

Evaluating Usability and Functionality of an Open-Source Electronic Medical Record System in a Tertiary Teaching Hospital in Ethiopia: A Cross-Sectional Survey

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Research Article

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Abstract

Background

Electronic Medical Record (EMR) systems are fundamental to digital health transformation, yet their success depends on how intuitively and efficiently end-users interact with them. In resource-limited settings, implementation challenges are common, and front-line user feedback is critical for guiding system improvements. This study evaluated the usability and functionality of an open-source EMR system during early roll-out at a tertiary teaching hospital in Ethiopia.

Methods

A descriptive cross-sectional survey was conducted in the Internal Medicine Department of St. Paul's Hospital Millennium Medical College from October 21–28, 2024. All 86 invited healthcare providers (42 residents, 14 interns, 30 nurses) completed self-administered questionnaires covering usability, functionality, training quality, technical issues, and open-ended feedback. Data were analyzed using descriptive statistics and thematic analysis. SPSS version 25 was used for analysis.

Results

The response rate was 100%. Most respondents (88.4%) used the EMR daily, and 68.6% used it multiple times per day. Usability challenges included difficulty with overall use (12.8%), non-intuitive navigation (14.3%), and difficulty retrieving information (20.0%). Satisfaction with system speed was low (38.8% dissatisfied). Technical issues were reported by 72.5% of users, with physicians experiencing significantly more challenges than nurses (85.5% vs. 44.0%). Only 30.9% rated training as excellent or good. Physicians reported more difficulties than nurses across all usability domains. Core features (patient charts, medication orders) were valued ($\geq 71.4\%$ useful), but reviewing imaging studies and clinical notes received lower ratings ($\leq 69.8\%$ useful). Open-ended feedback highlighted appreciation for documentation and data access, while suggestions focused on network improvements, hardware provision, and missing software features.

Conclusions

Despite high daily use, significant usability, technical, and training gaps persist. User-centered redesign, role-specific training, and sustained technical support are essential to optimize EMR effectiveness, improve clinician satisfaction, and ensure sustainable digital health investments in resource-limited settings.

Background

The adoption of Electronic Medical Record (EMR) systems is a fundamental pillar of digital health transformation. The EMR systems enhance operational efficiency, accuracy, safety, and quality of care, thereby improving patient outcomes.¹ By enabling real-time access to comprehensive patient data, EMRs facilitate better care coordination among healthcare providers and serve as a critical tool for managing health-related data, driving innovation in diagnosis, treatment, and prevention.^{1,2} However, in developing countries, implementation is often hindered by technological infrastructural limitations, insufficient trained manpower, shortages of financial resources, cultural barriers, and varying levels of user acceptance.^{1–3}

While technical attributes like functionality, security, and interoperability form the foundational requirements of an EMR system, its ultimate success is defined by its usability—how intuitively and efficiently end-users can interact with it during their daily work.⁴ Usability, alongside how well the system supports clinical workflows (functionality) and integrates with other platforms (interoperability), is not solely the domain of technical experts.^{4,5} Front-line healthcare providers and support staff, as the primary users, offer indispensable, ground-level insights into these critical dimensions.^{4,5} Actively seeking and incorporating this user perspective in real-world clinical environments is essential for identifying operational bottlenecks, guiding targeted system refinements, and ensuring that technological investments yield measurable improvements in patient care.^{2–7} This user-centric feedback loop is especially critical during the initial implementation phase, where timely, evidence-based adjustments are pivotal for driving user adoption and establishing a sustainable, effective system.⁴

This study evaluated the usability and functionality of an EMR system in its early implementation phase from the perspective of its primary users at a university hospital in Addis Ababa, Ethiopia. We intend for our findings to serve as baseline evidence to inform targeted system improvements and user training.

Methods

Study Design

We conducted a descriptive cross-sectional survey in the Internal Medicine Department of St. Paul's Hospital Millennium Medical College (SPHMMC), Addis Ababa, Ethiopia, between October 21 and 28, 2024.

Study Setting and Population

SPHMMC is a major tertiary teaching and referral hospital that initiated a digital transformation in 2021, including the introduction of an open-source EMR system. Development and pilot testing began in mid-2021, followed by a phased roll-out across clinical departments. By 2025, the system was fully operational within the Internal Medicine Department, which comprises five inpatient wards, nine

specialty outpatient referral clinics, one general outpatient clinic, and four outpatient diagnostic laboratories, all now integrated into the EMR platform.

The Internal Medicine Department of SPHMMC hosts four fellowship programs and an internal medicine residency program, training 24 fellows and 124 residents at the time of the survey. The department employs 251 staff, comprising 86 permanent academic staff, 6 part-time academic staff, 120 nursing staff and 39 administrative supportive staff. Our survey targeted the primary front-line healthcare providers in the department including residents working in outpatient and inpatient services, final-year medical students (interns) in inpatient settings, and nursing staff, including case-team leaders, nurses-in-charge, and staff nurses working in the inpatient services. These are the clinicians and nurses who experience the system's strengths and shortcomings firsthand.

Study Tools

Survey questionnaire was developed based on the authors experience and reviews of available relevant literature.^{4,5,8-10} The survey questionnaires were pilot-tested prior to the main study to ensure validity and reliability. Ten residents and ten nursing staff, who were not included in the final survey, completed the draft instruments. The pilot process assessed the clarity of instructions, wording, and relevance of questions, as well as the average completion time. Feedback from this phase was used to refine ambiguous items, adjust the response scale anchors for improved clarity, and streamline the flow of the questionnaire.

The final survey questionnaires consists of five sections. Section one covers participants' characteristics including levels of training, years of experience in nursing practice, role in nursing services, and frequency of use of the EMR system. Section two addresses usability and functionality of the EMR system including overall ease of use, ease of information search and retrieval, intuitiveness of navigation, usefulness of specific features of the system (e.g., clinical data records, medication orders and administration tracking, review of laboratory and imaging data), system's overall support for clinical workflow, and satisfaction with system speed. Section three focuses on healthcare providers' experience with technical problems while using the system. Section four consists of items inquiring about training and training quality related to the EMR system. The final section consists of open-ended comments on what are most liked aspects and suggestions for improvement of the system. The usability and functionality survey questionnaire file provides additional details regarding the survey questionnaire (see Additional file 1).

Data Collection

A purposive sampling method was used to sample healthcare providers who were primary users of the EMR system. The self-administered paper-based survey questionnaires were distributed to eligible participants during their regular working hours at their respective clinical stations and clinical service

areas. Participants were given adequate time to complete the questionnaires, and completed forms were collected by administrative assistant of the department.

Data Analysis and Ethical Considerations

Data were cleaned, entered, and analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0. Descriptive statistics (frequencies, percentages, median and range values), bar charts and tables were used to summarize the data. The open-ended responses were transcribed verbatim from the questionnaires for subsequent thematic and content analysis. The survey was approved the Institutional Research Ethics Review Committee of St. Paul's Hospital Millennium Medical College. Additional file shows details of participants' responses (see Additional file 2)."

Results

Participant characteristics

All 86 invited healthcare providers completed and returned the self administered survey questionnaire, resulting in a 100% response rate. The survey respondents comprised 42 internal medicine residents (48.8%), 14 final-year medical students/interns (16.3%), and 30 nurses (34.9%). Among the nurses, most had 4–6 years of experience in nursing (46.7%, n = 14), followed by 1–3 years (26.7%, n = 8), 7–10 years (16.7%, n = 5), and more than 10 years (10.0%, n = 3); none had less than one year of experience. The EMR system was integrated into daily clinical practice, with 76 (88.4%) respondents using it at least once per day. Specifically, 59 (68.6%) used the EMR system multiple times daily, 17 (19.8%) once per day, and 10 (11.6%) several times per week.

Usability and Functionality of the EMR System

On a scale of five-point (1.0 = very easy, 2.0 = easy, 3.0 = neutral, 4.0 = difficult, and 5.0 = very difficult), the median score for overall ease of use of the EMR system was 2.0 with a range of 4 (Figure-1). Eleven (12.8%) of the respondents found the EMR system difficult or very difficult to use. Physicians (residents and interns) reported higher difficulty (difficult or very difficult) of use of the EMR system than nurses, 10 (17.9%) versus 1 (3.3%). Similarly, median (range) score for the ease of searching and finding patient related information within the EMR System was 2.0 (4.0). Among all survey participants, 17 (20.0%) found difficult (difficult or very difficult) to find necessary information within the EMR system. The difficulty in searching and retrieving required patient related information in the EMR system was reported by comparable proportion of physicians (21.4%, n = 12) and nurses (16.7%. n = 5).

With regards to respondents' rating of intuitiveness of navigating the EMR system on 5-point Likert scale (1.0 = very intuitive, 2.0 = intuitive, 3.0 = neutral, 4.0 = confusing, and 5.0 = very confusing), the median (range) score was 2.0 (4.0). The EMR system was reported to be non-intuitive (confusing or very

confusing) by 8 (14.3%) of all respondents, 7 (12.5%) physicians and 1 (3.3%) nurses. The speed of the EMR system was dissatisfying (dissatisfied or very dissatisfied) for 31 (38.8%) of all respondents, 26 (46.4%) of doctors and 9 (31.0%) of nurses. The median (range) score for satisfaction with speed of the EMR system was 3.0 (4.0) on five-point Likert scale (1.0 = very satisfied, 2.0 = satisfied, 3.0 = neutral, 4.0 = dissatisfied, and 5.0 = very dissatisfied).

Figure-2 shows distribution of participants' ratings of the overall usefulness of the EMR system in supporting the workflow of their clinical work and practice on 5-point Likert scale (1.0 = very well, 2.0 = well, 3.0 = neutral, 4.0 = poorly, and 5.0 = very poorly). The median (range) score was 2.0 (4.0) for overall usefulness of the EMR system in supporting clinical work. Seven (8.1%) respondents reported the EMR system support the clinical workflow poorly (poorly or very poorly). The EMR was perceived to support the clinical workflow poorly (poorly or very poorly) by 6 (10.7%) doctors and 1 (3.3%) nurses.

On five-point Likert scale (1.0 = very useful, 2.0 = Useful, 3.0 = neutral, 4.0 = Not useful, and 5.0 = not useful at all), ratings of usefulness of the EMR system comparable across its different features and by healthcare provider categories. For physicians, median (range) scores were 2.0 (3.0), 2.0 (4.0), 2.0 (4.0), 2.0 (4.0), and 2.0 (4.0) for usefulness of the EMR system for accessing/reviewing patient charts, reviewing/writing clinical notes, laboratory test results, imaging studies, and medication orders, respectively. Core features of the EMR system like accessing/reviewing patient charts, and accessing/revising medication orders were highly valued by physicians ($\geq 71.4\%$ found them useful or very useful, and $\leq 6.1\%$ found them not useful or not useful at all). However, functionalities central to daily work, such as reviewing imaging studies and reviewing/writing clinical notes were given lower values from physicians ($\leq 69.8\%$ found them useful or very useful, and $\geq 13.2\%$ found them not useful or not useful at all). For nursing clinical practice, median (range) scores for usefulness of the EMR system were 2.0 (3.0), 2.0 (3.0), 2.0 (4.0), and 2.0 (4.0) for documenting/tracking vital signs, medication administration, nursing round notes, and nursing care plans, respectively.

Technical Issues With the EMR System

Overall, 58 (72.5%, 58 of 80) respondents experienced technical issues while using the EMR system. Technical challenges and difficulties occurred more among physicians (85.5%, 47 of 55) than nurses (44.0%, 11 of 25). A total of eighty-three technical challenges were cited by the participants. Table 1 shows details of technical challenges categorized into hardware, software, network and power supply issues of the EMR system.

Table 1
Technical Challenges Faced by Users of the EMR
System of a tertiary hospital in Ethiopia

Technical Challenges	Frequency	Percentage
Hardware issues*	6	7.2
Software issues [£]	25	30.1
Network slowness	38	48.8
Power outages	10	12.0
Miscellaneous ^{s#}	4	4.8

*Malfunctioning Keyboard; computer shortage; £Difficulty in searching doctor's progress notes; difficulty in editing mistakes; difficulty in viewing image results;; difficulty in linking patient to OPD at discharge; death summary, sick leave, consultation, and referral forms not supported; difficulty to upload investigation done outside; difficulty of sending some lab requests; inpatient list not updated frequently; search by MRN difficulty sometimes; difficulty of saving patients' notes sometimes; inconvenience with medication administration sheet; inconvenience with medication refilling; vital signs recording spaces close after some time.#Lab results long TOT; unavailable medication missed; redundancy in nursing care plan.

Training on the EMR System

Eight-one (94.2%) survey participants reported that they received training on the EMR system prior to the survey. These participants responded to a five-point scale item (1.0 = Excellent, 2.0 = Good, 3.0 = Average, 4.0 = Poor, and 5.0 = Very poor) regarding the quality of training they received on the EMR system. The median (range) score was 4.0 (4.0). Only 25 (30.9%) of survey participants rated the training they received as excellent or good.

Open-ended feedback

When asked about the features they appreciated most, 68 participants (79.1%) shared their thoughts. Users valued the EMR system for its overall ease of use (35 mentions), ease of access (20 mentions), and its ability to facilitate clinical workflow (18 mentions). Some also appreciated data storage safety (8 mentions) and the organization of the user interface (3 mentions).

Seventy respondents (81.4%) offered constructive suggestions and additional commitments for improving the EMR system. By far the most frequent request was for improvements to network speed and reliability, mentioned by 37 participants. Hardware-related issues were the second most common concern, raised by 31 respondents, and included the need for more desktop computers, stabilizers and capacitors to protect against power fluctuations, and scanners to facilitate uploading investigations and referrals from outside the hospital. Software-related suggestions ranked third, with 29 participants pointing to missing features such as referral and consultation forms, a psychiatric history section, vital

sign templates, and a dedicated section for lymphoglandular examination. Additional software suggestions included separating nurse and physician interfaces, enabling editing of clinical notes, simplifying the ordering of oncology medications, improving the categorization of order and history sections, adding automatic saving and signing functionality, enabling offline access, and easing access to radiology results. Other suggestions, though less frequently mentioned, included minimizing power supply interruptions (6 mentions), providing regular refresher training on the EMR system (6 mentions), and establishing a regular feedback mechanism for EMR users (2 mentions).

Discussion

This study evaluates user experience during the initial implementation of an open-source EMR system in a busy Ethiopian teaching hospital. Widespread daily use (86.4% at least once daily and 66.7% multiple times daily) confirms that the system has become essential for clinical workflows. However, our survey identifies several critical pain points: dissatisfaction with system speed (38.8%), difficulty retrieving information (18.8%), and challenges in navigation (8.8%). Functional ratings were also suboptimal, with only $\leq 68.6\%$ of users finding value in reviewing lab results or clinical notes, and 8.7% reporting poor workflow support. Furthermore, technical issues were prevalent (69.1%), and training was rated positively by only 33.8% of respondents.

Our findings demonstrate a distinct divergence in usability perceptions between physicians and nurses using the open-source EMR system. Physicians reported encountering significantly more challenges than nurses, including greater difficulty with overall use (15.7% vs. 3.3%), navigation (12.0% vs. 3.3%), information retrieval (19.6% vs. 17.2%), and dissatisfaction with system speed (43.1% vs. 31.0%). This pattern contrasts with some prior literature, which suggested that while nurses typically reported better ease of use and navigation, physicians often expressed greater satisfaction with system performance, such as speed and stability.^{9–11} In our study, technical challenges had faced more physicians than nurses (90% versus 44.0%). We recommend a user-centered redesign of the open source EMR system that accommodates the distinct clinical workflows of each professional group.¹²

Interestingly, in our setting, physicians rated the quality of EMR training more favorably than nurses (46.9% vs. 10.7%, good/excellent), a finding that appears disconnected from their poorer usability experiences.^{7,8,13} This discrepancy may be partially explained by evidence suggesting that the relationship between training quality and perceived usability is modest, as provider attitudes on EMR system can also be negatively shaped by prior poor experiences with the system or by excessively long training sessions.⁵ Implementation of tailored, role-specific training programs might improve attitude and experience of physicians and healthcare providers in general on usability of EMR systems.¹⁴

Our findings highlight that healthcare providers' perception of an EMR system in supporting their clinical workflow vary substantially across settings and professional roles. In our study, physicians expressed slightly greater agreement than nurses that the EMR facilitated their clinical workflow effectively (72.5% vs. 70% rating support as "well" or "very well"). This observation aligns with prior hospital-based reports

in which physicians often perceived EMR systems as more beneficial to workflow efficiency compared to nurses.^{9,15} Interestingly, this dynamic can differ by setting; for instance, research from primary health centers has shown nurses reporting more positive perceptions of EMR-supported workflow than physicians.⁹ In contrast, a Nigerian study found no significant difference between nurses and physicians, with both expressing comparable overall positive perception regarding the system's support of clinical workflow.¹⁶

There is a critical link between the usability of an EMR system and its impact on both clinical workflow and patient safety. Usability, commonly measured through the efficiency, effectiveness, and users satisfaction, determines how seamlessly a system integrates into daily practice.^{17,5} Poor usability disrupts workflows, wastes clinician time, contributes to burnout, and compromises patient safety by increasing cognitive load, leading to treatment errors and delays in care.¹⁸⁻²⁰ In a Swiss national survey of 1,933 physicians, hospital EMRs achieved only 52.2% of maximum usability, with most users citing inefficiency as a major concern.⁵ In this similar study, 55.9 percent of physicians reported that their EMR did not enhance safety, directly linking poor usability to clinical errors, delayed interventions, and patient harm.⁵ Conversely, intuitive EMR designs enhance usability and enable clinicians to devote more attention to patient care rather than navigating complex interfaces, thereby improving efficiency, reducing cognitive burden, and supporting safer care delivery.²¹⁻²⁴ While the usability metrics from our study are not discouraging, we believe that a provider and patient centered redesign of the open source EMR system, coupled with role specific training and sustained technical support, is essential to optimize system utilization and fully realize the benefits of the digital health transformation at SPHMMC.^{12,14,25,26}

In Ethiopia, prior published reports on user perceptions of and satisfaction with EMR system usability have varied considerably. Overall satisfaction among primary end users has been low to moderate, ranging from 38.6% to 65.6% across different studies.²⁷⁻²⁹ Several key factors have been linked to lower satisfaction, perceived usefulness, and utilization of EMR systems in Ethiopia. These include poor system and service quality, weak usability features and information quality, inadequate technical and managerial support, insufficient basic computer literacy, lack of EMR specific or health management information system (HMIS) training, not owning a personal computer, health professionals' age and work experience, and a negative attitude toward EMR system implementation.^{27,28,30-40} In our study, a substantial proportion of respondents reported experiencing technical difficulties with the EMR system (69.1%), and the majority rated the quality of EMR related training as poor (66.2%). Furthermore, infrastructure issues such as power outages and unreliable, slow internet connectivity have been identified as significant contributors to lower user satisfaction and reduced EMR utilization in Ethiopia, as they lead to frequent system downtime.^{32,38-40} In our sample, dissatisfaction with system speed, which is closely tied to slow internet connectivity, was reported by 38.8% of respondents.

Limitations

This study has several limitations worth noting. The cross-sectional design cannot capture how perceptions of EMR usability and functionality may change over time as users gain experience. Convenience sampling within a single department of one tertiary hospital limits the generalizability of our findings to other settings. Self-administered questionnaires are prone to recall and social desirability bias, which may lead to over-reporting or under-reporting of certain EMR usability issues. The relatively small sample sizes also limit our ability to detect subtle differences between professional groups. Furthermore, our assessments of technical issues and training quality relied on user reports rather than objective measures, and the analysis of open-ended feedback was descriptive rather than rigorous qualitative inquiry, potentially restricting the depth of insights extracted. Despite these limitations, we believe this study offers a model for continuous, embedded evaluation, providing timely and actionable evidence from a front-line user perspective during the early roll-out of an open-source EMR in a resource-limited setting. Such ongoing feedback is essential to ensure that limited digital health investments are both effective and sustainable.

Conclusions

This study evaluated the usability and functionality of an open-source EMR system during its early roll-out at a tertiary teaching hospital in Ethiopia. Despite high daily usage (86.4% of providers using the system at least once daily), we identified significant usability challenges. Over a third of users were dissatisfied with system speed, nearly one in five reported difficulty retrieving information, and more than two thirds experienced technical issues. Training quality was rated positively by only one third of respondents. Physicians consistently reported poorer usability experiences than nurses, particularly regarding system speed and navigation.

These findings underscore that system adoption alone does not guarantee effective use. To realize the full potential of digital health investments, we recommend a user-centered redesign that accommodates distinct clinical workflows, complemented by role-specific training and sustained technical support. Addressing these gaps is essential to improve clinician satisfaction, enhance patient safety, and ensure the long-term sustainability of EMR systems in resource-limited settings.

Declarations

Ethics approval and consent to participate

This survey was approved by the Institutional Research Ethics Review Committee of St. Paul's Hospital Millennium Medical College (SPHMMC-IRERC-887/26-08), and I carried it out in alignment with the ethical principles outlined in the Declaration of Helsinki. All information gathered from participants was used solely for the purposes of this study and treated with the highest level of confidentiality. Before participating, everyone was fully informed about the survey and gave their consent."

Consent for Publication

Not applicable.

Availability of data and materials

The data-set and tools supporting the conclusions of this article are included within the article and its additional files.

Competing Interests

The author declares that he has no competing interests.

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Authors' Contributions

SGG conceived the study, designed the survey tool, supervised data collection, performed the analysis, and wrote the manuscript.

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Abbreviations

EMR	Electronic Medical Record
SPHMMC	St. Paul's Hospital Millennium Medical College
SPSS	Statistical Package for the Social Sciences

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Figures

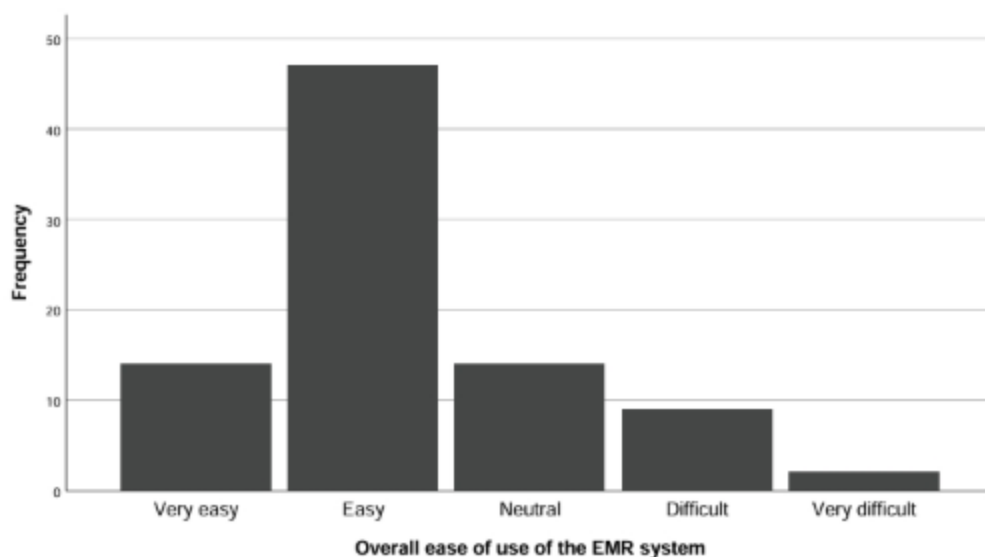


Figure 1

Distribution of Participants' Overall Ease of Use Rating of EMR system of a tertiary hospital in Ethiopia.

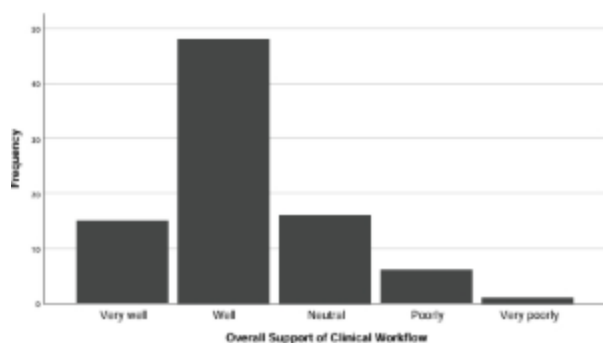


Figure 2

Distribution of Users' Perceived Usefulness of the EMR System for Clinical Workflow at a tertiary hospital in Ethiopia.

Supplementary Files

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