Technology for the Health Services of Ageing Societies in Developed Countries: Lessons for Developing Countries

Tunazzina Sultana
PhD student in Computer Science
University of Milano Bicocca Viale Sarca 336/14,
20126 Milan, Italy

Associate Professor in Chittagong University

{t.sultana}@campus.unimib.it

Abstract. The paper tries to analysis the current scenario of technological supports in the health service of the developed countries to assess their replicability in the developing regions. Secondary data have been used for the analysis and a framework has been developed to reach the objectives. The analysis has yielded important insights into the necessity of technological intervention to the health services in the developing countries in the form of mobile health services, tele-nursing and IPTV solution for e-learning to face the challenges of ageing people in the future. The paper ends with a future direction of specifying on implementinge-health in the health service sector of the developing countries.

Keywords: Ageing Population, Developed and developing regions, Health, Technological Support.

1 Introduction

We are living in a time of profound changes in economic, social, and political environment which bring both challenges and opportunities for us. When health service systems come into consideration, the most challenge of these changes is the impact of population ageing on social life.

According to the report of the Ageing Societies Working Group, in 2012, people aged 60 years and more was 0.8 billion and made up 11% of the world's population. By 2030, they will be 1.4 billion and make up 17% of the world's population. By 2050, they will be 2 billion and make up 22% of the population. In 2047, for the first time in human history, a higher proportion of people in the world will be aged 60 and over (21.0%) than aged below 15 (20.8%). The age distribution of the population is shifting towards older ages across most countries, due to a combination of declining mortality and falling fertility rates [14]. Thus, we are living longer and ageing affects all countries.

In the more developed regions, 22% of population is already aged 60 years or over and that proportion is projected to reach 32% in 2050; whereas just 9% of the population is today aged 60 years or over but that proportion will more than double by 2050 in developing countries [36].

Though the majority of the world's elderly resided in more developed regions, recent statistics shows that 59% (more than 248 million of the roughly 418 million persons age sixty-five and older in the world) of them now live in developing countries. In future, the distribution of the world's elderly will continue to shift significantly to the developing countries (67% in 2020) [27] . When examining the projected increase in the global elderly population over the next half century three patterns appears: relatively small increases in most of Europe which is below 50%; large increases in countries with high immigration in recent times like 135% in Canada; and the highest percentage increases in developing countries e.g., 200% in Bangladesh [20].

It implies that the population ageing is occurring fastest in less-developed countries, which have consequently less time than developed countries to build the infrastructure and tools to deal with this major social transition.

Infirmity, dependence, incapability and increasing levels of disability and dementia are associated with ageing throughout the world. As a result, elderly people make a new segment of market for health services as they bring new types of needs. These needs require and motivate investments and funding on innovative technologies that put up with the predicted needs of an aged population [5]. The more the future is exposed to the elderly people, the more the needs for tailored technology for the market of old consumer are increasing [4].

Different types of service tools have been developed to help people with physical and sensory deficits due to old age. Lift-chairs and ergonomic handles are the examples of such service tools that do not rely on computer technology. On the other hand, there are service tools that rely on artificial intelligence and other advanced computer-based technologies like text-to-speech systems, digital programmable hearing aid [10]; and a jewelry-like device that allows people with limited mobility to control household appliances using simple hand gestures [28]. However, all these technological assistive tools are used for the elderly people in developed countries.

Hence, this demographic shift has important implications for developing countries such as Bangladesh, Pakistan, and India as their populations' age and live longer, the demand for treatment of non-communicable diseases will increase. Moreover, longevity is associated with illness such as heart diseases; dementia, arthritis, and diabetes of ageing that are more complex and expensive for treatment [33]. However, a few researches have been conducted on the related issues.

Most of the researches conducted on future trend of the demography in developing countries emphasizing on social issues like education, marital status [13], economic issues [17], support system for living [23] and implications for policy. Streatfield and Karar highlighted the health issues in their research and expressed the concern for more expensive health services in responses to the changed needs of the elderly [31].

In addition, lack of research on recognition of role of scientific research and technological innovation result in an obstacle or a barrier in the field of reducing the diseases for the elderly. Moreover, lack of scientific and technological capacities brings inequalities in public health between developed and developing countries [38].

Among the developing countries, India, South Africa, Brazil and China are some that are making deliberate efforts to build their scientific and technological capacities. These countries are likely to be reducing their disease burden. Although many developing countries are making attempts to improve public health, on the whole, their scientific and technological capacities are still limited and not effective.

Against this picture, to the best of our knowledge, there is no holistic picture of the role of technology in meeting the needs of the health services of the emerging elderly people in developing countries. This lacking suggests the necessity to conduct a research study that will help to get a deeper understanding through exploring the current scenario relating to technology-based different services to the elderly people in developed nations. The derived lessons, after analyzing the scope of replication, can be used to take the necessary steps for facing the challenges of elderly people for developing countries.

This conceptual paper will try to explore the aspects of technologies that are being used for supporting the elderly people with the aim of responding to the following research questions: How developing countries can deploy technologies for improving the health services of the elderly people? To answer this main research question we tried to explore the current scenario of ageing society in developed countries and how the elderly people are supported by the technology.

2 Methods

A qualitative research has been conducted based on the dimensions of health conditions and technological tools for the elderly people. A broad literature review has been done for the basis of this paper. Relevant books, research papers, online materials, relevant reports have been used as secondary data for the analysis. Data were so collected have been analyzed and presented in a logical order to answer our research question. Ageing and Health Sustainability Framework [14]) has been used in a modified way. Current situation of ageing, health condition and technological support has been discussed for assessing the readiness with the changing situation and new ways of working for facing the challenges have been proposed.

2.1 Ageing and Health Sustainability Framework

Ageing and Health Sustainability Framework has been developed by the report of the Ageing Societies Working Group 2012 which consist the key actions and innovations that would help countries assess and enhance the robustness of their health systems. The objective of developing this framework is to create benchmarks for countries to gauge the sustainability of their health and care systems and to target innovations where they will make the most differences by assessing their readiness for the challenges and opportunities of the ageing revolution.

After highlighting the needs for all countries, to make a comprehensive response that addresses the different aspects of an ageing population and health care and

enables the various countries to learn from one another, the framework has been developed.

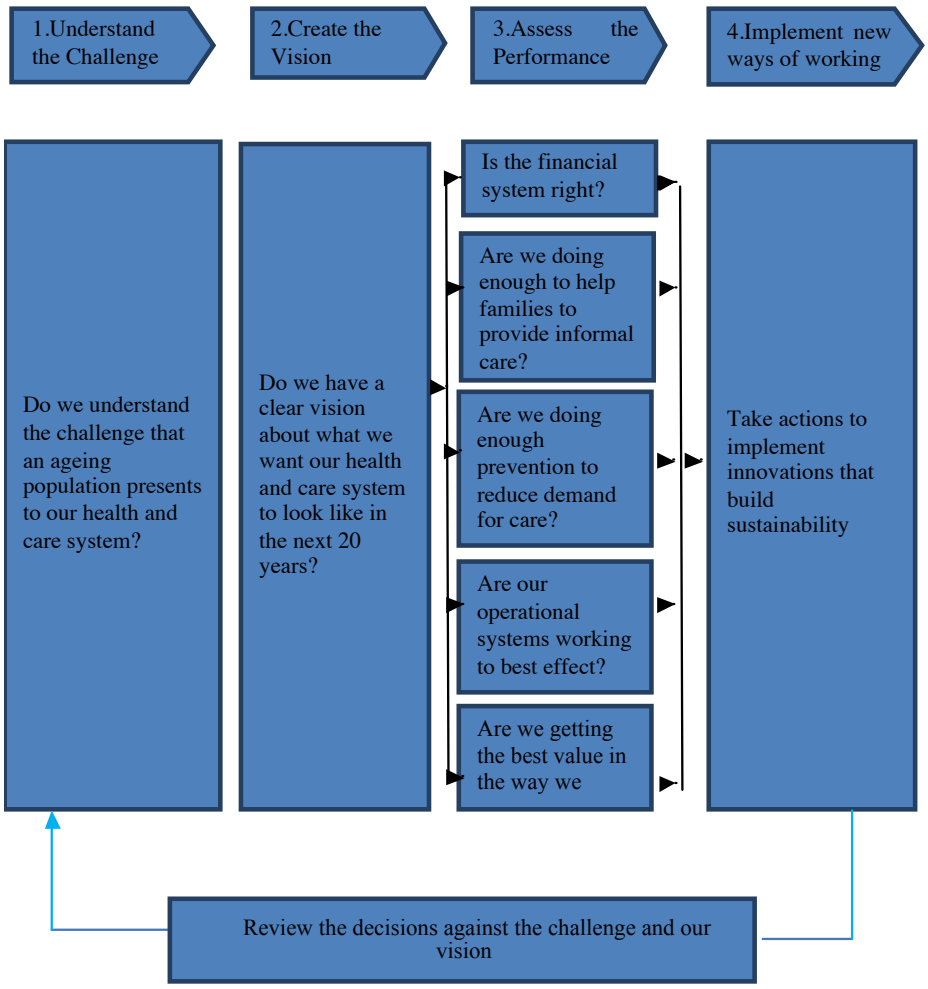

Fig 1: The Ageing and Health Sustainability Framework

The framework is consists of four steps – to understand the challenges of ageing societies, to create a vision for the health system in 20 years , to assess the present performance and to implement new ways of working i.e. the framework is so developed that help to understand the challenge now and in future, to know the requirement to achieve in improving the health and social care of older people over the next 20 years, to have a comprehensive approach that draws on other countries' experience and innovation as set out in the Ageing Forum Report, to assess the performance and to implement new ways of working. The sustainability Framework

covers four key areas- Getting the financial system right (reconciling growing demand with limited resources), Helping families to care (increasing the supply of informal care), Prevention and Self-Management (reducing the demand for care), and care at home and in the community-and the report showcases innovations in each.

Besides, methodology that was used to develop this framework is very concrete as it includes literature review relevant to the main themes of demographic changes, ageing, health and social care; semi-structured interviews with over 25 experts from different fields ranging from academia to NGOs like WHO, NICE International, HelpAge International, Alzheimar's Disease International and so on. Moreover, this framework is developed to measure the sustainability of the health system for the elderly people, a modified framework based on this framework may help us to identify whether the existing health services tools of the developed countries are sustainable and replicable for the developing countries.

Hence, we consider this framework as a strong background for evaluating the sustainability of the health system of developing country and construct a new and modified framework based on this for the research. Therefore, a modified framework based on this framework has been used in this research which is shown below (Figure: 1). It is being used in the research for evaluating the current usages of technology for the health care systems in the developed region and the potential of the replication in developing regions. It is expected that this framework will help to measure the effectiveness of the existing technologies and to identify the potentiality of the replication of these in the developing regions.

In order to match with the purpose of our research we use the framework by modifying its area of assessing the performance only into how the technological tools for supporting the elderly people are working to best effect in developed region? Keeping the objective of the research in mind the framework has been modified in the following way.

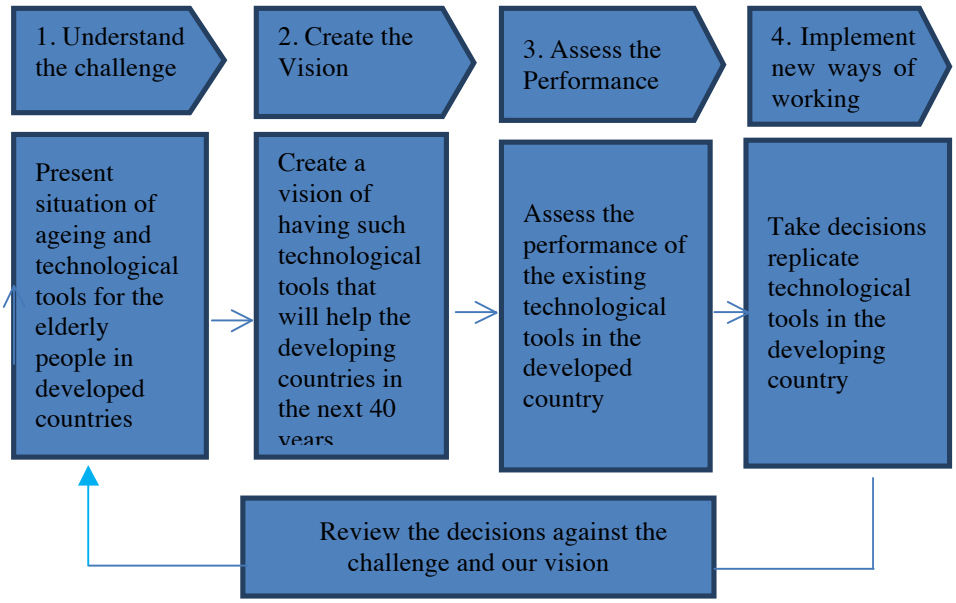

Fig: 2 Modified Ageing and Health Sustainability Framework

With this framework the study tries to explore the current scenario of ageing and the technological tools that are used for the elderly people in the health sector of developed country. This scenario is a challenge not only for the developed country, it is also considered as a challenge throughout the world. Then, it tries to create a vision of having such technological tools that would help the developing countries in the next 40 years. Thereafter, the study assesses the performance of the existing technological tools to understand whether these countries are capable enough to face the challenge with the existing technological products for the health services. Finally, it decides on whether it is possible to replicate the technological tools in a developing country or not.

3 Results (Health Condition and Technological Support)

3.1 Health Condition

Health is considered as the most important parameter for ensuring quality of life and health is very significant for active ageing. Nonetheless, diseases are associated with ageing. Though both chronic and degenerative diseases are associated with age, degenerative diseases are more closely related to old age. In all countries, the most common diseases of the elderly people are related to sight and hearing disorders,

frailty, dementia, cardio vascular diseases, fear of falling, mobility problem and so on. Yet, the scale of severity is different in developed and developing countries.

Among the developed countries, 5-10% of older people who live in community settings are categorized as frail and around 20-40% exhibits some signs of frailty in Finland. In the UK, 20% of the older people living in the community experience urinary in continence. Dementia is primarily associated with older people. About 35.6 million people around the world live with dementia and it is projected that it will reach at 115.4 million in 2050 [30]. In the developed country, among people over 60 years and above, Alzheimer's and other dementias account for 9% of lost healthy years due to pre mature death and disability [1].

In developing countries, the scale of sight and hearing disorders is much larger than in developed countries. Vision, hearing and mobility are considered as the biggest challenge arising from ageing for India [34]. Moreover, cardiovascular diseases are prominent among the people aged 60 and above. Hypertensive heart disease is identified as the leading single cause of loss of healthy years in the developing countries [39]. Two- thirds of the 35.6 million people living with dementia reside in the developing countries.

Fear of falling is an alarming issue when the body ages. A survey on the Norwegian elderly people found that around 25% of the respondents had experienced a fall in the preceding six months of the survey time. Of those, more than one-half reported that their most recent fall had led to an injury and roughly 15% said it had resulted in a fracture. Similar data have been found in other research reports on same issue in Europe. In the US, according to the CDC, falls are the leading cause of injury-associated deaths among the over-65s, and are the leading cause of non-fatal injuries and hospital admissions for trauma among the same group. It is also found that the fear of falling can in itself place great restrictions on mobility and causes social isolation which leads to further negative outcomes [34].

However, no data have been found relating to the fear of falling for the developing countries.

3.2 Technological Support

Science and technology are central to the lived experiences and normative definitions of health and illness for ageing people. From pharmaceuticals, to walking aids, to cell phones, old people interact with technologies and science on a daily basis. Everyday technologies as well as biomedical interventions can be part of the way older adults pursue, maintain, and negotiate life [19].

A growing range of technologies and information systems are now available that are used to promote health, safety and social connectedness as the basis for healthy longevity. Smart technologies are available to enhance safety, security and surveillance [16].

In the developed country new technologies are now available to help integration and deliver care at home and communities to the elderly people. In Denmark,

telemedicine is used in standard patient treatments [9]. Video-enabled smart phones are used for supporting and remote consultation to the older people in Sweden [33].

Similar to this, in USA "Smart Personal Advisers" are used that use radio frequency identification and wireless technology to make an individual's personal diet information available on a screen based device that offer them in-store guidance while shopping for food and intelligent cardiopulmonary decision systems that apply telemedicine to provide early detection of and warning about patients at risk of congestive heart failure [21]. In Japan, nurse robots are being built to help care for elderly patients along with service robots that assist them at home. Such type of robots can open doors and handle trays and are equipped with a camera for remote monitoring [34]. In Australia, smart home technology is used and is currently available to assist older people to stay living at home, including those with impairments, activity limitations and disabilities. Besides, home sensors are an effective way to monitor falls, mobility and the performance of activities of daily living such as dressing, cleaning and food preparation. Moreover, robotics technology is currently available to assist older people and people with physical disabilities of which lower limb "exoskeleton" technologies are fitted to the outside of the limbs, rather than being internally fixed using surgical methods. They help people to walk and move from one position to another. Other technologies to assist with walking and mobility included robotic walkers and robotic guidance systems. Upper limb technologies included both upper limb exoskeleton systems to guide arm movements and haptic visuomotor feedback systems to assist to compensate for disorders of sensation and visual impairment [16]. Moreover, an increasing amount of researches are being conducted by universities, Government and private organizations in the developed countries for innovating technological products that would help the elderly people in their health care. According to the proposed model of hospital hotels in England, a small team of two or three nurses would operate 24-hours a day from a front desk and doctors would have to be called in for emergencies for the patients. If the patients get into difficulty the rooms would be equipped with panic buttons for patients to alert nurses [35]. IBM has conducted a pilot project survey with one monitoring tool in Bologna, Italy. This can monitor regular carbon di oxide emission by a person who lives alone. If any kind of irregularity is monitored the tool would send signal to the center or anyone from neighborhood as the neighbors give their consent to be a part of this project.

However, most of these technologies are neither available nor easily replicable in developing countries. There are two reasons behind this; one is the cost of the technology. Around 75% of the people of developing countries live in rural area and most of them are poor [2]. In most cases, all the technologies or technology developments are focused on people in urban settings who have money to actually buy these technologies. The other issue is the appropriateness, i.e. the technologies that are used in the developed countries may not be appropriate in the developing countries [22]. Yet, a sustainable health service system is an urgent need for the countries that are prone to the risk of ageing population.

4 Discussions

4.1 Understand the Challenge of Ageing Population in Near Future

Population ageing is happening in all regions and in countries at various levels of development. It is progressing fastest in developing countries, including in countries with large populations of young people. Although population ageing poses social and economic challenges to individuals, families and societies, with the right policies in place, societies can prepare for an ageing world, address the challenges and take advantage of the opportunities.

The economic and social consequences of aging are considerable, particularly with regard to the increasing burden of dependency. These consequences in the industrialized nations of Europe and North America have been well publicized. However, less is known about the effects in less well developed regions [27].

Sound health is highly correlated with population ageing. Developed countries are ready to face this challenge with adequate latest system of medication and technological tools for providing the sound health to the old people in their daily lives as they are more prone to different old age diseases. Mostly, the elderly people suffer from visionary problem, Alzheimer`s Disease, dementia, cardio vascular disease, diabetes, prostate enlargement, frailty are also common as old age diseases. Technology is being used to provide health services to the older in the form of assistive technology.

Generally assistive technology can assist older people with cognitive impairment in three ways. It provides assurance that the elder is safe and is performing necessary daily activities, and, if not, alerting a caregiver. Assurance system tracks an elder's behavior and provides up-to-date status reports to a caregiver. It helps elder compensate for his or her impairment, assisting in the performance of daily activities; and it assesses the elder's cognitive status.

Compensation systems gives direction to people as they carry out their daily activities, reminding them of what they need to do and the way of doing it. Assessment systems attempt to assess the activities i.e. how well a person is doing by comparing what her current cognitive level of functioning of with her performance of routine activities by continuous observations [27].

4.2 Create a Vision of Having such Technological Tools that Will Help the Developing Countries in the Next 40 Years

At present, 7 of the 15 countries with more than 10 million older people are in the developing world. By 2050, another 15 countries currently classified as 'developing' are expected to have 10 million or more older people. This generation is growing at a faster rate than the total population in almost all regions of the world [37]. Moreover, there is a growing recognition that the extent to which developing countries will be able to reduce the burden of disease and achieve health related goals will depend on

whether and how well they build their capacities to harness and apply science and technology. Besides, there are many developing countries that are lack of necessary health research and innovation capacities [25]. Though it is true for overall health research for all , here we create a vision of having technological tools capacities that are using in the developed countries now, will help the developing countries in the next 40 years.

4.3 Assess the Performance of the Existing Technological Tools in the Developed Country

A growing range of technologies and information systems are now available that can be used to promote health, safety and social connectedness as the basis for healthy longevity in the developed countries. It ranges from telemedicine to artificial limbs to smart home.

Tele-health for professionals is more developed, with comparatively strong evidence for efficacy for people with chronic conditions such as diabetes, heart disease, arthritis and stroke.

It is very obvious that old people lose their mobility over time; most of the times they tend to remain at home. However, when the suitable technology, like wheel chair, for moving around is introduced their scope of mobility can once again increased [15].In addition, technologies such as the SmartWheel have become increasingly popular as clinical tools for selecting and fitting the manual wheelchair to the user [3,7]. Technology is also being increasingly used in the health care sector for the delivery of services, in-home monitoring, interactive communication (e.g., between patient and physician), the transfer of health information, and peer support [29].

53% of American adults ages 65 and older use the internet or email. Though these adults are still less likely than all other age groups to use the internet, the latest data represent the first time that half of seniors are going online [41]. If this becomes a trend in all other developed countries, it can be inferred that the online tool which is currently being piloted in UK for families and friends caring for someone with dementia will be very effective in near future.

Inappropriate use of pharmaceutical drugs is a common reason of visits to hospital and emergency units. Many older people used to take more than four or five different medications. In Finland, an estimated 40–50% of hospitalizations among older people results from the improper use of medicines. Hence, device like talking pill bottle : a single function standalone device that assist visually or cognitively impaired patients in accessing recorded medication information. Kaiser Permanente has implemented this technology in over 140 facilities [14].

As there are number of constraints in replicating the technological support tools for the elderly people in the developing countries, it is required to implement new ways that is compatible with the existing resources with technological intervention.

4.4 Implement new ways of working - Take decisions to replicate technological tools in the developing country

Technology is playing a vital role in the health service of the developed countries for the elderly people. However, it is not possible to imitate all of them because of the poor infrastructural facilities and cost in the developing countries. A healthy condition of the infrastructure is an important source to thrive innovation. Most of the developing countries face the problems of insufficiency of these infrastructures [25]. Most of the people of developing countries are poor and those technologies are not affordable by them [40]. However, a number of opportunities are there that may work for helping the elderly people in developing regions.

Mobile companies set up networks throughout developing nations and sales of inexpensive mobile phones soared into the millions despite the low incomes of their people. Even in case, when the mobile phones are not available to people, creative entrepreneurs make them available locally for a per-use fee. Moreover, it is such a technology that does not require continuous supply of electricity [12].

Moreover, The Grameenphone Community Information Center is a shared premise where rural people may access a wide-range of state of art services such as Internet, voice communications, video conferencing and other information services in Bangladesh. This initiative by Grameenphone (the leading mobile operator in Bangladesh) is in line with the company's objective to serve local community needs by bridging the "digital divide" by providing information access to rural people, educating the underserved and underprivileged on information-based services. These centers are a unique business model that has won appreciation from the International community, such as from the Washington Post, from UNDP, as well as the blessings of several International bodies like Katalyst and the GSMA. The pilot project started in February 2006 with 16 CICs in the rural areas of Bangladesh; today the project has become a massive operation with over 500 CICs operating in nearly 450 sub-districts [11]. Even mobile phone is considered as a minicomputer with internet access and the functionality to perform businesses in the developing regions of the world where there is a lacking of continuous electricity supply, pure drinking water and smooth roads [32].

Besides, nearly 73 per cent of households in developing countries are covered by television [18] yet; electricity is not available in all rural areas of most of the developing countries, like, Bangladesh [6].In order to ensure a continuous electricity supply in the developing regions, it is expected that the private sectors role will more likely to include actions to develop business models for new energy solution [8].

Hence, this can be inferred that there exists a vast scope of technology interventions for welfare of elderly people in the developing countries so that the technologies are accessible, affordable and adaptable to the specific needs. Therefore, we need to think for new ways of working for the challenges due to the ageing in future in the health services sector in the developing countries.

Mobile Health Services - Mobile health services could a possible solution to the health services of the ageing people in the near future in developing countries because market penetration is approaching 100% even in the developing countries.

Mobile phones have many advantages when used as a healthcare tool. It helps to send text messages and make phone calls at real-time for critical information quickly and easily. Ultimately people who are living in remote areas can reduce unnecessary travel to health centers for health services. Smartphones and broadband-enabled devices can become medical devices/tools, used for monitoring vital signs and body functions or as videoconferencing equipment, facilitating remote consultations even in the developing countries. In the developing countries where resources are under increasing pressure, mobile health service has the potential not only to cut costs but also to free up badly needed capacity. As we discussed earlier, for developed countries with aging populations, sensors connected to home alert systems improve safety and prevent needless deaths through accidents or falls. Similar services can be provided through mobile technology. Mobile technology can do everything from checking on patients' vital signs to sending individuals reminders to take their medications on time [33]. It also allows doctors to reach more patients. Pilot projects in India show that, using remote diagnostics and telemedicine, doctors can reach twice as many rural patients as they could through face-to-face consultations. Since the necessary infrastructure is already in the hands of millions of citizens, widespread adoption of mobile health services requires relatively low investment. Bangladesh, Pakistan, and India are rapidly growing markets for mobile services. Meanwhile, increasing bandwidth is enabling more complex services to be delivered to mobile devices, particularly as the adoption of smartphones increases. Through this process, patients receive and share more health information and become more skilled at managing their own healthcare. Hence, this can be a possible solution to the health services of the elderly people in future [33].

Tele-nursing - In many developing countries, like Bangladesh, Pakistan, and India lack sufficient numbers of skilled healthcare workers—physicians, nurses, and specialists—to serve their populations. This situation has been worsening by the migration of healthcare workers over the past three decades to mature markets. In this situation, tele-nursing could another way of providing health services to the elder people in the developing countries. Tele-nursing refers to the use of telecommunications and information technology in order to provide nursing services in health care whenever a large physical distance exists between patient and nurses. As we discussed earlier mobile telecommunication is diffusing in the developing countries in a high rate, therefore, there is a place for tele-nursing for providing health services to the elderly people in the future. Moreover, Community Information Center can also play a significant role in this case by bridging the gap between patients and the nurses. As most elderly people prefer home care to residential care, tele-nursing is essential to allow elderly people to maintain their autonomy by strengthening their emotional, relational and social abilities. As tele-nursing is considered as complement to traditional nursing practices and as the elderly have appreciated the opportunity to use video-telephony to communicate with a nurse about their needs, expectations and feelings, tele-nursing could be another way of supporting the elderly people in the developing countries for their health care.

IPTV Solution - IPTV could be another solution to the health services to the elderly people of the developing countries in future. This could be done through e-

learning of the health practitioners. IPTV is a nursing communication and management system using IP technology that can be used for both wired and wireless connections. In the developing regions, if training can be provided to the nurses for working on IPTV, they can have a contact with the patients who are in the remote place. The system is comprised of a set of push buttons and wireless sensors which make it possible for nursing staff to keep track at all times of the state of each patient or resident, thereby increasing their safety and comfort. In Australia, IPTV has been used in a pilot survey to measure its effectiveness as a distant health tool. It is considered as a tool that can be used to lower the rate of diabetes and to cut and manage the cost of the treatment [26]. Though the initial cost would be very high, with the increase in volume it could be decreased over time. According to International Telecommunication Union (ITU) coordinator Masahito Kawamori, it is expected that in near future people of developing countries might consult their medical doctors through their television sets at home, by using an IPTV [24].

Such technology can be used for the people who are not very familiar and comfortable with computer as TV is like a very common item in the household. If it is possible to train the nursing staff for IPTV, it may possible to provide necessary information by the trained nurse who interact with people in need and their care-givers and who are able to personalize the information and distribute it, especially to remote and regional areas in the developing countries.

5 Conclusions

The above analysis has yielded important insights into the necessity and of introducing technology in the health service sectors and showing the way out of the developing countries for meeting the challenges of the time ahead for ageing population. Presence of technological interference as health care tool in the developed countries provides an opportunity of learning lessons and innovation for the developing countries. Developed countries are well prepared for facing the challenge of ageing population as the scenario is approaching to them gradually. Moreover, researches are being conducted for coping up with the situation in a more affluent way in these regions. With the help of mobile technology or Community Information Center (CIC), developing countries would be capable of facing the challenges of health service problem related to ageing in the future. In this regard, exploring potentials for the implementation of e-health in the health service sector in the developing countries is considered as a realistic option for future work. Leveraging innovation to achieve sustainable health service systems that deliver defensible health sector builds the way forward strong for facing the challenges ahead and improving the quality of life in the developing countries.

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