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Routine Data for Disease Surveillance in the Undeveloped Region of the OR Tambo District of the Eastern Cape Province

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Abstract. The research team needed to upsize the solution previously tested so that it could expand the routine data collected via tablet computers. The research team identified the general flow of data within clinics. Data was mainly collected from registers, which were later converted to electronic form and checked for duplication. A database was designed for the collection of demographic data (Patient Master Index), which was aimed at eliminating duplication of patients' data in several registers. Open Data Kit (ODK) Collect was setup on Android tablets for collecting disease related routine data, while ODK Aggregate as the storage and aggregates of data captured by ODK Collect and the Patient Master Index for demographic data, were setup on an Apple Mini Mac server. Data collection is in progress. The expected results include improved data quality, reliability and quick access to summary data. Secondly, instant retrieval of patient demographic details and clinic numbers are included. Thirdly, ability to form standard reporting from the SQL database and lastly exporting data into the TIER.net and DHIS systems via CVS files thus eliminating the need for data capturers are shown.

Keywords. Disease Surveillance, Routine data, Clinic Registers, ODK, Data quality.

Introduction

It is accepted that the value of routine data is its availability, reliability and validity for those who are interested in that data for the purposes of disease surveillance, resource allocation and other applications.

This study is an upsize implementation of the project undertaken by the Walter Sisulu University (WSU) Health Informatics Research Team. The previous study data collection focused on Tuberculosis, while in this study the focus is on various kinds of diseases, which were recorded in the adult section of the Mthakulo Community Health Centre (CHC). This CHC is some 30 minutes travel from Mthatha. It is a rural CHC serving some 100,000 people who live in relative poverty.

Wright and Odama [1] have questioned the validity of data collected using government registers in rural clinics. Furthermore, O'Mahony states that the cost of generating and summarising this data is costing nurses valuable time that could be used for patient care [2].

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1. Methods

The Research team analysed how routine data were generated, stored and used at clinics prior to designing the data flow. Routine data are recorded in a number of clinic registers across various consultation rooms.

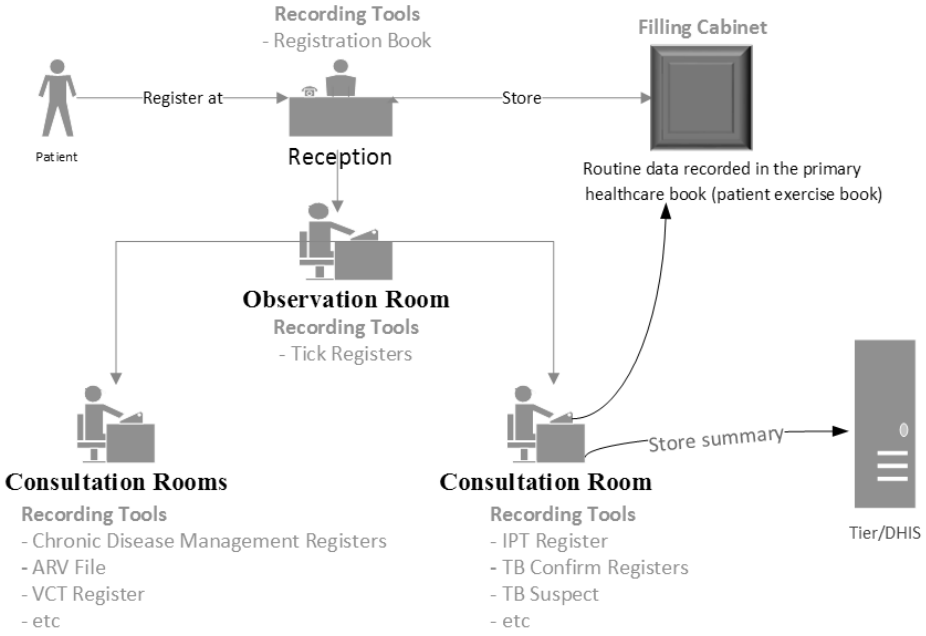

Figure 1. Activity Flow before Introduction of the Solution

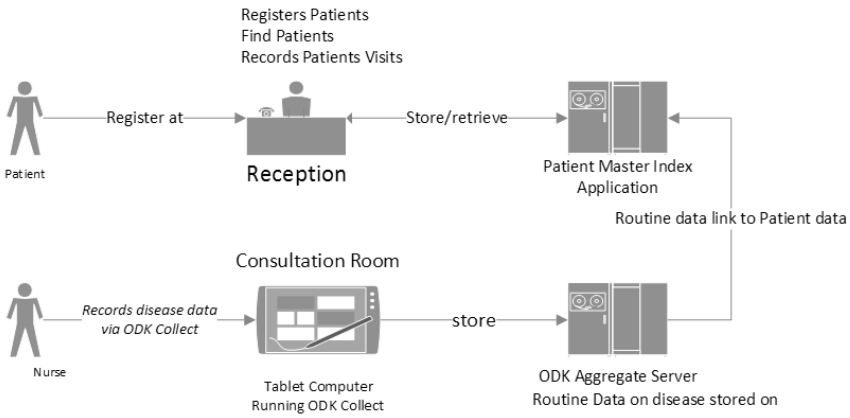

Figure 2. Activity Flow Diagram of Proposed Implementation

The results from the analysis were used to create XForms, which were downloaded to Open Data Kit (ODK) Collect. Processed XForms were used to collect clinical data from the consultation rooms while the Master Patient Index application was used to collect demographic data at the reception.

Having analysed routine data found in registers, the team focused on registers relocated in the adult section of the clinic. The registers included the IPT Register, Chronic Diseases Management Register, HIV Counselling and Testing Register, Chronic Disease and Minor Ailments Register (Tick register) and the TB registers. Data from the registers was separated into clinical data and demographical data. Clinical data was coded into XForms based on registers analysed, while demographical data was coded as HTML5 forms to be used in the Master Patient Index application.

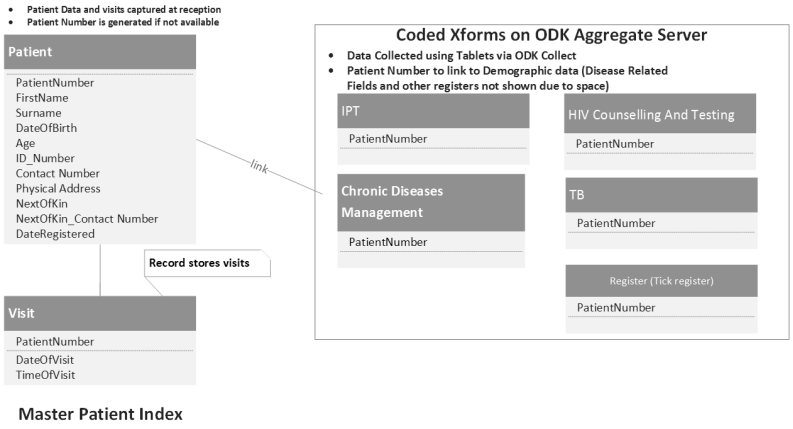

Figure 3 Conceptual Database Schema of the Implementation (without all fields in the ODK Aggregate)

Microsoft Excel was used to design the forms using clinical data collected from registers and then the XLSForm tool was used to convert the forms to XForms so that ODK tools could use them. An ODK Aggregate server was setup on an Apple Mini Server and all XForms created were validated and uploaded to the server. ODK Collect was downloaded from Google Play. It was configured to download XForms from the ODK Aggregate. The forms were tested on tablet computers after they were downloaded from the ODK Aggregate server.

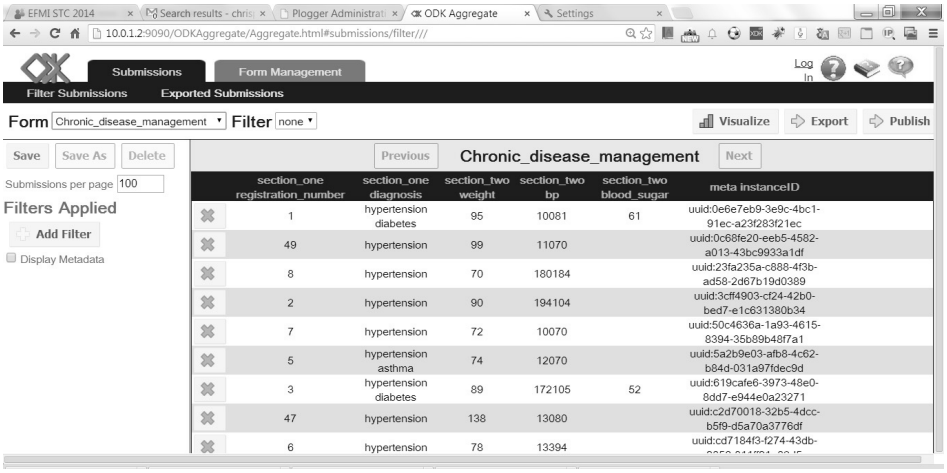

Figure 4. Sample Collected Data on Chronic Disease Management on ODK Aggregate Server

An application (Master Patient Index) to handle routine demographic data was designed using HTML5, Twitter Bootstrap®, Java Enterprise Edition Technologies (Java EE) and open source database MySQL server. Netbeans® Integrated Development Environment (IDE) was used as a developing environment for the application. The Master Patient Index application has the following features: ability to register new patients, to find patients who are already registered, and to record their visits. The application also has statistical reporting features.

In the previous study [3] Google App Engine cloud services were used to host the ODK Aggregate server. However, in this study the team completely avoided using cloud services for security and Internet speed reasons and instead opted for a locally installed tomcat deployment on an Apple Mini server. The research team has computer science skills to manage the deployment, maintenance and support of the tomcat deployment. The Apple Mini server was the best option for the server hardware because of it is ready to run out of the box, easy to install, set up, and manage. Furthermore, its small size makes it ideal for small offices since the clinics we were working in have no dedicated server rooms. Other reasons considered included the ability of the server to automatically backup the hard disk using the Airport Time Capsule, ability to encrypt the hard disk and inbuilt wireless access point which can easily be configured using the Airport Express and Airport Express Extenders.

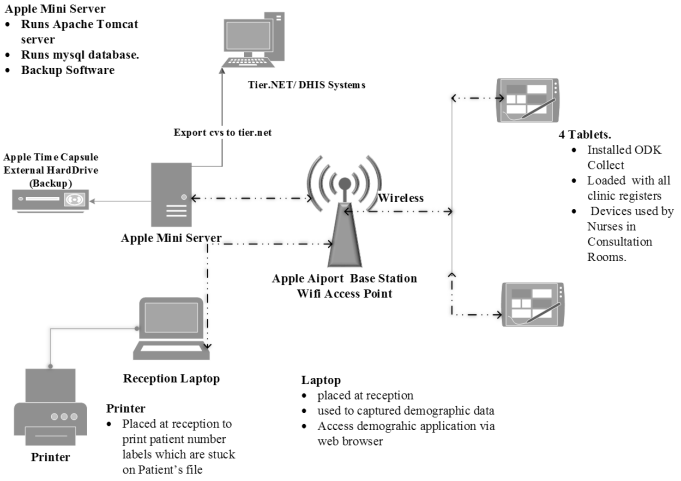

Figure 5. Network Architecture of the Deployment Planning

The Wi-Fi wireless was setup using an inbuilt wireless access point in the Airport Time Capsule and three Airport Express Extenders stations so that the wireless signal was boosted and covered all consultation rooms.

The choice of tablet computers was based on our previous experiences [3]. The team choose tablet computers with only Wi-Fi connection. This was to ensure that nurses were not tempted to connect to 3G networks. The 10.1" tablets running a 4+ version of Android operating system were chosen for this study. Backing up was automated via the Airport Time capsule. Offsite backing up was made easier by both the ODK Aggregate and Master Patient Index applications.

To ensure the smooth operation of this study, members of staff from the reception and the nurses in the consultation rooms were trained to use the ODK Collect and the Master Patient Index application and associated hardware, tablet and laptop computers. Technical and Medical Support was offered by the research team throughout the study.

2. Results and Discussion

As we undertook a pilot project with tablets to collect data we do not foresee any particular problems or issues that we have not addressed in the planning of this project. Early observations indicate that results should include:

- Improved data quality, reliability and quick access to summary & aggregate routine data that could improve disease surveillance in this region. Heunis et al., [4] have also bemoaned the problems of poor data quality. Douglas et al., [5] state that data quality improves the closer it is to the point of capture and if the staff who enter data benefit from the coding. Data is now more reliable since it is captured at the point of care and there is no longer duplication of patient data across registers.
- Instant retrieval of patient demographic details and clinic numbers has drastically reduced waiting times, improved access to statistics on patient visits and improved way to communicate with patients, since all contact details are now readily available throw the Master Patient Index system.
- Ability to form standard reporting from the data stored in the SQL database. Data captured via ODK collect by clinical staff is now available on ODK Aggregate for analysis, export and reporting.
- Exporting of xml instances into the SQL database. Exporting data into the tier.net and DHIS systems via CVS files eliminates the need for data capturers.

3. Conclusion

Given the service delivery problems in the rural clinics and Community Health Centres in the OR Tambo district of the Eastern Cape, South Africa, which include lack of electricity and water supply. Medicines are not delivered in sufficient quantities and there is a lack of medical as well as nursing staff. This study has shown the possibility to design and implement low cost IT solutions to help solve the problems of data capture in rural clinics. The cost of equipment for this project was about 4,000 €.

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