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The need for a security/privacy model for the health sector in Ghana

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Abstract

Many developing countries around the world are faced with the dilemma "brain-drain" as their healthcare professionals seek better economic opportunities in other countries. This problem is compounded by a lack of robust healthcare infrastructure requiring substantive improvements to bring them up to date. This impacts a countries ability to understand morbidity and mortality patterns which impact health care policy and program planning. The lack of IT infrastructure also negatively affects the safety, quality, and efficiency of health care delivery in these countries. Ghana is faced with this precise set of circumstances as it struggles to adopt policies to overcome these challenges. The Republic of Ghana is implementing strategies to accelerate is development through information and communication technology (ICT), however in implementing this in the health sector it is also important to put into operation a system that is secure and protects the privacy of health consumers. One technique that has proven effective in recent years in facilitating the delivery of quality healthcare services to a wide range of consumers is the use of smart cards. Research into the viability of smart cards is therefore necessary.

Keywords

Ghana, healthcare, developing countries.

INTRODUCTION

The competition in access to health services has always been a significant concern in Africa. These concerns have been raised on both social and political platforms over the past two decades and have underpinned key policy directives in the health sector. Many developing nations are faced with challenges in the development of effective delivery of healthcare services. Indeed, healthcare professionals have traditionally moved countries in search of better professional opportunities. More recently this trend has become even more pronounced. Chronic shortages of nurses, physicians, pharmacists, and other healthcare practitioners around the world have fuelled the migration from less affluent to more affluent countries. As a result, there is a growing global labour market for all types of professionals in healthcare today (Clark, Stewart & Clark, 2006). Even where there is effective training of health care staff, the lack of resources such as drugs and tests meant hat putting into practice good health care becomes difficult. Where a healthcare system is under funded and dysfunctional there is a greater flow of professionals away from that system which merely increases the problem. This is intrinsically linked to the health policy and government initiatives (Mullan, 2007).

Good healthcare delivery is policy driven and supported by IT Infrastructure. The shortage of appropriated qualified health professionals together with a lack of IT infrastructure to support delivery of healthcare creates a burden which most developed nations do not suffer from (Garrett, 2007). This paper considers the shortage of healthcare professionals in developing nations and specifically examines this in relation to the demographics of Ghana. Further, the effect of ICT and its role in effective healthcare in Ghana is reviewed, which is the basis for a research proposal to investigate the use of smart cards as a solution to the security issues of shared health records in a developing country.

HEALTHCARE SHORTAGES

In their study, 'The Globalization of the Labor Market for Health-Care Professionals', Clark and his colleagues (2006) report that

> Health-care systems around the world are in crisis. In developed and developing countries alike, these systems are struggling to meet the needs of the people dependent upon them. One of the most critical challenges these systems face is a shortage of health-care professionals (p. 37).

In developed countries, national healthcare systems experience shortages of healthcare professionals. Where some can be a result of demand growing faster than supply this is sometimes resolvable by providing increased incentives and resources. However for the developing nation this in itself is problematic (Mullan, 2007).

In recent years, a variety of demographic and societal changes have created continuing shortages in both developed and developing countries. Perhaps the most problematic of all of the challenges has been a universal shortage of registered nurses as a result of the increased demand at the same time as a declining supply. Many countries also face a significant shortage of trained physicians (Clark et al., 2006). One country that suffers such shortages in this healthcare area is Ghana, as reflected in Table 1.

Table 1: Worth Health Organisation: estimates of nurses and physicians per 100,000 in population, selected developing and developed countries. (WHO cited in Clark, Stewart, & Clark, 2006).

Country	Nurses per 100,000 population (year)	Physicians per 100,000 population (year)
Developing countries		
1. Liberia	5.9 (1997)	2.3 (1997)
2. Ghana	6.2 (1996)	7.0 (1996)
3. Central African Republic	8.8 (1995)	3.5 (1995)
4. Pakistan	34.0 (1996)	57.0 (1997)
5. India	45.0 (1992)	45.0 (1992)
6. Nigeria	66.1 (1995)	18.5 (1995)
7. Kenya	90.1 (1995)	13.2 (1995)
8. Botswana	219.1 (1994)	23.8 (1994)
9. Bahamas	229.7 (1996)	151.8 (1996)
10. Trinidad and Tobago	286.8 (1994)	78.8 (1994)
11. South Africa	471.8 (1996)	56.3 (1996)
Developed countries		
12. United Kingdom	497.0 (1989)	164.0 (1993)
13. Australia	830.0 (1998)	240.0 (1998)
14. Canada	897.1 (1996)	229.1 (1995)
15. United States	972.0 (1996)	279.0 (1995)

Healthcare is driven by social and economic policy and the resources/staff problems can only be resolved when public health services are underpinned by sustainable social and economic development (Bassett, 2006). Specific factors which have affected migration to more developed countries have been categorised as push and pull factors. Push factors include "inadequate compensation, poor working conditions/job satisfaction, work-related hazards (HIC/AIDS, tuberculosis, etc.), lack of career opportunities, poor quality of life, political instability/war/ethnic strife etc. and lack of opportunities (educational etc.) for children" Kline cited in (Clark et al., 2006). The pull factors are the antithesis to the push factors.

HEALTH SECTOR IN GHANA

The health delivery service in Ghana has gone through many changes since Independence in 1957. At this time health care services were free in Ghana through public health services. There was no gap payment as all services were funded from the government through tax revenue. Unfortunately this was not a sustainable situation and in 1970 nominal fees were introduced. The situation progressively declined and by 1980 a 'cash and carry' system for full recovery of costs was established. This resulted in a decline in the use of health services despite the introduction of an exception policy for the elderly, young children, the poverty-stricken, ante and post natal care, and for specific disease conditions. Access to services was however complicated by inconsistent application of these exceptions (Sulzbach, Garshong, & Banahene, 2005). In 2003 this was reviewed and by 2005 a more consistent application of the policy based on geographic regions in Ghana was initiated (Witter & Adjei, 2007).

These problems drove the introduction of community/facility managed insurance schemes to user costs at point of care. This saw the start of the mutual health organizations in Ghana. In 2001 there were 47 such organizations however this rose rapidly to 168 by 2003 (Sulzbach, Garshong, & Banahene, 2005).

Health Insurance Act

In 2003 the National Health Insurance Bill was passed into law by the parliament of Ghana. The Health Insurance Act (650) was to set up a National Health Insurance Scheme (NHIS), which would enable residents in Ghana to obtain basic healthcare services without paying money at the point of delivery of the service. This was to replace the cash and carry system. The legal framework was through the National Health Insurance Council (NHIC) as the regulatory body for the district wide mutual insurance schemes, voluntary non-profit mutual health organizations, and private commercial insurance firms (Atim, Grey, and Apoya 2003).

The Health Services in Ghana is organised at five levels namely community, sub-district, district, regional and national levels. Services provided at the community, sub-district and district levels constitute primary health services delivered in the context of a district health system. Services to communities are delivered through outreach programmes from the sub-districts and through the Community Based Health Planning and Services programme. Other services available to the communities are those offered by traditional birth attendants, chemical sellers and itinerant herbalists. The Region is responsible for strategic planning and it monitors performance of district and regional hospitals. Its main role is advisory and to provide technical support. The current structure of the regional health administration includes the Public Health Unit, Clinical Care Unit and the Regional Health Administration Unit. Some regions have additional structures including training and diagnostic facilities. At the national level, information requires more in-depth analysis to enable the development of policies and standards for health care delivery (IICDnews, 2003). This can only be provided by effective ICT solutions and indicates a significant challenge for policy makers to provide effective policy for ICT solutions.

THE DIGITAL DIVIDE

Another major challenge in African countries is a lack of ICT infrastructure for health care services. Information communications technology (ICT) has revolutionized the interconnectivity of the globe, increased production capacity and efficiency, and reduced the cost of international business. The Internet and ICT have improved the ease with which remote parts of the world connect and communicate. ICT has been a key driving force for globalization and has positively altered modalities of global commerce. While the benefits of ICT are numerous and well-recognized, its growth has not been even throughout the globe. While developed countries and some middle-income nations have benefited greatly from ICT, low-income countries have been left behind. This has created what has been termed the "Digital Divide". Bridging the digital divide in sub-Saharan Africa has been a topic of concern for many policy makers, and has received significant attention and resources from agencies such as New Economic Partnership for African Development (NEPAD), the United Nations Development Program (UNDP), the World Bank (WB), and other multi- and bi- lateral agencies (NetworkWorldHealth, 2006, p.4).

> Though the digital divide has various aspects that must be addressed to bridge it, the phenomenon has largely been seen through the lens of access to, and now increasingly, use of ICTs. Little work has in the past gone into unpacking social and other implications of the digital divide. However, it is increasingly being realised that the digital divide problem is not simply the lack of availability of hardware or connection to the internet. The International Telecommunications Union (ITU) observes that the digital divide is not attributable to the lack of equipment or connections but, in its present form, is changing from basic to advanced communications and from quantity to quality. Bridging the digital divide is about much more than providing internet and computer connections, because access to ICT is embedded in a complex array of factors encompassing physical, digital, human and social relationships. (Mutula, 2005)

Sceptics argue that ICT is not an appropriate strategic investment for managing healthcare in developing countries given the many problems facing African nations, including: food insecurity, limited access to education, the burden of infectious diseases such as HIV/AIDS, and other socio-economic and political maladies. However, policy experts who promote the growth of the IT sector in Africa argue that without addressing the digital divide, rich countries will accelerate their rates of growth through ICT while leaving behind poor nations, thus increasing global economic inequality (NetworkWorldHealth, 2006).

ICT Policy

Ghana began developing a National ICT policy in 2001 through a consultative process with government officials, the private sector, development experts, and some non-government organisations. Led by the Ministry of Communications, the policy was completed in 2003 as a multi-sectoral strategy for scaling up ICT throughout the country, in line with Ghana's broader poverty reduction plans. Ghana's national ICT policy for the health sector describes the core areas in health information and communications which will be priorities for the health sector, including:

4. medical record systems focusing on district and regional hospitals;
5. budget and planning systems for all levels of the national health administration;
6. performance assessment for all levels of the national health administration;
7. surveillance and rapid response systems down to the district and subdistrict level; and
8. the management of drugs and other health related commodities (NetworkWorldHealth, 2006, p.4).

SMART CARDS AS A POTENTIAL SOLUTION

As the health sector in Ghana takes steps to advance electronically, it is important to implement systems that combine secure information access and management with data mobility and patient privacy. Healthcare systems are not immune from attack by computer criminals, as the following examples indicate. In August of 2006, a laptop computer containing private homecare information of almost 30,000 patients was stolen along with the car of a Detroit area nurse (Rosencrance, 2006).

- A laptop computer that contained sensitive medical records went missing from Unisys, a company used by the Veterans Administration in Pittsburgh and Philadelphia (GAO, 2007).
- Information such as Social Security numbers about patients at Sky Lakes Medical Center was available online for about a month when the hospital's security was down (NEOHAPSIS, 2007).
- A Legacy Health System primary care physician practice discovered the theft of $13,000 in cash and personal data of 747 patients who got care at the clinic between January 2006 and February 2007. Patient receipts, credit card transaction slips and checks were also missing at Legacy Clinic Mount Hood, in addition to Social Security numbers and dates of birth for patients (BizJournal, 2007).

It is therefore important that the adoption of any particular system should offer protection for health consumers. It must be an electronic healthcare system that provides reliable patient identification, data quality management, and data confidentiality and security.

Views of medical data security and confidentiality vary in different developing countries. In some countries, the use of electronic databases is treated with great suspicion and in other countries healthcare workers email sensitive medical data. Patients can face serious risk if their communities discover their HIV status or other sensitive medical information. It is imperative that healthcare providers protect this information. (Fraser et al, 2005).

Smart card technology presents a new paradigm in computing environments based on embedding processing elements on a credit card-sized platform. The technology offers the benefits of mobility with storage capacity unmatched by magnetic-based plastic cards. More importantly, smart cards with local processing capabilities can facilitate the use of programs to manage complex patient medical records effectively and accurately. In such applications, the patient's information is augmented with active programs residing within the smart card to provide rich services, such as record management, security and authentication, and clinical alert capabilities (Chan et al, 2001). The data stored on a smart card can be protected by active data encryption schemes along with biometric identification (fingerprints, for example), which can be used to uniquely identify the authorized user (Shelfer & Procaccino, 2002, p.84).

Before the information can be accessed, a sufficient authentication process, such as fingerprint validation, can take place to verify the identity of the person using the information stored within the card. Also, the cardholder may have to provide a four-digit security code, similar to the PINs used with ATM cards, for a two-level authentication. The card may have additional digits added to the security code, thus providing a security code longer than four digits (Srinivasan & Levitan, 2003, p.28).

THE PROPOSED STUDY

Objective of the study

The primary aim of this research is to design security architecture through the introduction the introduction of smart card in the public and private health sector in Ghana. The study will address the question: to what extent can smart card be used to improve security and privacy in the public and private health sector in health information system in Ghana?

The Significance of the Study

The relevance of this research is that it has an important indirect role in the implementation of the ICT in the health sector in Ghana.

The theory and practice of ICT in development, and more specifically its utility in the health sector, are not necessarily an intuitive policy path for governments. Many policy makers are not fully aware of methods to assess countries' current development trajectories in relation to the IT sector, and subsequently determine whether or not ICT is a reasonable policy path to move toward greater development. (NetworkWorldHealth, 2006, p.12). The Ministry of Health in Ghana is undertaking an extensive ICT project to improve health information management throughout the national health system. Within the health sector, experts have started to explore possibilities in sub-Saharan Africa to ameliorate health outcomes and alleviate health inequalities through ICT. The idea of leveraging ICT in the health sector has not just been an issue of discussion in Africa. In the U.S. and Europe, health policy discussions increasingly touch on ICT and its potential implications including: electronic medical records, telemedicine, health education through the internet and other approaches (NetworkWorldHealth, 2006).

The healthcare sector in Ghana is poised to move from a paper world to an electronic one. A significant aspect this study is that it will enhance secure access to patient information enabling it to be shared for the ongoing care of patients.

This research will look at modelling a system that can improve the security and privacy for healthcare consumers. Many patients believe that the electronic transmission and storage of patient related information places the integrity and confidentiality of such information in serious jeopardy (WITSA-HIT, 2006). Patients and doctors expect medical records to be kept confidential. Medical records contain a great deal of mundane information about patients, such as height and weight readings, blood pressures, and notes about single health events such as the flu, cuts, or broken bones. These records also may contain some of the most sensitive information about topics such as fertility and abortions, emotional problems and psychiatric care, sexual behaviours, sexually transmitted diseases, HIV status, substance abuse, physical abuse, genetic predispositions to diseases, and so on. Access to this information must be controlled because disclosure may be harmful to the patient. It may cause social embarrassment or prejudice, affect insurability, or limit the ability to get and retain employment (Rindfleisch, 1998, p.94).

The introduction of a smart card will provide a more efficient and accurate collection, storage, analysis, and distribution of data than current manual operations. This study will investigate the potential impact of smart cards in creating a more efficient and secure information interface between health service providers and health insurance system (The Statesman, 2007). The use of smart cards to facilitate healthcare delivery in Ghana carries with it a number of advantages for both the healthcare consumer as well as the healthcare profession: "Patients using insurance cards that store huge amounts of data will ensure prompt, accurate payment for health-care services. Smart cards and online billing sites could be used at the point of care to determine if procedures are covered and how much is to be paid and to electronically transfer funds from the insurance company's account to the payee's account" (Wooten, 2000, p. 18).

Research Program

Smart cards are increasingly popular and relatively inexpensive credit card-sized devices that are capable of storing large amounts of healthcare-related information and/or provide the key to accessing personal healthcare-related information that is stored in an external computer network (Wooten, 2000). Healthcare consumers that visit doctors, clinics, or emergency rooms simply provide the smart card to the treating personnel, who are then able to display the information on their computer screens and encode in the card additional information such as which medical tests have been administered and the findings. Moreover, as the supporting technologies continue to improve, visual resources such as X-rays, EKGS, and sonograms could also be encoded onto the smart card (Wooten, 2000). This will facilitate mobility in health information which is not currently available in Ghana.

While the technology in support of smart cards is relatively advanced, there remain some important issues concerning how these cards are used and how the information they contain is used. In this regard, Etzioni emphasizes that, "Better protection of records' privacy requires complex treatment because it is affected by numerous technical, economic, and political considerations. Any policy suggestions have to be tested carefully" (1999, p. 164).

The program for this research will include:

- A study of Ghana's ICT for Accelerated Development (ICT4AD) framework document
- A study of the health sector IT strategy

- Identifying issues supportive/non-supportive of information security within the operation of the health sector
- Identifying the requirements and selection of the appropriate smart card
- Defining the appropriate algorithm
- Specifying the system security level
- Setting the privacy and security levels of the users

CONCLUSION

The healthcare sector in Ghana is poised to move from paper-based records to an electronic environment. Current global challenges of identity fraud, difficult insurance claims, and governments demand for secure, portable, and confidential patient information, requires healthcare providers to effectively use of systems that provide security. The need for a technology that can hold encrypted patient information and use a digital signature or a biometric template to reduce ambiguity about the cardholder's identity cannot be over emphasized. Whilst Ghana is subject to a lack of resources and loss of suitable healthcare professionals, alternative models of healthcare in developing nations are being sought. The use of smart cards is one which may provide a secure solution to effective and timely access to resources providing a mobile solution in a country where the ICT infrastructure is an issue. This research proposal; considering the adoption smart card in the health sector has an indirect role in implementing an effective IT strategy in Ghana.

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