Going Digital: Implementing an Electronic Medical Record

in Totonicapán Hospital, Guatemala

By John Preston Baker & Korey Marshall

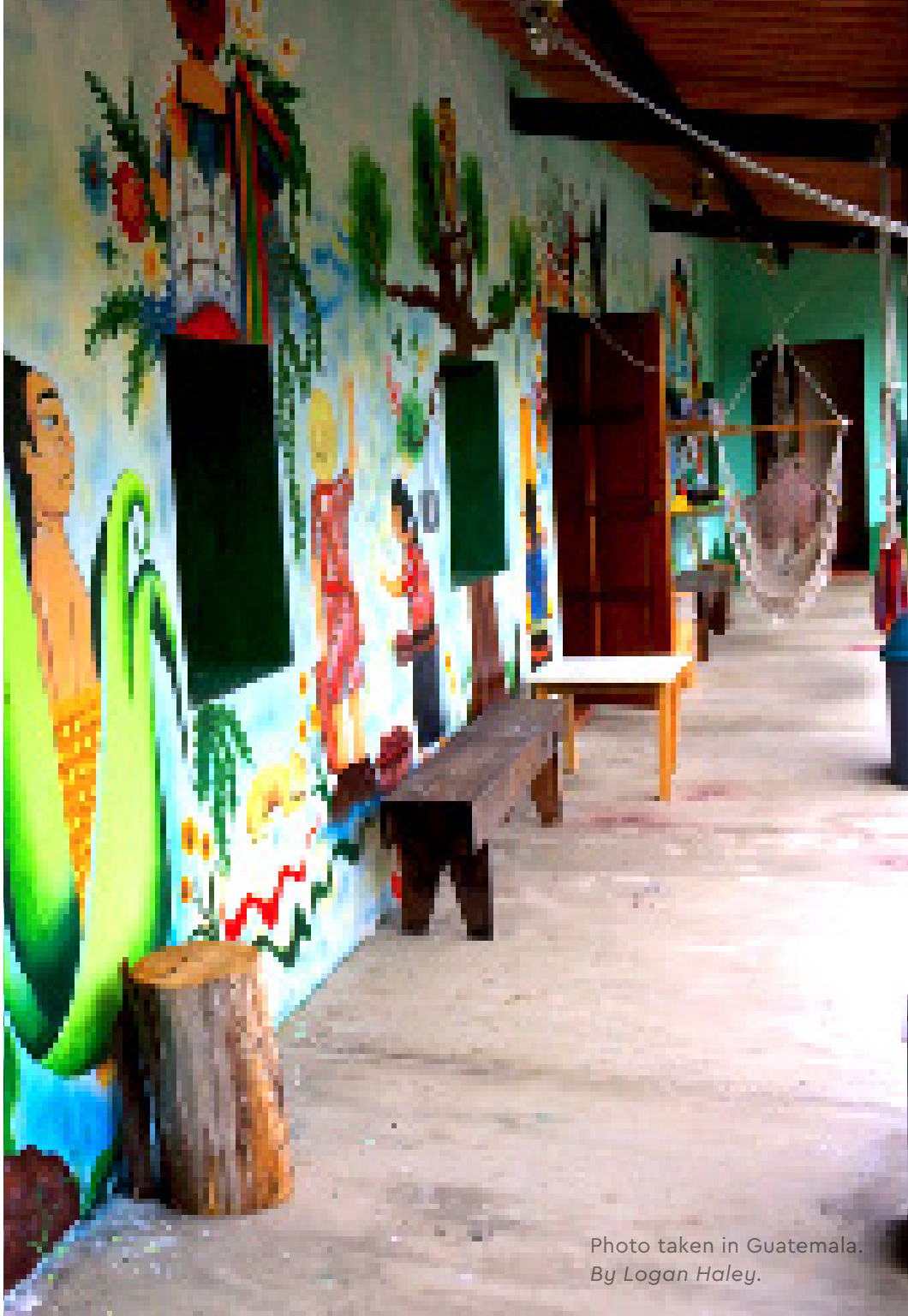

Photo taken in Guatemala. *By Logan Haley.*

ABSTRACT

The initial version of an electronic medical record system (EMR), known as SABER 1.0, was implemented in the Emergency Department of an under-resourced hospital in Totonicapán, Guatemala. Over the course of one month during the summer of 2016, Guatemalan medical students and physicians were trained to use the SABER software, and 63 initial test electronic records were produced. These initial trials indicated that electronic records only took 23 additional seconds to produce and resulted in significantly more patient data in comparison to paper records. In addition, survey results indicated that the Emergency Department staff were enthusiastic about adopting an EMR. However, they also expressed concerns about potential loss of data and difficulties involved in the incorporation of new technology in their hospital. Based upon these results, recommendations were made to continue with the implementation of SABER with several specific improvements that will increase speed, convenience, and functionality of the software. The SABER project demonstrates that EMRs can benefit both patients and staff in resource-limited hospitals.

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BACKGROUND

The adoption of electronic medical record record (EMR) systems in developing nations has progressed slowly due to factors such as lack of resources (e.g., reliable electricity, internet connection), lack of funding, and lack of adequate training. However, EMRs have been successfully implemented in resource-limited hospitals in Haiti, Cameroon, Kenya, and Peru [1–6]. The potential benefits of EMRs include reduced data-entry time, increased efficiency, increased and more organized data for research, increased security of patient data, and overall increased quality of care [7,8]. Thus, upgrading from paper health records to EMRs has the potential to benefit both hospital staff and patients if feasible.

Over the last several years, the University of Virginia-Guatemala Initiative (UVA-GI) has worked on implementing an EMR in a Guatemalan Hospital. Previous research groups identified Hospital Nacional “José Felipe Flores” (Totonicapán Hospital) as a viable location for EMR and subsequently researched the required specifications for EMR software at this location [9,10]. These previous research groups concluded that Totonicapán Hospital was ready for the initial introduction of an EMR to be conducted by our team.

Totonicapán is a city of 500,000 residents in the hot and humid western highlands of Guatemala, approximately 100 miles from the Guatemalan capital, Guatemala City. An overwhelming 97% of the population identify as indigenous peoples who speak the K’iche’ language, although Spanish is also widely spoken. Totonicapán has many prominent population health concerns including infectious disease prevalence, high infant mortality, and a lack of medical personnel and resources. The mortality rate by the age of 15 is 13.5%, and only 44.5% of the population reaches the age of 65 [11]. Totonicapán Hospital contains approximately 94 beds, cares for roughly 2,000-5000 patients annually and employs 28 doctors. It offers services in women’s health, maternity, emergency care, traumatology, surgery, internal medicine, and psychiatry [10].

RESEARCH QUESTIONS

Is SABER an effective EMR for implementation in Totonicapán Hospital? Are the medical staff receptive to adoption of EMR? How do electronic records compare to previous paper records?

Photo taken at Totonicapán Hospital, Guatemala.
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METHODOLOGY

UVA-GI received approval for this project (#2015-0232-00) by the Institutional Review Board for Behavioral Sciences of the University of Virginia. Based upon the contributions of previous research groups, an EMR, SABER 1.0, was developed in-house by UVA-GI programmer Roberto de Leon and our team. SABER is a browser-based Spanish language form that can be accessed via computers connected to a local area network. The EMR collects data concerning basic patient information, triage, initial evaluation, review of systems, physical exam, and evaluation and plan. It generates a PDF file based upon data entered into the browser form.

In order to determine if SABER represents a viable EMR in the Totonicapán Hospital Department, the system was tested from June 22 to July 15, 2016. Testing was conducted from approximately 8:00 am to 12:00 pm from June 22 to July 8th, and from 2:00 pm to 6:00 pm from July 11 to July 15 in order to introduce the EMR to both the morning

and afternoon shifts of the Emergency Department. In this initial stage of testing, the medical students responsible for record keeping were asked to complete a SABER electronic record upon completion of the traditional paper chart. Though this method of SABER introduction required students to document patient records twice, it allowed for a direct comparison between paper and electronic charts and also ensured that a paper record existed in case any problems were encountered with SABER. With assistance from our team, the medical students responsible for patient records generated approximately 63 SABER EMR files, in addition to the standard paper records for these patients.

The evaluation of SABER as medical record system was based upon observations of students as they conducted the medical charting and measurements of the time required to complete components of each patient record, as well as surveys completed by both medical students and an emergency department physician. Through collecting this data, we hoped to determine if SABER represented a faster, easier, more thorough, and better organized alternative to paper records. Advancement to complete adoption of EMR can only proceed if these criteria are met.

RESULTS AND OUTCOMES

Initial Observations of the Emergency Department at Totonicapán Hospital

Upon arrival at José Filipe Flores Hospital in Totonicapán, we began by personally studying the emergency department at Totonicapán Hospital in order to facilitate the initial steps of transition from paper medical records to SABER. We took specific note of the organizational structure of the emergency department and further established relationships with potential future users of SABER in order to understand their attitudes toward EMRs. It became clear very early that the Totonicapán medical students were target users, as they were the individuals responsible for completing the majority of the medical records in the emergency department. Thus, we spent much time interacting with medical students in order to understand their interests, needs, and concerns in relation to medical record keeping.

The environment and workflow in the Totonicapán emergency department differed significantly from our expectations. Due to staffing limitations, initial patient intake was typically handled by anyone available to complete the process, most often a medical student, but occasionally interns or attending physicians that happened to be available. The process of medical record keeping began with a standardized form found on one of three clipboards: one for Pediatrics, one for Internal Medicine, and one for Surgery. It was immediately apparent that the medical students spent a significant amount of time looking for the appropriate clipboard to document patient information. Moreover, when the required clipboard was unavailable, the medical students often would take brief notes on scrap paper before copying the data over to the clipboard.

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The medical students were the main conduit through which patient information was provided to the physicians. This is notable because while observing the students complete the paper records as well as the SABER form, we noticed that the extent to which the medical students complete the records depended both upon the individual student and the medical situation. There was a profound lack of consistency with which the medical students solicited certain information from patients that entered the emergency department. In some instances of high patient load, a record was not even produced for certain patients.

SABER: User Experience and Design

After our initial study of the Totonicapán Emergency Department, we began on training initial SABER users. Learning to use SABER was relatively straightforward. The layout and interface was similar to many other web-based forms, and most of the medical students were very competent using computers.

The main difficulties encountered were found to relate to SABER requesting information that the medical students had not been accustomed to collecting and understanding how to save progress while completing a medical record. We observed that after using SABER for only a few days, all of the medical students were competent users.

While working with the medical students to input patient data, it became apparent that a number of changes needed to be made to the software, which included "bug" fixes as well modifications in response to real-time user feedback. The first of these immediate changes included adjusting the form to allow the user to enter the patient's age instead of date of birth, which is rarely asked or even known for many of the patients. Another change was precipitated by two instances of data loss that occurred when users attempted to begin a new patient record before completing a previous one. In order to prevent this, we altered the software to ensure that no button— including the "Nuevo paciente" button— on the form could be pressed and result in the unintentional deletion of existing data. Fixing bugs early in the implementation process was key to ensuring continued enthusiasm for the adoption of SABER.

Overall, it became clear that two main characteristics of the SABER software were necessary in order to satisfy the staff of the Totonicapán Emergency Department: 1) The software needed to reach a level of convenience on par with paper records, which can be produced simply by finding a piece of paper and pencil. That is, SABER needed to be flexible, allowing the user significant freedom in determining what data to enter and how to go about entering it. 2) The software needed to include ample web-based tools, notifications and features that would increase the functionality, efficiency, usability, and reduce possible errors in medical records.

To this end, we recommend implementing a number of changes to SABER v2.0 (Table 1).

Table 1. Proposed SABER v2.0 change/feature

Incorporation of a function that allows access and editing of previously completed files (e.g. Intake has been completed for a patient, but it is not yet known whether the patient will be admitted)
Improved visual cues that alert users when sections of the medical record have been completed, including tabs that change colors when sections are completed
Display of the patient name and "Codigo ficha" (patient number) in a prominent location in the "registered patient information" box so this information is always easily available
Adjust the software to further encourage more complete records by reporting "N/A" in all input boxes that are left blank so that it is evident that a section was intentionally left blank

Analysis of effectiveness of SABER

Our observations indicated that students became proficient SABER users very rapidly, often after one or two days of using SABER. Approximately 8 medical students were observed to be responsible for patient record keeping during the morning shift and 6 during the afternoon shift. Every medical student encountered appeared proficient in computer skills necessary to operate the system. In addition, students who were more advanced SABER users were often willing to help other students who had questions about the EMR. The various sections of SABER often resulted in electronic charts that were more thorough and detailed than paper charts. Several times, medical students even returned to patients to ask follow-up questions in order to produce more complete SABER records. Most students were curious about SABER and were willing to enter the electronic records. However, some understandably expressed slight frustration when asked to enter patient records twice, once in paper and once in electronic form. Moreover, a few physicians seemed reluctant about the potential changes in protocol involved during a transition to electronic records. Nevertheless, our observations indicated that most medical students and physicians of the Emergency Department were receptive to the idea of using SABER as their primary record keeping system.

Table 2. Time required to complate patient records

	Time to complete basic patient information *(seconds)*	***Time to complete entire record*** *(seconds)*
Paper records	71 *(17 samples)*	694 *(17 samples)*
SABER records	95 *(41 samples)*	717 *(19 samples)*

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The time required to complete patient records was determined by timing medical students as they completed various sections of both paper and SABER charts. Results are summarized in the Table 2.

DISCUSSION

Our results indicate that record keeping with SABER took slightly longer than the traditional paper charts. However, these findings were confounded by several factors. First, students often completed patient charts while conducting other activities, which often greatly increased the time required to complete each record. During the data collection process, we attempted to limit the time measurements to the periods when the students were actively composing the patient records. In addition, measurements of the time required to complete each paper and electronic chart were affected by the various level of detail included by each medical student, the level of activity of the emergency department, and the specifics of each patient. Based upon these confounding factors, it was determined that the time to complete basic patient information was a more reliable metric for comparison between paper and SABER records because all the medical students included roughly the same information in this section for each patient. These data indicate that SABER did not significantly increase the time required for medical record keeping in comparison to the paper charts.

The surveys conducted also provided valuable information concerning the medical students' and physician's attitudes regarding a change from paper to electronic records. In total, four surveys were collected from medical students and one from an emergency department physician. Concerning paper records, respondents expressed frustration with the time required to complete the charts and the difficulty in finding charts of previous patients. In response to questions concerning electronic records, students expressed concerns about losing patient charts in the event of a computer malfunction as well as the additional time necessary to learn the system and complete the electronic records. Moreover, students were unsure whether the hospital was ready for electronic charts and expressed a wide variety of opinions concerning whether tablets, desktops, or laptops would be the best options for entering the electronic charts. Nevertheless, all survey respondents indicated that electronic records had the potential to improve record keeping in the emergency department.

Photo taken at Totonicapán Hospital, Guatemala.
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CONCLUSION AND NEXT STEPS

The results from the initial introduction of SABER indicate that it is a viable alternative to paper records in the Totonicapán Hospital Emergency Room. Moving forward, the changes to the software indicated in Table 1 should be implemented. Moreover, it is vital that the SABER team continue to forge strong relationships with the medical students and physicians of the hospital and continue to demonstrate the potential benefits of EMRs. Medical students and physicians should have constant support from the SABER should they encounter problems with the system. A successful SABER implementation will allow for faster, easier, and more organized and thorough medical records in the Totonicapán Hospital Emergency Department, benefiting both patients and staff.

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