be utilized by epidemiologists to characterize disease burden. Pertaining to trauma, such registries have the potential to quantify the severity of injuries seen regionally and nationally, assist in identifying major opportunities for injury prevention, and facilitating capacity-building among and within facilities(16).

Project Aims:
Taking all of these elements into account, we designed, implemented, and tested an injury surveillance tool that utilized a checklist format to collect history and physical exam (H&P) data from persons experiencing injury and/or trauma (Figure 1). We hypothesized that this surveillance tool would be both feasible to integrate into existing systems of care, and useful for characterizing trauma and related outcomes (e.g., deaths, complications, etc.) in the regions tested.

The study had multiple aims:
(1) to develop an injury surveillance tool appropriate for Haiti's low-resource setting; (2) to train nurses to utilize this tool to record data on all trauma patients; (3) to inform the Haitian Ministère de la Santé Publique et de la Population (MSPP) and the larger global health community on the barriers to implementing an injury surveillance tool in Haiti; and (4) To utilize the data collected to inform the continuation, design, and resource allocation needed to implement a national trauma system. In this paper, we present an evaluation of the pilot implementation of the injury surveillance tool, with recommendations and discussion of future directions that could be taken to strengthen the national trauma system in Haiti.

Methods:
Surveillance Tool Development and Training:

To develop the injury surveillance tool, we reviewed several published articles regarding trauma registries to learn from their experiences implementing registries in LMIC (19-24), as well as prior experiences of registry implementation in Haiti from 2005-2011 (14, 16, 25). From this review, and incorporating guidelines from the CDC and American Association of Surgery and Trauma (AAST), we developed a two-row, checklist format for a paper-based patient injury register (Figure 1a). The format was pre-tested and reviewed by Haitian nurses and physicians working at a tertiary referral center in Port-au-Prince before the pilot period initially started.

Training for healthcare workers implementing the surveillance tool covered the following topics: the purpose of the project, individual sections of the logbook, and eligibility criteria for patients. The training program was developed and approved by the MSPP. Materials included an 8-10 minute slideshow presented on an iPad, in French, that was deemed appropriate for both nursing and physician house staff. This study sought IRB approval and was given exemption due to the quality improvement focus of the project.

Study Design and Timeline:
The pilot study to evaluate use of the surveillance tool was conducted using a step-wise implementation method (Figure 2). Week 1 at a given facility focused on training as many health workers on-site as possible, observing to ensure the logbook was used for every injured patient that came into the emergency department, and answering any questions the staff may have had in using the logbook. For each site's weeks 2-4 in the study, hospital workers continued to use the book in each shift, and stayed in contact with our research team through weekly phone check-ins, to ensure that staff had necessary support. At the end of a site's 4-week trial period, our research team returned to perform the data collection and evaluation phase of the project.

Clinical Sites:
We worked with the Director General of MSPP and obtained approval to implement the study at four flagship sites. Each site was selected for being a large public hospital for the region, having capabilities of receiving trauma patients, and having staff available daily. Selections for potential flagship sites were determined with collaboration by McCullough et al, partners at Equal Health International, and input from administrative assistance of MSPP. Particular observations around the structure, staffing, system of recording, and general services provided at each clinical site can be found in Appendix 1. Prior to our recruitment of each site, an official letter was sent by the Director General's office requesting participation from the site to each of the administrative leaders at these facilities. These letters were followed up with phone calls and verbal acknowledgement by the department directors for the study group to visit and recruit staff for the pilot.

Institutional administration of each site granted approval for our team to examine the main emergency department registers for any patients with trauma that may not have been included over the study period. All patients with injuries or trauma were de-identified, and data was entered separately for statistical analysis.

Data Collection and Definitions of Variables:
A major objective of this project was to evaluate the feasibility of implementing a provider-based checklist-format registry in the busy, low-resource context of national public hospitals in Haiti. To this end, we examined four variables from all data abstracted at each site:

1- Injury rate at each facility;
2- Frequency of use of the form at each facility;
3- Completeness of the form, and
4- Perceptions of the forms' usability by the providers.

Observations of the size and structure of the Emergency Department, staffing distribution across shifts, and provider approaches to recording injury patients were made and documented by researchers during the initial training and final evaluation weeks at each site. The total number of visits to the Emergency Department were determined using the general department registers as source data and counting all visits seen over the study period; the percentage of visits attributable to injury or trauma over the study period was then reported as the injury rate for that site. The surveillance form was evaluated according to the WHO Injury Surveillance Evaluation Guidelines, using specific indicators of injury recording frequency, entry completeness, and time required to complete the form (9). The recording score indicates the proportion of all injuries seen by the hospital that were successfully recorded in the trauma registry by staff during the pilot month. The second metric, entry completeness, shows the proportion of trauma registry logbook entries where all 17 sections were completed. Process times were determined by observing providers in the emergency department and timing the duration of form completion during the first and last weeks at each site. Finally, provider receptivity to using the logbook routinely as a new standard of record-keeping was determined using the post-pilot survey.

Part of the purpose of the study was also to evaluate the likelihood of receptivity by physician and nursing staff after a trial of the logbook at each pilot site. Some of the known barriers to maintaining a logbook registry in resource-limited settings include completeness of data collection and consistency of use by providers. Our group believed that including post-pilot perspectives by participating physicians and nurses would be valuable in addressing these concerns. To this end, we developed a 21-question survey (18 Leichardt-scale and 3 free-form) to assess providers' perceptions around the relative advantage of the intervention, compatibility with existing value and practices, simplicity, trialability, and observable results (26), (Table 2, Figure 8). The post-pilot survey included questions with answers graded on a scale from 1 to 5. The grading schematic was proposed as: 5-Strongly agree; 4- Agree; 3- Neutral; 2- Disagree; 1- Strongly Disagree. All nurses and physicians who had participated in the study were approached to complete the post-pilot survey and provide perspective on the utilization of the logbook in their facility.

Data Analysis
At the conclusion of the pilot trial period, investigators took de-identified scans of the logbook pages for data collection and double-entry purposes. Data collected within each section of the logbook was coded numerically and entered into a separate database. Double entry of logbook data into the database was performed to ensure transcription accuracy. Calculations of the recording frequency and entry completeness scores were determined using Excel 2010 and OpenEpi software.

For the post-pilot survey, frequencies of the responses are summarized with median reported values shown in Table 2. Qualitative data from free-response questions were also used in the assessment of provider receptivity to the logbook format. Themes were determined from answers given using an inductive method by two research members. Following initial reads, graders made comparisons about themes deduced from the responses, and resolved any differences seen in assignment. Members again examined free answers and assigned themes, then compared assignments with one another. Iterations of thematic coding and comparisons were performed until inter-rater agreement for assigning themes to answers was >80% (27).

Results:

User Demographics:
Most users of the logbook were young (21-29 years old) and had been working at the site for less than 1 year. Participants varied from being nearly completed with internship or residency, to having more than 5 years of experience in the field (Table 1). Surprisingly, more physicians and medical students were

willing to use the book, compared to nursing staff. We did not find many senior nurses or staff members using the book (Table 1).

Process Time:
The first time providers would attempt to log an injured patient, it would take the user between 5-8 minutes to go through all of the sections with the patient and become accustomed to questions asked. After the provider had entered a few patients, this process time decreased drastically. On average, it took approximately 1-2 minutes per patient to record data on injured patients in the book. There was variation across sites regarding the best approach to filling out the book. The hospitals at site 3 and site 4 consistently recorded patients around the time of injury. At site 1, one physician-resident was consistent in recording patients as they were being seen during the morning shift, and would review patients seen during the night to record information at the end of night shift. At site 2, one resident was put in charge of filling out the book at the end of the shift, including all injuries cared for during that shift. For these "bulk recording approaches", total recording time would take 20-30 minutes per session.

Injury Rate
From the total ED data over the pilot month, the relative prevalences of injures were 25% at the Aux Cayes site, 15% at the Cap-Haitïen site, 51% at the Gonaives site, and 25% at the Port-au-Prince site (Figure 3). Patient encounters varied regionally; for example, Cap-Haitïen received over 3000 encounters during the four weeks, but only 15% of these encounters were injuries. In comparison, Gonaives saw fewer than 500 encounters over the entire study period, but 50% of their encounters involved trauma or injury. Across the board, all pilot sites saw an average of 150 injuries over the study month.

Frequency of Recording & Entry Completeness:
Figure 4 shows the logbook recording scores and entry completeness scores for each site. Gonaives and Cayes had the highest recording frequencies (59% and 57%). All sites except for Port-au-Prince had roughly 50-60% of all injuries seen documented by housestaff before the end of the pilot month. Notably, it the site at Port-au-Prince was the least-staffed department with observed major inconsistencies in inter-staff communication and reporting. Thus, communication among changing shifts of residents and nurses over the day and between the months of the project was a significant barrier to facilitating use of the book during the study. For all sites, motivating and training night shifts to use the book regularly was one of the more difficult challenges, as providers during this shift changed regularly (Appendix 2). Overall, these variations in staffing and communication may have contributed to the overall recording score for these facilities.

For patients who were included in the book, completeness of information for each section was available nearly 80% of the time in Gonaives and Cap-Haitïen. Anecdotally, these two sites were also noted to have established a system of communication between nurses and physicians for all shifts, and the chief resident running the department made a point of reminding staff throughout the shift to fill out the book (Gonaives) or kept a copy of the logbook available on the notice board to remind members of the details they needed to record for their patients (Cap-Haitïen). Alternatively, at Cayes and Port-au-Prince, the book would occasionally be filled out at the time the patient arrived, but largely data was recorded after the patient had left the department. Further, staffing discrepancies throughout the day had an effect on availability of department leadership in monitoring the department and enforcing regular use of the book. These observances, as well as variations across the weeks of the pilot month (for instance while we were present versus away at other sites), may have had an influence on relative completeness in the entries recorded (Appendix 2, a-l).

Figure 5 shows the trends of data collection over the pilot month. The immediate drop from the Port-au-Prince site was seen at the change of the month which was week 2 of the pilot; the new team of incoming residents was not aware of the study until the beginning of week 3. Most hospitals saw tapering off of

regular staff participation in logging patients as the month went on, despite research efforts to check in weekly with department directors and staff nurses. Over the course of the study, real-time completion of the logbook was found to yield more information for patient entries than retrospective review for all four weeks (Figure 6). It was found that entries provided information in >70% (14 of 17) of sections when completed by staff at the time of arrival, versus 60% (12 sections) when abstracting from chart review alone. Taking all of this together, it can be inferred that having regular quality control systems in place to motivate real-time collection of data would be beneficial to ensure that data collection is maintained at sufficient level for effective injury surveillance. A secondary recommendation would be to include early training of medical and nursing students on using particular subsets of questions or physical exam details in their notes for patients with trauma or injury. Engendering early habits in note-writing may help improve overall data abstraction from chart review.

We wondered whether provider familiarity with elements of surveillance forms would have an influence on relative completeness of the form. Figure 7 shows the relative completion of each section in the form by the source of data. Anecdotally and objectively, Number of Severe Injuries and the presence of Other Severe Conditions were the two newest, most confusing, and least utilized, sections of the registry (completion rates <30% overall, Figure 7). There were regional differences between sites, but most sites were easily able to record demographic variables (>87% completion by staff or review), and descriptors of injury and mechanism (65-90% availability overall). Prior to the study, details around the time of injury, mode of transport, and cause of injury were not always included in the general department logbooks, but were usually asked during the history and physical examination. We found that staff recording frequencies for these details were among the highest of all sections (48-50%, Figure 7) in the logbook. Globally, vital signs were not included in recorded entries nor were they routinely available by retrospective review of patient charts (one or more vital signs missing 48-56% frequency, figure 7). This finding was concerning for our study, as vital signs are used by most institutions to stratify severity of illness and to determine and guide appropriate treatment. Overall, we found that 13 of the 17 sections in this registry were completed > 55% of the time and could provide relevant details on the characteristics of injury victims, types and locations of injuries, interventions received, and short-term discharge status from these pilot sites. We observed that providers felt comfortable with most sections, and reported needing more clarification and advisement on how to complete the two newer sections, "Number of Severe Injuries" and "Other Severe Conditions". From these observances, we recommend eliminating the "other severe conditions" from the injury surveillance form, and instructing coders on how to determine the number of severe injuries based off body area and type of injury indicated on the revised form (Figure 1b). Importantly, we found that sections pertaining to the relative severity of injury seen, including vital signs, neurological status, and number of severe injuries, was not frequently provided. When providers were asked why vital signs were not always included, some responses pointed to "lack of equipment, like oxygen saturation monitors", or "no nursing staff available" as potential reasons. Development of secondary interventions addressing this need would be a significant area for future improvement in trauma assessment and medical recording.

Provider Perceptions around Logbook:
Quantitative Assessment:
Forty-eight of the participants filled out the post-pilot survey, offering their opinions on improvements to the book, perceptions of the medical record system, and expectations/beliefs about whether this book would be feasible to implement on a national level. Table 2 reports the Leichardt scale responses collected for each section. 78% of providers agreed they had enough time in their schedule to participate in the brief training on the logbook, and 75% agreed or strongly agreed that this training was helpful in understanding their role and use of the book. 88% of providers surveyed reported low work burden in using the logbook, and 98% of providers were in favor of using checklist formats to record patient-relevant data. The majority of providers (75%) rated scores of 4 or 5 in comfort level with reporting neurologic status, number of severe injuries, and completing all portions of the logbook during the study.

90% of providers surveyed were in agreement with making the logbook format the new standard of care for medical record-keeping in Haiti, and also reported agreement or strong agreement with continuing its use in the future.

Qualitative Assessment
In terms of providers' qualitative perspectives on the use of the logbook, healthcare workers contributed mostly positive feedback (Figures 8a-c). The top three categories of reasons why people thought this book should be implemented nationally included: improving the quality of national public health support available to institutions (46% responses, Figure 8a), identifying areas for improving patient care (26%), and preventing mortality and morbidity across the country (16%). When asked what they did not like about the form, 56% of providers reported no problems with the book, or that they thought it was a useful tool (Figure 8b). Examples of specific responses from the survey are reported in Table 3. Some staff were more hopeful than others, but most providers expressed a desire to have better system-wide care available in their country.

Discussion:

Trauma and injury registries are important components of existing trauma systems, and have been shown to contribute greatly to the development of stable, responsive trauma systems in low-resource communities (3, 6, 7). The relative success of a surveillance system in being both accurate and reliable relies on its ability to best represent the load actually seen by health professionals. It is arguable that the most accurate systems would collect applicable data consistently, and in real time. For a surveillance system to perform this way, it must be able to integrate easily into existing healthcare processes. In this study, we sought to develop a simple, provider-based, injury surveillance system that would capture meaningful data around hospital care for injuries, with minimal added effort on the behalf of the providers. We present that our checklist form, in logbook format, was able to capture higher rates of entry completeness than collected before for Haiti. Our format is most similar to existing registry formats, and takes less than 5 minutes per patient to complete. Further, it included sections and requested details that providers were largely familiar with and likely to receive during the initial assessment of the patient. These attributes of the tool make it easily understandable for providers, and increase its likelihood for sustainability as a potential surveillance system.

When looking at other studies on implementing injury surveillance systems in LMIC, one of the biggest challenges is finding a format for the registry that allows it to be maintained without over-burdening the existing health system. Constraints on ability to compensate distinct registry workers, unreliability of internet-based databases, and low incentivization of healthcare workers to maintain a new registry on top of other clinical duties often prevent sustained development of these systems (2, 19). We hypothesized that employing journal-style registers with simple checklists may help overcome some of the barriers to routine public health monitoring. Our primary approach was to attempt to modify an existing process of recording patient information in journal registries and standardize the data recorded for injured patients.

The project showed success in providing higher rates of documenting epidemiologic variables during this trial compared to prior attempts in Haiti. We found that all variables would receive some mark or check at some point over the pilot month, and that many of the variables of interest were searchable through retrospective review. Figure 7 shows that approximately half of the data collected was obtained by staff directly. This behavior is similar to the findings by Liu et al, who conducted a similar injury surveillance pilot project in China, basing implementation and evaluation of the registry using WHO guidelines(20). Our group combined the staff and retrospective data collected in determining the epidemiologic measures of injury across all 4 regions (Ludi, 2015). Importantly, this book was successful in providing important details around the time to arrival after injury, mode of transport to the hospital, and location of the trauma (Figure 7); these variables were not included in prior injury surveillance forms tested in Haiti. Time to

arrival and location of injury were available more than 70% of the time, and that mode of transport was available for 50% of all injures reported. Unfortunately, many of the variables that can be used to indicate severity of injury (i.e. vital signs, number of severe injuries) were recorded less frequently than desired. Similar studies conducted in Haiti and other LMIC also report low data recording rates for variables of injury severity, mode of transport, or time after injury (22, 23).

With respect to documenting vital signs, registry pilot studies from Cape Town, Rwanda, and China showed documentation of at least 1 vital sign (temp, blood pressure, respiratory rate, or pules) at least 80% of the time, with full sets of vital signs lower than 30% of the time for Rwanda and China, and 50% of the time for Cape Town (20-22). Prior studies by Schulz et al in Haiti reported that full sets of vital signs were available in 19% of patients recorded(16). In comparison, our study saw that full sets of vital signs were available 53% of the time without inclusion of oxygen saturation (Figure 7). When comparing against other pilot studies, overall data recording frequencies from this pilot study were comparable to or higher than those than seen in other registry pilots for LMIC. Placing the section for vital signs right after patient name and address help trigger early reminders to retrieve vital signs for patients with injury. Further, regular enforcement to all members of the healthcare team in needing to collect vital signs for all patients is useful in ensuring consistency of reporting.

Strengths of this logbook include ease of filling out (each participant, at longest, took 5 minutes or less to complete the entry for injury patients); standardization of variables that are reported in registry (each page is a pre-defined set or list that are checked off/included for each patient); and the ability to recover significant details of injury in Haiti that could be used for international epidemiologic monitoring. From the data recorded over the pilot month, it was possible for this group to compose epidemiologic reports for each hospital and nationally, detailing the type and distribution of injuries, trends of pre-hospital and discharge status, patterns of injury, and mortalities due to trauma (Ludi, 2015). These attributes are all important indicators of injury that will help with monitoring relative connectedness between facilities, plan resource allocation to develop a hierarchical network of centers, and better facilitate national care of injured patients.

During the study, we observed that not every hospital had a consistent system for data entry or recording. Additionally, each site was slightly different in its process of patient flow through the emergency department. Based off of shift staffing, the presence or absence of systems for communication, and investment of administrative staff, some sites found participating in the study more difficult than others. If this book replaced the current registries, or if the hospitals moved to electronic systems across the country, then reduction in data recording/charting would be hugely instrumental in encouraging appropriate use of the tool.

A few papers from other Low and Middle Income Countries suggest similar techniques to improve quality of data collection for injury surveillance registries. In Pakistan, the emergency department registry "Pak-NEDS" is administered by registrars hired to collect and maintain department registries on a 24-48hr basis. Since its development in 2011, the registry has proved to be fruitful for physicians, administrators, and global health practitioners to use for research and policy development (19, 28). This system of establishing specific clerks and clinical personnel for real-time data collection has been supported by other developing countries as they work to establish larger injury registries (2, 21, 22, 29). In the past 3 years, CDC has established a Field Epidemiology Training Program (FETP) in Haiti, which aims to train professional healthcare workers in performing field epidemiologic surveillance and statistical analysis(15). Providing a fundamental base of data around injures and trauma will facilitate quality improvement efforts and help identify areas for high-impact health policies(3). Potentially expanding the FETP program to include training in epidemiologic monitoring of trauma and injury could be a way of closing the loop between surveillance and epidemiologic reporting on a routine basis.

Overarching implementation problems:
The logbook was designed with the hope that it would be used in real-time as patients come in. Both personal experience, and monitoring methods have suggested that doing so would increase accuracy and decrease workload burden for users. But getting people to take us for our word on this idea was difficult. Despite the fact that it would take 2-3 minutes for people to actually check off boxes (slowest), providers were resistant to incorporating something new and unfamiliar (and elective) into their practice unless prompted. By day 2 or 3 at the facility, however, we would see people picking up the book when an injury came in; although, this could have been a side effect of associating our presence with prompts to fill out the book. We found that monitoring calls had less influence than anticipated on encouraging all department providers to continue using the book throughout the pilot month. However, we were encouraged to find that providers did start including relevant details pertaining to the logbook within the patient charts. Finally, we saw a higher likelihood of drop-off in logbook participation during the transition between calendar months, and concordant change of resident staffing in the departments. While this new system attempted to utilize familiarity with old/habitual methods of recording patient-related data, as well as incorporate standardized checklist formats, we still found deviation from our anticipated goals of data completion and accuracy. This deviation suggests that other processes may need modification to ensure this process of injury reporting is sustainable over time:

One of the limitations of the logbook is its inability to report on long-term outcomes for patients. When designing this logbook, these authors made the decision to focus on keeping the form short and present the logbook entry as a constrained picture of the patient's time in the emergency department, alone. The current format does not allow for long-term tracking of patient outcomes beyond discharge from the emergency department. However, the updated form (Figure 1b) does include a section for patient medical record numbers (MRN). If the form were to be modified and used by other services within the hospital, then facilities could create databases that match information by patient MRNs and track outcomes over longer periods of time. This approach is commonly used among most countries with developing and robust registries for various disease processes. If facilities in Haiti begin to move toward more standardized methods of reporting data around patient care, goals for long-term tracking and quality improvement efforts could become more easily realized.

Future Directions:
Currently, the Haitian health system is still using handwritten documentation. The power of electronic medical records (EMR) in retaining important health information, providing databases for quality improvement measures and tracking long-term patient outcomes, and in minimizing medical errors has been well established(30-32). While some hospitals in Haiti are trying to make advancements toward using electronic databases, a national utilization of electronic medical documentation is still many years away. However, from our experience through this study, transcribing data stored in a logbook format, such as ours, to an electronic system would be much more feasible than transcribing hand-written registry records. Implementing this system nationally, now, could be helpful in retaining patient information and decrease the burden in transition from paper to electronic record-keeping. Additionally, the pages of the logbook can be easily converted into electronic note templates for providers to use in their initial assessments of injured patients. Utilizing a paper-based system that can be easily bridged into an electronic system is advantageous to maintain data quality and continue public health surveillance processes.

We hope that this logbook format may be adopted by the MSPP and distributed to all private and public facilities in the Haitian healthcare environment. Creating versions of the logbook that are adaptable to each ward or branch of the hospital, moving the public and private hospitals closer to development of an electronic medical record-keeping system. Additional aspirations of the book are that it would be able to provide data for epidemiologic surveillance by FETP and/or MSPP-affiliated workers. We hope that this book may facilitate ease of data transcribing and reporting to the ministry of health. In providing usable

statistics, that can be easily calculated in a reasonable time, the ministry may be able to develop targeting goals and recommendations to individual facilities and to regions of the country, overall. This logbook presents a possible solution for data recording and management that improves the quality of data collected, and yields relevant epidemiologic trends that are useful for quality improvement efforts.

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