Sustainable Development of Medical Informatics in Africa: Need for a Health Informatics Curriculum.

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Abstract:

Information and communication technologies (ICT) have been recognized in the past decades as an essential tool for the scientific, economic, and social development of a country. In the health sector these technologies have proven to be a significant factor for an effective and comprehensive planning, management, and estimation of health care. The increased development and use of these technologies in health delivery systems in the industrialized countries led to an improvement of the quality of services, security as well as to cost reduction for patients. However in developing countries, the situation still looks differently at present. The observation of recent progress in some Asian countries such as India confirms the importance of the integration of ICT in health systems of developing countries. Despite this fact, there are hardly hospitals and health centres in developing countries –especially in Sub-Saharan Africa- with ICT-Infrastructure ready for accessibility to information systems. For these reasons, different international fora have discussed the transfer of technology into developing countries. Key roles have been attributed to education, training, and to development of IT-Systems. The execution of various pilot projects in health fields has certainly offered notable solution approaches to some developing countries. Nevertheless the extreme lack of health informatics experts in developing countries, who can model, develop, and implement appropriate IT-Strategies, as well as choose, evaluate, and manage local information technology infrastructures in the health sector of these countries remains a major barrier both to the development of Health Informatics as a discipline and to the sustainability of the implemented solutions of the pilot projects. This paper discusses the development of health informatics in Sub-Saharan Africa and presents why the development of health informatics university curricula based on a south-south and south-north network is a significant way to have a lasting effect on the development of Medical Informatics in developing countries in general and particularly in Sub-Saharan Africa.

1 Introduction

The important role, influence, and impact of Information and Communication Technology (ICT) in all sectors of our society has long been recognized [1-7]. In the health sector, ICT-tools are being more and more developed, recommended, and used to improve the quality of work in administration, health services, and research [8-10]. During the nineteen-eighties, at the inception of the use of ICT-tools in most developed countries, the use of ICT-tools were not an issue or at best a matter of low priority in less developed countries (LDC) [11]. Cost of hardware, economic constraints, limited infrastructure, and investment priorities were some of the major factors responsible for the difference. Over the years, opinions have changed and several authors, publishers and institutions like the World Health Organization (WHO) have recognized the necessity to introduce ICT-tools in the health sector of LDC and have placed great importance on it [7, 11-20]. An evaluation of the situation in some less developed countries confirmed the successful implementation of several projects in spite of some constraints [2, 21-23]. The importance of Health Informatics in the African continent was highlighted at the first international conference on Health Informatics in Africa (HELINA), organised by the International Medical Informatics Association (IMIA) in 1993 in the town of Ile-Ife in Nigeria. After HELINA 1993 some initiatives were implemented in Nigeria [24, 25]. Since 2000 several health Informatics projects have been implemented in Sub-Saharan Africa [26-30]. All these initiatives are a way of bridging the digital divide [31]. But the questions which remain to be answered are:

- Will the implementation of projects alone be capable of reducing the digital divide in the health sector in Sub-Saharan Africa?
- If not, how do we ensure a sustainable bridge of the digital divide in the health sector over time?

In 1996, at the second HELINA conference in Johannesburg, South Africa, Ball and Douglas reminded the participants of the significance to

attain certain basics which are frequently and most regrettably overlooked before entering the telematics world. They declared that, "Technology gives us tools, but it does not provide us with the wisdom and the skill to use them [32]." The logical question which follows is how does one acquire knowledge and the necessary skills to use these tools? Their answer to these questions was simply: good training and education programmes.

The lack of well educated and trained human resources in Health Informatics in LDC was identified as a great constrain to the sustainable development of information systems and information technology in the health sectors of these countries [3, 7, 12, 33-36]. In 1980, after an evaluation of medical information systems in South-Africa, Rienhoff et al. have recommended that "South-Africa should institute without delay training programmes for the professionals who will be required to organize and staff such systems [36]". Decision makers within the Medical School, University of Cape Town recognised this assessment and established in 1985 a postgraduate education programme in Medical Informatics [33]. But this clear recognition of the need of Health Informatics Programmes seems not to be the case in Africa in general and particularly in the Sub-Saharan African countries.

Hersh characterised Health Care as an Information based sciences [8]. This science has been connected to the Medical/Health/Biomedical Informatics sciences for more than three decades. Shortliffe defined Medical Informatics as, "the rapidly developing scientific field that deals with the storage, retrieval, and optimal use of biomedical information, data, and knowledge for problem solving and decision making. It also touches on all basic and applied fields in biomedical sciences and is closely tied to modern information technologies, notably in the areas of computing and communications [37]." How could LDC in general and particularly Sub-Saharan African countries increase their benefits from this rapidly developing scientific field?

The mains objectives of this paper are:

- to discuss the development and impact of health informatics in Sub-Saharan African countries
- and also to present why the development of a south-south and south-north network health informatics university graduate and post graduate programme could provide a new motivation for academicians and consequently a significant way to have a sustainable effect on the development of Health Informatics in this region of the African Continent.

2 Material and Methods

In order to achieve the objectives, a detailed analysis of the following points were executed: Literature, report of important implemented health informatics projects in Africa and some LDC, availability and cost of hardware and software in these countries, current health challenge and the quality of the local manpower. The analysis was confined within the period from 1980 to 2006.

Concerning the literature and other needed information, an extensive search was performed using the Medline database, the online database on Methods of Information in Medicine and the search-machines Google and Google Scholar. Research was also performed using the online library database of the World Health Organization (WHOLIS). The IMIA yearbooks, Reviewers of Methods of Information in Medicine and MEDINFO were searched for articles. In addition, some international reports of the WHO and ITU about health informatics activities and strategies in LDC were analyzed. The general search strategy included the Medical Subject Headings (MeSH) associated with the key words that reflected health informatics, medical informatics, less developed countries and curriculum. The search technique in Medline and the search-machines Google included the following terms: health informatics in Sub-Saharan Africa, health informatics in Africa, health informatics in developing countries, health informatics in less developed countries, health informatics in the third world and health informatics in under developed countries. Concerning the search of literature on the development and impact of health informatics curriculum in developing countries, we combined the terms mentioned above with the following words: education, curriculum and programme. A search for online French articles on health informatics in Africa was also performed. The following key words were used: "informatique et santé en Afrique, informatique médicale en Afrique, télésanté en Afrique, télémédecine en Afrique, Technologie de l'information et de la communication et santé en Afrique, formation en informatique médicale en Afrique".

The search strategy was not limited to the Sub-Saharan Africa region because a situation-analysis of health informatics in some LDC will be necessary and important for the purpose of comparison.

3 Development, Implementation, Impact and Sustainability of Health Informatics Projects in Less Developed Countries

According to scientific literature and project-reports, several health informatics pilot projects have been implemented within LDC. The important areas of application of implemented projects in LDC were: systems for health-care facilities, decision-support systems, electronic data exchange, educational activity support, electronic patient registration, telemedicine and medical imaging [22]. These areas of application show that some important Health Informatics facilities are feasible in areas poor with resources.

In Sub-Saharan Africa, the currently identified published projects concerned mostly the following areas: electronic medical record, electronic data exchange and both telemedicine and tele-education. The motivation behind these projects was principally to provide a better work environment to health workers of these countries in order to contribute to the fight against the principal or most known health crisis in this region that threatens the lives of millions of people and kill the most of them; HIV/AIDS, Multi-Drug Resistant Tuberculosis (MDR-TB) and Malaria [21, 23]. Fraser et al. mentioned that maternal and infant mortality, other infectious diseases, trauma, rising levels of hypertension, diabetes and cardiovascular disease represent also critical medical problems in LDC [21].

According to telemedicine projects in Sub-Saharan Africa, the primary motivation was mostly to reduce the difficulties faced by health workers in both rural areas and sub-urban areas [21, 23, 26]. It is also very important to mention that the rapid developments in ICT sectors enable an easier access of LDC to some ICT-facilities due to the falling cost of hardware. This could serve to develop economical telemedicine solution within Sub-Saharan African countries [21]. A significant aspect of the telemedicine project RAFT -Réseau en Afrique pour la télémédecine- is the south-south, south-north and north-south collaboration.

It would be important to mention that after the research, it was impossible to identify any scientific assessment of the impact of implemented health informatics projects on both patient care delivery and health workers working condition in Sub-Saharan African countries although some Implementation-reports claim to achieve significant impacts.

According to EMR-Implementation, Fraser et al. have summarized the most significant impacts reported by the different implementation-teams [21]. In addition to this, it would be important to make mention of another EMR-impact they did not mention. The Lilongwe Computer-based Order Entry (COE) team remarked after their implementation that COE enabled an elimination of errors in medication dosage calculations by clinicians and an elimination of the requirement for nurses to transcribe orders [29].

Concerning telemedicine projects, Mbarika and Okoli have summarized the majority of projects implemented in Sub-Saharan Africa [23]. But the RAFT project was not taken into consideration in their investigation. It would be important to point out the impact of telemedicine on the health care delivery in Mali mentioned by the RAFT. The RAFT team mentioned a connection of the network of health institutions of different parts of the country (Bamako, Segou and Tombouctou). The main realizations are: North-South tele-education, web-casting of scientific conferences, South-South tele-education, South-North tele-education, North-South tele-consultation, South-South tele-consultation, and South-North tele-consultation [26]. All these have led to an improvement of the quality of health care delivery in the connected health institution.

Unfortunately, neither did we find in general publications nor in project-reports a paragraph concerning the sustainability of implemented projects. Despite this, it would be important to point out the fact that the majority of implementation-reports have mentioned the lack of well trained local stakeholders as a significant constrain. Furthermore, most projects were designed, developed and financed to a great extent by international partners.

But there are positive factors on hand like the current development in ICT-sector which lead to a cost-reduction in ICT-products and an improvement of computer literacy[21] which are determinant for project-sustainability.

4 Health Informatics Educations

Developed countries have longer recognized the need of education programmes in health informatics [38-40]. In order to respond to the shortage of high qualified and well trained health informaticians in their countries, several developed countries have established various curricula [38]. The main motivation is to produce high qualified health informatics specialist capable of managing, appreciating, and solving complex health information and knowledge problems. Haux specified that, through an improved education of health care professionals, and an increase in the number of well-trained health and medical informatics specialist, this lack of knowledge and associated skills can begin to be reversed [4]. The International Medical Informatics Association (IMIA) has also recognized the importance and need for health informatics education and training. In order to attain its goals, the working group one

(WG1) of IMIA has sponsored several workshops in which a large number of medical informatics experts of the world have taken part [41]. The IMIA-WG1 has also developed and published recommendation on health informatics education which should help to establish a curriculum in health informatics [42]. The current challenge in health informatics like to support the future task of molecular medicine shall impose a revision of health informatics programmes [43].

The impact of well and high qualified health informaticians in the society has not been directly analyzed, although some authors have published the role played by health informaticians in their society [44, 45]. These articles have highlighted the different roles health informaticians assume in the society and also permit to really appreciate both their importance in the society as well as their multidisciplinary-skills. Well trained health informaticians can work in different branches of the society: hospital, hardware and Software Company, pharmaceutical company, research institute, university hospital, public services, consulting bureau, etc.

5 Health Informatics Education in Africa: why?

As previously mentioned, several authors have recognized the need of training programmes in LDC as a whole and particularly in Africa. Some less developed countries like South-Africa and Brazil have recognized this and have established training programmes [33, 46]. Some other LDC which have also recognized the importance of training programmes have attempted in the past to establish curricula without success [47]. The IMIA-working group nine "Health Informatics for Development" (WG9) founded in 1983 has also recognized the importance to introduce health informatics curricula in less developed countries, although it has been unsuccessful on its attempts to help some LDC to develop a curriculum in their countries. The most difficulty identified in most of the countries is the serious shortage of resources.

All the implementation-reports have also recognized the necessity to get trained stakeholders or at least to achieve more computer literacy. In 1998, Shortliffe pointed out the fact that computer literacy and knowledge of the role that computing and communications technology can and should play in the health-care system are different [48]. This remark by Shortliffe is not only addressed to developed countries but also to less developed countries. For Sub-Saharan African countries this should mean that efforts should be really made in the area of curriculum development in order to successfully solve the problem of the shortage of health informaticians in this region. In addition health informatics is not an ICT-tool but a scientific field. It is not possible to sustainably develop a scientific field far from universities and institutes of higher education [49].

In chapter three, some of the health crises of Sub-Saharan African countries which constitute significant barriers to the fight against poverty in this region of the world were cited. The motivation of the implemented projects and their impacts, demonstrated that African physicians need assistance from health informatics specialist in order to better face these calamities. Without an efficient fight against these calamities, it would be difficult and most probably impossible for these countries and the international organizations (WHO and UN, and others) to either reach or approach the millennium development goal by 2015. How can one be expecting to obtain results with such barriers?

All these constitute reasons why there is a need to develop appropriate and well trained local health informaticians in Sub-Saharan African countries, which will be able to model, develop, and implement appropriate IT-Strategies, as well as choose, evaluate, and manage local information technology infrastructure in the health sector of these countries. In addition, a recent report of the WHO-Africa points out the importance to institutions training health professional's to include courses on health research, knowledge management, informatics, and data management in their programmes [35]. Furthermore, in our global world, well trained health informaticians will strongly contribute to the improvement of the economic situation of their countries by acting as a pulling factor for ICT outsourcing from the developed countries. Examples of the Asian countries like India and China are proof enough of the importance to get well trained stakeholders in a country.

6 Development of Health Informatics Curricula in Sub-Saharan Africa: how?

After having recognized the importance and need of health informatics education in Sub-Saharan African countries in chapters one, three, and five, it is also important to show how a curriculum can be developed in this region of the world.

It is worth noticing that, the development of a curriculum is not a simple task. Some important factors to be taken into consideration are: economic situation and finance, social and cultural aspects, specific needs and profile of the absolvent, philosophy of the institution, job perspective, infrastructure (building, hardware, software, etc), human resources (qualified teachers, student, etc), and others. The development of each of the points

cited above will need several consultations and building of a working group which will work on the details. This chapter proposes models which can be successfully implemented.

Considering the economic situation of Sub-Saharan Africa countries, the financial cost generated by the work of a curriculum, and the fact that it is difficult to assemble high-quality health informatics lecturers within a country, it will be better to:

- Carefully use the limited scientific resources in each country because the utilization of information technology demands all available specialists who are systematically trained in their field [47].
- Develop a regional curriculum based on a conglomerate of the department of health informatics of each university teaching hospital of member countries.
- With regards to financial problems, the regional curriculum will be co-financed by all member countries of the network.
- Considering the resource problem, each university will have to rely on its resource potential. Only countries with established university teaching hospitals and/or which dispose of an informatics faculty may dispose a section of the curriculum.

Considering the language differences in Sub-Saharan Africa, different ways to build the network are proposed:

- Build a network among countries speaking the same language
- Build a network among all Sub-Saharan African countries without language consideration
- Build a network between countries of the same region: west Africa, central Africa, south Africa.

According to the first possibility, the two most spoken languages (English and French) of the region are considered. Limits to this case are: the possible isolation of countries like Equatorial Guinea and Angola; Cameroon is also a particular case because of its two official languages.

For the second case two possibilities are proposed:

- The first possibility presents the English, and French language respectively like prerequisite. In English speaking countries, the knowledge of French language will be a condition to take part in the programme and vice versa. It will then be easier to import and export lectures in and from other countries which are members of the network.
- Another possibility is to adopt English as the exchange language like in European universities. English will then be a prerequisite to take part in the programme in the non English speaking countries. This alternative is not a loss for French speaking countries but a gain. In the fact, the required language in all international exchange programmes is English. In addition, considering the world-wide market for ICT, and the work-possibility with international firms, they will be able after their studies to work in international firms.

The particularity of this model is that the problem of human resources, finance, and infrastructure are strongly reduced. The support of Academic institutional members of the IMIA will permit to assist the research groups, give exchange possibility for lectures, and provide high quality lectures using tele-education and consequently produce high qualified health informaticians.

7 Discussion and Conclusion

This paper has discussed the development of health informatics in Sub-Saharan African countries and has proposed a model curriculum based on a south-south and south-north network. The paper has also developed arguments which proof that the development of such a curriculum is a significant way to have a sustainable effect on the development of Health Informatics in this region of the African Continent. All these permit to show that African countries cannot fully reap the benefits from increased development of Information technology in health care delivery if both infrastructure and adequate research and education structures are not in place. African governments and the international community should raise funds in order to achieve these particular and strategic objectives which can help to come up to the UN millennium development goal of halving poverty by 2015.

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