

Can Smart Elderly Care Promote Active Aging Effectively? – A Mini-Review

Meiyu Li¹, Quan Zhang^{2,*}

¹China University of Petroleum (East China), Qingdao, Shandong 266580, China

²Ocean University of China, Qingdao, Shandong 266100, China

*Corresponding author

Keywords: smart elderly care; effect evaluation; active aging

Abstract: Objective answer the key question of whether smart elderly care can promote active aging effectively. Methods review the articles on the effect evaluation of smart elderly care systematically, and answer the research question from multiple aspects. Results smart elderly care can effectively promote the elderly's physical health, relieve their mental loneliness and assist their independent life. Conclusion smart elderly care has broad prospect in promoting active aging, which makes itself an important development direction of elderly care and aging industry.

1. Introduction

After World War II, the growing elderly population has put persistent pressure on economic, social, medical and care arrangements in various countries. According to the EU Aging Report, significant changes will occur in the social demographic structure, which requires each country to shift from the welfare model to individual model. In this sense, family will become the main place for caring the elderly [1]. In order to deal with the relative shortage of nursing staff and increasing demand for the elderly care services, many emerging technologies have been used to support the process of in-place aging, among which the smart home technology for elderly care (smart elderly care) is an important one [2]. Smart elderly care is committed to providing intelligent services through telemedicine, assistive technology and safety technology to meet demands of the elderly such as health, safety and independence, and it is considered as an important way to solve the aging problem [3]. However, an issue that cannot be ignored is, whether smart elderly care can achieve the expected results in the implementation process. In other words, whether it can actually help the elderly achieve the goals of active aging, and this is undoubtedly the key issue of smart elderly care's development. In this paper, we conduct a systematic review of articles on the effect evaluation of smart elderly care. In addition, we also put forward policy suggestion about smart elderly care according to the analysis result.

2. Definition of smart elderly care

Smart home care is the application of smart home technologies in the elderly care provision [4]. Since the physical and psychological conditions of the elderly are different from the children and the young, their needs for smart home technologies are unique to some extent compared with the non-elderly group. To be specific, Health needs are the elderly's most important needs for smart home care, which is due to the health challenges associated with their reduced physical function [5]. Safety needs are equally urgent for the elderly. It is vital for them to prevent external intrusion into the housing, fire and gas accidents, and their falling down in toilets and kitchens. Smart elderly care is committed to keeping the elderly safe through safety monitoring and emergency rescue [6]. Besides, smart assistive services (behavioral assistive services, environmental assistive services) [7] and nursing services (remote nursing, on-site nursing) [8] are also critical for those elderly people who are impaired in physical function and unable to live independently. To sum up, smart elderly care is to provide various kinds of smart caring services for the elderly with the use of smart home technologies, aiming to meet their essential needs (health, safety, independence, nursing etc.) and

promote their health and active aging.

3. Methods for effect evaluation of smart elderly care

In recent years, effect evaluation of smart elderly care has become a hot topic. Effect evaluation of smart elderly care aims to investigate whether it can bring better service with lower cost for the elderly and actually promote their active aging. This issue is related not only to the actual function of the smart elderly care, but also to the elderly' experience and perception [9]. The evaluation scenarios include both in the laboratory and in the real smart homes [10]. The evaluation methods include both qualitative methods (in-depth interview, semi-structured interview, focus group, participatory observation, cultural probes, etc.) and quantitative methods (questionnaire survey). Cultural probes are special kinds of observation method, which aim to record details of the elderly' daily lives by collecting information (hand-drawn plans, photo albums) other than answers to survey questions, which can gain a deeper understanding of their family space and family life [11]. Questionnaires are used to obtain quantitative data on the elderly' perceptions, emotions, intentions and actual use of smart home care. Comprehensive application of quantitative and qualitative methods makes the evaluation more scientific and meticulous.

4. Results of effect evaluation of smart elderly care

There are many kinds of smart elderly care, and the effect of smart physical health care, smart mental health care, smart assistive service and other kinds of smart elderly care have been evaluated by the scholars.

4.1 The effect of smart physical health care for the elderly

As the most mature type of smart elderly care, its effect has been proved by many scholars. Steven et al. confirmed that the indexes of blood glucose, blood pressure, low density lipoprotein cholesterol level have been improved in elderly users of remote smart care [12]. Giordano et al. found that home-based telemedicine services could significantly improve the health of the elderly, and their incidence of hospitalization were reduced by 36% [13]. West et al. also found that 68% of elderly' health was improved by home health services including tele monitoring and counseling [14]. Pinto et al. identified that smart elderly care and health services could significantly improve physical function and reduce the incidence of re-admission and emergency visit of the elderly [15]. Sicotte et al. also found that smart telehealth services can improve the older people's overall quality of life more effective than traditional care [16].

4.2 The effect of smart mental health care for the elderly

The vulnerability of the elderly is manifested not only by the decline of physical function, but also by the spiritual loneliness from isolation of society. Therefore, smart mental health care is of great importance for the elderly. Almost all researchers found that smart mental health care are effective in promoting the physical and mental health of the elderly. For example, smart interaction settings such as the Internet and smart robots can help the elderly to establish social contact with the outside world, which could effectively reduce the social isolation of the elderly [17,18]. Other scholars also found that smart mental health care can also increase the elderly' social function and overall health, enhance their positive emotions, and reduce their incidence of depression [19].

4.3 The effect of smart assistive services for the elderly

As for the effect of smart assistive services for the elderly, only a few scholars reported the lack of effect of assistive technology in helping the elderly with in-place aging [20] most scholars confirmed its positive effect. Shimada et al. confirmed that assistive technology can effectively improve the walking speed of the elderly [21]. Rantz et al. found that the use of sensors and other assistive technologies can effectively reduce the frequency of falls of the elderly [22]. Khosravi and Ghapanchi conducted a literature review study and also found that four among the five studies on

the effect of fall prevention service were significantly effective, and five among the five studies on the promotion of independent living were significantly effective [23]. In addition, many researchers also found that the elderly prefer simple solutions such as smart handles, video communication and emergency call button compared with complex solutions, and simple technologies such as electric doors can also help the elderly to gain autonomy in familiar environments [24]. That is to say, even the simplest assistive services can improve the elderly' ability of independent living and thus promote their in-place aging and active aging.

4.4 The effect of smart safety and nursing care for the elderly

There are few researches on the effect of smart safety and nursing care services for the elderly. Never the less, many studies have confirmed that comprehensive smart elderly care can effectively improve the overall quality of life for the elderly [25,26].

5. Discussion and conclusions

According to the systematic review of relevant studies, it is found that smart elderly care has significant effects in promoting the elderly' physical health, alleviating their loneliness, and assisting their independent life. Therefore, smart elderly care has broad prospects in promoting active aging and resolving the aging problem, which make itself an important development direction of elderly care and ageing industry.

The research result can also provide some important enlightenments for the development of smart elderly care. Firstly, the design of smart elderly care should go beyond technology itself, and pay more attention to the elderly' experience. Since the effect of smart elderly care is determined largely by the elderly' experience and perceptions, customer-oriented technology development is of great importance. Secondly, the technologies of smart elderly care has become more and more mature and show reliable and good practical effect. It is advisable to promote smart elderly care services and enlarge its application, which can not only help the elderly to save treatment and caring costs, but also reduce outpatient visits and bed pressures of the hospitals. Thirdly, more attention should be paid to the elderly' loneliness and risk of mental health, and the supply of smart mental health care should be strengthened. The physical health is closely related to mental health for the elderly, smart mental health services should be carried out prospectively for the elderly, which could prevent the physical diseases caused by depression and loneliness and maintain their physical and mental health at a lower cost. Lastly, both simple and complex smart assistive services can produce good effect, and those simple ones are more favored by the elderly. Therefore, the supply of smart assistive services should be in line with the elderly' needs rather than self-functional readiness.

Acknowledgements

The research was supported by the social science planning project of Shandong province, PR China (16CQXJ07). The funding body did not influence this paper in any way prior to circulation.

References

- [1] European Commission. The 2012 Ageing Report: Economic and budgetary projections for the 27 EU Member States (2010–2060). 2020.
- [2] Beard J. Innovative approaches to dealing with population ageing. *Gerontechnology*, 2010, 9 (2): 64.
- [3] Peine A, Rollwagen I, Neven L. The rise of the “innosumer”: Rethinking older technology users. *Technological Forecasting & Social Change*, 2014, 82 (2): 199-214.
- [4] Sponselee A, Schouten B, Bouwhuis D, et al. Smart home technology for the elderly: Perceptions of multidisciplinary stakeholders. *Communications in Computer & Information Science*, 2008.

- [5] Raad M W, Yang L T. A ubiquitous smart home for elderly. *Information Systems Frontiers*, 2009, 11 (5): 529-536.
- [6] Kang H G, Mahoney D F, Hoenig H, et al. In situ monitoring of health in older adults: Technologies and issues. *Journal of the American Geriatrics Society*, 2010, 58 (8): 1579-1586.
- [7] Fox C, Rodrigues L T, Altomonte S, et al. A review of the potential of smart homes to support independent living. *16th International Conference on Sustainable Energy Technologies*, 2017.
- [8] Udupa P, Yellampalli S S. Smart home for eldercare using wireless sensor. *Circuit World*, 2018, 44 (2): 69-77.
- [9] Connelly K, Mokhtari M, Falk T H. Approaches to understanding the impact of technologies for aging in place: A mini-review. *Gerontology*, 2014, 60 (3): 282-288.
- [10] Abowd G D, Atkeson C G, Bobick A F, et al. Living laboratories: The future computing environments group at the Georgia institute of technology. *CHI'00 Extended Abstracts on Human Factors in Computing Systems*, 2000.
- [11] Gaver W W, Boucher A, Pennington S, et al. Cultural probes and the value of uncertainty. *Interactions*, 2004 ,11 (5): 53-56.
- [12] Shea S, Weinstock R S, Teresi J A, et al. A randomized trial comparing telemedicine case management with usual care in older, ethnically diverse, medically underserved patients with diabetes mellitus: 5-year results of the IDEATel study. *Journal of the American Medical Informatics Association*, 2009, 16 (4): 446-456.
- [13] Giordano A, Scalvini S, Zanelli E, et al. Multicenter randomized trial on home-based tele management to prevent hospital readmission of patients with chronic heart failure. *International Journal of Cardiology*, 2009, 131 (2): 192-199.
- [14] West S P, Laguna C, Trief P M, et al. Goal setting using telemedicine in rural underserved older adults with diabetes: Experiences from the informatics for diabetes education and telemedicine project. *Telemedicine and e-Health*, 2010, 16 (4): 405-416.
- [15] Pinto A, Almeida J P, Pinto S, et al. Home telemonitoring of non-invasive ventilation decreases healthcare utilisation in a prospective controlled trial of patients with amyotrophic lateral sclerosis. *Journal of Neurology, Neurosurgery & Psychiatry*, 2010,81 (11): 1238-1242.
- [16] Sicotte C, Paré G, Morin S, et al. Effects of home telemonitoring to support improved care for chronic obstructive pulmonary diseases. *Telemedicine journal and e-health*, 2011, 17 (2): 95-103.
- [17] Bradley N, Poppen W. Assistive technology, computers and Internet may decrease sense of isolation for homebound elderly and disabled persons. *Technology and disability*, 2003, 15 (1): 19-25.
- [18] Wada K, Shibata T, Saito T, et al. Effects of robot assisted activity to elderly people who stay at a health service facility for the aged. *RSJ International Conference on Intelligent Robots and Systems*, 2003.
- [19] Gellis Z D, Kenaley B, McGinty J, et al. Outcomes of a telehealth intervention for homebound older adults with heart or chronic respiratory failure: a randomized controlled trial. *The Gerontologist*, 2012, 52 (4): 541-552.
- [20] Chau P C, Lee D T F, Yu D S F, et al. A feasibility study to investigate the acceptability and potential effectiveness of a telecare service for older people with chronic obstructive pulmonary disease. *International Journal of Medical Informatics*, 2012, 81 (10): 674-682.
- [21] Shimada H, Hirata T, Kimura Y, et al. Effects of a robotic walking exercise on walking performance in community-dwelling elderly adults. *Geriatrics & Gerontology International*, 2009, 9 (4): 372-381.

- [22] Rantz M J, Skubic M, Miller S J, et al. Sensor technology to support aging in place. *Journal of the American Medical Directors Association*, 2013, 14 (6): 386-391.
- [23] Khosravi P, Ghapanchi A H. Investigating the effectiveness of technologies applied to assist seniors: a systematic literature review. *International journal of medical informatics*, 2016, 85 (1): 17-26.
- [24] Siegel C, Dorner E. Information technologies for active and assisted living: Influences to the quality of life of an ageing society. *International journal of medical informatics*, 2017, 100 (4): 32-45.
- [25] Pal D, Triyason T, Funikul S. Smart homes and quality of life for the elderly: A systematic review. *2017 IEEE International Symposium on Multimedia*, 2017.
- [26] Thapliyal H, Nath R K, Mohanty S P. Smart home environment for mild cognitive impairment population: Solutions to improve care and quality of life. *IEEE Consumer Electronics Magazine*, 2018, 7 (1): 68-76.