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ICT ENABLED DELIVERY SYSTEM AND CHALLENGES IN PUBLIC HEALTH SERVICES MANAGEMENT

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ABSTRACT

Information and Communication Technology (ICT) has become a major tool in delivery of health services and has had a revolutionary impact on how we live and perceive the world. ICT has given birth to the contemporary "Es" such as e-learning, e-commerce, e-governance, e-banking, e-shopping and e-health. In response to the challenges of globalization and local development, educational reforms are inevitably becoming one of the major trends in the Asia-Pacific Region or other parts of the world. In the health sector, ICT is a cornerstone of efficient and effective services. In many countries, use of ICT within the sector continues to grow and the Internet in particular is driving significant change. In this paper we've examined the current scenario of ICT based delivery system and the challenges, constraints and opportunities in health services in India.

KEYWORDS

ICT, Public health, Service delivery, Stakeholders.

1. INTRODUCTION

The past decade has seen a remarkable growth in the diffusion of information and communication technology (ICT) across the world. This growth has been fuelled by technological advances, economic investment, and social and cultural changes that have facilitated the integration of ICT into everyday life. As information technology in the health care industry evolves, the scope of information sharing is expanding beyond the walls of individual institutions. Achieving this level of integration will require that software models overcome a host of technical obstacles, and that they are accessible, affordable, and widely supported. In response to the challenges of globalization and local development, educational reforms are inevitably becoming one of the major trends in the Asia-Pacific Region or other parts of the world. Based on the most recent research and international observations, a new paradigm has been identified including various new concepts, frameworks and theories for reengineering education.

e-Health, commonly referred to as the application of information and communication technology (ICT) in the health sector has rapidly developed around the world in the last few years. The Indian healthcare sector is undergoing a transformation with improved services becoming available to larger populations. The health sector has always relied on technologies. According to WHO (2004), they form the backbone of the services to prevent, diagnose and treat illness and disease. ICTs are only one category of the vast array of technologies that may be of use. Given the right policies, organization, resources and institutions, ICTs can be powerful tools in the hands of those working to improve health (Daly, 2003). Advances in information and computer technology in the last quarter of the 20th century have led to the ability to more accurately profile individual health risk (Watson, 2003), to understand better basic physiologic and pathologic processes (Laufman, 2002) and to revolutionize diagnosis through new imaging and scanning technologies. Such technological development, however, demands an increased responsibility of practitioners, managers, and policy-makers for assessing the appropriateness of new technologies (Hofmann, 2002). The methods people use to communicate with each other have also changed significantly. Mobile telephony, electronic mail and videoconferencing offer new options for sharing perspectives. Digital technologies are making visual images and the voices of people more accessible through radio, TV, video, portable disk players and the Internet, that change the opportunities for people to share opinions, experience and knowledge. This has been coupled with steps to deregulate the telecommunications and broadcast systems in many countries, which open up spaces and platforms, such as community radio, for increased communication.

Reliable information and effective communication are crucial elements in public health practices. The use of appropriate technologies can increase the quality and the reach of both information and communication. On one hand, the knowledge base is about information, which enables people to produce their own health. On the other hand, social organizations help people to achieve health through health care systems and public health processes. The ability of impoverished communities to access services and engages with and demand a health sector that responds to their priorities and needs, is importantly influenced by wider information and communication processes, mediated by ICTs. In this paper, we've highlighted the ICT in public health delivery system and its challenges.

2. ICT IN PUBLIC HEALTH DELIVERY SYSTEM

In the health sector, ICT is a cornerstone of efficient and effective services. In many countries, use of ICT within the sector continues to grow, and the Internet in particular is driving significant change. For example, in middle- and high-income countries, the Internet is dramatically changing the way in which consumers interact with health services, including access to health information and the ability to purchase pharmaceuticals and other health products. The Internet also plays a key role in expanding the reach of health services to remote areas. The spread of broadband networks and the development of new e-health applications, defined as the use of ICT for health, have a mutually stimulating effect on further developments. However, it is clear that, despite the numerous creative and sometimes quite costly efforts to improve the situation, access to these developments is not universal, and many countries do not benefit as they might from advances in ICT in health.

Hospitals no longer need to have every type of special ward or unit. If the hospital is linked to a network, far- away specialists can be consulted electronically. Based on the findings, it's evident that Online consultancy and online appointment plays a vital role in implementation of IT. The impact of information technology has been widely accepted by healthcare industry. The security and reliable data be very important and next important things are unique user ID, data backup, error free diagnostic testing and setting up a datacenter. One of the key characteristics of healthcare is the very strong emphasis on secure and reliable data- transfer between the stakeholders, in order to protect the sensitive personal data that is often involved. Health research and the health sector in general are experiencing a rapidly increasing need for high transmission bandwidth for high-resolution images and video streaming used for remote diagnostics, monitoring and the teaching of surgical techniques.

Healthcare has developed and deployed IT systems and ICT services in the last 40 years of the 20th century. Examples of how the technology has been used can be found in administrative applications, digitized diagnostic equipment and electronic health records. In an attempt to improve information flow and knowledge,

many healthcare providers have invested in technologies such as online order entry, electronic medical records, and picture archiving and communications systems (PACS). Fueled by the unrelenting pressures of cost, quality, and access, it is believed that the first two decades of the 21st century are the era in which healthcare systems around the globe will be driven into crisis. Consumers worldwide are demanding more and better healthcare services. Yet, in virtually every country, the growth in healthcare demand is increasing more rapidly than the willingness and, more ominously, the ability to pay for it. If left unaddressed, financial pressure, service demands driven by aging populations and other demographic shifts, consumerism, expensive new technologies and treatments, and the increased burden of chronic and infectious diseases will cause most of the world's countries to reach a breakpoint in their current paths. In other words, the healthcare systems will likely "hit the wall" be unable to continue on the current path and then, require immediate and major forced restructuring.

TABLE 1: EXAMPLES OF THE USE OF ICT IN HEALTH SYSTEMS AND SERVICES

Broad area	Examples
Access to information and knowledge	1. Improved access to health information, research, literature and training materials, such as access to biomedical and social sciences research. This supports the health research enterprise and enables comprehensive, evidence-based management of acute and chronic conditions 2. Improved access to resources on prevention, awareness and education, for the general public as well as for health professionals, researchers and policy makers
Networking and collaboration	1. Collaboration for the management and coordination of care across different health providers, community health services and health institutions 2. Better exchange of knowledge among policy makers, practitioners and advocacy groups 3. Rapid and coordinated response to disasters and disease events
Information for policy and action: measuring progress, tracking quality and trend analysis	1. ICT for collecting, organizing and disseminating public health evidence and information for advocacy, practice and policy 2. Improved ability to describe, model, analyze and monitor trends on health status, income, employment and service coverage, and disaggregate by gender 3. Support for research on policy effectiveness
Health education and training	1. Direct support to education and training for health professionals and workers, including both pre-service education and in-service training and resources 2. Improved efficiency and effectiveness of education delivery through strategic application of ICT and ICT-enabled skill development 3. Improved availability of quality educational resources through ICT 4. Outreach to special populations (girls and women) using appropriate technologies 5. Enhanced delivery of basic and in-service education
Public accountability through greater flow of information	1. Greater transparency, accountability and accessibility in delivery of public services 2. Improved enforcement of regulations and performance monitoring of decentralized services
Delivery of health services	1. Prevention of disease, health education and promotion, and support for diagnosis and treatment 2. Establishment of health registries and health information systems 3. Extension of care to rural and remote areas through telemedicine applications; increased access of rural health workers to specialist support and consultation

A number of these uses of ICT promise particular benefits for developing countries. For example, decreasing the isolation of the health community is seen as a major benefit and is thus a driver for adoption. ICT is increasingly well integrated in educational settings in middle- and high-income countries, where communication, collaboration and access to information are at the core of research and teaching. Universities in the developing world need to connect on an equal footing with their counterparts. This access will play an important role in advancing locally relevant research, and will improve capacity by enabling participation in the peer-review process required for publishing and participation in research conferences.

Improved access to care is an important benefit of ICT particularly for countries tackling the challenge of providing health care to people over a broad geographical area. One of the main drivers behind public investment in e-health systems is the expectation that ICT will improve access to services and reduce the inequities experienced by people in remote locations. This is a serious matter in countries that have chronic shortages of physicians, nurses and health technicians. The problem of shortages is often coupled with public concern over access and demographic shifts with concomitant major health resource implications, such as ageing populations and rapid population growth in native or aboriginal communities. In contexts such as these, the goal of access to health care has driven the adoption of ICT for remote diagnosis, monitoring and consultation.

Quality of care is another important driver for ICT adoption. Health service providers are not only attempting to deliver more effective care, they are also attempting to deliver care that is safe. Both goals require the use of ICT to measure, monitor and report on quality improvement initiatives, as well as the use of information systems such as pharmaceutical ordering systems that are proven to reduce errors. Developments such as e-prescription and computer-assisted imaging are part of this. With respect to technology-assisted care, it is critical to ensure that the care and information provided through e-health meet appropriate standards, relating to the quality of information transmitted as well as to the overall reliability of the system and the satisfaction of users, both professionals and patients.

2.1 FACTORS AFFECTING ICT USE IN THE HEALTH SECTOR

There are several factors that affect the use of ICT in the health sector. These include costs, access speed, education and collaboration between stakeholders.

Costs for ICT - These influence uptakes in all sectors. They are normally reflected at the service level, and incorporate the costs passed on to the user from the infrastructure level. In general, two basic disparities exist in the affordability of ICT: in the basic cost of the technology and in the cost relative to per capita income. Access costs such as high Internet service provider and telephone call fees can be two to four times as high in developing countries as in developed market economies. When the monthly cost for Internet access exceeds the monthly income of a significant proportion of the population, its level of use will remain low.

Access speed - This directly affects cost. In nearly all countries, telephone calls are charged on a per-minute basis for telephone mainlines, with an additional access charge. Where Internet access is through a dial-up connection, download times are long, and costs therefore increase. The trend to using large web pages and files is not an obstacle in countries where bandwidth is increasing, but in low-income countries the long download time further increases the cost. Although telemedicine can be successfully practiced via low-bandwidth connections, lack of affordable broadband infrastructure significantly hampers the ability to conduct telemedicine applications where transfer of high-resolution images is required.

Education - This clearly affects ICT use, and international disparities are evident at the user level. The degree of technical capacity at this level is a result of long-standing government investment or under-investment in education and training, not only through initiatives such as staff development programmes and technical training in schools, but also including investment in secondary and tertiary education.

Collaboration between stakeholders - At the infrastructure and service levels, regulations such as those for importation of telecommunications equipment in emergency situations show the need for cross-border collaboration in ICT and health. Clearly, ICT is central to an effective health sector response in disaster situations, whether natural disasters or man-made (e.g. armed conflict). In the absence of formally established procedures covering disasters and emergencies, customs clearance and type-approval procedures for telecommunications equipment, allocation of radiofrequencies and authorization for radio communications

can delay installation of urgently needed communications systems. For example, regulations on telecommunications equipment importation and type approval delayed help when a non-governmental organization arrived to install radio communications in Bam, Iran after a major earthquake in 2004. Lengthy national and local customs and telecommunications regulatory clearance resulted in an unnecessary and costly delay before the equipment could be installed where needed.

2.2 BENEFITS OF ICT IN HEALTH SECTOR

ICT has benefited the health sector both in developed nations and developing nations, the benefits affect the hospital's stakeholders: management of the hospital, health personnel and patients. The use of ICT in health sector reduces the cost of running hospitals (Remlex, 2007). ICT introduces potential of sharing of patients files easy without any threat to patient privacy. It is used for hospital management such as admission and appointment management. ICT improves the efficiency of medical personnel by reducing waiting times and minimize paperwork. ICT makes information available for the use of hospital personnel in an easily readable form. The result of patients' test can be added to the patients' case file as soon as they are ready. To the patients, ICT assists the patients to locate the health facility and personnel, gives 24-hour access to health information and through encryption and password protection can help to keep patients' data confidential.

There has been considerable international discussion about the potential of ICTs to make major impacts in improving the health and well being of poor and marginalized populations, combating poverty, and encouraging sustainable development and governance. Used effectively ICTs have enormous potential as tools to increase information flows and the dissemination of evidence-based knowledge, and to empower citizens. However, despite all its potential, a major challenge is that ICTs have not been widely used as tools that advance equitable healthcare access.

A critical mass of professional and community users of ICTs in health has not yet been reached in developing countries. Many of the approaches being used are still at a relatively new stage of implementation, with insufficient studies to establish their relevance, applicability or cost effectiveness (Martinez, et al, 2001). This makes it difficult for governments of developing countries to determine their investment priorities (Chandrasekhar and Ghosh, 2001). However, there are a number of pilot projects that have demonstrated improvements such as a 50% reduction in mortality or 25-50% increases in productivity within the healthcare system (Greenberg, 2005).

The ICTs have clearly made an impact on health care in the following points:

- Improved dissemination of public health information and facilitated public discourse and dialogue around major public health threats
- Enabled remote consultation, diagnosis and treatment through telemedicine
- Facilitated collaboration and cooperation among health workers, including sharing of learning and training approaches
- Supported more effective health research and the dissemination and access to research findings
- Strengthened the ability to monitor the incidence of public health threats and respond in a more timely and effective manner
- Improved the efficiency of administrative systems in health care facilities.

Experience demonstrates that there is no single solution that will work in all settings. The complexity of choices of technologies and the complexity of needs and demands of health systems suggests that the gradual introduction, testing and refining of new technologies, in those areas of health care where there is a reasonable expectation that ICTs can be effectively and efficiently used, is more likely to be the successful way forward.

3. CONSTRAINTS AND CHALLENGES

A number of factors can inhibit the introduction and successful application of ICTs in the health sector in developing countries. Satellife (2005) identified three main categories as **connectivity**, **content** and **capacity**. Madanmohan Rao (2005) adds five more categories for analysis: **community**, **commerce**, **culture**, **cooperation** and **capital**.

Connectivity - With connectivity there are issues such as the lack of an enabling telecom policy and regulatory environment; access to electricity, solar power options, UPS back-ups, insufficient infrastructure, connectivity access and high costs. Embedded in this are issues around broadcasting rights and regulations controlling the media.

Content - Content factors include the lack of local content creation, the language used and the relevance of content to the local situation. Appropriate language is frequently neglected in ICT programmes and little content is available in local languages for health programmes. Another major content issue is the quality and reliability of health information. The Internet can provide a wide range of users with timely, accurate, diverse and detailed health information. However, its decentralized structure, global reach, leveling of access to the tools of publication, immediacy of response, and ability to facilitate free-ranging interchange also make the Internet a channel for potential misinformation, concealed bias, covert self-dealing, and evasion of legitimate regulation. Given the sensitive nature of health care information, and the high degree of dependence of health professionals on trustworthy records, the issues of reliability (data residing in the electronic health record are accurate and remains accurate), security (owner and users of the electronic health record can control data transmission and storage), and privacy (subject of data can control their use and dissemination) are of particular significance and must be clearly and effectively addressed by health and health-related organisations and professionals (Ramsaroop, et al. 2003). Reliability, security, and privacy are accomplished by the implementation of a number of preventive and protective policies, tools, and actions that address the areas of physical protection, data integrity, access to information resources, and protection against unauthorized disclosure of information.

Capacity - While capacity to adapt information to ensure that it is culturally appropriate and relevant is a major challenge, so too is the capacity to use ICTs effectively, to service and maintain them. A skilled ICT work force is an essential ingredient for the effective use of ICTs in health. Systems professionals and technology products and services providers and project team leaders with high skill levels and experience in working in the sector introducing the ICTs are important components of success.

Community - The question to be addressed here is who is using ICTs? What are the communities of users and what services exist to facilitate use and to encourage those who have not been involved in health dialogues previously? An important approach to the design and implementation of any ICT and health programme is to identify the various stakeholders who need to be involved and find mechanisms for including their perspectives and concerns and to find ways to mobilize their skills, expertise and resources.

Commerce - New technologies have made it possible to open up trade in medicines and services via the Internet. This has both positive and negative consequences. One of the key factors to consider here is the degree to which it is possible to develop effective national or domestic Internet economies that promote online transactional capabilities that will be beneficial for consumers, for businesses and for public health interests.

Culture - Cultural issues need to be addressed in terms of appropriate and relevant content. Another aspect of culture is the need to examine and challenge the cultural inhibitions and barriers within society and institutions that prevent effective use of ICTs. This includes a commitment to transform the rules and regulations surrounding telecommunication and broadcast systems. It also means increasing political will to ensure that government procedures are more transparent and that information sharing cultures are encouraged.

Cooperation - The use of ICTs for health and development involves local, regional and international participants as stakeholders. No one sector or one set of stakeholders can deal with the complexity involved in the effective use of ICTs in health. Technical knowledge, experience, and financial investments needed to establish large and complex ICT initiatives require tapping into resources and expertise that no single organisation retains. Several key groups should be considered when discussing efforts for ICTs and health.

Dzenowagis (2005) identifies six major groups:

- Citizens (including patients)
- Professionals
- Hospitals and academia
- Health-related businesses
- Governments
- International agencies.

Each of these could be broken down further. For example, the OECD (2005) has catalogued the activities of the major international agencies with an interest in ICT programmes for development. Within each grouping, there may also be those with a health focus, those with a technology focus, or those who are most concerned with development issues. They often have different perspectives on the aims and objectives of introducing ICT into healthcare and hold different views on potential barriers to implementation.

Capital - Generally, there is little investment in ICTs for health even in most developing countries. The picture is one of fragmentation, with many different varieties of ICTs being acquired from different donors. Very few government-run health services have properly functioning ICTs within them, and there is no reliable infrastructure to enable inter-organizational transfers of information. Invariably, there is no national health information and IT infrastructure to underpin the delivery of health care. WHO (2004) makes the point that technologies must be 'integrated into health services that meet basic needs' if they are to be considered to be essential investments.

ICT projects, particularly those dealing with information systems, are notorious for running over time and over budget, yet often still failing to deliver all the specified functions satisfactorily. This can be largely avoided by effective project management, including planning, quality assurance, and resource management components. Obtaining an effective system is not simply a process of competitive tendering, local development, or acceptance of an externally funded donated system. The procurement process should be planned and structured, in order to match the solution to the need and circumstances. This in turn needs a systematic approach to defining the requirements and the available resources, including running costs and staff availability.

The convergence of new and old technologies is well documented in a report from FAO (Girard, 2003) that presents examples of converging radio and new ICTs for development. The report argues that radio will have even greater significance and value in years to come. Particularly relevant is the chapter on 'Take Five: A handful of essentials for ICTs in development' by Alfonso Gumucio Dagron where he describes a set of 'non-negotiable conditions for ICTs in development':

- Community ownership
- Local content
- Appropriate technology
- Language and cultural pertinence
- Convergence and networking.

The advent of wireless Internet access potentially allows the use handheld communication devices, web-enabled telephones, interactive television, web and email terminals (WideRay and Satellife, 2003). The novelty and improved efficiency of new technologies may have the biggest effect on the acceptance of second-generation technologies in youth programs. There is a need to identify or develop methodologies for passing content from one medium to another. For example, from the Internet to community radio. Several organizations are modifying computer technology to make it more appropriate for rural areas. For example, the Simputer is being developed in India for rural low-literate populations (Harvey 2002).

3.1 CHALLENGES AND OPPORTUNITIES

The problem with healthcare technology is that one hour of care in the emergency room means one hour of paperwork. It's not a good way to keep content those people who went into the care professions. The U.S. government, as well as several other governments around the world is aggressively moving on the problems related to healthcare paperwork, lack of IT, and the standardization and digitization of medical records. Through all of human history, health caregivers have been respected individuals in society. Now with the Internet, consumerism, the Baby Boomers aging, risk adjustment, outcomes measurement, and quality metrics, blind trust in clinicians has begun to erode. Many in academia, clinical practice, and government have suggested that use of information technology in healthcare is the answer to error reduction. However, information technology by itself can have only a limited impact, unless the information is used for deliberate improvement in healthcare practices. Despite the evidence that IT improves care, basic electronic information about patients remains out of reach for most clinicians.

ICT has the potential to solve many of the problems in this field. For example, an early diagnosis of symptoms can save a person's life. Rural health kiosks can transmit symptoms of a sick person to a centrally located hospital and provide a cure via the same medium to the person. To scale up its business and to achieve self-sustainability, it is imperative for the organization to revisit its management and human resources strategies, and find ways to improve the financial performance of its social enterprises.

4. CONCLUSIONS

The strategic directions at regional level will support the development of policies, capacities and programmes for managing health knowledge in countries. The strategy calls for countries to take steps towards institutionalization of knowledge management activities, develop capacity and make full use of the available health knowledge.

- Promote collaborative efforts of governments, planners, health professionals, and other agencies along with the participation of international organizations for creating a reliable, timely, high quality and affordable health care and health information systems and for promoting continuous medical training, education, and research through the use of ICTs, while respecting and protecting citizens' right to privacy.
- Facilitate access to the world's medical knowledge and locally-relevant content resources for strengthening public health research and prevention programmes and promoting women's and men's health.
- Alert, monitor and control the spread of communicable diseases, through the improvement of common information systems.
- Promote the development of international standards for the exchange of health data, taking due account of privacy concerns.
- Develop distance learning, training and other forms of education and training as part of capacity building programmes.
- Promote international and regional cooperation in the field of capacity building, including country programmes developed by the United Nations and its Specialized Agencies.
- Launch pilot projects to design new forms of ICT-based networking, linking education, training and research institutions between and among developed and developing countries and countries with economies in transition.
- Volunteering, if conducted in harmony with national policies and local cultures, can be a valuable asset for raising human capacity to make productive use of ICT tools and build a more inclusive Information Society.
- Encourage the adoption of ICTs to improve and extend health care and health information systems to remote and underserved areas and vulnerable populations, recognizing women's roles as health providers in their families and communities.
- Strengthen and expand ICT-based initiatives for providing medical and humanitarian assistance in disasters and emergencies.

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