



Review article

A review of electronic medical record keeping on mobile medical service trips in austere settings



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ABSTRACT

Introduction: Electronic medical records (EMRs) may address the need for decision and language support for Western clinicians on mobile medical service trips (MSTs) in low resource settings abroad, while providing improved access to records and data management. However, there has yet to be a review of this emerging technology used by MSTs in low-resource settings. The aim of this study is to describe EMR systems designed specifically for use by mobile MSTs in remote settings, and accordingly, determine new opportunities for this technology to improve quality of healthcare provided by MSTs.

Methods: A MEDLINE, EMBASE, and Scopus/IEEE search and supplementary Google search were performed for EMR systems specific to mobile MSTs. Information was extracted regarding EMR name, organization, scope of use, platform, open source coding, commercial availability, data integration, and capacity for linguistic and decision support. Missing information was requested by email.

Results: After screening of 122 abstracts, two articles remained that discussed deployment of EMR systems in MST settings (iChart, SmartList To Go), and thirteen additional EMR systems were found through the Google search. Of these, three systems (Project Buendia, TEBOW, and University of Central Florida's internally developed EMR) are based on modified versions of Open MRS software, while three are smartphone apps (QuickChart EMR, iChart, NotesFirst). Most of the systems use a local network to manage data, while the remaining systems use opportunistic cloud synchronization. Three (TimmyCare, Basil, and Backpack EMR) contain multilingual user interfaces, and only one (QuickChart EMR) contained MST-specific clinical decision support.

Discussion: There have been limited attempts to tailor EMRs to mobile MSTs. Only Open MRS has a broad user base, and other EMR systems should consider interoperability and data sharing with larger systems as a priority. Several systems include tablet compatibility, or are specifically designed for smartphone, which may be helpful given the environment and low resource context. Results from this review may be useful to non-government organizations (NGOs) considering modernization of their medical records practices as EMR use facilitates research, decreases paper administration costs, and improves perceptions of professionalism; however, most MST-specific EMRs remain in their early stages, and further development and research is required before reaching the stage of widespread adoption.

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1. Introduction

Short-term medical service trips (MSTs), often known as medical missions [1], commonly involve Western health care professionals and trainees providing intermittent care to patients in low and middle income countries (LMICs). Over a period of days to weeks, they carry point-of-care diagnostic equipment and medications between remote communities, and improvise mobile clinics

that typically consist of a nursing station, physician visit station, and pharmacy [2]. The need for electronic medical records (EMRs) is arguably greater in these austere, transient clinical settings than in the stable, rigorously controlled context of standing clinics in high income countries (HICs), yet implementation of EMRs in MSTs has been slow [2].

Previous reviews have broadly described the use, challenges, and benefits of EMRs in LMICs in general [3,4]. EMRs allow for legible documentation, lower transcription costs, and improved completeness of medical records [5]; this higher quality data allows identification of problems in patient treatment and facilitates research by non-government organizations (NGOs). Although

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paper record keeping poses similar challenges to both mobile MST clinicians and providers in low resource settings generally, certain features of EMRs are of particular relevance to the MST setting and warrant a review.

First, the use of an EMR is an opportunity to mitigate several challenges that Western physicians face when practicing in unfamiliar settings. Clinicians have a variety of professional backgrounds and may experience critical challenges to effective diagnosis and management during MSTs, resulting in inconsistency and high variability in treatment decisions. Presenting mobile MST clinicians with an EMR with integrated, relevant, evidence based information at the point of care is one critical element in developing a consistent and expected standard of practice on MSTs. Similarly, the multilingual support that an EMR can offer becomes more important in an environment where foreign clinicians may face barriers to adequate communication with patients.

Second, the mobile outreach format required to reach these remote settings also implies a diminished ability to rely on technological infrastructure. The impact of the environment is significant, as the locations of such clinics are often hot and dusty, or humid and wet [6]. Transport of records to and from a physical storage facility may be unreliable, meaning that at follow-up visits, previous medical records are often unavailable [2]. Particularly in cases where patients may not possess the health literacy to recall either their medications or the conditions with which they have previously been diagnosed, inadequate access to health records creates a critical threat to providing high quality care.

Third, a key concern of NGOs in planning such trips is understanding the local epidemiology, which would inform appropriate resource allocation (e.g. clinical supplies) and the medical formulary for each trip. EMRs can improve the integrity of data collected by clinicians that would allow for greater epidemiological analysis of common conditions seen in underserved communities and thereby inform the resource management of NGOs.

Despite the aforementioned benefits of EMR use by MSTs, there has yet to be a review of such EMRs and their attributes. A review will help NGOs determine which EMRs might be most effective to help meet their organizational goals, as well as inform individual clinicians of available EMR tools and the attributes that may strengthen their practice on MSTs. The purpose of this study is to review the features, availability, and adoption of EMR systems designed specifically for use by mobile MSTs in austere settings. While we will discuss adoption by MSTs of software intended for low resource settings, in-depth general discussion of EMR use in low resource settings is outside the scope of this review.

2. Methods

2.1. Search strategy

An electronic search of three data bases (MEDLINE, EMBASE, and Scopus/IEEE) was conducted on August 5, 2015 with the help of an information specialist using the terms “medical missions”, “global or health or medical or mobile” AND “brigade or trip or mission or missions”, “austere”, “resource limited”, “resource poor”, “relief work”, “outreach”, “developing countries”, combined with “medical records systems, computerized” OR “electronic and medical/health and record.” The search was limited to the year 2000 and all study designs were included. In order to include literature published from LMICs, no language limitation was applied to the search.

A supplementary Google search was performed on September 8, 2015 to find EMRs in current use on MSTs. The Google search was included in order to comprehensively describe current EMRs available to MSTs, since EMR companies may be more likely to

have a product website than academic publications in order to access a broader market. According to Haddaway et al. [7], results from a Google web search form a meaningful addition to traditional literature search methods, particularly for newer topics of interest that may not have been studied using rigorous methodology. The following keywords were used: medical missions, medical service trips, medical brigade, global health experiences, austere settings, and low resource settings, each combined with the keywords “electronic medical records” and “electronic health records”. For each of the 12 combinations of keywords; the first 100 results were reviewed for relevance. If relevant pages were encountered in the last 20 results searched; the search was extended to 250 results for that keyword combination to ensure the search was comprehensive. Individual site pages were searched manually to identify relevant information. It has been suggested that supplemental Google web searches used for grey literature should focus on the first 200–300 article results [7].

If contact information for the developer was found on a website, the authors attempted to make contact by email on two separate occasions to gather and confirm information on the features of each EMR. This Google web search strategy was repeated on January 8, 2016, and two additional EMRs (unEMR and NotesFirst) were added.

2.2. Selection criteria and data abstraction

Articles and search results were included if they: (1) described an EMR intended specifically for use on a mobile MST, or (2) described an EMR being used by clinicians (physicians, nurse practitioners, or physician assistants) on a mobile MST. An MST [1] was characterized by Western health care professionals and trainees providing intermittent care to patients in LMICs over a period of days to weeks. We excluded studies that were: specifically focused on disease specific documentation (e.g. HIV, tuberculosis care), or technological interventions intended for a hospital, clinic, or national health care system in low resource settings.

The researchers reviewed the titles and abstracts of potentially relevant articles independently based on the inclusion criteria; studies that violated the inclusion criteria were excluded. Eligible studies were retrieved for full-text review through academically affiliated hospital networks or university libraries. Reference lists from included papers were hand screened for additional studies.

Descriptive data regarding the characteristics of each EMR were extracted from each included study, as well as from results of the web search. The researchers used a standardized data extraction spreadsheet in Excel to summarize the name of the EMR, the organization responsible for its development, the scope of use, platform, use of open source coding, commercial availability, mechanism for data integration, and capacity for linguistic and clinical decision support. In addition, for the articles included from the electronic literature search, the following study data was extracted: author, journal and impact factor, aim of the study, study design, sample size, setting, results, and study limitations.

3. Results

The electronic literature search resulted in 122 abstracts, which were subsequently screened for relevance (Fig. 1). Seven articles were selected for full-text review, of which 5 were excluded. One article [8] discussed epidemiologic data collection on an MST using a Microsoft Access file, but did not describe use of an EMR. Groschel [9] discussed use of speech recognition technology on emergency medical missions, and Nwosu [10] discussed the potential use of biometric identification of patients on periodic MSTs, but neither mentioned a specific EMR. Lai [11] discussed the utility and design

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