OpenHDS
Health and Demographics System

About

The Problem

Health systems software needs to solve some relatively challenging problems. Modeling health data is among the most challenging because the underlying domain model between health centers may vary. In some cases, flexible data models are needed in order to handle the many different scenarios that can occur, such as the Entity Attribute Value (EAV) model. Security and privacy, multi-user access and communication with other government databases are also concerns. In addition, mobile phone support has been necessitated by the burden of paper based data collection, which introduces more complexity.

For many health research projects, households need to be studied over a period of time. Household characteristics and member relationships can clarify the causes and consequences of mortality and illness in developing countries. Strong observed correlations between social, economic, and health status attest to the value of information on household member relationships, customs and behaviors. Household analysis is also helpful in health interventions since the effectiveness of health services is determined by household social and behavioral factors.

Despite the principled approach of household studies, many household-based health studies in developing countries fail to meet their objectives. Reasons for failure vary, but the most prominent among them include data management problems. In many cases, adding site-specific health information requires modification of a software system and the associated database. This presents a great risk because modifying the software system directly can sometimes cause unintended consequences. Recording household data and member relationships can be a complex undertaking when studied over a period of time because events of interests must be recorded and linked with other characteristics of individuals. The maintenance of logical consistency with a steady stream field of data collection errors results in a large collection of data that becomes difficult to compile, manage and analyze.

One common form of a household study is known as longitudinal population-based surveillance and is primarily concerned with monitoring the general population of a region over time, collecting data on the core components of demographic change such as births, deaths, and migrations. Longitudinal population-based surveillance is a powerful research tool because it chronicles the life course of every individual in a population and simultaneously illuminates large-scale population dynamics such as morbidity patterns and fertility/mortality/migration rates and trends. Researchers can use this data to identify causal determinants of fertility, morbidity, and mortality and be able to map the distribution of risk in a population and to measure the population level of impact of health and family planning interventions. This information allows policymakers and program planners to make decisions based on sound scientific evidence.

Demographic data is in short supply in the developing world. Where the information is needed most, health and population related problems are at their worst. For one billion people living in the world's poorest countries, where the burden of disease is highest, those who are born or who die are still not counted. The primary reason why demographic data is in such short supply in the developing world is due to complexity and cost. Longitudinal population-based surveillance requires interviewing tens or hundreds of thousands of people in their homes, on a regular basis, over the course of years. The large quantities of data gathered in the field must be entered into the system. The health centers must have enough money, staff, and scientific/technical expertise in order to undertake and coordinate field and computer operations.

The Solution

Health and Demographic Surveillance systems (HDSS) have been designed to facilitate the collection, management, and analysis of demographic data. These systems are built around a core structure that is flexible enough to accommodate most longitudinal studies of populations. The core system is based on the principle that certain characteristics of households, household members, relationships, and demographic events are common to most studies of the human population. The logic for these characteristics is embedded in the core system.

Longitudinal household studies will vary across project sites and each site may have their own set of requirements on how a HDSS application should behave. It's

common for a site to collect additional information than what is provided in the core data model. Altering overall system behavior and modifying the underlying data model in such a way to incorporate all project sites is a requirement for most HDSS applications.

About OpenHDS

OpenHDS was created as an open source health and demographics system for developing countries. OpenHDS is being designed to address all of the issues mentioned above in order to work efficiently across multiple sites. The system has adopted many ideas from OpenMRS and the DHIS, including authentication schemes, database structure and system architecture.

The OpenHDS structures data and maintains logical integrity on the following basic elements of a social group:

- All households have defined members. Members may belong to multiple households.
- All households have a single head at a given point in time and members relate to one another and to the head in definable ways. It's possible for an individual to be the head of multiple households.
- Members have a name, date of birth, and other characteristics that do not change.
- Events can occur to members such as death, birth, in and out migrations, pregnancy, residency, and marriage. These events change the household membership and relationships according to fixed rules.

Although the list above is seemingly trivial, everyday relationships tend to become complex and unwieldy when arrayed as a logical system of longitudinal population data. Portraying even simple relationships requires rigorous standards to avoid error. For example, to register a death in the population, a social group member must be resident in the study area; a birth to a woman five months after she gave birth to another child is an inconsistent event. This logic may seem mundane, but lapses in the integrity of data management can generate deaths to individuals who are not logically members of the risk set, births to nonexistent mothers, or migrations among the deceased. The accumulation of minor logical lapses can render data useless for all but the most basic analyses. In addition, errors generated at one stage tend to cause additional errors in later stages. This compounding effect can quickly cause the database to become completely out of step with the study population. Longitudinal household research requires defining rigorous and unambiguous standards for data management. The logical integrity of the OpenHDS core when paired with appropriate field procedures permits these standards to be met.

OpenHDS thus defines the structure of households, demographic events to members, and the population at risk.

There are several layers to the system:

- The OpenHDS core consists of following modules: domain, dao, service, web, and reporting. Additional modules can be linked to the OpenHDS core expanding functionality.
- The data model can be extended in many definable ways, including the Entity Attribute Value model and by dynamically adding new attributes onto the core entity tables
- The Special Study module allows multiple household studies to be run simultaneously
- An export function to output all pregnancies, deaths, and the entire population broken down by month, location and age group into the DHIS
- An export function to output appropriate and thorough amount of documentation to describe the demographic data that's being collected in the health study according to the DDI standard.
- Mobile software components to facilitate data collection while in the field.

Features

This is a list of the features that are included in the core version of OpenHDS.

- **Security:** User authentication.
- **Privilege-based access:** User roles and permission system.
- **Individual level data**: Creation and maintenance of individual level data, including households, relationships, migrations, pregnancies, etc.
- **Data Entry:** With the web application, clients can design and enter data using the provided electronic forms.
- **Mobile Data Entry:** With the mobile client, field workers can enter round data and be able to submit the information into the database. This is currently being pilot tested with Mobile and Tablet devices.
- **Metadata:** Data can be exported into DDI2 and DHIS format for use in other tools.
- **Localization / Internationalization:** Multiple language support (currently English and Swahili) and the possibility to extend others.
- **Reporting tools:** Flexible reporting tools with JasperReports and BIRT.
- **Dynamic Attributes:** The attributes of the core entity tables can be extended to meet local needs.

META

- Log in
- Entries RSS
- Comments RSS
- WordPress.org

ARCHIVES

- October 2011
- September 2010

RECENT POSTS

- OpenHDS Presentation at INDEPTH
- OpenHDS Website
- Tools for the Community
- OpenHDS M4 Release

TAG CLOUD

OpenHDS