Affordable Patient Record Automation for Small Clinics: Field Testing the piClinic Console

Robert B. Watson
watson_rb@mercer.edu
Mercer University
Macon, Georgia

ABSTRACT

Small clinics in low-middle-income countries frequently lack the financial and technical resources to support patient-record automation—relying instead on paper records to track patient visits. Earlier successes introducing automated solutions into these clinics often eroded quickly after external support was withdrawn. The piClinic Console is designed to automate key aspects of patient information management in small, limited-resource clinics so as to introduce automation into a clinic in a way that the clinic can sustain with little or no additional support. Unlike previous efforts to scale down existing medical records systems for a small clinic, the piClinic Console was developed to include only the functions that benefit most from automation. The design was implemented to work on low-cost hardware to minimize initial cost and dependence on external support. After encouraging laboratory test results, this design was tested in four Honduran clinics to evaluate the users' experiences and the utility of the design. Clinic response was universally positive; however, field testing identified that success relied on accommodating the different roles in the clinic, supporting at least one printer, and enabling multiple users to access the system from multiple devices.

CCS CONCEPTS

• **Applied computing** → **Health care information systems**; **Collaborative learning**.

KEYWORDS

electronic health record (ehr) systems, information communication technology for development (ict4d), international teams, technical communication education

ACM Reference Format:
Robert B. Watson. 2019. Affordable Patient Record Automation for Small Clinics: Field Testing the piClinic Console. In *SIGDOC '19: ACM Special Interest Group on the Design of Communication, Oct, 2019, Portland, OR.* ACM, New York, NY, USA, 2 pages.

SIGDOC '19, Oct, 2019, Portland, OR

1 INTRODUCTION

While supporting medical missions in Eastern Honduras, I observed that the clinics kept patient records on paper and stored them in manila folders. While the clinic staff expressed few concerns, the format presents reporting, storage, and retrieval challenges as a clinic grows. Research on the subject [6, 13] showed that automation could provide benefits to these clinics; however, successful installations of automation in small clinics typically required a reliance on external support [1, 3–5, 9].

In 2017, a low-cost solution seemed possible such that it would require minimal financial and technical support, making it suitable for small clinics, such as those that non-governmental organizations (NGOs) support, but it could automate only a subset of the patient-information management tasks in a small clinic [7, 11]. I returned to Honduras in 2017 to study small clinic operations and identify that subset. That research, and collaboration with the School of Public Health at the Universidad Nacional Autónoma de Honduras, resulted in a prototype of the piClinic Console that was reviewed by the staff in several clinics in 2018 [12]. From their feedback, field test prototypes were developed for testing in four small, Honduran clinics in 2019. This paper presents the preliminary observations from those tests.

2 BACKGROUND

Development of the piClinic Console followed user-centered and participatory-design models [11, 12] by involving end users in the process as much as possible. Early in the development, contextual observations of the users and the feedback they gave in interviews informed the final design, which complemented the paper records instead of replaced them [11]. Interviews with the stakeholders and on-site observations of their activities identified that the paper patient records, which contain the patient's detailed medical history in the clinic, provided the medical staff with the information they needed to attend to individual patients. However, the individual patient records were cumbersome when the clinic staff evaluated multiple patients, such as when they compiled the official monthly reports of clinic activity and accounted for the cash that the patients paid to visit the clinic [11]. The clinic activities observed were divided into three categories [11]:

- Activities served sufficiently by paper-based processes
- Activities served better by computer-based processes and that required more resources than a small system could provide
- Activities served better by computer-based processes and that could be adapted easily to a small system

Activities in the first category, such as the use of specialized patient-visit forms, were left as-is and not considered for automation. Activities in the second category, such as pharmacy inventory management or connecting clinic staff and patient records to a central computer, were considered for future development, but were outside of the scope of the console prototype. The core features to support clinic activities in the third category and tested in field test prototype include [11]:

- Patient master index and basic patient information.
- Patient-visit encounter data with ICD-10 (CIE-10) diagnosis coding.
- Clinic data report generation and export.
- Basic cash accounting.
- Data backup and recovery.

3 FIELD TEST

During summer 2019, I installed piClinic Console prototypes in four Honduran clinics that volunteered to participate in the field test. The goal of the field test was to determine if a low-cost, limited feature system would provide sufficient utility to the clinic without incurring additional operating costs.

In each clinic, the existing clinic processes were observed before installing the console. The console was introduced, and the staff was trained on its use, after which clinic operations were observed as they used the console. The observations and data collected in the field were primarily qualitative [2, 8] due to the exploratory nature of the project; however, the consoles also collected some quantitative workflow and interaction data that will be analyzed after the field test.

The console provided valuable utility and the clinic's experiences with the c onsoles were universally positive; however the operating cost was slightly higher than expected. Further, the field test revealed aspects of the patient flow and division of labor that will inform future development.

The patient flow through each of the clinics shared the same process steps: reception, pre-clinic or triage, the doctor's consult, collecting medicine, and discharge from the clinic. Depending mainly on the clinic size and staffing, the people responsible for each step varied. In the smallest clinic, one person performed all steps, while in the larger clinics, the steps were performed by several different people. Through iterative, participatory design, user interfaces were modified to accommodate each type of clinic [10].

Field testing also revealed the utility of printing and multi-user access to the data. The field-test prototype was intended to be a stand-alone terminal that would tabulate the clinic information independent of and in parallel with the clinic's paper records and not require a printer; however, all clinics saw that as cumbersome. For clinics larger than one-person, multi-user access was also seen as requirement, if only to minimize duplication of data entry. Reconfiguring the piClinic Console to support multiple users at the same time was necessary in each clinic [10].

Honduran national law requires clinics to maintain paper records of patient visits; however, the field-test clinics all preferred a more paperless workflow. The proposed workflow in which the patient-information was collected on paper and then copied into the computer at the end of the visit was seen as unnecessarily complicated in all clinics. The ideal workflow collected visit information in the computer throughout the visit and printed a paper report at the end of the visit to file in the patient's folder [10]. Requiring a printer increases the operating cost of the system; however, each clinic reported they had to print their own forms anyway, so the result was a negligible marginal cost increase.

To accommodate the division of labor in the clinics, minor modifications were made to the user interfaces. In larger clinics, the roles of the different staff were very clearly defined and not easily transferred. Some tasks, such as recording the patients' diagnoses, were seen as "the doctor's work" [10], such that other positions in the clinic did not feel comfortable even copying the doctor's written diagnoses. Modifying the workflow and user interface to accommodate these divisions of responsibility made it easier for the clinics to adopt the system.

4 NEXT STEPS

More comprehensive analyses will be conducted to study the workflow data collected by the systems and to guide the next phase of the piClinic Console's development. Support for this research has been provided by The Fulbright Scholar Program, Mercer On Mission, the Mercer University School of Engineering, and Clínica Esperanza.

REFERENCES

[1] Adnan Barjaktarevic. 2008. Specific Implementation of Electronic Medical Record in Pediatrics Practice - ProQuest. *Acta Informatica Medica* 16, 3 (Sept. 2008), 172–175. http://search.proquest.com/openview/67123cea64d3d2f7c6f582c7cef7e7cb/1?pq-origsite=gscholar&cbl=1216391

[2] HR Bernard. 2006. *Research methods in anthropology: qualitative and quantitative approaches* (fourth edition ed.). Altamira Press, Lanham, MD, USA.

[3] Stefan Hochwarter, Do Duy Cuong, Nguyen Thi Kim Chuc, and Mattias Larsson. 2014. Towards an Electronic Health Record System in Vietnam: A Core Readiness Assessment. *Journal of Health Informatics in Developing Countries* 8, 2 (Dec. 2014). http://www.jhidc.org/index.php/jhidc/article/view/129

[4] Jayna M. Holroyd-Leduc, Diane Lorenzetti, Sharon E. Straus, Lindsay Sykes, and Hude Quan. 2011. The impact of the electronic medical record on structure, process, and outcomes within primary care: a systematic review of the evidence. *Journal of the American Medical Informatics Association* 18, 6 (Nov. 2011), 732–737. https://doi.org/10.1136/amiajnl-2010-000019

[5] Eugenio G. Lopez and Karina M. Diaz. 2017. Electronic Health Record in Bolivia and ICT: A Perspective for Latin America. *International Journal of Interactive Multimedia and Artificial Intelligence* 4, Regular Issue (2017), 96–101. https://doi.org/10.9781/ijimai.2017.4412

[6] Pan American Health Organization. 2016. *Electronic Medical Records in Latin America and the Caribbean: An Analysis of the current situation and recommendations for the Region.* Technical Report. Pan American Health Organization. http://iris.paho.org/xmlui/handle/123456789/28210

[7] Raspberry Pi Org. 2016. Raspberry Pi 3 Model B. https://www.raspberrypi.org/products/raspberry-pi-3-model-b/

[8] Jane Ritchie, Jane Lewis, Carol McNaughton Nicholls, and Rachel Ormston (Eds.). 2013. *Qualitative Research Practice: A Guide for Social Science Students and Researchers* (2 edition ed.). SAGE Publications Ltd, London.

[9] MJ Van Der Meijden, Huibert J Tange, J Troost, and Arie Hasman. 2003. Determinants of success of inpatient clinical information systems: a literature review. *Journal of the American Medical Informatics Association* 10, 3 (2003), 235–243.

[10] Robert Watson. 2019. Field Notes, piClinic Console Field Test.

[11] Robert B Watson. 2018. Bridging the Gap Between Paper Patient Records and EHR Systems with the piClinic Console. In *Proceedings of the 2018 IEEE Global Humanitarian Technology Conference (GHTC).* IEEE, San Jose, CA, USA, 1–8. https://doi.org/10.1109/GHTC.2018.8601547

[12] Robert B Watson. 2018. Enriching Technical Communication Education: Collaborating Across Disciplines and Cultures to Develop the piClinic Console. In *Proceedings of the 36th ACM International Conference on the Design of Communication.* ACM, Milwaukee, WI, USA, 20. https://doi.org/10.1145/3233756.3233929

[13] World Health Organization. 2006. Electronic health records: Manual for developing countries. (2006). http://apps.who.int/iris/bitstream/10665/207504/1/9290612177_eng.pdf