The Perceived Benefits on the Use of an Open-Source e-Health Platform in Tarlac Province, Philippines

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Abstract—**Wireless Access for Health Initiative is a public-private partnership (PPP) that was put together in 2009 to improve access to quality health data and improve local health governance. Towards this goal, the Initiative helped develop and replicate an open-source electronic medical record (WAH-EHR) in the Province of Tarlac (population, 1.27 million). The WAH e-Health platform now boasts of added features such as SMS Patient Alerts and the use of mobile devices for data recording and reporting at the point of care. WAH is now finalizing the interoperable Dental Module and Primary Care Benefit Forms of Philippine Health Insurance Company. Starting with four pilot clinics in 2010, WAH is now present in 68 clinics and 40 city and municipalities covering Metro Manila, Luzon, Visayas and Mindanao.**

E-health; mobile health; electronic patient records; public health; health information system; public-private partnership

I. INTRODUCTION

The Philippine health information landscape is largely defined by the Field Health Service Information System (FHSIS). The FHSIS is the major resource for public health data used for policy analysis and planning at all levels of the public health system. FHSIS data originate during patient care at barangay (village) health stations and health clinics in City Health Centers (CHC) and Rural Health Units (RHU). There are approximately 42,000 barangays and 1,900 public clinics in the Philippines.

Public clinics, especially those in the rural areas provide critical health care services to families and communities, especially the poor. An estimated 80% of patient-level information is managed by midwives assigned to barangay health stations who are mobile health workers for family health monitoring [1].

Effective delivery of patient care requires good information at all levels of the health care system. Patient-level information enables health care workers to provide individual patients with more effective, efficient and comprehensive care.

The doctors and nurses, supported by midwives in barangays, at CHCs and RHUS, treat patients as they manually record information, compile, and send reports to the Department of Health (DOH) on a monthly, quarterly, and annual basis. This process is time-consuming and error-prone.

Accessing and managing health information, even at the barangay level, is labor-intensive. Data are often outdated or incorrect. More importantly, the inability to easily access and trust patient data leaves rural health workers with little sense of data ownership. This adversely affects data quality and the availability of information needed to measure and improve the quality of health care service delivery.

The DOH acknowledges that reliability of health information remains the number one challenge in health policy planning and intervention [2]. An integrated fixed/mobile electronic medical record system accompanied by other health information system solutions that can record, report and compile, has the potential to improve access to quality patient records and provide quality data to the FHSIS.

Former DOH Secretary Dr. Esperanza Cabral further recognizes that "[an] electronic health record system is the appropriate response to the DOH's need for finding innovative ways of transmitting reliable health data to allow for speedier decision making and action" [3].

Most importantly, if local health care providers, such as the midwives who are the front line health care providers in the Philippines are taught how to analyze and use the health data they collect; it is hypothesized that this could help to improve patient care and ultimately health outcomes.

II. THE WIRELESS ACCESS FOR HEALTH INITIATIVE

Supported by Qualcomm's Wireless Reach™ initiative and in collaboration with various stakeholders led by the Province of Tarlac and RTI International[1], the WAH Initiative successfully helped develop an award-winning [2] e-Health platform that is designed to improve health care in the Philippines by reducing

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[1] RTI International is a trade name of the Research Triangle Institute.

[2] WAH was conferred the 2011 Galing Likha Kalusugan (Health Initiative Excellence) Award for Excellence in Technology and Process Innovation by the Department of Health, the Center for Health Market Innovations, and the Philippine Institute for Development Studies, for its "unique innovation,

significant impact, and high sustainability" and for being the most extensive information technology system of its kind among local government units in the Philippines. In 2012, WAH also earned 1st Place in the Philippine Department of Interior and Local Government's Jesse Robredo e-Governance Awards for Client Empowerment for its "effective and efficient utilization of information and communications technology in the delivery of services".

the time and effort required for recording and reporting health data and by facilitating access to accurate and relevant patient information by clinicians and decision makers.

A. The WAH e-Health Platform: Open Source-Open System

The WAH e-Health platform offers practical solutions to local health information management problems. It brings together three innovative telecommunications technologies—wireless, mobile, and (digital) information—and process management innovation to create a clinic-centered health information platform that helps local clinicians to improve health care delivery. Specific technologies include:

- A high-speed 3G wireless network that provides fast and reliable data services to health clinics and mobile midwives. Reports that used to be delivered by motorcycle or *jeepney* (a local mode of transportation) can now be transmitted wirelessly directly to the people who need them most.

- Low-cost computer hardware, including netbooks, tablet computers, and mobile phones, that are locally affordable and provide powerful tools to health care providers, even in regions where health care budgets are limited.

- The Community Health Information Tracking System (CHITS), a free and open source EHR system developed in the Philippines for public health clinics, provides clinicians with quick access to patient records and automatically generates standard FHSIS reports required by the Philippine Department of Health (DOH).

- Synchronized Patient Alerts via SMS (SPASMS), an SMS messaging system integrated with the EHR, issues alerts and reminders to encourage the regular visits of patients enrolled in the Maternal, Neonatal Child Health and Nutrition, Family Planning, and Tuberculosis programs.

- Coconut Mobile Midwives, a free and open source mobile application, enables mobile midwives to efficiently access and manage patient records at the point of care (barangay health stations), and to synchronize records wirelessly with the EHR

- Statistics Aggregator, through which provincial and municipal local chief executives (LCEs) and health managers gain real-time access to up-to-date health statistics aggregated at the provincial level and disaggregated down to the barangay level.

WAH's innovations are within the parameters of the existing FHSIS national health reporting framework, as well as the national health insurance program's (PhilHealth) electronic reporting protocols. This ensures seamless integration when clinicians submit electronic reports to these institutions.

As of March 2013, WAH is helping twenty-four clinics submit monthly electronic reports directly to the DOH main server in Manila – following standard protocols and guidelines. This is by far the largest number of clinics doing so in any province in the country.

B. The Partnership: Sharing Responsibilities and Success

In addition to the technology, WAH unites a diverse group of stakeholders with a common vision. In fact, the Initiative is the first and only multi-stakeholder public-private partnership on electronic health (e-Health) in the Philippines. The partnership features thirteen organizations led by the Provincial Government of Tarlac and supported by government agencies, such as the DOH's Information Management System Division (DOH-IMS), National Epidemiological Center (DOH-NEC), and Center for Health Development 3 (DOH-CHD 3); private sector partners Qualcomm Incorporated and Smart Communications; academic partners University of the Philippines Manila-National Telehealth Center (UP-NThC), Tarlac State University (TSU), and the Asian Institute of Management-Zuellig Center for Asian Business Transformation (AIM-ZCABT); non-government organizations such as RTI International, the League of Municipalities of Tarlac, the Zuellig Family Foundation (ZFF); and international aid organizations such as the US Agency for International Development (USAID). Their combined expertise, influence, and resources have been critical to the project's achievements.

The partnership centers on what each party can bring to the table: this enhances the features of the platform and the overall collaboration among different but willing stakeholders. The partnership continues to grow and has so far added three more partners since 2010.

To date, the support of local governments in Tarlac has exceeded project expectations. As the primus inter pares in the partnership, the province and the municipalities have taken concrete steps in ensuring that the WAH platform continues to prosper in the province despite decreasing funding support from private sector and development agency partners.

Since 2012, all local government units in Tarlac have incorporated the maintenance and improvement of their health information system (HIS) in their annual budgets expenses [4]. The four pilot municipalities have each passed their own *Sangguniang Bayan* (Municipal Council) ordinance supporting the adoption of the platform.

An indicator of the project's local sustainability and ownership has been the steady decrease in the proportion of funding provided by Qualcomm Incorporated's Wireless Reach program and corresponding increase in local funding over the past three years [5]. In the first year Wireless Reach provided 90% of project funding. In year two this reduced to 70%, and in year three to 50%. By year four Wireless Reach funding is expected to amount to less than half of its original 2009 grant as local partners step up to sustain the gains and momentum of the partnership.

III. EFFECTS ON LOCAL HEALTH MANAGEMENT AND PATIENT CARE

While the WAH Partnership aims to broaden the support for the adoption of modern HIS in Tarlac, its main product, the WAH e-Health platform is seen to benefit patients, clinicians, policy makers and decision makers. Electronic recording and reporting reduces time spent by clinicians on manual health information management and increases time spent by health workers on consultation, thereby helping improve patient care.

The WAH-EHR in particular makes data recording and reporting faster, according to its users in Tarlac. It makes patient information encoding, retrieval, and management more efficient as it reduces to a matter of seconds the minutes wasted in finding patient records during consultation.

The WAH-EHR also minimizes, if not eradicates, the frequent cases of missing patient records. With digital encoding and encryption, patient records are also more secure, while improving accessibility by authorized personnel.

More importantly, the ability to easily view, record and share patient information across multiple computers within a health clinic means that clinicians are able to complete patient consultations earlier in the day in order to provide more support to community health workers.

Electronic medical reporting also improves access to higher quality health data. The Mobile Midwife feature of the platform trains and equips midwives with mobile devices for speedier recording, reporting, and retrieval of health data. By encoding patient health data at the point of care (villages), WAH minimizes mistakes and promotes reporting of more updated and reliable health data.

WAH process innovation products also help guide clinicians and smooth the transition from manual to electronic reporting. The WAH Clinic Scorecard tracks health data quality according to four set of indicators: Timeliness, Completeness, Reliability, and Accuracy.

Timely reports are those submitted by the 7th day of the current month, covering data for the previous month. Completeness is measured when all four main component health programs, i.e. Morbidity, Maternal Care, Child Care, and Family Planning, are submitted.

Concerning reliability, discrepancies, if any, are checked between the RHU's manual Monthly Program Report[3] (or M1, an aggregate report based on the Target Client List[4] or TCL) and that generated by the EHR. Accuracy is measured by conducting data quality checks (DQC) at the clinic, where the M1 report is further validated against the TCL and system-generated reports [6].

Another process innovation introduced by WAH is data analysis and utilization training for health workers and Local Chief Executives (LCEs). More than half of key health personnel in public clinics in Tarlac have undergone the training on how best to use the data stored in WAH servers to promote health programs and implement timely health interventions.

Combining expertise in technology and process innovation, WAH recently introduced the Statistics Aggregator, which enables real-time monitoring of monthly reports from clinics in the province. This gives decision makers, such as the governor and the mayors, complete access to relevant and reliable statistics for policy planning and health program implementation. Since electronic reports can be aggregated and disaggregated easily, health managers and decision-makers alike

are able to track current health indicators and implement timely health interventions.

IV. THE ARGUMENTS FOR HEALTH INFORMATION SYSTEM

WAH experience in Tarlac suggests that electronic medical recording helps improve local health management and patient care. The WAH project was based on the following three hypotheses:

1: Use of an EHR can increase time spent of health workers on consultation thereby helping improve patient care.

2: Use of an EHR can improve access to higher quality health data.

3: Use of an EHR can facilitate data analysis and utilization by health workers and local chief executives, thereby helping promote health policy planning and timely health intervention.

The next section details the evidence in support of these three main hypotheses.

V. THE WAH EXPERIENCE

The WAH project began with four pilot RHUs and has now grown to include all of Tarlac's 39 health centers, comprising approximately 85% of the catchment population and serving approximately 2,500 patients a day.

In 2012, WAH expanded to clinics outside the Province and now has five clinics located in Pateros, Metro Manila, Dao, Capiz, Ipil, Zamboanga Sibugay, Don Salvador Benedicto, Negros Occidental, and Libon, Albay. Collectively, as of March 2014, the system is now a repository to over 503,627 patient records and 2,002,090 consultations in the country.

WAH end-users (physicians, nurses, midwives, dentists, and medical technologists) confirm improved and better encoding, retrieval, storage, generation and management of patient and health information reports. In 2012, more than 90% of all WAH users report that they are now able to find patient information more easily [7].

Whereas in the paper-based system, it takes 3 to 15 minutes to locate a patient record in the health center (resulting in long lines at the admission area), searching for a patient's EHR with WAH now takes no more than a minute. The average four to eight hours per week that nurses and midwives previously spent recording and reporting patient information can now be used for patient care, improving the quality of care and making patient visits more efficient.

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[3] The Monthly Program Report (M1) captures the monthly summary of data on the same indicators found in the Target Client List.

[4] The Target Client List (TCL) is a manually-accomplished clinic-level database of clients identified as "targets" or "eligibles" for one or another program of the Department of Health and is used to monitor service delivery.

The average patient consultation time has also been reduced based on observations of end-users and patients. Documented interviews with patients by representatives of award-giving bodies that conferred citations to WAH confirmed shorter and better service delivery in clinics using the system.

Annie Marie Brillantes, Public Health Nurse at the Municipality of San Clemente, in an interview in 2012 comments, "The use of an electronic health record system has improved the way we do things at the clinic. It has improved patient care as more time is spent for consultation than searching for papers. It has improved public health by making it easier for health care workers to record, track, and report health information. With WAH, everything became organized, fast and systematic. Just a click on the patient's name and everything that is recorded about the patient is there." [8]

The RHU Scorecard, implemented in September 2012, reports increases in the timeliness (see Fig. 1) and completeness (see Fig. 2) of the electronic reports submitted by clinics. In August 2012, 65.4% of reports were submitted on time and 61.5% were complete. In January 2014, the percentage of punctuality has risen to 71.79%, and completeness to a perfect 100%.

Improved health data quality also positively influences health outcomes at WAH user sites. Mayor Eldwin Alibutdan of the Municipality of Ipil, Zamboanga Sibugay remarks, "With WAH, we are now certain that our health personnel can properly and promptly track and manage pregnancies. With WAH enabling our clinicians to submit timely, complete, reliable and accurate reports, we hope to further reduce our MMR (Maternal Mortality Rate) and at the same time do timely interventions and manage outbreaks of diseases." [9]

Bimonthly monitoring visits to each of the project sites are undertaken by the project implementation team to check on the reliability and accuracy of patient and health information encoded by the RHUs, and to validate the reports they submit. This has helped improve the accuracy of data reporting, as explained in a statement by the Tarlac Provincial Health Office [10].

With the WAH recording and reporting system in place in his three RHUs for more than two years now, the president of the League of Municipalities in Tarlac, Mayor Dennis Norman Go, declares that he has been able to do evidence-based planning using information generated by the WAH-EHR [11].
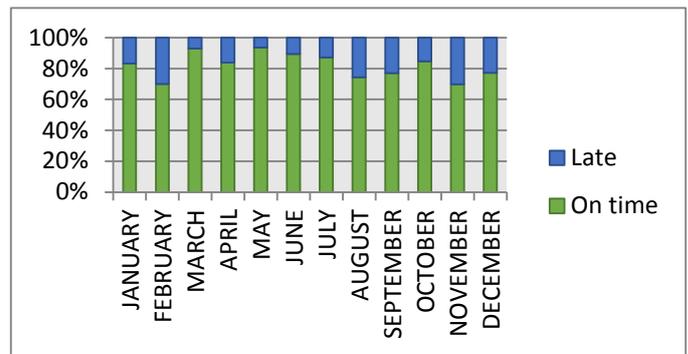

Figure 1.   Timely Submission of Electronic Reports

"Local communities," notes Crispinita Valdez, director of the DOH Information Management System Division, "[are] empowered by promoting [this kind of] participatory health planning among local leaders, health managers and providers, thereby transforming clients and patients into partners." [12]
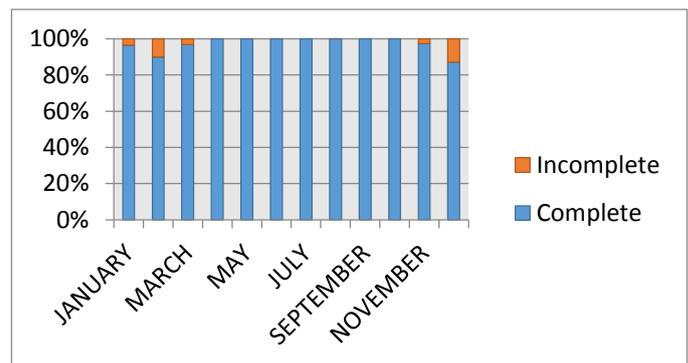

Figure 2.   Complete Submission of Electronic Reports

Mayor Go also further claims that LCEs in the province report a boost in the morale and increased professionalism in the ranks of their health workers. He claims that "RHU workers no longer see themselves as backward since they are now able to use gadgets and devices on par, if not better, than those used by their counterparts in private clinics." [13]

WAH is also credited for having accelerated the goal of the DOH to have all health personnel in the country ICT literate by 2016 as all RHU health personnel in Tarlac are expected to be ICT-literate by June 2013.

The ultimate goal of WAH is to have this clamor and commitment to the transformational effects of HIS at the national level sustained. WAH partners have committed manpower and financial resources to scale the project inside and outside Tarlac. The Tarlac Provincial Government will soon complete its goal of connecting all of its clinics to WAH. The Zuellig Family Foundation is expanding the platform to 26 clinics across the country by the end of 2013, and the DOH CHD 1 is launching it in four provinces in the Ilocos Region.

VI.   CONCLUSION

Demand for the EHR system among local governments and from health workers has remained high in the Philippines. WAH

aims to set a standard for how to replicate and scale up health information system in the Philippines.

This paper acknowledges the shortcomings of the largely anecdotal and testimonial evidence presented. An independent research team is already starting an intermediate assessment of WAH to determine the outcomes and impacts in Tarlac over the last three years of the project.

While awaiting the result of tis independent research, WAH continues to advance based on available empirical evidence and the first hand testimonials of users. To date these alone have been enough to convince new adopters and new partners.

The available empirical evidence supports the hypothesis that WAH has helped to improve the timeliness, completeness, reliability, and accuracy of data recording and submission in Tarlac. Anecdotal evidence and qualitative data suggest that clinicians in Tarlac now feel and work with more pride and enthusiasm. This suggests that WAH has been remarkably successful in using technology and process innovation to change perceptions and behaviors.

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