The eHATID LGU Program: A Continuing Effort in the Collaborative Challenge of Nationwide Health Informatics

Andrei Coronel¹, Ma. Regina Estuar¹, Dennis Batangan¹, Rose Ann Camille Caliso¹, Jann Alfred Quinto¹
¹ Ateneo de Manila University, Philippines

Presenting author’s email address: acoronel@ateneo.edu

Biography of Presenting Author: Dr. Andrei D. Coronel is an Assistant Professor in the Department of Information Systems and Computer Science, Ateneo de Manila University, Philippines, teaching for more than ten years. He holds a Bachelors degree in Biology, earned his Masters and Doctorate degree in Computer Science, from Ateneo de Manila University. His current projects reflect his research interests in the field of health informatics, environmental science, and computational music. He heads the Ateneo Computational Sound and Music Laboratory.

Abstract: The government program called eHealth TABLET for Informed Decision Making of Local Government Units [eHATID LGU] follows the success of the 2013 eHealth Technology Assisted Boards for LGU Efficiency and Transparency [eTABLET] project, which aimed to leverage ICT to improve the efficiency of health care delivery across ten municipalities in the Philippines. The new program, eHATID LGU, has expanded the project to reach deployment to up to 450 cities and municipalities nationwide. The new program has five new thrusts: institutional development and partnership, integration to currently existing communication channels, capacity building, systems integration, and sustainability. The program, as with its preceding pilot study, continues to work toward the actual main goal of bridging the gap across disparate manual health systems implemented in separate locations, thereby improving both health care delivery and the vertical transfer of information starting from the municipality level. These goals are achieved through the program’s products and services, which highlight a cloud-based infrastructure that serves units of an Android based mobile electronic medical record system and its various web components. It was concluded that both the technical development and capacity building facets of the program are adequate in delivering the program goals.

Keywords: eHealth, ICT, interoperability, health information systems, EMR

1. Electronic Medical Records: From eTABLET to eHATID LGU

In 2013, the Ateneo de Manila University Institute of Philippine Culture [ADMU-IPC] and the Ateneo Java Wireless Competency Center [AJWCC] began with the eHealth TABLET project aimed to leverage ICT to improve the efficiency of health care delivery across ten municipalities in the Philippines. This project was funded by the Department of Science and Technology [DOST], specifically the Philippine Council for Health Research and Development [PCHRD]. It aimed to provide an eHealth solution in the form of a tablet-based electronic medical record [EMR] system used by medical health officers and public health professionals within the local government units. Previous learnings from this project include the validation of a bottom-up approach in system design, the effect of the tablet-based EMR on unification, efficiency, acceptance and transparency in the context of the local government unit, as well as findings that stem from tracing user behavior from the voices and actions of the users (Estuar et al. 2013). Following the success of this pilot study, the project has scaled up to a full program last 2014. This project was identified to have continued value since health program implementers and policy-makers are continually investigating on how technology can help address the challenges faced by health markets like that of the
Philippines in terms of the availability, quality, and financing of healthcare (Lewis et al. 2014). Now renamed as eHealth TABLET for Informed Decision Making of Local Government Units [eHATID LGU], the main focus of the renewed program has shifted from software design and development, system usage, and real-time visualization to complete processes supporting objectives falling under five program components, namely, institutional development and partnership, integration of the system to currently existing communication channels, capacity building, systems integration, and sustainability. The eHATID LGU Program aims to deploy the tablet-based EMR system up to 450 cities and municipalities. Currently, 236 cities and municipalities have been introduced to the system and have been formally trained on how to use the mobile and web components of the system.

1.1 eTABLET 2013

The predecessor of the current program is the eTABLET project which stands for electronic Technology Assisted Boards for LGU Efficiency and Transparency. This project was the first attempt of the team to develop and distribute an Android based mobile electronic medical record system to communities of local government units [LGUs].

The study employed a convenience sampling method for its site selection process. The pilot implementation sites were primarily the recommendations from the League of Municipalities of the Philippines [LMP] in support of their strategic area development approach for program development. The pilot sites of the project were Paombong in Bulacan, Guimba in Nueva Ecija, Sta. Rita in Pampanga, Lal-Lo in Cagayan, Anilao in Iloilo, Alcoy in Cebu, San Jose de Buenavista in Antique, Dumalinao in Zamboanga del Sur, Bacuag in Surigao del Norte, and Isulan in Sultan Kudarat.

The deployment experiences of the project highlighted the issues of Internet connectivity of the LGUs, adjustment of the users from a paper-based to a tablet-based system, and user responsibilities such as recall of user account information. Since the system was designed to store and access data via the web services on the cloud, the lack of stable and strong Internet connectivity yielded problems on data loss or interruption during patient data encoding. The users of the system found it cumbersome to encode patient data using an Android based, ten-inch tablet. Encoding manually on paper or through a standard PC-keyboard set up was preferred. These issues and more were addressed through the SMS/email communication protocol between the project team and LGU users in an open online forum.

The bottom up approach of the project in developing the eHealth TABLET system proved to be an important factor in the acceptance of the technology at the local government level. The approach provided the intended end users with ownership, not only of the data, but also of the whole system, catalyzing an increase in the chances of technology acceptance and utilization of the system in the end (Estuar et al. 2013).

1.2 The eHATID LGU Program and its objectives

1.2.1 Software development to incentivize use of the system through integration with health insurance features

It was one of the original objectives of the 2013 eTABLET Program to incentivize the use the tablet-based EMR System by linking it, or having embedded with it, health insurance features. The Philippine Health Insurance Corporation [PhilHealth/PHIC] is a tax-exempt, government-owned and government-controlled corporation of the Philippines, with a goal of ensuring a sustainable national health insurance program for all. The social insurance program PHIC provides is a means for the healthy to pay for the care of the sick and for those who can afford
medical care to subsidize those who cannot. Both local and national governments allocate funds to subsidize the indigent (Philhealth 2014). The PhilHealth Primary Care Benefit 1 [PCB 1] is an outpatient benefit module of PhilHealth, and it was the goal of the eHATID LGU Program to incorporate access to the said module within the technology of the mobile application of the program.

On a later section of this paper, the infrastructure that aims to connect and allow interoperability among health record systems called the Philippine Health Information Exchange [PHIE] will be discussed. This is the entity that allows the working connection between eHATID LGU technologies and PhilHealth.

1.2.2 Incorporate existing web-based solutions in support of new eHATID LGU technologies

A project similarly funded by DOST-PCHRD aimed to create an online informative hub for health related issues at the national scale. This was achieved in the form of an official government funded website for eHealth, appropriately named eHealth.ph. The eHATID LGU Program, stemming from its project predecessor, is entailed with service requirements best implemented using a web-based solution. Instead of re-inventing a web-based component specifically for eHATID LGU, it was a directed goal of the program to augment and redesign eHealth.ph to satisfy these requirements. These requirements include information dissemination, user support, user feedback, operational requirements, and administrative features.

In line with these requirements, the web components of the eHATID LGU Program features informative pages, user and admin communication via forums, registration for new users, and eHATID LGU Administrative User features.

1.2.3 Capacity building

With the aim of focusing not only on the development of the system but instead geared towards capacity building, the objectives of the eHATID project included: a) enhancing existing institutional development and partnership models for more effective implementation and sustainability, b) establishing capacity building and technical assistance process to support the deployment, utilization, monitoring and evaluation of the software and the device, c) integrate eHATID LGU system and outputs into provincial and regional health information systems as related to the PhilHealth PCB 1 package, and d) prepare a transition and sustainability plan for eHATID LGU project phasing it to regular LGU and national government programs.

Development and enhancement of institutional partnerships is necessary because eHATID resides in an academic institution being funded by the government agency and was designed to be used by local government units. From a project standpoint, preparing institutions for turnover as well as full adoption, the system necessitates formalization of partnerships as well as formation of technical working groups that will serve to govern its community of users. At its core, eHATID LGU needed to establish a training program that will be used during deployment as well as be given to future trainors of the system. Continuous use of the system is pushed by the opportunity to connect and interoperate with the primary care benefit package [PCB 1] of PhilHealth. Lastly plans to maintain and increase adoption of the system were the focus of plans for scaling and sustainability.

1.2.3.1 Technology Acceptance Framework

Technology acceptance is one of the standard measures on usability and usefulness of a system. eHATID adopted the Unified Theory of Acceptance and Use of Technology [UTAUT] structural model with modifications for health information technology adoptions (Boonchai et al. 2013), which measures the following factors: performance expectancy, effort expectancy, social influence, facilitating conditions, voluntariness, system satisfaction, care report and use and communication use. Performance expectancy is related to the usefulness of the system to a person’s task. Figure 1 shows the Technology Acceptance Framework.
Following its predecessor, eTABLET, eHATID LGU was designed to be used by three types of users: the municipal health officer, the local mayor and the encoder, which can be a barangay health worker, midwife or nurse or an information technology officer. Effort expectancy was related to the ease of use of the system. Other external factors relevant to measure acceptance include social influence (if others are using it then I will use it also), facilitating conditions (do we have enough resources to ensure that the system will continue to function), voluntariness (is the system attractive enough to be used even if it is not required), system satisfaction (I am satisfied with the eHATID LGU system), care report and use (I can use the system for providing care and required reports) and communication use (I can use the system for information search purposes and communicating with my supervisors and colleagues).

2. Methodology of the eHATID LGU Program

The eHATID LGU Program Methodology is divided into System Development and Capacity Building. This section will discuss both.
2.1 Methodology for system development

The tablet utilizes an Android operating system with four services: Electronic Medical Record System [EMR], Graphs and Reports, Doctor Requests, and Local Chief Executives [LCE] instructions.

The EMR System is the heart of the application, providing the main point of entry for all users input. The Graphs and Reports provide visualization of data entered on the patient record system (i.e., maps, bar, graphs, chart) thus giving the user a quick analysis of the local health snapshot. The services Doctor Request and LCE Instruction provide communication and documentation log services which increases transparency on the decision making activities on local health system.

To facilitate interoperability with other EMRs, as well as maintain protocol with health related entities (i.e. PhilHealth), the eHATID LGU products and services implement the ICD10 standard for diagnosis identification.

It is the mandate from DOST that the eHATID LGU Program web components be able to generate reports consistent with the reporting requirements of the national Department of Health [DOH] to the municipalities. The web component of the program incorporates a report-generation facility that is compatible with the DOH Field Health Information System [FHSIS] reports.

The development process for the integration of PCB 1 system in eHealth TABLET included a joint architectural design by the project team and PhilHealth technical and software personnel. Existing health data standards, security and privacy protocols and framework of PhilHealth was adopted by the system.

The existing eHealth.ph website is currently used as online support platform for mobile application deployment where documentation, training materials, updated application and other related instructional and educational materials can be downloaded.

The project currently utilizes cloud computing technology for data storage and management and is directed to be incorporated in the Philippine Health Information Exchange [PHIE] infrastructure on data reporting.

2.2 Methodology for capacity building

Capacity Building for eHATID included development of instructional and training materials, including short learning videos, presentation materials, user manuals, an online forum and paper assessment. The content of the presentation materials, manuals as well as the assessment were designed by an instructional designer. The design of the materials was for intended users as well as for future trainors. With the objective of deploying eHATID LGU in over 450 municipalities in the entire country, there was a need to select universities, agencies and institutions that can serve as extensions of eHATID in the province or region. Regional Technical Assistance Partners [RTAPs] were selected based on a set of qualifications to assist the core team in deploying and monitoring the system. Specifically, the RTAPs serve as the help desk of the LGU end users whenever they encounter technical and non-technical difficulties with the system, provide echo training to the users (as needed), and monitor the system utilization. A total of 22 RTAPs were trained last February 2015 and April 2015.

Deployment plan includes selection of sites, submission of letter of intent and ICT survey. Monitoring of sites through field visits were done by the RTAPs. RTAPs also collected surveys on technology acceptance from the various users of the system.

Given the dispersed geographical locations of the LGUs interested to be part of the project, the team has employed a dynamic deployment strategy, constantly changing depending mainly on the following factors: 1) responsiveness
and availability of the LGUs for either a provincial or regional training; 2) responsiveness of the partner regional and provincial government agencies tapped by the project team to support the training and deployment activities; and 3) number of requests received by the team from partner government agencies regarding their preferred LGUs for eHATID implementation. As of 9 December 2015, the eHATID LGU project has successfully deployed the system to 236 cities and municipalities from 42 provinces nationwide and 13 regions, as seen in Figure 2.

The deployment activities, which started in April 2015, were conducted through partnership arrangements with the DOST Regional Offices, Provincial Governments, and PhilHealth. The project’s partnership with these government agencies was formalized through a Memorandum of Understanding [MOU] for a more effective implementation and sustainability of the project.

The implementation process of the technology is as follows: First, the LGU will send an accomplished and signed (by their Mayor) Letter of Intent [LOI] and ICT survey to the central eHATID LGU team via email, fax, or courier. Second, the team acknowledges the receipt of the accomplished forms and schedules the training and deployment activity either at the provincial or regional level. Except for highly-urbanized cities, the project accepts LGUs from all levels of municipal and city income classification as long as they have submitted the duly signed LOI and accomplished ICT survey form. Lastly, the team conducts the training through the help of the regional and/or provincial agency partners. The post-training support includes an SMS-based and online help desk, Regional Technical Assistance Partners [RTAPs], and instructional materials.
Specifically on the training and deployment activity, the project deploys two units of Lenovo tablet devices with the pre-installed eHATID LGU mobile application and hard copies of the instructional materials. To formalize the partnership between the IPC and LGU and more significantly, to ensure the seamless and sustainable implementation of the project, a conforme letter and MOU between the LGU and ADMU IPC, which stipulate the accountabilities of each of the parties involved in the project as well as the best practice guidelines for technology utilization, are given to the LGU representatives during the training.

Pairwise correlations were used to determine significant relationships among the technology acceptance factors and the user’s intention to use the system as well as usage in relation to encoding and consultation. To determine the consistency between intention and actual behavior, independent sample t-Test was used to determine if there was significant differences in intention to use and actual use.

The social mobilization strategy for the deployment included the Training of Trainers where trainers come from local universities, DOST and PhilHealth Regional Offices. Technical support and services can be provided by regional partners. Training modules and protocols are standardized based on the pilot testing result and PhilHealth standard protocols on PCB packages.

Selection of provinces were based on the DOST Community Empowerment through Science and Technology [CEST] sites, municipal LGU sites of eHealth TABLET project and preferred sites of the project partners especially by PhilHealth. Assistance from the LMP, League of Cities of the Philippines [LCP], and League of Provinces of the Philippines [LPP] and PhilHealth, as well as DOST and DOH, on the engagement process of provincial, city and municipal local chief executives. Selection criteria includes: a) local chief executive support for innovations, b) presence of development – oriented programs in the LGU, c) responsive health sector, and d) no electronic health information systems at the local level.

For the sustainability plan of the eHATID LGU system, the Ateneo School of Government and the Ateneo University Business Affairs Office are tapped to assist the team in developing the appropriate business model for eHATID LGU.

3. **Technical discussion of the eHATID LGU IT infrastructure**

The eHATID LGU system parts include both web and mobile components. The web components were developed with MySQL and PHP using the Laravel framework, while the mobile components were developed with Android Studio. Both the web and mobile components of eHATID share a similar cloud based backend in the form of a government provided remote server infrastructure. The government partner utilized in the infrastructure is a branch of the same funding body, DOST. All clients of the eHATID environment (i.e. every user, both web and mobile) across the different program-deployed cities and municipalities transmit data into this cloud, referred to as the “DOST eGov Cloud Facility,” also known as the National Government Data Center. This is a guaranteed secure backend foundation for government funded services as this program. Figure 3 illustrates the simple yet effective IT infrastructure of the program.
This secure cloud facility is connected to the Philippine Health Information Exchange [PHIE], which allows the eHATID LGU system to interconnect and at a limited capacity, operate with other public health based systems connected to PHIE. The PHIE infrastructure is explained in the next section.

3.1 The Philippine Health Information Exchange framework

The PHIE is a government lead infrastructure that provides an enterprise system bus that will allow partial interoperability among entities, such as medical record systems, that connected to the infrastructure. Figure 4 provides an illustration on how an EMR system such as the eHATID LGU Application connects to PHIE, thereby allowing eHATID to interoperate, at the field level, to entities also connected to PHIE, such as PhilHealth, as previously discussed in section 1.2.1.

The PHIE will eventually interconnect different systems in the context of public health for the facilitation of interoperability among the said systems.
3.2 eHATID LGU and its relationship with partners

Program efforts on institutional development and partnership have lead to the creation of an official Electronic Medical Record Experts Group [EMREG], a specialized group under the nation’s eHealth Technical Working Group [TWG] involving the main public eHealth projects with electronic medical record systems and Health Information Technology Partners [HITP] at the national level. The importance of these partnerships cannot be neglected since the ICT based solutions that the program provides are niched within pre-existing structures of information transfer. Unlike non-dependent, stand-alone software applications, the products of the eHATID LGU Program cannot and does not operate outside standing protocols of the nation’s eHealth Framework, since the one of the key components of the program involves interoperability. Given this, and the natural progression of partnerships for institutional development, the focus naturally leads towards the next program component, which is systems integration.

The Systems integration component of the eHATID LGU Program involves efforts to facilitate interoperability across the different electronic medical records systems (aside from that of the eHATID LGU Program) of the EMREG. The minimum goal is to implement, at the least, structural interoperability involving data exchange. In such level of interoperability, the structure or format of data exchange is defined, such that the clinical and operational purpose and meaning of the data is preserved. Defining the syntax of the data exchange only ensures that data exchanges among health information systems can be interpreted at the level of data fields. From this step, higher levels of interoperability (i.e. functional and semantic interoperability) involving successful exchange of processed information as well as the exchange of the interpretations of information logically follow. The integration of back-end services and information technology infrastructure of the different electronic medical record systems is the main objective, which leads to the program’s participation in the ongoing development of the PHIE. The development and eventual implementation of this enterprise bus will facilitate interoperability of eHATID LGU applications for both mobile and web platforms alongside the other EMR systems, while preserving the separation of the infrastructure of all EMRs involved.

4. Outcomes and discussion

4.1 Development results

During the duration of the program, system development was performed for 10 months before the first deployment of eHATID Version 1. Best practices observed during this period include the implementation of rapid prototyping methodologies, with product demonstrations performed in two-week sprints. Testing protocols included an internal and external quality assurance officer performing smoke testing. Common software errors that were eventually eliminated involved user registration problems, patient list downloading, and other admin level issues. Throughout the ten month period, the number of bugs encountered exhibited a gradual decline. It was determined that most errors encountered involved Internet connectivity problems, as opposed to the core functionalities of the eHATID LGU System.

4.2 Capacity building results

A total of 236 cities and municipalities from 42 provinces and 13 regions nationwide were trained, with an average of 2-3 users per LGU, with a total population of 196 males and 352 females. Distribution of user types was 40 doctors, 51 nurses, 32 encoders.IT staff, 3 midwives, 10 administrative staff, and 1 medical technologist (412 not declared designation).
At the end of each training conducted, a standard evaluation form is accomplished by the participants. However, it must be noted that out of the 18 trainings conducted, only seven (7) training groups were able to accomplish the evaluation forms due solely to the tight schedule of the training program. All in all, the evaluation form was accomplished by 150 LGU participants (total number of attendees for all the trainings is 549). Among the guide questions stipulated in the form, more than half of those who answered the survey strongly agreed (53%) that the presenters and resource speakers were well-prepared, knowledgeable, and responsive to their questions and comments. Further, the participants also strongly agreed that the training materials provided were appropriate to the objectives, comprehensive, and useful (50%). As for the level of satisfaction of the participants on the trainings conducted, 58% agreed that they were satisfied while more than half of the participants also agreed that the training design was appropriate for their needs (52.67%) and that they have gained the knowledge and skills on how to use the eHATID application (51.33%).

From among the training sessions, most of the participants liked the hands-on demonstration of the eHATID system and the presentation which highlighted the features and benefits of eHATID system, such as the digitized electronic medical record, visualized health data, and the communication tool.

In terms of usage, aside from standard users like municipal health officer, some LGUS opted to hire encoders to enter data on the tablet or use the batch upload available on the web by designated systems administrators. As of this writing there are consultation records covering 42 provinces in 13 regions across the country.

In terms of usage and based on the technology acceptance survey, significant association among the factors of performance expectancy, effort expectancy, social influence, facilitating conditions, care and report use, communication use, and system satisfaction were established using the Spearman’s rho and Kendall’s tau-b tests of associations.

5. **Current status, learnings, and next steps**

The eHATID LGU Program and its product and services, both in the context of technical infrastructure and capacity building, implements measures for quality, reliability and safety among its stakeholders (i.e. users, patients, and partners).

Internal and external quality assurance officers guarantee the correctness of the system. In the context of capacity building, the results discussed in section 4.2 show that there is a general sense of acceptance from the users of the products and services, and that post-deployment support provided to everyone through the program’s web components, including eHealth.ph, is adequate.

The implementation of ICD10 diagnosis standard in the program ensures correctness of communication in the context of disease identification. Not only is this important in the context of health care delivery, but this also provides clarity and avoidance of process mistakes involving PhilHealth benefit (insurance) claims. If any claim is not consistent with the diagnostic criteria after going through standard verification processes, the claiming process will not proceed. ICD10 implementation addresses this and other potential issues related to disease identification, thus guaranteeing reliability of service through eHATID LGU.

Data consistency of these eHATID-generated reports with those of regional level FHSIS reports, together with PhilHealth verification claims, can be indicators of the effectiveness of EMR usage with the eHATID LGU Program, as well as the assigned clinicians’ appropriate usage.
The use of the National Government Data Center as the central backend of the entire system, the safety and security of all data and subsequently processed information sourced from and distributed through eHATID LGU is anchored with the existing government policies on safety and security in the context of these infrastructures. Every user and patient data interaction within the program’s products and services are guaranteed with the implementation of government level safety and security measures. The program’s connection to PHIE, likewise, follows the same level of layered protection for all stakeholders involved.

It has been noted that the strength of the program lies in the straightforwardness of system design, although conversely it has been observed that the system’s dependence on Internet connectivity can prove to be a constraint. This was made apparent in areas where national telecommunication channels are considerably weak. Though the system’s offline-mode addresses this, a telecommunication signal is eventually needed to transmit subsequently cached data to the National Government Data Center. The capacity building methods, on the other hand, are proven to be a program strength as they were validated by experts, and offers greater opportunities for expansion, such as potential certification for trained users and an increased number of instructional videos, eventually.

The program is currently in its continuing deployment phase, aiming to reach the planned deployment site targets within the first quarter of year 2016. Aligned with suggested tasks of the EMREG, the eHATID LGU Program is now involved in the development of integration plans with an ePrescription System and local interoperability efforts with the interface of one of the EMREG partners.

The continuing effort of the eHATID LGU Program opens windows in further studying the specific differences in the challenges of adoption beyond the municipality level. Such can be performed at the regional and provincial level, as the increased number of deployment sites rose from ten to 450. This is a continuing challenge, since ICT is not a primary component of the profession as medical doctors (Marcelo, 2006).

The eHATID LGU Program involves entities that connect to it both technically (i.e. PHIE) and organizationally (DOH, DOST, etc.), and to achieve the goal of effective nationwide health informatics, this collaboration among all stakeholders must be consistent at the least, if not progressively moving towards faster development.

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7. References


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