

Full Length Research Paper**Immunization Awareness and Alert Mobile Phone Based System for Kapsabet County Referral Hospital****Kamau Anthony Gichatha^{1*}; Harrison Bii² and Edna Milgo³**¹Department of Information Systems and Computing, School of Business, University of Eastern Africa, Baraton, Eldoret, Kenya.²School of Information Sciences and Knowledge Management, University of Kabianga, Kericho, Kenya.³Department of Information Technology, School of Information Sciences, Moi University, Eldoret, Kenya.**Article history**

Received: 04-11-2017

Revised: 07-11-2017

Accepted: 20-11-2017

Corresponding Author:**Kamau A. Gichatha**

Department of Information Systems and Computing, School of Business, University of Eastern Africa, Baraton, Kenya.

Abstract

Despite increased investment on immunization awareness globally, immunization adoption rates still remain low in developing countries. However, the exponential growth, ease of access, and acceptance of mobile based ICTs has opened up possibilities of using mobile phone based Health Information Systems to enhance patients' awareness and access to healthcare. The aim of this research study was to investigate the effectiveness of available immunization awareness systems at Kapsabet County Referral Hospital and the possibility of developing a mobile phone based immunization awareness and alert system to improve immunization adoption rates. A review of related literature showed that on one hand, there was a gap in access and communication of immunization awareness and on the other hand, there was an exponential growth, ease of access, and acceptance of mobile based ICTs. However, no studies had been conducted specifically on the use of mobile-phone immunization awareness systems thus the need for this study. A qualitative research design was used in this study, with qualitative data being collected using a structured interview schedule from 246 MCH parents, 10 MCH nurses, 3 administrators and 5 ICT personnel who were sampled using stratified random sampling. Descriptive statistics and thematic analysis were used to analyze data. The findings of the study indicated that; 1) Majority of the respondents had received immunization awareness through Television & Radio stations, health professionals, and printed materials, but none had received immunization awareness through Mobile phones. 2) There is a gap on the methods used to communicate and follow-up immunizations awareness information, 3) The existing system is compatible with the proposed mobile phone based immunization awareness and alert system, 4) ICT staff lacks skills and training on mobile based systems and there would be a need for capacity building if such a system was to be implemented. Based on the findings, the researcher recommends; that the government should develop policy guidelines that will ensure WHO recommendations on immunization communication that incorporates both personal and social mobilizations so as to change personal knowledge and attitudes towards immunization thereby prompting people to action have been implemented in all hospitals and health centers. Further research should be conducted towards development of a national framework for mobile phone based immunization awareness systems to provide a nationwide interoperability and benefits of reduced cost.

Key Words; Immunization-awareness, adoption rates, mobile-phone-systems,

Cite this article as: Gichatha, K.A., Bii, H., & Milgo, E. (2017). Immunization Awareness and Alert Mobile Phone Based System for Kapsabet County Referral Hospital. *International Journal of Research in Engineering and Management*, 2(1), 11-16. Retrieved , from www.crdeepjournal.org/ijrem

Introduction

Leveraging on the use of Information and Communication Technologies (ICTs) to gain competitive advantage has become a key strategy to corporate success (Duncombe and Molla, 2009). Many organizations are embracing the use of ICTs to improve their efficiency and effectiveness and to reduce their operation costs (Rastrict and Corner 2010; Kapurubandara, 2009; Lin and Lin, 2006). In Healthcare, ICTs have traditionally been used in Health Information Management Systems (HIMS) that help to access electronic medical records, online journals and databases, appointment scheduling and feedback systems that helps the doctors to improve on health care delivery (Gagnon, et al, 2009). However, the exponential growth, ease of access, and acceptance of mobile based ICTs has opened up possibilities of using mobile phone based ICTs to enhance patients' awareness and access to healthcare (Maharaj et al 2011, Waema et al 2011). The potential use of a mobile based ICT systems in Kenya to enhance immunization awareness is highly supported by the high rate of mobile subscriptions and penetration. According to the Communications Authority of Kenya in the year 2017 mobile subscriptions and penetration stood at 39.1 million and 86.2 percent respectively (CA, Q3 statistics, 2017). In Kenya, mobile based ICTs have successfully been used in mobile banking and money transfer leading to greater access to banking services especially to those living in the rural areas. Indeed, mobile based ICTs have the potential to catapult developing nations to catch up with the developed nations especially in the area of improving access to basic services such as healthcare.

Immunization is one of the most powerful and cost-effective of all health interventions, which helps to prevents debilitating illness and disability, and saves millions of lives every year (WHO, UNICEF, World Bank, report 2015). Save for safe drinking water, there is no other modality that has had such a major effect on mortality reduction (Saunders, 2008). The contribution of immunization is especially critical to achieving the fourth Millennium Development Goal (MDG) to reduce deaths among children under five years old (UNDP MDG Report, 2013). Since 2000, efforts have been scaled up to meet the MDGs and the supporting goals of the Global Immunization Vision and Strategy (GIVS), developed by WHO and UNICEF. With financial support from the GAVI (Global Vaccine Alliance) and other partners, more children are being immunized in recent years (WHO Global factsheet, 2014). Despite the progress, more must be done to target the 24 million children mainly in developing countries who are unimmunized (WHO Global factsheet, 2014). Identifying and implementing strategies to overcome the barriers to access must be a top priority, given the right of every child to protection from preventable diseases.

Immunization adoption rates highly depend on the immunization awareness programs and systems available. In Kenya, children receive one dose of BCG at birth, three doses of Diphtheria, Whooping Cough, Hib, Hepatitis B, Oral Polio Vaccination, and Pneumococcal at 6, 10 and 14 weeks, measles at 9 months, and Vitamin A after every 6 months up to the third year (KDHS, 2010). For improved efficacy, these vaccination schedules should be strictly followed by the parents. However, the reality on the ground as depicted by Kenya Demographic Health Survey (KDHS), indicate that often times parents do not take their children to these basic immunizations thereby exposing them to the risks of stunted growth, disability and even death. A review of grey literature by Favina et al, (2011), indicated that the main reasons for under-vaccination were related to; access to services, health staff attitudes and practices, lack of promotion/follow-up of routine immunization, health communication, reliability of services, false contraindications, parents' practical knowledge of vaccination, fear of side effects, conflicting priorities and parental beliefs. Majority of these reasons are related to gaps in knowledge levels, awareness, attitudes and communication and they can be greatly improved through a mobile phone based communication system. Currently, most of immunizations awareness campaigns in Kenya are done through donor funded initiatives like, African and global immunization weeks conducted through local mass media as well as printed materials distributed to the health centers (WHO concept paper, 2013). While these awareness initiatives have recorded some success, they are not personalized and are often too expensive and unsustainable. A mobile phone based awareness and alert ICT system can therefore be used to enhance the efficiency and effectiveness of immunization awareness.

The Unified Theory of Acceptance and Use of Technology by Venkatesh was adopted to provide the theoretical framework for the study. Several researchers have assessed the attitude towards SMS technology using Technology Acceptance Model (TAM). Yan, et al. used TAM to assess attitude towards SMS technology and usage and found that the attitude towards the usefulness, ease of use, and subjective cultural norms lead to changes in attitudes toward text messaging and usage. Similarly, Aripin and Omar, (2007), found that attitude towards SMS usage is influenced by perception that SMS is easy to use, useful, fun, and expressive. However, Tang and Wong, (2008), investigated the role of permission towards the attitude of SMS message recipients and found that consumers had negative attitude towards mobile text messaging as a communication channel when permission is not granted. These studies, however, were based on qualitative research approach and focused on commercial applications. Baron et al. (2006), applied a perspective that focused on cultural context of technology acceptance underscoring the role of culture, and found out that the use of technology is greatly influenced by the social cultural aspects of a certain community and this explains why certain technological solutions may work very well in certain societies and entirely fail in others. Furthermore a meta-analysis of TAM reveals that different type of population and time period resulted in varying results suggesting that TAM may not be applicable in certain context. In other words, applicability of TAM is moderated by the organizational culture; system, processes and users' characteristics. Furthermore, the link between attitude towards technology and its application may be influenced by culture and economic status.

The aim of this research study was to investigate the effectiveness of available immunization awareness systems at Kapsabet County Referral Hospital and the possibility of developing a mobile phone based immunization awareness and alert systems to improve

immunization adoption rates.

Material and methods

Study Area

The study was carried out at the Kapsabet County Referral Hospital a public hospital managed by the Nandi County Government. It is located in Kapsabet township environs, with an estimated population of 23,990 people (County fact sheet 2011). It has a bed capacity of 137 beds and gives several services including; Antiretroviral Therapy, Curative In-patient Services, Family Planning, and Immunization

Research Design

A qualitative research design was used since it is best suited for gaining an understanding of underlying reasons, opinions, and motivations and helps to develop ideas or hypotheses for potential quantitative research.

Sampling and Data Collection Instruments

A structured interview guide was used to collect data from 246 MCH parents, 10 MCH nurses, 3 administrators and 5 ICT personnel who were sampled using stratified random sampling. In determining the sample size the researcher adopted Slovin's formula as shown below.

$$n = \frac{N}{1 + Ne^2}$$

Where: n = sample size to be studied

N = Total population

e = Margin of error (0.05)

Table 1: Distribution of study population and the sample size

IS Users	Study population	Sample size	%
MCH parents	246	152	62%
MCH nurses	10	9	90%
IT personnel	5	5	100%
Hospital Administrators	3	3	100%
Total	264	204	55.4 %

Reliability and Validity of the Research Instruments

To establish the reliability of the research instrument, the researcher conducted a pilot study at Baraton Jeremic Hospital which serves Baraton University and its environs. The interview guide was administered to 10.4% of the sample size based on recommendation from Connelly (2008). The data from the pilot study was analyzed using the Cronbach's alpha. Reliability check was also done on the clarity of wording, grammatical errors, and amount of time taken to administer the questionnaires, interpretation and response of the questions by respondents, and if there is any research bias. To achieve content validity, questions were based on information gathered from the literature review. Content validity was further ensured by consistency in administering the questionnaires.

Data Collection Procedure

The researcher sought permission to collect data from the Nandi County government ministry of Health and Sanitation as well as the Hospital administration. The hospital administration assigned the researcher an MCH nurse to guide in data collection. The nurse guide created a station for us through which parents attending MCH clinic would attend as they progressed through other stations. The researcher together with three other trained research assistants interviewed the respondents in line with the interview guide and recorded the feedback

Data Analysis and Findings

The qualitative data generated from the interviews was transcribed and grouped. It was then analyzed based on the research questions and developed themes. Content and thematic analysis was used to analyze the data and make inferences by objectively and systematically identifying characteristics of responses.

Results

The collected data was analyzed in response to the research problem guided by the research objectives.

Sample Characteristics

The respondents were asked to specify their age, gender and education qualifications. The results from their responses showed that; all the MCH Parents were female aged between (25-30 years). This result reflects the usual age distribution of child bearing age bracket. The results also showed that majority had a basic secondary level education, which means that their results could be trusted.

The research findings

The findings of this research showed that;

- a. Both the MCH parents and the MCH Nurses agreed that the hospital had used printed materials and health professionals to create immunization awareness. However, while a majority of the MCH parents indicated that they had received immunization awareness information through the Radio and Television the hospital workers contradicted by saying that they had not used these methods to create the awareness. This disparity can be explained by the fact that immunization awareness through the Radio and Television are implemented at the national level and the workers may not be directly involved.
- b. Both the MCH Parents and the hospital MCH Nurses agreed that they had neither used nor received immunization awareness information through mobile phones
- c. Both the MCH Parents and the hospital MCH Nurses agreed that they had faced challenges in communicating immunization awareness information, follow-up and promotion on immunization awareness and that immunization awareness information was not clear.
- d. The results from the research also shows that the ICT personnel agree that the network infrastructure is adequate, there is sufficient bandwidth, and the current system has provision to integrate with a mobile based immunization awareness health information system. However, they disagree with the question that the ICT staff have adequate skills set to support a mobile based health information system.

Conclusion

From the findings of the study it is evident that both the MCH parents and hospital workers agree that printed materials and health professionals are the main methods used to communicate immunization awareness information. The disparity between the MCH parents and the hospital workers regarding the use of Television and Radio could be explained by the fact that such methods are coordinated at the national level rather than at the local level and this means that the local health providers may not be directly involved in using those methods. It can therefore be deduced that there is a gap on the methods used to communicate immunizations awareness messages. The findings from this study also indicate that the existing system is compatible with the proposed mobile based immunization system although there is need to train the current ICT personnel with mobile based information systems. Based on all these findings, it is logical to conclude that a mobile based immunization awareness and alert system could play a significant role in increasing immunization awareness communication thereby improving immunization adoption rates.

Recommendations

Based on the findings of the study, the researcher recommends the following;

Immunization Awareness Communication System

1. There is need to develop a comprehensive immunization communication strategy that incorporates both personal and social mobilizations so as to change personal knowledge and attitudes towards immunization thereby prompting people to action.
2. The study has also shown that there is a gap on the reliability and effectiveness of immunization awareness communication as well as follow-up. According to literature review from different research, these challenges can be solved by establishing trust between the care giver and the MCH parents by using social and personalized messaging systems such as mobile phones and social media.
3. Develop the proposed mobile phone based immunization awareness and alert information system for Kapsabet County Referral Hospital.

Policy

The government should have a policy that will ensure that WHO recommendations on adverse events following immunization (AEFI) have been implemented in all hospitals and health centres.

For Research

Similar studies, both qualitative and quantitative, should be supported by the health stakeholders in the private and public sector to help establish whether the study can be replicated in other areas

References

- Aripin, N. and Omar, S.Z. (2007). *Perception and attitude of short messaging services (SMS) among students of University Utara Malaysia*, International conference on Media, Culture and Society, Malaysia.
- Atun RA, Sittampalam S. (2006). A review of the characteristics and benefits of SMS in delivering healthcare. The role of mobile phones in increasing accessibility and efficiency in healthcare. Vodafone Group Plc, 2006.

- Atun RA, Gurol-Urganci I. (2006b). Analysis of calls to NHS Direct. The role of mobile phones in increasing accessibility and efficiency in healthcare. Vodafone Group, 2006
- Baron, S., Patterson, A. and Harris, K. (2006). *Beyond technology acceptance: understanding consumer practice*, International Journal of Service Industry Management. 17(2): 111-135.
- Bhanot A, S Agarwal, K Srivastava (2004). *Improving age appropriate immunization among urban poor infants. Possible Options and Approaches*. USAID/ Environmental Health Project, November 2004. (India)
- Bjerregaard, P, SK Lwanga, DD Mutie (1991). *Factors affecting immunization coverage. Availability of services, parental education and social situation. 1991. (Kenya)*
- Bos A, Hoogstraten J, Prahl-Andersen B (2005). *Failed appointments in an orthodontic clinic*. American Journal of Orthodontics and Dentofacial Orthopedics 2005; 127(3):355–7.
- Bryman, A. (2008). *Social Research Methods*. New York: Oxford University Press Inc.
- Car J, Gurol-Urganci I, de Jongh T, Vodopivec-Jamsek V, Atun R. *Mobile phone messaging reminders for attendance at healthcare appointments*. Cochrane Database of Systematic Reviews 2012, Issue 7.
- Chetley A. (2006). *Improving Health, Connecting People: The Role of ICTs in the Health Sector of Developing Countries*. A Framework Paper Published on 31 May, 2006
- Del Becarro MA, Jeffries HE, and Eisenberg MA, et al, (2006) .Computerized provider order entry implementation: No association with increased mortality rates in an intensive care unit. Pediatrics, 2006; 119:290e5.
- Duncombe, R., & Molla, A. (2009). *Formalizations of Information Systems in sub-Saharan African Small and Medium Enterprises: Case of Botswana*. The Journal of Information Systems, 1 (2), 1-29.
- Dahlgren, G. and Whitehead, M. (2006). *Levelling Up (Part 2): a discussion paper on European strategies for tackling social inequalities in health*. Copenhagen: World Health Organization.
- Ferrer-Roca O, Cardenas A, Diaz-Cardama A, Pulido P. *Mobile phone text messaging in the management of diabetes*. Journal of Telemedicine and Telecare 2004; 10(5):282–5.
- Fishbein, M. and Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*, Reading: Addison-Wesley.
- Franklin V, Waller A, Pagliari C, Greene S. (2003). “Sweet Talk”: text messaging support for intensive insulin therapy for young people with diabetes. Diabetes Technology & Therapeutics 2003; 5(6):991–6.
- Free C, Phillips G, Galli L, Watson L, Felix L, and Edwards P, et al (2013) .*The effectiveness of mobile-health technology based health behavior change or disease management interventions for health care consumers: a systematic review*. PLoS Medicine 2013
- Fusilier, M. and Durlabhji, S. (2005). *An exploration of student internet use in India the technology acceptance model and the theory of planned behavior*. Campus-Wide Information Systems, 22(4): 233-246.
- Gatero G. (2010). *Utilization of ICTs for Accessing Health Information by Medical Professionals in Kenya: A Case Study of Kenyatta National Hospital*. Journal of Health Informatics in Developing Countries; February 2010.
- Han YY, Carcillo JA, Venkataraman ST, et al, (2005). *Unexpected increased mortality after implementation of a commercially sold computerized physician order entry system*. Pediatrics 2005; 116:1506e12.
- International Telecommunication Union Journal: The world in 2010 – *ICT facts and figures* (April 2010)
- Jeannine L., (2011). *Scaling up mobile Health: Elements necessary for scaling up mHealth in developing countries*. Advanced Development for Africa, December 2011.
- Kapurubandara, M. (2009) *A Framework to E-Transform SMEs in Developing Countries*. Electronic Journal of Information Systems in Developing Countries, 39, 3, 1-24.
- Kaplan WA. (2006). *Can the ubiquitous power of mobile phones be used to improve health outcomes in developing countries?* Global Health 2006; 2: 9.
- Kenya National Bureau of Statistics (KNBS) and ICF Macro. 2010. *Kenya Demographic and Health Survey 2008-09*. Calverton, Maryland: KNBS and ICF Macro.
- Kenya, Republic of, *National Development Plan 2002 – 2008*, Nairobi, Government Printer, (2002).
- Kotler P, Andreasen A. Strategic marketing for nonprofit organizations (6th edition). New York: Prentice-Hall; 2003.
- Krishna S, Boren SA, Balas EA (2009). *Healthcare via cell phones: a systematic review*. Telemed J E Health 2009; 15: 231–40
- Kwon HS, Cho JH, Kim HS, Lee JH, Song BR, Oh JA, et al, (2004). *Development of web-based diabetic patient management system using short message service (SMS)*. Diabetes Research and Clinical Practice 2004; 66 Suppl 1:S133–7.
- Kyobe, M. (2004) *Investigating the Strategic Utilization of IT Resources in the Small and Medium-sized Firms of the Eastern Free State Province*, International Small Business Journal, 22, 4, 131-158.
- Laudon, K. C., & Laudon, J. P. (2006). *Management information systems: Organization and technology in the networked enterprise*. Upper Saddle River, NJ: Prentice Hall.
- Lin, W. T. & Lin, H. J. (2006). International productivity paradox of IT in commercial banking: A cost efficiency analysis. *The Business Review, Cambridge*, 5(1), 246-252.
- Lucas H. (2008). *Information and communications technology for future health systems in developing countries*. Social Science & Medicine. 2008; 66(10):2122-2132.
- Neereja. K.P (2011). *Textbook of communication and education technology for nurses* Jaypee Brothers Medical publishers, New Delhi

- Margaret Nyambura Ndung'u, Timothy M. Waema, (2011) "*Development outcomes of internet and mobile phones use in Kenya: the households' perspectives*", info, Vol. 13 Iss: 3, pp.110 - 124
- Mugenda, O. M., & Mugenda, A. G. (2003). *Research methods: Quantitative and qualitative approaches*. Nairobi: African Centre for Technology Studies.
- Nandi County fact sheet: <http://kenya.usaid.gov/sites/default/files/profiles/Nandi%20County%2023%20Jan%202012.pdf> (Accessed on 15th April 2013).
- Oso, W.Y. and Onen, D. (2005). *A General Guide to Writing Research Proposal and Report*. Kisumu, Kenya: Opts Press and Publishers.
- Ostojic V, Cvoriscec B, Ostojic SB, Reznikoff D, Stipic- Markovic A, Tadjman Z.(2005). *Improving asthma control through telemedicine: a study of short-message service*. *Telemedicine Journal and e-Health* 2005; 11(1):28–35.
- Rastrick, K. & Corner, J. (2010). Understanding ICT Based Advantages: A Techno Savvy Case Study. *Interdisciplinary Journal of Information, Knowledge, and Management*, 5, 2010.
- Richard et al. (2010). *Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya1): a randomized trial*. *Lancet* 2010; 376: 1838–45
- Rickards G, Magee C, Artino AR., Jr (2012). You can't fix by analysis what you've spoiled by design: developing survey instruments and collecting validity evidence. *J Grad Med Educ*. 2012; 4(4):407–410.
- Rodgers A, Corbett T, Bramley D, Riddell T, Wills M, Lin RB, et al (2005). *Do u smoke after txt? Results of a randomized trial of smoking cessation using mobile phone text messaging*. *Tobacco Control* 2005; 14(4):255–61.
- Schoen C, Osborn R, Huynh PH, and et al. (2006). *On the front lines of care: Primary care physician office systems, experiences and views in seven countries*. *Health Aff* 2006; 25:w555e71.
- Tang, E.P.Y. and Wong, M.M.T. (2008). *Consumers' attitude towards mobile advertising: The role of permission*. *Review of business research*, 8(3): 181-185.
- Siriginidi SR. *Achieving millennium development goals: Role of ICTS innovations in India*. *Telematics and Informatics*, 2009; 26(2):127-143
- UNDP MDG Report, (2011). *Millennium Development Goals Report*: http://www.un.org/millenniumgoals/11_MDG%20Report_EN.pdf (Accessed on 15th April 2013).
- Venkatesh, V. and Davis, F.D. (2000). *A theoretical extension of the technology acceptance model: Four longitudinal field studies*. *Management Science*, 46(2): 186-205.
- Wainaina, M. 2005. "*Using ICTs for poverty reduction and environmental protection in Kenya* ". http://www.iisd.org/pdf/2005/networks_dev_connection_kenya.pdf (accessed 15 April 2013).
- Wamuyu, Patrick Kanyi and Maharaj, Manoj (2011) "*Factors influencing successful use of mobile technologies to facilitate E-Commerce in small enterprises: The case of Kenya*," *The African Journal of Information Systems*: Vol. 3: Iss. 2, Article 2. Available at: <http://digitalcommons.kennesaw.edu/ajis/vol3/iss2/2>
- WHO, UNICEF, World Bank. *State of the world's vaccines and immunization*, 3rd ed. Geneva, World Health Organization, 2009.
- World Health Organization. *WHO recommendations for routine immunization summary tables*. Available from http://www.who.int/immunization/policy/immunization_tables/en/ (Accessed on 15th April 2013).
- World Health Organization. *Epidemiology of unimmunized child*. Available from http://www.who.int/immunization/sage/ImmBasics_Epid_unimm_Final_v2.pdf (Accessed on 4th May 2013).
- WHO-UNICEF *Global and regional immunization profile – Africa Region*. Accessed from: http://apps.who.int/immunization_monitoring/en/globalsummary/ga_afrprofile.pdf. (Accessed on 15th April 2013).
- Yan, X., Gong, M.T. and James, Y.L. (2006). *Two tales of one service: user acceptance of short message service (SMS) in Hong Kong and China*. *Journal of Policy, Regulation & Strategy for Telecommunication, Information & Media*, 8(1):16-28