

Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions as Correlates to the Adoption of Wireless Access for Health

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ABSTRACT

Technology has been integrated into various levels at the rural health systems by both government and non-government agencies. The study aimed to identify the factors influencing adoption of Wireless Access for Health (WAH) by rural health workers and how it influences the perception of health workers regarding the health-seeking behavior of their clients. Some selected rural health workers from 11 Philippine municipalities responded to a survey adopted from the Unified Theory of Acceptance and Use of Technology (UTAUT) questionnaire. Correlation analysis and one-way analysis of variance were used to test the relationships between the variables. Results showed that to establish high adoption of WAH among rural health workers, interventions must ignite appreciation among health workers as regard to the importance and relevance of the technology to their work (performance expectancy). Support from the health managers and local chief executives of the municipalities, both administrative (social influence) and logistical (facilitating conditions) are necessary for them to adopt the technology. There is also perceived increase in facilities-based deliveries and deliveries by skilled birth attendants in the municipalities after installation of WAH.

Keywords – Health Information Technology, public health, behavioral science, unified theory of acceptance and use of technology, descriptive design, Philippines

INTRODUCTION

The effective use of health information technology (IT) by primary care practices to facilitate quality improvement (QI) can help practices improve their ability to deliver high quality care and improve patient outcomes (Higgins, Crosson, Peikes, McNellis, Genevro & Meyers, 2015). Nations around the globe have shown encouraging progress that demonstrates how the effective use of ICT in healthcare can improve access and quality of care, reduce costs and improve satisfaction among both patients and providers (Intel, 2013). In the Philippine context, there are already existing evaluative studies which looked into the effectiveness of health information technologies. However, there still remains a dearth of timely and evidence-based researches looking into the interoperability and capacity of these technologies in effectively integrating health data from various sources. Also, existing studies hardly explored the behavioral changes required both at the level of the individual and at the level of the organization for health technological innovations to be adopted and sustained.

The Asian Development Bank, looking at the trends in ASEAN and Asian region as a whole states that the state-centric facility reporting model tends to be “passive and does not work well on private facilities when no registration or reporting system is enforced. Indeed, the state-centric model is becoming increasingly inappropriate in the current move toward institutional autonomy and privatization for hospitals and clinics. Information technology may be a game changer facilitating the monitoring of health-related development outcomes. New measurements, for example, could be developed to encourage the shift to electronic medical records or other e-vital statistics and also to leapfrog new technological application in mobile and e-health” (Huang, Moser and Roth, 2013). There are quite limited studies, however, regarding the magnitude of impact of technology in health systems in ASEAN.

In the past, the Philippine Department of Health (DOH) has been testing different methodologies in an attempt to improve its health information system (Valmero, 2011; DOH, 2013; Health Metrics Network, 2007; Tolentino, Marcelo, Marcelo & Maramba, 2005). Part of these methodologies is to include modern technologies as a tool for facilitating a faster and more accurate data gathering process. Evaluations of these programs, however, lacked consideration regarding social aspects of technology adoption. The use of technology in health

information in the Philippines is not only relevant, but almost necessary. The primary problem of the Philippine health care system is accessibility (Philippine Health Information Network, 2007) owing to a number of reasons including the archipelagic nature of the country. However, this situation can be mitigated by the use of health information technology which will hopefully provide information to health care practitioners even to the remote areas of the country.

However, introducing a technology is one thing, but integrating it in the system institutionally is another. Embracing technological change is a gradual process and social acceptance of such change could take time before it can be fully embraced by its users. In fact, the local government units are still used in collecting, processing, and analyzing health data manually despite the integration of health information technologies (Tolentino, Marcelo, Marcelo & Maramba, 2005; Health Metrics Network, 2007; Marcelo & Canero, 2010).

The study addresses the research gap on the knowledge regarding factors that influence a rural health worker would be persuaded to use the technology and knowledge regarding the influence of Adoption of WAH on the health-seeking behavior of pregnant women in Zuellig Family Foundation (ZFF) partner municipalities. It also contributes to existing knowledge by adding a social dimension on technology adoption. It addresses the research gap on the application of UTAUT framework in a post-adoption setting in ZFF partner LGUs. ZFF is a Non-government organization working on local health systems development through leadership formation.

FRAMEWORK

The study adopted and modified the UTAUT framework in assessing the determinants that influence adoption and acceptance of WAH as a technological innovation. The original UTAUT framework cites only four major determinants, namely, performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitating conditions (FC) and other intervening moderators affecting *adoption* which eventually influences *behavioral intent to continue use*. In this study, some of the moderators will be limited only to age, position/rank in the office and length of service, which were collectively referred to as socio-demographic profiles. Venkatesh, Morris, G. B. Davis and F. D. Davis (2003) came up with a Unified Theory of Acceptance and Use of Technology (UTAUT). The Unified Theory proposes that there are predominantly four main determinants of behavioral intention regarding people using information technology: 1) Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI),

and Facilitating Conditions (FI). In addition to these variables, the study also included the influence of physical infrastructures in the municipality such as electricity, internet, and technical hardware. They were collectively referred to as Enabling Resources.

The conceptual framework pushes it even further to include outcomes in health-seeking behavior as an indicator of success for the adoption of WAH, a research gap which the study aims to address.

As shown in the conceptual framework, adoption of WAH is determined by the socio-demographic profile of the respondents, their perception on the performance expectancy, effort expectancy, social influence and facilitating conditions and the enabling resources present in the municipality. The Behavioral Intent to Continue Using WAH deals with the probability of the health worker to continue using the technology. It is measured as High, Moderate or Low Behavioral Intent. As shown in the conceptual framework, the level of frequency of actual use determines the level of behavioral intent to continue using WAH. It is expected that rural health workers with high levels of adoption of WAH would have high level of behavioral intent to continue using WAH.

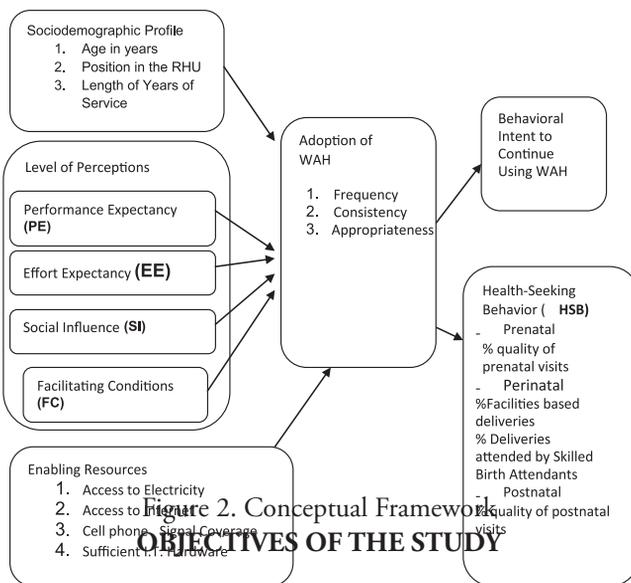


Figure 2. Conceptual Framework
OBJECTIVES OF THE STUDY

The study examined the determinants of the adoption of the WAH among

rural health workers in selected ZFF partner rural health units in the Philippines. It likewise investigated how the adoption of WAH is related to the behavior of health care providers and their pregnant clients.

METHODOLOGY

Research Design

The study is a descriptive research. Since the study is focused on the perception of the rural health workers with regards to their actual and intent to continue using the WAH, including changes in the health-seeking behavior of their pregnant clients, the descriptive method was the most appropriate method to use.

Participants

The study included respondents directly from the Rural Health Units of the partner LGUs of ZFF adopting WAH. Specifically, the rural health workers of the RHUs were randomly selected as respondents in the survey. The rural health workers included municipal health officers, public health nurses, rural health midwives and other health staff such as the medical technologists or microscopists, dentists and pharmacists. Among the rural health workers, the doctors, nurses and midwives are those providing direct maternal care services. Other rural health workers who also participated in the study were the dentists, pharmacists, medical technologists, microscopists, nursing aides and clerks who perform secondary roles in the provision of maternal care services in the RHUs.

Only rural health workers who have been trained in WAH and were expected to utilize the technology have been included in the list. A list of names of the rural health workers in all ZFF partner LGUs was from each RHU and was encoded in computer software that randomly generated a sample list. The sample size was determined using a confidence level of 95% and a confidence interval of 5. Therefore, with the population size of 273 health workers, the calculated sample size for the study was 160.

Research Setting

There were 15 ZFF partner LGUs in total that initially adopted WAH at various levels. These 15 ZFF partner LGUs have been adopting WAH for at least 12 months and have already progressed to the subsequent levels. There are recently some ZFF partner-LGUs that have started adopting WAH. They were not included yet in the list due to the short time of implementation nor have they

yet to progress to the next higher levels of operation of WAH, unlike the first 15. The ZFF partner LGUs were from across different regions: 6 from Luzon, 2 from the Visayas and 7 from Mindanao. In this particular study, only 11 LGUs participated.

Instrumentation

A survey form was provided to the Rural Health Workers through their Rural Health Units. The instrument underwent pre-testing using face validity among selected rural health midwives from LGUs. Feedback on the layout of the survey form including ambiguity of the questions was obtained and subsequent changes were made. The instrument underwent pre-testing using face validity among selected rural health midwives from LGUs not included in the target participants. Feedback on the layout of the survey form including ambiguity of the questions was obtained and subsequent changes were made.

The 32-item questionnaire was adapted from UTAUT questionnaire of Venkatesh, Morris and Davis (2003). In this study, a few words in the instrument was reframed to make it more suited for the actual setting considering that the original instrument was. Other than wording modifications to fit the specific technology studied in this research, no changes were made to the user acceptance scale. In addition to the constructs or determinants used in the UTAUT study, 2 additional constructs are included: Adoption of WAH (5 items) and Health-seeking Behavior (4 items).

The scale used in this instrument was adapted in full from the UTAUT study. All items would be measured on a seven-point Likert scale, where 1 = completely disagree; 2 = moderately disagree; 3 = somewhat disagree; 4 = neutral (neither disagree nor agree); 5 = somewhat agree; 6 = moderately agree; and 7 = completely agree. The questionnaire was in English with the assumption that all the respondents are fluent in the English language. The survey also included the following information of the respondents for profiling purposes: name of municipality, age in years and number of years working in the RHU.

A second survey form (Survey Form No. 2) was also designed to collect information regarding the municipality's enabling resources and actual data on prenatal visits, facilities-based deliveries, deliveries attended by skilled birth attendants and postnatal visits.

A multiple choice questionnaire was used for Survey Form No.2. Responses to access to electricity and availability of internet included four options: 1) Always (24 hours a day); 2) Most of the time (Less than 24 hours a day but more than

12 hours a day); 3) Often (Less than 12 hours a day); and 4) None. Responses to cellphone signal coverage included the following options: 1) 100% of the entire municipality; 2) less than 100% but more than 50% of the barangays; 3) less than 50% of the barangays; and 4) None.

To derive the data for sufficiency of I.T. Hardware, the survey form listed the minimum hardware needed to operate WAH. Whenever they were available, they were ticked as Yes and if not, they were ticked as No. The hardware items indicated in the survey form were: Computer at OPD, Computer at Consultation Room, Computer at Laboratory, Computer at Pharmacy, Dedicated Main Server, Router and External Hard Drive. Out of the 7 hardware items, the researcher categorized the sufficiency of I.T. hardware of an LGU by either at least 75% hardware complete, less than 75% hardware but more than 50%, less than 50% hardware.

Finally, respondents filled out the Health-Seeking Behavior section of Survey Form No. 2 by extracting data from their FHSIS reports from 2008 to 2013 of their municipal data on prenatal visits, facilities-based deliveries, deliveries attended by skilled birth attendants and post-natal visits.

Data Gathering Procedures

The primary data were derived from the answers of the respondents in the self-administered survey. Survey Form No. 1 was sent out mostly via email and snail mail addressed to the local chief executive of the LGU, specifically requesting that the Municipal Health Officer distribute the survey forms to his or her selected rural health workers. Included was a letter addressed to the Mayor describing the objectives of the study and seeking permission for their participation in the study. A separate letter was addressed to the MHO highlighting the same but also adding other instructions such as making explicit the importance of confidentiality and anonymity of the answers of the rural health workers. A list of the names of the rural health workers randomly selected to answer the survey was provided to their respective municipal health officers. The MHO was also requested to ensure that all survey forms have been filled up, which means no question was left unanswered or blank, before the forms were sent back to the researcher either via e-mail or snail mail. Whenever possible, the researcher picked up the forms personally in the vicinity or nearby municipality or city in case the MHO found it difficult to send the forms back.

The LGUs were given 14 days to fill up and return the survey forms either via e-mail or snail mail. The MHOs were also given specific instructions that they would also personally answer Survey Form No. 2. Their responses, particularly

on the Health-seeking Behavior section, were validated using their official FHSIS reports previously submitted either at their respective Regional Offices, Provincial health offices or Zuellig Family Foundation Knowledge Management (KM) Unit. Phone calls were also made to follow up the submission of forms from the municipalities.

In compliance to research ethics protocol, the researcher obtained informed consent from the respondents.

Data Analysis

Data gathered were encoded using statistical software which is Statistical Package for Social Science (SPSS). The mean scores for each construct were calculated and encoded using the same software. During the data presentation, the calculated mean scores for each construct were subjectively categorized whether they are Low, Moderate or High.

Calculated Mean Scores	Categorization
1.0 – 3.5	Low
3.6 – 5.5	Moderate
5.6 – 7.0	High

RESULTS AND DISCUSSION

Out of 160, data from 156 respondents were tabulated and analyzed. Data from 4 respondents were not included due to incompleteness of the answers provided in the survey instruments. The average age of the respondents is 39.9 years old with 50% of the respondents aging 41 years old and above. The average length of years in service of the respondents is 12.8 years or 152 months, with 59% of them working as midwives.

Generally, the respondents have high levels of Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. Of the 11 LGUs, 73% of them have available electricity always. Fifty-five percent of the LGUs do not have access to the Internet. Sixty-four percent of the LGUs experience 50%-100% cellphone coverage in their areas. The same percentage of LGUs have at least 50% of the minimum required I.T. hardware to operate WAH.

A one-way ANOVA was used to test level of adoption differences among the different positions in the RHU. Data showed that the level of adoption among the different positions in the RHU did not differ significantly, $F(3, 152) =$

2.051, $p = 0.109$. The same has been observed when the adoption of WAH has been further segregated according to frequency of use, consistency of use and appropriateness of use of WAH. Overall, the adoption of WAH among all the respondents was moderate even when grouped according to their positions.

The respondents have a moderate level of overall adoption of WAH although 52% of them reported low frequency of use of WAH. Seventy-five percent of the respondents have high level of behavioral intent to continue using WAH. Among the LGUs, a slight decrease in prenatal visits is observed after installation of WAH. A slight increase, however, in their post natal visits is observed after installation of WAH. An increase in their facilities-based deliveries and deliveries attended by skilled birth attendants have been observed after installation of WAH.

Analysis ($r = -0.164$, $n = 156$, $p=0.041$) revealed that there is indeed a significant negative correlation between the two variables. The negative correlation between the two variables indicates that the longer the tenure in RHU, the lower the adoption of WAH among the respondents. A Pearson product-moment correlation coefficient was computed to assess the relationship between the respondents' PE scores, EE scores, SI scores, FC scores and scores of overall adoption of the respondents. It revealed that: 1) As the PE scores of the respondents increased, their level of adoption scores also increased; 2) As the EE scores of the respondents increase, their level of adoption scores also increase; 3) A strong positive correlation indicates that as the SI scores of the respondents increase, their level of adoption scores also increase; and 4) As the FC scores of the respondents increased, their level of adoption scores also increased.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the respondents' Current Adoption of WAH scores and scores of Behavioral Intent to Continue Using WAH. Analysis revealed that there is a strong significant correlation between the two variables ($r = 0.478$, $n = 156$, $p=0.000$). This strong positive correlation indicates that as the Current Adoption of WAH scores increase, their behavioral intent to continue using WAH scores also increase.

A one-way analysis of variance was done to investigate difference in the mean scores of behavioral intent to continue using WAH among respondents when grouped according to their current level of adoption of WAH. Data showed that behavioral intent to continue using WAH scores among the respondents differ significantly, $F(2, 153) = 20.173$, $p = 0.000$. Tukey post-hoc comparisons of the three groups indicate that the respondents with High Adoption of WAH ($M = 6.6$, 95% CI [6.42, 6.78]) gave significantly higher intent to continue using WAH ratings than the respondents who have Moderate Adoption ($M = 6.00$,

95% CI [5.8, 6.21]), $p = .0.000$ and the respondents with Low Adoption ($M = 5.15$, 95% CI [4.68, 5.62]), $p = .0.000$.

Length in years of service, performance expectancy, effort expectancy, social influence and facilitating conditions are significantly correlated with levels of current adoption of WAH. At the same time, current level of Adoption of WAH is also significantly correlated with behavioral intent to continue using WAH and the perception of the respondents with regards to the health-seeking behavior of their pregnant clients. There appears to be a more positive change in the actual health indicators of the municipalities before and after the adoption of WAH. In this case, the higher the perception that the technology is useful and beneficial (in this case Wireless Access for Health), the more likely the respondents will adopt the technology, similar to the study done by Verhoeven, Heerwegh and De Wit (2010). Positive change is greater among High adoptee-LGUs than Moderate adoptee-LGUs. The results affirm what Yeatts, Folts and Knapps (1999) described with regards to long-tenured employees in the workplace that there is a propensity for long-tenured employees to lag behind in knowing how to apply new tools and techniques as well as an inability to see how their work performance can be improved through the implementation of new knowledge or new skills. Many of these long-tenured rural health workers have been used to doing their work manually and it can be a difficult transition shifting from pen-and-paper based type of work to technology-based work such as Wireless Access for Health.

Influence of Socio-demographic Attributes

Majority of the respondents have been working in the RHU for more than 6 years, some having been employed for at least 22 years. The observation that the respondents who have been serving in the RHU longer than the rest have low adoption of technology can be likened to resistance to change.

It was initially assumed that age in years would be associated with adoption of WAH in the same way the latter is associated with length of years in service. However, age does not appear to influence the way the respondents adopted the technology. It does not follow, therefore, the older the individual is, the more likely the respondent will not adopt the technology. It is more likely the length of exposure to a certain way of doing things rather than the age that tends to influence the respondents' openness to change.

Perception towards WAH and Its Influence on Adoption

Results indicated that the perception of the respondents towards the technology, particularly WAH, and towards their environment, influence their

behavior. Levels of perception among the respondents for these four determinants range from moderate to high. They find WAH as beneficial to their work as public health workers and easy to learn and use. The default comparison is always with their prior manner of doing things in the RHU which is largely manual. However, it is also possible that the respondents have been basing their perception of WAH on its comparison with other existing Information Technology made available in their RHU. The Department of Health has also recently launched other forms of digital-based information systems which also require the use of similar technological hardware.

However, one perceives a technology to be useful and beneficial influences one's behavior to use or intend to use the technology. In this case, the higher the perception that the technology is useful and beneficial, the more likely the respondents will adopt the technology, similar to the study done by Verhoeven, Heerwegh and De Wit (2010). Respondents consider WAH as something useful to them. They see it as something beneficial to their work. Swamped with paper works, the public health worker sees the advent of technology, particularly WAH, as something that would expedite certain processes at work.

The result is similar to H.W. Wang and S. H. Wang's (2010) study on the user acceptance of mobile internet; wherein they describe how effort expectancy, including perceived value and self-efficacy of the technology influence the intention to adopt and use mobile internet by the respondents.

When it comes to social influence, the level of perceived support from peers and supervisors and other influential people to the respondent affects the level of adoption of technology. In this case, the higher the perception of social support from workmates and other influential people to use the technology, the more likely the respondents will adopt the technology. Sykes, Venkatesh and Gosain (2009) highlight this importance of peers in their study, saying that an individual's co-workers can be important sources of help in overcoming knowledge barriers constraining use of a complex system (technology) and interactions with others can determine an employee's ability to influence eventual system configuration and features.

More than social influence, the presence of supporting or facilitating conditions, albeit perceived only, can influence the behavior of the respondents in adopting the technology. Data revealed that the level of perceived facilitating conditions influences the level of adoption of technology. In this case, the higher the perception of a supportive environment, including high internal capacity, the more likely the respondents will adopt the technology. The results are similar to a study done by Maarop and Win (2011) concerning the interplay of

facilitating conditions and organizational setting in the acceptance of technology (Teleconsultation) in Malaysian public hospitals. Respondents must at least perceive that they have the capacity to do use the technology either through the presence of tangible support such as hardware or the intangible support such as trainings and mentoring to increase knowledge and skills.

Availability of IT infrastructure and WAH Adoption

Even in the actual absence or limitation of certain enabling resources such as electricity, internet, cell phone coverage and availability of I.T. hardware components, the constraints in these aspects seem to be not affecting the way the respondents are adopting the technology. Most of the LGUs in the study do not have critical problems with electricity and cell phone coverage. However, while majority of them do not have internet connection regularly, it was not perceived as a limitation to the use of the technology.

Relationship of Level of Adoption and Behavioral Intent

The current level of adoption of WAH among respondents is associated with their behavioral intent to continue using WAH in the immediate and longterm future. Respondents who have currently high adoption ratings of the technology are more likely to continue using the technology in the short-term and long-term, even when the technology is upgraded and assumed to be more complex in operations. The experience of using the technology in a more regular basis, guided by certain conditions such as office culture, norms and policies, making the use more appropriate, appears to reinforce the thought of continue using the technology, thus, sustaining the desired behavior which is adoption of the technology. Following the Transtheoretical Model for Behavior change (Proschka, Johnson & Lee, 1998), the process by which a current action or behavior transitions to maintenance phase involves reinforcement management and stimulus control. Constant exposure to the technology and ensuring that it becomes part of the way things are done in the office are just ways of reinforcing the behavior of using the technology.

Public Health Workers saw the need to continuously apply the technology in their work if they are rewarded. This subscribes to the Expectancy Theory which describes that an individual's motivation to increase his or her performance of a given task depends on two types of expectations: 1) that the effort will result in a desired level of performance and 2) their performance will result in desired outcomes (Bandura, 1986; Lawler, 1973). The proposed study focuses on the impact of a specific health information system, in this case, Wireless Access for

Health. It did not compare this digital-based health information system with other forms of health information system. It did not also consider the influence of the other five building blocks of a health system as described in the WHO framework of action.

CONCLUSIONS

The findings of the study offered several conclusive insights relevant to the understanding of the determinants of the use of WAH. First, an individual's perception of the importance of WAH in relation to his work, its utility and relevance to his job as public health worker, is associated with their subsequent adoption of WAH. The same can be said about their perception towards the technology's less complicated operations, how effortless the utilization of the technology and how straightforward the manner of learning how to use the technology. It is important, therefore, that a health worker must have a relatively high performance expectancy and high effort expectancy for him or her to adopt the technology.

An individual's perception regarding social influence and facilitating conditions supporting him or her to use WAH also are associated with his or her subsequent adoption of the technology. The health worker must feel or at least perceive himself to be surrounded by influential people such as co-workers and supervisors who also support the use of the technology. The more the individual felt the support from peers and supervisors, the more he or she will use WAH in his or her work. The same can be said with his or her perception on facilitating conditions. An individual who felt he or she has the capacity and logistical support to use the technology will most likely use WAH in his or her work. Even if there are certain actual constraints such as insufficient I.T. hardware or irregular access to the Internet, these limitations do not seem to affect the adoption of WAH among ZFF partner LGUs.

Lastly, high adoptors of WAH had positive perception of the health-seeking behaviors of their pregnant clients. These perceived positive changes in health-seeking behaviors correspond with the actual data as shown by the health-seeking behavior indicators. While there was no adequate evidence to show a cause-and-effect relationship between the use of WAH and actual improvements in health-seeking behaviors of the pregnant clients, the association between levels of adoption and perceived positive changes in health-seeking behaviors implies positive reinforcement among rural health workers to continue using WAH in their work.

TRANSLATIONAL RESEARCH

Findings of the study could be incorporated in future trainings and plannings of local government units who are poised to pursue the installation of WAH or any technology in their health system. It can be incorporated in training modules and how-to- guides for health managers who are planning to integrate health information technology into their health system.

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