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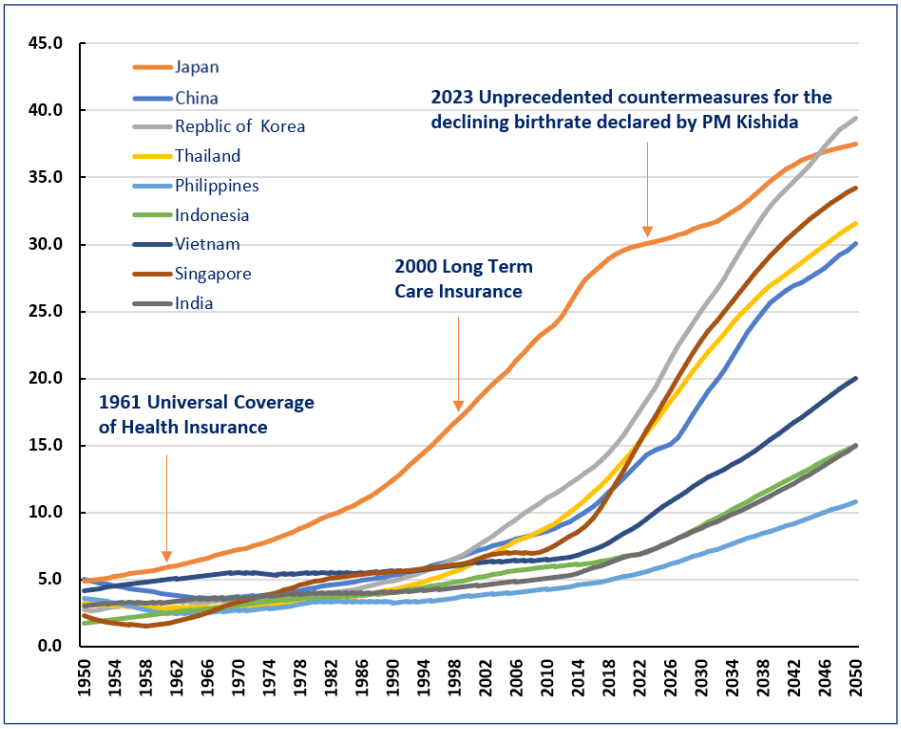
Special Topic: Super-Aged Society in Japan



Population ageing in selected countries in Asia (1950 - 2050) and major Japanese policies (Page 50)

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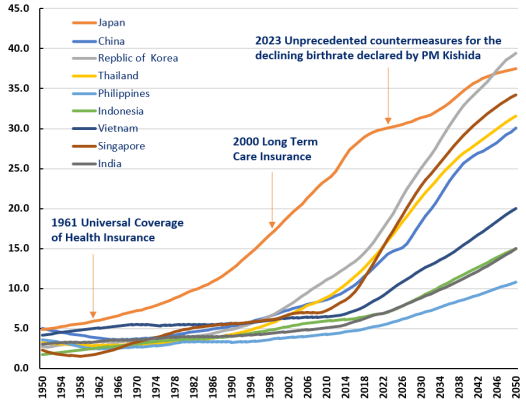

Population ageing in selected countries in Asia (1950 - 2050) and major Japanese policies. Japan achieved universal health insurance coverage in 1961 and a subprogram for persons over 75 was started in 2008 to sustain financial stability. The long-term care insurance was launched in 2000 as a system for society as a whole to support the long-term care of the elderly. While attention was given to aging, birth rate decline has continued in Japan and the fertility rate dropped to a record low of 1.26% in 2022. At the Parliamentary session in the beginning of 2023, Prime Minister Kishida declared, "unprecedented measures to address declining birth rate". (Page 50).

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Aging populations and perspectives of geriatric medicine in Japan

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Abstract: It is well known that Japan's population is aging, and the number of people older than 75 years is increasing significantly. Since older people, especially old individuals, are often multimorbid and cannot be always successfully treated and cared for by individual organ-specific treatment, it is essential to utilize knowledge of geriatrics when treating such older patients. Therefore, it is indisputable that education on geriatric medicine is extremely important in Japan, which is the country with the largest aging population. However, the number of universities in Japan that offer geriatrics courses is decreasing. This means that many medical students become doctors without learning the essential characteristics of medical care for older patients despite the need for prompt treatment of older patients in clinical practice in Japan, which is a major obstacle to the development of geriatric medicine in Japan. Here, we review the current status of geriatrics in Japan and overseas and consider the future of geriatrics education to provide holistic and cost-effective medical care for older patients and improve their quality of life and well-being.

Keywords: geriatrics, research, education, clinical practice

Introduction

In general, older patients are characterized by multimorbidity, polypharmacy, atypical symptoms, and complications of geriatric syndromes such as frailty, sarcopenia, and dementia. Agism and ethical issues related to end-of-life care also need to be addressed when caring for older patients, especially those who are frail. However, there are very few acute care hospitals in Japan, including university hospitals, that have geriatrics departments; as such, and it is difficult to acknowledge that holistic and appropriate care for older patients is being appropriately provided because most older patients are treated using a traditional disease-based approach. The treatment of older patients with multimorbidity in organ-specific departments is inefficient due to multiple visits to several hospitals and clinics, and it leads to problems related to inappropriate drug administration, such as polypharmacy and prescription cascades, due to a lack of communication among these doctors. In addition, since the focus of care for older patients is still disease-based in most health care settings, preventive measures for frailty or attention to the quality of life and well-being of older patients are not provided in most cases. On the other hand, in geriatrics, along with the diagnosis and treatment of diseases, the diagnosis, prevention, and intervention of frailty and other geriatric syndromes are appropriately provided based on comprehensive geriatric assessment (CGA) and frailty assessment (*1*).

Thus, to promote appropriate medical care in a superaged society, geriatrics should be mandatory in university undergraduate education, and a specified period of training should be required in postgraduate education. However, few medical schools in Japan have geriatrics departments even though the Subcommittee of Aging of the Science Council of Japan issued proposals to mandate the placement of geriatrics departments in university hospitals twice (*2,3*). Currently, it is unlikely that appropriate training in geriatrics is provided in undergraduate or postgraduate education, and there is likely a gap between medical practice and education and training in medical schools in Japan.

What is a geriatrician?

What can a geriatrician do for the care of older patients? A geriatrician is a physician specializing in the care of older patients, from health promotion and health care to long-term and end-of-life care. Specifically, along with the management of multimorbidity, which is a feature of older patients, geriatricians can appropriately manage polypharmacy, which emerges as a related problem, as well as prevent and intervene in age-related frailty, sarcopenia, urinary incontinence, falls, cognitive dysfunction, *etc*., based on appropriate assessments. Geriatricians are also experienced in taking

a team approach and can demonstrate leadership in the multidisciplinary collaboration required in medical care for older patients, as well as in training of health care professionals involved in multidisciplinary collaboration. Therefore, integrated outpatient services, post-acute/subacute care programs, and all-inclusive care programs for older adults have emerged to address the multifaceted requirements of frail older patients. In addition, there is increasing awareness of geriatric co-management in different care settings, such as fragility fracture prevention and surgery. These models have demonstrated clinical and cost-effectiveness, primarily attributed to the active participation of geriatricians (*4,5*).

The expertise of geriatricians in managing multiple complex care needs is essential for health care systems, especially for high-need, high-cost older patients (*6*). Additionally, there is clear evidence of improved clinical outcomes when geriatricians provide care for frail older patients with multiple complex health care needs (*7*). Furthermore, a long-term care insurance system was implemented in Japan in 2000, and the integration of medical care and long-term care is extremely important. Geriatricians can also demonstrate excellent skills in coordinating to fill the gap between medical and long-term care provisions.

Japan has one of the highest life expectancies worldwide, and the demand for geriatric care is increasing; however, the number of medical professionals specializing in geriatrics has not kept pace with this demand. Despite this demographic change, however, there are only approximately 1,800 geriatricians certified by the Japan Geriatrics Society in Japan, which means that only 0.4% of the total physician population comprises board-certified geriatricians. Additionally, it should be noted that not all geriatric specialists have been trained under an appropriate program; as such, we need continuous efforts to develop better geriatrics education and training programs in Japan. This shortage extends to the academic field as well, with only 24 of the 82 universities with medical schools offering training programs in geriatrics in 2010 (*8*); thereafter, the number of geriatric departments in medical schools decreased in Japan. Based on the efforts of the Japan Geriatrics Society, Japan introduced a new geriatric specialist training program aimed at developing specialists across various disciplines through a structured training initiative in 2018 to address the shortage of well-trained geriatricians.

Undergraduate geriatrics education in Japan

In Japan, Kaneko *et al*. surveyed students' satisfaction with geriatrics education and reported that students at universities in "geriatrics departments" were more satisfied with geriatrics education than those without (*9*). On the other hand, a survey by the Education Committee of the Japan Geriatrics Society conducted by Furukawa *et al*. reported that providing geriatrics training in nursing homes and home-care settings is considered important for gaining a deeper understanding of geriatric care and the medical environment (*10*). However, approximately 55% of Japanese medical schools do not provide such training due to a lack of cooperation with local medical institutions and a lack of understanding and support from the medical schools themselves. Many of the medical schools cited a lack of staff and beds for education and training as the causes, revealing the circumstances and factors that make it difficult to implement out-of-hospital training. Many of the medical schools also cited the number of faculty members engaged in geriatrics education, educational facilities for geriatric training, an increase in the number of class hours, improvement in students' motivation, and promotion of regional cooperation for education as the issues to be improved.

To improve quality of geriatrics education, all medical schools try to cover geriatrics-related items in the Model Core Curriculum for Medical Education and the National Medical Examination Criteria for Geriatric Education. Because the role of medical care for older patients is becoming increasingly important in Japan, geriatrics education is essential for medical students and young doctors to provide better medical care for older patients.

Geriatrics education in foreign countries

The Education Committee of the Japan Geriatrics Society conducted an internet survey on geriatrics education in medical schools in foreign countries (*10*). In many countries, the number of staff members responsible for geriatrics education is insufficient, and the number of students who receive geriatrics education is very small. In many of these countries, the number of faculty members and staff and the amount of time required for education have been cited as problems. The importance of geriatrics education has been emphasized in many countries; however, few countries have satisfactory geriatrics education programs, and there is an ongoing struggle to improve geriatrics education in many countries. Compared with cardiology and gastroenterology, which have long histories and many specialists, geriatrics is still a young specialty with an insufficient number of specialists. In this sense, geriatrics has not yet established a sufficient presence in the field of undergraduate education in many countries.

Similar to Japan, in many countries, the problem is that geriatrics education is conducted by faculty members who are not "professionals" in geriatrics. In Japan, the overall number of geriatricians is insufficient, and they are busy with clinical and research duties, which makes it difficult for geriatric specialists or geriatricians to provide satisfactory education. Thus, in many countries, geriatricians do not play a major role in geriatrics education. Therefore, it is urgent to increase

the number of geriatric specialists both qualitatively and quantitatively and to create a system that can fully contribute to undergraduate education.

Geriatrics in Europe and the United States

The average number of medical schools with geriatrics departments or professorships in European countries was reported to be 7.2 in 1999, 6.9 in 2002, and 4.9 in 2006 (*11,12*). Recently, Gurwitz also highlighted the paradoxical decline in geriatric medicine in the United States over the past 35 years, despite its establishment in response to an aging baby boomer population (*13*). The decline in geriatrics is further exacerbated by the negative attitudes of medical students and residents toward older people, as indicated by a study in northern California (*14*).

Given the aging population and the challenges of multimorbid complications, functional disability, dementia, and frailty, there is an urgent need for geriatric specialists. The importance of addressing the decline in the geriatric profession is emphasized, especially in light of the significant decrease in the number of geriatric specialists and the challenges facing the field. In the United States, acute care programs for frail older people are relatively limited, and geriatricians play an important role across diverse medical disciplines, whereas geriatricians operate primarily within acute care hospitals in the United Kingdom (*15*). These differences in health care systems have a significant impact on services provided to frail older people. While geriatricians and geriatric wards play an important role in the care of frail older people in the United Kingdom (*6*), there is an urgent need for a new model of care that can seamlessly incorporate the CGA approach for the majority of older patients admitted to hospitals other than geriatric wards and that has the potential to extend beyond the acute hospital setting. The CGA approach has been used in the United Kingdom for many years. In the last decade, a co-management approach has been developed in the United Kingdom (*16*) and other European countries to address this gap.

Additionally, the European Union of Geriatric Medicine Society (EUGMS) was established in 2001 to develop geriatrics as an independent specialty to care for older people with age-related conditions, to ensure that these services are accessible to all European citizens, to support development of health care services appropriate for an aging society and to promote education and continuing professional development (*17*). In the majority of European countries, geriatrics has been identified as an important specialty for health care of older people. Despite the heterogeneity of postgraduate geriatric curricula in European countries, European societies have succeeded in defining a common core curriculum that includes a minimum list of training requirements for the title of geriatrician (*18*). Despite the established status of geriatrics in Europe, 55% of leading geriatricians perceive that geriatrics is not popular among practitioners (*18*). A recent survey indicated that recruitment in geriatrics is trending positively, with more medical trainees considering geriatrics their first choice of specialty than they did in previous surveys (*19*). An earlier study that aimed to investigate senior medical students' interest in geriatrics and their career aspirations revealed that one-third of them later specialized in geriatrics (*20*). In addition, a study that scrutinized career choices of young physicians in the field of geriatrics revealed that a greater percentage of women than men choose geriatrics and that geriatrics has recently experienced a slight increase in popularity (*21*). Furthermore, the study suggested that early career choice is not a strong predictor of final specialty choice, underscoring the need for flexibility in participation in geriatrics training.

Current status of geriatrics in Asia

In contrast to the United States and European countries, Asian countries and regions are experiencing a markedly accelerated pace of aging. For example, this demographic shift took 118 years in France, 26 years in Japan and 25 years in Taiwan. As a result, the process of transforming health care systems and incorporating geriatric care is an even greater challenge in the Asian region than in Western countries.

In Korea, numerous obstacles hinder the advancement and integration of high-quality geriatric medicine into the health care system, encompassing the requirement for widespread clinical proficiency in older adult care across diverse health care providers and settings, absence of structured training programs, inadequate financial incentives for geriatric care, a substantial proportion of older adults receiving care in acute care hospitals instead of more suitable settings, and a dearth of coordination among medical societies focused on geriatric medicine, thereby impeding effective establishment of geriatric medicine as a subspecialty (*22*). A study conducted in Malaysia examined the current state of geriatrics education for Malaysian medical students and revealed that while some schools have integrated these topics into their curricula, others lack expertise and curriculum inclusion, highlighting need for a nationwide geriatric medical curriculum and further research on addressing teaching barriers (*23*). In Taiwan, specialized geriatrician training started in 2004, adopting a model similar to that of the American Geriatrics Society; however, at present, there are 860 certified geriatricians, accounting for 1.2% of the total physician population, and the number of geriatrics fellows has exhibited a consistent trend, with approximately 20–30 individuals per year, a pattern attributed to uncertainties regarding their roles within the health care system. Nonetheless, it is worth noting that Taiwan has acknowledged the escalating

significance of improving care for older individuals with multifaceted health care needs. Consequently, geriatric medicine has been integrated as a mandatory component of postgraduate year training programs in Taiwan. Moreover, teaching hospitals are now mandated to ensure availability of adequate staffing and health care services for geriatric medicine to fulfill requirements of postgraduate year training and to function as standard services within these institutions. With a population exceeding 200 million older than 65 years, China has established a policy mandating that 90% of general hospitals establish a dedicated geriatrics department by 2030.

The perspective of geriatric medicine

As discussed, the role of geriatric practice is clearly defined in most European countries, where health care systems generally rely on the public sector, either through taxes or universal health insurance. Collaborating with general internists, geriatricians in Europe primarily provide acute hospital care, similar to hospitalists in the United States. In contrast, these roles are less clearly defined in the United States and Asian countries, where geriatricians are actively involved in community medicine and long-term care in addition to hospital and clinic care. Even in European countries, based on opinion leaders' views, geriatrics is not growing in popularity, although students and trainees continue to express interest in specializing in geriatrics. Asian countries face even greater challenges than the United States and European countries in promoting quality care for frail older people. Such transformation must encompass the delivery of integrated, patient-centered care across diverse health care settings.

However, as the country with the largest aging population, Japan is not well prepared to care for older patients. Therefore, geriatricians should take a more active role in acute care settings and provide leadership within health care teams to ensure seamless care delivery, with an emphasis on care plan structure and continuity across different health care settings in Japan. Furthermore, in line with the UN Decade of Healthy Aging resolution, geriatricians should be actively involved in promoting population-level healthy longevity initiatives and should play a pivotal role in facilitating the transition of health care from a reactive to a proactive model, from a disease-centered to a function-centered approach, and from a treatment-driven practice to a prevention-driven approach. In Japan, the primary focus should be on transforming existing health care systems to effectively address the myriad challenges associated with rapid aging. This transformation should encompass the provision of person-centered integrated care across diverse health care settings.

In conclusion, the role of geriatric practice in different health care settings is apparent; therefore, we need to emphasize the need for geriatricians to play an active role in medical care, long-term care, and population-level healthy aging initiatives. Thus, we need to transform health care systems to provide person-centered integrated care and address challenges in promoting quality care for frail older people, which is faced in Japan.

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Japan's healthcare delivery system: From its historical evolution to the challenges of a super-aged society

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Abstract: Although Japan's healthcare delivery system is highly regarded internationally, the COVID-19 pandemic has exposed its structural problems. Behind these issues lies a history of medical care provisions supported mainly by an unrestricted, "free labeling" system, and independently financed private hospitals. In addition, patients have a high degree of freedom of choice under the Japanese medical insurance system, making it difficult to provide comprehensive and continuous health management from initial diagnosis and treatment (primary care), specialized treatment, to supporting a return to home, providing nursing care and lifestyle support. As Japan becomes a "super-aged" society with individuals over 65 making up over 30% of the population, the nature of medical care will have to undergo major changes. Medical care's basic function must still be the treatment and cure of patients, but the system will also have to provide support. That means conceiving of care in a way that treats a person's life with dignity and does not sacrifice life for treatment. The implementation of a family doctor function and the clarification of the functions and roles of small and medium-sized community-based hospitals that support this function, as well as the establishment of a community comprehensive care network with multidisciplinary cooperation that goes beyond medical care, should also be set forth in future regional medical care plans.

***Keywords*:** healthcare delivery system, medical insurance system, population ageing, medical care, Japan

Introduction

Hospitals are believed to have originated in the Middle Ages as accommodations for pilgrims. These early hospitals were mainly institutions for the nursing of the poor, sick, and stranded. The Hospice de Beaune in Beaune, France, is the world's oldest sanatorium, established in the mid-15th century.

Later, the Elizabethan Poor Law of the 16th century in England created "Contagious Hospitals" as places to care for patients in isolation. The same laws created poorhouses but these were mainly institutions where workers were treated and then sent to work again. In the 19th century, as modern medicine developed, military medicine and military hospitals developed as separate systems.

Either way, all modern hospitals in Europe for the treatment of the general public developed either as religious hospitals or public hospitals for the poor. In contrast, "clinics" have completely different origins and developed separately.

In Japan, hospitals developed in an altogether different way. As a 2013 government report (*1*) states:

"The difficulty of Japan's healthcare policy stems from the fact that, unlike in Western and Northern Europe, where national and municipal hospitals and other facilities are publicly owned, physicians have established medical corporations and private capital has been used to manage hospitals and other facilities (private ownership)".

"In the case of a publicly-owned system, governments can mandate reforms, such as how reforms have taken place in response to healthcare needs in some European countries recently".

"No other developed country as Japan has such a deregulated and market-dependent healthcare delivery system. In the case of Japan, publicly-owned healthcare facilities account for only 14% of all healthcare facilities and 22% of all hospital beds. Therefore, it has been difficult for Japan to do what other countries where healthcare institutions are publicly-owned can do systematically".

Characteristics of Japanese healthcare delivery system: Ownership-based medical care structure

Professor Shuhei Ikai of Hitotsubashi University, in his book "A Theory of the Hospital Century" (*2*), states that the Japanese healthcare delivery system is characterized by an "ownership-based medical care structure", which

he defines as having the following characteristics:

i) *Free access with a high degree of freedom.* This leads to bloated outpatient care. It means "if you wait for three hours, you can see a doctor on the same day. There are very few countries where this type of outpatient consultation is possible.

ii) *Ownership of hospital beds by physicians in a system where any licensed physician has the freedom to choose where he or she opens their business and their specialty (free labeling).* The functions of large hospitals and clinics are undifferentiated, and large hospitals also have outpatient departments, creating a competitive relationship between them. General practitioners have certain specialties, and both hospitals and clinics provide both primary and secondary care, which means offerings overlap.

iii) *Direct employment of physicians by hospitals.* It is the physicians attached to (*i.e*., employed by) the hospital who provide medical care using the hospital's medical resources. So-called open-type hospitals do not function in Japan.

iv) *High ratio of private hospitals and hospital bed stock.* The historical development of Japanese hospitals is unique in that private clinics became hospitals with their own beds, and then became incorporated as medical corporations.

v) *Decentralized distribution of hospital beds and expensive medical equipment.* As a consequence of *iii*) and *iv*), each medical institution manages its own hospitals based on its own risk and judgment in a competitive relationship. As a result, the distribution of beds among facilities is decentralized, and each institution decides how it will invest capital. making it difficult to systematically allocate beds and equipment.

vi) *High specialization of general practitioners.* Most general practitioners start their career through the medical office and resident physician system, then open their own practice, and many also have a specialty. This situation is quite different from that of general practitioners in other countries; in reality, Japanese general practitioners are able to provide not only primary care but also a certain level of secondary care.

vii) *The lack of a family doctor (GP) system.*

viii) *Medical office system and egalitarian hiring. Because both resident physicians and doctors in private practice both have the same level of specialization, a system of specialized doctors does not work.*

Japan's modern medical care system has taken shape since the Meiji era. This extremely stable and immutable system has come to be a defining factor for medical policy, and, as a result, medical policy has only progressed gradually.

An evaluation of Japan's healthcare system to date

Japan's healthcare system is highly regarded internationally, as the country achieved universal healthcare coverage in the 1960s. There are very few treatments that are not covered by health insurance, and services covered are provided in an extremely fair, equal, and inexpensive manner. Free-access is guaranteed, and Japan was the first in the world to establish a systematic long-term care insurance system (*3*).

The World Health Organization report in 2000 (*4*), a Newsweek feature in 2010 (*5*), and The Lancet in 2011 (*6*), international media and organizations speak highly of Japan's healthcare delivery system. On the other hand, however, the Lancet points out, for example, that Japan is facing a declining birthrate and an aging population, and there is no guarantee that the current system can be maintained in such an environment. This is a very good system, but if it is to be maintained, it must be reformed.

Issues surrounding Japan's medical care: Challenges of a "super-aged" society

Japan is already one of the world's most aged societies, its population declining by 800,000 to 1,000,000 people every year (*7*). There are no signs of any reversal to this decline, or to the aging of the population. Japan's population is expected to decline by about 15% by 2040 (*7*). On the other hand, the number of elderly people, especially those in the later stages of life, will increase, so the growth in the number of people requiring nursing care will outpace that of the overall aging of the population. Japan's elderly population will peak in 2040, and its super-elderly population in the 2060s (*8*), so numbers of individuals requiring care will not start to ease until after that time.

In addition, the structure of diseases will change. The number of chronic diseases will increase, pushing up treatment rates and length of treatment. The length of time people require nursing care will also increase. In other words, medical care needs per capita will increase.

Furthermore, medical technology is advancing at an ever-increasing pace, so medical care will become more sophisticated, and diseases that could not be cured before will be cured. If diseases can be cured, the average life expectancy will further increase.

An increase in medical care needs is unavoidable. Recently, Japan's fiscal authorities have argued without evidence that an increase in costs can be kept in line with gross domestic product (GDP) growth, but a look at other countries reveals that this is impossible. The Organization for Economic Co-operation and Development has published research showing that the ratio of medical care costs to GDP will increase over the next 20 years in all developed countries (*8*). This does not mean that nothing can be done about costs, but as long as there is a substantive increase in needs, an increase in medical care costs should be considered inevitable.

Meanwhile, the socioeconomic structure of Japan and the profile of its elderly population continue to evolve. Family and community ties are weakening,

and the number of elderly living alone or in pairs will increase. Already today, most of Japan's elderly are already in single- or two-person households. This means that the point at which support is necessary is getting closer and closer to individuals. For example, a helper must be dispatched if an elderly person living alone needs something as small as a lightbulb changed. The proportion of the elderly who depend on public services will continue to increase.

Since the postwar generation will become the core of Japan's elderly population, a majority will be made up by long-time urban residents and Employees' pensioners. On the other hand, however, income disparities within the elderly population will widen.

In addition, the post-bubble generation, who were of working age during Japan's 30 years of economic stagnation, and those over 40 who struggled to find work and became contract employees, will grow old. The number of elderly people who are single, poor, and without relatives will increase. The burden on the social security system will continue to grow.

Issues surrounding Japan's medical care: Challenges of human and material resources

The level of human and material resources supporting medical care in Japan is surprisingly not very high. If we reiterate the characteristics of Japan's medical care delivery system, the reasons for this become clear.

i) *Japan has the most private capital-dependent healthcare delivery system of any developed country.* Profits and losses of private hospitals ultimately belong to individuals (medical corporations) who manage those corporations at their own risk. Furthermore, even if the hospital is a non-profit corporation, the president of the hospital must act as a personal guarantor for any capital investment, no different from any other small business. Because they are managed by individuals who guarantee their debts, they cannot be easily reorganized and integrated.

ii) *Governance of the regional healthcare provision system is not yet established.* Until the revision of the Medical Service Act in 1985, it was not even possible to regulate the number of hospital beds. The allocation of human and material resources and capital investment is done by individual medical institutions based on their own judgment. In other words, they are facility-complete, and not "community-complete", in which the entire region coordinates and maintains its own facilities.

Not only private hospitals, but also public hospitals and public medical institutions, which are supposed to be well governed, duplicate functions and investments, wasting resources. In addition, medical institutions have undifferentiated functions and don't sufficiently coordinate between each other. As a result, although the number of hospital beds in Japan is high by international standards, higher functions are weak, medical care functions are inadequate, and there is no coordination with long-term care.

The number of doctors per population in Japan is not so bad, but the number of doctors per hospital bed is only one-fifth of those in the U.S. and the U.K., and less than half of those in Germany and France (Figure 1 and Figure 2). In addition, the number of doctors per hospital bed in other countries is increasing significantly as medical care becomes more sophisticated. The number of doctors per hospital bed in Japan has hardly increased at all, the gap between Japan and other countries is growing wider and wider; and the same is true for nursing staff (Figure 2).

This is reflected in the difference in the average length of hospital stay. Although the hospital stay in Japan has become much shorter, it is still longer than in the West. It is well known that the length of hospital stay is correlated, or rather inversely related, to the number of doctors in a hospital. In short, in Japan, hospital care has become "thin-on-the-ground medical care".

Looking at the percentage of hospitals by type of

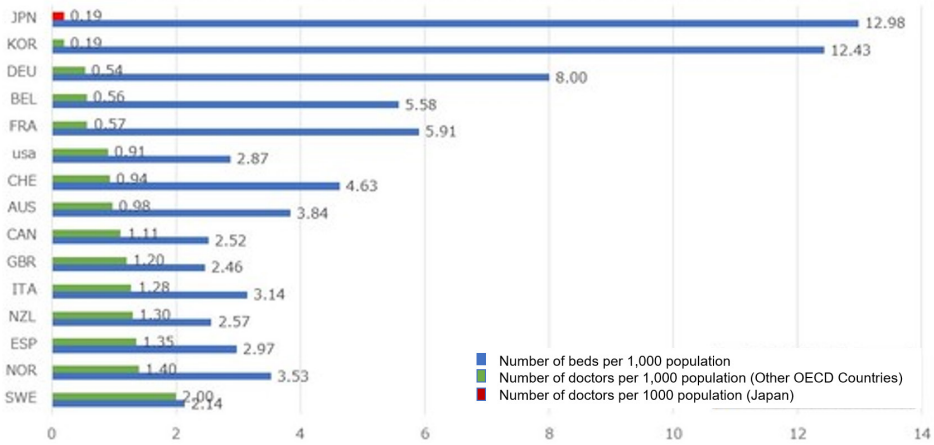

Figure 1. The number of physicians per hospital bed in Japan. *Data Source: OECD Health Statistics 2018. https://www.oecd-ilibrary.org/social-issues-migration-health/data/oecd-health-statistics_health-data-en*

○ Japan has fewer doctors, nursing staff and hospital staff per hospital bed than other G7 countries.
○ In terms of average length of stay and number of outpatient consultations, Japan has a higher frequency of outpatient consultations and longer hospital stays.

	average hospital stay a number of days	population of 1,000 each number of beds occupied (hospital)	100 sickbeds each Number of Clinical Doctors	population of 1,000 each Number of Clinical Doctors	100 sickbeds pertinent clinical case Number of nursing staff	population of 1,000 pertinent clinical case Number of nursing staff
Japan	27.8 (16.1)	13.0	19.2	2.5	90.6	11.8
Germany	8.9 (7.5)	8.0	53.1	4.3	164.0*	13.2*
France	8.8 (5.4)	5.9	53.7	3.2	182.6	10.8
United Kingdom	6.8 (5.9)	2.5	113.8	2.8	311.7*	7.8*
USA	6.1 (5.5)	2.9	91.2	2.6	410.8	11.9

Figure 2. International comparison of the Number of hospital staff per hospital bed, average length of stay and discharge in G7 countries. *includes staff working at research institutes, *etc.*, in addition to staff actually engaged in clinical practice. *Data Source: Ministry of Health, Labour and Welfare. Survey of medical facilities (2020). https://www.mhlw.go.jp/bunya/iryouhoken/database/zenpan/iryoukikan.html*

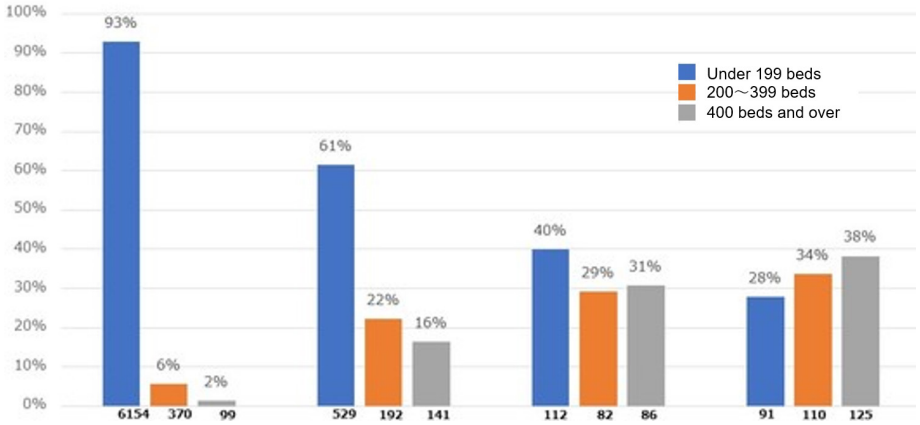

Figure 3. Percentage of hospitals by type of establishment and bed size. Hospitals in Japan are small in size. In particular, more than 90% of private hospitals have less than 200 beds. *Data Source: Ministry of Health, Labour and Welfare. Survey of medical facilities (2020). https://www.mhlw.go.jp/bunya/iryouhoken/database/zenpan/iryoukikan.html*

establishment (Figure 3), 93% of private hospitals have 199 beds or less (*9*). These hospitals account for 70% of Japan's total (*9*). The fact that there are many medical facilities and patients can go where they choose, and that there are medical facilities close by, means that it is easy to get medical care, but the question remains as to whether this is the case from the perspective of allocating finite medical resources.

A simple calculation shows that each hospital physician is responsible for 5.5 inpatients in Japan, in other words, one doctor is in charge of 5.5 beds. In the U.S., the number is 1.1. This means that Japanese hospital physicians are responsible for five times as many patients as their American counterparts.

In the outpatient setting, the total number of outpatient visits per year by U.S. physicians is 1,538, compared to 5,333 in Japan (*10*). Under the Japanese healthcare system, which guarantees free access, the working environment for doctors is extremely harsh. It would be strange if reforming physicians' working environment was not on the table.

Why is this happening? Since the achievement of universal health insurance, Japan has not developed enough human and material resources to meet exploding medical needs. The history of medical care demand has been handled mainly by private medical institutions with minimal facilities and manpower. Looked at from a different perspective, the system of fee-for-service payment, may also be said to solve the problem by simply encouraging the creation of more medical institutions.

Hospital doctors and staff are chronically overworked, but unable to provide concentrated inpatient care; diagnosis responsibilities are undifferentiated and hospitals are unable to keep up with changes in the kinds of diseases that patients present. Many medical institutions don't have the facilities or the staff to provide advanced functions.

Nevertheless, since the medical care delivery system is built on the premise that medical institutions

are self-financed, the entire system will collapse if reimbursement is not designed so that each medical institution can operate independently. As a consequence, various policy inducements have been made, but the remuneration system (allocation of financial resources) has largely been set up to maintain the status quo.

The problems inherent in this structure were exposed in one fell swoop with COVID-19.

What we learned in the COVID-19 pandemic

Although there are various opinions, mine is that what Japan experienced during the COVID-19 pandemic gives a glimpse of what Japan's medical care will look like 20 years from now.

Even today, 70% of hospitalized patients are already over 65 years old. Half of them are over 75 years old (*11*). In 20 years, most patients will require nursing care and have underlying diseases. A large percentage of them will have dementia. It will be the norm for such people to come in with infections, acute exacerbations, pneumonia, and broken bones — and there is no one at home to take care of them.

We have to think about the medical and nursing care system with such patients in mind. The plan was to get there by 2040, but this situation is now unfolding before our eyes. Remember what happened in the infectious disease ward when an elderly dementia patient was hospitalized with the coronavirus? In 2040, such situations ― while the majority of patients admitted to acute care hospitals are those in need of care with multiple underlying medical conditions at the same time ― will occur on a large scale on a daily basis.

If this is the case, medical and nursing capabilities must be thought of together. A unilinear regional care delivery system with hospitals at its core, with the hospital upstream and the home care system downstream, will no longer be possible. Acute care hospitals must also consider having medical and long-term care capabilities, and chronic care hospitals must be able to provide at least secondary emergency care in order to support the community.

Nursing homes, as well, cannot skimp on medical care capabilities. The entire home care provision system will literally break down if a comprehensive and coherent care network is not implemented.

These things have been discussed for a long time, but unless they are seriously implemented now, we will not be able to survive in the future society. The pandemic forced this realization upon Japan by exposing structural problems in its healthcare delivery system.

Of course, a pandemic is a one-off, large-scale disaster that does not happen every day. In that sense, it is correct to consider Japan's "contingency response". At the same time, the situation that occurred — the so-called "collapse of medical care" — should be viewed as the manifestation of structural problems that were inherent in the system during normal times, and as an opportunity to solve structural problems in the current healthcare delivery system itself.

The reasons that Japan's system of delivering medical care is functionally undifferentiated, inefficient, "thinly spread", and lacking in spare capacity is precisely because medical care has been delivered mainly by independently-financed private hospitals in an unrestricted medical system where doctors can freely select their own medical specialties and disclose them to the public (free labeling). Cooperation and collaboration among medical institutions is not the default, and any cooperation among doctors and medical institutions is basically left to the resourcefulness and actions of individual doctors and medical institutions on the frontline.

Furthermore, under a free-access medical insurance system with a high degree of freedom of choice on the part of patients, there is no institutional control of patient flow. In Japan's free access system, patients are entirely responsible for deciding whether or not to go to a doctor, which doctor to go to, and which department to go to, without any advice or assistance from professional medical personnel. In other words, the system is not designed to objectively provide timely and appropriate medical care or to provide necessary medical care when needed. If this is the case, it is difficult to create a system for comprehensive and continuous health management, a flow of prevention and health management, initial diagnosis and treatment (primary care), specialized treatment, return home, and nursing care and lifestyle support. In other words, neither the supply, nor the demand side can be controlled.

Despite this situation, the system has managed to function to date. However, the frontline healthcare workers who support medical care shoulder a heavy burden. As mentioned above, the number of inpatients per physician in Japan is five times that of the U.S., and the total number of outpatients per year is 3.5 times that of the U.S. As the recent pandemic has made clear, Japan's healthcare system is fragile and can easily collapse if there is two much pressure put on one specific point.

Will medicine really be able to sustain itself for the next 15 to 20 years in Japan? Even now, there are cases of emergency patients being shunted around from hospital to hospital and individuals who are unable to access medical care and nursing care. The lack of coordination and networking on the provider side has led to blockages here and there, and there have been many cases of families running around looking for a facility to stay in.

Now that the pandemic has brought the problem to the fore, perhaps now is the time for reform.

What is required of medical care in a super-aged society

In the long-term care world, it's already common understanding that the goal of elderly care should be to enable people to live with dignity at home, in their community, for as long as possible (*12*). The role of long-term care service is to support lives and lifestyles. In a super-aged society, regular medical practitioners need to also start thinking this way.

The basic function of medicine — providing treatment to cure — will not change, but in addition to that, it will be important to heal and support. In other words, what will be required is medical care that supports the dignity of people's lives, and does not sacrifice life for the sake of treatment. Medical care will exist as a part of life.

"Healing and support" cannot be achieved by medical care alone, unless a comprehensive regional care network, provided by medical care and long-term care together, with the cooperation of many different professions that support patients, is created.

As is already the case in the world of social service and, outreach to patients/users in close proximity will also be required of medical care. House calls will become more important, and asynchronous, remote medical care, such as telemedicine, will become an important weapon in the future, especially when considering the limited human and material resources available to support local medical care. There have been remarkable advances in medical digital transformation and other home healthcare support technologies, and it is already technically possible to perform a considerable amount of diagnostic procedures remotely (*13*). These technological innovations will contribute to reducing the burden on both patients and medical personnel, and should be actively implemented.

In order for this system to work, IT infrastructure to centralize patient health information and share information, is an indispensable prerequisite. "Tooling" such as medical IT, IoT, and digital transformation must be standard, and should be prioritized as essential to support home medical care and community comprehensive and coherent care networks.

Medical care challenges faced by a super-aged society

The functions of hospitals in a super-aged society will be divided into two major approaches. On one hand will be highly-specialized, acute care hospitals that provide intensive acute care, on the other, community-based hospitals that provide medical care for healing and support (*3*).

While there has been a lot of discussion about rethinking regional medical care, we should further promote functional differentiation of hospital beds, selection and concentration, strengthening of acute care functions, and concentrated investment of resources (efficient use of hospital beds by reducing the number of hospital beds). At the same time, we should also clearly set a direction for strengthening regional medical care and home medical care. As I have emphasized in this paper, if home medical care is not strengthened, the burden on hospitals and emergency medical services will increase, and the entire medical care delivery system will break down.

In this sense, the implementation of primary care physician function and the clarification of the functions and roles of small and medium-sized community-based hospitals that support this function, as well as the establishment of a regional comprehensive and coherent care network with multidisciplinary cooperation that transcends medical care, should also be pillars of regional medical care.

Regional medical care impacts the overall medical care delivery system. Although debate tends to focus on reducing the number of hospital beds, the original purpose of regional medical care is to reallocate and reorganize human and physical resources to "efficiently meet the future medical (and nursing care) needs of the region with the existing human and physical resources".

The realization of better regional medical care will lead to better resource allocation and the optimization of overall medical care costs. Reforming how care is delivered is the most realistic and effective way to optimize costs.

Long-term care becomes more important in a super-aging society

Finally, I would like to share some interesting data. As you may recall, all elderly people aged 65 and over are enrolled in Medicare in the US. In other words, all medical costs for the US population after the age of 65 are reflected in the Medicare database.

One study (*14*) compares the cumulative amount of medical and long-term care expenses spent by those aged 65 or older who are enrolled in Medicare up to the time of their death, segmented by age at death. The data shows that the longer a person lives, the more his/her lifetime medical expenses increase until they peak out at around age 90–95. In other words, the lifetime medical costs of someone who lives to be 100 or and someone who lives to be 110 years old are not very different. It follows, then, that if average life expectancy were to increase to 90 or 100 years, medical costs would gradually start to peak out as people lived longer healthy lives.

The data for long-term care costs shows a different picture. The lifetime cost of long-term care increases with the age at death, and exceeds the lifetime cost of medical care for those over age 95. This means that as more people age in a super-aged society, the relationship between cumulative medical costs and cumulative long-term care costs by the time of death is reversed.

In other words, aging (increase in life expectancy) will be a factor in increasing lifetime medical costs until about the age of the 90s, but long-term care (long-term

care) will continue to grow without peaking out.

In conclusion, The COVID-19 disaster revealed structural weaknesses in Japan's healthcare delivery system. We should take this as an important warning: this is only the beginning. Looking ahead to the year 2040, it is inevitable that Japan will need to streamline and optimize its healthcare delivery system given its limited resources. This will depend on a reform of the entire regional medical care delivery system, and a move towards a more community approach to medical care. Only this shift will allow Japan to more efficiently use resources and give patients better care — and a shot at a better quality of life — overall.

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A policy overview of Japan's progress on dementia care in a super-aged society and future challenges

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Abstract: Dementia is highly prevalent in Japan, a super-aged society where almost a third of the population is above 65 years old. Japan has been implementing ageing and dementia policies since 2000 and now has a wealth of experience to share with other nations who are anticipating a similar future regarding dementia. This article focuses on the 2019 National Framework for Promotion of Dementia Policies that, based on its philosophy of Inclusion and Risk Reduction, lays out five complementary strategies. Together, these five strategies encourage a whole of society approach in dementia care. We first elaborate on the activities being undertaken under each of these strategies and then discuss the future challenges that Japan needs to address. These policy and social innovations spearheaded by Japan can be useful information for other countries that are anticipating similar future as Japan.

***Keywords*:** Japan, dementia, policy, social innovation

Introduction

Dementia is a degenerative neurological disorder that affects an estimated 50 million people worldwide and is projected to double by 2030. Dementia impairs multiple cognitive abilities such as language, problem solving, general intelligence, orientation, and social abilities among others. Since 2000, Japan has seen rapid growth in its ageing population. Today, 65 years or older people comprise 29% of the population (*1*). With an ageing population, long-term cognitive diseases like dementia are on the rise and Japan has one of the highest rates of dementia in the world. Nearly 5 million Japanese people were living with dementia in 2015 (*2*). By 2025, one in 5 people in Japan is projected to have dementia and by 2060 one-third of the population will be afflicted by this condition (*3*). More recently, two simulation studies have applied updated assumptions of changing education level and cardiovascular health in elderly population in Japan, and reported that dementia cases will stay stable at around 5 million up until 2050 (*4,5*). In Japan, dementia caused approximately 182,077 deaths in 2016 (*6*) and in 2019 Alzheimer's disease was the leading case of mortality with 164,874 deaths (*7*).

The social burden of dementia is unquestionably high. The cost of dementia in Japan was 14.5 trillion Japanese Yen (JPY) (USD 107.3 billion) as estimated in 2014 and a single dementia patient can add JPY 5.95 million (USD 44,000) to the cost burden (*8*). The cost of home care was more than that of institutional care and the total cost of informal care was JPY 6.16 trillion (USD 45.6 billion). A microsimulation modelling study projected the costs of formal care to rise to USD 125 billion in 2043 and informal care to USD 103 billion for informal care (*4*). This indicates that a lot of the care burden falls on the families of people with dementia. Moreover, an overall shrinking population since 2011 means that there are fewer people to support the elderly, increasing the care burden on the youth.

Recognizing the rising burden of age-related health problems such as dementia, the Government of Japan has taken several steps and implemented health policies and social care initiatives to address the effects of dementia. In 2000, a landmark health system reform was made through the introduction of the Long-term Care Insurance Act (*9*). This insurance system intends to provide user-oriented care and support the independence of elderly people by providing generous coverage and benefits to people of all levels of income. Another crucial milestone for dementia was the thoughtful change of the Japanese word used for dementia from "Chiho" (fool) to "Ninchisho" (cognitive disorder) in 2004 (*10*) to address the stigma associated with the condition and also set the direction of the

Table 1. Dementia supporting policies and events in Japan

Years	Policies and Events
2000	Long-term Care Insurance Act was enacted. It contributed to developing dementia care
2004	Japanese word to mean dementia was changed from "Chiho" to "Ninchisho"
2005	"Dementia Supporter Program" was started
2014	Legacy event in Japan following Dementia Summit in UK was held
2015	"New Orange Plan" was launched by 12 related ministries and agencies (revised in 2017)
2017	Revision of the Long-term Care Insurance Act
2018	Ministerial Council on the Promotion of Dementia Policies was set up
2019	"National Framework for Promotion of Dementia Policies" was adopted at the Ministerial Council

nationwide momentum. Table 1 presents the major policies enacted and events held in Japan to improve the care and quality of life of the people living with dementia and their families.

The latest national framework for the promotion of dementia policies is a radical piece of work in setting a vision for a society where people living with dementia are valued as assets and not considered a burden. It demonstrates how policy innovation leads to social innovation. This framework can be useful for other nations that are, and would be, dealing with the rising incidence of dementia. This article provides a narrative overview of the 2019 National Framework for Promotion of Dementia Policies (*11*) and then discusses the future challenges for Japan that need further deliberation and innovative solutions.

National Framework for Promotion of Dementia Policies 2019

The underlying philosophy of this framework is "Inclusion" and "Risk Reduction" (*11*). Inclusion refers to living as one society irrespective of the presence or absence of dementia. Risk reduction means delaying the onset or progression of dementia. These two concepts are two sides of the same coin to realize a society where people can live their daily lives with dignity and hope, even after they are diagnosed with dementia. This framework incorporates the perspectives of people with dementia and their families to help develop people-centered services. There are five complementary strategies in the framework when combined can help to build such an inclusive society: *i*) Promoting public awareness and supporting efforts made by people with dementia to disseminate their stories and opinions to the public; *ii*) Prevention; *iii*) Medical care, nursing services, and support for caregivers; *iv*) Promoting the creation of barrier-free spaces and services for people with dementia and providing support to people with early-onset dementia; and *v*) Research and development, industrial promotion, global expansion.

These five strategies are elaborated below through examples of activities that are being implemented in Japan upholding the philosophy of Inclusion and Risk reduction.

Promoting public awareness and supporting efforts made by people with dementia to disseminate their stories and opinions to the public

Policies and social care initiatives are effective when there is proper public awareness about the problem, its effects, and support services. There are two notable programs currently being rolled out in Japan for raising awareness and providing community support to people living with dementia. The first one is the "Dementia Supporters" training program funded by the national budget. The program takes place mainly in the community, at workplaces such as the police station, and schools. As of June 2021, 13.3 million people have been trained as dementia supporters. The supporters are certified with orange bracelets as a token. In Japan, salespeople, bus drivers, and store staff working at the cashier are often seen with orange bracelets. Supplemental Figure S1 (*https://www.globalhealthmedicine.com/site/supplementaldata.html?ID=68*) depicts dementia support in training.

The second program is a community-based scheme known as Team Orange. This program aims to connect dementia supporters and health professionals to people with dementia and their families in the community. The government targets to set up 1,700 Team Orange at the municipality level nationwide by 2025. Team Orange facilitates early intervention to provide mental support and daily life support to those diagnosed with dementia. A coordinator is assigned to each team who coordinates with the person with dementia and connects them to appropriate resources. They also establish collaborations with local businesses such as hair salons, supermarkets, banks, and more where the people with dementia can then avail necessary services. The ecosystem of activities of Team Orange is presented in Figure 1.

The other program to increase awareness about dementia in the community is the Dementia Hope Ambassadors. Here, people with dementia are assigned as ambassadors who share their experiences and views for dementia promotion and attend international meetings to introduce the Declaration of Hope. Also, more people with dementia spending time in public helps to eliminate discrimination and prejudice. In Supplemental Figure S2 (*https://www.globalhealthmedicine.com/site/supplementaldata.html?ID=68*), five ambassadors are seen at the launch event of the Dementia Hope Ambassadors.

Prevention

Preventive programs are critical in slowing the

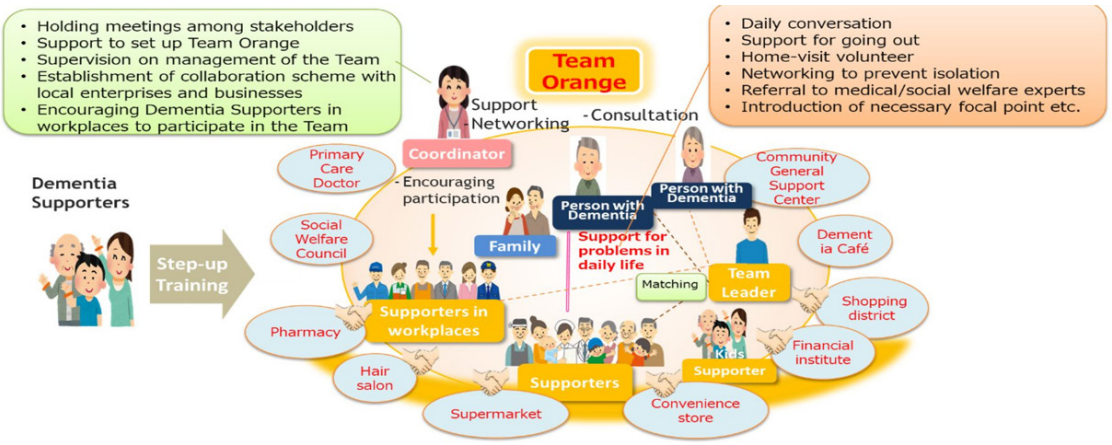

Figure 1. Team Orange activities. Source: *Reference* (*10*).

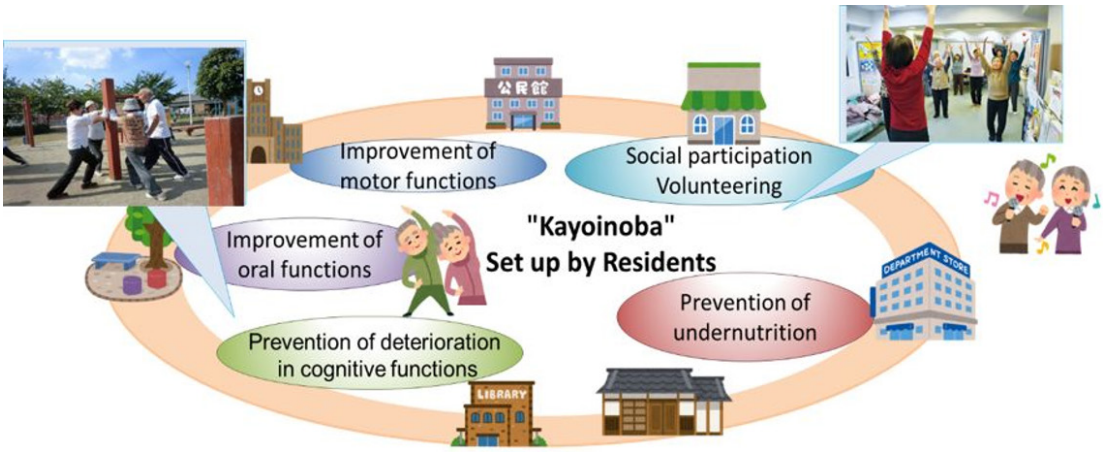

Figure 2. Different ways Kayoinoba helps to delay the onset of dementia. Source: *Reference* (*18*).

progression of dementia and operationlaise theme of Risk Reduction. The Kayoinoba program is set up for local residents with dementia (Figure 2). Various social activities and learning opportunities are organized by the residents for elderly people to stay active. Activities include exercising, dining, attending tea-party, and practicing their hobbies. Staying socially and physically active improves motor and oral functions, prevents deterioration of cognitive functions, and prevents undernutrition in people with dementia.

Medical care, nursing services, and support for caregivers

Properly established medical and community care are vital for risk reduction by ensuring early detection and timely intervention. Dementia care providers are trained through multi-layered programs to enhance the care and support to the person with dementia in the community. Training is being given to 300,000 caregivers on basic principles, knowledge, and skills of dementia care. Around 50,000 caregivers are given "practice leader" training to lead dementia care teams and nearly 3,000 caregivers are given "dementia care leader" training (*12*). These leaders plan dementia care practitioner training and lead care quality improvement.

A streamlined collaboration and communication system has been developed between community care centers, primary care doctors, and long-term care support specialists (Figure 3). Activities range from home visits to raise awareness, investigate the situation of elderly people with dementia living alone who tend to face many difficulties, and early detection of people suspected to have developed dementia through care planning conference calls. When a person is diagnosed with dementia, an early intensive support team provides the initial care and then various players including medical professionals collaborate to provide coordinated care and support.

Japan is also in the process of building a community-based Integrated Care System by 2025 when the baby boomers will be 75 years old and above. This integrated system will comprehensively ensure the provision of dementia-responsive health care, nursing care, prevention, housing, and livelihood support. This would enable the elderly to live the rest of their lives in

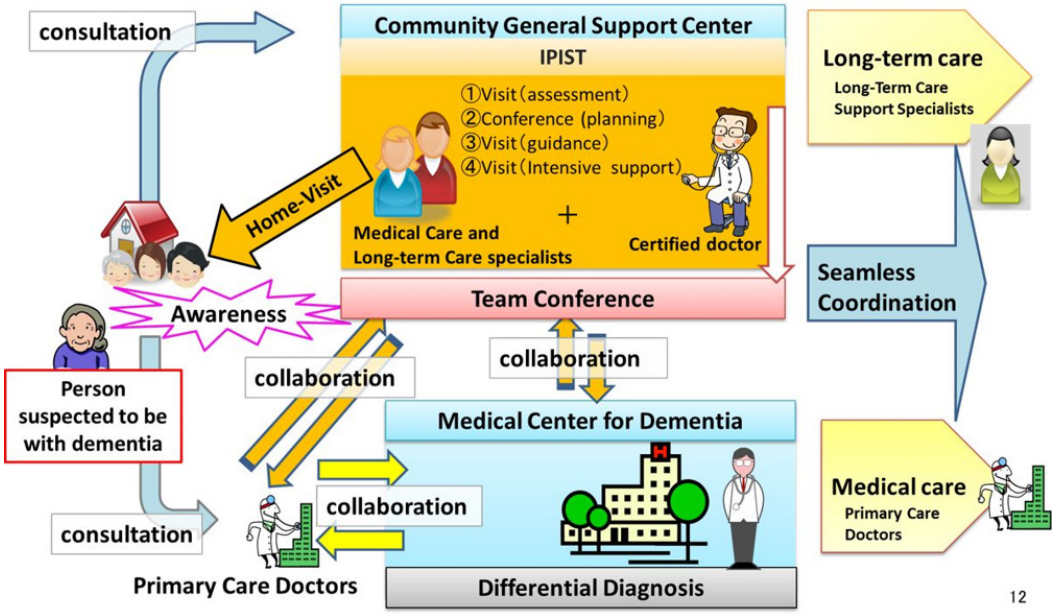

Figure 3. A model of the collaborative care between community support groups, primary care doctors and long-term care support specialist. Source: *Reference* (*19*).

their own way in environments familiar to them, even if they become heavily dependent on long-term care. The progression status of this project varies from place to place. Ideally municipalities, as insurers of the Long-term Care Insurance System, as well as prefectures are required to establish the community-based Integrated Care System by utilizing local resources.

Besides these, it is known that informal caregivers such as family carers shoulder a major share of care responsibilities of people with dementia. To alleviate their burden through peer support, a unique approach known as Dementia Café has been implemented. A dementia café is where people with dementia and their families can gather (Supplemental Figure S3, *https://www.globalhealthmedicine.com/site/supplementaldata.html?ID=68*). As of 2020, Dementia Cafés are operated at almost 8000 places in 1,516 municipalities across the country (*13*). At the Dementia Café, families caring for a person with dementia discuss their concerns and exchange opinions. These cafés also provide opportunities for families and people with dementia to connect with society.

Promoting the creation of barrier-free spaces and services for people with dementia and providing support to people with early-onset dementia

A bold vision set by the framework is to establish a society where people with dementia can live without any barriers. To achieve this vision, the Dementia Barrier-Free program has been developed. Under this program, the Japan Public-Private Council on Dementia was formed in 2019. Nearly 100 organizations from economic organizations, financial sector (bank/insurance), transportation, life-related industries (retails), medical and welfare organizations, local governments, academic society, groups of persons with dementia, ministries, and agencies *etc*. joined the council. The council accredits and commends dementia-friendly companies. It also facilitates the development of dementia barrier-free products and services. Various members in the council cooperate to address long-term and burning issues around dementia such as frauds targeting people with dementia, traffic safety, and find solutions such as contractual assistance to people with dementia for making critical decisions.

Research and development, industrial promotion, global contribution

The framework not only focuses on guiding programs for the present day, but also promotes research and development (R&D) for the discovery of prevention and curative medicine. Moreover, R&D is also highlighted to continue to improve the understanding of mechanisms of the onset of progression of dementia and developing better methods for risk reduction, diagnosis, cure, rehabilitation, and long-term care model. These new approaches and methods will need to be validated and evaluated to ensure that they are working. Taking this into consideration, the framework also emphasizes establishing indicators of validation and evaluation for technologies, services, and devices for risk reduction and care of dementia.

Another forward-thinking component is the focus on establishing a registration system for research

and clinical trials for people with dementia. Called the Orange Registry, this nationwide registry and collaborative system allows people with dementia to be observed throughout the clinical stages of the disease. The primary goal of the registry is to use the data accumulated to develop new treatments, medications, and care techniques for dementia from a range of patients including healthy individuals to those with preclinical stage, mild cognitive impairment, mild dementia, moderate dementia, and advanced stage dementia. These results will be used for early detection and response to dementia, establishing diagnostic methods, and developing fundamental treatments and preventive methods. Thus, this centralized system is expected to produce faster results in research and treatment. Lastly, the framework aims to promote and to globally expand the long-term care services model.

Challenges of Dementia Care in Japan

Despite the various policy and social care initiatives implemented by the Japanese government, there are still numerous challenges and limitations facing dementia policy and social care in Japan. People with dementia belong to society and need not be institutionalized for the remainder of their lives. This shift of their lives from hospitals and psychological institutions to the community is yet to be realized in full. To facilitate this process, as a society we need to see beyond the abilities lost because of dementia and utilize the residual abilities of the people with dementia. This mindset transformation needs constant messaging and enabling a dementia-friendly environment in the community and in the service industry.

Additionally, there is still a scope to develop intergenerational programs that will value the skills of the people with dementia and benefit the youth. Instead of making top-down policies for the people with dementia, it is important to discuss with the beneficiaries themselves and their families how they want to spend the remaining of their lives. It remains a challenge to get the beneficiaries engaged in Advanced Care Planning. Providing support not only to the people with dementia but also to the family and caregivers is essential. Dementia Café is one approach, but other effective avenues will need to be established such as providing financial support to the caregivers.

While comprehensive in guiding the development of systems for a better quality of life for those with dementia, the National Framework for Promotion of Dementia Policies 2019 lacks the life-course approach recommended for healthy ageing in general by the WHO (*14*). Even for dementia, it is now known that cognitive reserve is built during the early years of life and that mid-life behaviors and the environment profoundly impact when dementia will occur in one's life and how severe it will be (*15*). So, the risk reduction programmes in this framework will have to begin at gestation.

Conclusion

The rising threat of dementia in developed and developing countries alike needs anticipatory preparation of both the healthcare and the social systems. Japan's experience in implementing policies for healthy ageing and dementia provides valuable lessons and guidance to other countries to envision the changes that need to occur for successfully tackling a future with a high prevalence of dementia. Previous reviews of dementia policies have centered on the clinical aspects of dementia screening and management (*16,17*).

In this article, we highlighted the comprehensive way of thinking that Japan has launched through policy and social innovations for managing the dementia crisis. The 2019 National Framework for Promotion of Dementia Policies developed in Japan adopts a whole of society approach by considering multiple interweaving psychosocial, environmental, and healthcare aspects needed to reduce the risk of dementia and provide a better quality of life for those living with dementia. We have discussed some challenges that Japan has yet to address and devise appropriate solutions. Despite that, this framework's underlying philosophy of Inclusion and Risk Reduction is highly applaudable and can be adapted by other countries for their context.

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Exploring the contribution of Japan's experience in addressing rapid aging in Asia: Focus on dementia care

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Abstract: This review article explores the potential contribution of Japan's experience in addressing rapid aging in Asia with a specific focus on dementia care. As Japan is a frontrunner in terms of aging society, we consider valuable insights and lessons from Japanese policy history and reflect on its contribution. The World Health Organization, Regional Office for the Western Pacific Regional Action Plan on Healthy Ageing for the Western Pacific was compared with the Japanese "Outline for Promotion of Dementia Policies". The following five issues were discussed: *i*) improving awareness of dementia and community engagement in Japan from a mutual aid perspective; *ii*) social activities for prevention of dementia at the local level; *iii*) human resources for medical and long-term care; *iv*) local coordinators for old people care at home to evaluate the needs for care and tailor the care-plan on an individual basis; *v*) research and development of long-term care products. Given these factors, it is important to address the aging society through a combined cross-sectoral approach, including policy, research, development of care products, community, and education of care workers. Aging population measures in Japan do not provide a definitive answer, which prompts the consideration of better solutions derived from Japan's trial and error. The aging rate of 7%, 14%, and 21% are commonly used in international comparisons as indicators of the speed of the aging process, but before this 7% is reached, policies tailored to each country should be considered.

***Keywords*:** long-term care, healthy aging, Japan, policy

Introduction

Population aging is an inevitable global trend. With the improvement of health and survival, as well as the reduction of fertility rates, population aging is expected to increase in many low- and middle-income countries (LMICs), where current populations are relatively young. Population aging is expected to occur considerably faster in LMICs than in high-income countries, which poses a major challenge for LMICs in terms of adopting public policies addressing this social transformation. The Asia-Pacific region is aging faster than any other region, and the number of people aged 60 years or senior will increase from 630 million to 1.3 billion by 2050 (*1*).

The United Nations (UN) and the World Health Organization (WHO) have discussed aging, which affects all aspects of economies and societies, for decades. The Madrid International Plan of Action on Ageing (*2*), the UN's landmark international agreement, linked aging to other frameworks for social and economic development and human rights. In 2002, the WHO adopted a policy framework of active aging (*3,4*). Active aging is a concept that encompasses ongoing involvement in social, economic, cultural, spiritual, and civic affairs beyond physical health and should be addressed by the three pillars of policy: participation, health, and security. Recently, the UN has set 2021–2030 as the Decade of Health Ageing (*5*) to provide everyone with the opportunity to maintain the functional ability that ensures well-being in old people. In response, the WHO Regional Office for the Western Pacific (WPRO) adopted the "Regional Action Plan on Healthy Ageing for the Western Pacific" in 2021 (*6*).

Japan has been at the forefront of the global trend of population aging ahead of other countries. When contrasted with other countries, the transition toward a super-aged population in Japan is significant and notably rapid. Compared with Western countries, Japan initially fell behind in reaching a 10% proportion of its population aged 65 years and older adult in the 1980s. However, it has since become one of the earliest countries to achieve a 20% share of this age group in the 2000s (*7*). As the

population continues to age, the prevalence of dementia continues to increase. The prevalence of dementia in Japan is projected to rise from 16.7% in 2020 to 28.7% by 2045, primarily due to further population aging (*8*). In response to these challenges, a community based integrated care system was introduced in Japan 2017, to provide medical care, nursing care, preventive care and livelihood support integrally in the communities where older people used to live. The increase in dementia is not limited to Japan alone but also elsewhere in the Asia-Pacific region. Nevertheless, studies on the insights garnered from Japan regarding dementia are lacking, as well as the potential for their application in other LMICs, particularly in the Asian context. Decades long endeavours and systematic models enabling sustainable healthy aging and universal access to health and long-term care services in Japan are crucial to share with countries around the world. This study provides recommendations on how to address dementia in the aging society, focusing on the Asia-Pacific region, and compares strategies of Japan and global, consideration from specific Japanese initiatives.

History of Japanese experiences for dementia and areas of possible contributions

The key events in Japanese policy for dementia are summarized in Table 1. In 2000, the Japanese government enacted the Long-Term Care Insurance Act (the Act). The Act contributed to the development of dementia care through the definition of Communal Daily Long-Term Care for a Dementia Patient (Group Homes) as one of the specialized services for dementia, which increased the number of persons certified as in need of long-term care or support (*9-13*). In 2004, to reduce the prejudice regarding dementia, the Japanese word meaning "dementia" was changed from "Chiho" to "Ninchisho" (*14*). In 2005, the "Dementia Supporter Program" was started to promote understanding of dementia among citizens; however, this was implemented through only 90 minutes of training for volunteers (*15*). Following the dementia summit in the UK in 2014 (*16*), the New Orange Plan, the cross-ministerial strategy for dementia by 12 related ministries and agencies, was launched in 2015 (*17*). Responding to this new strategy, the Act was revised as follows (*18*): raising awareness of dementia, comprehensive promotion of proper rehabilitation and support for carers, and prioritizing the viewpoint of persons with dementia and their families. To further promote dementia policies as population aging progressed, the Ministerial Council on the Promotion of Dementia Policies was set up in 2018 (*19*), and the "National Framework for Promotion of Dementia Policies" (Framework) was adopted at the Council in 2019 (*20,21*). Recently, as the comprehensive and systematic promotion of policies to enable those with dementia to live in dignity with a sense of purpose, the Basic Act on Dementia to Promote an Inclusive Society was enacted in 2023 (*22*).

The basic concept of the Framework is to promote policies that focus on "inclusion" and "risk reduction" while underlining the perspectives of people with dementia and their families to delay the onset of dementia and build a society in which everyone can live with hope, even if they develop dementia. "Inclusion" means that persons with dementia can live with the condition with dignity and hope and that people can live together in one society regardless of whether they have dementia. Moreover, "Risk Reduction" means not "to never develop dementia" but "to delay the onset" or "slow the progression" of dementia.

The Framework includes five objectives (*20,21*): *i*) raising awareness/supporting persons with dementia to express their views through promoting "Dementia Supporters", especially in the private sector, and publicizing "Declaration to live well with dementia"; *ii*) reducing the risk of dementia through expanding "Kayoinoba", places for older citizens to meet in the community, gathering and publicizing evidence; *iii*) strengthening medical and long-term care/support for caregivers through enhancing the quality of the system for early detection/intervention and promotion of training for family caregivers and peer activities among family caregivers; *iv*) promoting "Dementia Barrier-Free"/ support for people with early onset dementia/support for social participation through establishing living environments accessible for persons with dementia, considering certification and awards for the private sector, and promoting social participation activities; *v*) research and development (R&D) / industrial promotion/

Table 1. Key events of Japanese policy for dementia

Year	Events
2000	Long-term care insurance act was enacted.
2004	Japanese word to mean "dementia" was changed.
2005	"Dementia Supporter Program" was started.
2014	Global Dementia Legacy Event Japan was held.
2015	"New Orange Plan" was launched.
2017	Revision of long-term care insurance act was released.
2018	Ministerial council on the promotion of dementia policies was set up.
2019	"National Framework for Promotion of Dementia Policies" was adopted at the Ministerial Council.
2023	"Basic Act on Dementia to Promote an Inclusive Society" was enacted.

global expansion through establishing a clinical trial-ready cohort. Furthermore, the policy emphasizes that *i*)–*v*) should be promoted, prioritizing the perspectives of persons with dementia and their families.

In 2020, the WHO launched the latest regional strategy (*6*), the Regional Action Plan on Healthy Ageing for the Western Pacific, which is composed of five objectives: Objective 1: Transforming societies as a whole to promote healthy aging based on understanding the implications of population aging. Objective 2: Transforming health systems to address each individual's lifelong health needs by providing necessary health and non-health services in a coordinated manner. Objective 3: Providing community-based integrated care for older adults tailored to individual needs. Objective 4: Fostering technological and social innovation to promote healthy aging. Objective 5: Strengthening monitoring and surveillance systems and research on older adults to inform programs, services, and policies. A comparison with the Framework in Japan is presented in Table 2. Accordingly, a substantial number of elements are similar to each other, especially regarding emphasis on the importance of interventions not only for individual physical and mental health, but also for social and cultural transformation. Innovation is considered a key component of both policy instruments. However, the WPRO strategy focuses on strengthening the health system to deliver health services in health facilities, whereas the Japanese policy mainly prioritizes risk reduction and promotion of social inclusion. The difference may derive from the long history of awareness and recognition of health problems among the older population in Japan. The Japanese government strongly recognizes that the health system alone cannot solve the complicated issues in the aging society, and more broader stakeholders must collaborate closely.

As a global front-runner of the super aging society, Japan presents useful lessons for other countries because most will inevitably face age-related issues. To identify the possible area of contributions from Japanese experiences, several specialists of aging in Japan and other countries listed the strengths of Japanese measures for older people care as shown in column 3 of Table 2. The experience of long-term insurance in Japan is an important aspect for establishing financial and service delivery systems for aging in LMIC. Nevertheless, given the extensive literature covering this topic (*11*), we do not discuss this aspect in this study Other possible contributions are as follows: *i*) community awareness activities, including dementia supporters; *ii*) social activities for the prevention of dementia at the local level; *iii*) human resources for medical and long-term care; *iv*) local coordinators for older people care at home to evaluate the needs for care and tailor the care-plan on an individual basis; *v*) R&D of various long-term care products. The details are discussed in the following sections.

Area 1: Dementia supporter: Improving awareness of dementia and community engagement in Japan from a mutual-aid view

In 2005, the Ministry of Health, Labour and Welfare (MHLW) initiated the "Dementia Supporters" program to raise awareness about dementia among local communities. The background to the program was the stigma surrounding dementia owing to the negative name (Chihou). Therefore, the aim was to change the name and promote a correct understanding of dementia. In their annual reports in 2012, the WHO and Alzheimer's Disease International highlighted this program as one of the lessons learned from beating stigma and public understanding of dementia (*23,24*). The program allows individuals to become supporters after completing training organized by "The National Caravan Mate Liaison Council" (Council). Every municipality in Japan has its council and manages training accessible to people nationwide. Upon completing a 90-minute training course, participants can become certified Dementia Supporters. As of June 2023, approximately 15 million individuals have registered as Dementia Supporters (*25*).

The Dementia Supporter Program is not exclusive to the Council; it is open to everyone. The council provides standardized training courses, which ensures consistency in the education provided. Further, as courses are held in primary, junior high, and high schools, children can also participate. The primary aim is to ensure Dementia Supporters have correct knowledge and understanding of dementia, without prejudice. Moreover, the program aims to create a dementia-friendly environment so that local people with dementia and their families can live safely in their neighborhoods. To this end, they are expected to take the initiative in the community to create a network of community, interaction, and support. Therefore, the training course covers basic knowledge of dementia, how to treat family members and community members with dementia, and an introduction to various activities.

Most participants are local individuals, and the program also acts to connect local residents with each other. The completion of one course leads to a permanent qualification, but some residents have participated multiple times. Many of the participants are older people. They may be motivated to attend by the need to create a new zest for life after career retirement, join the community, or prepare for their future. In addition, they have a family member or neighbor with dementia.

Numerous supporters are students who attended the course at their school. Other participants include engaged business enterprises and organizations caring for local residents. For instance, most workers include professionals from banking organizations, transportation staff, and stockists, police officers, and the owners of real estate. Nonetheless, despite the substantial number of Dementia Supporters, only a small fraction of the total dementia patient population in Japan is covered.

Table 2. Comparison of dementia policy in Japan with aging policy in WHO Western Pacific Regional Office (WPRO) and possible contribution areas

Regional Action Plan on Healthy Aging in the Western Pacific 2020	Japanese National Framework for the Promotion of Dementia Policy 2019	Possible Contributable Areas from Japanese Experiences
Objective 1: Transforming societies as a whole to promote healthy aging based on understanding the implications of population aging	*Pillar 1: Raising awareness/Supporting persons with dementia to express their views* ●Promoting dementia supporters in the private sector ●Publicizing the "Declaration to live well with dementia"	*Community awareness activities including dementia supporters and Minsei staff* ●Seminar and lectures held by local governments ●Developing local leaders ●Collaborating with other sectors (*e.g.*, education)
i) Understanding the broader implications of population aging *ii*) Transformating policies across sectors to ensure that they are age-friendly *iii*) Advocacy to prevent ageism and create a positive culture around aging	*Pillar 4: Promoting "Dementia Barrier-Free"/Support for people with early onset dementia/Support for social participation* ●Establishing living environments that are accessible to persons with dementia ●Considerating certification and awards for the private sector ●Promoting social participation activities	*Social activities for prevention of dementia at the local level* ●Socialization activities by local communities ●Relevant laws and policies to promote the social participation of older adults ●Collaborating with businesses in the private sector to provide appropriate working environments for older adults
Objective 2: Transforming health systems to address each individual's lifelong health needs by providing necessary health and non-health services *via* a coordinated approach. *i*) Curative services, including NCDs *ii*) Preventive services, including NCDs *iii*) Social and welfare services *iv*) Innovation	*Pillar 2: Risk Reduction* ●Expanding "Kayoinoba" (*i.e.*, places for older citizens to gather in the community) ●Gathering and publicizing evidence *Pillar 3: Medical and long-term care/Support for caregivers* ●Enhancing the quality of the system for early detection/intervention and strengthening collaboration ●Promoting training for family caregivers and peer activities among family caregivers	*Human resources for medical and long-term care* ●Special education concerning aging for doctors, nurses, and other health professionals ●Collaboration among health professionals (*e.g.*, dental technicians, nutritionists, occupational therapists) to reduce the workload on nurses and strengthen the quality of care
Objective 3: Providing community-based integrated care for older adults tailored to individual needs *i*) Health care *ii*) Long-term care *iii*) Social activities and services *iv*) Individual-level coordination	*Pillars 2, 3, and 4*	*Long-term care insurance system Local coordinators for at-home older adult care to evaluate care needs and tailor care plans on an individual basis (integrated community support center and care managers)* ●Maximizing locally available resources for the care of older adults ●Supporting older adults at home to achieve their expectations at end of life and reduce caregivers' workloads, both financially and physically ●Supporting older adults efficiently and inclusively
Objective 4: Fostering technological and social innovation to promote healthy aging *i*) Technological innovation a) Technology to support skill development and maintain the workforce b) Technology to support health and health systems c) Technology to promote social connectedness and aging in place *ii*) Social innovation	*Pillar 5: Research and development/Industrial Promotion/Global expansion*	*Prioritization of research on aging* ●MHLW research funds for aging ●Research centers for aging to be established at the national and prefecture levels
Objective 5: Strengthening monitoring and surveillance systems and research on older adults to inform programs, services, and policies *i*) National survey *ii*) Research *iii*) Monitoring and evaluation of healthy aging	●Establishment of clinical trial cohorts	*Innovation of various long-term care products*

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To address this gap, the Council has established a supporter network called "Team Orange". This network is open to all Dementia Supporters who wish to register. Moreover, supporters have the opportunity to advance to become "Caravan Mates" by meeting specific requirements. These advanced supporters typically collaborate closely with local municipalities to organize various events aimed at improving community awareness about dementia. In 2016, in a joint partnership with the UK, the MHLW appointed celebrities from both countries as "Dementia Supporters Ambassadors" (*26,27*). The UK has a similar program known as "Dementia Friends". This is intended to go beyond local activities by supporters and the domestic network of Team Orange, with both countries taking the initiative to expand dementia-friendly community development and supporter activities globally. Recently the network is expanding worldwide (*28*).

Given the substantial number of dementia patients in Japan, fostering greater local awareness about dementia is vital. The "Dementia Supporters" program, alongside the "Team Orange" supporter network, represents a commendable initiative to engage communities, promote understanding, and support those with dementia. With ongoing efforts and collaborations, Japan is continuing to make strides in creating a dementia-friendly society in super-aged society.

Area 2: Social activities for prevention of dementia and healthy aging at the local level (Community Trainers): Dementia prevention activities for people who are not certified as requiring support or nursing care

As Japan's population ages, the opportunities for everyone to receive medical and nursing care are increasing. Japan has universal health insurance — both the patient and the government bear hospital and nursing care costs. However, the country's financial situation is becoming increasingly strained owing to rising medical and nursing care costs. In response, the government is attempting to curb costs by intervening and conducting preventive activities before patients become bedridden or suffer from dementia, which incur high medical and nursing care costs, and working to prevent further deterioration of these conditions.

Under Japan's long-term care insurance system, people can use long-term care services if they become bedridden, suffer from dementia, or need assistance in daily living, such as housework and personal care. However, care prevention activities, in which people can participate before they need assistance, have been developed nationwide. The objectives of these efforts include health maintenance, lifestyle improvement, exercise, nutritional management, dementia prevention, and the promotion of social participation to maintain current physical and mental conditions. Originally, residents and local governments took the initiative in implementing these activities. Nonetheless, the MHLW launched the "Support for Promotion of Care Prevention through Community Development (2016)" as a model project for care prevention policy and further expanded the initiative to a nationwide scale with the "Care Prevention Activity Dissemination and Development Project (2018)" (*29*). Currently, numerous entities operate the activities and their content.

According to a 2021 survey ("Results of the Survey on the Implementation Status of the Comprehensive Project for Care Prevention and Daily Life Support (Community Support Project)"), the most common main operator of care prevention activities was "residents' groups", followed by "individual residents" and "social welfare councils". The most common main activity was "gymnastics (exercise)", followed by "hobby activities", "tea ceremony", "dementia prevention such as recreation and oral function improvement" and "communal meals" (*30*). While most residents and local governments offer gymnastics and hobby activities, many private companies offer activities that make the most of the characteristics of their respective companies (*31*). For example, telecommunications companies hold smartphone classes and encourage older adults to participate in local exercise classes online, which creates opportunities for exercise habits and social participation. In response to frequent traffic accidents caused by older adults, an automobile manufacturer is conducting safe driving courses and providing health education on frailty prevention and cognitive function. All the operating entities involve various professions, ranging from medical professionals to caregivers and welfare workers. As described above, many sectors are undertaking care prevention activities, from residents to private companies, and approaches to prevent bedridden persons and dementia are being taken from various angles through the involvement of multiple professions. However, specific performance indicators for effective projects are in the development stage. A manual for municipalities ("FY2021 Municipal Manual for Strengthening and Promoting Efforts for Long-Term Care Prevention") has been prepared but not from the perspective of private companies, non-profit organizations, or educational institutions. Thus, each organization is currently implementing the program through trial and error (*32*). To conduct effective care prevention activities in the future, past activities must be evaluated, and manuals and guidelines must be developed for multisectoral efforts.

Care prevention activities now involve many professions and are becoming established as national policies. This is because the aging of the population is expected to increase the number of people requiring nursing care and result in large medical costs. By intervening before people develop dementia or require nursing care, it is possible to keep them healthy. In the future, Asian countries are also expected to witness this

phenomenon. To continue to be as healthy as possible, it is important to start exercises and other activities while in good health and work on dementia prevention.

Area 3: Human resources for medical and long-term care

One of Japanese policies for addressing population aging is the training of health-care workers. Japan is faced with the needs of an aging society and has always formulated policies in response to those needs, which has led to several health professionals in Japan (Table 3) (*33-53*). For example, in 1987, the enactment of the Social Worker and Care Worker Law (*54*) created the new occupations of "social worker" and "care worker", which became national qualifications. In the 2000s, the Model Core Curriculum (MCC) was developed and revised for several occupations, requiring students to study subjects related to older adults as required courses (credits) (*55*). This section introduces the status of education on older adults for representative occupations for which the Ministry of Education, Culture, Sports, Science and Technology has begun formulating the MCC as pre-graduate education.

Medical Doctor: The introduction of curriculum in geriatrics in medical education has been considerably slow, with only 23.7% of universities offered a course in geriatrics in 2000 (*56*). In medical education, the 2007 revision of the curriculum made geriatrics-related items mandatory. Notwithstanding, in a panel discussion on geriatrics education at the 51st Annual Meeting of the Japan Geriatrics Society held in 2009, Dr. Hiroyuki Arai highlighted the lack of textbooks for medical students (*57*). As a result, a textbook edited by the Japan Geriatrics Society was published in 2013.

Dentist: Some dental procedures (dentures, bridges, implants, *etc.*) were naturally included in lectures related to older patients as they represent most of the target population. Additionally, as a basic policy of the MCC (*34*), the basic items to be mastered were revised in light of rapid demographic changes, such as the fact that Japan's older population will peak around 2040 and that the aging rate will continue to rise, and the population in the region will have thereafter.

Pharmacist: Pharmacist education comprises a six-year program to strengthen clinical training, contribute to the improvement and enhancement of public health by dispensing and supplying medicines, and play a role in the comprehensive community care system (*58*). The MCC for 2022 (*59*) clearly states that pharmacists must have sufficient qualities and abilities to be human resources who proactively contribute to medical care,

Table 3. Healthcare professionals for the older adults with dementia in Japan

Occupation	Qualification	Availability of Model Curriculum	Availability of Older People-Related Contents	*Reference*
Medical Professionals				
Medical Doctor	National Qualification	Available	Available	(*33*)
Dentist	National Qualification	Available	Available	(*34*)
Pharmacist	National Qualification	Available	Available	(*35*)
Nurse (including Public Health Nurse and Midwife)	National Qualification	Available	Available	(*36*)
Dietician	National Qualification	Available	Available	(*37*)
Physical Therapist	National Qualification	Available	Available	(*38*)
Occupational Therapist	National Qualification	Available	Available	(*39*)
Speech Therapist	National Qualification	Available	Available	(*40*)
Orthoptist	National Qualification	Not available, Guideline only	Available	(*41*)
Radiological Technologist	National Qualification	Not available, Guideline only	Not available	(*42*)
Clinical Laboratory Technician	National Qualification	Not available, Guideline only	Available	(*43*)
Dental Hygienist	National Qualification	Available	Available	(*44*)
Dental Technician	National Qualification	Not available	Available	(*45*)
Biomedical Equipment Technician	National Qualification	Not available, Guideline only	Available	(*46*)
Emergency Life-saving Technician	National Qualification	Not available	Available	(*47*)
Prosthetist and Orthotist	National Qualification	Not available	Available	(*48*)
Care Workers				
Certified Social Worker	National Qualification	Not available, Guideline only	Available	(*49*)
Mental Health Social Worker	National Qualification	Not available	Available	(*50*)
Certified Care Worker	National Qualification (Qualify for the examination without attending a school. Can take the exam with at least 3 years of work experience and training)			(*51*)
Care Manager	Qualification by Prefecture Government Persons with at least five years of work experience in the health and medical welfare field who have passed the practical training examination for Care Manager and completed the practical training course for Care Manager			(*52*)
Caregiver/Home Helper *Occupation, but not qualification	A system that allows participants to take the training courses for entry-level Care Workers and Caregivers qualificator by the prefectural government while they are working (although it is a job title, it is not the name of the qualification)			(*53*)

**Not all health care occupations are listed.*

nursing care, welfare, and community health promotion. Regarding activities of pharmacists in society and the community, they study social security (medical, welfare, and long-term care systems) and comprehensive community care.

Nurse: In the nursing profession, which plays a central role in care, the basic nursing curriculum on gerontic nursing was one of the earliest to be introduced owing to the need to respond to social needs. The 1989 curriculum revision made gerontic nursing a stand-alone subject (*60*) and began to provide education systematically, specifically focused on older adults (*61*). In the 2022 revision, the course of home health care nursing was expand to community and home health care nursing to include the community as a place of care for various individuals and groups, and the number of credits (hours) for related courses was increased (*62*).

Dietician, Physical Therapist, and Occupational Therapist: Along with the MHLW, each professional organization/association is responsible for developing the MCC and guidelines. Dieticians, for example, have studied geriatric nutrition because they work with people in various life stages and health conditions (*37*), and physical and occupational therapists, who often work with older patients, have studied it before the MCC was developed (*38,39*).

Radiological Technologist and Clinical Laboratory Technician: There is little content related to older adults in the MCC, which may be because they are expected to provide accurate imaging and test results necessary for diagnosis, regardless of whether the subject is young or older (*42,63*).

Dental Hygienist: National certification (*64*) as a specialized profession has existed since 1948. As a profession responsible for preventive dentistry, it also plays an important role in the fight against dementia. The "8020 Movement", a Japanese policy launched in 1989 to raise awareness of the importance of eating well with one's teeth throughout one's life – to eat with one's 20 teeth until the age of 80 – is also considered effective in combating dementia (*65,66*). Similar to locomotive syndrome; proposed by the Japanese Orthopaedic Association in 2007, refers to "a condition in which motor function is impaired due to disorders of the locomotor system", and many older people suffer from it (*67,68*), and frailty prevention, based on the concept of preventive dentistry rather than dental treatment, interventions such as dental health checks, tartar removal, and instruction on how to brush are also provided to prevent tooth decay and periodontal disease. The MCC for dental hygienists includes learning and on-the-job training according to the following life stages: fetal (pregnant women), infancy, school age, adolescence, adulthood, old age, and terminal stage. In particular, regarding older adults, students practice at health centers, nursing homes, and dental clinics that provide in-home and home visits, and experience dental-related health education, oral cleaning, home visits, and so on (*43*).

Care Workers: The shift from a time when family caregiving was the norm in Japan to the nuclear family has resulted in the need for many caregivers who specialize in nursing care (*69*). In response, a training system has been established to secure caregivers, in which they are trained not through schools or training institutes but by gaining experience in the field while working and the skill-up system (*70*). Furthermore, from the perspective of guaranteeing the quality of care, it was necessary to provide training to various levels and establish a system to provide care by professionals.

Next, this study discusses the status of post-graduate training, particularly regarding dementia. The Japanese government recommends that each profession conduct Continuing Professional Development to ensure the quality of care in dementia. Such training is linked to Japan's health insurance system, medical insurance, and long-term care insurance, and budgetary measures have been established. Regarding medical personnel, medical doctors, and nurses specializing in dementia provide regular training for all hospital staff. Regarding care workers, the Japanese government distributes budgets to local governments for training and awareness-raising activities related to dementia and provides support for implementation systems. Thus, local governments play a role in training and awareness-raising activities related to dementia countermeasures. Hospitals, long-term care facilities, and home care services employ personnel who have taken these dementia-related training courses, which provides an incentive for hospitals and facilities to provide care based on the training. Hospitals receive an "additional fee for dementia care" through national health insurance (*71*), and nursing homes and home care service facilities receive an "additional fee for specialized dementia care" through the long-term care insurance system (*72*).

Area 4: Local coordinators for older people care at home to evaluate the needs for care and tailor the care-plan on an individual basis. (integrated-community support center and care managers)

In many LMICs, family remains the main pillar for giving care for older people. When caregiving becomes necessary, the physical, financial, and emotional burdens on family members and other caregivers increase. In addition, caring for a person with dementia is intensive and continual ensuing opportunity cost incurred by job loss for their family member. For example, they are responsible for household chores such as meal preparation and laundry that the dementia person can no longer do, taking the person to the hospital. After all, they sometimes even quitting their jobs owing to the amount of time they spend caring for the person. In Japan, a number of nursing care service

programs exist to reduce the burden on caregivers and to prevent further deterioration of the care recipient's condition. When using long-term care services, a "care plan" (provision of long-term care services, *etc.*) must be prepared so that the person can lead an independent daily life as much as possible. A care support specialist called care manager consults with the person receiving care and responds to their physical and mental condition, prepares care plans, and liaises and coordinates with municipalities, service providers, and facilities so that the person can receive appropriate services (*51*). A care manager holds a care support specialist certificate as a person who has professional knowledge and skills in assisting older adults in need of nursing care to lead independent daily lives. In Japan, various professionals such as doctors, nurses, and social workers can become care managers. If they have a certain level of work experience, they can become care managers by passing an examination and undergoing a short training course.

Older people usually have multiple morbidity that demands integrated services delivered to their home. Therefore, one of the main tasks of a care manager is to create a care plan tailored to the individual's level of care, family circumstances, and financial situation, from among 26 different types of care services. A typical care plan modeled for the older person with dementia is presented in Figure 1. The background of the person is that she is able to walk, go to the toilet, and eat meals without assistance, but she has difficulty in bathing, shopping, and cooking meals by herself. She lives with her husband, but he is too old to provide her with all the care she needs. The key points of this care plan are to ensure the patient's social participation and quantity of activities and reduce the burden on her husband, who is her caregiver. She goes to a "Day Service", which is a facility that people can receive nursing care and functional training, three times a week to socialize with helpers and other people, and because she has difficulty bathing at home, she takes her baths at the facility. On days when she does not go to the day service, a nurse visits to check for any deterioration of her physical condition, and a physical therapist provides rehabilitation to prevent muscle weakness. The visiting helper performs shopping and housework that the patient is no longer able to do. On weekends (every other week), a short stay of one night and two days is available to reduce the burden of caregiving on the family. This tailored care plan requires 34 service visits per month at a cost of 207,540 yen (approximately 1,384 USD at exchange rate in 2023) according to long-term care service fees set by the MHLW (*73*); however, as the patient pays only 10% of the total cost, the actual payment is 20,750 yen (Table 4). The care manager periodically monitors the prepared plan to ensure that it is appropriate and makes revisions when necessary. However, while the number of users of long-term care services is increasing, the number of care managers

Mon.	ALL DAY (9:00–15:00)	
	Facility for older adults "Day Care Center" -pick-up by bus -bathing	-lunch -recreation -snack time -drop-off by bus
Tue.	A.M.	P.M.
	Home-visit nursing service	Home-visit care service -cooking
Wed.	ALL DAY (9:00–15:00)	
	Facility for older adults "Day Care Center" -pick-up by bus -bathing	-lunch -recreation -snack time -drop-off by bus
Thu.	A.M.	P.M.
	Home-visit care service -cleaning -washing	Home-visit rehabiritation service Home-visit care service -shopping -necessaries
Fri.	ALL DAY (9:00–15:00)	
	Facility for older adults "Day Care Center" -pick-up by bus -bathing	-lunch -recreation -snack time -drop-off by bus
Sat.		Short-term stay in a facility for older adults (one night)
Sun.		

Figure 1. Home-based plan of a model case with dementia for a week. Patient condition: 75 years old, female, with dementia, needs someone's constant support and supervision in daily life.

Table 4. Long-term care service fee of model case*

Service	Unit price (JPY)	Frequency	Total (JPY) / month
Facility for older adults "Day Care Center"	9,610	3 times/week	115,320
Home-care service	3,230	3 times/week	38,760
Home-visit nursing service	5,250	Once a week	21,000
Home-visit rehabiritation service	3,360	Once a week	13,440
Short-term stay in facility	9,510	Twice a month	19,020
Total		34 times/month	207,540

**Reference (66)*

has remained flat, and the workload assigned to each care manager is growing. The shortage of staff makes it difficult to create care plans and conduct monitoring tailored to everyone, which makes the quality of care a challenge (*74*).

As Japan's birthrate declines, and the nuclear family becomes more common, fewer family member is taking on the responsibility of caring for older adults, after that the burden on caregivers is increasing, and caregiver fatigue. In Asian countries, it is common for families to provide care for older adults at home, but it is necessary to consider the burden of caregiving when the number of children and nuclear families is declining and increasing, respectively. In recent years in Japan, in addition to the issues of elder abuse and neglect, further social problems have been drawing attention, such as the old family member to provide care for their old people. There are many issues to consider, such as what kind of care is needed, whether it can be provided as a service, and who will coordinate these services. In Japan, care managers are in charge of these tasks, but as the population ages, they must play a role in bridging medical care and welfare services and the community with individuals and families.

Area 5: Research and Development of long-term care products

Research is one of five priority areas in the Framework to provide the knowledge for the promotion of the development of prevention/diagnosis/treatment methods, rehabilitation models and nursing care system (*20,21*). Multiple ministries have secured substantial research funds for these purposes (*75,76*). To make effective use of these, various public research centers for dementia at the national level; National Center for Geriatrics and Gerontology, National Center for Neurology and Psychiatry, as well as prefecture level; Tokyo Metropolitan institute for Geriatrics and Gerontology. Furthermore, numerous medical universities, academic societies, and other research institutes exist for diverse areas of research for dementia, and industrial sectors collaborate to translate research results into the improvement of actual practices in nursing care sites. These public-academic-industry collaborations are maintained through a network supported by the Japanese government to share knowledge and information on their relevant activities (*77*). The lessons learned from such initiatives can contribute to the R&D on dementia in LMICs.

Innovation of products to support older adults is also an important relevant area for Asian countries. In Japan, several initiatives of innovations to support aging society have been organized such as Innovation 25 under the Prime Minister's Office and the Dementia Innovation Alliance Working Group under cross-ministerial initiatives (*78,79*). These initiatives accelerate R&D of products to support the lives of older adults including robot technology, life-support applications on mobile phones, and social innovations. However, most of these innovative products are not delivered and accessed by older adults in need, especially in LMICs. Therefore, several Japanese public authorities provide a variety of supports for relevant industries to expand their quality products to LMICs, including Medical Excellence of Japan under the Ministry of Economy, Trade and Industry (*80*), Projects for the Growth for Medical Technologies under MHLW (*81*), Japan International Cooperation Agency (*82*) and others.

However, these efforts could not satisfy the high demands from Asian countries. The National Center for Global Health and Medicine (NCGM) organized the knowledge exchange program for aging with Sri Lanka with World Bank support (*83*). High-level public officials visited older people care facilities expressed interest in Japanese products to reduce the burden of care givers, support the daily living and promote mental care. However, these products were usually only domestically accessible for several backgrounds. First, Japanese companies, especially small and medium-sized companies, have low interests in market expansion overseas in Asia because of their capacity and the risk. Second, if the companies have the interests, complicated processes of access and delivery of health products (*84*) hinder their efforts to promote their products in Asian countries. These factors include the development of products to match the usability with the local situation, accreditations by local governments, selection of the products in the authorities-approved essential service lists, functioning supply chain, and effective health systems to deliver older people care services to people

in need. Public sector aid should be strengthened to promote the interests of Japanese companies and support them to overcome these possible obstacles. However, the government supports related to older people care remain insufficient. To achieve universal health care under the rapid aging of Asian countries in the future, public support should focus more on companies and organizations with the knowledge and skills in older people care to introduce their experiences and products overseas.

Discussion

This review has suggested the areas in which Japan's experience can contribute to dementia measures in LMICs. However, there are several points to consider when incorporating the Japan's approaches into LMICs. Firstly, it is important to acknowledge that Japanese policies for the older person are not universally superior or infallible. In the 1980s, when an aging population rate was around 10%, Japan had been focused on interventions in the medical care, resulting in many older adults seeking hospital care and utilizing a significant amount of healthcare resources. However, Japan acknowledged that many of the older people needed more support in their daily lives and preventive measures to maintain their health, not medical intervention, and furthermore, exercise, diet, and peer involvement were also found to be effective in the treatment of dementia (*85*). In addition, if the older people are healthy, they have considerable potentials to contribute to society, such as in productive activities, hobbies, and community activities (*86,87*). Based on these observations, Japanese government has evolved the policies that emphasizes preventive measures. In this way, Japan's policies have developed through a process of trial and error driven by necessity, resulting in their current form. Additionally, there are currently many challenges. For example, there are issues related to the insufficient number and quality of caregivers, and the burden of caregiving by family members has not yet been fully resolved.

Furthermore, it should be believed that in LMICs with diverse regions, religions, and cultures, there is the potential to establish effective mechanisms rooted in the characteristics of the country by leveraging the specificities of the nation ore territories. In LMICs, it is conceivable that there are still many community and regional leaders that Japan has already lost. These leaders taking on leadership roles in such community could assume roles similar to Japan's "Care Managers", coordinating the deployment of caregiving personnel. The development of healthcare professionals is a time-consuming endeavor. Not necessarily, there is no need to certify many occupations or establish complex training and budget systems, as is the case in Japan. Each country and territory should deploy policies tailored to its own circumstances, taking into account its customs, characteristics, and strengths.

In actually implementing the measures, it is necessary to keep the following points in mind. Firstly, based on Japan's experience and current challenges, a crucial aspect in responding to an aging society is the recognition that policy intervention is necessary before the aging rate reaches 7%, that is, before aging becomes prevalent. As it is difficult for the public to perceive the seriousness of the future super-aged society, the government needs to make decisions and initiate measures such as the establishment of legal arrangement. The second point is that stakeholders should share a common understanding that the goal in aging measures is to reduce the number of severely dependent individuals. It is important to provide people with activities such as exercise, nutrition/oral health, and communication from the healthy aging stage, rather than intervening only when care is needed. Hence, there is a need to invest in healthy aging to prevent the escalating demand in health and long-term care. Finally, to meet the needs of individual older persons, it is indispensable to adopt flexible mindsets and collaboration involving various sectors, not confined by the traditional vertical structure. While initially it may appear that measures pertaining to the older person primarily fall within the purview of healthcare, it is imperative to foster collaboration with the Ministry of Finance due to its involvement in government finances, as well as with the Ministry of Economy, Trade, and Industry for the advancement of nursing care equipment. In addition, it should be also important to build partnerships with industry and academia, involving not only government but also local businesses, universities, and volunteer organizations.

Conclusion

Through this review paper, we have proposed areas where Japan's experience in addressing aging issues can contribute to the strategies in low- and middle-income countries. However, directly transferring Japan's policies to other countries is challenging, and it is necessary to understand the uniqueness of Japan's aging policies and the considerations in their implementation. Moving forward, based on the areas discussed in this paper, we would like to examine the effects and issues involved in the transferring Japanese experience to LMICs, for supporting aging strategies.

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Prevention of cardiovascular disease, a major non-communicable disease, in a super-aging society: Health success and unsolved issues in Japan

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Abstract: As far as non-communicable disease is concerned, Japan is unique in showing a substantial decline in stroke mortality and the lowest and declining mortality from ischemic heart disease during the past half century, which contributed to the elongation of a 4-year average life expectancy, leading to top longevity in the world. However, several issues have remained in the prevention of cardiovascular disease with super-aging: *i*) how to manage the screening and lifestyle modification for both individuals with metabolic syndrome and those with non-overweight/obesity plus metabolic risk factors, and *ii*) how to enhance the referral of very high-risk individuals screened at health checks to physicians for seeking treatment and examine whether an early clinical visit was associated with a lower risk of cardiovascular disease and total mortality. Health counseling is needed for both persons with metabolic syndrome and high-risk individuals with non-obese/overweight because the population attributable risk fraction of ischemic cardiovascular disease was similar for both high-risk individuals. Standardized counseling for very high-risk individuals accelerated clinical visits and reduced levels of risk factors. In health counseling, public health nurses were more effective in increasing clinic visits. Furthermore, the earlier clinic visit after the counseling suggested a lower risk of hospitalization for stroke, coronary heart disease, heart failure, and all-cause mortality. This article reviews these epidemiological findings for health practitioners and policymakers to perform further prevention and control for cardiovascular disease in Japan and other Asian and African countries with emerging cardiovascular burden and aging.

***Keywords*:** metabolic syndrome, cardiovascular disease, prevention, referral, epidemiology, Japan

Introduction

A major component of non-communicable diseases is cardiovascular disease, primarily ischemic heart disease and stroke, and are the leading cause of mortality and a major cause of disability in the world (*1,2*). In Japan, the age-standardized mortality rate of stroke declined substantially from the highest level since 1965 and that of ischemic heart disease was the lowest level and continued to decline until recently; the mortality rate reached approximately two-times higher for stroke and one-fourth for ischemic heart disease in Japan compared to Western countries (*3*). That large decline in cardiovascular mortality contributed to a rise in the average life expectancy in Japan by 4 years (*4*). The average life expectancy in 2022 has become 81.5 years in men and 87.6 years in women leading the top longevity in the world (*5*).

The backgrounds for this health success are multifold, primarily due to the improvement of diets including reduction of sodium intake along with fresh foods due to improved transport systems and freezing technology under the sharp socioeconomic development between the 1960's and 1990's, and mandatory health screening for cardiovascular risk factors and health instructions, and referral to local physicians to seek treatment under the universal health coverage since 1980's (*3*). Previous articles reported that the improvement in lifestyles and cardiovascular risk factors were associated with declining trends for cardiovascular disease trends in Japan (*6-8*).

The community-based prevention programs are based on public health services and medical care under universal health coverage, aiming: *i*) the primordial and primary prevention of cardiovascular risk factors through environmental improvements and lifestyle modification for the general population, *ii*) secondary prevention of screening high-risk individuals, their lifestyle modification, if necessary referral to physicians for seeking medical treatment, and *iii*) tertiary prevention

of early treatment for cardiovascular disease patients and their rehabilitation (*3*). The prevention programs of these components are feasible and effective in reducing the incidence of stroke (*9*) and ischemic heart disease (*7,10*) and attenuating an increment of medical cost compared to the reference communities (*11,12*).

In 2008, the Japanese government started a screening and education program for people aged 40-74 years focusing on metabolic syndrome to attenuate the burden of medical cost primarily for kidney hemodialysis (*13*) because diabetes, one of the major components of metabolic syndrome, had become the major cause of chronic kidney disease and kidney failure (*14*).

In spite of the health success in the prevention of cardiovascular disease in Japan, several issues have remained in the prevention of cardiovascular disease with super-aging such as an increasing trend for the number of patients with chronic heart failure, chronic kidney disease, and dementia (*15*). One of the major issues is how to manage the screening and control both for high-risk individuals with metabolic syndrome and those with non-overweight/obesity because the latter group numbers are over half of high-risk individuals with high glucose, high blood pressure, and dyslipidemia (*16,17*). The other is how to enhance the referral of very high-risk individuals screened at health checks to physicians to seek treatment and examine whether early clinical visits were associated with a lower risk of cardiovascular disease and total mortality because more than half of such high-risk people did not visit physicians (*18*). We conducted epidemiological studies to provide scientific evidence on the above issues (*19,20*). In addition, such preventive programs would help to make self-care interventions for health and well-being, *i.e.* the ability of individuals, families, and communities to promote health, prevent disease, maintain health, and cope with illness and disability with or without the support of a health worker (*21*).

This article overviews the epidemiological findings on the above issues and provides clues for health practitioners' and policymakers' recommendations to enhance the prevention and control of cardiovascular disease and well-being in Japan and other Asian and African countries with emerging cardiovascular burdens and aging (*22*).

How to manage the screening and control both for high-risk individuals with metabolic syndrome and those with non-overweight/obesity?

The major strategy of nationwide programs on screening and lifestyle interventions is the reduction of abdominal obesity by lifestyle modification such as balanced diets and reduced alcohol consumption, smoking cessation, and enhanced physical activity, which are expected to control for high blood glucose, high blood pressure, and dyslipidemia (low HDL-cholesterol and/or high triglyceride levels) (*9*). Metabolic syndrome is defined as the presence of obesity/overweight as an essential component plus metabolic risk factors, which is different from the American criteria with obesity/overweight (one of the metabolic risk factors) (*23*). Thus, the Japanese program focuses on high-risk individuals with abdominal obesity/overweight, but not non-obese/overweight ones with other metabolic risk factors, which may overlook the risk of non-obese/overweight individuals because over 60% or more of Japanese high-risk adults are the latter. Therefore, it is unclear whether the risk classification in the national program captures high-risk individuals who could benefit from lifestyle interventions, and it is necessary to examine how to manage the screening and control both for high-risk individuals with metabolic syndrome and those with non-overweight/obesity.

In a previous article described in detail (*19*), we examined the validity of risk classification to relate the classification with the risk of ischemic cardiovascular disease (ischemic heart disease and stroke) by a pooled analysis of 10 Japanese cohort studies on approximately 30,000 residents aged 40–79 years followed for a median of 9 years.

Metabolic syndrome is defined as the presence of high waist circumference of ≥ 85 cm in men and ≥ 90 cm in women and/or BMI of ≥ 25.0 kg/m^2, an essential component plus one (probable metabolic syndrome) or two or more (definite metabolic syndrome) of the following: *i*) systolic blood pressure ≥ 130 mmHg, and/or diastolic blood pressure ≥ 85 mmHg, or medication use; *ii*) triglyceride level ≥ 150 mg/dL and/or HDL-cholesterol level < 40 mg/dL; and *iii*) fasting glucose level ≥ 100 mg/dL, or non-fasting glucose level ≥ 140 mg/dL, or medication use. As shown in Table 1, the risk classification categories are information supply only (ISO), motivation-support intervention (MSI), and

Table 1. Risk classification in the national program of screening and lifestyle interventions for metabolic syndrome

Non-obese/overweight	Information supply only (ISO)	Motivation-support intervention (MSI)	Intensive support intervention (ISI)
Waist < 85 cm for men, < 90 cm for women and BMI < 25 kg/m^2, regardless of risk factors	Waist ≥ 85 cm in men, ≥ 90 cm in women and 0 risk factor OR	Waist ≥ 85 cm in men, ≥ 90 cm in women and 1 risk factor OR	Waist ≥ 85 cm in men, ≥ 90 cm in women and ≥ 2 risk factors OR
	Waist < 85 cm for men, < 90 cm for women and BMI ≥ 25 kg/m^2, and 0 risk factor	Waist < 85 cm in men, < 90 cm in women and BM ≥ 25 kg/m^2, and 1 or 2 risk factors	Waist < 85 cm in men, < 90 cm in women and BMI ≥ 25 kg/m^2, and ≥ 3 risk factors

intensive support intervention (ISI) based on sex, age (40–64 and 65–75 years), current smoking status, and grade of metabolic syndrome (probable or definite). Current smoking is considered an additional risk factor when the number of the above risk factors, was counted one for high waist circumference ≥ 85 cm in men and ≥ 90 cm in women, and two for waist circumference < 85 cm in men and < 90 cm in women and BMI ≥ 25.0 kg/m^2. The ISI collapsed into the MSI for ages of 65–75 years.

The criteria for referral to local physicians to seek medical treatment were defined as: *i*) hypertension: systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg or medication use; *ii*) dyslipidemia: triglyceride level ≥ 300 mg/dL, and/or HDL-cholesterol level < 35 mg/dL, and/or non-HDL-cholesterol ≥ 170 mg/dL, or medication use; and *iii*) diabetes: fasting glucose level ≥ 126 mg/dL, or non-fasting glucose level ≥ 200 mg/dL, or medication use. See the methods of incidence determination of ischemic heart disease and stroke in the previous report (*19*).

As shown in Figure 1, the risk of ischemic cardiovascular disease adjusted for age (years), area (community) and non-HDL cholesterol using the Cox proportional hazards model was 60% to 70% higher in middle-aged men and women who received ISI, and 30% higher in older women who received MSI, compared with non-obese/ overweight individuals: the corresponding hazard ratios (HRs) and their confidence intervals (CIs) were 1.60 (95% CI, 1.26–2.04), 1.71 (95% CI, 1.16–2.54), and 1.31 (95% CI, 1.01–1.69). The population attributable fractions in middle-aged men and women receiving ISI were 17.7% and 6.6%, respectively, while that in older women receiving MSI was 9.4%.

Because the reference category included those with metabolic risk factors, we built a supernormal group (non-obese/overweight with no risk factor) as another reference. It was noteworthy that nonobese/overweight individuals with risk factors had similar hazard ratios and population-attributable risk fractions as individuals with metabolic syndrome (Figure 1). The middle-aged non-obese/overweight men and women with two or more risk factors and even middle-aged non-obese/overweight women with only one risk factor had two to four times excess risk of cardiovascular disease, compared with the supernormal group. These findings justified the system for screening for both persons with metabolic syndrome and high-risk individuals with non-obese/overweight to conduct lifestyle interventions, and if needed, referral to local physicians in terms of risk stratification for cardiovascular disease.

The findings may be useful for researchers, practitioners, and policymakers to construct preventive strategies, evaluation, practice guidelines, and health policies in countries or populations where the prevalence of obesity is not common as well as in Japan.

How to enhance the referral of very high-risk individuals screened to local physicians for seeking treatment and examine whether an early clinical visit was associated with a lower risk of cardiovascular disease and total mortality?

In 2008, a national program for health checks and counseling for people aged 40–74 years was enacted in

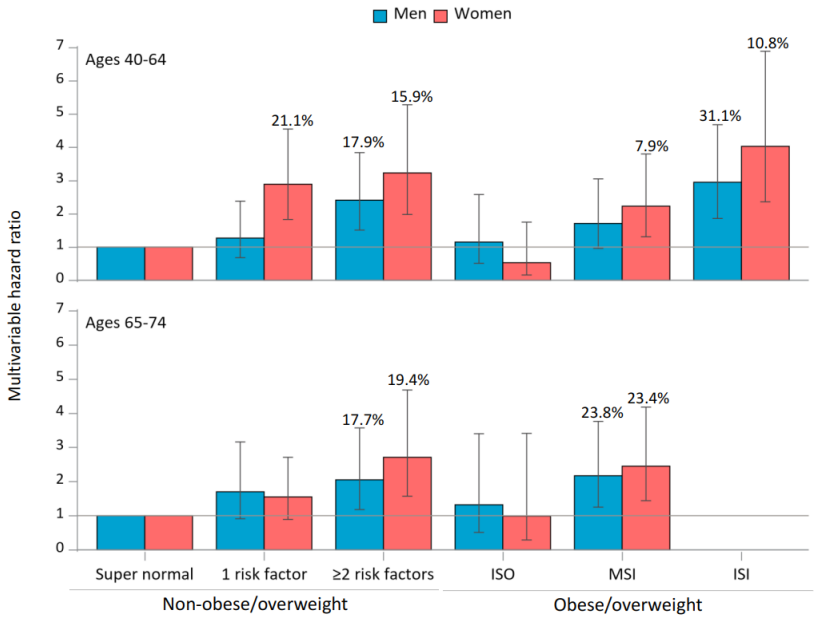

Figure 1. Age- and sex-specific multivariable hazard ratios of total cardiovascular disease according to the refined category of health intervention with non-obese/overweight subtypes for screened participants. Bar: 95% confidence interval. The number of percentages: population attributable risk. ISO: information supply only, MSI: motivation-support intervention, ISI: intensive support intervention. *Data Source: modification from Reference 19.*

Japan to screen for individuals with high blood pressure, high hemoglobin A1c or glucose, high low-density lipoprotein cholesterol levels, and proteinuria to reduce their risk through lifestyle modification and to refer very-high risk individuals to local physicians.

However, less than half of patients with untreated extremely severe hypertension (systolic and/or diastolic blood pressures 180/110 mmHg and over) screened *via* health checks did not visit physicians thereafter probably because of the lack of symptoms as well as insufficient health counseling following health checks. We thus test the effect of a community-based program to accelerate referral to local physicians for people at very high risk of cardiovascular disease using a parallel-arm, non-blinded, cluster randomized trial.

The trial was performed for forty-three municipalities (21 intervention and 22 usual care) to examine whether standardized health counseling for very high-risk individuals aged 40-74 years accelerates clinic visits (*18,20*). A total of 8,977 and 6,733 were allocated to the intervention and usual care groups, respectively, who were not under medical treatment but had high levels of blood pressure (systolic/diastolic 160/100 mmHg or more), hemoglobin A1c/glucose 7.0% or over/corresponding glucose levels or more), LDL-cholesterol (180 mg/dL or more for men), and/or proteinuria of 2+ or more who were expected to be at a 10-year risk of 15% (*18*). The usual care group was under the local counseling protocols.

For the intervention group, health counseling was provided primarily by a certified public health nurse and secondarily by a clinical nurse and a certified nutritionist based on the health belief model (*24*), and the detail of counseling was reported elsewhere (*18,25*). Briefly, a trained counselor explained how high blood pressure, hyperglycemia, and hyperlipidemia damage the brain, heart, and kidney vasculature and, if untreated, could lead to the occurrence of serious health problems, including stroke, heart attack, and renal failure (perceived susceptibility) using a progression flowchart of lifestyle-related diseases, the so-called "*Where am I ?*" chart (*i.e.*, risky behaviors such as high salt intake and smoking leading to the development of metabolic risk factors, preclinical vascular disorders, ischemic heart disease and stroke, bedridden status, heart failure, dialysis, dementia, blindness, and necrosis of the extremities) (Figure 2), and emphasized that these diseases would harm the counselee and their family's life physically and economically (severity) using newly developed health education flyers. The counselor then provided information regarding the benefits of visiting a physician to seek treatment (benefits) and asked about

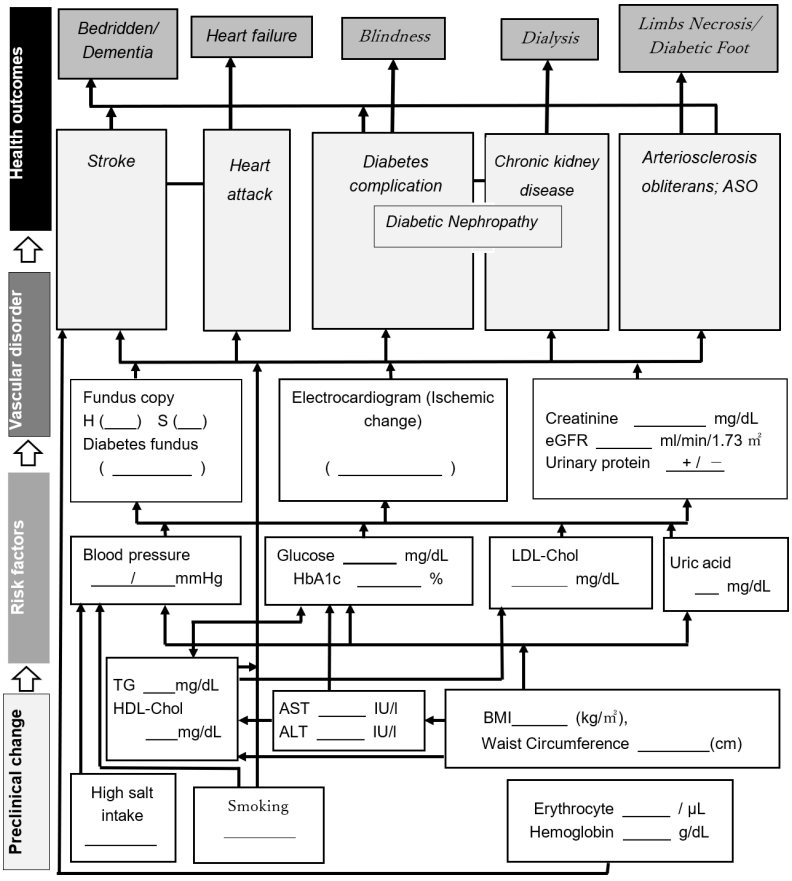

Figure 2. "Where am I?" Chart, a flow of disease progression. The underlined parts will be filled in by the data of each subject. *Source: modified from Reference 18.*

barriers that prevent clinic visits (barriers). Accordingly, the counselee is expected to make their own decisions (self-efficacy) and take the appropriate action, such as seeing a physician to seek treatment (trigger to action). The above process is in line with self-care with the support of a health worker addressed by WHO (*21*).

The counseling was provided three times (1–3, 4–6, and 7–9 months) after the health checks with the initial counseling primarily by home visits, secondarily through a face-to-face session at a municipal office or public health center, and tertiary telephonic counseling. In results, the 12-month cumulative proportions of clinic visits after health checks were 58.1 (95% CI: 57.0–59.3) % *vs.*44.5 (43.2–45.8) %, with the probability ratio of clinic visits between the groups being 1.46 (1.24–1.72) for the total population (Figure 3), 1.48 (1.23–1.78) for hypertension, 1.34 (1.11–1.63) for diabetes, 1.67 (1.38–2.02) for dyslipidemia, and 1.25 (1.02–1.53) for proteinuria. The between-group differences between the baseline and 1-year surveys were −1.50 (−2.59, −0.41) mmHg for diastolic blood pressure in the hypertension group, −0.30% (−0.53%, −0.07%) for HbA1c in the diabetes group, −0.37 (−0.48, −0.27) mmol/L for LDL-cholesterol in the dyslipidemia group, and none for proteinuria. That trial demonstrated that standardized counseling after health checks for very high-risk individuals accelerated clinical visits and reduced levels of risk factors.

The next question is what factors of health counselor's profession (public health nurse, clinical nurse, and nutritionist), their ages, and years of counseling experience for lifestyle-related diseases achieve the larger referral. Compared to nutritionists, the cumulative proportions of clinic visits at 3, 6, and 12 months were significantly higher for public health nurses, and intermediate for nutritionists, and tended to be higher for clinical nurses (Figure 4). The probability ratios (95% CIs) of clinic visits were 1.22 (1.11–1.35) for public health nurses and 1.04 (0.90–1.20) for nurses compared with nutritionists. After adjustment for participant and counselor characteristics, initial timing, mode, and number of counseling sessions. The corresponding probability ratios (95% CIs) were 1.16 (1.05–1.29) and 1.12 (0.95–1.31), respectively. The counselor's age and years of experience did not influence clinic visits of the target population. Public health nurses were more effective in increasing clinic visits among the target population, owing to their profession-specific competency focusing on disease prevention and health promotion (*26*).

This trial did not report the effect of referral to physicians on the cumulative incidence of composite outcomes, *i.e.*, hospitalization for stroke, myocardial infarction, unstable angina, chronic kidney disease, renal failure and dialysis, sudden cardiac death, and deaths from cardiovascular disease, chronic kidney disease, and renal failure) because of insufficient statistical power. Therefore, we examined the potential effect using a large observational cohort study of approximately 400 thousand very high-risk individuals (the same criteria as the above trial) from the health claims database of the Japan Health Insurance Association (*27*).

Our research team examined the associations between the timing of clinic visits during 12 months after health checks (early: < 3 months, intermediate: 4–6 months, late: 7–12 months, and none) and the risk of hospitalization for stroke, coronary heart disease, heart failure, or all-cause mortality.

During a median follow-up of 4.3 years, we found 15,860 composite outcomes of first hospitalization for stroke, coronary heart disease, heart failure, or all-cause mortality. Compared to very high-risk individuals without clinic visits after health checks, the adjusted hazard ratios (95% CIs) of a composite outcome were 0.78 (0.74, 0.81), 0.84 (0.78, 0.89), and 0.94 (0.89, 1.00) for early, intermediate, and late clinic visits, respectively. Similar associations were observed for hospitalization for stroke, coronary heart disease, heart failure, and all-cause mortality. The earlier clinic visit suggests lowering the risks of all individual endpoints.

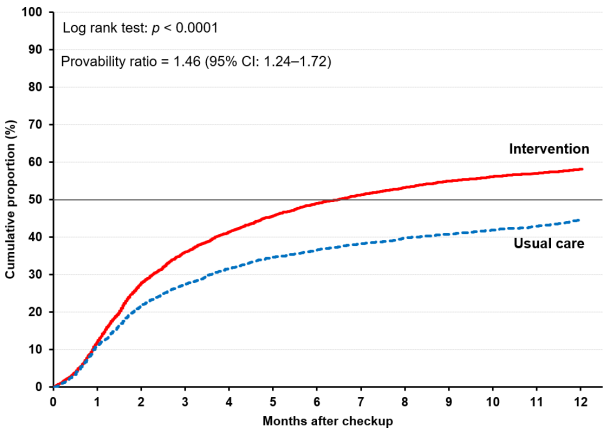

Figure 3. Cumulative proportions of clinic visits for participants in the intervention and usual care groups. *Data Source: modified from Reference 20.*

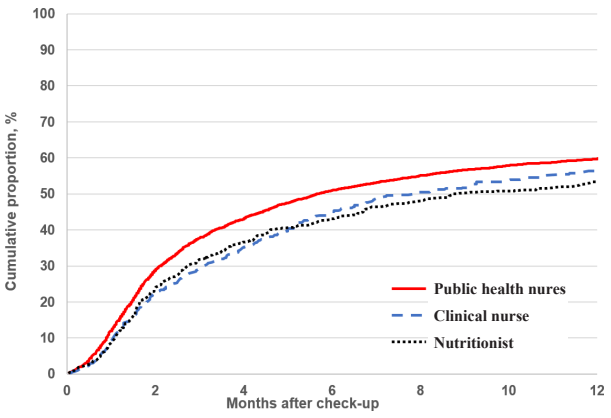

Figure 4. Cumulative proportions of clinic visits for participants according to health counselor's profession. *Data Source: modified from Reference 25.*

Conclusions

Health counseling after the health checks is necessary not only for both persons with metabolic syndrome but also for high-risk individuals with non-obese/overweight because the population attributable risk fraction of ischemic cardiovascular disease was similar for both high-risk individuals. A randomized trial demonstrated that standardized counseling based on a health-belief model for very high-risk individuals accelerated clinical visits and reduced levels of risk factors. In health counseling, public health nurses were more effective in increasing clinic visits probably because of their profession-specific competency focusing on disease prevention and health promotion. Furthermore, a large observational prospective study indicated that the earlier clinic visit after the counseling was associated with lower risks of hospitalization for stroke, coronary heart disease, heart failure, and all-cause mortality. These epidemiological findings may be useful for health practitioners and policymakers to enhance the prevention and control of cardiovascular disease and well-being in countries with emerging cardiovascular burdens and aging.

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Senility deaths in aged societies: The case of Japan

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Abstract: Senility is now the third largest cause of death in Japan, comprising 11.4% of the total number of deaths in 2022. Although senility deaths were common in the period before the Second World War, they declined sharply from 1950 to 2000 and then increased up to the present. The recent increase is more than what we could expect from an increasing number of very old persons or the increasing number of deaths at facilities. The senility death description in the death certificate is becoming poorer, with 93.8% of them only with a single entry of "senility". If other diseases are mentioned, those are again vague diseases or conditions. Senility, dementia and Alzheimer's disease, sequelae of cerebrovascular disease, and heart failure are the largest causes of death in which senility is mentioned in the death certificate. The period from senility onset to death is often described within a few months, but it varies. In some cases, the deceased's age was written out of a conviction that the ageing process starts from birth. As senility is perceived differently among the certifying doctors, a standardised protocol to certify the senility death is needed. On the other hand, senility death is the preferred cause of death and many people do not wish to receive invasive medical examinations before dying peacefully. Together with other causes of death related to frailty, there would be a need to capture senility as a proper cause of death, not just as a garbage code, in the aged, low-mortality population.

***Keywords*:** senility, cause of death, Japan

Introduction

While Japan's life expectancy remains one of the longest in the world, the very old population inevitably increase the number of deaths. In 2022, it recorded 1,569,050 (*1*), the second highest in the history of Japanese vital statistics, following 2,115,162 deaths that occurred in 1945 due to the Second World War (WWII) (*2*). The 2022 high death toll was in part due to the increase in COVID-19 deaths, which counted 47,661, 30,877 increase from the previous year. The second largest increase was due to senility deaths, which counted 179,529, 27,502 increase from the previous year. The senility is now the third largest cause of death in Japan. According to the ICD-10 stipulated by WHO, senility is allocated in chapter XVIII of "symptoms, signs or clinical findings, not elsewhere classified". It has been supposed to be an ill-defined cause which should be avoided to be used as the cause of death. In this international context, the "pandemic" of senility in Japan should be studied and clarified. Does the negligence of the certifying doctor cause it, and could the senility death be reduced? This paper aims to describe Japanese realities on why there are so many senility deaths and what could be the possible orientation in the future of the super-ageing society.

Internationally, the proportion of senility deaths over the number of deaths aged 60 years and over varies, and most of the countries which produce cause-of-death statistics based on full registration have a low proportion of senility (Figure 1). Belarus and Japan are the highest, 12%, followed by Russia (7.9%) and South Korea (6.6%). Queen Elizabeth II of the United Kingdom died of "old age" (*3*), but the proportion of senility deaths in England and Wales was only 1.7%. The senility proportions in France, Germany, and the USA are even lower, 0.8%, 0.3%, and 0.2% respectively.

The high proportion of senility deaths in Belarus and Russia could be explained partly due to the order issued in 1989 by the Soviet Minister of Health, Mr. Evgueny Chazov, to classify all deaths after age 80 as

senility unless there is evidence of external causes or a specific diagnosis (*4*). Following this order, senility deaths increased in Belarus with the symmetrical decrease of atherosclerotic cardiosclerosis without hypertensive heart disease (*5*). Hence it is considered that these changes were man-made, by the Soviet order, not the real change of diseases before the death. Similarly, in more recent times in Russia, the exchange between senility, cardiovascular diseases and other causes occurred after the presidential decree issued in 2012 on the circulatory disease mortality reduction by the numerical target (*6*). It is probable that many deaths by circulatory diseases were registered as senility, to achieve the target. While there is ample space for reflection on whether senility and circulatory diseases are truly separable or not, the high rate of senility in Russia and Belarus has its own causes induced by policy. In the case of Japan, there was no such policy to increase senility.

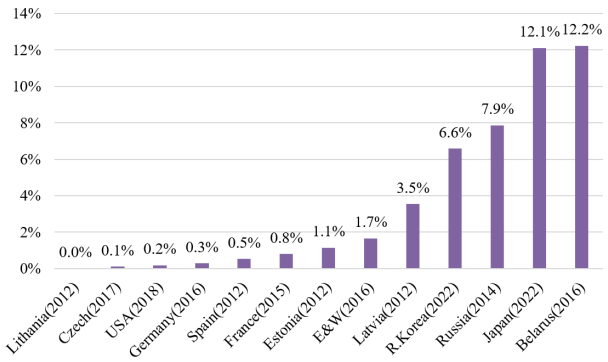

Figure 1. The proportion of senility deaths to deaths aged 60 years and over (various countries). Note: E&W is England and Wales. R. Korea is the Republic of Korea. The number in () denotes the year of the statistics. Data Source: The Human Cause-of-Death Database *https://www.causesofdeath.org*, *KOSIS.kr* for the Republic of Korea, Vital Statistics (Ministry of Health, Labour and Welfare) for Japan.

Historical trend of senility death in Japan

The Japanese national cause of death statistics started in 1875 by the Sanitary Bureau of the Ministry of Home Affairs after the Meiji government launched the *Isei,* the Medical Act. The classification adopted at the time was similar to the Farr classification, and there was a category of constitutional diseases (zenshinbyo) to which senility death was attributed (*7*). The single entry of senility death became available in the cause of death statistics in 1899 when the vital statistics started. The cause-of-death statistics of that year, which was published in 1902, reclassified thousands of cause-of-death descriptions reported by doctors into a classification composed of 46 items, which was comparable both to the existing 12-item classification made by the Sanitary Bureau (*8*) and also the first International Classification of Diseases, which had one chapter for senility (*9*). The number of senility deaths in that year was 55,189, 5.9% of total deaths and 21.4% of the deaths aged 60 years and over (Figure 2). The proportion remained stable with a slight upward trend until 1943. After three years of missing data caused by WWII, both the number and proportion of senility deaths declined in 1947 and kept on declining since then. The sharp decline was recorded in 1950 when the ICD-6 was adopted, and the independent chapter on senility was abolished. The senility was allocated in chapter XVI, "Symptoms, senility, and ill-defined conditions". There were concerns about this change among those in charge of cause-of-death statistics. In the statement of the Japanese Committee to the Sixth Decennial Revision of International Lists of Diseases, Injuries, and Causes of Death, it was stated that the subcommittee in charge had

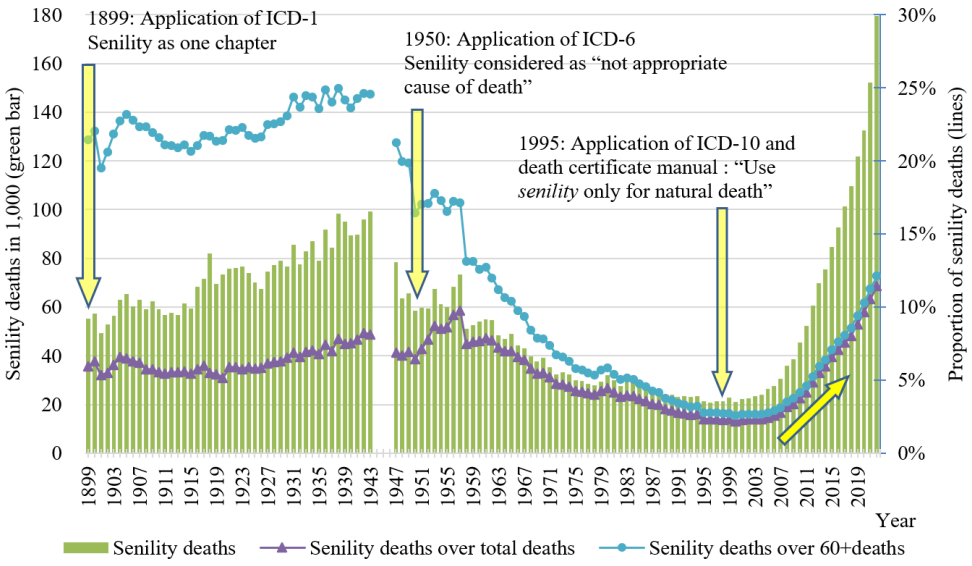

Figure 2. The trend of senility deaths in Japan. Data Source: Vital Statistics (Statistics Bureau until 1943, Ministry of Health and Welfare from 1947 to 1998, Ministry of Health, Labour and Welfare from 1999).

no objection except for senility, but "in the long run, they agreed with the World Health Organization, taking into account the peculiar nature of senility". Having agreed to follow this international decision to allocate senility as an ill-defined cause of death, efforts were made to reduce them, mainly through training and information dissemination to medical doctors to remind them that senility was a garbage code. The number and proportion of senility deaths kept on declining. However, since around the end of the 20th century, the number turned again to an upward trend. At the time of the ICD-10 application in 1995, the death certificate form and death certificate manual were revised, and an explanation was added that stated: "use senility as the cause of death only in the case of so-called natural death, which is an elderly person with no other obvious cause of death" (*10*). Thus, the senility was acknowledged as a proper cause of death. This might trigger the gradual increase of senility death written in the death certificate.

The proportion of senility deaths to the deaths aged 60 years and over was high before WWII, at around the level of 20 to 25%. After WWII, it declined until it hit the lowest, 2.0%, in 2000 and increased again to 12.1% in 2022. If we consider the decision of WHO, that senility is an ill-defined cause, is legitimate, the high proportion of senility in recent times suggests the quality of cause-of-death statistics in Japan is deteriorating. However, we need to look closely further at the data.

The age structure of senility death changed greatly from 1900 to 2022 (Figure 3). In the early 20th century, most of the senility deaths were aged 70s and 80s, whereas the majority of recent senility deaths are more than 90 years and over. If senility death results from the natural, genetic, intrinsic process of human ageing, then there should be the same amount of senility deaths at the same age. Life expectancy doubled from around 40 to 85 years during the same period, so the deaths that occurred after the life expectancy, or the appropriate age that people accept to die, could be easily labelled as senility. If so, the senility death is not truly natural but ill-defined, influenced by ageism. Or, it might suggest the natural ageing process evolved along with the extension of life expectancy.

Senility has never been the top cause of the deaths of older persons (Figure 4). Before WWII, the largest causes were cerebrovascular and digestive organ diseases. After WWII, cancer, cerebrovascular, and heart diseases were the main killers. Cancer mortality was low in the pre-WWII period, but it increased enormously after WWII. The low cancer mortality in the pre-WWII period could be partly due to the limited knowledge and technology to diagnose cancer, and hidden cancer deaths might be included in the senility deaths. The increasing proportion of cancer from 1950 to 2000 is in parallel with the decreasing proportion of senility. After 2000, the cancer-senility relation continued but in the opposite direction; the proportion of cancer decreased while senility increased. The possible explanation for this trend is that medical technology development cured diseases notably cancer, and pushed longevity further but not to eternity, resulting in the senility increase.

The structure of the recent increase in senility death

The senility death increase after 2000 is caused partly due to the increase in the total number of deaths, especially very old people. In 2022, among 179,529 senility deaths, 88% (158,638) were aged 85 years and over (Figure 5). However, the ageing of deaths is not the only reason. By age, the senility death rate is increasing steadily (Figure 6). For example, among those aged 95 to 99 years and over, the senility death rate per population was 3.0% in 2005 but increased to 8.3% in 2022. As the all-cause mortality of that age group did not increase in the same period, the increase in the senility death rate implies that senility is over-utilized or preferred as the cause of death in the death

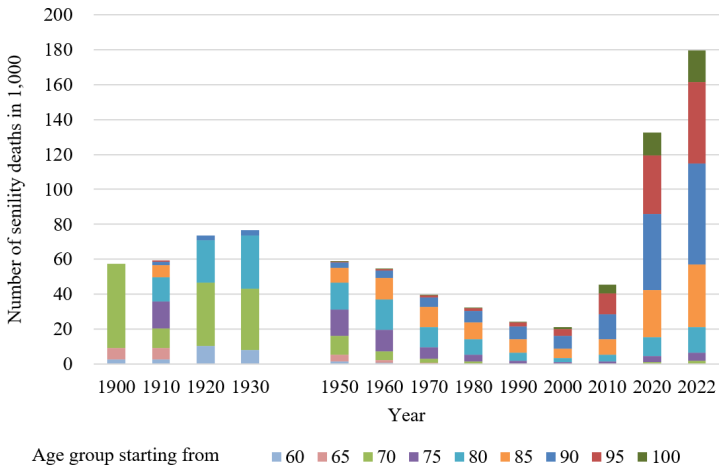

Figure 3. Senility deaths by age group. Data Source: Vital Statistics (Statistics Bureau until 1943, Ministry of Health and Welfare from 1947 to 1998, Ministry of Health, Labour and Welfare from 1999).

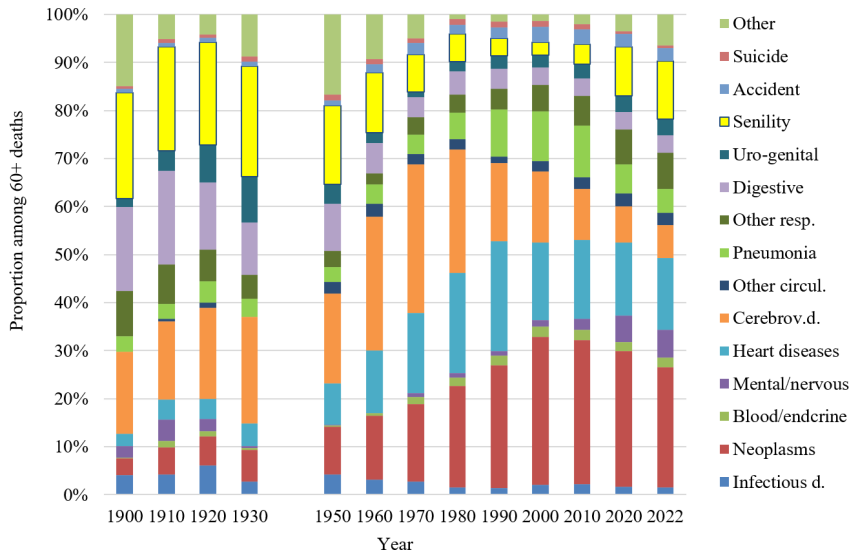

Figure 4. The proportion of major causes of deaths aged 60 years and over. Data Source: Vital Statistics (Statistics Bureau until 1943, Ministry of Health and Welfare from 1947 to 1998, Ministry of Health, Labour and Welfare from 1999).

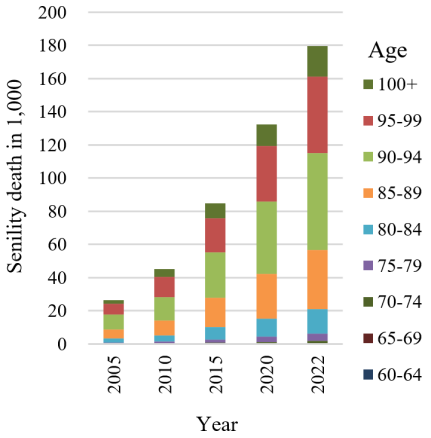

Figure 5. Number of senility deaths by age. Data Source: Vital Statistics (Ministry of Health, Labour and Welfare).

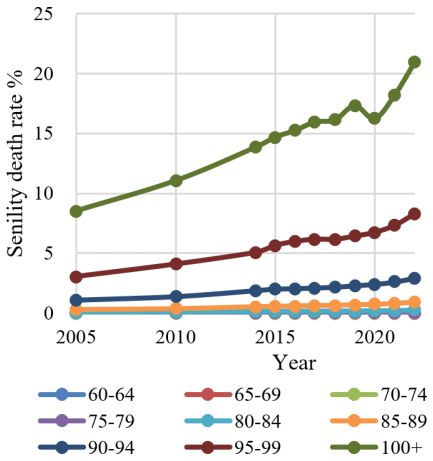

Figure 6. Age-specific senility death rate. Note: The decrease and increase in the senility death rate of centenarians from 2020 to 2022 show the irregularities under the mortality fluctuation during the COVID-19 pandemic, which would need further investigation. Data Source: Vital Statistics (Ministry of Health, Labour and Welfare).

certificate.

By place of death, an increasing number of senility deaths are occurring in facilities (Figure 7). In 2022, 32% of senility deaths occurred in hospitals, which also included clinics and designated "long-term care beds" in the hospitals. 17% occurred at home, including elderly housing with care service. 2% occurred at "other" locations, such as the daycare service center or the house of family member. The largest proportion, 49%, occurred in facilities, composed of those covered by the Long-term Care Insurance Act (Intensive Care Home for the Elderly, Long-term Care Health Facility, or Integrated Facility for Medical and Long-term Care), or other types of facilities (Fee-based Home for Elderly, Low-cost Home for the Elderly or Nursing Home for the Elderly).

For all causes of death, along with the long-term care services expansion since public insurance was introduced

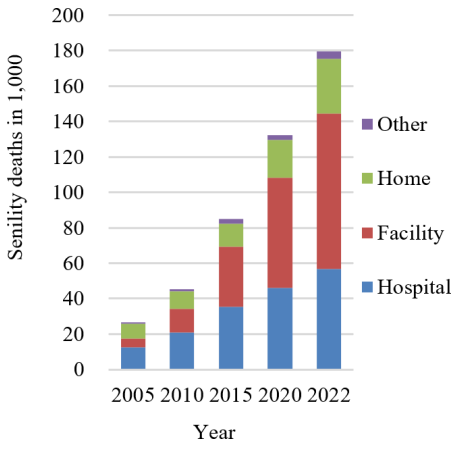

Figure 7. Number of senility deaths by place of death. Data Source: Vital Statistics (Ministry of Health, Labour and Welfare).

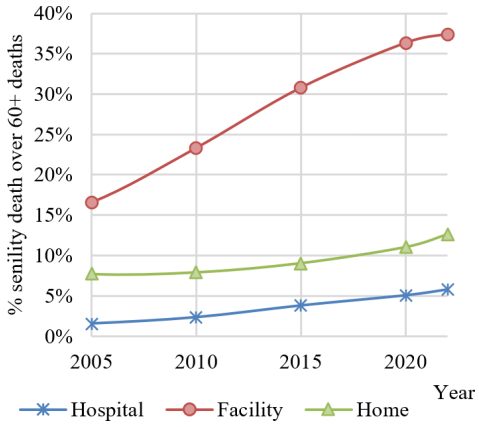

Figure 8. Senility death proportion by place of death. Data Source: Vital Statistics (Ministry of Health, Labour and Welfare).

in 2000, the number of deaths occurring in facilities has been increasing. However, even among the deaths that occurred in facilities, the proportion of senility deaths is increasing much more than deaths that occurred in hospitals or at home (Figure 8). One explanation is that those who do not have any particular curable diseases but progressing frailty move out from the hospital or home to a facility and stay there for a certain period until they end their life by senility. Another explanation is, as in the increase of senility mortality by age, that more and more doctors prefer to use senility as a cause of death, especially at facilities.

Description of senility in the death certificate

Since the ICD-6 was adopted by the newly created WHO in 1948, it was decided that the underlying cause, the disease or injury that initiated the train of morbid events leading directly to death, should be designated as the cause of death for primary tabulation (*11*). To determine the underlying cause, multiple descriptions of diseases and injuries which led to the death are required. Currently, the Japanese death certificate form provides one cell to describe the direct cause, three cells to describe other causes which caused the direct cause, and one cell to describe related diseases and injuries. The duration from the onset of each disease or injury to death must also be filled. All this information is used to determine the underlying cause of death to be published in the Vital Statistics by the Ministry of Health, Labour and Welfare. Since 2003, the online transmission of death registration from the municipality level to the national level has started (*12*), and these data containing death certificate information became available for research purposes under the Statistics Act.

The senility death, defined here as a death in which the underlying cause is senility, is increasing, but the description in the death certificate is becoming poorer. The proportion of senility deaths in which only one word of senility was written on the death certificate was 93.8% in 2020, up from 87.4% in 2005 (Table 1).

The most described other disease in the death certificate of senility death was unspecified heart failure (I50.9) until 2016. Due to the adoption of the ICD-10 2013 revision in 2017, the death mentioning both senility and unspecified heart failure was no longer defined as senility death. In 2020, the diseases mentioned in the senility death were general symptoms (R68.8), malaise and fatigue (R53), unspecified respiratory failure (J96.9), muscle wasting (M62.5), and dysphagia (R13), followed by other degenerative diseases and conditions (Table 2).

On the other hand, the senility-related deaths, defined here as the deaths in which senility is mentioned in any part of the death certificate, are more than the senility deaths. In 2020, senility-related deaths counted 218,001, 1.7 times more than the senility deaths. The underlying causes of those deaths were mostly senility, followed by dementia and Alzheimer's disease, sequelae of cerebrovascular disease, heart failure, pneumonitis due to solids and liquids (aspiration pneumonia), and pneumonia, organism unspecified (Table 3). These

Table 1. Number of cause descriptions of senility deaths

Number of sections with meaningful information	2005	2010	2015	2020
0	6	6	25	16
1	9,233	31,642	73,531	123,459
2	1,233	4,361	6,888	7,630
3	91	477	647	448
4	2	29	36	21
5	1	1	1	0
6	0	2	0	0
Total	10,566	36,518	81,128	131,574
1 item only %	87.4%	86.6%	90.6%	93.8%
Senility deaths not reported online	15,794	8,824	3,682	866
Total senility deaths	26,360	45,342	84,810	132,440

Note: The cases with no meaningful information (for example, 16 cases in 2020) are presumably cases in which separate communication was made to determine the underlying cause of death other than online registration. Data Source: Vital Statistics (Ministry of Health, Labour and Welfare), microdata provided pursuant to Articles 32 and 33 of the Statistics Act.

diseases are important causes of death, and they are intertwined with senility. Also, if these diseases are written on the death certificate, the death will not be a senility death due to the coding rule. However, it is questionable if these deaths are distinctively different from senility deaths.

Another information we can obtain from death certificate data is the duration from the onset of diseases to death. The duration from senility onset to death among senility-related deaths is shown in Figure 9. The most frequent duration is one month, and the proportion has recently increased. Together with the frequent duration of two or three months, it could be said that most doctors perceive the senility process within a few months. However, not a negligible number of senility-related deaths mention the senility duration as 1 week or 1 year. Also, in some death certificates, 177 in 2020, the deceased's age was written as the duration of senility out of a conviction that the ageing process starts from birth. The senility duration is perceived quite differently among the certifying doctors.

Table 2. Diseases mentioned in the senility death (2020)

No.	Name of disease	ICD-10	*n*	%
1	Senility	R54	130,556	99.2%
2	General symptoms	R68.8	778	0.6%
3	Malaise and fatigue	R53	557	0.4%
4	Respiratory failure	J96.9	358	0.3%
5	Muscle wasting nec.	M62.5	334	0.3%
6	Dysphagia	R13	263	0.2%
7	Acute respiratory failure	J96.0	222	0.2%
8	Eating disorder	F50.9	166	0.1%
9	Shock, unspecified	R57.9	147	0.1%
10	Gangrene, nec.	R02	117	0.1%
	Other diseases and injuries		974	0.7%
	Total		131,574	100.00%

Note: "nec." stands for "not elsewhere classified". Total *n* (131,574) is the number of senility deaths reported online. It is less than the sum of all rows, as a death might have more than one disease written on the death certificate. Data Source: Vital Statistics (Ministry of Health, Labour and Welfare), microdata provided pursuant to Articles 32 and 33 of the Statistics Act.

The importance of senility as a cause of death

Back in 1948, when WHO adopted the ICD-6, senility was attributed to an ill-defined cause of death. 70 years later, the increasing number of senility deaths in Japan does not mean that it became a well-defined cause of death. The increase is more than what could be expected from the increase in deaths of very old people, and at facilities. The death certificate description is becoming poorer, as most of the senility death certificates only mention one word: "senility".

However, senility is a preferred cause of death in Japan. According to a survey conducted in 2020, 81.5% of people think senility is a peaceful death, and only 7.3% think that senility deaths are caused by insufficient medical services (*13*). In addition, many people do not wish to receive invasive medical examinations before dying or to give those painful procedures to the family member before death. More than half (57.2%) of people do not wish to receive either a blood test, X-ray test, CT test, or endoscopic test if she or he faces senility death, and 48.5% of respondents wish not to give those tests to the family member (*14*). Further, home care physicians tend to respect the wish of the patient or their family for a peaceful death (*15*). All these preferences contribute to the increasing number of senility deaths in Japan, where the death certificate made by the doctor is handed to the family member who is responsible for the death registration at the municipality office.

Is it medically wrong to certify the death as senility? The doctors who deliver home medical care have a common understanding of how to certify senility death; most doctors consider the gradual decrease in daily activities and eating, the absence of any other diseases,

Table 3. The underlying causes of death of the senility-related death (2020)

No.	Name	ICD-10 code	person	%
1	Senility	R54	130,484	59.9%
2	Dementia and Alzheimer's disease	F01, F03, G30	19,955	9.2%
3	Sequelae of cerebrovascular disease	I69	10,146	4.7%
4	Heart failure	I50	9,256	4.2%
5	Pneumonitis due to solids and liquids	J69	4,301	2.0%
6	Pneumonia, organism unspecified	J18	3,503	1.6%
7	Cerebral infarction	I63	3,051	1.4%
8	Parkinson's disease	G20	2,111	1.0%
9	Chronic kidney disease	N18	2,076	1.0%
10	Unspecified diabetes mellitus	E14	1,715	0.8%
11	Other degenerative diseases of nervous system, not elsewhere classified	G31	1,268	0.6%
12	Essential (primary) hypertension	I10	1,259	0.6%
13	Fracture of femur	S72	1,189	0.5%
	Other diseases and injuries		27,687	12.7%
	Total		218,001	100.0%

Data Source: Vital Statistics (Ministry of Health, Labour and Welfare), microdata provided pursuant to Articles 32 and 33 of the Statistics Act.

and continuous care for months to years are important factors so that they can confidently certify the senility death (*15*). It is not certain yet if these criteria are also applied to senility deaths in facilities, where half of senility deaths are occurring at present. A standardised protocol to certify the senility death is needed.

However, we cannot simply assume that senility is used for an old person's uncertain, or even dubious death. For those deaths, heart failure or pneumonia, instead of senility, is used as the cause of death, which is the case in some criminal incidents in Japan (*16*).

Internationally, Japan's high proportion of senility deaths is outstanding. On the contrary, the proportion of deaths by dementia, including Alzheimer's disease, is lower in Japan. Some argue that dementia should be regarded as an underlying cause and needs proper attention (*17*), but others, especially neurologists, consider dementia should not, and could not be the underlying cause of death as it is a natural process of ageing. The causality of dementia and senility is not yet certain, and further research should clarify the mechanism. However, one can say that the high senility death proportion is offset by the low dementia death proportion in Japan compared to other countries. For example, in England and Wales, the top cause of death has been dementia, while senility deaths are rare. When these two causes are combined, the proportion to all-cause deaths by age shows a similar level between the two countries (Figure 10). The proportion to deaths aged 60 years and over is almost identical, with 13.2% for England and Wales and 13.3% for Japan in 2021.

In addition to dementia and senility, there are other similar causes of death related to frailty, such as cachexia, malnutrition or incontinence (*18*). While the interconnectivity and causality between these various frailty and senility-related diseases are to be clarified, there would be a need to capture them as proper causes of death in the aged, low-mortality population, not just

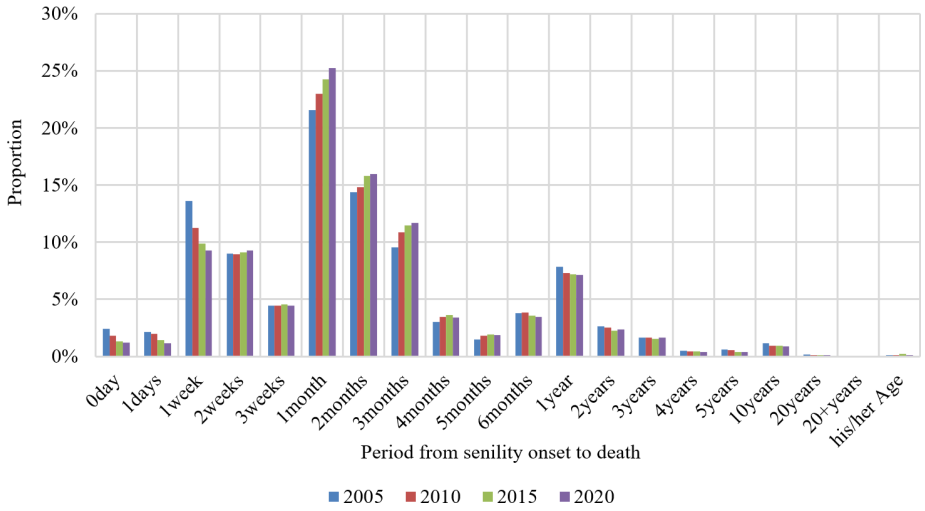

Figure 9. The period from senility onset to death. Data Source: Vital Statistics (Ministry of Health, Labour and Welfare), microdata provided pursuant to Articles 32 and 33 of the Statistics Act.

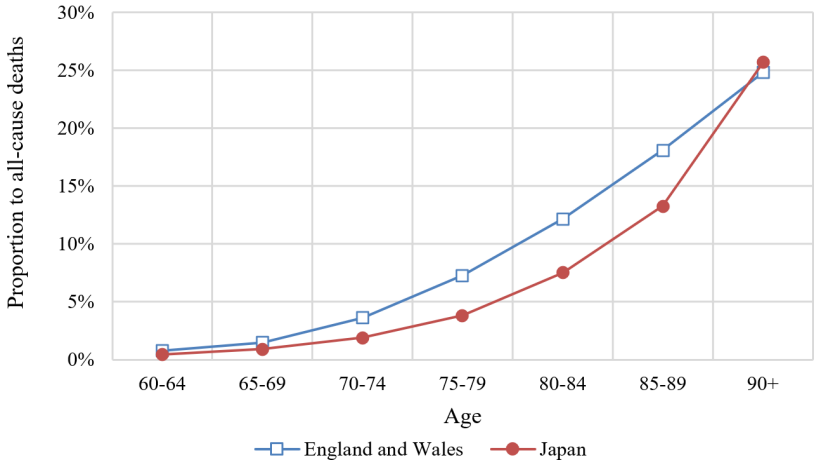

Figure 10. Proportion of dementia and senility deaths, Japan and England & Wales (2021). Note: Dementia is the sum of F01-F03, G30, senility is R54. Data Source: Vital Statistics (Ministry of Health, Labour and Welfare) for Japan, NOMIS Mortality Statistics (Office for National Statistics) for England and Wales.

as garbage codes.

Conclusion

The high proportion of senility deaths in Japan could be a sign of the deteriorating quality of cause-of-death statistics. To avoid an easy description on the death certificate only with one word, "senility", a clear, objective guideline is needed so that certifying doctors judge correctly the senility death. However, considering the similarity with the post-Soviet countries, or England & Wales, the high level of senility deaths in Japan could not be just a statistical quality issue.

Historically, the gradual increase of senility deaths towards the end of the 1940s drastically turned to a decline from 1950 to 2000. This was due to the advocacy training to doctors not to write senility in the death certificate. But also, the senility death proportion declined when the cancer death proportion increased. If we assume that the high proportion of pre-WWII senility deaths was partly due to undiagnosed cancer, then the medical progress in diagnosing cancer in the post-WWII period contributed to the reduction of senility deaths. If we apply this analogy, the increasing senility deaths at present could again decrease if or when we have new technologies. In the near or far future, when we can control the human ageing mechanism, we will be able to stop ageing and reduce senility deaths. Technology development is already on the horizon, especially at the genetic level.

However, for now, we are still living within the conventional limit of human lifespan, which would be, at most, 120 years. How to live better and die better within this limit is a common interest of all human beings, and analysing senility deaths would give many insights on that.

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International promotion of Japanese aging-related health services and products: Perspective of an international agency

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Abstract: Asia is at a critical juncture of health development. The population is aging and shrinking. At the same time, the economy is developing rapidly. These two factors, which necessitate a new paradigm of health development: departing from dependence on Official Development Assistance (ODA) and transitioning towards a model with more involvement of industries (private sector), academia, and health care providers, the so-called public-private partnership (PPP) model. The Economic Research Institute for ASEAN and East Asia (ERIA) is studying the potential for broader application of the new concept for collaboration between Asian countries and Japan. In this article, the authors attempt to introduce the complete picture of a new health ecosystem advocated by Japan. We first look at the impacts of population aging and shrinking, followed by introducing two new approaches; regional and country-specific, with the involvement of ERIA. Then, the outcomes of the projects and Japanese technology, services and products relevant to the older population are introduced. Finally, based on the various projects and products, we focus more closely on the new health development model, the PPP model. We start from the theory and move to examine a tool for implementation, which is the formulation of a dialogue forum named the MEX (Medical Excellence X, where X can be substituted by the acronym of any participating country) project. The experience of these projects and case studies will benefit all ASEAN member countries and beyond. ERIA finds that the facilitation works of the Institute catalyze the progress. ERIA will remain committed to helping the endeavors initiated by Japan for the benefit of all.

***Keywords*:** aging-related health services and product, Economic Research Institute for ASEAN and East Asia (ERIA), international collaboration, health ecosystem, public-private partnership (PPP)

Introduction

Asia is at a critical juncture of health development. The population is aging and shrinking. At the same time, the economy is developing rapidly. These two factors bring a new paradigm of health development: departing from dependence on Official Development Assistance (ODA) and transitioning towards a model with more involvement of industries (private sector), academia, and health care providers, the so-called public-private partnership (PPP) model. The Economic Research Institute for ASEAN and East Asia (ERIA) is studying the potential for broader application of the new concept for collaboration between Asian countries and Japan.

In this article, the authors attempt to introduce the complete picture of a new health ecosystem advocated by Japan. We first look at population aging and shrinking as the dominant force driving mortality and morbidity changes, followed by introducing the new approaches initiated in Japan with the involvement of ERIA and the outcomes of the projects. Then, we focus more closely on the new health development model; the PPP model, together with the tool for implementation, which is a dialogue forum named the MEX (Medical Excellence X; where X can be substituted by the acronym of any participating country) project.

Population aging and shrinking: Lessons from Japan

The Asian population is aging and shrinking, a phenomenon that first started in Japan (*1*). However, this trend is spreading worldwide if one examines the most recent World Population Prospects (WPP) published by the Department of Economic and Social Affairs Population Division, United Nations (*2*). As shown in Figure 1, the total population in Asia is projected to peak at 5.306 billion in 2055 (for reference, global population is projected to peak at 10.431 billion in 2086), to be followed by a negative population growth thereafter; in other words, population shrinking starts. The percentage

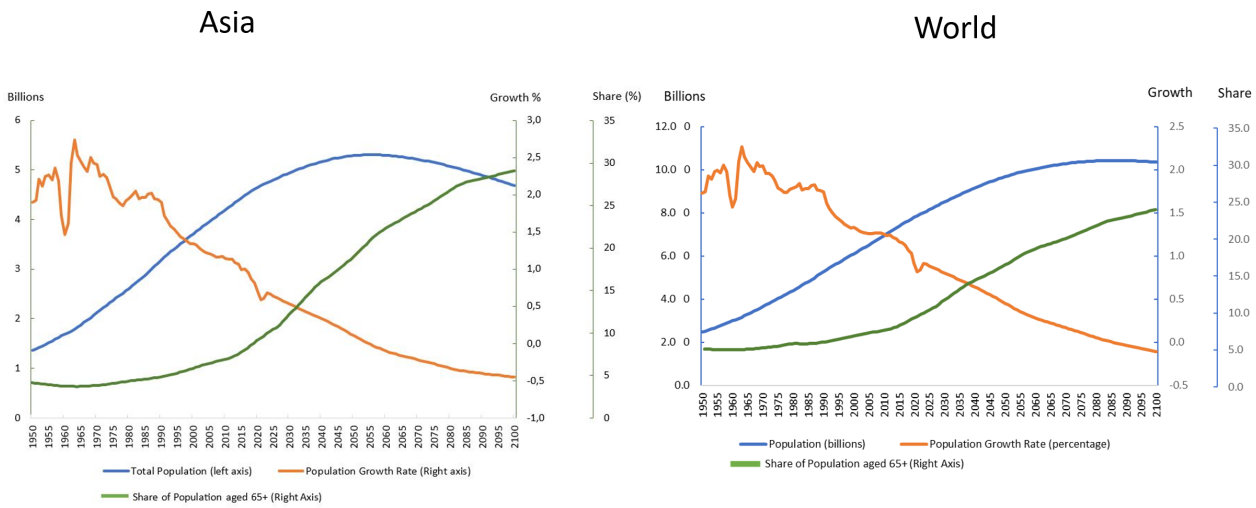

Figure 1. Total population, growth rates and share of population aged 65+ in Asia and the world. Data source: *i*) Percentage of 65+: Population Percentage by Select Age Groups Both Sexes. WPP 2022 File POP/06-1: Percentage of total population by select age group, region, subregion and country, annually for 1950-2100. Estimates, 1950–2021. *https://population.un.org/wpp/Download/Standard/Population/*; *ii*) Total population, growth rates: Demographic indicators. Compact (most used; estimates and medium projections) WPP 2022 File GEN/01/REV1: Demographic indicators by region, subregion and country, annually for 1950-2100. Estimates, 1950–2021. *https://population.un.org/wpp/Download/Standard/MostUsed/*

of the population aged over 65 in Asia is projected to reach 19.0% in 2050 and 29.2% in 2100 (global figures are 16.5% and 24.0%, respectively). Aging in Asia appears to be moderate in the above WPP report. This is because Asia in the report consists of five subregions: Central Asia, Eastern Asia, Southern Asian, South-East Asia, and West Asia. Japan, China, and the Republic of Korea belong to Eastern Asia, and the projected percentage of over 65 in this subregion is 30.8% in 2050 and 40.5% in 2100, compared with the figures of 13.7% and 27.0%, respectively, in the Southern Asia subregion comprising the population giants including Bangladesh, India and Pakistan. Furthermore, there are vast differences among countries in the South East Asia subregion. Among the ASEAN (Association of Southeast Asian Nations) members, for example, aging is already advancing significantly in Thailand and Vietnam, but not so much in Indonesia and the Philippines, as shown in Figure 2. The trends of aging in three countries in the Eastern Asia subregion – Japan, China, and the Republic of Korea – are also depicted in Figure 2, together with the major measures implemented in Japan to address the aging population.

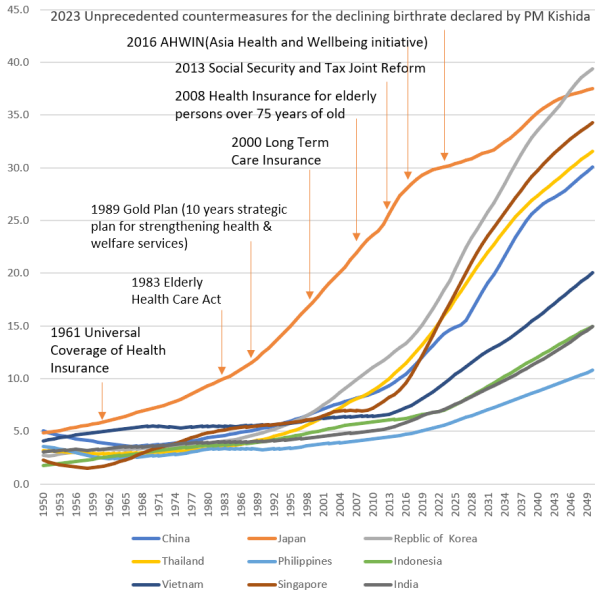

Figure 2. Population ageing in selected countries in Asia (1950–2050) and major Japanese policies. Data source: Percentage of 65+: Population Percentage by Select Age Groups Both Sexes. WPP 2022 File POP/06-1: Percentage of total population by select age group, region, subregion and country, annually for 1950-2100. Estimates, 1950–2021. *https://population.un.org/wpp/Download/Standard/Population/*

Japan achieved universal health insurance coverage in 1961 and enjoyed the bonus of population growth (*3*) until the 1980s when Japan recognized the impact of population aging and started to prepare for the forthcoming aged and super-aging Society (*4*). The measures include the enactment of the Elderly Health Care Act in 1983 that mandated annual health checkups for early detection and prevention of chronic conditions, and strengthening of the financial basis to cover increasing healthcare costs for the older population. In 1989, the Gold Plan started ten-year investments in health and welfare service infrastructure for senior citizens to prepare for the launching of universal coverage of long-term care insurance in 2000. Despite such efforts, healthcare financing has been a major challenge, especially with the increase of senior citizens aged over 75. A subprogram for persons over 75 within the universal insurance coverage scheme was started in 2008 (*5*) to sustain financial stability. In 2013, a whole-government review of social security (health and welfare) and taxation initiated by late Prime Minister

Abe concluded a coordinated approach to sustain appropriately coordinated services for everyone in need in the super-aging society after 2025, when all baby boomers will be over 75. Another grand agenda of the Abe cabinet was to revitalize the Japanese economy. The cabinet office saw population aging as both challenges and opportunities. Indeed, many innovative products and services for senior citizens have been invented and developed in the last decade. These are perceived as business opportunities for Japan, and at the same time valuable for countries that follow a similar path of population aging as Japan. With this in mind, Asia Health and Wellbeing Initiative (AHWIN) was launched in 2016 (*6*). While attention was given to aging, birth rate decline has continued in Japan and the fertility rate dropped to a record low of 1.26% in 2022. At the Parliamentary session in the beginning of 2023, Prime Minister Kishida declared, "unprecedented measures to address declining birth rate" (*7*).

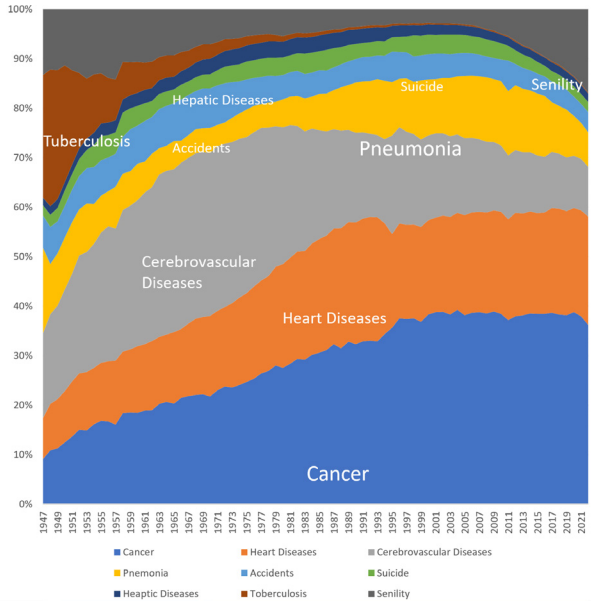

Figure 3: Trends of major causes of death (per 100,000 Japanese Population): 1947-2022. Data Source: Ministry of Health. Labour and Welfare: Vital Statistics 2022. *https://www.mhlw.go.jp/toukei/saikin/hw/jinkou/geppo/nengai22/index.html*

The demographic changes are both consequences and contributing factors of changes in mortality pattern, as shown in Figure 3. After World War II, tuberculosis and pneumonia declined, and typical lifestyle-related diseases of the middle-aged and senior population including cerebrovascular diseases, heart diseases, and cancer dominated. Then, the last two decades saw a return of pneumonia and senility as killers of senior citizens as the population ages. Naturally, these changes in mortality demanded changes in health care provision. Also, the decrease in cerebrovascular diseases is noteworthy as a favorable outcome of public health interventions (*8*). The Japanese experience is summarized in Table 1, which may be a helpful reference for other countries to predict the looming policy agenda to prepare for the forthcoming era of aging and shrinking population. There are no solid definitions for different grades of aging and aged society. However, the number of years taken for the over 65 population to increase from 7% to 14% is used as the doubling time. Therefore, in Table 1, we choose the years when the proportion of over 65 population in Japan reached 7%, 14%, 21%, and 28% (doubling, tripling, and quadrupling time, respectively) as milestones, and list the significant agendas for each period.

Approaches of Japan and Involvement of ERIA

As described above, Japan sees population aging as both challenges and opportunities, and believes that international collaboration is helpful for both Japan and the collaborating countries. ERIA is an organization

Table 1. Summary of Japanese experience

	Aging Phase	Aged Phase	Super Aging Phase	Super Aged Phase	Population Aging and Shrinking Phase
% 65+	7%	14%	21%	28%	depending on country: Japan 30.1 (2023 by WPP 2022)
in Japan	1969	1994	2006	2017	2023
Major Agenda	Mortality/Morbidity Pattern Changes, Necessary changes of health and public health services	Preparation of Long term Care Insurance and strengthening service capacities	Financing seniors among elderly population (75+) for financial sustainability of health insurance	Integration of health and welfare services at community level and ensure sustainable financing by insurances and support from taxation	Multisectoral interventions such as better work-life balance and wedge increase of younger generation, expanding child care facilities, with wider considaration of mitigating impact of shrinkage of population such as maintining social functions and keeping workforce.
Health focus	Prevention and Care of Major chronic diseasaes	Provision of care of aging associated conditions	Continuing care at community level	Dementia and other mental issues	Life course approach

with the mission to deepen the economic integration, narrow the developing gaps, and achieve sustainable developments in Association of Southeast Asian Nations (ASEAN) and East Asian countries through conducting a variety of projects and studies as part of its efforts to promote collaboration and community building throughout the region (*9*). The Institute examines various topics including trade, investment, energy, IT, health, and the environment. Within such wide mandates, ERIA perceives the benefits for member countries to work with Japan in the health field, especially in the aging-related area. The role of ERIA is to facilitate relevant works and initiatives jointly developed by the governments of the respective ERIA member states and Japan. The health-related works of ERIA can be categorized into regional infrastructure building and facilitation of country-specific cooperation by building public-private-academic platforms (*10*). Examples are illustrated below.

Regional approaches

As in Japan, the morbidity and mortality patterns of ASEAN countries are changing, creating a need for much-awaited new health policies and products. Development of such healthcare technologies and products require generation of robust evidence to apply for approval from regulatory bodies to ensure safety and effectiveness of the products, so that they are truly useful for the end users. Concerning evidence generation, conducting high-quality and large-scale clinical trials through international and well-coordinated projects such as multiregional clinical trials (MRCT) is ideal. MRCTs may facilitate health product-specific marketing approvals in participating nations *via* due regulatory processes. Moreover, MRCTs can provide regional and national data for evidence-based health policy recommendations. To strengthen MRCT and its networking, the Ministry of Health, Labour and Welfare of Japan has been supporting an international research team by launching the Department of International Trials (DIT) in the National Center for Global Health and Medicine (NCGM) in Tokyo (*11*). The DIT is the first team in Japan to be staffed by both Japanese and non-Japanese healthcare professionals. Non-Japanese staff includes health care professionals from Indonesia, the Philippines, Thailand, Vietnam, and the Democratic Republic of the Congo. The team is intimately involved in project planning in Tokyo, followed by local implementation in the countries of origin. Thus, DIT can cross multiple borders to manage MRCTs with less cumbersome efforts and financing than conventional methods such as contract research organizations. Recently, DIT has collaborated with the Ministry of Foreign Affairs of Japan, Osaka University, and other stakeholders to conduct MRCTs during the COVID-19 pandemic. After that, a region-wide clinical trial network called the Academic Research Organization Alliance for Southeast and East Asia (ARISE) was developed (*12*) (Figure 4). The early member institutions of ARISE included DIT in Tokyo, Bach Mai Hospital (*13*) in Hanoi, the Indonesian Medical Education and Research Institute (IMERI) (*14*) of the University of Indonesia in Jakarta, the National Clinical Trials and Translation Center (NCTTC) (*15*) of the University of the Philippines in Manila, as well as Siriraj Institute of Clinical Research (SICRES) (*16*) of Mahidol University in Bangkok, and was later joined by the Clinical Research Malaysia (*17*).

The initial phase of team building at the ARISE during the COVID-19 pandemic attracted due attention and hence resources. The initial efforts have focused on clinical trials of products related to infectious diseases, which later expanded to include non-communicable diseases and now global health in the framework of universal health coverage (UHC), including aging. The information generated through ARISE should help avoid prolonged regulatory approval processes in each nation through harmonization of the regulatory process advocated by the Pharmaceutical and Medical Devices Agency (PMDA) of Japan (*18*). ERIA has had a long relationship with NCGM, particularly with its Bureau of International Health Cooperation (BIHC). Now that BIHC, DIT, and ARISE are based in NCGM, partnership with ERIA, particularly its Healthcare Unit (*19*), has been strengthened. ERIA is thus facilitating the development of joint initiatives for the entire ASEAN community through the ASEAN Secretariat (*20*) and ministries of health of ASEAN member states, as well as for the global and regional community through World Health Organization (WHO) and Organization for Economic Cooperation and Development (OECD). These efforts are now paving the way for developing

Figure 4. Membership of Academic Research Organization Alliance for Southeast and East Asia (ARISE). Collaborations of ARISE with the Economic Research Institute for ASEAN and East Asian (ERIA) effectively expands ARISE membership from 5 Southeast Asian countries (red broken lines and red solid line) to 16 ERIA member countries, including 10 ASEAN member countries, 3 East Asian countries such as Japan, and 3 neighboring countries.

and marketing innovative healthcare products and services by collaborating with Japan and like-minded member countries. For example, ERIA supports ASEAN countries in the assessment of coverage by public health system of health services to be included in the WHO Essential Diagnostics List (EDL) in support of UHC (*21*). This initiative may increase regional awareness toward narrowing of national EDL gaps and development of policy recommendations to implement provisions for basic diagnostics in urban poor and rural communities, including disabled- and elderly-friendly access to devices. Participation by member countries would ensure a region-wide market-friendly health ecosystem with global standards of excellence.

Another regional approach is AHWIN. In July 2016, Japan announced AHWIN as one of its contributions to achieving UHC in the Asian region. This initiative was initially intended to offer Japanese experience and ongoing efforts in developing a comprehensive community-based long-term care system for Asia (particularly in Southeast Asia), where the aging society was expected to develop. The initiative called for mutually beneficial cooperation and economic growth in Asia (especially in the Southeast Asian region) through achieving a healthy society and economic development from comprehensive community care with the spirit of UHC (*22*). AHWIN was subsequently revised in 2018 to expand the scope of works to broader areas including disease prevention and nutrition. The principles of the revised AHWIN are to achieve a virtuous cycle of healthcare services in Asia as a whole by strengthening the provision of services, the development of data and research infrastructure, and the flow of human resources; not only in the field of aging but also in disease prevention and nutrition (*23*). Such concepts are illustrated by the shape of Mount Fuji as illustrated in Figure 5. The top hierarchy is the provision of health care, but it would only be meaningful if we have a broad infrastructure of services and products that are useful for healthy living.

Since ERIA is committed to maximizing the virtuous cycle of health and development, it works with Japan in the capacity of an international organization. One typical example is advocacy. ERIA is working with the Japan Center for International Exchange (JCIE) on the Healthy Aging Prize for Asian Innovation (HAPI) since 2020, under the auspices of AHWIN (*24*). HAPI is an award program to recognize and amplify innovative policies, programs, services, and products that address the challenges of aging societies, highlighting innovations that people throughout the region can emulate or access. To date, three rounds of awards have been held, with 237 applications from 12 countries and regions. The winning organizations came from China, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand, and Vietnam. HAPI is unique not only in the diverse background of the applicants but also in the wide range of the award winning organizations. Awards have been presented to elderly care businesses, technology companies, local governments, academic programs, civil society organizations, and multisectional initiatives. As such, HAPI offers a unique and valuable asset of assembling a collection of innovations and addressing a broad spectrum of activities for promoting healthy aging. Approximately one-half of the 237 applications received were from Japan, which could be taken as an implication of the leading-edge research and innovations the country has undertaken in tackling population aging. One example of an awardee in technology was a QR code company called "NailQ" located in a suburb of the Metropolitan Tokyo area. The company developed an innovative personalized QR code to address the issue of wandering by people with dementia. According to the 2022 statistics of the Tokyo Metropolitan Police Department, the number of reported cases of missing due to wandering that year was over 18,000, and the figure has been increasing steadily over the past decade (*25*). The company produces QR code stickers for applying to

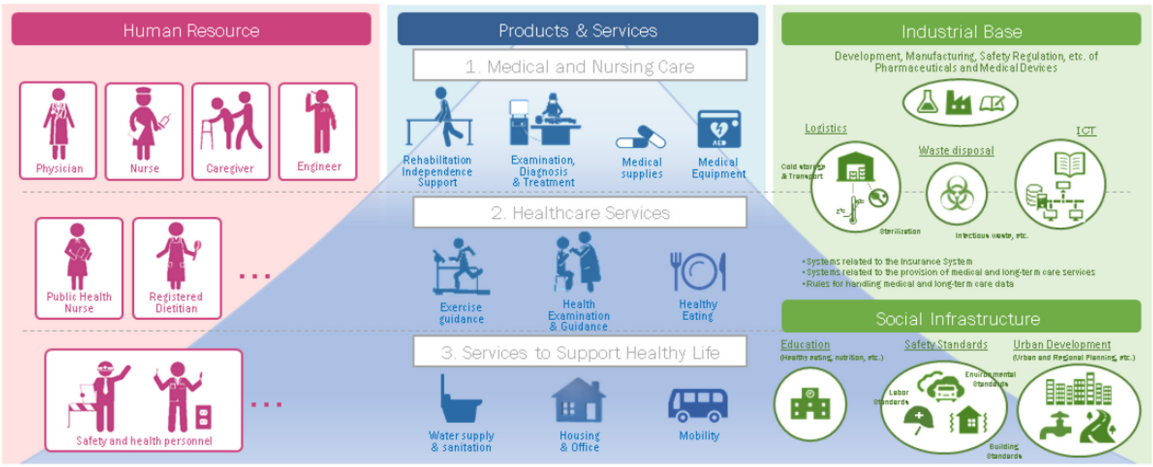

Figure 5. Concept of the Asia Health and Wellbeing initiative (AHWIN). Source:*https://www.kantei.go.jp/jp/singi/kenkouiryou/en/torikumi/index.html*

fingernails, which facilitate verification of the identity of persons with dementia and ensure their safety even if they wander off (*26*). The technology itself is simple, but implementation on a large scale requires cooperation from local stakeholders. The enterprise has collaborated with the local government, railway company, and police office. To date, the innovation has been widely used to support people with dementia and their families. NailQ has also started to be recognized internationally, receiving inquiries from Australia, Singapore, Hong Kong, and Taiwan. While HAPI is an international scheme that encourages applications not only from Japan but across Asia, the inquiries and feedback to this program prove that there is great interest in the knowledge and experience accumulated in Japan over the decades since the country became an aged society in 1994, ahead of other Asian countries. Given the uniqueness of HAPI in taking into consideration the diverse nature of the Asian region, it is an asset in assembling and showcasing a collection of innovations that can potentially be expanded further according to the context and economic development of individual countries.

Facilitation of country cooperation

According to the data of Institute of Health Matrix and Evaluation (IHME), the shares of development assistance for health in Southeast Asia, East Asia, and Oceania in 2000, 2010, and 2019 were 7.76%, 5.09% and 4.28%, respectively (*27*). With the shrinking public investment for health, private sector investment gains weight in Asia. Reflecting this trend, Japan launched a general incorporated association named Medical Excellence JAPAN (MEJ) in 2011. The priority objective of MEJ is to serve as a central hub and platform to promote international healthcare business jointly with the Japan government, medical communities, academic organizations, and healthcare industries (*28*). This approach seemed to work, but a study group of the Ministry of Economy, Trade and Industry (METI) identified three major areas requiring further strengthening: *i*) Twenty-four collaboration sites were established but these lacked robust expandability and profitability, hence sustainability; *ii*) There was insufficient focus in terms of geographic area and scope of products; and *iii*) Participating business partners were limited, and further involvement of new partners was essential (*29,30*).

With this background, more sustainable arrangements and participating partners were sought. Dr. Tatsuya Kondo, late CEO of MEJ, proposed the concept of MEX in his presentation at the International Deployment of Healthcare Service and Products Council organized by the Office of Healthcare Policy, Cabinet Secretariat on October 1, 2020 (*31*). He underscored that a government-endorsed international network with a coordination mechanism among industry, academia, and health service providers was critical to realize rational patient-centered health care and to support the progress of health care and development of health industries. He advocated that like-minded countries should have their own MEJ-like organizations (MEX, where X can be substituted with the acronym of any participating country), and all MEXs, including MEJ, would interact and collaborate through a network. Also, each participating organization, including MEJ, can utilize this project as an opportunity to promote internal collaboration to generate and develop potential business opportunities. In this concept, the core agency is MEJ. However, since such networks will help develop healthcare industries in member countries and serve as a new model of collaboration for the emerging economy where ODA is not applicable, ERIA has been engaged to facilitate collaboration between Japan and like-minded countries since 2021. The first country that came forward was Vietnam. Already, Medical Excellence Vietnam (MEV) was established. MEJ, MEV, and ERIA jointly organized three "MEV-MEJ Forum" meetings and identified possible area(s) for further collaboration. The outcome was presented at the Joint Coordination Committee of Japan and Vietnam on November 28, 2023 (*32*).

Potential assets, evolving new technologies, services, and products in Japan

The policy initiatives adopted need some time to produce tangible outcomes, and this is particularly true for the regional approaches such as ARISE and AHWIN. However, some encouraging results have been achieved. Significant progress has been made in Japan as a result of the AHWIN initiatives. With the continuous population aging and shrinking in Japan, there is an increase in demand for assistive devices due to the physical and mental characteristics of older people as well as the needs of caregivers. The industries have been urged to develop assertive technologies that meet various user needs under public funding of the Long-term Care Insurance (LTCI) scheme (*33*). As of FY2020, approximately 14,000 types of assistive devices and about 800 companies were listed in the Technical Aids Information System for assistive devices (*34*). The domestic market of all the assistive products was anticipated to be 1,521 billion yen in FY2021 and growing, according to the Japan Assistive Products Association (JASPA) (*35*). Personal care items such as diapers, communication devices such as hearing aids, and mobility devices such as canes and wheelchairs account for two-thirds of the market.

Rapidly growing areas are services and digital applications to manage nursing care facilities. An example is an application that visualizes the care needs of residents of elderly care facilities and the contents of services provided, and anticipates the changes in users' conditions. This tool allows constant update of well-structured care provided in Japan to the residents with a

minimum additional burden to professional caregivers. Another example is services for older individuals with relatively good physical conditions who are not eligible for coverage by the LTCI scheme. Such services include housekeeping services, outing support, and remote monitoring systems for older people living alone. These products and services have been developed out of the real needs of seniors and family caregivers, taking advantage of the changes in lifestyle and public attitudes toward care and support for older people, and are potentially acceptable by the Asian market (*36*). A Japanese assistive device manufacturer established a subsidiary company in Thailand and invited other Japanese companies to form a consortium of Japanese companies to expand their business in Thailand (*37*). The aim of this venture is to adapt Japanese-made services and products to the needs of older people in Thailand.

In addition to the services and products, the MEX initiative urges the Japanese stakeholders to review the strengths and weaknesses of their own healthcare industries. An analysis by METI (*38*) has concluded that Japanese healthcare industries have strength in diagnostics such as endoscopies and ultrasound imaging, but not in the treatment area. Also, the Japanese conventional manufacturing technology (hardware) is insufficient to engage in product development that benefits from digital (software) integration through AI analysis. New approaches for health care industries in the context of industrial structural changes, innovation, and international collaboration are thus required. Concerning country cooperation, Vietnam has progressed well. MEV was established, and MEV, MEJ, and ERIA jointly organized three focused forum meetings on cancer, non-communicable diseases, and aging. After the forum meetings, MEV and MEJ held follow-up discussions to identify specific collaboration projections.

Introducing a new approach with industry-government-academia-medicine collaboration mechanism

Rationale for introducing the industry-government-academia-medicine collaboration approach in place of ODA approach

In above sections, we introduced various regional approaches and mechanisms to facilitate inter-country collaboration. These approaches and mechanisms are dependent on each other. Regional approaches create a cross-country cooperation framework through smooth R&D and health product development to support the country's participation in a new collaboration ecosystem. This section will discuss the broader concept and practice based on the previous sections, using the MEX project as an example. ERIA supports the creation of an ecosystem of collaboration among industry, government, academia, and medicine in Asian countries. This initiative also supports the development of a platform to promote dialogue between key stakeholders in industry, government, and academia in Asia and their counterparts in Japan and other developed countries. Such a new cooperation model will contribute to advance the health ecosystem in each participating country. There are four reasons why ERIA has begun to explore the possibility of promoting such a model of international cooperation.

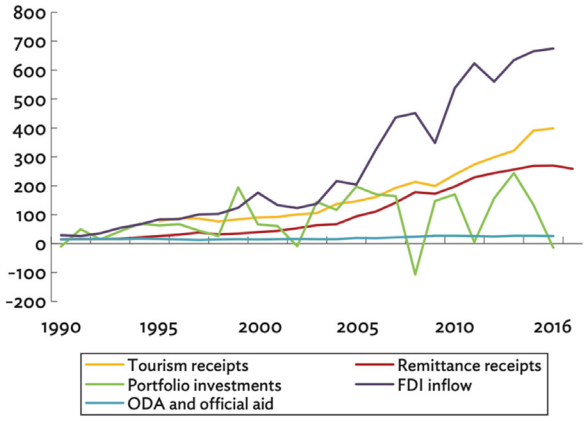

Figure 6. Financial inflow to Asia by type (US$ billion). FDI = foreign direct investment, ODA = official development assistance. Source: Asian Development Bank. Remittances and Tourism Receipts, Asia Economic Integration Report 2017. *https://aric.adb.org/pdf/aeir/AEIR2017_5_remittances-and-tourism-receipts.pdf*

First, an approach that relies too heavily on ODA from developed countries is unsustainable anymore (*39,40*). Figure 6 shows the evolution of financial inflow in the Asian region (*41*). Portfolio investment inflows have fluctuated significantly in response to changes in the global financial and economic environment, while foreign direct investment, balance of payments in services, and overseas remittances have been increasing constantly in recent years. On the other hand, the amount of ODA has remained stable at a low level for more than two decades, and the share of ODA in total financial inflow from outside the region has decreased markedly. This is because the income levels of Asian countries have risen accompanying rapid economic growth, and as a result they are not in a position to benefit from ODA in the same way as in the past. Therefore, Asian countries must consider promoting the so-called PPP or projects based on unsolicited private proposals, to replace ODA or the public-works type development of healthcare infrastructure.

Second, when Asian countries attempt to attract cooperation and investment from businesses outside the region, multinational companies (MNCs) often encounter barriers entering the medical and health market in Asian countries. Collaboration and harmonization among domestic and foreign stakeholders are required to facilitate market entry by MNCs. Figure 7 shows the four distinct strategies of industry globalization applied to the integration-responsiveness framework

(*42*). This figure indicates that global responsiveness and local adaptability are indispensable for MNCs. Still, an appropriate balance is required depending on the product/service and business domain. The first domain is where the pressure to respond globally and the pressure to adapt locally are both weak (bottom left quadrant of Figure 7). The representative businesses in this domain include civil engineering and repair services. The second domain is where the pressure to respond globally is intense but the need to adapt locally is weak (top left quadrant). Representative businesses include passenger aircraft, natural resources and materials, and finance. The third domain is where the demand to respond globally is not necessarily strong but the need to adapt locally is high (bottom right quadrant). Contents creation services affected by language and culture, as well as products and services supported or regulated by national policy would belong to this domain. The fourth domain is where the pressure to respond globally and the need to adapt locally are both intense (upper right quadrant). Representative businesses would include automobiles and consumer goods. MNCs must develop international business strategies for each quadrant when considering market entry (*43*). Healthcare business is most fitted to the third domain (bottom right quadrant of Figure 7). Therefore, MNCs should select a "multi-domestic strategy" for their international business development. In other words, they need to transfer significant authority to local operations, while the head office focuses on overall business management. Thus, when developing overseas business, it is difficult for MNCs to enter the medical and health care market of Asian countries without focusing considerably on local applications in these countries, while maintaining their technology and services at global standards. These imply that it is difficult for Asian countries to attract and promote the entry of MNCs without helping them to achieve cooperation and harmony with local industry, government, and academia. Therefore, setting up a platform for key stakeholders in industry, government, and academia both domestically and internationally is imperative to promote dialogue.

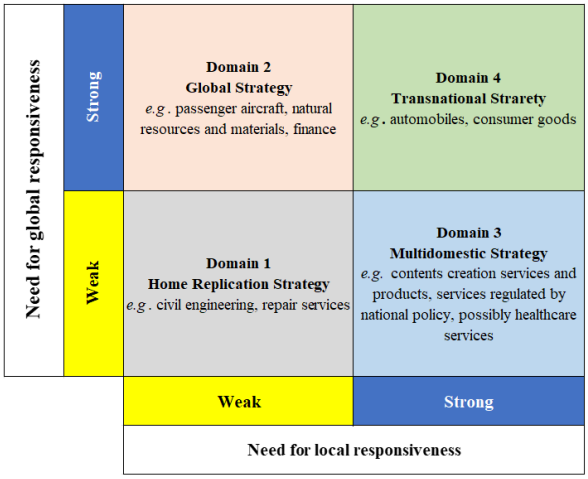

Figure 7. Strategies of industry globalization based on the integration-responsiveness framework. Source: modified from Reference 42 (Cavusgil ST, Knight G, Riesenberger J. *International Business: The New Realities, Second Ed.* Pearson Education, Inc. 2012, Chapter 12.).

Third, the experience of the efforts made in Japan in establishing collaboration among the industry-government-academia-medical communities (IGAMC) deserves close examination. Figure 2 also shows the evolution of policies in the medical and health fields in Japan. The evolution was initially based on

Table 2. Mapping of broadening international health care products and business at various stages of pharmaceutical research and development

	Basic Research	Applied Research/ Clinical Trial	Approval by Regulatory Agency	IP Protection	Business Plan and Price Setting	Production	Procurement
Role	Exploring Seeds	Verification	Legal Procedure	Protection of IP	Business Plan	Production Capability	Provision of Services and Goods
Main Providers	Researchers, Companies and Institutions		Regulatory Agency	Company	Company + Consultants	Company Grants/Investments	Service Beneficiaries and Gov.
Health Approach by MHLW	AMED	Strengthening Clinical Trials by MHLW	Strengthening PMDA and Harmonization of Regulations				Insurance Coverage
Development Approach by MoFA/JICA		Private Sector Coordination Project and Technical Cooperation by JICA				Loan to Companies by JBIC	Contribution to International Organizations (GAVi, GF, UNTAID) Grants/Loan/Technical Assistance
Industry Approach by METI	Next Generation Health Care Project/ outbound service providers and their	Hub Creation Initiative	JIH/Certified Medical Visitor Supports Encouragement of Inbound/ infrastructure building				Government-Government Dialogue
Approach by MEJ		Secretariats Function		Business Model of MEJ/Mexx (One-stop Shop)			

Source: Nakatani H, *et al,* Approach of Medical Excellence JAPAN to create platforms of collaboration in Asia. Glob Health Med. 2021; 3:401-405.

the changes in disease burden and demographics in Japan. However, it was gradually recognized that the challenges of population aging could not be addressed sufficiently without forming multi-sectorial alliances or cooperations. The first policy of applying such a concept was the Gold Plan launched in 1990. The plan offered the vision and predictability of government-committed service demand based on the ability of IGAMC to make investment plans. These plans are based on expected service needs, service volume, and quality, considering technical, operational, and financial prospects to serve the community. In such task-driven studies, stakeholders in IGAMC need to work together, fulfill their respective roles and responsibilities, and sometimes accept the division of labor. This Japanese experience may serve as a reference to other Asian countries.

Lastly, a characteristic of the value chain, or a series of consecutive steps with increase in value that go into the creation of a finished product from its initial design to its arrival at customers, in the healthcare field is that the process from upstream to downstream involves a variety of stakeholders, including industry, government, academia, and healthcare providers. This implies that if coordination and cooperation do not proceed well along this process, there is a possibility that the products and services provided may not be appropriate to patients and users. Since each player has a unique and solid culture, coordination/cooperation among them is very challenging. The difficulties of the linkage between each of research, development, commercialization, and marketing process of pharmaceutical products, *i.e.*, "death valleys", are well acknowledged and documented, as shown in Table 2 (*28*). In other words, discovery of seeds through primary research, verification of safety and efficacy, approval procedures for commercialization, protection and management of intellectual property, formulation of business strategies including pricing according to market demand, and production and sales based on these strategies are all part of the process. This linear process shows the critical role of each step participated in by different stakeholders to avoid bottlenecks during the process. In addition, this process is at risk of disruption if coordination among each step is insufficient. With such rationale, forming a PPP involving IGAMC has been advocated to ensure smooth progress from research, production, accreditation, and delivery to the target community and people. Such need of IGAMC involvement is painfully recognized in COVID-19 vaccine development and deployment. Those countries in which all actors collaborated were successful in developing novel vaccines for their populations and beyond. However, forming a PPP per se cannot provide solutions. A hub or coordinator may be needed to encourage all the actors to fulfill their duties with a spirit of cooperation.

Thus, PPPs and collaboration among industry, government, academia, and the medical communities are extremely important in the medical and health fields. It is particularly so for Asian countries in which the traditional ODA is rapidly shrinking, thanks to their own economic success. This also means that ODA-driven government-proposed (solicited) approaches are insufficient to solve the population's increasingly diverse and complex medical and health needs. Building an "ecosystem" where industry, government, academia, and the medical community work closely together domestically and internationally is necessary in such an environment.

With the above background, a PPP model in which the MEX concept is integrated is evolving, as illustrated in Table 3. Although the steps of operation of the PPP model appear similar to the ODA model, there is a fundamental difference between the two models: the ODA model has a top-down approach led by the government, while the PPP model has the IGAMC approach right from the beginning of the market survey phase.

In the ODA model, the recipient government initiates the process sequence by first conducting a market survey to identify the issue that the government wishes to address, followed by proof of value (POV) and proof of concept (POC) of the initiative to be pursued, and finally assigns the task to a local implementation agency to operate the initiative (*44*). Regarding supportive policy measures/tools, they are provided mainly by ODA loans. The ownership and funding source of this model are relatively simple, since recipient and donor governments are the vital actors. However, the process lacks the involvement of national/international industry, academia, and healthcare providers, which may generate risks regarding the relevance of the initiative to the actual community needs, since industry, academia, and healthcare providers are closer to the patients they serve. In addition to this potential weakness of this model, the AESAN countries lost eligibility for ODA loans due to their recent economic development. These two forces necessitated an alternative model, taking advantage of the growing healthcare industries. Hence, the PPP model was proposed.

The PPP model involves all stakeholders including the recipient government, national institutions, and international players in the whole process, and creates a forum for national and international dialogue. In other words, the government, industry, academia, and healthcare providers of a country form a partnership, and partnerships from different countries engage in dialogue *via* the forum. The first step of the process is a market survey to identify the missing piece in the health ecosystem, which potentially generates business opportunities to ensure the initiative's sustainability. Regarding the supportive policy measures/tools, the top-down approach of the ODA model was not capable of continuously procuring funds, and had difficulties encouraging the implementing agency to be autonomous and make the project economically viable

Table 3. Comparison of ODA model and PPP model, and role of MEX

		Market Survey	Project Ideation (1) POV	Project Ideation (2) POC	Project Development (1) Pre FS	Project Development (2) FS	Procurement	Construction	Finance	Operation
ODA Model	**Public Works (Solicited Project)**	Identifying Policy Challengs	Policy Impact Projection	Feasibility (technical/business model) Analysis	Project Planning through Feasibility (economics/financial) Analysis	Detailed Project Planning for ODA Specification and Government Approval	ICB with emphasis on economic saving and efficiency on basic specification and transperancy	EPC Works	Public Financing (ODA)	Management by Local Implementing Agancy, which tend to rely on government and/or Development Agency for operational improvement and renovation
	Stakeholder	Receipient Govenrnmet ODA Task Force	Recipent Government, Local Implementing Agency, Development Agency and hired experts							Local Implementing Agency
	Policy Measures/Tools	Support for Development Policy Formulation	Assistance for Project Formulation		ODA Loan					(Monitoring)
					Support for Feasibility Study		(Support for tender management, followed by disursement, completion of construction work, determination of loan receivable amount, repayment)			
PPP Model	**PPP Works (Unsolicited Project)**	Identifying Business Opportunity (finding missing piece in health ecosystem)	Anaysis of competivness and value proposition being offered	Feasibility (technical/business model) Analysis to judge "Feasibility"	Project Planning through Feasibility (economic/financial) Analysis to judge "Bankability"	Detailed Project and Business Planning including market strategy with FEED, decision of DE Ratio, FID and Government Approval, if any	Negotiated Lump Sum Contract with emphasis on sharp specifications for securing merchantability and timely market-in	EPC Works	self-funded investment, short-term loan (domestic) long-term loan (international) comfort letter/performance guarantee (governmnet)	Managemnt by initiator (Joint Venture), which manages, operates and renovates from commercial perspective
	stakeholder	Receipient Government, Local Institution, International Players and PPP Players plus local/international industry-government-academia-healthcare provider framework (MEX)			PPP Players plus local/international industry-government-academia-healthcare provider framework (MEX)		PPP Players and EPC Contractors plus local/international industry-government-academia-healthcare provider framework (MEX)		PPP Players and financial stakeholders plus local/international industry-government-academia-healthcare provider framework (MEX)	
	policy measures/tools	Research works supported or subsidized by METI	-	Demonstaration project supported or subsidized by METI	Subsidy-Based FS Project for Overseas Expansion on High-Quality Infrastructure, PPP projects by METI		-	-	Private-Sector Investmenet Finance by JICA Loan and investment banking by JBIC	-
	Additional Policy Measure: Scope of MEX	Bridging the gaps of "dealth valleys" and link to cooperative PPP formulation between identified countries and Japan for making use cases applicable for ASEAN countries with healthcare market and policy impact					→	→	→	→

POV = Proof of Value, POC = Proof of Concept, Pre FS = Preliminary Feasibility Study, ODA = Official Development Assistance, ICB = International Competitive Bidding, EPC = Engineering, Procurement and Consutruction, PPP = Public Private Partnership, FEED = Front End Engineering Design, DE Ratio = Debt Equity Ratio, FID = Final Investment Dicision, JICA = Japan International Cooperarton Agency, JBIC = Japan Bank for International Cooperation, METI = Ministry of Economy, Trade and Industry, MEX = Medical Excellence Initiative.

and sustainable. Here, Japan proposed to narrow the gaps by offering coordination and support through the MEX project at the market survey, POV, POC, and feasibility study phases, so that the project can demonstrate itself to be "bankable" and "sustainable". It must be emphasized that such initiatives should be more relevant to the communities they serve, since a platform of dialogue between all stakeholders is in place, which cannot be expected from the top-down approach often seen in the ODA model.

Lessons learned from ongoing initiatives

Japan and Vietnam signed a memorandum of cooperation on healthcare in July 2019 to strengthen collaboration between the two governments. The MEV Project was launched in 2021. This project aims to solve problems in the medical and health care fields, improve the healthcare ecosystem, and foster the development of the healthcare industry in both countries by developing MEV, a partnership that involves all relevant stakeholders including the industry, government, academia, and healthcare providers in Vietnam. It was hoped that the MEV and its counterpart partnership in Japan; *i.e*. MEJ, would have continuous dialogue and develop the practical implementation of collaborative projects (*45*). In other words, this approach emphasizes dialogue and discussion between the partnerships of the two countries. As a platform for dialogue, discussion, and matching, the "MEV-MEJ Forum" was organized (*46*). The Forum meetings are designed to serve as the driving force for advancing this initiative. The inception of the MEV-MEJ Forum was traced back to the High-Level Meeting on Japan-Vietnam Medical Deployment held in October 2021. At that meeting, Mr. Son, Deputy Minister of the Vietnamese Ministry of Health, and Ms. Chau, Deputy Director-General of the International Cooperation Department, expressed their priorities for cooperation with Japan, followed by expert presentations and discussions on collaboration between industry, government, academia, and healthcare providers. Cancer, non-communicable diseases, and aging were identified as areas for further discussion. To address each challenge, three MEV-MEJ Forum meetings were organized under the tripartite memorandum of understanding (*47*) among Hanoi Medical University Hospital, MEJ, and ERIA, which was endorsed by the two governments in July 2022. Therefore, it is understood that both the Japanese and Vietnamese governments recognize the MEV-MEJ Forum as a mechanism to materialize the Japan-Vietnam Memorandum of Cooperation in Healthcare.

During the preparation for the forum, it was felt necessary to have a central hub to organize symposia (MEV-MEJ Forum meetings) and generate specific Japan-Vietnam collaborative projects based on the discussions. This idea was materialized with the establishment of the Joint Strategic Council (JSC) in December 2022. The core membership has a unique composition, consisting mainly of non-governmental organizations from Vietnam (including representatives from national hospitals and the National University of Medicine and Pharmacy) and from Japan (centered on MEJ member companies), with the goal to foster and expand collaboration between the Japanese and Vietnamese healthcare industries.

Under the leadership of the JSC, three forum meetings were jointly organized by MEV, MEJ, and ERIA in 2023, focusing on cancer, other non-communicable diseases, and aging. Participants discussed challenges in Vietnam, introduced Japanese strategies, and explored potential collaborative project ideas. The common themes identified in the wrap-up of each meeting are as follows:

i) In addition to strengthening primary and secondary prevention through the introduction of health checkups, screenings, and coordinated treatment, primordial prevention is crucial for improving national health and reducing inequalities.

ii) It is necessary to build a consensus across society to support the health and aging of the population.

iii) The setting of policy visions and the allocation of budgets by the government are essential (*e.g*., exploring the creation of healthcare and long-term care insurance systems funded by premiums or systems financed or subsidized by taxes). There is a need for a reinforced recognition that investing in the healthcare sector is not a wasted resource for economic growth.

iv) It may be effective to place responsibility for providing healthcare and long-term care services at the municipal level, with the actual service provision carried out by the private sector. Regarding human resources, various measures can be considered, such as introducing qualification tests for care workers and using IT technologies to supplement human resources. In this context, the possibility of collaboration with Japan in developing relevant private sector and human resources needs further exploration.

v) Recognizing that the direct adoption of the Japanese model may not be feasible for Vietnam, it might be advisable to consider a unique Vietnamese model for each challenge, such as nationwide deployment, starting from a small-scale model. Collaborative efforts involving various organizations including the private sector, government, hospitals, and universities from Japan and Vietnam are desirable.

Specific achievements resulting from these activities are worth noting. First, a unique project generation mechanism has been established. After each MEV-MEJ Forum meeting, the Vietnamese side submitted over 20 project ideas for the Japan-Vietnam collaboration. Several projects in line with mutual interests received attention from Japanese private companies and are moving toward concrete outcomes in 2023 and beyond. The process of formulating project ideas, further

exploration, and matching stakeholders' interests in both countries, along with feasibility studies was carried out through the Japan-Vietnam dialogue. This inclusive approach involving stakeholders from the industry, government, academia and health providers from the upstream phase of project creation facilitated the engagement of private companies.

In addition, while ODA has traditionally been the mainstream of Japan-Vietnam cooperation, the nature of the MEV Project allows exploration of alternative funding avenues. Recognizing the need for non-ODA-dependent collaboration, the Forum set criteria of project adoption focusing on social impact, business effectiveness, and sustainability. This encourages members from companies, hospitals, and universities to contribute to addressing the challenges within their organizations as well as the future healthcare and development of healthcare industries in Vietnam.

To advance the MEV Project, further efforts are needed to: *i*) utilize diverse funding options from domestic/international and public private sources without interruption throughout the process of each project, *ii*) strengthen and sustain the governance of the overall MEV-MEJ Forum, and *iii*) maintain the momentum of dialogue and collaboration after the initial and good outcomes gained in 2023.

Ways forward

ERIA has been involved in developing various initiatives, starting from clinical trials and moving on to a more prominent framework of AHWIN. ERIA actively works to broaden the concept of MEX and build a platform to facilitate dialogue among national/international partnerships, each consisting of industry, government, academia, and healthcare providers. The first-line collaborating countries are Vietnam and India, but more countries are expected to be added. The experience and case studies gained from these projects will benefit all member countries of ASEAN. ERIA will remain committed to helping and facilitating the endeavors initiated by Japan for the benefit of all.

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Utilization of Japanese long-term care-related data including Kaigo-DB: An analysis of current trends and future directions

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Abstract: Despite high expectations from the government and researchers regarding data utilization, comprehensive analysis of long-term care (LTC)-related data use has been limited. This study reviewed the use of LTC-related data, including Kaigo-DB, in Japan after 2020. There was an increase in studies using LTC-related data in Japan between 2020 and 2021, followed by a stabilization period. The national government provided 13.5% of this data (6.5% from Kaigo-DB), while prefectures and municipalities contributed 85.2%, and facilities provided 1.3%. The linked data used in 90.4% of the studies primarily consisted of original questionnaire or interview surveys (34.6%) and medical claims (34.0%). None of the studies based on Kaigo-DB utilized linked data. In terms of study design, cohort studies were the most common (84.6%), followed by descriptive (5.1%), cross-sectional (3.2%), and case-control studies (1.3%). Among the 138 individual-based analytical descriptive studies, the most frequently used LTC-related data as an exposure was LTC services (26.8%), and the most common data used as an outcome was LTC certification or care need level (43.5%), followed by the independence degree of daily living for the older adults with dementia (18.1%). To enhance the use of LTC-related data, especially the valuable national Kaigo-DB, insights can be gleaned from how researchers effectively utilize municipal and prefectural data. Streamlining access to Kaigo-DB and enabling its linkage with other datasets are promising for future research in this field.

***Keywords*:** long-term care claims, certification information, LIFE data

Introduction

Japan introduced its Long-Term Care (LTC) insurance system in 2000, providing universal coverage to ensure all citizens can access it when needed (*1*). Older adults requiring these services usually approach their local municipalities, which act as insurers. Subsequently, they undergo a care-needs assessment and are then certified for needed LTC. A qualified care manager then develops a personalized care plan, including home visits, day services, short-term stays, and residential or in-facility care. Service providers submit LTC claims to the National Health Insurance Organizations for processing and reimbursement, with municipalities bearing most of the costs.

In administering the Japan's LTC system, a nationwide standardized data on LTC certification and claims are generated. This data is initially held by the municipalities and aggregated at the national level for policymaking. The comprehensive LTC insurance database, Kaigo-DB, established in 2013 by the Ministry of Health, Labor and Welfare, compiles LTC-related data anonymously (*2*). It consists of three main data categories: anonymous LTC certification information from municipalities, anonymous LTC receipt data from service providers, and anonymous Long-term care Information system For Evidence (LIFE) data from service providers detailing user conditions and care. LIFE data includes a wide array of information, such as demographics, daily living activities, oral health, nutrition, dementia, functional training and rehabilitation plans, and more. Although these data categories are anonymous, they share the same individual IDs, enabling interconnected analysis.

The LTC certification information and claims held by local governments and the Kaigo-DB are rich data sources in Japan, encompassing regional and national data. These datasets are invaluable for research purposes, not just for administrative use. Despite high expectations from both the government and researchers regarding the utilization of data for research, comprehensive analysis of LTC-related data use has remained limited. Apart from Jin and Tamiya's review in 2021 (*3*), there has been minimal in-depth exploration into the volume and trends of research papers employing this data or the themes and content of such papers. Furthermore, despite the government's efforts to promote the use of Kaigo-DB, a valuable resource at the national level, no study has focused on its utilization. To address this gap, our study

undertakes an extensive literature review post-2020, the period after Jin's coverage, examining the use of LTC-related data, including Kaigo-DB. We aim to provide an updated overview of the research landscape, highlighting the current state of this field and proposing directions for enhancing future research.

Comprehensive search of studies using LTC-related data

Search strategy and selection criteria

To conduct this review, we performed a literature search using the PubMed database in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (*4*). Our search included titles, keywords, and abstracts from January 1, 2020, to November 15, 2023.

We used specific search terms to narrow the results: ("long-term care" OR "long-term care insurance") AND ("data" OR "database" OR "databases" OR "claims" OR "billing" OR "certification" OR "research" OR "administrative data") AND ("Japanese" OR "Japan"). The search was limited to studies published in English or Japanese.

This review focused on studies that used LTC certification information, receipt data, and LIFE data within the Japanese LTC system. Studies based on independently obtained information about LTC certification status or the use of its services and those utilizing LTC-related data from outside Japan were excluded. Additionally, non-original articles, such as letters, were not included.

We also conducted manual searches of electronic databases, including PubMed and the Japanese Medical Abstracts Society's Ichushi Web, to supplement our primary search.

Data classification and analysis

We systematically screened studies adhering to the predetermined inclusion and exclusion criteria. The final selection of studies and the determination of their characteristics was achieved through consensus among the authors. Each study was methodically categorized based on its year, language, and publication journal. Additionally, studies were classified according to their source of data, any linked data, design, and unit of study. Furthermore, outcomes and exposures were detailly analyzed for observational studies focusing on individuals.

Description of identified studies using LTC-related data in Japan

Study selection process

Figure 1 illustrates the study selection process. The initial search yielded 466 studies. Upon assessing eligibility, 142 studies were deemed suitable for inclusion in this review. Additionally, 14 studies emerged from manual searches, culminating in 156 studies being identified for the final review.

Publication characteristics

Studies using LTC-related data in Japan rose from 2020 to 2021, then stabilized, as depicted in Figure 2. Most publications (84.6%) are in English. "Geriatrics & Gerontology International" is the most common journal, comprising 7.1% of these studies, followed by "BMC Geriatrics" and "Japanese Journal of Public Health (Nihon Koshu Eisei Zasshi)", each accounting for 6.4% of the total publications (Table 1).

Data Characteristics

Table 2 outlines the LTC-related data sources and linked data used in the analyzed studies. The national government provided 13.5% of the data, with prefectures and municipalities contributing 85.2% and facilities 1.3%. Government-held data included 6.5% from the Kaigo-DB and 7.1% from the Statistics of Long-term Care Benefit Expenditures containing national-level

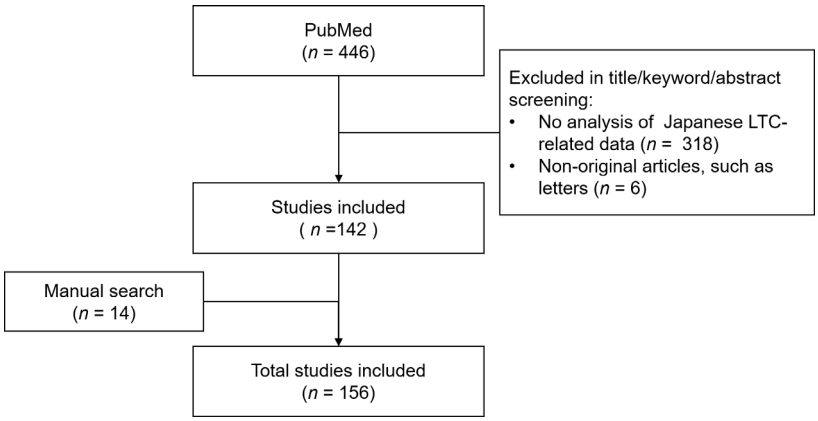

Figure 1. Study selection process.

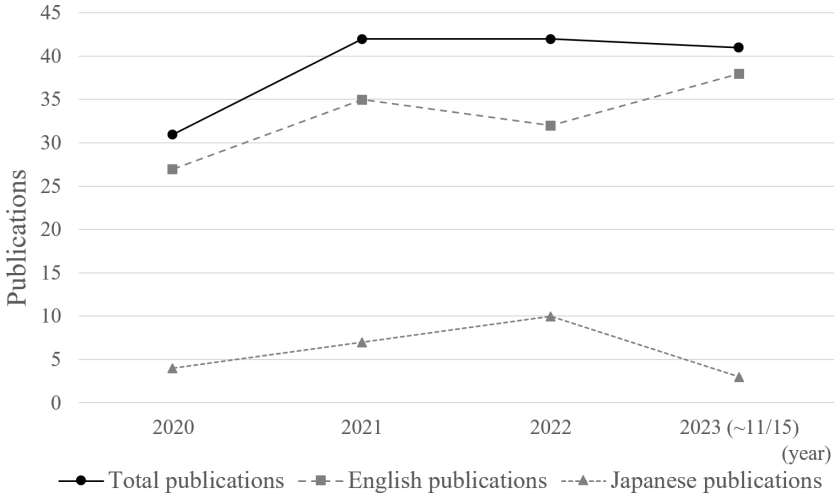

Figure 2. Frequency of publications using studies using LTC-related data in Japan.

Table 1. Characteristics of publications utilizing LTC-related data (*n* = 156)

Characteristics	*n*	%
Language		
English	132	84.6%
Japanese	24	15.4%
Journals		
Geriatr Gerontol Int	11	7.1%
BMC Geriatr	10	6.4%
Nihon Koshu Eisei Zasshi	10	6.4%
J Am Med Dir Assoc	9	5.8%
J Epidemiol	7	4.5%
Others	109	69.9%

Table 2. Characteristics of LTC-related data and linked data utilized in studies (*n* = 156)

Characteristics	*n*	%
Data source		
Kaigo-DB	10	6.5%
Statistics of Long-term Care Benefit Expenditures	11	7.1%
One prefectur	26	16.8%
Multiple municipalities	39	25.2%
One municiparity	67	43.2%
Multiple facilities	2	1.3%
Linked data*		
Questionnaire survey / Interview	54	34.6%
Medical claim	53	34.0%
Health check-up data	10	6.4%
Measurement data without health check-up	10	6.4%
Kihon checklist	7	4.5%
Vital statistics	7	4.5%
Others data only	4	14.1%
No data Linked	29	9.6%

*Multiple choices possible.

LTC receipts available to researchers before the Kaigo-DB. Data from prefectures and municipalities were split, with 16.8% from one prefecture, 25.2% from multiple municipalities, and 43.2% from a single municipality.

Linked data, used in 90.4% of studies, mainly comprised original questionnaire or interview surveys (34.6%) and medical claims (34.0%). Health check-up data and other measurement data each contributed 6.4%. Many studies used pre-created datasets such as The Japan Gerontological Evaluation Study (JAGES) survey (*n* = 19), Ohsaki Cohort (*n* = 8), National Center for Geriatric and Gerontology–Study of Geriatric Syndromes (NCGG–SGS) (*n* = 5), and the Longevity Improvement & Fair Evidence Study (LIFE Study) (*n* = 4). However, it was often unclear whether studies utilized mortality information or basic resident register data such as addresses from local governments, making it difficult to analyze these data. None of the studies employing Kaigo-DB used linked data.

Study characteristics

Table 3 provides an overview of study designs and participants. Cohort studies were the most prevalent (84.6%), followed by descriptive (5.1%), cross-sectional (3.2%), and case-control studies (1.3%). Others were two ecological studies, two difference-in-differences approaches, one regression discontinuity design, three methodological and one validity studies. The study participants varied, with 42.9% focusing on healthy older adults, 24.4% on patients with specific conditions or treatments, and 22.4% on older adults needing care. Other studies targeted older adults, LTC facilities and users, municipalities, and secondary medical areas.

Table 4 reviews 138 individual-based analytical descriptive studies, including cross-sectional, case-control, and cohort studies. Of these, 36 (26.8%) utilized LTC-related data as exposure, 17 (12.3%) examined the use of LTC services, and 12 (8.7%) focused on LTC certification or care need level. One study utilized LIFE data, that began collection in 2021. There were 113 studies (81.9%) that employed LTC-related data as an outcome, of which 60 (43.5%) analyzed LTC certification or care needs level, and 25 (18.1%) concentrated on

Table 3. Characteristics of studies utilizing LTC-related data (*n* = 156)

Characteristics	*n*	%
Study design		
Descriptive study	8	5.1%
Cross-sectional study	5	3.2%
Case-control study	2	1.3%
Cohort study	132	84.6%
Ecological study	2	1.3%
Difference-in-differences approach	2	1.3%
Regression discontinuity design	1	0.6%
Methodological study	3	1.9%
Validity study	1	0.6%
Study subject		
Healthy older adults	67	42.9%
Patients with specific conditions or treatments	38	24.4%
Older adults needing care	35	22.4%
All older people	8	5.1%
LTC facility users	4	2.6%
LTC facilities	1	0.6%
Municipalities	1	0.6%
Secondary medical areas	2	2.6%

Table 4. Characteristics of individual-based analytical descriptive studies utilizing LTC-related data (*n* = 138)

Characteristics	*n*	%
Exposure*		
LTC certification or care needs level	12	8.7%
Use of LTC Services	17	12.3%
Independence degree of daily living for the disabled elderly	4	2.9%
Independence degree of daily living for older adults with dementia	4	2.9%
LTC certification information	3	2.2%
LIFE data	1	0.7%
Other than LTC-related data	101	73.2%
Outcome*		
LTC certification or care needs level	60	43.5%
Use of LTC Services	13	9.4%
Independence degree of daily living for older adults with dementia	25	18.1%
LTC cost	18	13.0%
Other than LTC-related data	25	18.1%

*Multiple choices possible.

independence degree of daily living for older adults with dementia.

Discussion of current status and perspectives of studies using LTC-related data

This review has demonstrated increased research involving LTC-related data in Japan from 2020 to 2021, consistent with Jin's findings of a similar rise from 2016 to 2020 (*3*). However, recently, this growth has slowed down. Most of these studies, published in English and focused on gerontology and public health, align with Jin's findings (*3*).

The national government provided 13.5% of the LTC-related data, with 6.5% coming from Kaigo-DB (*5-14*). However, prefectures and municipalities contributed the majority (85.2%). Despite governmental support for Kaigo-DB, there has been a noticeable preference among researchers for local LTC-related data. This could be attributed to the challenges associated with Kaigo-DB, such as its limited allowance for linkage (restricted to NDB and DPC-DB) and the complexities involved in accessing it (*15,16*). Linked data, utilized in 90.4% of the studies, mainly consisted of original questionnaire or interview surveys (34.6%) and medical claims (34.0%). Notably, none of the studies using Kaigo-DB incorporated linked data. Datasets like the JAGES survey (*n* = 19), Ohsaki Cohort (*n* = 8), NCGG-SGS (*n* = 5), and the LIFE Study (*n* = 4), which integrated local LTC-related data with unique surveys and/or medical claims, were frequently employed. The widespread use of pre-created, user-friendly linked data may offer valuable insights for enhancing the utilization of Kaigo-DB.

In terms of study design, cohort studies were predominant, accounting for 84.6% of the research, followed by descriptive (5.1%), cross-sectional (3.2%), and case-control (1.3%) studies. Within the individual-based analytical descriptive studies, including cross-sectional, case-control, and cohort studies, the most commonly used LTC-related data as exposure was the use of LTC services (26.8%). The most frequent outcome data involved LTC certification or care needs level (43.5%), followed by the independence degree of daily living for older adults with dementia (18.1%). The typical study was a cohort of healthy older adults, with information from unique questionnaires, interviews, health check-up data, other measurement data measurements and medical claims as the exposure and LTC certification or care needs level data as the outcome (*17-42*). Additionally, several similar studies with the independent degree of daily living for older adults with dementia as an outcome were conducted (*43-59*). Easily applicable research like this is expected to continue to be widely conducted. Only one study has utilized LIFE data, collected by the Ministry of Health, Labor and Welfare since 2021, and this study used data from facilities (*60*). Although currently underutilized, this rich dataset holds potential for broader application in future research, thereby enhancing studies related to LTC (*61*).

To optimize the utilization of LTC-related data, especially national Kaigo-DB, we can learn from the successful use of municipal and prefectural data by researchers. Furthermore, drawing insights from implementing datasets like the JAGES study is crucial. An important consideration is reducing the time and effort required to access Kaigo-DB and enabling its integration with other datasets while maintaining personal data protection. The government's initiatives aimed at simplifying access to the Kaigo-DB and enhancing its integration with other databases are promising for future research in this field (*15,16*).

This study is not without limitations. Given the

variations in how LTC-related data is expressed in English, we followed Jin's methodology and limited our searches to some common keywords, such as "long-term care" and "databases" (*3*). Despite conducting an extensive search, it's possible that we might have overlooked some relevant publications.

Conclusion

This review highlights an increase in the utilization of LTC-related data between 2020 and 2021, followed by a stabilization period. The national government's contribution to the data source was modest, including data from Kaigo-DB, while most data was sourced from prefectures and municipalities. Notably, most studies utilized linked data. This study underscores the importance of concerted efforts to streamline access to Kaigo-DB and promote its integration with diverse data sources. Implementing these measures is essential for enhancing research involving LTC-related data in Japan.

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Factors associated with community residents' preference for living at home at the end of life: The Yamagata Cohort Survey

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Abstract: Japan's rapidly aging and high-mortality society necessitates a wider awareness and implementation of advance care planning. This Yamagata Cohort study investigated local residents' preferences for where they would like to spend their final days, and the underlying factors associated with those preferences with a self-administered questionnaire survey of local residents aged 40 years and over . Logistic regression analyses were used to assess those factors and, specifically, the choice of "Home" as the preferred place for end-of-life residence. Among the 10,119 responders, 61% chose their home as the most desirable place to spend their final days. The multiple logistic regression analysis showed that the independent factors associated with the choice of "Home" were: *male*, *older age*, *not living with someone who needs care*, *not discussing the end of life*, *currently happy*, *struggling to live on current income*, *not feeling anxious or depressed*, and *current place of residence the same as their grandparents' birthplace*. This suggested that reducing the burden of home care and addressing frequent emotional issues such as happiness and anxiety could increase the number of people choosing "Home". Open-ended comments indicated the importance of getting information and options, and discussing the choice of place for terminal care in light of individual backgrounds including having reservations about family. Support and systems are needed to understand what community residents consider important when deciding where to spend their final days, and to bridge the gap between their desired location and their actual end of life.

***Keywords*:** final days, advanced care planning, terminal care, life choices

Introduction

As the demand for end-of-life care increases with the progression of an aging and high-mortality society in Japan, so does the need for advance care planning (ACP). ACP is a process in which the patient, their family, and their medical care team discuss in advance the medical care that the elderly patient desires and will receive in their final stage of life (*1*). Surveys of the general public and local residents have reported that one's own home is the most popular place to spend one's final days, with 36.6% to 60.0% choosing this option (*2-5*); however, only 17.2% of deaths actually occur at home (*6*). Furthermore, the desired place to receive terminal care varies widely depending on the presence or absence of terminal cancer, cardiac disease, or dementia, as well as the stage of the patient's illness (*1*).

Several studies have shown that the factors related to the individual attributes of those who prefer their own home as the place to receive end-of-life care and to spend their final days are *male*, *elderly*, and *living with a caregiver or children* (*2-4*); however, few detailed surveys exist on this topic. Yamagata Prefecture has some of the highest aging and mortality rates in Japan; 33.8% of its population is 65 years or older, the mortality rate is 503.1 per 100,000, and the death rate from senility is 202.3 per 100,000 (the highest in Japan). Importantly, the death rate at home is only 14.4% (*6*), which is lower than the national average. The purpose of this study was to clarify the prevalence of local Yamagata residents who preferred their own home as the place in which they wished to receive terminal care, to explore the factors related to and the thoughts behind this preference, and to examine the issues involved in realizing people's wishes for their terminal care in a comprehensive community system.

Materials and Methods

Study participants and survey procedures

The Yamagata Cohort Study was supported by the 21st Century COE Program and the Global COE Program and was conducted in seven cities in Yamagata Prefecture

from 2009 to 2015. Participants were local residents covered by the National Health Insurance system; most were engaged in agriculture, forestry, and fishery, were self-employed, part-time workers, retired workers, or unemployed. In the present study, health and lifestyle questionnaires were mailed from December 2021 to March 2022 to 17,527 of the 20,969 baseline participants (*i.e.*, those who responded to the original survey) who were known to be alive in December 2021. The questionnaires were returned by 12,216 respondents (response rate 69.7%), and analysis was conducted on the 10,119 who provided valid responses regarding the place in which they prefer to receive end-of-life care.

Survey items

The questionnaire comprised items that covered the following topics: sex, age, whether they discussed end-of-life issues (Yes/No), whether they live with someone who needs care (Yes/No), whether they have a family doctor (Yes/No), whether they consult with family and friends (Yes/No), their current level of happiness (Happy/Neutral/Unhappy), their living situation on their current income (Comfortable/Neutral/Suffering), Whether they feel forgetful (Yes/No), whether they feel anxious or depressed (Yes/No), whether their current residence and their grandparents' birthplace are the same (Same/Not same), and what their preferences were for where they would like to spend the final days of their life by choosing "Home" or "Hospital/Nursing home/Other". Regarding where they would like to spend the final days of their life, "Hospital/Nursing home/Other" was defined as "Not Home", and comparisons were made between "Home" and "Not Home". In addition, an open-ended item was included in "Other".

Statistical analysis

A *t*-test and a chi-square test were conducted to compare continuous and categorical parameters between those who answered "Home" and "Not Home" as their preferred place to receive terminal care. Simple and multiple logistic regression analyses were conducted to identify factors independently associated with those whose preference was "Home". Open-ended items were qualitatively categorized and simply tabulated. A *p*-value of less than 0.05 was considered statistically significant. Statistical software JMP pro16 for Windows was used for all statistical analyses.

Ethical considerations

When the questionnaires were distributed, an overview of the study, including the voluntary nature of participation and the protection of personal information, was provided to the participants, and consent was obtained in writing. This study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of Yamagata University School of Medicine (2009–1222, 2022–193).

Results

Overview of participants and their preferences for where to receive their end-of-life care

The number of valid responses to the self-administered questionnaire was 10,119, of which 4,072 (40.2%) were male and 6,047 (59.7%) were female. The mean age was 71.9 ± 8.0 years; 1,649 (16.3%) were between 40 and 64 years old, 4,315 (42.6%) were 65–74 years old (*i.e.*, early elderly), and 4,155 (41.0%) were 75 years old or more (*i.e.*, late elderly).

The most common preference for where to spend one's final days was "Home" (6,184 participants, 61.1%). "Not Home" was 3,935 (38.8%), which included Hospitals (2,028, 19.2%), Nursing homes (1,818, 17.2%), and "Other" places (89, 0.84%). A total of 3,549 respondents (35.0%) reported that they discuss or have discussed end-of-life care with their families (Table 1).

We compared the characteristics of participants who chose "Home" as their desired place to spend their final days with "Not Home". Those who chose "Home" were more likely to be male (Home 45.1% *vs.* Not Home 32.5%), late elderly (Home 44.1% *vs.* Not Home 36.1%), had not discussed their end of life (Home 33.8% *vs.* Not Home 37.0%), were not living with someone who needed care (Home 7.8% *vs.* Not Home 9.8%), currently happy (Home 87.6% *vs.* Not Home 84.1%), not feeling anxious or depression (Home 26.7% *vs.* Not Home 31.8%), and living in a place of residence that was the same as their grandparents' birthplace (Home 46.4% *vs.* Not Home 39.6%).

Factors associated with the choice of "Home" as the preferred place in which to spend one's final days

We conducted simple and multiple logistic regression analyses on the factors associated with the answer, "Home", in response to the item, "place I want to spend my final days". In the simple logistic regression analysis, the associated factors were: male, late elderly, having end-of-life discussions, living with someone who needs care, being happy, not feeling anxious or depressed and the same current place of residence as the grandparents' birthplace (Table 2). In the multiple logistic regression analysis, the independently associated factors were: male (odds ratio [OR]: 1.59, 95% confidence interval [CI]: 1.45–1.74), late elderly (OR: 1.63, 95% CI: 1.43–1.85), not having end-of-life discussions (OR: 1.17, 95% CI: 1.07–1.28), not living with someone who needs care (OR: 1.18, 95% CI: 1.02–1.37), currently being happy (OR: 1.35, 95% CI: 1.18–1.55), having a difficult living situation on current income (OR: 1.16, 95% CI: 1.05–

Table 1. Participants' characteristics

Characteristics	Total 10,119 (100%)	Home 6,184 (61.1%)	Not Home 3,935 (38.8%)	*p*-value
Sex				
Male	4,072 (40.2%)	2,793 (45.1%)	1,279 (32.5%)	< 0.001
Female	6,047 (59.7%)	3,391 (54.8%)	2,656 (67.5%)	
Age group				
40–64 years old	1,649 (16.3%)	859 (13.8%)	790 (20.0%)	< 0.001
65–74 years old (Early elderly)	4,315 (42.6%)	2,592 (42.6%)	1,723 (43.7%)	
75 years old or more (Late elderly)	4,155 (41.0%)	2,733 (44.1%)	1,422 (36.1%)	
Having end-of-life discussions				
Yes	3,549 (35.0%)	2,090 (33.8%)	1,459 (37.0%)	< 0.001
Have a family doctor				
Yes	9,164 (90.5%)	5,607 (90.6%)	3,557 (90.3%)	0.643
Living with someone who needs care				
Yes	872 (8.6%)	486 (7.8%)	386 (9.8%)	< 0.001
Consultation with family or friends				
Yes	8,296 (83.6)	5,076 (83.7%)	3,220 (83.4%)	0.715
Current level of happiness				
Neutral	1,117 (11.2%)	626 (10.3%)	491 (12.7%)	< 0.001
Happy	8,577 (86.2%)	5,325 (87.6%)	3,252 (84.1%)	
Unhappy	247 (2.4%)	125 (2.0%)	122 (3.1%)	
Living situation on current income				
Neutral	5,801 (58.9%)	3,541 (58.9%)	2,260 (59.0%)	0.045
Comfortable	1,046 (10.6%)	606 (10.0%)	440 (11.4%)	
Suffering	2,994 (30.4%)	1,865 (31.0%)	1,129 (29.4%)	
Forgetfulness				
Yes	7,890 (78.8%)	4,799 (78.4%)	3,091 (79.4%)	0.218
Anxiety or depression				
Yes	2,840 (28.7%)	1,615 (26.7%)	1,225 (31.8%)	< 0.001
Place of residence and grandparents' birthplace				
Same	4,399 (43.8%)	2,848 (46.4%)	1,551 (39.6%)	< 0.001

Table 2. Factors associated with the desire to spend one's final days at Home

Factors	Simple OR (95% CI)	*p*-value	Multiple OR (95% CI)	*p*-value
Sex				
Male (*vs*. Female)	1.71 (1.57–1.86)	< 0.001	1.59 (1.45–1.74)	< 0.001
Age group				
40–64 years	1		1	
65–74 years old (Early elderly)	1.38 (1.23–1.55)	< 0.001	1.32 (1.17–1.74)	< 0.001
75 years old or more (Late elderly)	1.77 (1.57–1.98)	< 0.001	1.63 (1.43–1.85)	< 0.001
Having end-of-life discussions				
No (*vs*. Yes)	1.15 (1.06–1.25)	< 0.001	1.17 (1.07–1.28)	< 0.001
Have a family doctor				
No (*vs*. Yes)	0.97 (0.84–1.11)	0.644	1.10 (0.96–1.28)	0.177
Living with someone who needs care				
No (*vs*. Yes)	1.28 (1.11–1.47)	< 0.001	1.18 (1.02–1.37)	0.030
Consultation with family or friends				
Yes (*vs*. No)	1.02 (0.92–1.14)	0.715	1.05 (0.93–1.18)	0.409
Current level of happiness				
Neutral	1		1	
Happy	1.28 (1.13–1.46)	< 0.001	1.35 (1.18–1.55)	< 0.001
Unhappy	0.80 (0.61–1.06)	0.121	0.86 (0.65–1.16)	0.326
Living situation on current income				
Neutral	1		1	
Comfortable	0.88 (0.77–1.00)	0.059	0.90 (0.78–1.03)	0.141
Suffering	1.05 (0.96–1.15)	0.253	1.16 (1.05–1.28)	0.003
Forgetfulness				
No (*vs*. Yes)	1.06 (0.96–1.17)	0.218	1.06 (0.95–1.18)	0.280
Anxiety or depression				
No (*vs*. Yes)	1.28 (1.17–1.40)	< 0.001	1.15 (1.05–1.27)	0.004
Place of residence and grandparents' birthplace				
Same (*vs*. Not same)	1.32 (1.22–1.43)	< 0.001	1.23 (1.13–1.34)	< 0.001

1.28), not feeling anxious or depressed (OR: 1.15, 95% CI: 1.05–1.27), and the same current place of residence as the grandparents' birthplace (OR: 1.23, 95% CI: 1.13–1.34) (Table 2).

Subgroup analyses by sex and age

Since gender and age were strongly related to the choice of "Home" in the multivariate analysis of Table 2, we conducted subgroup analyses by gender and age considering the possibility that factors related to the choice of "Home" differ by gender and age. A total of 10,119 patients were included in the subgroup analysis. In the "sex" subgroup analysis, the associated factors for men were, in descending order of OR: being currently happy (OR: 1.56, 95% CI: 1.27–1.91), having the same current place of residence as the grandparents' birthplace (OR: 1.21, 95% CI: 1.05–1.39), and suffering in the current living conditions (OR: 1.17, 95% CI: 1.00–1.37). For women, the nine associated factors were, in descending order of OR: being late elderly (OR: 1.84, 95% CI: 1.57–2.15), being early elderly (OR: 1.39, 95% CI: 1.20–1.60), not living with someone who needs care (OR: 1.36, 95% CI: 1.13–1.64), having the same current place of residence as the grandparents' birthplace (OR: 1.24, 95% CI: 1.11–1.39), not having a family doctor (OR: 1.22, 95% CI: 1.02–1.46), being currently happy (OR: 1.21, 95% CI: 1.01–1.46), not having end-of-life discussions (OR: 1.21, 95% CI: 1.08–1.35), not feeling anxious or depressed (OR: 1.16, 95% CI: 1.03–1.31), and suffering in living situation on current income (OR: 1.16, 95% CI: 1.02–1.31). Thus, the factors associated with "Home" as the "place I want to spend my final days" differed by sex, with females having more facilitating factors than males (Supplemental Table S1, *https://www.globalhealthmedicine.com/site/supplementaldata.html?ID=73*).

In the "age" subgroup analysis, the significantly associated factors in the 40–64-year-old group were, in descending order of OR: male (OR: 1.97, 95% CI: 1.55–2.50), being currently happy (OR: 1.40, 95% CI: 1.02–1.93), not having end-of-life discussions (OR: 1.32, 95% CI: 1.04–1.66), and suffering in living situation on current income (OR: 1.30, 95% CI: 1.04–1.63). In the 65–74-year-old (early elderly) group, the extracted five factors were: male (OR: 1.65, 95% CI: 1.44–1.90), being currently happy (OR: 1.31, 95% CI: 1.05–1.62), not having end-of-life discussions (OR: 1.21, 95% CI: 1.06–1.39), not feeling anxious or depressed (OR: 1.21, 95% CI: 1.04–1.41), and having the same current place of residence as the grandparents' birthplace (OR: 1.16, 95% CI: 1.03–1.33). In the 75 years and older (late elderly) age group, four associated factors were extracted: male (OR: 1.42, 95% CI: 1.24–1.63), being currently happy (OR: 1.39, 95% CI: 1.12–1.74), having the same current place of residence as the grandparents' birthplace (OR: 1.32, 95% CI: 1.15–1.52), and not feeling anxious or depressed (OR: 1.17, 95% CI: 1.00–1.37). The analysis clearly showed that the factors most commonly associated with "Home" as the "place I want to spend my final days" for all ages were male and being currently happy (Supplemental Table S2, *https://www.globalhealthmedicine.com/site/supplementaldata.html?ID=73*).

Open-ended responses to the question, "Where do you want to spend your final days?"

Of those who answered "Other" to the question about where they would like to spend their final days, 306 provided qualitative responses in the open-ended items. The answers were categorized by descriptive similarities, as follows: "Don't know/can't decide/thinking about it", "Specific place (*e.g.*, fee-based senior citizen home, hospice, or child's home) ", "Depends on the physical condition and situation at the time", "Does not think about it or does not want to think about it", "Abides by the family's wishes or a place that does not disturb the family and surroundings", and "No preference/anywhere is fine" (Figure 1). Actual examples of "Don't know/can't

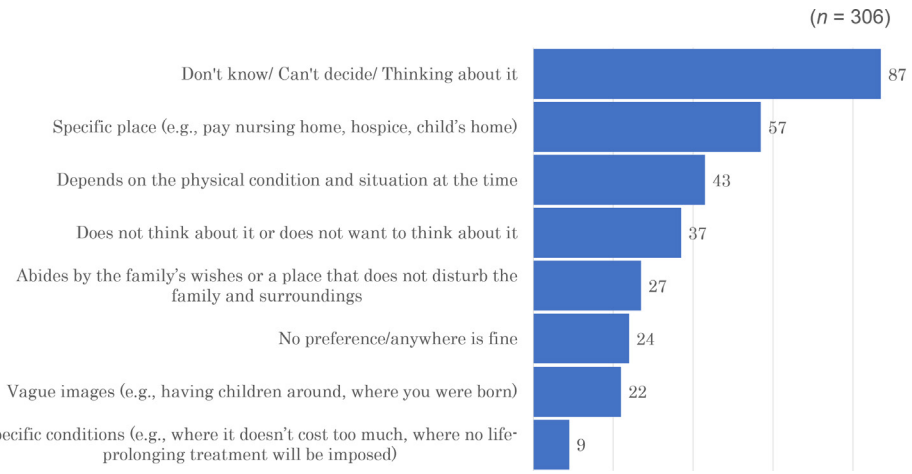

Figure 1. Open-ended response to the question, "Where do you want to spend your final days?"

decide/thinking about it" statements were: *"I don't know because I have never thought about it",* and *"My spouse is dead and I am an elderly person living alone so I have no one to consult"*. A further example of "Depends on the physical condition and situation at the time" statement was, *"Hospital if I am sick, nursing home if I have dementia, home if I am well"*. Another example of "Abides by the family's wishes or a place that does not disturb the family and surroundings" was, *"Anywhere that will not inconvenience my family"*. A further example of "Specific place" was, *"A nursing home that is adequate for my income"*.

Discussion

Factors associated with "Home" as the "place where I want to spend my final days"

In this study, several factors associated with "Home" as the preferred place to receive end-of-life care were consistent with previous studies (*2,3*): male, not living with a person in need of care, early elderly, and late elderly. Importantly, new associated factors were also found: not having end-of-life discussions, being currently happy, difficulty living on one's current income, not feeling anxious or depressed, and the current place of residence being the same as the grandparents' birthplace. Furthermore, subgroup analyses showed that the associated factors differed by sex and age: females had more multiple associated factors, and all age groups were associated with the common factors.

Not having end-of-life discussions

In this study, 61.1% of the respondents who preferred "Home" as the place in which to receive end-of-life care reported not discussing where they would spend their final days. Inagaki *et al.*, by contrast, reported no difference between holding end-of-life discussions and the preferred place for end-of-life care (*2*). One possible reason for this is that a low percentage of the participants in the present study had discussed end-of-life care, and it is possible that they did not have a concrete image of what their end-of-life care would be or of the place where they would spend their final days. However, the open-ended answers suggest that perhaps these participants wished to stay at home but were hesitant to tell their families about their wishes because they did not want to bother their families or were simply unsure, and as a result, they did not discuss end-of-life care with their families.

Being happy and not feeling anxious or depressed

No previous study has examined the association between being happy and not feeling anxious or depressed, and the preferred place for spending one's final days. Our results suggest that for a person who is currently happy at home and has no anxiety, the idea of wanting to spend their final days at home is a natural extension of their present life. It is also possible, however, that participants are optimistic about the possibility of spending their final days at home as an extension of their current life because they are unable to visualize information and options such as illness and nursing care. Further investigation is needed to determine the relationship between sudden physical deterioration owing to aging and the availability of information about situations requiring nursing care.

Difficulty living on current income

Sugimoto *et al.* suggest that economic level can lead to decision-making that is contrary to the will of the individual and their family members (*7*); those in lower economic brackets have fewer opportunities and less capacity to care for their elderly than those in higher economic brackets, and thus may initiate home care for unavoidable reasons and are less likely to express a preference for spending their final days at home. Furthermore, Noguchi reports that the elderly with dementia may not be able to choose the place of treatment for their terminal care owing to the limitations of family caregiving and economic hierarchy that cannot afford the cost of institutionalization (*8*).

As the present super-aging society emerges in Japan, people's economic situations and their family's lack of caregiving capacity may prevent them from choosing nursing homes or long-term care facilities, and they may be forced to choose their own home. We believe that social support policies and the provision of easily accessible information are necessary to enable people to choose the medical treatment they desire at the end of their lives.

Current place of residence is the same as the grandparents' birthplace

Although this study did not investigate the rate of cohabitation, 43.8% of respondents were born — and continue to live — in the same place as their grandparents, which may indicate that they are familiar with and attached to the community and their home. In the Nippon Foundation's survey report (*4*), respondents gave reasons for choosing their current home, such as "I feel safe and the surroundings are familiar" and "I can be myself until the end of my life". The survey also found that for local residents, those who continue to live in the place where they were born and raised are more likely to want to stay at home. Furthermore, the participants in the present study were agricultural, forestry, fisheries or self-employed workers, this may have contributed to their desire to stay in the familiar surroundings of their hometowns or homes until the end of their lives.

What local residents consider important when thinking about the place to receive their end-of-life care

Although 95.8% of participants in this study indicated a

specific preference for where they wanted to spend their final days, only 35.0% had actually discussed end-of-life care with their families. In addition to the main category, "Don't know/can't decide/thinking about it", the themes that were extracted from the open-ended responses indicate a wide variety among local residents in their considerations of where to spend their final days and receive terminal care, which depends on their individual circumstances and associated choices (*e.g.*, "follow family's wishes, a place that will not bother family or surroundings" and "depends on physical condition and circumstances at the time"). This outcome may be an indication of the difficulty that Japanese people tend to experience in being both reserved and assertive toward their families and others.

The category, "follow the family's wishes and do not want to inconvenience the family and surroundings" has also been mentioned in previous surveys as a factor that is taken into consideration when thinking about terminal care (*1,9*). The results of a Nippon Foundation survey (*4*), however, show a discrepancy between parents' and children's end-of-life medical care and recuperation preferences and their thoughts about those choices: parents do not want to "burden the family" at the end of their life, but children may not know this reality and want their parents "to receive aggressive medical treatment" and "to live as long as possible". For this reason, we believe it is important for families to discuss not only the physical location of the place where the person wants to spend their final days, but also the thoughts behind the person's wishes.

Many participants also indicated that their choice of location for spending their final days and receiving terminal care "depend[s] on the physical condition and circumstances at the time of death". The Japanese Ministry of Health, Labour and Welfare promotes the establishment of a comprehensive regional support and service delivery system to enable the elderly to continue to live their lives in their familiar neighborhoods for as long as possible. The objective is to preserve people's dignity, support independent living, and provide palliative care and end-of-life care at home regardless of disease or physical condition, as well as the enhancement of services to reduce the burden of care on families. However, available resources and maintenance conditions vary from region to region (*10*) and the options are likely to be narrowed depending on factors such as economic level (*7*) and the presence or absence of dementia (*8*). Public health approaches to end-of-life care have the potential to enhance the integration of services and provide a comprehensive approach that engages the assets of local communities (*11*). Therefore, when discussing places for end-of-life care, it is important for local residents to have knowledge and information about the actual medical and nursing care options available in their area for terminal physical and mental health conditions.

Towards a community where people can choose "Home" as the place where they spend their final days

Surveys of the preferences of the general public and terminally ill people report a growing consensus that, with sufficient support, most people would prefer to receive end of life care at home (*12*). Table 2 shows that among the factors related to not choosing to stay at home, the items that can be improved include: avoiding having a person in need of care at home, increasing the number of people who feel happy in their current situation and increasing the number of people who are not anxious/unhappy. Each of these is found with frequency in having a person in need of care at home (8.6% of all respondents), not feeling happy in the current situation (Unhappy 2.4%, Normal 11.2%) and being anxious/depression (28.7%). In particular, addressing the more frequent, mental health issues such as happiness and anxiety could significantly increase the number of people choosing "Home" as the place where they spend their final days.

Conversely, this is might also true for those who choose "Home" as a place to spend their final days, who are satisfied with their current living environment, have less anxiety and fear about the end of life and image of death, and have a more positive view of death. Maintaining health and well-being may lead to better end of life care (*13*), and creating a community where more people choose "Home" may help to create a society where residents are healthy in mind and body, benefit from a comprehensive community system and live a happier life now.

Strengths and limitations of this study

The strengths of this study include the large sample size (the largest among past surveys in Japan) and the large geographical area from which responses were obtained within the prefecture. These factors facilitate an understanding of the preferences and thoughts of a wide range of local residents regarding places in which to receive end-of-life care. Several limitations should be noted. First, there may have been selection bias. The participants in this study regularly receive community health checkups, have a high level of health awareness, and are currently in good health; therefore, they may not have information on or specific images of end-of-life medical care or be aware of the options available to them for places of recuperation. Second, this survey was conducted only once. Participants' opinions may change depending on their physical condition and surrounding circumstances.

Conclusion

This study identified factors associated with community residents' desire to spend their final days at home.

When considering where community residents should spend their final days, it is necessary to understand their personal characteristics and what is important to them, and to provide support and systems that can bridge the gap between their desired location and their actual end of life.

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Pyelonephritis due to *Escherichia coli* in the older population in Japan: Impacts on activities of daily living and medical costs

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Abstract: This study aimed to investigate differences in Activities of Daily Living (ADL), at admission and discharge, as well as the medical costs of pyelonephritis in older adults in Japan. Patients hospitalized for pyelonephritis between January 1, 2013 and March 31, 2019, were retrospectively enrolled. The inclusion criteria were urine culture within 48 h of admission with > 10^4 colony-forming units/mL of *Escherichia coli* and symptoms of pyelonephritis. Patients were divided into Young (20–64 years), Pre-old (65–74 years), Old (75–84 years), and Super-old (≥ 85 years). ADL and medical costs were compared. Finally, 393 patients were included: 112 (28.5%) were Young, 72 (18.3%) were Pre-old, 130 (33.1 %) were Old, and 79 (20.1%) were Super-old between January 1, 2013, and March 31, 2019. The median differences between Barthel Index (BI) scores, which indicates ADL, at admission and discharge were 0, 0, 25, and 23 in each age group, respectively ($p < 0.001$). No significant differences existed between the groups aged ≥ 65. Median medical costs were $3,368, $4,894, $5,372, and $6,078 for each age group, respectively ($p < 0.001$). Medical costs per day did not differ significantly between the groups ($p = 0.163$). Pyelonephritis due to *E. coli* in patients aged ≥ 75 is associated with a decline in ADL, longer hospital stays, and higher medical costs compared to that in young patients. Pre-old patients did not have lower ADL; however, they tended to have longer hospital stays and higher medical costs.

***Keywords*:** ageing, urinary tract infections, cost analysis

Introduction

Japan has a rapidly aging population. In 2021, 28.9% of the total Japanese population will be 65 years old or older, and 14.9% will be 75 years old or older (*1*). Urinary tract infections (UTIs) such as acute pyelonephritis are the second most common type of infection requiring hospitalization after lower respiratory tract infections (*2*). Complications and deaths from acute pyelonephritis are a significant medical burden, with the direct and indirect costs of acute pyelonephritis in the United States estimated at $2.14 billion in 2000 (*3*). In a retrospective study using surveillance data of hospitalized patients with UTIs in Japan (*4*), the average medical costs during hospitalization for treatment of UTIs were $4,250 (1 United States Dollar (USD) = 100 yen). The medical costs incurred by older adults were greater, with mean costs amounting to $3,154 for those ≤ 65 years and $4,630 for those aged ≥ 65 (*4*).

It has been reported that hospitalization due to acute illness is stressful for older adults and leads to a decline in physical functions (*5*). Even after the disease is cured, physical function often declines before hospitalization. As a result, the coordination of hospital transfers is difficult, leading to prolonged hospital stays, increased medical costs, and the development of new healthcare-associated infections.

Previous studies have reported low mortality due to pyelonephritis (*4*). Nonetheless, pyelonephritis still imposes a burden on the older population. Thus, it is necessary to examine the impact of pyelonephritis on physical function and medical costs, rather than on mortality. This study investigated the impact of pyelonephritis on physical function in older adults and the economy by comparing the Barthel Index (BI), which indicates Activities of Daily Living (ADL), with the medical costs of patients hospitalized for pyelonephritis.

Material and Methods

Study design

This retrospective observational single-center study was conducted at the National Center for Global Health and Medicine (NCGM) in Tokyo, Japan. The study protocol was reviewed and approved by the Ethics Committee of the Center Hospital of NCGM (NCGM-G-004104-02).

The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patients

We enrolled patients with pyelonephritis who were hospitalized between January 1, 2013, and March 31, 2019. Patients who met the following clinical criteria were enrolled: *i*) Urine culture examination in the outpatient setting or within 48 h of admission demonstrating over 10^4 colony-forming units/mL of *Escherichia coli*, and *ii*) patients with at least one of the following: fever ≥ 38°C, costovertebral angle tenderness, suprapubic tenderness, urinary frequency, urinary urgency, and dysuria at the time of admission. The exclusion criteria were as follows: *i*) patients transferred from other hospitals, medical care facilities, or nursing homes; *ii*) patients with indwelling bladder catheters inserted at admission; *iii*) patients certified for Japanese long-term care insurance need levels over 3 (BI score < 60) (*6*) because their capacity for ADL declined before developing pyelonephritis, and *iv*) two or more hospitalizations for pyelonephritis during the study period. Enrolled patients were divided into four groups according to age: Young (20–64 years), Pre-old (65–74 years), Old (75–84 years), and Super-old (≥ 85 years). Data were collected by a single infectious disease doctor using an electronic medical chart.

Data

We collected the following data: age, sex, main department, underlying diseases and status of immunity, vital signs, quick Sequential Organ Failure Assessment (qSOFA), antibiotic treatment and invasive treatments, rehabilitation during hospitalization, medications used during hospitalization, admission to the intensive care unit, complications during hospitalization, *E. coli* bacteremia, extended-spectrum β-lactamase (ESBL)-producing *E. coli*, BI score at the time of admission and discharge, medical costs (1 USD = 140 yen), length of hospital stay, mortality during hospitalization, and discharge destination. We calculated the Charlson Comorbidity Index (CCI) scores (*7,8*). We also calculated qSOFA as a measure of severity (range, 0–3 points, with 1 point each for systolic hypotension [≤ 100 mmHg], tachypnea [≥ 22 /min], or altered mentation) (*9*). Antibiotic treatment included inappropriate empirical therapy, length of intravenous antimicrobial infusion, and rate of conversion to oral antibiotic therapy. Inappropriate empirical therapy was defined as the use of antibiotic agents against which the isolated *E. coli* was resistant. Invasive treatments include surgeries used to treat pyelonephritis, such as ureteral stent insertion, renal or bladder fistulotomy, percutaneous drainage, and open surgery. Complications during hospitalization included iatrogenic infections, peripheral line-associated bloodstream infection (PLABSI), central line-associated bloodstream infection (CLABSI), catheter-associated urinary tract infection (CAUTI), and *Clostridioides difficile* infection (CDI). ESBL-producing *E. coli* were identified using the broth microdilution method, disk diffusion test, or Cica-beta test (Kanto Chemical, Tokyo, Japan).

The BI scale used in this study consists of 10 items: eating, bathing, grooming, dressing, defecation, urination, toilet use, movement, mobility, and stair climbing. Each item was scored as 0, 5, 10, or 15 points (*10*), with the maximum score varying per item and total scores ranging from 0 (complete dependence) to 100 (complete independence). Differences between the BI on admission and discharge were expressed as absolute values. Patients who died during hospitalization were excluded from the analysis. Medical costs were estimated without using a diagnosis-procedure combination (DPC). The discharge destinations included homes, other hospitals, and nursing homes.

Statistical analysis

Patient information was used to compare each group using Fisher's exact test and the Kruskal–Wallis test. The Bonferroni corrected p-value < 0.05 was deemed to be statistically significant. Categorical variables are presented as counts (%), and continuous variables are presented as median and interquartile range (IQR). All statistical analyses were performed using the EZR ver. 1.55 (*11*).

Results

Patients' characteristics

A total of 393 patients were included: 112 (28.5%) Young, 72 (18.3%) Pre-old, 130 (33.1%) Old, and 79 (20.1%) Super-old patients.

The patients' characteristics are shown in Table 1. Moreover, there were more female patients than male patients in all age groups. The percentage of patients with a CCI of 4 or higher increased with age; in the Super-old group, all patients had a CCI of 4 or higher. The rates of *E. coli* bacteremia in the Pre-old and Old groups were higher (61.1% and 60.0%, respectively) than those in the Young and Super-old groups (37.5% and 41.8%, respectively). The percentage of ESBL-producing *E. coli* was lower in the Super-old group (5.06%); however, it remained the same in the other groups (11.6–16.9%). The rates of inappropriate empirical therapy were 8 (7.1%), 4 (5.6%), 15 (11.5%), and 4 (5.1%) in Young, Pre-old, Old, and Super-old, respectively (p = 0.325). The rate of conversion to oral antibiotic therapy decreased with increasing age: 88 (78.6%), 36 (50.0%), 56 (43.1%), and 24 (30.4%) in Young, Pre-old, Old, and Super-old, respectively (p < 0.001). The length of intravenous

Table 1. Patients' characteristics, *n* (%)

Characteristics	Young *n* = 112	Pre-old *n* = 72	Old *n* = 130	Super-old *n* = 79	*p*-value*
Sex					
Female	89 (79.5)	48 (66.7)	90 (69.2)	60 (75.9)	0.200
Main department					0.971
Internal Medicine	81 (72.3)	53 (73.6)	94 (72.3)	59 (74.7)	
Urology	10 (8.9)	7 (9.7)	12 (9.2)	4 (5.1)	
Emergency department	11 (9.8)	9 (12.5)	22 (16.9)	15 (19.0)	
Others	10 (8.9)	3 (4.2)	2 (1.5)	1 (1.3)	
Charlson Comorbidities Index [IQR]	0 [0, 6]	3 [0, 4]	4 [3, 7]	6 [4, 8]	< 0.001
Myocardial infarction	1 (0.9)	5 (6.9)	18 (13.8)	8 (10.1)	< 0.001
Chronic heart failure	0 (0)	3 (4.2)	10 (7.7)	7 (8.9)	< 0.001
Stroke	3 (2.7)	5 (6.9)	20 (15.4)	13 (16.5)	< 0.001
Dementia	0 (0)	0 (0)	16 (12.3)	21 (26.6)	< 0.001
Chronic lung disease	3 (2.7)	5 (6.9)	7 (5.4)	3 (3.8)	0.536
Collagen disease	8 (7.1)	10 (13.9)	13 (10.0)	5 (6.3)	0.355
Severe renal dysfunction	1 (0.9)	5 (6.9)	9 (6.9)	4 (5.1)	0.074
Severe liver disease	0 (0)	1 (1.4)	1 (0.8)	1 (1.3)	0.697
Severe diabetes mellitus	3 (2.7)	7 (9.7)	3 (2.3)	1 (1.3)	0.039
Solid tumor	7 (6.3)	11 (15.3)	23 (17.7)	19 (24.1)	< 0.001
qSOFA†score	*n* = 76‡	*n* = 57‡	*n* = 110‡	*n* = 67‡	< 0.001
0	38 (50.0)	31 (54.4)	36 (32.7)	21 (31.3)	
1	31 (40.8)	14 (24.6)	61 (55.5)	35 (52.2)	
2	7 (9.2)	11 (19.3)	12 (10.9)	9 (13.4)	
3	0 (0)	1 (1.8)	1 (0.9)	2 (3.0)	
Immunodeficiency					
Human immunodeficiency virus infection	5 (4.5)	2 (2.8)	1 (0.8)	1 (1.27)	0.238
Neutropenia	0 (0)	0 (0)	0 (0)	0 (0)	
Steroid use	2 (1.8)	0 (0)	1 (0.8)	1 (1.3)	0.678
Chemotherapy	18 (16.1)	6 (8.3)	7 (5.4)	4 (5.1)	0.344
Immunosuppressed	19 (17.0)	5 (6.9)	5 (3.8)	5 (6.3)	0.762
Organ transplantation	0 (0)	0 (0)	0 (0)	0 (0)	
Rate of inappropriate empirical therapy	8 (7.1)	4 (5.6)	15 (11.5)	4 (5.1)	0.325
Length of intravenous antimicrobial infusion, days [IQR]	7 [5, 11]	9 [4, 14]	10 [7, 14]	11 [7, 14]	< 0.001
Rate of conversion to oral antibiotic therapy	88 (78.6)	36 (50.0)	56 (43.1)	24 (30.4)	< 0.001
penicillin	15 (17.0)	1 (2.8)	6 (10.7)	4 (16.7)	
penicillin/β-lactamase inhibitor	6 (6.8)	7 (19.4)	8 (14.3)	1 (4.2)	
cephalosporin	30 (34.1)	8 (22.2)	18 (32.1)	9 (37.5)	
fluoroquinolone	37 (42.0)	19 (52.8)	23 (41.1)	9 (37.5)	
sulfamethoxazole-trimethoprim	0 (0)	0 (0)	0 (0)	1 (4.2)	
tetracycline	0 (0)	1 (2.8)	1 (1.8)	0 (0)	
others	0 (0)	1 (2.8)	0 (0)	0 (0)	
Invasive treatment					0.341
Ureteral stent	10 (8.9)	5 (6.9)	8 (6.2)	2 (2.5)	
Renal fistula	0 (0)	0 (0)	0 (0)	0 (0)	
Bladder fistula	0 (0)	0 (0)	0 (0)	0 (0)	
Percutaneous drainage	0 (0)	2 (2.8)	0 (0)	1 (1.3)	
Open surgery	0 (0)	0 (0)	0 (0)	0 (0)	
Admission to the intensive care unit	6 (5.4)	7 (9.7)	11 (8.5)	11 (13.9)	0.232
Conducting rehabilitation during hospitalization	4 (3.6)	16 (22.2)	52 (40.0)	50 (63.3)	< 0.001
Complications during hospitalization					
Peripheral line-associated blood stream infection	1 (0.9)	0 (0)	1 (0.8)	0 (0)	
Central line-associated blood stream infection	1 (0.9)	0 (0)	0 (0)	0 (0)	
Catheter-associated urinary tract infection	0 (0)	1 (1.4)	0 (0)	0 (0)	
Clostridioides difficile infection	2 (1.8)	1 (1.4)	0 (0)	1 (1.3)	
Escherichia coli bacteremia	42 (37.5)	44 (61.1)	78 (60.0)	33 (41.8)	< 0.001
Extended-spectrum β-lactamase *Escherichia coli*	13 (11.6)	11 (15.3)	22 (16.9)	4 (5.1)	0.0600

**p*-value is calculated for the difference among four groups. †qSOFA: quick Sequential Organ Failure Assessment. ‡Patients without recorded respiratory rate, blood pressure, or mental status in their medical charts were excluded.

antimicrobial infusion and the rate of rehabilitation increased with age by 7, 9, 10, and 11 days, and 4 (3.6%), 16 (22.2%), 52 (40.0%), and 50 (63.3%) days in Young, Pre-old, Old, and Super-old patients, respectively ($p < 0.001$).

Outcomes

The patient outcomes are shown in Table 2. The median number of days of hospitalization was 8, 14, 14, and 16 days; the differences in BI between admission and

Table 2. Patients' outcomes

Variables	Young *n* = 112	Pre-old *n* = 72	Old *n* = 130	Super-old *n* = 79	*p*-value*
Barthel index at admission [IQR]	100 [100, 100]	100 [38 100]	50 [5, 100]	20 [0, 58]	< 0.001
Barthel index at discharge [IQR]	100 [100, 100]	100 [100, 100]	90 [60, 100]	58 [30, 100]	< 0.001
Differences in Barthel index between admission and discharge [IQR]	0 [0, 0]	0 [0, 45]	25 [0, 50]	23 [5, 49]	< 0.001
Medical costs, United States Dollar† [IQR]	$3,368 [2,886, 5,705]	$4,894 [4,019, 8,852]	$5,372 [4,575, 10,239]	$6,078 [5,169, 12,336]	< 0.001
Length of hospital stay, excluding death, days [IQR]	8 [6, 12]	14 [10, 18]	14 [10, 18]	16 [12, 21]	< 0.001
Medical costs per day of hospitalization, USD† [IQR]	$344 [321, 503]	$320 [301, 524]	$354 [320, 655]	$366 [324, 625]	0.163
Mortality during hospitalization, *n* (%)	1 (0.9)	2 (2.8)	5 (3.8)	1 (1.3)	0.392
14-day mortality, *n* (%)	1 (0.9)	1 (1.4)	4 (3.1)	1 (1.3)	0.176
30-day mortality, *n* (%)	0 (0)	2 (2.8)	4 (3.1)	1 (1.3)	0.146
Discharge destination, *n* (%)					< 0.001
Home	110 (99.1)	68 (97.1)	109 (87.2)	60 (76.9)	
Other hospitals	1 (0.9)	1 (1.4)	13 (10.4)	16 (20.5)	
Nursing home	0 (0)	1 (1.4)	3 (2.4)	2 (2.6)	

**p*-value is calculated for the difference among four groups. Patient information was used to compare each group using Fisher's exact test and the Kruskal–Wallis test. The Bonferroni corrected *p*-value < 0.05 was deemed to be statistically significant. †1 United States Dollar = 140 yen

discharge were 0, 0, 25, and 23 in Young, Pre-old, Old, and Super-old patients, respectively ($p < 0.001$). The BI at admission and discharge was 100 in the Young and Pre-old groups, 50 and 90 in the Old group, and 20 and 58 in the Super-old group, respectively. The median medical costs (1 USD = 140 yen) were $3,368, $4,894, $5,372, and $6,078 in the Young, Pre-old, Old, and Super-old groups, respectively ($p < 0.001$). Nevertheless, a comparison of medical costs per day showed no significant differences between the groups ($p = 0.163$). The number of deaths during hospitalization was one in Young and Super-old, two in Pre-old, and four in Old patients.

Discussion

This retrospective study in Japan, involving 393 hospitalized patients with pyelonephritis due to *E. coli* compared the activities of daily living and medical costs between different age groups. Pyelonephritis in patients aged 75 and older was associated with a decline in ADL, longer hospital stays, and higher medical costs than in younger patients. Pre-old patients did not have lower ADL; however, they tended to have longer hospital stays and higher medical costs.

In our study, the Young and Pre-old groups did not experience a decline in BI at admission. By contrast, the Old and Super-old groups demonstrated lower BI scores upon admission. However, they showed improvement in scores from admission to discharge. This finding suggests that the acute pyelonephritis causes a temporary reduction in BI, which can be improved by adequate medical intervention. The impact of the acute pyelonephritis burden differed between the Pre-old group and the Old and Super-old groups. Thus, it may be more appropriate to distinguish individuals between the ages of 65–75 and those over 75 years when evaluating the physical impact of acute pyelonephritis, instead of grouping all 65 years and older together.

Our study observed that medical costs were higher in the older age groups; however, the cost per day of hospitalization remained the same among all groups. In other words, the aged 65 and older patients were hospitalized for longer periods, resulting in higher medical costs.

We considered three reasons for longer hospital stays in patients aged 65 and older with pyelonephritis. First, Pre-old, and Old patients had a higher rate of *E. coli* bacteremia. Second, it may take longer for Old and Super-old patients to adjust to hospital discharge. In our study, most Young patients and Pre-old were discharged; however, the rate of discharge to other hospitals or nursing homes increased with age. Toh *et al.* (*12*) reported that discharge to intermediate- and long-term care services was a significant factor for an increased length of hospital stay. Third, patients aged 65 and older are less likely to convert to oral antibiotics from intravenous infusions. Przybylski *et al.* (*13*) reported that the average length of hospital stays for patients who converted to oral antibiotics therapy was 1.53 days shorter than that of patients who were not converted. Therefore, Pre-old, Old, and Super-old patients aged ≥ 65 may have longer hospital stays and higher hospitalization costs than in Young patients.

In our study, patients aged 65 and older have longer intravenous antimicrobial infusion periods. In general, once a patient's condition stabilizes and oral medication becomes available, intravenous antibiotics are switched to oral agents to which the causative organism is susceptible. Clinicians should set longer intravenous treatment periods for older patients. Rieger KL *et al.* (*14*) reported that, in the treatment of bacteremic UTIs, the intravenous antibiotics-only group included more severely ill patients than the intravenous/oral group. In

our study, since the patients aged 65 and older included more severely ill patients with a higher CCI than in younger patients, clinicians likely tended to complete treatment only with intravenous antibiotics.

In our study, the length of hospital stay was comparable among patients aged 65 and older. The total duration of antimicrobial therapy for pyelonephritis generally ranges from 7 to 14 days, depending on the rapidity of the clinical response and the antimicrobial chosen to complete the course (*15*). In our study, the mean length of hospitalization was 16 days, even in the Super-old group. This may be due to the implementation of rehabilitation, fewer complications during hospitalization, and a low rate of inappropriate empirical therapy. We investigated the complications during hospitalization, such as PLABSI, CLABSI, CAUTI, and CDI, and observed that the incidence of these diseases was low in each group. The rate of inappropriate empirical intravenous therapy was low in all groups. This may be because ESBL-producing *E. coli* was less prevalent in the study groups than in previous reports (*16,17*).

Our study has several limitations. First, it was conducted at the NCGM, a single tertiary hospital in Japan. Hospital characteristics and the unique Japanese medical system may have strongly influenced these results. However, it is highly likely that other countries will enter a super-aging society, such as Japan, and we believe that this study will be useful for these countries as well. Second, baseline BI scores before hospitalization were not determined. One of the exclusion criteria was certification for Japanese long-term care insurance with need levels over 3, equivalent to a BI score < 60 (*6*). Therefore, we included those who were independent and had a BI score of 60 or higher. However, the exact baseline BI score was unknown. Because the BI score at discharge does not necessarily correspond to the BI score before hospitalization, the difference in BI scores at admission and discharge may not be caused by the disease burden from pyelonephritis. Third, as mentioned above, our study included patients who were independent in ADL. Because bedridden older patients with declining ADL were excluded, there may be a discrepancy with the actual clinical practice. Fourth, the effects of diseases other than pyelonephritis that occurred at the time of admission or during hospitalization cannot be excluded. Fifth, we did not use indicators other than BI scores to assess ADL, such as the Comprehensive Geriatric Assessment and Lawton-Brody Instrumental Activities of Daily Living Scale (*18*), because we were unable to collect any corresponding information from the medical records.

In conclusion, in our study, even in the Super-old group, the mortality rate of hospitalized patients with pyelonephritis was low. Pyelonephritis due to *E. coli* in patients aged 75 and older is associated with a decline in ADL, longer hospital stays, and higher medical costs than that in young patients. Pre-old patients did not have lower ADL; however, they tended to have longer hospital stays and higher medical costs. Therefore, when evaluating the physical impact of acute pyelonephritis, it would be more appropriate to distinguish between the ages of 65–74 and those over 75 years, rather than lumping those aged 65 and older together as older adults.

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BRIEF REPORT
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Challenges and solutions for discharge support of elderly people in the acute care ward: Interviews with community-based integrated care supporters and patients in Tokyo, Japan

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Abstract: Japan, which has become the country with the longest-living people in the world due to rapid population aging, has an insurer function for each local government and socialized long-term care under a public system. Japan aims to build a Community-based Integrated Care System (CICS) for each municipality with the goal of integrating medical care and long-term care. However, despite the policy and management studies, the challenges and solutions for discharge support by the parties have not yet been clarified. This study aimed to obtain suggestions on challenges and solutions for discharge support in the acute care wards for the elderly for community-based integrated care support providers and patients in Kita Ward, Tokyo. Semi-structured interviews were conducted, and the obtained data were a priori analyzed by a deductive thematic analysis using a conceptual framework for integrated care based on the integrative functions of primary care. The challenges were found to include: *i*) disparity between medical and lifestyle perspectives, *ii*) competencies of medical and care workers at homes, *iii*) discharge support challenges related to the elderly themselves, *iv*) nursing care dependent on family; and *v*) the impact of payment of medical service in the health insurance system and payment of long-term care services. The solution that can be applied at the local government level was community connection. While aiming to build a CICS for each local government, there was a contradiction in that the challenges and solutions required examination at the national and prefectural levels.

***Keywords*:** community-based integrated care in Japan, elderly people, discharge support, thematic analysis

Introduction

Japan, 60 years after the spread of universal health insurance, has received international recognition for both the extension of healthy life expectancy and the development of its medical system (*1,2*). However, the demand for care for elderly people living at home is increasing. In particular, the system for providing nursing care and medical care at home for those with illness is still in the trial-and-error stage. Japan is in the process of developing its system based on the concept of integrating medical care and long-term care (*3*). To maintain the dignity of the elderly and support independent living, the Japan Ministry of Health, Labour and Welfare aims to build a system that provides comprehensive support and services in the community so that the elderly can continue to live as long as possible in the community to which they are accustomed (Table 1) (*4*).

Discharge support has been positioned in the healthcare systems of many countries to shorten the length of hospital stay, reduce unplanned readmissions, and improve service coordination after discharge, and its effects have been reported (*5,6*). The main function of discharge support is to foster the ability of patients to smoothly transition to different care settings (*e.g.*, from hospital care to family care). Discharge support is a "series of processes" to help patients, and a "hospital-wide system" is needed to accomplish it (*7*). Financial incentives are generated to provide support by adding to the payment of medical services in the health insurance system. Medical services in the health insurance system are paid for by fees that healthcare institutions and insurance pharmacies receive from insurers as compensation for health and medical services delivered. Most general hospitals in Japan provide discharge support (*8*). Ever since higher remuneration along with the assignment of both nurses and social workers was approved by the central government, staffing in the discharge support department has been enhanced (*9*). The payment of medical services in the health insurance system has been revised repeatedly to reduce medical expenses and encourage a shift towards home care. However, there are no definitive results regarding the effect of discharge support on reducing readmissions in

Table 1. Five elements of the Community-based Integrated Care System (CICS)

Elements		Commentary
Five elements of CICS		"Housing" and "living support/welfare services" are interrelated and from the foundation, and specialized services such as "nursing care", "medical care", and "prevention" support elderly living at home.
Non-professional services	1.Housing	CICS means that the necessary housing has been developed as a basis for living and that a way of living that meets the wishes and financial capabilities of the person is secured. A daily living environment that adequately protects the privacy and dignity of the elderly is necessary.
	2.Livelihood support/welfare services	Livelihood support will be provided so that the elderly can continue to live with dignity even in the face of declining mental and physical abilities, economic reasons, and changes in family relationships. Livelihood support includes a wide range of support, from service-oriented support such as meal preparation to informal support such as talking to and watching over neighbors. It is also provided as a welfare service to the needy.
Professional services	3.Nursing care/rehabilitation 4.Medical care/nursing 5.Health/prevention	"Nursing care/rehabilitation", "medical care/nursing", and "health/prevention" are provided by professionals and organically provided in an integrated manner. Based on care management, professional support is provided integrally with daily living support as needed.

Japan (*10,11*).

Japan's the concept of the Community-based Integrated Care System (CICS) is mainly composed of a combination of the two concepts of integrated care and community-based care (*12*). Hospital discharge support at acute care hospitals is the cornerstone of medical and nursing care collaboration in Japan. The movement to integration and incorporation is also an international trend (*13*).

Despite the necessity of continuous implementation, the issues that the parties involved in discharge support face (including the patients themselves) and the solutions that they have found remain unclear. Therefore, in this study, we aimed to clarify the challenges of and solutions for discharge support in acute care wards for the elderly through qualitative research.

Materials and Methods

Study site and participants

Interviews for this study were conducted from April to August 2021 in Kita Ward, Tokyo. Among the 23 wards of Tokyo, Kita Ward has the highest percentage of people aged 65 and over, with 24.7% in 2021, whereas the average for the whole of Tokyo prefecture is 22.7%, and that for Japan is 28.6% (*14*). In the medical service coverage area that includes Kita Ward, 68.5% of patients are received medical care in the hospital with acute care facilities, and when the adjacent areas of Tokyo are included that rate rises to 91.9%, the highest rate in Tokyo. As there are two university hospitals in the suburbs of Kita Ward that provide advanced medical care, there is easy access to hospitals with acute medical care (*15*).

The interviewees were six elderly care support providers and a patient and family member. The support providers were staff members of a department specializing in acute hospital discharge support, as well as visiting nurses, long-term care support specialists, and clinic doctors. The interview contents addressed the role of support promoting the discharge of elderly patients through discharge support and the role of providing support after discharge. The interviewees were recruited from a workshop on elderly care in Kita Ward. Supporters were required to have sufficient experience in CICS, and all those who responded to recruitment matched this requirement. Personal interviews were conducted face-to-face by the researcher, with the patient and the family at home, and the support providers in the consultation room of the service office. The interview time was approximately 30-50 minutes and was recorded with an IC recorder with the consent of the participants as obtained by handwritten signature on a consent form.

Table 2. List of research participants

ID	Sex	Affiliation	Occupation
1	Male	Clinic	Doctor
2	Female	Home-visit nursing office	Nurse
3	Male	Home-visit nursing office	Care manager
4	Female	Hospital (Discharge collaboration office)	Nurse
5	Male	Hospital (Discharge collaboration office)	Social worker
6	Female	Home-visit nursing office	Nurse
7	Male	Patient	–
8	Female	Patient family	–

After analyzing the interviews of the research participants identified as ID 1-5 and 7, 8, it was determined that theoretical saturation had been reached through the analysis of ID 6. The participants comprised 4 males and 4 females, and they are listed in Table 2.

Data analysis

This study was a thematic analysis of face-to-face individual interviews using a semi-structured questionnaire. The conceptual framework used for the deductive analysis was the Conceptual Framework for Integrated Care based on the integrative functions of

Table 3. Five themes of challenges and details

Theme	Reference remarks
Disparity between medical and lifestyle perspectives In the theme of (I) Disparity between medical and lifestyle perspectives, information was subdivided into "I-i Difficulties in grasping and sharing information", "I-ii Different ways of thinking about hospitals and home care", and "I-iii Information asymmetry in medical care".	ID3 "*Especially when it comes to discharge support, (omitted) there is discharge support that brings the hospital system to your home and creates a small hospital room*". ID2 "The perspectives of hospitals and homes are completely different, so I wonder if it is necessary to reconcile them".
Competencies of medical and care workers at homes In the theme of (II) Competencies of medical and nursing care workers at home, regarding each occupation, the subdivisions were "II-i Characteristics of care managers", "II-ii Challenge of home visiting nurses supply system in the community", and "II-iii Improving the quality of helper work".	ID2 "*There are strengths and weaknesses of care managers. There are people who are good at nursing care, but who don't understand medical care*".
Challenges-related to discharge support for the elderly themselves In the theme of (III) Challenges-related to discharge support for the elderly themselves, intrinsic problems of the elderly were subdivided into "III-i Powerless elderly", "III-ii Difficulty in confirming intentions of the elderly", and "III-iii Necessity of intervention for the elderly who need medical treatment".	ID4 "*There are many elderly people who live alone, so I think they definitely need support for those who need support at home or who cannot manage their finances*".
Nursing care system dependent on the family In the theme of (IV) Nursing care system dependent on family, challenges related to family-related discharge support were subdivided into "IV-i Insufficient nursing care capabilities of the family", "IV-ii Difficulty in leaving the hospital at home due to the burden of nursing care", and "IV-iii Sorry about family cooperation".	ID5 "*When it was time to leave the hospital, they actually told me that they couldn't discharge because of the situation at home*".
Impact of payment of medical service in the health insurance system and payment of long-term care services In the theme of (V) Impact of medical and long-term care fees, challenges related to hospital discharge coordination related to the system were subdivided into "V-i Insufficient medical/nursing fees" and "V-ii Acceptance of patients according to hospital functions".	ID6 "*Even if we send a nursing summary, the medical fee will not be added*".

primary care (*16*), and the terms indicating the Strength of Integration referred to the definitions by Leutz (*17*).

The first author was in charge of the interview and transcription, and after the first careful reading of the transcription verbatim, with attention to the overall context of the transcribed text, the authors gave five themes after checking by other two researchers. To examine the validity of the results of the analysis, member-checking was obtained from two consenting participants, who agreed to interpret the results. The analysis was performed using the MaxQDA2020 software program (VEBRI GmbH, Berlin/Germany).

Ethical consideration

This study was approved by the Teikyo University School of Medicine Ethics Review Committee (No. 20-144-2).

Results and Discussion

The thematic analysis identified 49 codes, 31 categories, and five themes of challenges, namely: *i*) disparity between medical and lifestyle perspectives, *ii*) competencies of medical and nursing care workers at homes, *iii*) challenges related to discharge support for the elderly themselves, *iv*) Nursing care system dependent on the family, and *v*) impact of payment of medical service in health insurance system and payment of long-term care services, and five themes of solutions, namely: *i*) community connection, *ii*) improved collaboration through financial incentives by payment of medical service in the health insurance system, *iii*) expectations of doctors, *iv*) role of the discharge collaboration office, and *v*) the active role of nurses. The details of the themes are shown in Table 3. The relation between the themes based on these considerations is shown in Figure 1.

Disparity between medical and lifestyle perspectives

Regarding information, the theme of (I) Disparity between medical and lifestyle perspectives included "Difficulties in grasping and sharing information", "Different ways of thinking about hospitals and home care", and "Information asymmetry in medical care". We found a difference in the value and priority of information between the viewpoint of medical care at a hospital for treatment and the viewpoint of living daily life. We hypothesized that this difference was the root of the divergence in value and priority between medical care and daily living.

This theme suggested that the value and priority of information differed within hospitals, between local support offices, and between hospital and community

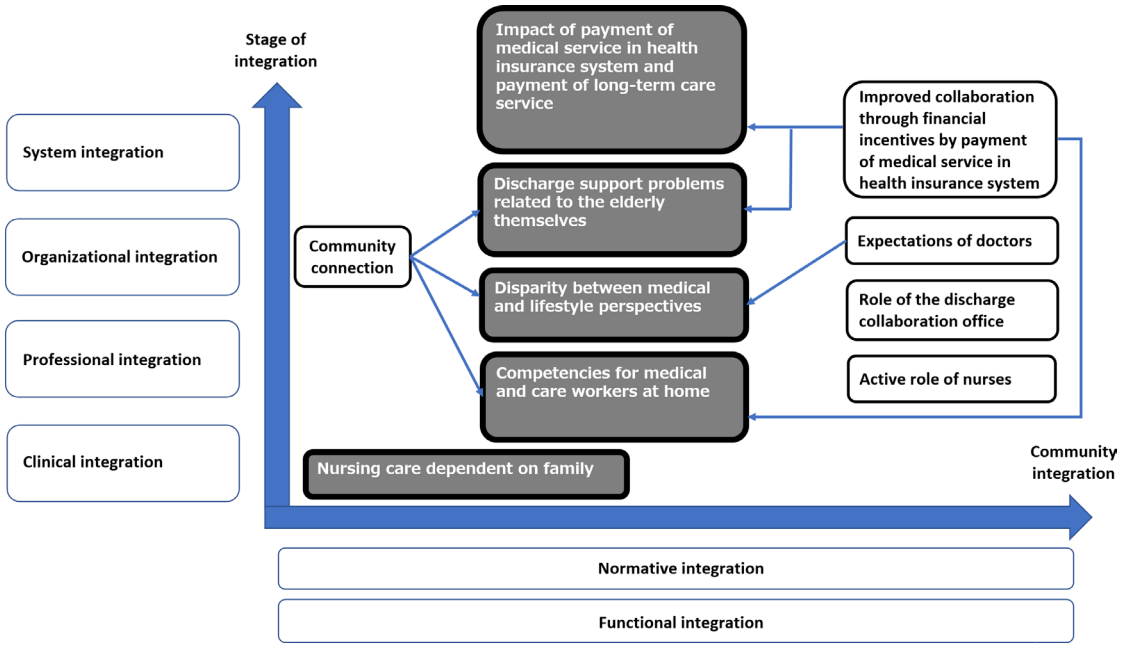

Figure 1. Solutions for each of the challenges by the conceptual framework of integrated care. The vertical axis is the stage of integration, which is indicated by arrows pointing from challenges to solutions for each theme arranged at the same height. The horizontal axis shows community integration, which is organized under normative and functional integration.

partnerships. We considered that the discharge collaboration office, which is responsible for discharge support and which requires cooperation among various occupations, corporations, and offices, is expected to play a role in bridging the gap between medical care and daily living support. According to the survey research project report on support for discharge collaboration offices, following the revision of payment of medical services after 2000, more than 70% of hospitals are promoting the establishment of discharge collaboration offices to support discharge (*18*). The current installation rate is high (98.0%). A high percentage (80–90%) of the respondents answered that they faced the following challenges in providing smooth discharge support: in-hospital work (*e.g.*, document preparation, communication, overtime, the scope of work), skill improvement, in-hospital cooperation, and information sharing. We considered that the challenges associated with discharge support that were identified in this study corresponded to the challenges described in the qualitative content of these reports, without contradiction.

CICS is described as a form of system that embodies the concept of integrated care (*3*). It refers to effective integration of collaboration between healthcare professionals and organizations. The determination of its success depends on how service providers better coordinate care and how professional groups work together in teams around people in need (*19*). The theme of a proposed solution, [Community connection] is an ongoing activity. "Smooth cooperation in building a support system" contained in this theme corresponds to "Benefits of home care", "case sharing", and "practice of Advance care planning (ACP)", and we considered these elements to promote [Community connection].

One of the reasons for the [Disparity between medical and lifestyle perspectives] is that the Japanese long-term care system has been influenced by the medical system (*20*). We considered that the transition to long-term care was set based on hospital standards as medical care was used for elderly people who did not require treatment.

Competencies of medical and care workers at homes

Regarding each occupation, the theme of (II) Competencies of medical and nursing care workers at home, included "Characteristics of care managers", "Challenge of home visiting nurses supply system in the community", and "Improving the quality of helper work". Competency was defined as "the latent characteristics of an individual that are responsible for effective or superior performance in a particular job performance situation or task situation, according to some criteria" (*21*). The occupation of care manager, which plays a central role in managing medical care and nursing care in the homes of the elderly, was created in line with the enforcement of the Long-Term Care Insurance Law. It has been pointed out that the competency of long-term care support specialists depends on whether their basic qualifications are medical or non-medical, and how they cooperate with their attending physicians differs (*22*). In the background of the extraction of challenges related to medical and nursing care workers at home, we considered that the interviewees had a variety of opportunities to come into contact with medical and nursing care workers at home in their daily work. From the remarks of the research participant who was a care manager (ID3), it was shown

that the common competency of medical and nursing care workers at home is collaboration. The skills and knowledge of helpers, home-visit nurses, and clinic nurses who support care in daily living were also pointed out as other competencies.

Because elderly people requiring nursing care frequently use home-visit nursing care after being discharged from the hospital, home helpers are required to have high skills and knowledge. In particular, improving the competency of helpers leads to the smooth acceptance of elderly people at home and may affect hospital admission and discharge support.

Challenges-related to discharge support for the elderly themselves

Regarding intrinsic problems of the elderly, the theme of (III) Challenges related to discharge support for the elderly themselves included "Powerless elderly", "Difficulty in confirming intentions of the elderly", and "Necessity of intervention for elderly who require medical treatment".

The content included in this theme was almost the same as the screening items used to calculate payment of medical services in the health insurance system. Screening items were based on the results of studies (*23,24*) identifying patients at high risk for re-hospitalization and long-term hospitalization, and they matched the actual requirements of patients requiring discharge support. However, even if discharge support was provided to a patient who needed it, there were cases of maladaptation, depending on the timing and procedure used for discharge support. In hospital discharge support in acute wards, patients are required to make various decisions in a short period during the process of returning to daily living from the non-daily living environment of hospitalization. The difficulty of making decisions in daily living after discharge is considered to be the essence of the problem of discharge support caused by the elderly patients themselves.

Regarding the decision-making ability of the elderly, Silveira *et al.* reported that about 70% of the terminally ill elderly show a decline in decision-making ability (*25*). The Ministry of Health, Labour, and Welfare has presented several guidelines on decision-making support for the elderly. The guidelines do not recommend making fixed assumptions about decision-making capacity. As the decision-making ability of the elderly changes depending on their medical condition, symptoms, and behavior, it is recommended that their decision-making ability be respected according to the current situation (*26*). One research participant made the statement, "Basically, I think everyone needs discharge support". This remark supports the idea that all elderly people need discharge support if it leads to decision-making support, even if it does not fall under the criteria for calculating payment of medical services in the health insurance system. People who provide decision-making support in relation to discharge are not limited to specialists who provide care or administrative staff; rather, this support is provided by a wide range of people who have contact with the patient and know him or her well. In the provision of decision-making support for the elderly according to the situation as well as sharing their expressed intentions, rather than making a judgment based on a single assessment, involving a variety of people will lead to solving the challenges associated with discharge support that are faced by elderly individuals themselves.

Nursing care system dependent on family

Regarding discharge support for elderly, the theme of (IV) Nursing care system dependent on the family included "Insufficient nursing care capabilities of the family", "Difficulty in leaving the hospital at home due to the burden of nursing care", and "Sorry about family cooperation".

Family caregivers who care for elderly individuals are known to experience physical, mental, and economic burdens. In particular, dementia or terminal illness (of the care recipient) are believed to be associated with a sense of caregiving burden (*27*). With the development of the long-term care insurance system in Japan, families who care for the elderly at home have various options for public service support. However, such support has limited effect in reducing the burden of caregiving on families (*28*).

We suggest that there is still a need for family care at the time of discharge, even though service options have increased. The structural factors of the family's ability to provide nursing care that are related to the sense of burden of nursing care include the ability to practice nursing care and negative emotional expression toward nursing care (*29*). Access to public service support is unlikely to resolve hospital discharge support related to family caregiving burdens. No solution was found in this study to ensure a care system that would allow the family to accept discharge.

Impact of payment of medical service in the health insurance system and payment of long-term care services

The theme of (V) Impact of payment of medical service in the health insurance system and payment of long-term care services included "Insufficient medical/nursing fees" and "Acceptance of patients according to hospital functions" regarding hospital discharge coordination related to the system.

The review of payment of medical services in health insurance system points has been politically induced as an opportunity to solve medical problems. Regarding the impact of payment of medical services in health insurance system revisions on discharge support, one interviewee commented, "*I wonder if the addition is*

significant. It's clearly different from 10 years ago". It is thought that the effect of policy guidance has permeated the field in terms of payment of medical services in the health insurance system. "Improved hospital discharge support" was extracted as the solution theme [cooperation improved by addition]. Furthermore, [conferences before discharge are used] and [use of contact points for cooperation between patients and residents] were cited as specific examples of operation.

Nursing staff pointed out the low remuneration for cooperation. ID2 noted that, "*Even if the patient's pre-hospital information is sent to the hospital as material for discharge support, there is no additional point for payment of medical services in the health insurance system*".

In the 2022 revision of payment of medical services in the health insurance system, the facility standards, which are the requirements for calculating the hospital admission and discharge support addition, were reviewed. One solution to this challenge is improved collaboration through financial incentives by payment of medical services in the health insurance system. We suggest that the theme of [Impact of payment of medical service in the health insurance system and payment of long-term care services] is a continuous solution, and the results thus far indicate that it has had some effect.

While CICS aims to establish a system for each municipality, medical services in the health insurance system require consideration of challenges and solutions at the national and prefectural levels, and contradictions in the integration of medical and long-term care were extracted.

Limitations of the research

Based on the conceptual framework of integrated care, which is the theoretical background of the CICS, this research aimed to address the issues and solutions of discharge support in the acute ward for the elderly. The results were obtained from interviews with support providers involved in the CICS and patients and families in Kita Ward, Tokyo. However, these results were obtained from a limited area, and they should not be generalized to other areas. In addition, there was a bias in the types of occupations of the interviewees. Even so, this study was significant in that it clarified the issues associated with discharge support and reflected the circumstances of a specific region and the solutions considered by the parties concerned.

Conclusion

Challenges include [Disparity between medical and lifestyle perspectives] and themes related to integration between support providers. As solutions, we extracted themes that show the cooperation of residents and professionals [Community connections] and the work of support providers involved in discharge support.

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Bloodstream infections in the elderly Japanese population: Current reality and countermeasures

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Abstract: We reviewed bloodstream infections in the elderly in Japan, referring to data recently reported from the National Center for Global Health and Medicine in Tokyo. We divided the locations of bloodstream infections into Hospital-onset (HO), healthcare-associated (HCA), and CA (community-acquired), as the elderly reside in different places. The study focused on the fact that the general condition and underlying diseases of the elderly differ by age group. And thus, we divided them into three groups: Pre-old (65–74 years), Old (75–89 years), and Super–old (≥ 90 years), and compared their characteristics of bloodstream infections. HO bacteremia was most common in the pre-old group. On the other hand, HCA bloodstream infections tended to increase as the population aged, and it was most prevalent in super-old group. According to the study results, early intervention through infectious diseases (ID) consultation may improve the prognosis of bloodstream infections even in the elderly. Since the rate of ID consultation is lower in the super-old group than in other groups, this group may be a significant target. In conclusion, a study of a cohort of elderly patients with bloodstream infections in Japan indicates that bloodstream infections in patients over 65 years is not uniform.

***Keywords*:** elderly Japanese population, older people, bacteremia

Introduction

Japan is one of the "super-aging" countries, and the average life expectancy in 2022 is 87.09 years for women and 81.47 years for men, one of the highest in the world (*1*). The number of elderly people in the world is expected to increase in the future as the population ages. Among the infections of various organs, bloodstream infection is an extremely important infectious disease because of its high mortality rate, which is often associated with sepsis (*2*).

Although bloodstream infections are a threat to elderly patients, it is difficult to single out the elderly population as a whole. Among the elderly, it is clear that the mortality rate of bloodstream infections also increases with increasing age (*3-6*). Our knowledge of bloodstream infections in older adults in Japan is limited. We have recently reported on bloodstream infections in the elderly from the National Center for Global Health and Medicine (NCGM) in Tokyo. In this letter, we refer to these data and provide an overview of bloodstream infections in the elderly in Japan (*7*).

Descriptive characteristics of the elderly patients with bloodstream infections in the NCGM

We conducted a study to determine the clinical epidemiology and characteristics of bloodstream infections in the elderly patients (1,415 patients with 1,211 episodes excluding contamination) aged 65 years or older who had been diagnosed with bloodstream infections at our center (*7*). In this study, the older adults were classified into Pre-old (65–74 years: n = 397, 32.8%), Old (75–89 years: n = 658, 54.3%) and Super-old (≥ 90 years: n = 156, 12.9%) for analysis according to the definitions of the Japan Geriatrics Society and the Japan Geriatrics Society.

Descriptive characteristics differed significantly among the three groups. Hospital-onset (HO) bacteremia was most common in the Pre-old group. On the other hand, as the population aged, there was a trend toward an increase in healthcare-associated (HCA) bloodstream infections in the Super-old group, which was associated with an increase in nursing home residency (Figure 1A). Among underlying diseases, solid malignancies decreased from 36% in the Pre-old group to 11.5% in the

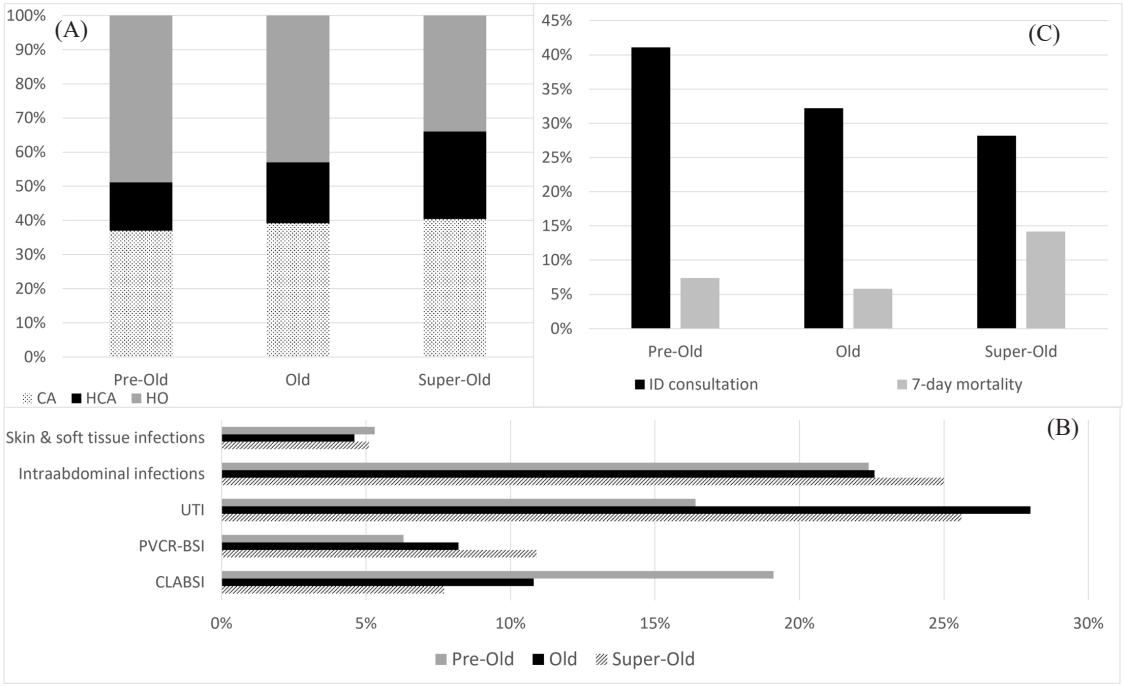

Figure 1. (A) Percentage of bloodstream infections among facilities by age at which the patient developed a bloodstream infection; (B) Causes of bloodstream infections by age; (C) ID consultation rates and 7-day mortality rates by age group for bloodstream infections. *Abbreviation*: CA, community-acquired; HCA, healthcare-associated; HO, hospital-onset; UTI, urinary tract infection; PVCR-BSI, peripheral venous catheter-related bloodstream infection; CLABSI, Central-line associated blood stream infection; ID, infectious disease.

Super-old group, while congestive heart failure increased from 8.8% in the Pre-old group to 18.6% in the Super-old group.

The focus of bloodstream infections also differed significantly among the three groups (Figure 1B). Central-line associated bloodstream infections (CLABSIs) were most common in the Pre-old group, while peripheral venous catheter-related bloodstream infections (PVCR-BSIs) were most common in the Super-old group, showing different trends even for the vascular device infection.

The 7-day fatality rate was highest in the Super-old group. Infectious disease (ID) consultations were most common in the Pre-old group (Figure 1C).

Independent predictors of mortality

Multivariate analysis was performed to determine which factors were independent predictors of mortality in the elderly population with bloodstream infections in the NCGM (*7*). The results showed that the Super-old group and hospital-onset each contributed to an increased risk of death (adjusted odds ratio [95% confidence interval]: 2.09 [1.13–3.88], 1.97 [1.20–3.33], respectively), whereas ID consultation was associated with a decreased risk of death (0.59 [0.35–0.99]).

The appropriate tailored management of bloodstream infections in elderly patients.

A review of more than 1,000 episodes of bloodstream infections in the older adults revealed some interesting points. Among the older adults, the underlying disease and the place of occurrence of bloodstream infections differed among different age groups, and there were also differences in the focus of infection of bloodstream infections: Super-old patients were more likely to live in nursing homes and to have urinary tract infections than Pre-old patients who were more likely to develop CLABSIs while hospitalized for treatment of malignancies.

The trend toward a higher risk of death from bloodstream infections due to hospital-onset or older adults was similar to other studies (*5,8,9*). Previous studies have suggested that infectious disease (ID) consultation for bloodstream infections improves the prognosis of bloodstream infections (*5*), however the effect of ID consultation in elderly patients with bloodstream infections has not been clarified. Our study suggests that early intervention with ID consultation may improve the outcome of bloodstream infections even in older adults by recommending changes of antimicrobial regimens, *etc*. Since the ID consultation rate was lower in the Super-old group than in the other groups, this group may be a particularly important target.

On the other hand, there are many opportunities to confirm the wishes of the patient and family regarding end-of-life care when the patient is admitted to the hospital following a bloodstream infection. The natural

course of advanced dementia, advanced malignancy, or other terminal illnesses themselves cannot be improved by antimicrobial agents. Therefore, when considering the treatment of patients at the end of life, it is important to set treatment goals and consider the place of antimicrobial therapy in this context (*10*). It is desirable to have more active discussions on the relationship between infectious diseases and end-of-life care in Japan in the future.

In conclusion, a study of a cohort of older adults with bloodstream infections in Japan showed that bloodstream infections in patients ≥ 65 years are not uniform. Tailored preventive and therapeutic approaches including ID consultation are needed to optimally manage BSI in the elderly patients.

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Perspectives			
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