

# *Healthcare Management Information System Implementation for Emerging Regions*

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## **ABSTRACT**

*Every month, healthcare workers at Hope Clinic in Uganda fill out an average of 100 claim forms by hand. The clinic may wait for 30 to 60 days after a patient is given care to receive payments. Moreover, there are often mistakes in the claims that require adjustment and reprocessing. Fiscally well-established clinics could reasonably weather this claims cycle but in resource-starved hospitals, such as the Hope clinic, delays in processing can translate into patients getting turned away. This project aims to significantly reduce the time spent processing patient care claims and in turn reduce the number of patients that are denied care. I am implementing a mobile phone based application that will allow healthcare workers to fill out the claims forms digitally. This application will help reduce errors as well as the time it takes for the form to be entered in the database and reviewed. Mobile devices provide an economical yet robust platform for managing patient data and processing claims. The claims form will be implemented in J2ME on the Palm platform and support dynamic validation, and real-time calculations of the claim value totals. The main emphases of this project are to design a software infrastructure that is intuitive within the users' social context yet broad enough to be applicable to similar use cases. We will demo this system, submitting the claims form from a phone to a laptop over GPRS, in Uganda in August.*

## **Author Keywords**

*Healthcare, Information Technology, Mobile Computing, Uganda*

## **INTRODUCTION**

The broader goal for this project is to promote the social well-being and economic development of low-income countries. Improving healthcare delivery systems in developing regions is a critical component of this effort for several reasons. For instance, an estimated 17% of economic losses in developing countries can be attributed to health-related issues. Additionally, an estimated 85% percent of all new cases of curable sexually transmitted infections (STIs) occur in developing regions [6].

The need for improvement in the health sectors of developing countries is underscored by the current HIV/AIDs epidemic. Treating curable STIs has been found to be an effective strategy for HIV prevention. HIV transmission and infection is facilitated by the presence of other STIs. For example, the presence of genital ulcers may increase the probability of HIV transmission by a factor of 50-300 per contact [8]. Although there is often a general agreement on the need to address these concerns, inefficiencies in the health care delivery system render such objectives farfetched.

## Output-Based Aid

Donor agencies funding STI prevention and treatment initiatives often find that their contributions are not being used well. In traditional public funding schemes, a donor agency allocates money for supplies and services to be provided. This payment system frequently leads to an inefficient use of funds since payments are received before any actual services are rendered.

Output-Based Aid (OBA) programs present a more practical funding method for health services in low-income countries. OBA programs aim to eliminate inefficient use of funds by providing a performance based payment scheme. The focus in such a program is more on the patient because the service providers have to verify who received care, what they received care for, and prove that the care was appropriate for the patient's needs [3].

## Healthy Life

The HealthyLife Voucher Program is one such program. Healthy Life program in Uganda reimburses healthcare providers for the diagnosis and treatment of STIs. The program is run by Marie Stopes International and Microcare Insurance Ltd., in partnership with the Ugandan Ministry of Health and the Kreditenstadt for Wiederaufbau. The program has been very successful in increasing the number of patients receiving treatment for STIs [4]. The trade-off for this more efficient payment method is that it introduces additional layers of recordkeeping into the claim process.

### Claim Process

The claim process under the Healthy Life program is initiated when a patient seeking medical treatment for STIs brings a voucher to a participating health clinic. Vouchers are sold in pairs to the client and their partner, and are good for a consultation and three follow up meetings. During the first meeting, lab tests are conducted and the patient receives a diagnosis and a drug prescription. Follow-up meetings are scheduled to ensure the patient gets well.

The clinic fills out a new claim for each new visit. The claim form contains fields for demographic information about the patient, the results of the medical examination, and the prescribed medicine. The claim also requires a fingerprint from the patient, a voucher sticker, and a clinic stamp. Completed claim forms are then sent to the management agency for review through the local carrier. Claims can spend, on average, two or more weeks traveling from the health clinic to the management agency.

Once received by the management agencies, it may take two to four more weeks for the claims to be reviewed and approved. The review process can also be delayed by incomplete or questionable claim forms

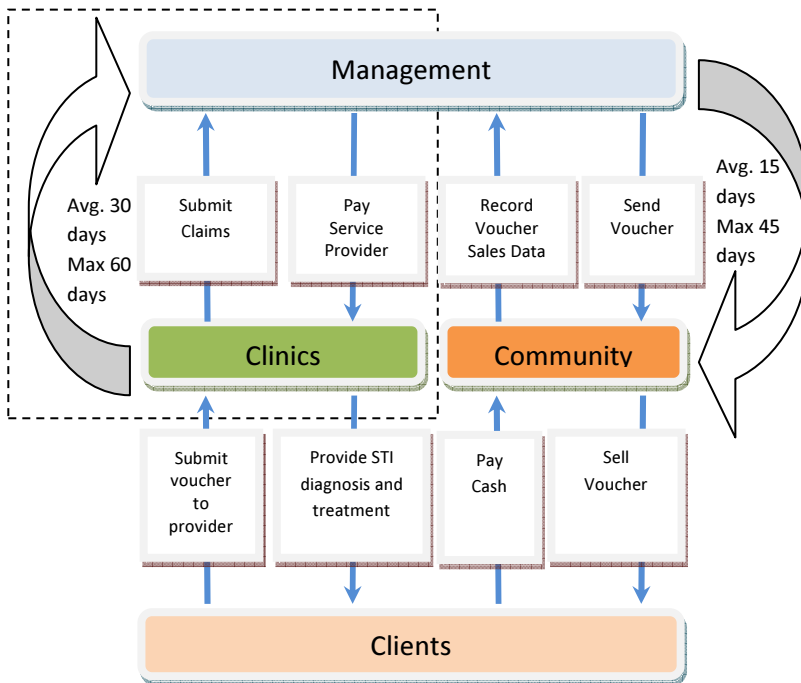


Fig. 1: Overview of the HealthyLife voucher program

that often have to be reprocessed. All in all it may take anywhere from one to two months before a clinic is reimbursed for their services.

This project addresses the funding and delivery of vital STI health services in the Uganda HealthLife Voucher Program. The information management aspect is exactly where smartphones can play a crucial role. The goal of this project is to design a more time efficient replacement for the current claims process. A digital claim can be validated and provide feedback to the health worker at the time of entry. A digital claim can also serve as a communication channel between the clinics and management during review and reprocessing.

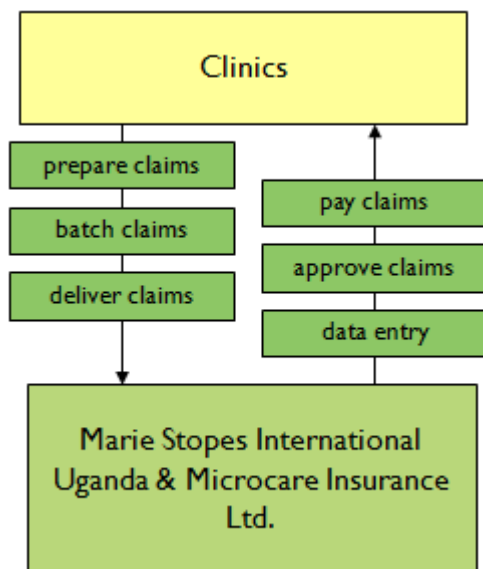


Fig. 2: Overview of claim submission process

**RELATED WORK**

There have been numerous projects that have applied information and communication technologies (ICT) to the developing world. Along with healthcare, ICTs have addressed education, disaster management, banking and more [1].

Mobile computers are uniquely situated for development work because of their relatively low cost, ever-increasing availability, and small size and energy consumption. The following is a snapshot of ICT for development projects in Africa that focus on health care.

**e-IMCI**

The Integrated Management of Childhood Illness (IMCI) protocol specifies a set of steps to be taken during a medical exam for an ill child. A course of treatment is chosen for the child based on the results of investigations. The e-IMCI project is a PDA adaptation of the IMCI protocol with a pilot in Tanzania. The application guides the user step-by-step through the IMCI protocol. Also, e-IMCI encourages a greater adherence to the IMCI protocol [2]. Claim Mobile has a similar goal of automating an existing health process but with additional goals of providing a management platform for the collected data and facilitating ongoing communication between user classes.

**Ghana Telemedicine**

The Ghana Telemedicine project focuses heavily on promoting communications between health professionals. The system gives doctors in Ghana a platform to communicate with the global community of health professionals. Currently the system only has support for users with a PC or laptop [5]. Claim Mobile targeted handheld computers specifically because of their comparatively cheap price and portability.

**Uganda HealthNet**

The Uganda Health Information Network is a project whose goal is to increase access to medical and health information through the use of handheld computers connected to local GSM telephone networks. Health

professionals can send and receive health information from free-standing access points [7]. Claim Mobile is different in that it focuses on managing health data on the handheld as opposed to collecting and sharing health data. Additionally, Claim Mobile has a focus on direct communications between health professionals.

### PROTOTYPE: CLAIM MOBILE

This prototype was designed as part of an ongoing research project. This implementation focused on increasing the claim processing speed and facilitating communication between the clinics and the management agencies.

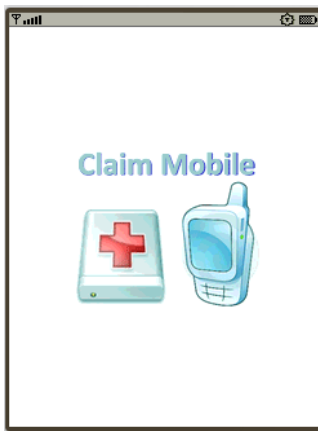


Fig. 3: Program splash screen

### Overview

Claim Mobile lets you create, edit and manage ClaimReports. ClaimReports consist of PatientData, the claim StatusReport and the Annotation portion. The PatientData portion corresponds to the paper form. It contains the client's personal information, medical information alongside the results for the clinical examination and the prescription. The StatusReport contains the status of the claim, a message concerning the given status, the amount of money requested and the amount of money approved for the claim. The Annotation portion contains a collection of messages about the

ClaimReport. After receiving a judgment on the submitted ClaimReport, the two parties can dispute or clarify details of the PatientData through the Annotation. For this reason the Annotation portion was set up like a chat log.

### Completing a Claim

- 1) Patient enters the clinic requesting a consultation about possible STI symptoms. The health worker enters the patients voucher number into the program. The voucher number is checked against a local data base for verification.
  - a. If the voucher number matches a previous record (i.e. the patient is seeking a follow-up consultation) the digital claim form is prefilled with the data from the past visit.
- 2) The health worker performs an initial assessment to determine if the patient shows warning signs of an STI covered by the voucher program.
  - a. If patient's ailment is not covered by the voucher program, they are informed and offered a course of treatment for a fee.

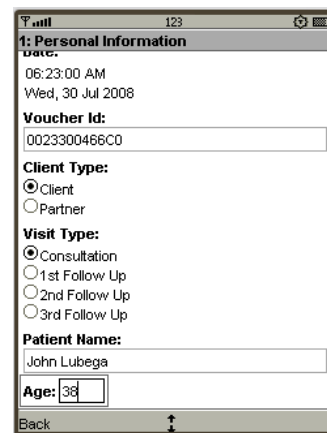


Fig. 4: Personal information

- 3) The health worker enters the patient's personal information including name, age, gender and location information.
- 4) The health worker performs a medical examination and checks off identified syndromes and symptoms on the handheld.
  - a. For flexibility, the health worker may also enter in unlisted symptoms.

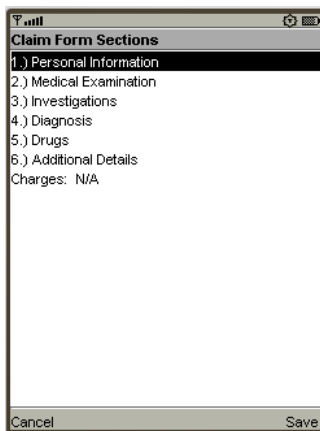


Fig. 5: Claim form sections

- 5) Based on the syndrome and symptoms identified during the examination, the program presents the health worker with a list of lab test to perform.
  - a. The health worker may save and move on to a new patient after the lab test depending on how long it takes to get the results back.
- 6) The lab results and diagnosis are entered in the handheld.
- 7) The hand held then lists acceptable drug prescriptions.
  - a. Charges are fixed and determined by the consultation, laboratory and prescription fees.
  - b. For flexibility, the health worker may also enter in an unlisted treatment but are warned

that the treatment may not be covered by the OBA program.

- 8) Upon saving the completed claim, the health worker is asked if they would like to submit the claim.
  - a. If they answer no, the claim is tagged as "Not Submitted", and the program returns to the list of claim forms.

### Status Update

- 9) When the program begins, the status ("Not submitted", "Pending Approval", "Approved" etc.) of each claim is noted on the screen that lists the claim forms.
- 10) Detailed information about the status can be viewed by selecting a claim from the list, and selecting "View Claim Status" from the list of options.
  - a. Problem claims, such as those receiving a "Quarantined" or "Adjusted" status, often come with a message from the agency explaining status.

### Annotations

- 11) The annotation portion can be viewed by selecting a claim from the list, and selecting "View Annotation" from the list of options.
  - a. Messages from management and the health workers are posted in the annotations to help resolve problem claims.
  - b. Additionally, a log entry is added to the Annotation portion every time changes are made to a claim that has already been submitted.

## DESIGN

### Minimizing airtime costs

There are four situations when the application requires a connection: when the claim is submitted, checking for an update of the status, adding to the annotation, and requesting a report from another clinic. The fourth case can happen, for example, if a patient goes to one clinic for an initial consultation and goes to another clinic for the follow-up consultations. The health worker is notified whenever an activity requires a connection.

Also, to minimize cost associated with network usage there is no server-side user authentication and the claims are handled locally whenever possible. Server-side authentication necessitates establishing a connection every time the application is run. It was more important to avoid such a situation than it was to provide this layer of security. Furthermore, forged claims are easy for the management agency to identify. Of course, this is a big assumption that may be revised after getting feedback. For now, a user is asked for the name of the health clinic and their name when the program begins. This is done only to establish who is completing the claim.

### Reducing Data Entry without Leading

Data entry was reduced where *appropriate*. An example of an appropriate situation is eliminating male syndromes if the user has already indicated that the patient is a female. An example of an inappropriate situation is forcing the user to a select a specific treatment. We try to avoid steering the user and also provide space for exceptional treatment options to be explained.

## FUTURE WORK

Verification of the patient was not addressed in this implementation. We will explore using phones with a camera to capture an image of the patient's fingerprint and GPS functionality to record the location.

A future implementation should include functionality for updating form items and validation, and allow for the download and management of new form types. Several open source APIs that address forms management were explored. However, supporting multiple form types is beyond the scope of this prototype.

Some design decisions were intentionally addressed ambiguously during the prototyping process. In those situations there was a design requirement; however, the actual implementation of the requirement may change based on user surveys. For example, it was important to divide the claim form into sections to facilitate step by step form validation and user feedback, allow for the dynamic adjustment of related sections, and also to better utilize the small screen sizes of mobile phones. However, it was not critical in this step of the process to know exactly how best to divide the sections. We will rely on user feedback when addressing the more open-ended areas.

We will be meeting with key actors in the coming weeks: the health clinic workers involved with data entry, and the management workers involved with approving claims. During our visit to management agency in Kampala, we will demo the prototype along with a mock-up of the management web application. We will discuss possible integration options. For example, it may make sense to fit the application into their existing database schema or to develop a management version of the mobile phone application. Next we will visit health clinics in Mbrara. Will demo the prototype alongside the current process and get

feedback from the health clinic workers. We will also learn more about the HealthBaby program and explore possible application of this work.

## CONCLUSION

This paper details an initial implementation for a mobile claims process in the Uganda HealthyLife Voucher Program. Claim Mobile demonstrates a low cost implementation that has the potential to improve the efficiency of the current claims process. The next step is to use Claim Mobile in the health clinics and incorporate new findings into the next iteration of the project.

## ACKNOWLEDGEMENTS

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