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Volume 2 | Issue 1 | January 2020 | Page1-31
Journal of Geriatric Medicine

Contents

ARTICLE

REVIEW

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Journal of Geriatric Medicine
https://ojs.bilpublishing.com/index.php/jgm

REVIEW

Covid-19 and Immunity in the Elderly

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ABSTRACT

Population ageing is an issue of worldwide importance. People are living longer due to advances in education, technology, medicine, food distribution, and public health. While the COVID-19 pandemic has significant global impacts, in many countries the elderlyface threats and challenges that are unique and disproportionately severe. One such threat is that aging results in a decline in immune function, meaning elderly bodies respond more slowly and less effectively to external threats like COVID-19. Responses at individual, family, community and societal levels should take into account the heightened vulnerability of older adults during this pandemic.

1. Introduction

The coronavirus, widely accepted as having originated in and spread from Wuhan, China, is considered by the World Health Organization (WHO) to be a severe acute respiratory syndrome coronavirus 2, or SARS-CoV-2 [1]. The resultant coronavirus disease is popularly called COVID-19. Until February 2020, few nations outside China reported COVID-19 cases. In March 2020, based on confirmed cases, the virus began spreading rapidly: initially in South Korea, by the second week of March in Italy, Spain and other European countries, and in the third week of March to the United States [2]. On 11 March WHO declared COVID-19 a pandemic [3]. As of 7 July there are more than 11.7 million confirmed cases, with more than 540,000 deaths and more than 6.6 million recovered [4]. The latest data also show that COVID-19 cases rates are increasing more rapidly in poor and developing countries than in wealthier and more developed nations [4,5].

Rapid population aging is a global phenomenon, regardless of a nation's level of development [6]. Today, people are living longer than ever before due to advances in education, technology, medicine, food distribution, and public health [7]. An aging population impacts almost every area of government policy and presents a number of socio-economic and health challenges. The main objective of this paper is to explore older adults' increased vulnerability to COVID-19 in terms of the function of the

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immune system, and to suggest that local, regional and national responses consider the higher risk of COVID-19 to older adults.

2. COVID-19 and the Elderly

Around the world, people are suffering from COVID-19. It is, after all, a pandemic. But the virus death rates are unequal across age groups. Since the COVID-19 death rate increases sharply with age, the larger the older population, the greater the challenges for communities and societies. And within older populations, the older subgroups (e.g., age 80+), which are most vulnerable to infection and physiologically least able to recover, are growing more rapidly than younger subgroups (e.g., 65-74). Thus cross-national differences in population age compositions partly explain the spread and the crude fatality measures of the disease. Considering population age structure is therefore critically important in assessing, for example, the potential impact of COVID-19 on mortality in Europe -- especially southern Europe, the world's oldest region [8]. Data shows 29 of the 30 nations with the highest percent of older people are in Europe [9].

Although people of all ages are affected by COVID-19, older adults are at disproportionate risk of contracting and dying from the virus. WHO data from April 2020 shows more than 95% of COVID-19 deaths were among people over 60 years of age, and more than half of all deaths occurred in people age 80+ [8]. In March, the Chinese Centers for Disease Control and Prevention offered data showing COVID-19 mortality increased with age: the fatality rate was 3.6% for adults in their 60s, 8% for those in their 70s, and 14.8% for people age 80+ [10]. A report from Sweden showedthat 90% of COVID-19 deaths were among people age 70+ [11]. And as of mid-May in New York City, nearly three-quarters (73.6%) of COVID-19 deaths were people age 65+. Nearly half (48.7%) of New York's COVID-19 deaths were people age 75+ [12].

Nursing home populations are at high risk of coronavirus infection and death. For example, 53% of Belgium's COVID-19 deaths occurred in care homes.In Canada the figure is 62%, in France between 39.2-51%, and in Spain 67% [11].

Many studies show older adults are more likely than younger people to have pre-existing conditions such as cardiovascular disease, diabetes, chronic respiratory disease, hypertension, and cancer. Further, the inevitable natural deterioration of the immune system makes it harder for older adults to fight off infection. Obesity and smoking also weaken the immune system and are thus associated with increased risk. There are gender correlations as well: in Italy, higher risk has been reported in men than in women [13], perhaps due to their higher smoking rates and subsequent comorbidities.

But age is not a completely determining risk factor for severe disease. In some places or situations, younger people are also at very high risk during a pandemic. A recent Nepal study found that people below age 50 account for more than 80 percent of COVID-19-infected persons and a similarly disproportionate share of COVID-19 deaths [14]. And anecdotal evidence suggests old age per se is not a COVID-19 death sentence: it has been reported that even centenarians who were admitted to hospital for COVID-19 have made complete recoveries. Among themare a 113-year-old Spanish woman, a 107-year-old Turkish woman, a 106-year-old British woman, a 104-year-old Korean and a 102-year-old woman from Singapore.

3. Aging and the Immune System

According to Sadighi Akha, aging is a multifaceted process, involving numerous molecular and cellular mechanisms in the context of different organ systems. An important part of aging is a set of functional and structural alterations that weaken the immune system. This can be manifested as a decreased ability to fight infection, diminished response to vaccination, increased incidence of cancer, higher prevalence of autoimmunity, and constitutive low-grade inflammation, among others [15].

The immune system thus has a vital role in health; in general, however, older adults have a weaker immune system and consequently are less resilient in fighting off infection. The immune system protects the body from outside invaders such as bacteria, viruses, fungi, and toxins. According to John Hopkins Medicine [16], the immune system, made up of different organs, cells, and proteins, works to protect the body against disease. This protection is called immunity. The immune system has main two parts. The innate (natural) immune system, which one is born with, provides general protection. The adaptive immune system is what the body develops when exposed to microbes or chemicals released by microbes - that is, outside invaders. These two immune system dimensions work together, discriminating between self and foreign components and reacting against any foreign molecule different from the body's own structure.

According to Márquez [17], our immune system has two sets of defenses against viruses and other pathogens: a first-line army of cells, called leukocytes, that attack invading microbes within minutes to hours, and a second-line force of precisely targeted antibodies and T cells that engage the invading microbes up toseveral days later. T cells produce virus-fighting chemicals. As the body ages, it has fewer T cells. By puberty, the thymus is pro-

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ducing tenfold fewer T cells than it did in childhood; by age 40 or 50, there is another tenfold drop. That leaves the body severely depleted of T cells that have not yet been programmed to defend against a specific microbe. Fewer such "naïve T cells" means fewer able to be deployed against a never-before-seen microbe [17]. It is clear, then, why and how immunity weakens with age, and why older people are less likely to be able to react effectively to microorganisms their bodies haven't encountered before. Still, it is not chronological age alone that determines how one does in the face of a life-threatening infection such as COVID-19. Pre-existing conditions, such as chronic diseases, and frailty can be as or more important than chronological age [18].

There is ongoing research on maintaining a strong immune system, retarding immune system decline, and strengthening weakened immune systems. But to date no definitive solution has emerged. We know why immunity decreases with age, but not how to prevent this. Put simply, you have fewer immune cells as you age, and the ones you do have don't communicate with each other as well. Thus they take longer to react to harmful germs and you are more likely to get sick. In addition, the aging body produces fewer immune cells, including white blood cells, which can slow recovery from injuries, infection, and illness [19].

In general, then, aging results in a decline in immune function. Older adults are not necessarily immune deficient, and there is great individual variation. The elderly can, but usually do not, respond effectively to COVID-19. Thus public health efforts, which of course include sheltering in place, social distancing, and masks, should also focus onimmune system health promotion for older people. Activities that are correlated with immune system maintenance or even boosting (thus increasing resistance to various viruses)include getting a flu vaccination, eating a healthy diet, being physically active, loweringone's stress level, gettingadequate sleep, maintaining a healthy weight, avoiding tobacco, and spending time outdoors.

Finally, COVID-19 is most likely to be lethal to older adults with pre-existing health conditions. Maintaining good health through health promotion activities and a healthy lifestyle play crucial roles in minimizing immune system decline and maximizing disease resistance. People who age healthily are less at risk. Individuals, families, societies, governments, policymakers, and international development institutions must invest in culturally appropriate programs and services that promote active aging. This will, simultaneously,maintain immune system strength and overall good health.

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ARTICLE

Analysis of the Dilemma and Strategies of Elderly Patients Access to Outpatient Services - Based on the Examples from three Grade A Tertiary Hospitals in Jiangxi Province

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ABSTRACT

Objective: To identify the dilemma of elderly patients' access to outpatient services, develop strategies to improve the environment and functions of the outpatient department, and encourage the elderly to access medical services independently. Methods: By observing and interviewing, this paper studies the environment, behavior, and experiences of elderly patients when accessing medical services, identifies and classifies the key issues, and provides corresponding suggestions. Results: Existing signs and voice prompt systems fail to guide elderly patients to access to medical services; Elderly patients have difficulty in finding places to transit and rest when accessing to outpatient services; Elderly patients have problems in using AI (artificial intelligence) technologies when they access to outpatient services; There are communication barriers between elderly patients and medical staffs. Conclusion: Optimizing the guiding signs and voice prompt systems according to the characteristics of elderly patients; Designing the areas of transition and rest reasonably; Enhancing the ability of elderly patients to use self-service equipment; Promoting the medical treatment process to the elderly in a humanized way.

1. Purpose and Significance

In 2016, the Communist Party of China Central Committee and the State Council released the 'Healthy China 2030' blueprint, which put forward the goals of Healthy China. In 2017, the 19th National Congress of the Communist Party of China made a decision-making plan to implement the Healthy China Strategy. On the one hand, it emphasized the provision of high-quality and efficient medical services; on the other hand, it pointed out that it was necessary to strengthen the health services of critical populations and actively respond to the population aging. In 2019, the State Council issued a guideline to implement the Healthy China Strategy, which states that the government should maintain the whole life cycle health and promote the health conditions of the elderly. The medical care and health conditions of the elderly have received unprecedented attention. The critical issue of providing high-quality and efficient medical services for elderly patients needs to be solved urgently. With the growth of

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the age, the elderly show increasing demands of medical services. Thus, creating a suitable environment for elderly patients to access medical services independently can become an essential part of the reform of the medical and health systems in the future. Compared with hospitalization and emergency treatment, elderly patients make more frequent use of outpatient services and are more likely to access medical treatment independently in the outpatient service department. Therefore, it is of great practical significance to analyze the difficulties of elderly patients accessing medical services from the outpatient department. It is also more convenient for the research team to observe and interview.

2. Materials and Methods

2.1 Research Object and Method

By the end of 2018, the number of elderly people over 65 years old in Nanchang was 593,400, accounting for 10.7% of this city's total population. The proportion of the elderly population in Nanchang stays similar to the national level, and they both showed an upward trend year by year. The rate of economic development and the per capita income in Nanchang is in the mid-level among provincial capital cities in China. Thus, it is reasonable and representative to take the elderly in Nanchang as the research object.

From November 2018 to October 2019, the research team took advantage of weekly hospital social worker placements to analyze the outpatient environment of three Grade A tertiary hospitals in Nanchang through participatory observation and interview research methods. The research is not only beneficial to the horizontal comparison between medical institutions but also beneficial to the contrast between the current situation of outpatient medical service supply and the medical demands of the elderly.

The observation objects include the outpatient lobby partitions, the efficiency of guiding signs and voice prompt systems, the settings of spaces for transition and rest, the classification and quantity of service windows, the utilization of self-service equipment, the allocation of medical staff, and their attitudes. The interviewees include the elderly patients who access outpatient services and the medical staff who work for the outpatient department (including volunteers and hospital social workers). The interview focuses on the elderly's experience, habits, and difficulties when accessing outpatient services and the problems of medical staff in the outpatient department.

2.2 Observed Indicator

In China, hospitals are classified into three grades according to the resource allocation and service capacity. Primary and secondary hospitals can be further classified into Grade A, B and C, tertiary hospitals can be further classified into Grade S, A, B and C. Hospital F, Hospital R, and Hospital Z in Nanchang are all Grade A tertiary hospitals, with concentrated medical resources, a high volume of outpatients, and many elderly patients.

As one of the first Grade A tertiary referral hospitals in China, Hospital F is a provincial comprehensive hospital integrating medical treatment, teaching, scientific research, and preventive health care. The hospital is located in Yongwai Central Street, Donghu District of Nanchang City, covering 17.3 acres. There are many hospital departments, such as outpatient, internal medicine, surgery, emergency trauma, tumor, infection, burn, medical technology, regulation and training, scientific research, etc. There are 2900 beds and 46 clinical and medical departments in the whole hospital, which are famous for gastroenterology, neurosurgery, cardiac and vascular surgery, intensive medicine, respiratory medicine, burn, pain and emergency departments. In 2018, the outpatient volume of Hospital F reached 2.78 million.

Hospital R, formerly a church hospital founded by American Methodist Church, is the first western medicine hospital in Nanchang and the largest Grade A tertiary referral hospital under the Health Committee of Jiangxi Province. The hospital is located in Aiguo Road, Donghu District of Nanchang City. The headquarters of Hospital R covers an area of 7.7 acres with 2342 employees. There are many hospital departments, such as outpatient department, emergency department, inpatient department one and two, oncology radiotherapy room and dual-source computer tomography (DSCT), etc. There are 2000 beds and 57 clinical and medical departments in the whole hospital, which are famous for respiratory, digestive, cardiology, nursing specialty departments and intensive care units (ICU).

Hospital Z is a comprehensive Grade A tertiary referral hospital with unique features of tumor diagnosis and treatment, and plastic repair. Hospital Z is located in Beijing East Road, Qingshanhu District of Nanchang City, covering 20.3 acres. The hospital includes the outpatient department, emergency department, old and new inpatient department, laboratory department, medical technology center, radiotherapy center and internal medicine center in the hospital, with 1607 employees. There are 1650 beds and 22 clinical departments in the whole hospital, which integrate tumor prevention, diagnosis and treatment, teaching, scientific research and rehabilitation services.

Table 1 below indicates the environment of transiting

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and resting in the outpatient lobbies of three hospitals. The three hospitals have divided several areas for consultation, labor, self-services, and rest, which helps patients choose different services according to their demands and preferences. The three hospitals have posted guiding signs on the ground or the wall, assisting patients to find their ways easier. However, the research team observed that some signs did not clearly indicate directions, and some signs are severely damaged, which is difficult for patients to read and follow. The three hospitals have set up bench seats according to the number of outpatients and the structure of outpatient lobbies. However, the observation results show that the current number of bench seats still cannot adequately meet patients' demands. Taking Hospital Z as an example, the utilization rate of eight massage chairs is lower than expected. Besides, the problem of insufficient seats is not solved by the hospital. The lifts of three hospitals are all set to stop in single or double layers to improve the efficiency, but it also causes many patients to go back and forth often because they take the wrong lift. The escalators in Hospital Z effectively alleviate the massive flow of people in the outpatient lobby, but installing escalators has higher requirements on the acreage and structure of the lobby.

Table 1. Transition and rest environment in outpatient lobbies of three hospitals

Name of hospital	Number of areas	Guidance signs			Number of bench seats		Number of elevators	
		Signs on the ground	Signs on the wall	Voice prompt	Ordinary chair	Massage chair	Lift	Escalator
F Hospital	7	8	3	Yes	178	0	4	0
R Hospital	6	7	6	Yes	36	0	3	0
Z Hospital	5	29	2	No	51	8	4	1

Source: Observation data of the research team in July 2019

Table 2 indicates an overview of outpatient services in three hospitals. All three hospitals have set up service windows for priority groups like pregnant women, retired cadres and patients over 70 years old. When patients line up in a long queue at the ordinary service windows, the priority service windows will not help to share the registration and payment work. The three hospitals have introduced self-service equipment and encouraged patients to use self-service machines to replace manual service windows. The number of patients who prefer manual service windows is higher than those who use self-service equipment.

Meanwhile, patients using self-service equipment need manual assistance and guidance. The three hospitals have classified the medication windows to improve efficiency. However, due to a large number of patients, there are still long queues in front of the windows. There are several referrals in outpatient lobbies of three hospitals to assist patients, but their identities are different. Referrals from Hospital F are medical staff. Hospital R is attempting to introduce volunteers as guiders. A security guard from Hospital Z also works as a referral to assist patients in using self-service equipment.

Table 2. Overview of outpatient services in three hospitals

Name of hospital	Number of service windows				Number of self-service equipment		Medication windows	Number of referrals		
	Normal	Priority	Refund	Problem-solving	All-in-one	Reporting		Medical staff	Volunteer	Security guard
F Hospital	0	1	1	2	51	9	11	4	0	0
R Hospital	12	1	0	0	10	2	8	5	3	0
Z Hospital	7	1	0	0	7	1	3	4	0	1

Source: Observation data of the research team in July 2019.

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3. Results

3.1 Incompetent Guiding Signs and Voice Prompt Systems

During the interview, the research team found that elderly patients tend to seek help from the medical staff in the consultation desk and outpatient service center instead of using guide signs, mainly for the following reasons. First, most of the guiding signs in the outpatient lobby are pasted on the ground. Because the lobby is usually crowded, it is difficult for elderly patients to follow the guidance under their feet. Second, the elderly patients pointed out that the guiding signs on the ground are severely damaged, making them difficult to read and follow. Third, some elderly patients show confusion on the guiding signs because some signs cannot indicate the directions. Sometimes there can be several arrows included in one sign, and sometimes the content of the sign is difficult to read and understand. Occasionally when the elderly use the signs, they may spend lots of time going around because the signs are not clear to understand. Besides, the elderly patients reflected that the volume of prompt voice is too low to be heard. Many people have to queue again because they missed the voice messages.

3.2 Difficulties of Transition and Rest

According to the interview of elderly patients, they need to go between floors to access registration, medical treatment, payment, examination and medication. The elderly encountered many difficulties in transiting. Firstly, the waiting and riding time of the lifts are too long and inefficient. The elderly often rely on elevators to transit between floors, but they have to wait for a long time to get on the elevators and stay in the crowded space, sometimes they arrive on the wrong level because the lifts stop single or double levels. The elderly wasted plenty of time in transit and can feel tired physically and mentally. Secondly, there are potential risks for the elderly to use escalators. Even though some hospitals improve patients' transition efficiency by installing escalators, the elderly think that escalators move very fast. It is difficult for the elderly with visual and physical disabilities to use escalators due to potential risks of falling and dizziness [1]. In addition, elderly patients find it difficult to get a good rest while waiting for outpatient services. First, the number of bench seats is not enough; second, there is a distance between rest areas and waiting areas; third, the calling system of some waiting areas is invalid and people still need to queue up. Those reasons cause great inconvenience when they are waiting for medical treatment.

3.3 Difficulties in Using AI Equipment

The installation of self-service equipment brings convenience to young patients, while elderly patients feel challenging to learn to use high-technology equipment. The manual registration services and payment windows in some hospitals have been cancelled, and both registration and payment need to be carried out on WeChat public account or self-service machine. Some elderly patients said they could not use smartphones and don't have WeChat accounts, making it difficult to register and pay for themselves. Some elderly patients from rural areas told the researchers that they have difficulty operating the self-service machine because they had never seen one in rural hospitals and their education levels are limited. The elderly also reported that there is few medical staff in the self-service area to assist them and provided simple answers, which could not relieve their anxiety about using AI technology. Besides, the elderly patients also found difficult in paying fees. In many hospitals, self-service devices require patients to pay with mobile payments like WeChat, Alipay or credit cards, and elderly patients who are used to paying in cash can only queue at manual service windows. Those unnecessary transitions not only waste plenty of time but also cause the physical tiredness of elderly patients.

3.4 Communication Barriers between Elderly Patients and Medical Staff

There is an imbalance of information between patients and doctors, which is particularly evident in elderly patients. During the interview, many elderly patients said that they have limited education level and medical knowledge, and they can feel the barriers when communicating with doctors. The elderly hope to get more information about their illness, treatment plan, medical expenses and daily precautions from doctors. However, doctors have no time to answer all the questions raised by patients due to a heavy workload. The demands of elderly patients for the explanation of illness and counseling can hardly be met [2,3]. Elderly patients also mentioned that they could scarcely understand the terms in the doctor's advice and certificate. It's difficult to find which floor they need to go for what kind of check, so they often ask medical staff repeatedly. The elderly have difficulties understanding the details of medical expenses and medical insurance and often forget the direction of medication after going home, which makes them feel worried about accessing medical services independently [4].

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4. Discussion

4.1 Optimizing the Guiding Signs and Voice Prompt Systems according to the Characteristics of Elderly Patients

Optimizing the guiding signs and voice prompt systems is the most cost-saving way to create a suitable-for-aging environment regardless of hardware conditions. However, hospitals should consider more humanized thinking and design in the process of transformation. First of all, hospitals should take into account the visual defects of the elderly and pay attention to their blind spots. To attract the elderly's attention for the first time, hospitals should ensure the complementarity between the floor signs and the wall signs. The damaged floor signs and wall signs should be removed and repaired in time to avoid misleading patients. Secondly, hospitals should design guiding signs reasonably by considering the physiological characteristics of the elderly. The size of the signs and the characters should be taken into account the visual aspects of the elderly. Fonts of signs can be classified according to the importance, the colors can be distinguished according to the type of signs, and graphics or characters can be selected according to the practical degree [5]. Thirdly, it is necessary to combine the guiding signs with voice prompt systems to help the elderly overcome hearing or visual impairment. Elderly with hearing problems often rely on words or pictures habitually, and elderly with poor eyesight may need auxiliary voice prompts. Voice prompt can be used not only to guide the way for elderly patients but also can remind elderly patients for the call in the waiting area. It is necessary to increase the voice volume properly by considering the noisy environment.

4.2 Designing the Areas of Transition and Rest Reasonably

Most elderly patients reflected the difficulties when they were transiting and resting, which puts forward practical requirements for the improvement and optimization of the outpatient environment. There are three following suggestions:

First, design the elevator in the way convenient for elderly patients. Hospitals can remind the elderly patients through the guiding signs and voice prompt systems near the lifts, and can also organize volunteers near the lifts to assist elderly patients; Hospitals with escalators should adjust the escalator speed reasonably, to avoid the inconvenience caused by faster pace to the elderly. Volunteers can assist unaccompanied elderly patients with physical disorders to transit them in the process of medical treatment. Second, increase the number of payment counter on each floor to avoid the elderly patients going around floors. Most elderly patients said they had to go back and forth between each treatment area and the lobby to complete payment and spent a lot of time waiting for the elevator and queuing at the window. To optimize the environment, hospitals can try to add payment counters on each floor, and capable hospitals can take the lead in introducing the payment service between clinics in a pre-paid way to reduce the number of queues in the service windows. Third, plan the number and position of the bench seats. While adequately increasing the number of seats, hospitals should rationally plan the locations of seats. It is necessary to combine the rest area with the waiting area [6]. At the same time, making effective use of the voice calling system can reduce the time of standing when the elderly patients wait for consultation and reduce the anxiety of the elderly patients when they sit down and wait.

4.3 Enhancing the Ability of Elderly Patients to Use Self-service Equipment

The introduction of self-service equipment should be a gradual process, which should not bring inconvenience to elderly patients when they access to outpatient services. On the one hand, hospitals need to consider the demands of different groups and keep an appropriate number of manual service windows to provide registration and payment services for elderly patients. On the other hand, when promoting self-service equipment, hospitals should optimize the interface and function of the equipment based on the elderly's characteristics. First, the self-service device interface should be simple, easy to understand, and the font size should be moderate, which is convenient for the elderly to identify and operate. Second, self-service equipment should combine visual and auditory effects, and assist the users' manual operation by using voice prompts to bring convenience for the elderly with visual impairment. Third, it is necessary to consider the elderly's preference for cash payment and improve the cash payment function of self-service equipment. Meanwhile, more medical staff and volunteers should be organized beside the self-service equipment to assist elderly patients in getting familiar with the use of equipment by explaining and demonstrating the functions and operation methods.

4.4 Promoting the Medical Treatment Process to the Elderly in a Humanized Way

Based on implementing the measures, medical staff and volunteers should try to publicize the consultation process to the elderly in a humanized way. For example, the con-

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sultation desk's medical staff can introduce registration, examination, and payment procedures to the elderly using tools such as cards and notes. This way can ensure the elderly know the distribution of the service windows and consultation areas in the hospital and eliminate the confusion and anxiety of the elderly when they find space and place. Doctors should also consider the characteristics of the elderly, such as low educational level, limited medical knowledge, decreased vision and hearing, and briefly introduce the illness, treatment plan, medical expenses and daily precautions. This can reduce the fear of elderly patients and increase their trust in medical staff. Nurses and volunteers in the outpatient service center can use easy-to-understand language to assist the elderly in completing payment, examination and medication. They can also help to explain the examination results and doctor's advice for the elderly and help the elderly understand the composition of medical expenses and medical insurance. The medication window can optimize services in a more humanized way. For example, recording the medicines' directions for elderly patients to ensure that they can understand the usage and dosage of the medication after leaving the hospital. This series of work will encourage and support elderly patients to independently access medical treatment in the future.

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ARTICLE

Effect of Family Nutrition Therapy on Elderly Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Objective: The aim of the study was to explore the influence of family enteral nutrition support on nutritional status, lung function, activity tolerance and quality of life in elderly patients with chronic obstructive pulmonary disease (COPD) in stable stage and malnutrition. **Methods:** A prospective observational study of COPD and malnutrition in the geriatric department of our hospital, control group (n=82) and intervention group n=82). The control group was treated with conventional diet, and the intervention group was treated with conventional diet and enteral nutrition suspension. One month later, observe the nutrition indicators,lung function,exercise tolerance and quality of life. **Results:** (1) BMI and ALB were higher than control group ($t = 10.465, 6.189, P < 0.05$), TP and Hb had no change, ($t = 1.310, 1.302, P > 0.05$). (2) FVC, FEV1, FEV1 / FVC, FEV1% were higher than control group ($t = 11.999, 19.654, 13.418, 16.924, P < 0.05$). (3) the quality of life symptom score, activity score, influence score and total score were lower than control group ($t = 15.303, 6.773, 23.600, 14.766, P < 0.05$), and 6MWT were higher than control group ($t = 111.962, P < 0.05$). **Conclusion:**Oral enteral nutritioncan improve the nutritional status, lung function, activity tolerance and quality of life of elderly patients with COPD in stable stage and malnutrition.It can be a early,safe and effective nutritional support strategy for COPD patients with malnutrition

1. Introduction

The. aging trend of China's population is becoming more and more intense.The consequent nutrition problems of the elderly are also becoming more and more significant.The elderly patients at risk of malnutrition were as high as 49.7% and the malnutrition was as high as 14.7% [1].The survey came from the Chinese Society of Parenteral and Enteral Nutrition on the nutritional status of hospitalized elderly patients across the country in 2012.Bring a heavy economic burden to society and families[2]. One of the most common respiratory diseases in the elderly is chronic obstructive pulmonary disease (COPD). According to statistics, COPD occupies the fourth place among the causes of death globally, and will jump to the third place by 2020.The economic burden caused by it will also rank the fifth in the world [3-4]. COPD patients with different degrees of malnutrition often affect the respiratory muscle structure and function.The body's defense and resistance functions will also decrease.Pulmo-

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nary infection is prone to occur. Increasing risk of acute exacerbations of COPD. Our study explored the effects of enteral nutrition on the nutritional status, lung function, activity tolerance and quality of life of elderly patients with COPD and malnutrition.Provide new nutrition methods for elderly patients with COPD and malnutrition.

2. Methods

2.1 Participants

From April 2016 to April 2018, 165 elderly patients with COPD at stable stage combined with malnutrition were selected as the research objects from the Geriatrics Department of our hospital.

Inclusion criteria: (1) Age of participants was ≥65 years; (2) Diagnostic criteria for COPD reference "global initiative chronic obstructive pulmonary disease (GOLD) 2018 edition" [5]. Clinical manifestations of stable COPD [6]: Cough, sputum and shortness of breath are stable or mild. The condition returned to the state before the acute exacerbation. (3) Micro-nutrition assessment method is used for malnutrition standards(MNA-SF), mainly including 6 problems: body mass index decline in 3 months, body mass index, activity ability, stress, neuropsychiatric disease, dietary changes. A total score of 14 points, ≥11 points indicates good nutritional status; 8-11 points indicates the risk of malnutrition; < 8 points indicates malnutrition [7]. (4) All the candidates can intake half fluid diet through mouth.

Exclusion criteria: (1) Suffer from a disease that cannot eat by mouth, such as gastrointestinal diseases, severe nausea, vomiting, choking on food and water, intestinal obstruction and difficulty swallowing; (2) Patients with severe heart, liver and kidney dysfunction and severe diabetes; (3) Patients who are allergic to any ingredient in enteral nutrition; (4) Patients who did not follow the doctor's instructions to complete the experiment.

This study included 165 participants with COPD and malnutrition. A simple random sampling method is used to divide the selected patients into control group (82 cases) and intervention group (83 cases).During the study, there were 3 cases in the control group and 7 cases in the observation group were excluded from this study. 155 participants were included in the final data analysis. There are 79 cases in the control group, including 49 males and 30 females.The average age was 75.6±3.5 years old. There are 76 cases in the intervention group, including 40 males and 36 females. The average age was 73.1±3.1 years old. All participants were recorded demographic and historical data. There was no significant difference in gender or age between the two groups ($P > 0.05$).

2.2 Ethics

The study was approved by the hospital ethics committee. All participants provided written informed consent.

2.3 Enteral Nutrition Intervention

The control group was given a regular diet. The observation group was given enteral nutritional suspension and regular diet. Enteral nutrition is produced by Nutricia Pharmaceutical Co., Ltd (1kcal/ml, 500ml/bottle). All participants take one bottle each time, twice a day. Take 500ml a day for the first three days. Then gradually increase to 1000ml according to the patient's tolerance. Intervention time is 1 month. Studies have shown that 1 month of enteral nutrition support can improve lung function in patients with COPD [8]. Participants asked to record their daily diet and enteral nutrient fluid intake. Study staff called participants to verify the details and to seek clarification if required.

2.4 Lung Function, Exercise Tolerance and Quality of Life Analysis

Observe the nutritional status of participants after 1 month, including body mass index (BMI), serum albumin (ALB), total protein (TP) and hemoglobin (Hb).

Observe the lung function: Forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), 1 second rate (FEV1/ FVC), and FEV1 % of the estimated value. Assessment of activity tolerance: 6 Min Walking Test (6MWT) was used [9].6MWT is suitable for the response of patients with lung disease to medical intervention.6MWT is easy to manage, better tolerated, and better reflects daily activity ability. The technicians conducting the 6MWT test should be trained in the standard scheme.

Assessment of quality of life: St. George's Respiratory Questionnaire (SGRQ) was used. SGRQ was consisted of three points: symptom score, activity score, and score of the influence of disease on patients' daily social activities and psychology. The score was 0-100, and the lower the score, the higher the quality of life [10]. SGRQ is a commonly used questionnaire to evaluate the quality of life of patients. SGRQ is a disease-specific scale. The subjects of this questionnaire include chronic obstructive pulmonary disease and bronchial asthma patients with different countries, races, gender, age, disease severity, and poor lung function. The SGRQ scores are calculated repeatedly. It has been translated into different versions for clinical research needs. SGRQ is suitable for patients with chronic obstructive pulmonary disease worldwide. SGRQ has a good correlation with lung function. It can not only evaluate the treatment of COPD, but also evaluate the overall

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quality of life of patients with COPD. The SGRQ score is highly sensitive to determine changes in the condition of patients

2.5 Nutritional Status Analysis

Blood samples were collected in the early morning from 8:00 to 9:00 am after fasting for at least 11 h. The levels of serum albumin (ALB), total protein (TP), hemoglobin (Hb) were measured with a full-automatic biochemistry analyzer (7600-120 HITACHI, Japan). Body mass index (BMI) was calculated as weight (kilograms) divided by height (meters) squared.

2.6 Statistical Analysis

Data were analysed using IBM SPSS 22.Continuous data were expressed as means±standard deviation (SD). To compare continuous variables, an independent-sample t test was performed. Results among three groups were evaluated by analysis of variance (ANOVN) using Scheffe's F test. The chi-squared test was used to analyze categorical data. P-values of less than 0.05 were consid-ered significant.

3. Results

There were no significant differences between Interventions and controls for TB, HB, ($P > 0.05$). Compared with the control group, BMI, ALB, 6MWT,FVC, FEV1, FEV1/FVC and FEV1 as a percentage of expected value% levels were significantly higher in intervention group ($P<0.05$). Compared with the control group, Symptom scores, Activity score, Influence score and Total score were significantly lower in intervention group ($P<0.05$).

Table 1. Changes of nutritional indicators in the two groups

	Controls (n=79)	Interventions (n=76)	t/x^2	*P*
Age(year)	75.6±3.5	73.1±3.1	1.421	0.167
BMI(kg/m2)	18.35±1.32	21.10±1.90	10.465	0.001
ALB (g/L)	31.17±3.68	34.3±2.54	6.189	0.003
TB (g/L)	56.34±3.15	57.05±3.67	1.310	0.138
Hb (g/L)	125.02±10.91	127.34±11.39	1.302	0.416
FVC (L)	2.10±0.18	2.49±0.22	11.999	0.001
FEV1 (L)	1.02±0.12	1.42±0.13	6.189	0.000
FEV1/FVC	49.58±4.46	58.86±4.16	13.418	0.002
FEV1 as a percentage of expected value%	47.12±4.41	58.83±4.22	16.924	0.001
Symptom scores	54.43±3.51	44.23±4.73	15.303	0.000
Activity score	67.20±5.99	60.81±5.79	6.773	0.001
Influence score	45.66±3.17	33.31±3.67	23.600	0.000
Total score	58.53±4.16	48.12±4.63	14.766	0.001
6MWT (m)	198.25±8.58	359.36±9.37	111.962	0.000

4. Discussion

COPD is a common disease among the elderly, with high morbidity and mortality. It seriously affects the quality of life of elderly patients, but also aggravates the economic burden of the family and society. Malnutrition has adverse effects on the structure and function of the body. Weak the body's resistance, and thus affec the clinical outcome of patients. Studies have shown that elderly COPD patients are often accompanied by malnutrition due to the deterioration of the functions of various organs in the body. The function of the digestive system, and the severity of COPD and its complications is significantly correlated with malnutrition [11-12]. Malnutrition not only reduces re-

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spiratory muscle function, but also weakens respiratory ventilatory reflex. By affecting the structure of lung tissue, it reduces the immune defense function. Weak its respiratory function. One of the independent risk factors for clinical adverse outcomes in elderly patients with COPD is malnutrition. Therefore, improving the nutritional status of elderly patients with COPD combined with malnutrition can significantly improve lung function. Significant implications for disease progression and quality of life. The 2018 revision of the Global Initiative on CHRONIC Obstructive Pulmonary Disease (GOLD) also makes it clear, that relieving symptoms, improving exercise endurance and halting disease progression were remain the main goals of COPD management worldwide.

Home enteral nutrition includes oral or tubular feedin. It is a way to provide energy and nutrients needed to patients through the gastrointestinal tract at home [13]. Oral enteral nutrient can avoid gastrointestinal mucosal atrophy, intestinal flora imbalance and intestinal bacteria and toxin diffusion [14]. It is a safe and effective method.

Nutrition mixed suspension can be the best choice. It is composed of water, maltodextrin, casein, vegetable oil, dietary fiber, minerals, vitamins and a variety of trace elements. It can provide the necessary nutrients for human body, especially in older patients. Oral can play a good nutrition effect [15].

However, most of the current studies focus on nutritional support for hospitalized patients with COPD. Nutritional intervention for elderly patients with COPD at stable stage is obviously insufficien. There are few reports on nutritional intervention and less attention to the quality of life of discharged patients. Therefore, in this study, the changes in nutritional indicators, lung function, exercise tolerance and quality of life of the patients were studied. The results showed that compared with the diet alone, the enteral nutrition support not only improved the nutritional status of the patients, but also enhanced the lung function, activity tolerance and the quality of life of the patients. The results of our are study basically consistent with previous related studies [16].

To sum up, early family enteral nutrition support can be a early,safe and effective adjunct to treatment for elderly patients with COPD with stable stage of malnutrition. This study focuses on the nutritional status of the elderly, pays attention to nutritional assessment. Carring out nutritional support as early as possible has significant prognostic significance for the disease. The shortcomings of this study are that the sample size of this study is small. Therefore, a larger sample size and a more rational design of multi-center, high-quality randomized controlled study are needed to further clarify the value of family enteral nutrition in elderly patients with COPD at stable stage.

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REVIEW

Philosophy of Gerontology from the Past to the Future in Japan

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ABSTRACT

Gerontology is not only an interdisciplinary and intra disciplinary study, but also an international and inter-professional study. Gerontology is a study to create awareness on the concept among people, throughout the world. The philosophy of Gerontology is a lively active philosophy to explore the nature of humanity itself and to practice learning. Moreover, Gerontology is considered as a science as well as human philosophy. This paper introduces philosophy of Gerontology in Japan from the past to the present. It explains that Zen has fundamental philosophy of Gerontology.

1. Introduction

Gerontology is the comprehensive studies of aging, which are not only interdisciplinary and intra disciplinary study, but also international and inter-professional to create awareness on the concept throughout the world [1]. According to the Academy for Gerontology in Higher Education, "Gerontology is the study of the aging processes and of individuals as they grow from middle age through later life. It includes: (1) the study of physical, mental and social changes in older people as they age, (2) the investigation of the changes in the society resulting from our aging population, (3) the application of this knowledge to policies and programs". Geriatrics is a study of medical and clinical about aging people. It is introduced as follows: (1) the study of health and disease in later life, (2) the comprehensive health care of older persons and the well-being provided by their informal caregiver. Therefore, it must be emphasized that the geriatric medicine is very important aspect of gerontology, as well. This article contains only preliminary, associations about the issue whether gerontology should be developed in the direction of a philosophical discipline in connection with Japanese related culture and philosophy.

2. What is Gerontology?

Gerontology is existed to learn more of the purpose of life in not only the terms of longevity, but also of the quality of life. Gerontology is considered as the comprehensive studies of aging which is not only an interdisciplinary and intra disciplinary study. Moreover, it is the international

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and inter-professional study of aging to create awareness of the concept among people throughout the globe. According to the Academy of Gerontology in Higher Education (AGHE), "Gerontology is the study of the aging processes and individuals as they grow from middle age through later life. This definition is included as follows: (1) the study of physical, mental, and social changes in older people as they age, (2) the investigation of the changes in society resulting from our aging population, (3) the application of this knowledge to policies and programs". Geriatrics is considered as follows: "(1) the study of health and disease in later life, (2) the comprehensive health care of older persons and the well-being of their informal caregiver." Therefore, it must be emphasized that geriatric medicine is a very important aspect of gerontology as well. This paper contains a discussion of philosophical discipline in connection with Japanese culture and religious practice including Zen.

The word "Gerontology" is introduced through the book that IIya Metchnikoff (1845-1916) wrote in "the nature of man" in 1903 as follows, "Recognition of the true goal of life and of science as the only means by which that goal may be attained would group themselves around that, as in former days men were held together by religion. I think it extremely probable that scientific study of old age and of death, two branches of science that may be called gerontology and thanatology, will bring about great modification in the course of the last period of life" [2]. Metchnikoff is known as a zoologist and microbiologist, but his interest has been developed to the studies with various languages and cultures, and seeking the true meaning of life, science, and religion.

3. What is Philosophy of Gerontology?

Philosophy of Gerontology is generally understood as an applied Science with all age related practical pedagogy. It draws forth the significance of human existence with practical science for applying into Japanese martial arts even it is called budo for various age persons with various conditions. Budo means way of Bushi's living matter. "Gerontology" is generally translated as Rounengaku in Japan [3,4,5]. Rou means Old. Nen means Year. Gaku means science. Even before modern University was established in Japan Ekken Kaibara (1630-1714) introduced Gerontological Concept through his book, the Book of Yojokun [6,7]. It is also translated as "Soureigaku". This was originally created by Nippon Care-Fit Education Institute [8]. Professor Edward F. Ansello at Virginia Commonwealth University gave addresses on The Clark Tibbitts Lecture at the 37th annual meeting of the Academy for Gerontology in Higher Education, entitled: What colors would we add? The curriculum palette. Professor Ansello reported that the democratization of aging has spread across the world and the so-called globalization of aging has brought yet another lens to examine what we teach [9]. Dr. Ansello and myself , Ryo Takahashi worked together with a number of Americans began collaborating with Southeast Asian colleagues about 2003, with the grand vision of bringing a set of curriculum standards to Japan. Although the overwhelming majority of Japan's medical schools had established geriatrics departments, there was at the time only one university, Oberin University with an educational gerontology program. I, Ryo Takahashi organized Gerontology International Conference in India with the hosts at Andhra University wished to initiate a yoga gerontology program, incorporating not our American concept of yoga as exercise but the sense of meditation, internal communion with a spirit, acceptance rather than resistance. Most of general gerontologist from abroads became aware that their content (subject matter), their methods (research studies) and their values (aging as decline) had limitations. Quantitative studies and descriptive statistics appraise the normative characteristics of groups, the collective of acquired behaviors and lifestyles". Each Japanese Kanji character has meaning with symbolic characters. "Sou" in "Soureigaku" consists of "Kura" and "Katana". "Kura" means "path finding" or "pioneering". "Katana" has means "sword", which stands for the action "to open the way". "Rei" consists of "Ha" and "Rei". This originated from the idea that strengthening one's teeth leads to his/her longevity. "Rei" is a pictograph that shows people gathering and kneeling down to seek enlightenment. These words show that "Soureigaku= Creating Aging Learning or Study" is a type of learning in which people come together and teach each other ways of happiness and longevity. Gerontology is also history of individual life which is called genealogy. That is explained that searching family history is searching philosophy of individual gerontology [10]. Zen is Japanese word which is derived from the Chinese word "chán" and the sanskrit word "dhyana", which mean "meditation". In sanskrit, the root meaning is "to see, to observe, to look". I would like to introduce how Zen can be applied into Philosophy of Gerontology [11].

4. What is Zen

Zen is internationally recognized by Dr. Daisestu Suzuki [11]. There is a book entitled "Zen to Chojuhou(Zen and Method of Longivity)in Japan" [12]. Many people are interested in Zen. Zen came from the Japanese term for the principle in Buddhism [13]. The term Zen is derived from the Japanese pronunciation of the Middle Chinese word chan, which is a Chinese transliteration of the Sanskrit

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word of dhyāna ("meditation"). Bushido stresses importance of Zanshin within Buddhism. Zanshin is understood as the state when the mind is fully vigilant and aware of its surroundings; when the mind remains still without being attached to anything and is totally present during every moment and action in the here and now. Zanshin is a concept which is found in Zen and Budo (Japanese martial arts), particularly Kyudo, Kendo, Shogido and in many Japanese arts, such as Ikebana (flower arrangement), Sado (the tea ceremony) and Shodo (ink painting), as well. We can Keiko in Bushido for practice among master and disciples. Keiko means to learn from the ancestors and old cultures in Japan. That can be understood as adaptive practical philosophy, as well. In nowadays, it is used not only martial arts and performing arts, but what masters and teachers teach is called Keiko. Also, practicing what you have just learned is called Keiko. Rehearsals include not only traditional performing arts but also piano lessons. In each case, we will improve our ability by Keiko. Rehearsal is also used in the meaning of "Keiko", but it is also used not only in the arts but also when it is not called "Keiko" because it is included philosophy with all actions in all learning process in all life.

Keiko has philosophy to learn each other regardless age and length of experience with respect and humble soul which is called Edification. The word edify comes from the French edifier and from the Latin aedificare and means to "improve spiritually" and to "instruct" (Robert K. Barnhart, The Barnhart Dictionary of Etymology [New York: H. W. Wilson Company, 1988], s.v. "edify," 315). The Oxford English Dictionary gives this meaning: "In religious use: To build up (the church, the soul) in faith and holiness; to benefit spiritually; to strengthen, support" (2nd ed., s.v. "edify," 5:71). Thus, to edify is to instruct and improve the soul in knowledge generally, and in particular to increase in moral and religious knowledge, in faith and holiness…To edify is part of a revelatory process. The word revelatory refers to the supernal gifts of the Spirit, the source of all light and truth [14]. Zen is not only practice, but also meditative prayer to universe. People may not be recognized that is pray or meditation. It is not really important because everything is relating to harmonize to one common language of human beings in universe as we breathe in each moment time. This understanding can be considered how men has to be edified to create harmony through such practical philosophy of Gerontology.

5. Conclusions and Recommendations

Understanding of individual value is important which may be developed into our own philosophy which will become original philosophy of Gerontology with individual culture, and art and human nature. This philosophy can be learned by learning and observing ourselves from third person. This is a concept of Meditation, Prayer with pondering, and Zen. When Rabindranath Tagore, the first Asian Nobel Prize awardee visited Japan, he expressed his feel of Japan with respect and love to the people as follows:

"West is dangerous for Japan is not the imitation of the outer features of the West, but the acceptance of the motive force of Western nationalism as her own" [15]. Suzuki Daisetz gave also his lecture that Some Japanese think that the East doesn't have an independent philosophy like the West, and somehow think that the East are inferior to the West, but that is a mistake. The philosophy of the Orientals is not "human", and is always out of it, not out of it. This is its characteristic. Even art is not separated from humanity. Music, poetry, and painting are all closely related to the training of the person [16].

(1) The Japan Gerontology Society was founded in 1959. However, even before modern geriatrics and Gerontological society was founded in Japan Ekken Kaibara (1630-1714) introduced Gerontological Concept through the Book of Yojokun. The purpose of Gerontology is not only contribute Aging study, but also providing assistance to professionals a variety of fields such as industry, government, academia and the private-sector who are interested in improving services for an aged society. Providers of services to the aging and their families require wide-ranging expertise in gerontology.

(2) Family history is world widely known through the book called "Roots: It is important to learn oneself who we are as human beings. It is called Genealogy work. Genealogy work is a part of Gerontology. This work is applied for school teaching and learning within Positively Aging Curriculum.

(3) Martial Arts is originally called in Japanese as Budo. Sasaki stated that historically, Budo has had a very broad meaning [17]. Even nowadays, Budo is still used in a broad way, in that there is still a tendency for it to be used to defi ne a culture of spirituality and moral values. It is important to keep these pioneers' SOUL as we call again, "Kigatsuku" means "an inner spirit to act without being told what to do". SOUL can be grown by See, Observe, Understand, and Listen to learn each other. Zanshin is also a central philosophy of Bushido. Zanshin is a way of Yawara. Zanshin is unconditional SOUL to grow for caring and concerning others even relaxing dairy living. Zanshin is to polite to others with humble heart to express thanks. Zanshin is a way of learning from everybody to grow oneself and going back to basic principle mind. The most important feature of Gerontology is the research and

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practice to raise individual quality of life based on current living circumstances, placing the right people in the right jobs. It is required to apply the power of "awareness" according to each country or environment. Therefore, in order to carry the project forward, it is important to focus on developing the potential ability of awareness, which is naturally possessed by human being (SOUL Theory), before acquiring cultures around the world. SOUL Theory is a hands-on theory, which argues that developing synthetic abilities of Seeing, Observing, Understanding and Listening develops the potential ability of human nature. The term "gerontology" is derived from Ilya Ilyich Mechnikov (1845-1916) in the book "The Nature of Man: Studies in Optimistic Philosophy", "The basis of research is the real life and scientific objectives when we take a comprehensive approach to research based on various languages and cultures, including religious and philosophical fundamental ideas from various perspectives. People can become one towards one ideal" [2].

I recommended the following action for developing applied gerontology in future.

(1) It is important to develop his/her own philosophy of life instead of learning philosophy of others.

(2) Active learning with collaborative learning is necessary to develop unlearned experience to share each other in national and international setting with culture difference.

(3) It is important to breakout barrier of academic fields to make and find commonality to unit as one living and acting community.

(4) It is the most important to find of self-value of ourselves with mind of respect others by searching family history and keeping his/her own living history as journal toward to the journal in the context of our future as an individual and community journey from Japan as a central of the SUN shining.

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ARTICLE

Understanding the Spatial Requirements that Facilitate Personal Leisure Activities of the High-Needs Elderly

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ABSTRACT

The growth of the ageing population and the desires for ageing-in-place have resulted in an ever-increasing need for housing that can support the independent living of the elderly with care needs. As impairments and care needs increase, spatial use typically changes. However, there is limited information on how to accommodate leisure activities and spatial use in private dwellings to inform housing design. Through an ethnographic investigation of 30 high-needs elderly people living independently, patterns of spatial use for personal leisure activities were established. Seven key themes for residents' perceptions were revealed, which include; comfort in posture, access to sunshine and warmth, facilitating activities to occupy residents, views to outside, control for doing everything from one space, and keeping active. In the design of housing for the high-needs elderly, greater attention should be given to the micro-environment of the main sitting space, to improve occupant control while enhancing comfort and warmth. This paper provides key considerations for housing design, which will help elderly people continue their fulfilled life in their own home as long as possible.

1. Introduction

The extension of life expectancy recent years has resulted in the prolonged period when people live with disability and care needs [1,2]. In many countries, including New Zealand, residential care is a major accommodation option when some level of care is required [3]; however, the policy for ageing-in-place calls for staying in one's own home as long as possible, without entering residential care [4,5]. While many elderly people wish to age in their current dwellings, the lack of suitability for those with impairments would require adaptations/modifications and maintenance services for both the garden and the property in the future [6-8]. With these limitations, combined with financial concerns, many anticipated the need to move to a smaller house [6-8], but wanted to live independently in the community [8]. With the rapid increase in the ageing population there is an urgent need for housing that can support independent living in the community, even after care needs arise. To ignore this will mean both a decreased quality of life for the elderly, but also higher government costs for residential care facilities.

The quality of life of the high-needs elderly has been

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studied internationally and research finds that; As dependency increases, a decrease in quality of life is often experienced [9-11]. Maintaining activities that are interesting and meaningful to the individual is a significant contributor to the quality of life for this cohort, along with other factors such as the maintenance of Personal identity, the maintenance of important relationships and the provision of care that facilitates autonomy and individual needs [9,10]. These activities not only contribute to greater happiness, they also provide stimulation and help with the prevention of falls or physical and mental decline [12-14].

With the recently increasing attention to the importance of engaging in their meaningful activities [15-18], research has stressed the importance for activities and spaces to be designed to suit residents' particular interests and to facilitate choices for their participation [10,19,20]. These requirements have been adopted in many OECD standards. For example, National Care Standards in Britain recommend that communal spaces in care homes include rooms where various social, cultural, and religious activities can take place [21]. With a variety of spaces, residents typically have higher levels of active behaviour [9,22,23].

Recently, providing options for undertaking meaningful activities *in individual space* has been receiving increasing attention [10,19,20]. The private housing environment has a great impact on individual's meaningful activities, as space used for activity becomes more restricted in old age, with activities more likely occurring within their private dwelling [15]. Greater difficulties with mobility often result in different spatial uses. For example, Hale et al. reported that, in private dwellings, a 'reorganisation of space', such as 'placing necessary items conveniently to hand, on small tables on either side of the individual's chair, to ensure as little movement as possible' often occurs in order to afford as much control as possible [24].

In contrast to the great attention to the provision of communal spaces, there is limited information on the design requirements of individual spaces particularly as they relate to the micro-environments of the sitting space. Some design guidelines only require the day area large enough to contain a table and chairs [25]; and others include requirements for the layout of a comfortable chair near a telephone and a TV, as well as requirements for space accommodating furniture such as a bookcase, TV, CD/music player stand and a computer desk [26]. For designers, these requirements are too generic to inform the effective design of the sitting space of high-needs residents. Information is also lacking regarding the kinds of activities that the high-needs elderly typically enjoy, and the spatial requirements to facilitate them.

In order to design housing that improves the quality of life of high-needs elderly residents, greater information is needed on the requirements of private space that facilitates their personal activities in their individual dwellings. This paper aims to clarify those spatial requirements needed to facilitate personal activities, limiting the scope to leisure activities, but excluding daily basic activities such as cooking, showering and sleeping.

2. Methods

An ethnographic survey for built environments that improve quality of life, was conducted of 30 elderly people in the Wellington Region in New Zealand, who consisted of 17 residents of retirement villages, 6 from public-sector rental housing and 7 from private-sector rental housing. Participants were selected from those who were 70 years and older and received care in daily activities from professional caregivers in their own house. Through documentation of the housing environment, semi-structured interviews and single-day observation of elderly residents, data on their day-time activities, the space and their perceptions were collected. Ethics approval was obtained from the Victoria University Human Ethics Committee (approval number: 23243). The consent was obtained from all participants prior to the data collection.

The collection of housing environments included the measurement of the layout of the buildings and rooms and the furniture and fixtures, which were collected in plans, sketches and field notes. Photographs were also taken. Semi-structured interviews were conducted to collect resident's perceptions and experiences. To collect the in-depth data, questions 'which are open (rather than closed), and which do not make too many assumptions towards particular answers [27]' were chosen. Questions relating to residents' personal leisure activities included "Can you tell me about your most important activities?", and "Can you describe your favourite space in this house, and why?" In the event that they could not think of answers or in order to delve into the topic, some prompts and sub-questions were prepared for each question; particularly, it was deemed useful to use prompts such as 'Can you tell me a bit more about that? [27].' Interviews were conducted in the participants' dwellings, to remind them more clearly of their experiences in their space. Interviews were audio-recorded and professionally transcribed, and then cross-checked by the researcher while listening to the original recordings. Observation of residents was conducted to witness the interaction between the user and physical environments. The researcher stayed for seven-eight hours in the residents' house during the daytime on a typical day. During the observation, unstructured interviews were conducted to clarify their behaviours, which is common

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and effective in ethnographical studies [28]. Information collected included residents' behaviours, postures, use of space and the time when any of them changed.

For this study, data on the personal solitary activities of the residents was analysed. The data from observation was analysed to clarify the types of micro space used for leisure activities focusing on the furniture used. The duration of time that participants spent in each space was calculated to analyse the patterns of usage of spaces for personal leisure activities. Data from semi-structured interviews and observation were coded manually, using a coding scheme typically used in Interpretative Phenomenological Analysis [27]. After reading and rereading the interview transcript and observation notes, explanatory comments were noted, and then emergent themes for residents' perceptions were produced. This information was coded by emergent themes. Finally, the patterns and connections between the emergent themes were identified to emerge the super-ordinate themes.

3. Findings

3.1 Participants Basic Information

Participants' basic information is listed in Table 1. Of the 30 residents, 13 were male and 17 were female. The majority (n=19) were aged between 80 and 89, and the remainder were either in their 70s (n=6) or 90s (n=5). The participants' ethnicity was largely European and/or New Zealand, but included one Middle Eastern and one Asian individual. Most participants were living alone, while three were living with their partner. The most common condition was pain or arthritis, which was experienced by half of the residents, followed by cardiac conditions and diabetes/high blood pressure (n=8). Five residents had experienced a stroke. Urinary/bowel conditions, injuries by recent falls and sight impairments were mentioned by four residents. Two thirds of the residents used mobility aids indoors. Of those who used an aid, the most common type of aid was a walker frame or a trolley (n=16), a walking stick and a wheelchair were also used by two residents.

Table 1. Basic information of residents (the numbers in italics show the number of residents)

Gender		**Age group**		**Ethnicity**		**Living arrangements**	
Male	13	70-79	6	European/NZ	28	Alone	27
Female	17	80-89	19	Middle Eastern	1	With partner	3
		90-99	5	Asian	1		

Conditions/impairments stated*		**Type of mobility aids used indoors**	
Had stroke(s)	5	No aid	10
Parkinson's	2	Walking stick	2
Other neurological conditions	2	Walker frame/ trolley	16
Musculoskeletal conditions	1	Wheelchair	2
Cardiac conditions	8		
Pulmonary conditions	3		
Diabetes/high blood pressure	8		
Urinary/bowel conditions	4		
Spinal conditions	2		
Injuries by recent fall(s)	4		
Other pain, arthritis	15		
Sight impairments	4		
Other	9		
No specific conditions	2		

Note:
**Participants were allowed to state more than one conditions.*

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3.2 Patterns of the Use of Space

Through the analysis of the space used for the leisure activities and the time spent, patterns in space used for activities is clarified and summarized in Figure 1. All required space that allowed an easy posture such as sitting and lying during and between personal leisure activities. All used specific sitting space (including chairs and walker frames) to spend most of their time, except for one person who stayed mostly in his bed and one wheelchair user.

Five types of space were identified as those most used. These were spaces occupied by; armchairs, dining room chairs at a table, sofas, beds and wheelchairs. Spaces occupied by armchairs were the most common. The number of used spaces in any one dwelling varied from one to six. The use of two spaces was most common (n=16), followed by those only using one space (n=5).

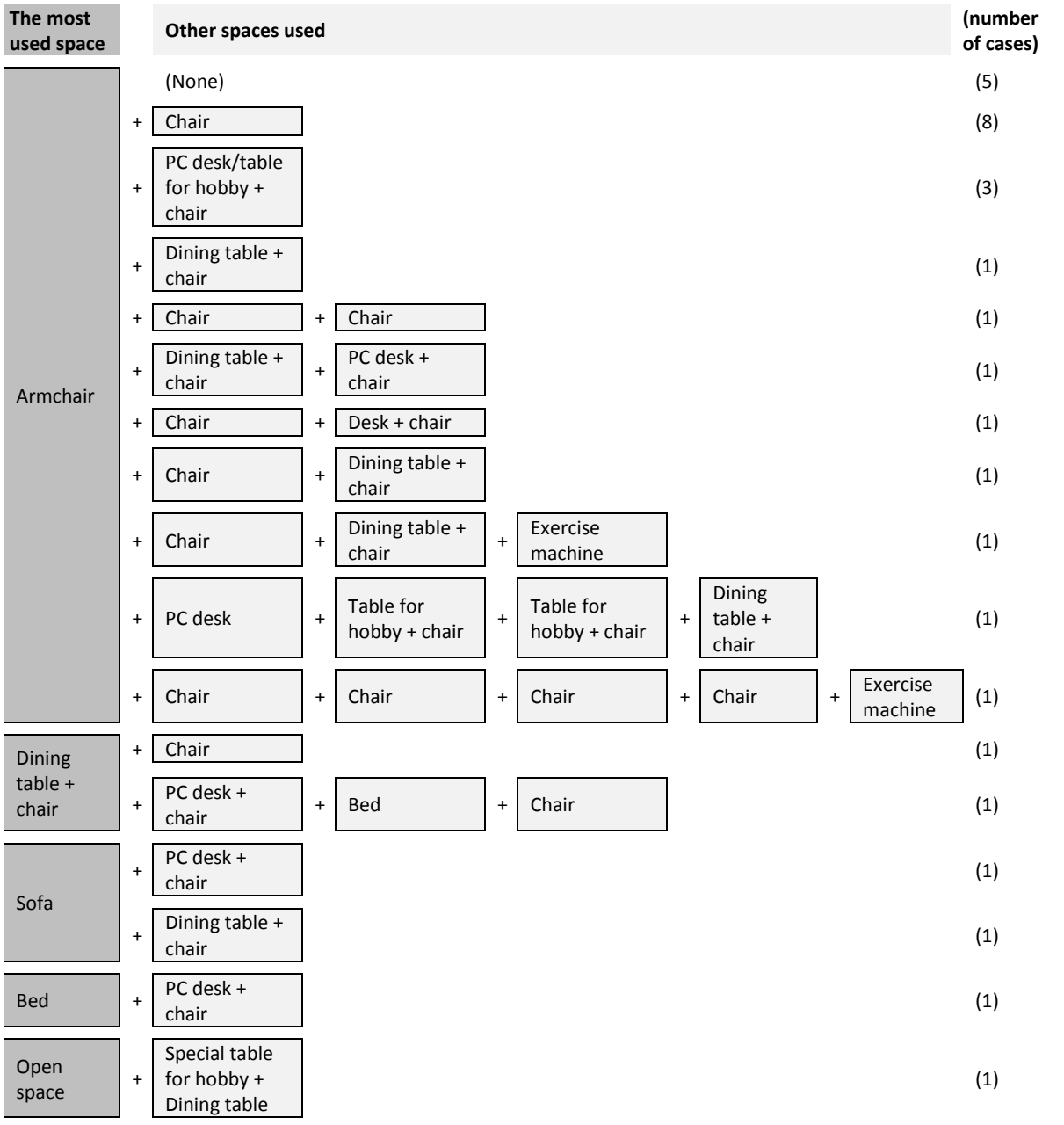

Figure 1. Patterns of spatial usage for personal leisure activities

Note:
The spaces shown in boxes in a row represent different spaces in each dwelling.

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3.3 Perceptions Regarding the Use of Space

The qualitative analysis found six key themes for residents' perceptions that related to the use of space, which included; comfort in posture, access to sunshine and warmth, and facilitating activities to occupy residents, views to outside, control for doing everything from one space, and keeping active. In this section, four participant identifiers, PU, PR, RVI and RVS, are used to signify the housing types of public-sector rental housing units (PU), private-sector rental housing for the elderly (PR), retirement-village independent-living units (RVI), and retirement-village supported-living units (RVS).

3.3.1 Comfort in Posture

Sitting space was important for residents' rest: '*If I exert myself I've gotta come and sit down for a while, get my breath back'* (RVI3). An armchair was the most common type of chair, which could allow an easy, relaxed posture (PU5, PR1, PR5, RVI1, RVI2). One resident said, '*because, I don't know where else to sit … I can't sit up on the [normal] chair right now, I can't sit on that thing, because I can't get up properly'* (PR5). The armrest was an important feature for many residents because it provided a support when they stood up (RVS3). Many armchairs could adjust back and feet positions. Raising the feet position was important for some (PU3, PR1, PR5, RVI4); one participant said, '*I've been told that, you know, because diabetics' … ankles are inclined to swell … the more I can keep my legs elevated, the better I'm off'* (PU3). An adjustable chair also facilitated having a sleep in the early afternoon, which was a common routine for some (PU5, PR7, RVI8, RVS2). A resident wanted an electronically adjustable armchair instead of her armchair that was manually adjustable with a lever handle, '*because the lever handle is too hard for my shoulder*' (RVS4).

While most elderly people used an armchair, one resident used another type of chair due to special requirements for his sitting posture. One resident used a side chair at a desk rather than an armchair like most residents used, because, he said, '*I have to sit up straight, I can't slouch. … With the vertebrae, if I bend over like that, then those two are touching and that can cause pain, so I'm better sitting straight up so the weight is evenly distributed'* (PU4).

3.3.2 Access to Sunshine and Warmth

Accessibility to sun from the north significantly affected residents' satisfaction and their choice of the space they stayed in. One bedsit resident was fond of her sitting space with a north-facing window, because it got the sun. When she was offered to move to a newer and bigger apartment, she declined because of her attachment to the sunshine that came into her room: '*They said "you're a silly bugger." I said, "I know I am," but I like it here, I've got the sun, and I'm happy here. I'm happy here'* (PU5). On the other hand, others were not satisfied with their access to the sun, especially those who did not have a north-facing window (PR1, RVI3, RVS3, RVS4). One resident said, '*I've got nothing facing north here, and it annoys me like mad*' (RVI11). He moved his sitting spaces '*trying to find the sun all the time.'* In the morning, he sat in a chair in the garage, looking out to the east; around noon he sat out in the deck where the sun shone from above; in the afternoon, he sat in the lounge with west-facing windows (Figure 2).

Figure 2. Changing sitting spaces according to the sun movement

In an apartment block with units on the north and south, residents on the southern side envied the northern side: '*I would like more sunshine. That's [the units on the northern side] the sunny side of the building'* (RVS3). She and her next-door neighbour often sat in the communal lounge facing the north (RVS3, RVS4), and said *'I was freezing cold. … This is warmer*' (RVS3). Another participant who didn't have a north-facing window in his lounge mainly stayed in his north-facing bedroom, saying, 'It sounds silly to spend most of your time in the bedroom. … *It would be nicer, I suppose, if you sat out in the lounge and you got more sun'* (RVI1). Apartment residents who had east-facing windows wished for more sunshine (RVS1, RVS2). One resident said,

It comes up early in the morning over the back of these, over these houses. Usually, it comes up over that highest point in the morning and then it makes its way over, and it's off of the terrace by about 2 o'clock - almost one or two. And then it goes over the house and it shines on that side for a little while, but on the whole, that's quite a cold

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side. Often people are saying, "Wish we had a bit more sun here". (RVS2)

All-day sunshine was particularly pleasing. A first-floor-apartment resident could sit by the window without a concern about being watched. He enjoyed the sun all day through the north-facing window, and said, '*It [the sun] comes in here from sunrise to almost sunset. It's very warm in here' (RVS6).*

Residents used various appliances for indoor heating such as an electric heater (PR4), an oil heater (PU6, PR3), a heat pump (PU3, RVI3, RVI4) and underfloor heating (RVS2, RVS3, RVS4). In one damp bathroom, the resident installed in a towel heater (PR5). Where a heat pump was used, residents arranged their sitting space near the heat pump mounted on the low part (RVI3, RVI7, RVI10). However, one resident was dissatisfied with her heat pump, which had been installed on the high part of the wall and didn't efficiently warm up her sitting space (RVI10). She would have preferred a heat pump on the floor.

Another resident had an infrared heater on the ceiling just above her sitting space, which she found '*too hot'* (RVS1). In contrast, residents in serviced apartments who had underfloor heating were satisfied (RVS2, RVS3, RVS4). The cost for underfloor heating was included in the housing cost in serviced apartments, but residents of other housing types had a concern about the cost (PU1, RVI3). One resident said, '*Some of them [other units] have got underfloor heating but what they didn't know was ... their power bill in the winter would go up to $600 a month. They're very expensive'* (PU1). One couple didn't use their underfloor heating because it was '*far too expensive*' (RVI3).

3.3.3 Control for Activities to Occupy Residents

Some high-needs elderly expressed their boredom due to a limitation in activities. However, others succeeded in being engaged in private activities in their own dwellings. One resident said, '*I've got plenty to keep me occupied during the day... Oh I'm busy enough, you know. I'm not bored, put it that way. I love life, I love life*' (PU3).

Watching TV was the most common activity, and most seating was laid out in respect to the location and direction of the TV. In a small lounge, residents wanted to put the TV on the wall (PU5, RVS3). There were differences in preference and duration of this activity. A man who had very limited mobility watched TV all day, saying, '*That would be the only thing, I'd go nuts without the television. Gives me something to do'* (PU1).

All sitting spaces or beds were laid out in respect to the location and direction of their TV, except for one person who did not like watching TV (RVI8). A participant with limited eyesight put his chair close to the TV (RVI11). Those who had sight impairments prefer to sit with their backs to the windows (PR4, RV7). One resident said, '*I don't think I could cope with that [the opposite layout]. Because you're looking into the light all the time'* (PR4) (Figure 3). Residents had remote controls to turn on and change channels as well as adjust the screen brightness, and kept a program guide within their reach.

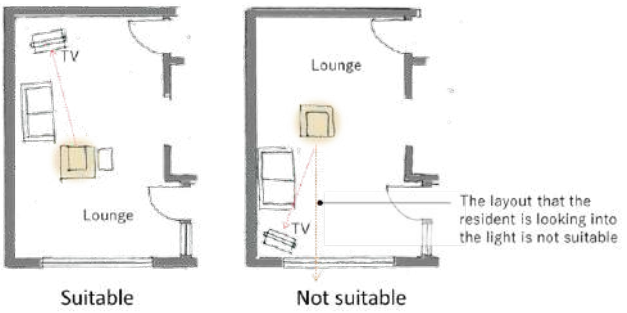

Figure 3. Layout of a chair and a TV for people with vision impairment

Reading was often an important activity during sitting for many residents. Reading a newspaper was problematic as the size of the newspaper was too large to easily manage. A woman with Parkinson's said, '*It's difficult to handle them without a table. It's too big'* (RVS1). Necessary tools and Writing was also a preferred reach of their sitting space, such as eyeglasses, a magnifier, a letter opener, a lamp, a level surface to put books on, and bookshelves.

Writing was also a preferred activity. Some often wrote letters or postcards (PR3, PR7, RVI6, RVI7, RVS3). Some wrote about their life (PR2, RVI6); one resident said, '*I do quite a bit of writing still. Now I just do diaries and things for my family really. ... A lot of questions [from her family]. And still writing the answers to her questions in this book*' (PR2). A man whose wife had dementia and lived in a hospital said, '*I usually start writing two diaries. There's a diary for me as to what my activities have been during the day, and the other one is a diary about how I have found [my wife]'* (RVS6). A dining table or a writing desk were often used for handwriting, and a PC table for writing with a computer.

Some people liked to listen to music, with CDs (PU1, PU2, PR2, RVI11, RVS1) and vinyl records (PU3), and some liked listening to the radio (PR2, RVI11, RVS4). A man with limited eyesight talked about the benefits of listening to music: *'I just like, sort of, listening to it. It passes, time goes quickly, and it helps get you relaxed, and feel all right'* (RVI11). He also liked listening to audiobooks

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that he subscribed to, saying, 'I *read a lot, I read, I listen to talking books. I have a lot of magazines and a lot of books*' (RVI11). Another man who had also issues with eyesight used read-to-speech software to read the contents on the computer (PU4).

Crosswords were a common activity while sitting (PU2, PU5, RVS2, RVS3). Some people played games on a computer (PU2, PU3, PR1) or a tablet (PU5). A man explained the benefit of PC games: '*It keeps your brain ticking over, that's what it's all about, you know*' (PU3). He played them sitting in his armchair, putting his laptop on the armrest, while a resident with hemiplegia needed to sit at a table to support his left arm (PU1) (Figure 4).

Figure 4. Posture of the resident with hemiplegia when sitting at the table

Having a cup of tea and eating meals often took place in this space. Many people used their knees, and adjacent level surfaces such as a side table, a portable table, a kitchen bench or their trolley were used for dining.

3.3.4 Views to Outside

Many people liked seeing outside, which was often the main reason for the choice of the positioning of their sitting space, though some people had little concern about other people's movements outside (PR3, RVI3). Seeing moving things such as people and cars was preferred. A resident said, *'You can see out and see what's going on ... Reminds me I'm still alive'* (RVI2). An elderly couple looking outside and subsequently arranged from each other regarding looking outside and subsequently arranged their armchairs differently (RVI3) (Figure 5).

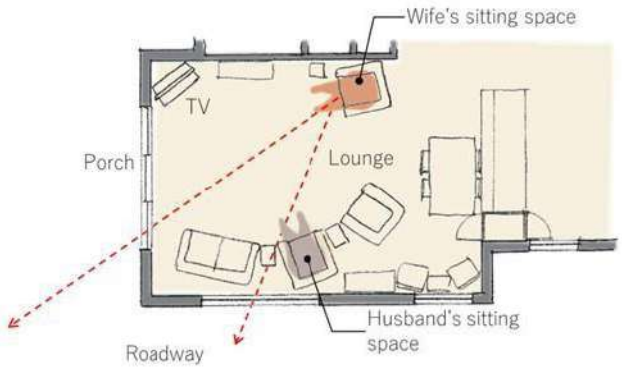

Figure 5. Difference in the sitting position depending on the preference for seeing outside

3.3.5 Control for Doing Everything from One Space

Some residents engaged in multiple activities and tasks, which could be fostered by the organisation of furnishings surrounding their sitting space. One resident sat at his chair facing his PC screen as well as his TV screen. While watching TV, the PC screen notified him of the arrival of messages from friends, at which point he walked to the PC and read the messages (PU4) (Figure 6 left). Another resident with a limited mobility could reach the mouse as well as see his PC screen, which allowed him to view emails from his armchair. He said, '*Yeah, I have to do everything, eat and everything here, from here and, um, do my computer over there'* (PU1) (Figure 6 right). Another man said, '*I can do two things at once. The ear's that way [to the TV] but mostly the eyes are looking this way [to his laptop]'* (PU3). He liked horse racing, which required him to watch TV, take notes on paper, and place bets through the computer that he rested on the armrest of his armchair (Figure 7). He said, *'I've got everything at my fingertips here'*.

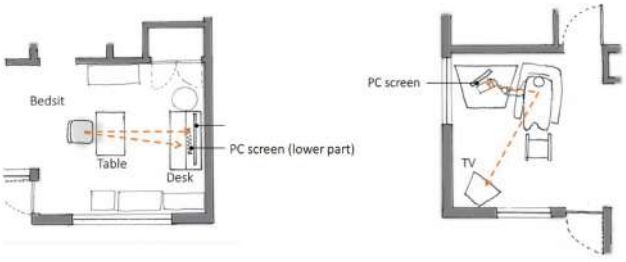

Figure 6. Layout of the PC screen that can be viewed from the sitting space

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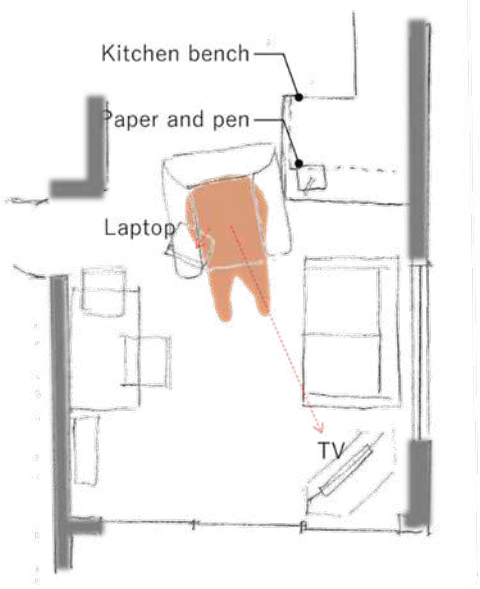

Figure 7. Sitting space that facilitated engagement in multiple activities

Various tools for activities and the furniture and fixtures to accommodate them were placed within reach of residents' sitting space. Level surfaces such as shelves or cupboards with multiple drawers were particularly useful for keeping things tidy (PU3, PR1). A woman who was good at needlework made a handmade organizer for two remote controllers and stationary (scissors, a letter opener, two pens) that could be hung on the armrest of the armchair (RVS2) (Figure 8). Where there were not enough level surfaces, residents placed objects on an adjacent table or desk and put things on the floor (PU1, PU5, RVS3).

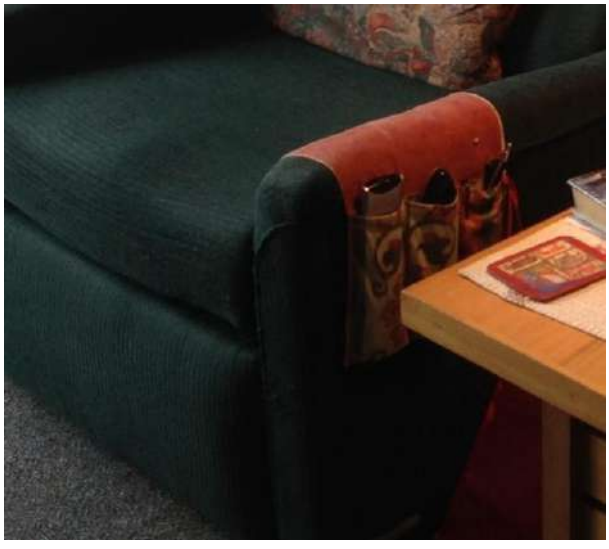

Figure 8. Hand-made storage for remote controls, pens and so on

3.3.6 Keeping Active

Some residents did exercises on their own. Two men had exercise bikes at their unit and used them often. A post-stroke elderly man used his exercise bike quite regularly: "*[I do exercise] at least once a day. ... Because I'm trying to get this leg okay, you know.* (PR2)". The exercise bike was also used as an alternative for going out for a walk: "*I'm too light-headed, and I'm likely to have an angina attack or something, so when I can't walk outside or if it's too wet, I get on my exercycle*" (RVI11). One man performed an exercise of raising his knees while sitting in his armchair: '*I do this. ... two, three, four, five, six, seven, eight, nine, ten. That's it. ... "Knees up Mother Brown"* (RVI4). Another participant performed his routine exercises, moving his legs, ankles and hip lying on the bed (PU6). One lady who has arthritis in her hands did knitting to help her hands: '*I used to knit years ago. I'm starting up now to keep my hands, um, arthritis and that. If you don't work, you get all crippled, so I knit'* (PU5). A man who had impairments following a stroke kept a ball on the side table by his armchair. He said, "*My left arm ... That's why I have a ball [for exercise] there*" (RVI8).

Some residents preferred to avoid a completely sedentary lifestyle. A male resident spent most of his time in an armchair in his bedroom, except for when he watched TV in the lounge. When asked whether he would like to have the TV in the bedroom, he said,

"Oh yeah, it'd be quite nice... No, if I had the TV in here I would spend too much time sitting or lying down. I think having it in the lounge keeps me active… No, if it was in here I'd be lying on the bed for hours… In one sense it'd be nice, but it wouldn't do me any good. (RVI1)"

One caregiver suggested the significance of space for moving around;

You have to have a small patio kind of area from their living room area they can go out on when it's a sunny day, where they can sit down and stay. So that will make them kind of move… They have to move around. (PR5)

Some activities required a separate space with special furniture, such as a writing table, a PC desk or a table for handcrafts and needlework. One female resident who lived in a two-bedroom house had different spaces for different activities (Figure 9). She liked reading in an armchair by the window, with the sunlight falling on the book. She also had a card table where she liked to do jigsaw puzzles, which were kept on the table even if uncompleted. She operated her computer at her PC table, and she wrote at the writing desk in her bedroom, which she really liked because it was "very private" (RVI9).

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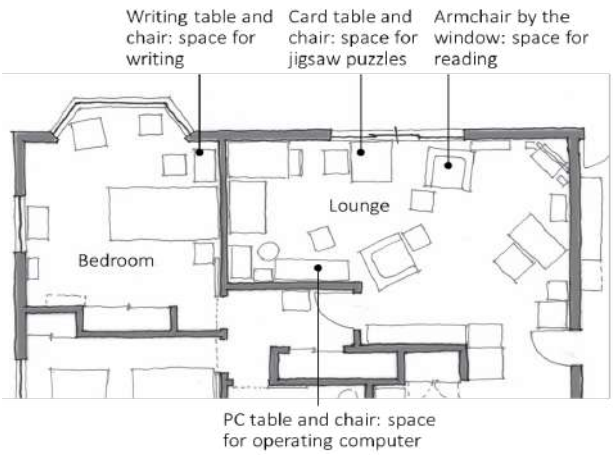

Figure 9. Using different spaces for various activities

4. Discussion

Facilitating individual meaningful activities for elderly people living in private dwellings is a research area which has been receiving attention [10,19,20], yet there is only limited information with regard to the necessary spatial design requirements. Using an ethnographic approach, this research has delved into personal activities of those with care needs and provided insights into optimal housing design for them. In particular, it has provided clarity regarding essential considerations for the micro space of the high-needs elderly described by Hale et al. such as "placing necessary items conveniently to hand, on small tables on either side of the individual's chair, to ensure as little movement as possible" [24].

Providing multiple spaces for activities widens the range of activities that can be enjoyed by residents. However, this research highlighted the significance of the design of the single sitting space which the residents used most of their time. Careful consideration should be given to the micro-environment surrounding this space as most leisure activities occur in this space, such as reading, knitting, doing sitting exercises, talking on the telephone, doing crosswords, cutting fabrics or paper, writing letters and using the computer. An armchair is most commonly used as it allows for comfortable posture and the armrests help with getting up and sitting down. Adjustable reclining armchairs are appreciated by participants who needed to lift their legs to ease discomfort, which has implications for the areas both to the front and rear of the chair.

The spatial organisation should allow for a layout which can accommodate an adjustable armchair with room for adjacent level surfaces or storage to ensure necessary things are within reach, enhancing residents' control of their environment and facilitating activities. The adjacent level surfaces and storage areas can include shelves, tables, desks, kitchen benches, drawers and trolleys that can accommodate various items such as a telephone/handset, remote controls, glasses, medicine, cups of tea, pens and paper. Additional lighting should be provided for this space, where residents often enjoy reading. Additional power outlets, ideally located at sitting height and within reach are needed to accommodate a range of technologies and charging devices.

As watching TV was the most common activity, room layout should consider the location and proximity of the TV in relation to potential armchair locations (including the option of hanging the TV on the wall) and the windows. The layout of a TV in front of a window, which compels residents to stare at the window, should be avoided for those with eye impairments. Similarly, window glare on the screen should be avoided. Given that some elderly people like to view their computer screen to detect the arrival of new messages or updates on social media websites, similar attention should be given to views of a computer screen as well.

Attention should be given to the layout of doors and windows so that residents can enjoy the views of people and vehicles moving outside but at the same time maintain privacy. The use of sheer or lace curtains, which can both let sunlight in and block views into rooms; can block views to the outside and are not ideal for unobscured views. These can also be difficult to close and open. Using vertical blinds that can be angled is a better solution for blocking views from the outside in, while allowing views from the inside to the outside. Other strategies should also be considered to facilitate the connection with the outdoors without losing privacy, such as limiting the window height (e.g. avoiding full-height windows) and providing a level difference between inside and out, or ensuring that there is adequate distance between the unit and any communal pathways.

Warmth is essential in the sitting space; however, the use of solar warmth relates to windows and as such can present special challenges. In Southern hemisphere countries such as New Zealand, the space should ideally have north-facing windows for passive solar gains and to provide a warm sunny well-lit space. However, in the evening this same window can result in radiant heat loss unless strategies such as double glazing and/or thermal curtains are employed. Windows directly facing south in the Southern hemisphere can be detrimental to residents as they contribute to radiant heat loss, while offering little in the way of natural light. Study participants in east-facing units also felt cold. A heat supply should be provided in proximity to the sitting space, and suited to warming

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lower areas where drafts are more prevalent. Underfloor heating or a heat pump mounted on the low part of the wall can address this concern. Overhead positioning of heat pumps or infrared radiant heating on the ceiling is often uncomfortable, so should be avoided. Finally, considering that doors are often kept open between the lounge and adjacent rooms, the heating capacity of any heating device should take this into consideration.

While the design of the space where the elderly spend most of their time has a significant impact on their control and enjoyment of activities in a comfortable manner, the interior layout of housing also has implications for maintaining an active lifestyle and facilitating a wider variety of possible activities. Occupying larger housing with more rooms is not always a better solution. In order to evaluate a suitable size, attention should also be given to the ease of upkeep as many elderly people experience difficulty in keeping up maintenance of their housing [6,7,8].

The use of space and perceptions of elderly residents can provide architects and designers with new insights to form the basis of improved housing design. Designing around a reclining armchair or a pair of reclining armchairs can shed much light on the challenges of designing for this cohort. This research will be benefited by combining it with insights with regard to other activities occurring at home, such as social activities and interactions with caregivers, to provide more holistic design considerations.

Future research is needed to focus on differences between sub-groups such as by types of impairments and conditions, or types of mobility aids used, as this research has identified different requirements for those with specific conditions/ mobility aids. For example, the suitable type of chair was different for people with spinal conditions, some of whom preferred a side chair to an armchair, and for post-stroke patients with hemiplegia who required space that could provide extra support for their impaired side. Special attention was also required for the layout of the chair with respect to windows for those with sight impairments. Suitable space was also unique for wheelchair users, who only required open space. Given that the preference in activities can also differ by ethnicities [29], research with various ethnic groups can inform the design that is most suited to facilitate preferred activities of each group.

5. Conclusion

This paper clarified the spatial considerations for private space to accommodate personal leisure activities of the high-needs elderly, through an ethnographical investigation of 30 elderly participants with care needs. It first examined the typical use of space for leisure activities and perceptions of it. Then, it clarified the types of micro space focusing on the furniture used, and examined the patterns of the spatial use. The five most commonly used spaces were those that accommodated; a reclining armchair, a dining table + chair, a sofa, a bed and open space. Next, a qualitative analysis was conducted from the interviews to distil themes for the residents' perceptions with regard to the spatial use, which included; comfort in posture, access to sunshine and warmth, facilitating activities to occupy residents, views to outside, control for doing everything from one space, and keeping active.

The research finds that most participants had a space where they sat for long periods of time, which became increasingly important as mobility declined. Careful consideration for the layout of the micro-environment surrounding the sitting space where residents spend most of their time is necessary to maintain quality of life. The main object requiring careful design consideration is that of the reclining armchair which consumes quite a large amount of space when in its reclining position. Design should focus on serving this space and permit the layout of furniture for sitting and lying with adjacent level surfaces and sufficient sources of power to ensure things are within reach, thereby facilitating greater control and access to activities. Types of sitting space should also take account of differing spatial requirements for type of impairments and mobility aids used. Sunshine, warmth, views, and privacy are also important factors for the design of this space but often present contradictory conditions which must be addressed. The interior layout has implications for maintaining an active lifestyle as well as facilitating the variety of activities that occur in the house. Designs should be tested against these requirements using furnishings to ensure comfort and lifestyle are not compromised. Thoughtful housing design can help residents continue their fulfilled life in their own home even after care needs arise.

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