

# Chapter 10

## Using Pervasive Computing for Sustainable Healthcare in an Aging Population

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### ABSTRACT

*Statistics have shown that not only the proportion of elderly as part of the world's population is growing, but there also is a growing deficit of the working population compared to the retired population. Therefore, the provision for age-related medical conditions will put a heavy pressure on the healthcare system. This chapter discusses how pervasive computing can be used to help to achieve sustainability in healthcare for the elderly. Mobile devices can facilitate old adults to actively seek for health and nutrition information, beware of their vital signs, and follow an active life style in a safe manner. Light-weight wearable electronic devices can provide acute care and rehabilitation services to the elderly without causing a big impact to their quality of life. A model is suggested to integrate the use of pervasive computing in health education, health management, doctor support, and monitored rehabilitation at home.*

### INTRODUCTION

This chapter discusses the use of pervasive computing in health care at a time when the world is facing the challenge of an aging population and uncertain economic future. The world's population is expected to grow to 9.2 billion by 2050. Although the rate of growth is dropping, from approximately 1.2% per year at 2012 to less than 0.5% per year by 2050, this is a trend of population aging. The median age of the world's population was 28 in 2012, and it will be about 38 in 2050. Moreover, the problem of the population aging will be more serious in developed countries than in developing countries. By 2050, the median age will be 41 in North America and Asia, 45 in China, and 47 in Europe (Magnus, 2012).

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As people grow old, their needs for health care increase. For example, old people may suffer from acute illness such as stroke or bone fracture due to falling, and chronic illnesses such as dementia, diabetes, or high blood pressure. The provision for age-related medical conditions will put a heavy pressure on the healthcare system. In China alone, it is estimated that the expense on age-related diseases will be more than 200 billion yuan by 2050 (Sun et al., 2016). Therefore, there is a real and urgent need to find ways to improve the quality of healthcare, while controlling the cost of diagnostics, treatment and rehabilitation. An important part of the solution to the problem is to change the focus of health care for the elderly from a reactive model to a preventive model. This means on one hand, old adults have to be encouraged and educated to actively seek for health and nutrition information, beware of their vital signs, and follow an active life style in a safe manner. On the other hand, another part of the solution is to use light-weight wearable electronic devices, in association with communication technologies, to provide acute care and rehabilitation services to the elderly without causing a big impact to their quality of life. As the elderly take a more active role in self-care, they can help to prevent injuries, minimize illness and reduce the cost on healthcare and rehabilitation.

## **BACKGROUND**

The problem of the aging population can be measured by the Elderly Dependency Ratio (EDR). Basically, EDR is ratio of the number of people who have reached retirement age to the number of people of working age. An EDR of greater than 50% means there is a person at the working age has to support more than one elderly person. The specific definition depends on the designated retirement age of the society under study. For example, Athauda et al. (2015, p.97) defined EDR as “the ratio between the population over 65 years, and the population between 15-65 years of age”. The Organization for Economic Co-operation and Development (OECD) defined EDR as the number of persons of working age (aged 15 to 64) per person aged 65 or over (Harper, 2014). The OECD estimated that by 2050, the EDR is expected to reach 51% for the European Union members, and 74% for Japan. An alternative measure is the difference in the number of people reaching the working age to the number of people reaching the retirement age. Based on this measure, there is a demographic deficit for the OECD members around 2016. In the foreseeable future, the world will see an EDR of greater than 51% and a demographic deficit. This implies that not only a working person has to support more than one elderly, but also that the trend will get worse as time goes by. Therefore, new and sustainable forms of health care will be crucial to meet the growing demand for more and more age-related spending, in the face of a declining portion of people of the working age.

Blowfield (2013, p.6) defined sustainability as “meeting the needs of the present generation without compromising the ability of future generations to meet their own needs”. This definition has implications for governments and businesses. One of the implications is that it must meet the increased expectations of today’s citizens and consumers. With today’s advances in telecommunications network and high proliferation of technology, the elderly and their care-takers expect that they can get better healthcare without substantial increase in cost and causing excessive burden on future generations. The use of pervasive computing is a solution to achieve that sustainability.

Korhonen and Bardram (2004, p. 229) defined pervasive computing as “the integration of computing power (microprocessors) and sensing (sensors) into anything, including not only traditional computers,

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