Can Informatics Transform Public Health Practice, Research and Learning in the Kingdom of Saudi Arabia (KSA)?

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Abstract. Improvement in public health was the main reason behind the major achievements in health and wellbeing of people in the past 20th century. Challenges facing public health in the 21st century can be tackled cost-effectively by improving further public health practice, research and learning. For such improvement to take place in this information age, information and communication technologies have to be an integral part of public health practice and education. In developed countries, public health informatics has become a recognized discipline that enhanced and even transformed public health functions. The Kingdom of Saudi Arabia (KSA), with the largest economy in the Middle East has witnessed unprecedented development and growth in healthcare, higher education, and information technology over the last few years. However, the current multiple providers and sectors of public health services and education need to be connected to enhance their outcomes. This paper describes briefly current status of public health services and education and proposes a public health informatics as a national-wide integrated and systematic information technology approach to optimize and transform public health practice, research and learning in KSA. The aim is to draw attention to this important subject so leaders, decision makers and academic organizations participate scientifically in setting the stage for this promising project.

Introduction

Major achievements in health and wellbeing of people over the past century were contributed to improvement in public health as it is concerned with preventing disease, promoting health, and enhancing cost-effectiveness of health care services [1-4]. Public health addresses policy and operational issues at the population level and tackles the root of ill health as well as ensuring the provision of cost-effective health system that meet population's needs [1-4]. The 30 years gain in life expectancy, the eradication of deadly infectious diseases, and the efficiency of health systems in the 20th century were mainly due to improvement in public health services and functions [1-4]. However, taking care of old challenges of public health such as communicable diseases and short life span brought new ones related to new communicable and non-communicable diseases, aging and many other challenges facing people's health in the 21st century.

Globalization; easy travels and communications; natural and man-made disasters (hurricanes, chemical and biological terrorists attacks); emergence of new and unanticipated diseases and health threats (SARS, MERS-CoV); new patterns of diseases and health problems (e.g. epidemic of non-communicable chronic diseases); and information avalanche are just examples of the new challenges [3]. Public health

has to be developed more and even transformed to cope with these and other unanticipated challenges. Recent advancement of information and communications technology (ICT) can play major role in developing and transforming public health in the 21st century. In fact, developed countries have made significant progress in the field of health informatics that enhanced and transformed public health [5]. Developing countries, particularly rich ones, need to learn from the experience of developed countries and use their resources well to invest in informatics that can optimize and transform their public health system and services.

Kingdom of Saudi Arabia (KSA), has witnessed unprecedented growth in healthcare, higher education, and ICT over the last few years. Hundreds of health care facilities and projects were commissioned and budget allocated to health care tripled over the last 5years only [6]. Growth of higher education and expansion in colleges, programs and scholarships particularly in health related disciplines were also gigantic. Such huge growth and development in health care, higher education, and ICT will have positive impact on nation's health and literacy. ICTs can be used to optimize and transform current and future functions of public health to prevent diseases and threats, promote health and wellbeing of people, and enhance the cost-effectiveness of health care systems in the KSA.

This paper describes briefly major developments in healthcare and higher education related to public health practice, research and learning in KSA and proposes public health informatics as an optimizing and transforming agent for public health to meet current and future challenges. The aim is to encourage scientific debate and writing to set the stage for such promising discipline.

1. Public health in Saudi Arabia

Public healthcare system in the KSA developed over the last 90 years from a health department in 1926 to current large ministry of health (MoH) operating and managing 244 hospitals, more than 2037 primary health care centers (PHC), and tens of public health related programs and activities [7]. In addition, MoH supervises other public healthcare sectors and services including hundreds of hospitals and PHC centers run by National Guard Health Affairs, Military Medical Services, Security Forces Medical Services, King Faisal Specialist Hospital, Universities, ARAMCO health services, the Royal Commission of Jubail and Yanbu, and Red Crescent. Moreover, MoH is also supervising private healthcare services which amount to more than 125 hospitals and 2218 PHC centers [7]. These multiple providers of health care are not well linked to ensure proper and fast exchange of vital public health data and information. Moreover, public health as a discipline is not well defined organizationally and functionally. Public health activities in terms of disease prevention, health promotion and other health system related policies and activities are provided by multiple health sectors in absence of a well-defined national public health system. In 2002, the Council of Health Services (CHS) was established to ensure proper coordination and collaboration among existing multiple sectors and providers to strengthen functions. CHS chaired by the minister of health while the board members are representing all government and private health care sectors and providers in KSA. Clearly, ICTs can play major role in facilitating and enhancing the objectives of CHS to strengthen cooperation and

collaboration between and among different health care sectors/providers and to exchange relevant and important information for protecting and promoting population health.

There are also many scientific medical and health associations that have a national responsibility to prevent diseases, promote health and contribute to the development of healthcare profession and professionals. For example, the Saudi Scientific Association for Public Health (SAPH) sets a vision of healthy nation by 2030 with very ambitious goals to enhance and transform public health practice, research and learning. In its strategic plan, SAPH emphasized the importance of working with many stakeholders of public health (governmental and non-governmental) to ensure a healthy nation. Again ICTs can play major role in executing the vision and mission of SAPH and other scientific associations. In particular, SAPH and the Scientific Association of Health Informatics (SAHI) can play major role in transforming public health in KSA through ICTs utilization.

KSA also has witnessed unprecedented growth in higher education and training programs related to healthcare and public health. Currently, almost all major universities and medical cities provide higher degrees and programs in public health and public health related specialties that include Masters Programs of Public Health (MPH); Bachelor and Masters Programs in Health Informatics; Fellowships and Boards of Family and Community Medicine; Diplomas in Field Epidemiology; and others. In 2005, College of Public Health and Health Informatics (CPHHI) was established at King Saud bin Abdul-Aziz University for Health Science (KSAU-HS), Riyadh, KSA, to provide four masters programs in Public Health and Health Informatics and to be a land mark in the recognition of public health higher education. Saudi Commission for Healthcare Specialties (SCHS) accredited the master of public health program and recognized its graduates as public health specialists. Now, there are 5 colleges of public health and health informatics in different regions of the KSA (central, southern, northern and western regions) which indicate the pattern of growth in this important field.

Certainly, the above mentioned educational and training programs in public health and public health related specialties will contribute to capacity building of well-educated and trained staff. Graduates of these programs are the future leaders, practitioners, researchers, and scholars of public health and they have to be well prepared for the current and future challenges of public health in KSA. So it is important to ensure the standards of these programs to produce the competencies required for the public health in the KSA. Informatics has to be integral part of these programs in order to enable graduates to deal with challenges in the ground. Moreover, since these programs are usually run in isolation from each other's, more collaboration and coordination among these programs are essential to avoid duplication, and to enhance standardization and outcomes. Informatics can play major role in this aspect and transform current status.

2. Informatics as emerging and transforming theme in public health practice

KSA invests heavily in information and communication technology (ICT) in health care and education. Hundreds of computer-based programs are executed and planned in

both healthcare and higher education. There is a strong movement towards computerization of all healthcare authorities, services and transactions. Currently, major hospitals, clinics and health authorities use some sort of computer based information management systems. Many programs, activities, and functions that support public health use ICT including pilgrims (Umrah and Hajj) surveillance system (8), national data and registries, different computer based systems for clinical data management, electronic medical records (EMR) and other smart cards systems in different hospitals, health authorities and clinics. The Global Public Health Informatics Program (GPHIP) of the CDC has been working with KSA since 2009 to strengthen "health systems, building public health capacity in disease surveillance and response, and strengthening linkages between the public health, medical, and scientific communities in areas of mutual concern to CDC and KSA" (9). This resulted in creating and using surveillance system for mass gathering called Mobile-based Notifiable Electronic Disease Surveillance System (MNDSS) in collaboration with Ministry of Health (MoH) and the first integrated electronic surveillance system in the region with National Guard Health Affairs called National Guard Integrated Electronic Disease Surveillance System (NG-IEDSS) (9).

Higher education also has witnessed unprecedented growth particularly in relation to health and health informatics. For example, the growth rate of computer science colleges in higher education increased by 500% while colleges of health science (medicine and medical sciences) increased by 400% over 5 years period only (10). This is in addition to thousands of scholarships abroad and nationally. This huge and fast growth in colleges and scholarships paralleled with rapid development of many ICT centers, programs, functions and organizations. In 2006, The National Center for e-Learning and Distance Education was established as the cornerstone and main support of e-learning. One of the Center's mission is to support the educational operation in the institutions of higher education through the best use of ICTs. More recently, Saudi Electronic University (SEU) was established as one of its kind in the KSA where almost all its functions done electronically and concentrate on public health programs in addition to information management programs. MoHE is also creating deanships of IT at Saudi universities to promote use of ICT in all transactions, functions, learning and teaching processes. There are more than 200 technological projects for Saudi universities that include integrating computer science and internet to curricula, creating higher degrees (diplomas and masters) in ICT and to utilize ICTs in all teaching and learning processes 10). These huge programs and projects of ICTs should be utilized to enhance and transform public health in order to meet the present and future challenges.

3. Present and future challenges for public health in KSA

Globalization, new patterns of diseases and health threats, young population with high growth rate, multiple sectors/providers of healthcare, multi-tier healthcare systems, fast development and growth of ICTs programs and projects in both higher education and healthcare, multiple uncoordinated public health programs, logistical and organizational issues are among the top challenges facing effective public health in KSA. These challenges are compounded by not having well established system and practice of public health as well as lack of coordination and collaboration between different health systems and programs to ensure timely and appropriate management of information. Globalization makes the world not only a 'small village' but a 'big office'

in which different views, ideas, products, and sociocultural aspects are exchanged rapidly. ICT is instrumental as a cause and effects of the globalization. This brings many opportunities as well as risks and threats. With easy travels nowadays millions of people from all different parts of the world visit KSA annually for Haj (pilgrims) and other purposes. Saudis are among the top tourists in the world and ranked highly in Internet and social media use. Cross borders diseases and threats can spread fast. Using efficient and comprehensive means of detecting diseases and health threats is essential to pass information and take actions swiftly and effectively. ICT has been instrumental in globalization and has the capacity to provide rapid, reliable and valid data about health needs and threats so that public health can respond effectively to them. The young and rapid growing population of KSA use ICT on their daily lives and it is appropriate to make the best out of this use to improve their health and well being, prevent diseases and threats and optimize health services and programs.

From the above briefing and observation on the ground it is clear that most of the development and growth in health care and public health education are vertical and isolated from each others. Developing and implementing effective public health practice and education require efficient and reliable coordination between and among different organizations and programs. The current logistical, organizational and political constraints dictate that ICT is the most viable option for integrating and collating relevant public health information. Public health core functions in terms of assessment, policy development and implementation and assurance need national and local representative data and information that can be accessed, analyzed and evaluated on a timely manner.

The perspective of public health is wide, compelling and based on high records of achievements particularly in developed countries. Developing countries should learn from these achievements and work hard to develop further and invest in robust public health education, practice and research. Kingdom of Saudi Arabia (KSA) as one of the wealthiest countries that can use such wealth in developing and implementing public health that responds cost-effectively to public health challenges of the 21st century. To maximize achievements there must be a strategic plan based on evidence-based approach to deal with the above mentioned challenges as well as unanticipated ones. Schools of public health and public health scientific associations can play a major role in forming such strategy. Education and training of public health professionals must be a priority to carry out public health functions in a more integrated health care system that is based on preventing of disease and promoting of health. Today KSA has the finances to take and do mega projects and organizational change that respond to challenges ahead and must be seized for better future.

4. The way forward

The above-mentioned developments, programs and projects in both health care and education indicate the need for establishing a robust national public health system that responds effectively to current and future challenges. For such system to function effectively, it requires fast, reliable and comprehensive means of data collection, analysis and sharing between and among different agencies and bodies responsible for public health albeit nationally or locally. Only information technology and management can do such huge task. According to the latest strategy of healthcare in the

KSA, lack of proper "management and information systems" was among the hindering factors for further development. Ministry of Higher Education (MoHE) also recognized the importance of integrating current systems for information technology programs and activities.

Thus there is a great need to establish a national informatics system that facilitates integration, coordination and collaboration among relevant public health services and functions; encourages complementarily and congruity between current and future systems and programs; enhances harmonious relationship between existing information systems, networks, and programs to enhance competency and performance; and optimizes competency and capabilities of information systems and networks at local and national levels. Such informatics system is known in developed countries as Public Health Informatics (PHI) and defined "as the systematic application of information and computer science and technology to public health practice, research, and learning" [5]. PHI is more than automation of information: it uses principles of public health and information technology to promote population health, prevent diseases, interrupts causal chains of health threats, and enhances cost-effectiveness of government public health functions. PHI transforms the traditional functions of public health through "conceptualization, design, development, deployment, refinement, maintenance, and evaluation of communication, surveillance, and information systems relevant to public health" [11]. PHI enables national and local public health bodies to access timely, accurate, and relevant information in order to respond cost-effectively to the health needs of the populations they serve. The use of sophisticated information technology to collect, analyze, and share information is crucial in this information age to safeguard against outbreak of serious infectious disease or chemical and bioterrorism attack as well as preventing and controlling chronic diseases, such as obesity, diabetes, and other non-communicable diseases which become epidemic in KSA. PHI enhances day-to-day operational processes and rapid exchange of information electronically between and among different health care sectors/providers at a national as well as local level. This is crucial to compensate for the lack of a unified national public health system and to interconnect current multiple healthcare sectors/providers for better health outcomes for our population.

Council of Health Services (CHS) which represents all healthcare sectors/providers in the KSA may host the national office/center of PHI to facilitate linking and integrating current public health data and information available at different health sectors/providers and prepare for a national PHI system over time (see Figure 1). PHI also must be an integral part of any educational and training program for public health to ensure competent graduates who can use and utilize informatics in their practice, research and learning. These two steps can pave the way for building a robust national public health programs based on sound PHI that lead and managed by well qualified public health professionals. The central office in addition to collating, analyzing and disseminating relevant public health data, should formulate strategy that ensure development of coherent national PHI that integrate current different programs/systems and accommodate future ones; integrate current individuals clinical data to national population health data; and generate competencies for higher education public health degrees programs to incorporate; and ensure the confidentiality and privacy of PHI. These duties can be carried out in collaboration with all stakeholders.
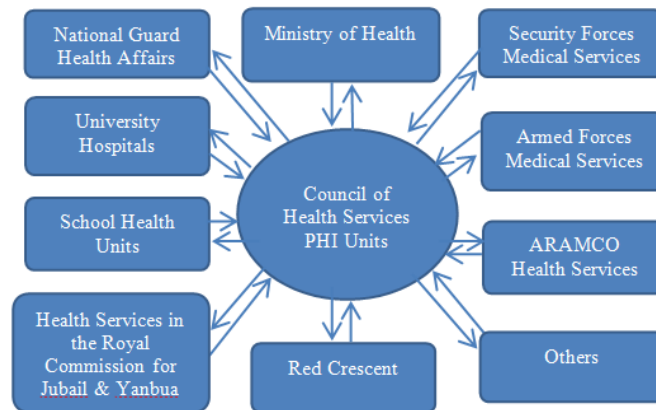
Figure 1. Proposed Structure of Public Health Informatics (PHI)

Stakeholders such as MoH, health sectors/providers, MoHE, universities particularly public health colleges, ministry of information technology and communications and others should be involved in formulating strategy for PHI that take in consideration current and future challenges. Colleges and scholars of public health and health informatics, Saudi Scientific Association for Public Health (SAPH), and other professional bodies and individuals must contribute to such development through scientific workshops, training programs, communications, research, and evidence-based policy development briefing, and the use of mobile health and social media technologies [12-23]. It is important for all stakeholders to recognise that using informatics in public health practice, research and learning become a necessity rather than an option in this information age.

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