Research on Urban Elderly Service Design
In Post-epidemic Era

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Abstract

The sudden emergence of COVID-19 has brought about huge challenges in urban elderly care services, including Super Aged countries (Japan, Singapore) and Entering Aging countries (China). COVID-19 has greater harm to the elderly as they have weaker resistance to the virus compared to others. The health crisis not only highlights the problems of the existing urban elderly care services; it also exposes issues associated with the insufficient preparations for the health crisis. This includes the shortage of health resources (materials and professional treatment procedures) as well as the inability of existing elderly care services to quickly adapt to the new normal.

There is practical significance in moving forward and transforming existing elderly care services in the post-epidemic era. This crisis acts as a turning point to create new methods in providing elderly care services. Investigative case analysis projects were done in China since January 2020. The research was done specifically on families and nursing homes in Shanghai, Bozhou (Anhui Province), and Guangzhou to decipher new problems that have emerged during the epidemic. This research used a comprehensive cross-professional collaboration and the service design methodology to build a service design system framework for urban elderly care services in the post-epidemic era. The framework includes a smart service system combined with normal and critical service scenarios for elderly with special needs, as well as cross-generational games to promote active ageing and

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intergenerational communication.

Keyword: Service Design, COVID-19, Urban health crisis, Elderly care services.

I. Introduction

A.   *Overview of Urban Elderly Care*

The world population aged over 65 is expected to double from 357 million in 1990 to 761 million in 2025 [1]. By 2030, 34 major countries around the world would become "Super Aged", meaning that over 20% of their population will be aged 65 years or older. By 2030, the proportion of people aged 60 and over in Chinese cities will reach 14.8% [2]. Urban elderly care in these cities is mainly composed of home care, nursing home care, and community care. There have been several countermeasures introduced by various countries. For example, the "9073" plan launched in Shanghai since 2005 allowed 90% of the elderly to use self-help or family member care at home. 7% was supplemented by community care and 3% was supplemented by nursing home care. Singapore announced an Action Plan for Successful Ageing to help Singaporeans confidently lead active lives with their families and the community [3]. Tokyo, Japan launched the Social 5.0 policy in 2016, where smart services was applied to change the way of service, life, and survival to tackle the low birthrate and aging society.

The influence of traditional family concepts and structure has led to the demand for home elderly care becoming very huge. Hence, it has become the focus of the elderly care industry in the future [5]. In China, home care in different regions still face common problems such as insufficient service providers, inadequate service levels, ineffective communication between government bodies, and low elderly participation [6]. In Japan, the government and companies are trying to use family companion robots to imitate family members to provide companionship services to solve the problem of families being smaller in the current context [13].

Nursing homes for the elderly should obtain better medical and nursing services. Nursing homes are mostly equipped with rehabilitation staff, doctors, nursing staff, and related facilities to provide professional nursing services and rehabilitation services. The elderly can benefit more from professional services as compared to from receiving home care. This is because, medical treatment is more accessible in the former. Nursing homes also organize a variety of activities, thereby assisting the elderly to socialize. Nursing homes currently have problems with semi-collectivization, lack of freedom and privacy, and high costs.

Community care is an effective supplement and combination of the above two elderly care modes. Community care combines the advantages of both home care and institutional care. The elderly live in their own homes, and while being taken care of by their family members, they can receive services provided by community organizations. For example, Shanghai has launched a "Good-Neighborhood Center" and an "Old Mate Program" as part of their smart community planning. In addition, Japan has launched services such as daycare, elderly care, and remote elderly care. The relevant elderly facilities in their daycare centers provide basic medical care, nursing services, dining services, learning, and training services. Singapore Active Ageing Programs (AAPs) encourage seniors to stay active, healthy, and socially engaged in their neighborhood [4].

B.   *Challenges in Urban Elderly Care due to COVID-19*

The elderly have lower resistance to the virus due to their relatively weaker immune system compared to others. This has resulted in the urban elderly being greatly affected by COVID-19. More than 80% of deaths among patients with pneumonia infected with COVID-19 were over the age of 60, and more than 75% had one or more underlying diseases.

Nursing homes lacked countermeasures during the epidemic and faced huge challenges. The number of deaths in elderly care institutions accounted for 1/3-1/2 of the total number of people infected with the virus. In the early stage of the epidemic, anti-epidemic materials were insufficient, and there was critical pressure on elderly care institutions. In China, the elderly

care institutions have been struggling to cope with the massive demand for medical resources by infected individuals during the outbreak. [8]. Moreover, the nursing staff consists of older people have a weaker learning ability and less practical experience to deal with medical emergencies. The nursing homes in the U.S. faced issues such as the lack of isolation measures and having insufficient epidemic prevention materials [9]. In addition to being vulnerable to the virus, the elderly in nursing homes are also prone to suffer from physical and psychological distress. In additions, they face malnutrition due to the lack of common food and nursing assistance. This leads to the risk of illness and hospitalization being increased [10]. The closed management of nursing homes causes the elderly to encounter social isolation, and this further trigger anxiety and depression [11].

Since the elderly is a high-risk susceptible group, their frequency of going out if minimized even in home care. Tasks that could normally be done independently now require more support from community services [12]. Moreover, the reduction of social connection and physical exercise can bring about issues of family tension and depression.

During the spread of COVID-19, many of the community daycare centers were closed. Amid the chronic shortage of home care workers, daycare centers faced difficulty in dispatching new caregivers. In many cases, family members had to be requested to take care of the elderly.

In response to this public health crisis, there is a need for urban elderly care to form a strong capability to prevent undesirable consequences during emergencies. Cities have the advantage of internet technology and urban comprehensive supporting services. Community and home care services should make full use of these infrastructures and conditions, to provide assistance to the elderly flexibly and efficiently, and save public medical resources for patients in more dire situations.

II. Related Work

Countries around the world actively use information and computer technologies to respond quickly. The elderly may be less adaptable to new technologies, however, under the circumstances of COVID-19, they would need to learn quickly. The government, communities (online and offline), and young people should actively help the elderly to adapt and learn quickly so that the elderly can enjoy the benefits of technology, as well as keep connected with society.

The research team has observed that some of the current practices are extensions of existing elderly care services and emergency plans. Although the epidemic is separated from the physical space, at the psychological level relationships between people are getting closer. More people have been offering help to the neglected elderly with tasks such as shopping, studying, and providing companionship, which reflects the glory of humanity. However, a systematic design for the normalization of the epidemic needs to be explored. This includes creating a bridge for the digital divide; a customized design for the physical and mental peculiarities of the elderly; and considering the lack of adequate caregivers; creating a quick iterative transformation at a reasonable cost.

- Weekly Volunteer Phone Call, USA

    The student interest group of Geriatrics at Yale University School of Medicine had a key focus on the social isolation of the elderly. They initiated a weekly phone call activity between the elderly in nursing homes and student volunteers to alleviate the social isolation of the elderly during COVID-19 [15].

- Adopt a Grandparent, UK

    The "Adopt a Grandparent" campaign in Brownscombe House Nursing Home in the UK, was intended to bring about a sense of comfort to young people and the elderly who may not have grandparents/grandchildren of their own. This helps to create long-lasting intergenerational friendships.

- Virtual Support and Activities to Help More Seniors During Circuit Breaker, Singapore

The Infocomm Media Development Authority (IMDA) has partnered with National Library Board (NLB) and Mediacorp to develop Season 3 of the "Learn Together With Me" television programme to share tips on common digital services and applications. IMDA is also using the concept of selling fresh seafood through Facebook Live. This initiative aims to build seniors' interest to go digital and also to help them understand the convenience of using digital tools to carry out their daily activities such as purchasing groceries online easily.

- Go Out for the Elderly, Japan

The nursing homes in Japan began to ban elderly people from going out, and they were only allowed to see their families through the windows. This has led to increased mental distress amongst the elderly. Nursing homes and service agents have negotiated and launched a new purchasing service. The service agent needs to use a smartphone to perform a live broadcast of the whole process. The elderly can then go out to watch the live video to relief any mental distress.

III. The Design Approach

The research team adopted a tools of service design for the methodology in this research. Service design helps to innovate or improve existing services to make them more useful, desirable for clients, efficient and effective for organizations. It is a holistic, multidisciplinary, and integrative field. There are six service design principles: Human-centered, Collaborative, Iterative, Sequential, Real and Holistic [14].

In recent years, service design has played many roles in elderly care services. This research attempts to combine the various situations and demands of different types of elderly to create a service design process for them. The epidemic can be categorized into three phases. The pre-crisis, during-the-crisis and post-crisis. These phases are linked with three concerns. When the crisis is considered as a turning point, the design of the service system would be carried out to improve urban elderly care services under the new normal.

A.   *The In-depth Interviews and Co-Creation Workshops*

From April to August 2020, the research team conducted in-depth research and co-creation in some urban nursing homes in the cities of Shanghai and Bozhou (Anhui Province). The research and co-creation were further extended to 8 families with elderly people in Guangzhou (Guangdong Province) and Shandong Province, China. A total of 36 elderly people and 20 stakeholders were interviewed, including:

1) 36 elderly people aged between 60 and 88: 23 were staying in a small nursing home in Bozhou (Anhui Province), 5 were staying in a large nursing home in Shanghai, 3 individuals from a family in Shanghai, 3 individuals from a family in Guangzhou and 2 individuals from Shandong Province where each was living alone;

2) 20 stakeholders who consisted of the staff involved in different positions in the nursing home, administration, and medical staff, family caregivers, and community volunteers, etc.

The research was comprised of three parts:

1) Semi-open interviews were conducted to understand the living conditions contributed by the existing services during the epidemic, and also to understand the needs and expectations of the elderly and different stakeholders.

2) Co-creation workshops of needs were designed to explore the pain points and needs of the elderly during the epidemic based on the promotion of better mutual communication between the caregiver and the elderly.

3) Co-creation workshops of designs were created to explore smart service systems and service scenarios for the elderly in the future by utilizing the epidemic as an opportunity.

Considering the fact that the elderly are usually less open to accepting new concepts, the workshop provided a variety of cards in different links to motivate the elderly and stakeholders to participate in the workshop more smoothly. In the Co-creation workshops of needs,

stakeholder cards, tool kits, technology empowerment cards, inspiration cards, and blank cards were provided. In the Co-creation workshops of designs, behavior cards, technical products, epidemic prevention cards, and epidemic response cards were also provided. Figure 1 shows the in-depth interviews being conducted as well as the some of the cards provided in the co-creation workshops.

Figure 1. The in-depth interview and co-creation workshop

B. *The Visioning and Backtracking*

After the in-depth interview, the research team mainly adopted visioning and backtracking, which are part of the design tools developed by the transition design proposed by Carnegie Mellon University in 2015 [16]. It uses a regressive thinking model to think about how to solve systematic problems on a macro level. By envisioning a long-term future and backtracking to present, the "short-term future" and "long-term future" can be connected, and the possible future and the current situation can be integrated. Backtracking based on the envisioning, three phases were defined: long-term (6-10 years), medium-term (4-6 years), and short-term (0-3 years) were defined. In each phase, service scenarios were established from far to near and the corresponding strategy was developed in the four dimensions namely technology, service, business, and community.

IV. Results

The research team concluded that urban elderly care services in the post-epidemic era should focus on three top-down and point-to-face concerns which are as follows:

- Smart service system combining normal situations and crises

- Service scenarios for elderly with special needs

- Cross-generational game to promote active intergenerational communications

A.   Smart service system combining normal situations and crises

The service system is an organic structure that incorporates user behavior, time, place, product, information, environment, personnel, and emotional experience. The service system can manage the elderly's personal information, nursing records, and other information obtained through sensors. Through the communication network, medical staff can understand the overall information of the elderly and relevant chronic diseases at a glance. The computing and decision-making platforms can quickly make responses to abrupt changes based on the logic model.

This research makes reference to the existing disaster prevention service system in Japan, where a three-stage service of pre-crisis, mid-crisis, and post-crisis was developed to ensure that emergency and epidemic prevention can be done as soon as possible by using appropriate technical tools. This further helps to reduce the impact of the epidemic on the elderly and to improve the quality of care during and after the epidemic. Figure 2 illustrates the smart service system. The technological tools include telemedicine solutions that aid non-contact remote medical support and monitoring, as well as audio-visual systems that can help the elderly, nursing home staff, and family members to exchange information. The handy education and training are essential for the elderly to adapt to digital services, and for the nursing and health caregivers to prepare for the normalization of the epidemic.

Figure 2. Smart service system combining pre-crisis, in the crisis, and post-crisis

Pre-crisis

(1) Training and enhancing the caregivers' professional knowledge of geriatric medicine or geriatric psychiatry, including preparations for crisis response materials, blocking facilities. This stage further includes training of nursing staff.

(2) Establishing good relationships between caregivers and the elderly and conducting health assessments for elderly. This further includes improving their participation in self-health management and assisting them to fully prepare for the crisis.

(3) Establishing basic databases and electronic medical records for the elderly in home care and nursing homes.

In the crisis

(1) Rapid detection and treatment: Trained nursing home staff can use portable medical clinics to perform auxiliary clinical assessments, tests and quickly set up temporary blocking areas and send positive-tested patients to the hospital.

(2) Communication and spiritual encouragement: Volunteers will provide neighborhood shopping, drug delivery, and accompany services, and coordinate nursing and health supplies with local public health agencies.

(3) Remote monitoring and care: The "treatment team" composed of clinical monitors test the elderly and caregivers for potential infections through remote guidance.

Post-crisis

(1) Rehabilitation and healthy behavior: Conduct regular physical and mental assessment on the elderly. Following which, rehabilitation plan is developed, and sports and social activities would be supervised.

(2) Continue to maintain appropriate social distancing: Observe and provide feedback on infection control measures and the use of personal protective equipment.

(3) Digital learning: Provide continuous education and information for the elderly and caregivers through the online learning system.

B. *Service scenarios for elderly with special needs*

The research team found that female elderly who live on their own and the elderly living in nursing homes are the elderly with special needs that are worthy of in-depth analysis. The research team generated the following service scenarios.

1) *Service scenarios for Elderly Women who live on their own*

The China Development Report in 2020 pointed out that the number of households with elderly living on their own aged above 65-years-old is on the rise. The increase is projected to be from 25.4 million households in 2020 to 53.1 million households in 2050 [17]. The proportion of women living on their own is higher than that of men since women have a longer average life expectancy. There is also a higher likelihood of widowhood amongst the elderly. In addition, the mental and physical health of elderly women and men are quite different [18, 19, 20]. The existing home elderly care services face difficulty in adapting and meeting their various needs.

With the reduced burden of childcare and the loss of social contact in the workplace, coupled with the social isolation that may be brought about by the epidemic era, companionship will become a very important part of the retirement lifestyle of elderly women who live on their own. They may prefer to live together with a few friends in a shared space to enjoy companionship as well as look out for each other.

The research team used envisioning and backtracking to generate three terms of service scenarios for elderly women living on their own The short-term (0-3 years) service scenarios provide co-living services suitable for female elders, including the joint design of indoor facilities before move-in, daily assistance, and emergency services after move-in. This further includes the smart service system for healthy and independent living. The medium-term (4-6 years) service scenarios establish a co-living community suitable for elderly women. The living space is customized according to the physical conditions and personal needs of the different residents. Convenient living assistance would also be provided to help residents live independently through smart services. Indoor smart services such as artificial intelligence and telemedicine would also be normalized. The long-term (6-10 years) service scenarios are the vision. Figure 3 illustrates the three terms of service scenarios for elderly women living on their own.
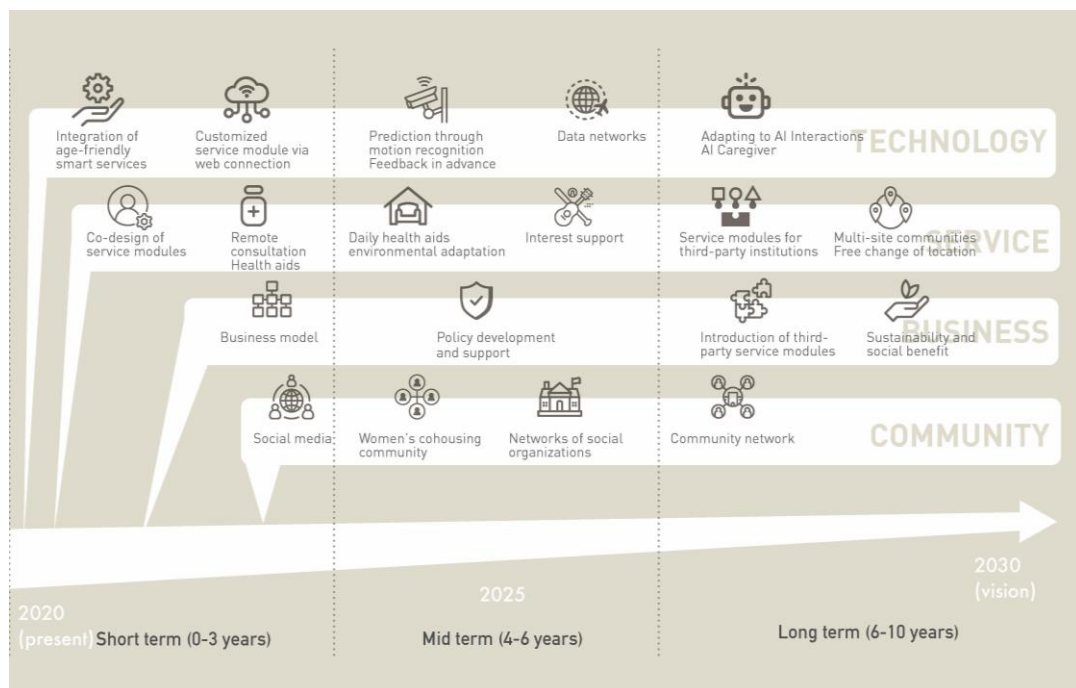

Figure 3. Three terms of service scenarios for living-alone female elderly

2) Service Scenarios System for the Elderly in Nursing homes

In nursing homes, personal services include a safe and secure environment, supervision, assistance as well as daily activities such as medication prescription, bathing, hairdressing,

eating, laundry, entertainment [1, 21]. The elderly can also enjoy more professional medical services than with home care. With the weakening of family care functions and the increasing number of disabled and semi-disabled elderly people, up to 50% of those over the age of 85 are likely to be placed in a nursing home at some point in their life [7]. Nursing home services are complex service systems involving multiple stakeholders, whose core needs and emotional appeals need to be carefully balanced as follows:

1) The health management services of nursing homes need to reshape the form and enhance diversity with different quality levels.

2) The service scenarios for the elderly in nursing homes need to improve the efficiency with respect to centralized information processing and mobile internet support for remote consultation and timely response.

3) In response to the epidemic, isolation spaces need to be reserved in advance. Such spaces around public areas help reduce the spread of the infection between elderly people. In the post-epidemic era, sufficient space and proper isolation are still needed to maintain social distancing. Therefore, mobile and flexible-sized isolation spaces such as lightweight glass rooms can be added in public areas to maintain proper social distancing. Relative independence and privacy are achieved while meeting the needs having connectivity with friends and relatives amongst gatherings.

4) Robots can reduce contact amongst personnel and thus reduce the risk of infections in nursing homes. The use of vacuum cleaner robots and food preparation robots can help reduce the number of entrances made into the private spaces of the elderly. However, immersive devices such as AR and VR need to be designed to enrich the elderly's daily entertainment and activities during isolation by taking their visual perception in account. Figure 4 illustrates the smart service scenarios system for the elderly in nursing homes.
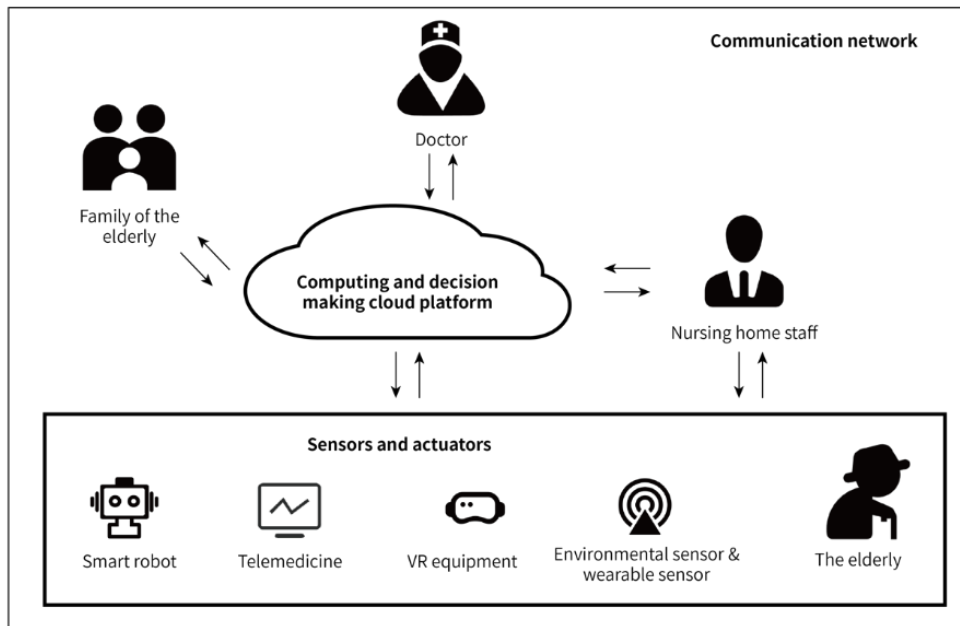
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Figure 4: Smart service scenarios system for the elderly in nursing home

C. *Cross-generational games to promote active intergenerational communications*

In home care, elderly who experience debilitation often undertake the housework such as cooking only within their capacity. This is an important way for them to maintain social relations, social activities, and obtain value recognition. During the epidemic, the problem of intergenerational communication was highlighted. Family members spend more time indoors as going out was greatly minimized. This has caused more family conflicts between the older generation and the young.

The design of this cross-generational game is based on "Active Aging", which emphasizes the process of optimizing health, social participation, safety for the elderly, maximizing lifespan and transforming the elderly from being cared for to being independent health seekers. This would help with responding to the increasing number of emergencies flexibly [22].

In terms of the cognitive characteristics of the elderly, they tend to have weakened audiovisual abilities. Hence, it is suitable for family members to play games together in a closed environment during the epidemic. These cross-generational games were designed with a combination of online and offline games to tackle the current hard-to-tune phenomenon in

families where members of the young and old live together. This is in addition to the fact that the elderly suffer from a higher proportion of chronic diseases. The games include the promotion of offline family card games and an online APP community sharing to help the elderly lead more active and youthful lives.

1)   Offline family card games and refrigerator stickers

The cards contain information regarding food and beverage ingredients, cooking methods, and other tasks. For example, the food ingredients card contains 112 common ingredients in the market with categories such as vegetables, cereals, meat, soy products, egg, and dairy products, and so on.

The refrigerator stickers contain 6 sections representing the six meals a day. It is designed such that each food is listed with its corresponding effects according to various age groups. By randomly generating food ingredients to form different dishes, the elderly will learn about healthy eating and cooking methods suitable for their family, while learning to flexibly change the combinations according to their preferences.

Figure 5: The offline family card games and refrigerator stickers of cross-generational games

2) Online APP and community sharing

The online APP and community sharing aim to encouraging the young to guide the elderly to operate the online APP to upload information regarding the dishes they have come up with. The online APP contains two parts. Part One is a demo to help family members quickly understand the use of the entire design. The video intuitively shows the process of each step. Part Two is the function of uploading and sharing game results. Through this simple operation, family members can upload offline card game results, photos of cooked dishes and so on. Younger generations can teach the elderly to use this simple online function to get digitally involved and enhance their confidence in communications.

Figure 6: The online APP of cross-generational games

V. Conclusion

Elderly care is an issue that every family faces. It is a key issue that combines people's livelihood and social stability. This research focuses on the new challenges faced by elderly care services under the normalization of the epidemic. Starting from the perspective of smart services, the project subdivided the urban elderly into different groups, discussed their specific needs, and proposed a three-stage elderly care service framework. As smart technology is becoming increasingly integrated into the service scenarios of the elderly's lives, the technology of intelligent systems will be more closely linked to the service scenarios and thus would be able to cater to individual needs.

The next step of the research is to verify the prototype and move forward with user testing. Artificial Intelligence (AI) solutions should be further explored to test applications to contribute to

elderly with special needs, such as female elderly, those living on their own, and disabled elderly. How the elderly can overcome the digital divide and face the normalization of the health crisis actively will also be the next step of research.

Acknowledgement

References

[1]   S. Betge-Brezetz, M. P. Dupont, M. Ghorbel, G. B. Kamga, and S. Piekarec, "Adaptive notification framework for smart nursing home," in *Conf Proc IEEE Eng Med Biol Soc*, 2009, pp.7244–7247.

[2]   F. Cai, D. Wang, *Demographic transition: implications for growth*, 2005.

[3]   Ministry of Health, Singapore, *AGEING IN PLACE IN SINGAPORE*, 2016.

[4]   The Ministerial Committee on Ageing, Singapore, *Successful Ageing: Progressive Governance and Collaborative Communities*, 2015. Retrieved from https://www.gov.sg/ 2015, Accessed May 2020.

[5]   Deloitte, *Explore the "last mile" of healthy elderly care-Prospects for the Trend of Integrated Medical Care in China*, 2018.

[6]   H. N. Yu, M .Wang, C. Li, "A research of pattern of home endowment based on communities' outlet in China," in *Henan Social Sciences*, 2011.

[7]   W. E. Reichman, A. C. Coyne, S. Borson, A. E. Negrón, B. W. Rovner, R. J. Pelchat, K. M. Sakauye, P. Katz, M. Cantillon, and R. M. Hamer, Psychiatric consultation in the nursing home. A survey of six states. *Am J Geriatr Psychiatry* vol. 6, (4), pp. 320–327, 1998.

[8]   P.C. Liu, 2020. "To keep more than 20,000 elderly people safe -- Chronicle of The Battle against the Epidemic in Wuhan Pension Institutions," in *China Social Work* vol. 17, pp. 32–33, 2020.

[9]   R. Prasad, "How bad is the Covid crisis in US care homes?" in BBC News, 2020.

[10]   L. S. Edelman, E. S. McConnell, S. M. Kennerly, J. Alderden, S. D Horn, and T. L. Yap, "Mitigating the Effects of a Pandemic: Facilitating Improved Nursing Home Care Delivery Through Technology," in *JMIR Aging* vol. 3, 2020.

[11]   J. Crockett, "New Orleans nursing home says COVID-19 restrictions causing depression and anxiety in residents", in WDSU News, 2020.

[12]   L. Liu, Y. Wang, Y. Jin, "Reference to China from the Foreign Elderly Care Service System from the Perspective of the "New Crown" Epidemic," in *Building Technology*, vol.11 pp. 55－58, 2020.

[13]   A. Kinoshita, M. Matsuo, A. Ohbuchi, et al., "An approach to preparatory clinical pharmacy education in disaster medicine conducted by university faculty and disaster life support pharmacists," in *Japanese Journal of Pharmaceutical Education*, vol.3, 2019.

[14]   M. Stickdorn, M. E. Hormess, L. Adam and J. Schneider, *This Is Service Design Doing: Applying Service Design Thinking in the Real World*. Sebastopol, CA: O'Reilly Media. 2018.

[15]   V. Dyck, I. Laura, et al., "Combating Heightened Social Isolation of Nursing Home Elders: The Telephone Outreach in the COVID-19 Outbreak Program," in *The American journal of geriatric psychiatry: official journal of the American Association for Geriatric Psychiatry*, vol. 28, pp. 989－992 2020.

[16]   T. Irwin, K. Irwin, *The Visioning and Backcasting Process in Transition Design*, 2016.

[17]   China Development Foundation, *China Development Report 2020: Development Trends and Policies of China's Population Aging*. China Development Press, 2020.

[18]   J. Y. Qu, X. L. Wu, "The living style and willingness of the elderly in China," in *Scientific Research on Aging,* vol. 1, pp. 46-54, 2013.

[19]   World Health Organization, *Women, Ageing and Health: A Framework for Action: Focus on Gender*, WORLD HEALTH ORGANIZATION, UNITED NATIONS POPULATION FUND, 2007.

[20]   L. Esposito, S. Writer, "What Nursing Home 'Memory Care' Means". *U.S. News & World Report.* 2016.

[21]   P. Li, Z. Chen, L. T. Yang, Q. Zhang, and M. J. Deen, "Deep Convolutional Computation Model for Feature Learning on Big Data in Internet of Things," in *IEEE Transactions on Industrial Informatics*, vol. 14, no. 2, pp. 790-798, Feb. 2018.

[22]   World Health Organization, *Active ageing: a policy framework.* Retrieved from http://www.who.int/ageing/publications/active_ageing/en/ Accessed July 2020.

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