



Translated Paper

Distribution characteristics of residences for elderly people with services in the greater Tokyo area based on the residents' care level

Ken Miura  and Kei Yasuda

Department of Architecture, Faculty of Engineering, Kyoto University, Kyoto, Japan

Correspondence

Ken Miura, Department of Architecture, Faculty of Engineering, Kyoto University, C2-204, Nishikyo-ku, Kyoto 615-8540, Japan.
Email: miura@archi.kyoto-u.ac.jp

Funding Information

No funding information is provided.

The Japanese version of this paper was published in Volume 86 Number 790, pages 2578–2586, <https://doi.org/10.3130/aija.86.2578> of *Journal of Architectural and Planning (Transactions of AIJ)*. The authors have obtained permission for secondary publication of the English version in another journal from the Editor of *Journal of Architectural and Planning (Transactions of AIJ)*. This paper is based on the translation of the Japanese version with some slight modifications.

Received April 11, 2023; Accepted June 23, 2023

doi: 10.1002/2475-8876.12393

Abstract

This study analyzed location trends in residences for elderly people with services in the Tokyo Metropolitan Area, and the result shows that residences for elderly people with services in the central metropolitan area have a large area of housing, and many residents with high levels of independence live in it and are provided home-care services for the elderly. On the contrary, residences for elderly people with services in remote areas from the Tokyo metropolitan area are smaller, and many older adults need nursing care to move into these housing units. Also, these tiny residences for elderly people have a daycare service to provide care for their residents.

Keywords

degree of nursing care level, residences for elderly people with services, segregation adjunct care function, Tokyo metropolitan area

1. Background and Objectives

Residences for elderly people with services (REPS) were established in October 2011 with the policy goal of housing 4% of the elderly population. Over the past 8.5 years, more than 26 800 units have been provided with the help of subsidies (as of November 2020).¹ However, more REPS have been allocated to people in need of nursing care than anticipated, and those units are often considered final abodes for the allocated residents. As a result, various challenges have been identified, including the need to address dementia and end-of-life caregiving in order for the residences to become the final home of the elderly,² as well as the sharing of roles with nursing care facilities³ [Note 1] such as special nursing homes for the elderly.

Research on buildings and facilities for REPS⁴ [Note 2] has been subsidized by the Ministry of Health, Labor, and Welfare. Fixed-point observation of elderly care facilities, including REPS, has been implemented every year to analyze trends across the nation. Suzuki et al.⁵ have been conducting questionnaire surveys with unit residents to analyze the site quality of the units. Moreover, Yamaguchi et al.⁶ have been

investigating the characteristics of construction projects by analyzing the ground plans of REPS. Sannomiya et al.⁷ conducted a study similar to ours, in which they investigated REPS across the nation on a city-by-city basis in terms of their areas, facilities/amenities, space composition, and services provided. The results of their study showed that most REPS in rural municipalities were providing nursing care in the group-living format; however, as the by-city scale expanded, the number of REPS fully equipped with facilities/amenities increased, with a higher percentage of REPS providing simple services such as serving meals. Based on these results, they indicated qualitative differences in REPS depending on the size of the city. Moreover, more than 50% of the residents in a group-living REPS were either independent or mildly dependent, indicating a possible mismatch between the space composition of REPS and the lifestyle of their residents. The Ministry of Land, Infrastructure, Transport, and Tourism Study Group held study sessions for exploring the policies on the maintenance of REPS.⁸ In these sessions, a geographic information system (GIS) was utilized to investigate the relationships between urban planning areas and REPS, access to

TABLE 1 The number of housing units and the residents' average long-term care level in REPS

	Number of dwelling unit							
	-30		30-50		50-		Total	
	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio
Average nursing care level (-1)	172	44.3%	136	35.1%	80	20.6%	388	100.0%
Average nursing care level (1-2)	455	47.4%	285	29.7%	220	22.9%	960	100.0%
Average nursing care level (2-3)	608	53.4%	363	31.9%	168	14.7%	1139	100.0%
Average nursing care level (3-)	240	65.6%	110	30.1%	16	4.4%	366	100.0%
Total	1475	51.7%	894	31.3%	484	17.0%	2853	100.0%

transportation facilities such as bus stops, access to medical institutions, and relationships with disaster danger zones. The results revealed some relationships between REPS and their site locations. For instance, more REPS were provided in proportion to the elderly population in areas with lower land prices, and when the provision rate increased in proportion to the elderly population, the number of REPS situated outside urban planning areas increased.

REPS is a framework aimed at achieving continued habitation in familiar places, also known as “aging-in-place.” People from remote regions are expected to be accommodated in urban areas with highly developed transportation systems. However, the current REPS is designed to manage applications and registrations at the prefectural, ordinance-designated city, and core city levels, making it difficult to fully monitor the situation at the supra-municipal level. Accordingly, it is unclear what impact metropolitan areas have on the surrounding regions. In the Tokyo metropolitan area, where the very elderly population is anticipated to grow, the construction of REPS is expected to continue in the foreseeable future. This emphasized the importance of comprehensively understanding the actual circumstances in a broad context. This study aimed to reveal the distribution characteristics of REPS, mainly in the Tokyo metropolitan area [Note 3], where approximately 30% [Note 4] of all REPS are situated, based on the nursing care levels of the residents and the types of nursing services provided, while also referring to the state of REPS nationwide.

2. Study Methods

REPS have been constructed for a wide range of people, from those who are mildly dependent on others to those who require nursing care, making it difficult to visualize the livelihoods of individual residents. To address this issue, the “REPS Information-sharing System (ISS)”⁹ was established and has since been providing elderly resident applicants and their families with basic information on the housing, such as its name, address, rent, exclusive area, presence/absence of annexed nursing facilities, and number of years after construction (hereinafter referred to as the “registration information”). In May 2017, the ISS also started providing/distributing management-related information on REPS status reports and life consultation services (basic services included in life support service expenses, status reports, life consultation/emergency responses, etc.), as well as the residents' nursing care level, age, and male-to-female ratio (hereinafter the “management information”), albeit as optional information. In this study, we obtained 7415 items of registration information and 3261 items of management information from the nationwide REPS [Note 5], which were posted on the information provision system as of August 2019, and performed an ArcGIS analysis

using a “CSV address matching service” [Note 6]. This report primarily presents the results from the Tokyo metropolitan area, where a characteristic distribution tendency was noted.

3. REPS Status Analyzed from Registration Information

Based on the 7415 items of nationwide REPS registration information, the scale of each REPS (number of dwelling units), exclusive area of each dwelling unit, and rent per square meter were calculated. Consequently, the mean number of dwelling units per REPS was 33.3 (median: 30.0), indicating that REPS with approximately 30 dwelling units were the most common. An analysis of exclusive area showed that each dwelling unit had a mean exclusive area of 21.8 m² (median: 19.4 m²), revealing that the majority of dwelling units were smaller than 25 m². Moreover, the mean rent of a dwelling unit, as calculated from the mean REPS rent and mean exclusive area, was 2742 yen/m², indicating that the monthly rent for an average 20-m² dwelling unit would be 54 840 yen.

Next, based on 2853 of the 3261 items of REPS management information that also listed the residents' nursing care levels along with the number of residents, the mean nursing care level of each REPS [Note 7] was calculated and the relationships between nursing care levels and the number of dwelling units, exclusive area, and rent were analyzed.

As shown in Table 1 and Figure 1, larger-scale REPS with 50 or more dwelling units tended to accommodate people with lower nursing care levels. Conversely, people with higher nursing care levels were more likely to be housed in smaller-scale REPS with ≤30 dwelling units. Small dwelling units with an exclusive area of <20 m² accommodated 87.4% of residents

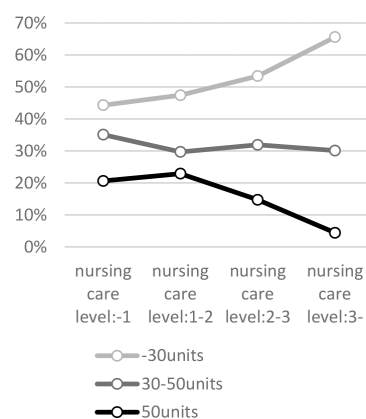
**FIGURE 1** Relationships between long-term care level and the number of housing units in residences for elderly people with services

TABLE 2 Dwelling unit areas and the residents' average long-term care level in REPS

	Dwelling unit areas							
	–20 (m ²)		20–30 (m ²)		30– (m ²)		Total	
	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio
Average nursing care level (–1)	91	23.5%	164	42.3%	133	34.3%	388	100.0%
Average nursing care level (1–2)	618	64.4%	309	32.2%	33	3.4%	960	100.0%
Average nursing care level (2–3)	904	79.4%	228	20.0%	7	0.6%	1139	100.0%
Average nursing care level (3–)	320	87.4%	45	12.3%	1	0.3%	366	100.0%
Total	1933	67.8%	746	26.1%	174	6.1%	2853	100.0%

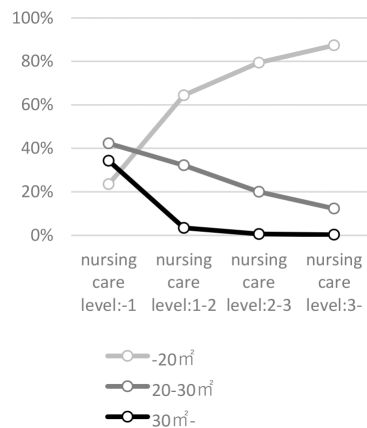
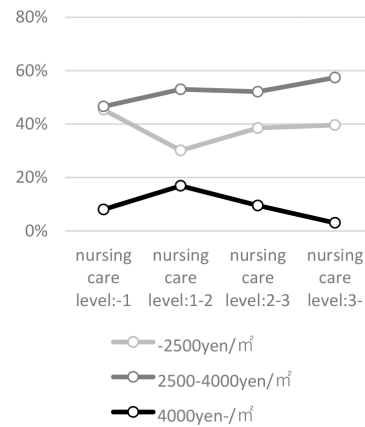
with a mean nursing care level of ≥ 3 (Table 2 and Figure 2). This implies that elderly people requiring a higher level of care were more likely to save their rent because they had to pay for nursing insurance in addition to the rent. Meanwhile, nursing care levels were not as significantly correlated with rent as with the number of dwelling units and exclusive area (Table 3 and Figure 3). Residents with a mean nursing care level of <1 were more likely to be housed in a REPS in the higher rent brackets, suggesting that people applying for REPS while still being in relatively good shape were more inclined to choose convenient locations with higher land prices.

As with the above findings, the data as of August 2019, which was investigated in this study, demonstrated a nationwide trend in which REPS for highly independent elderly people are greatly affected by the level of nursing care required by the elderly residents. In particular, REPS that accommodated very elderly residents tended to be larger in

scale, have a larger dwelling space, and charge a higher rent, whereas REPS intended for elderly residents requiring higher levels of nursing care had a lower rent. These results were consistent with the findings of previous studies.

4. Very Elderly Population and REPS Construction

To analyze the relationships between the aging of the population and the supply of REPS, the supply status of REPS in proportion to the very elderly population (population of people aged ≥ 75 years) was calculated based on the “Long-term Care Insurance Business Status Report (tentative edition)” published by the Ministry of Health, Labor, and Welfare in January 2019. Next, the mean nursing care level in each prefecture was calculated from the nursing care population data listed in the abovementioned report (Table 4: ②/①). Then, the mean nursing care level of REPS residents in each prefecture was

**FIGURE 2** Relationships between long-term care levels and dwelling unit areas in residences for elderly people with services**FIGURE 3** Relationships between long-term care levels and rent per square meter in residences for elderly people with services**TABLE 3** Rent per square meter and the residents' average long-term care level in residences for REPS

	Rent per square meter							
	–2500 (yen/m ²)		2500–4000 (yen/m ²)		4000 (yen-/m ²)		Total	
	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio
Average nursing care level (–1)	176	45.4%	181	46.6%	31	8.0%	388	100.0%
Average nursing care level (1–2)	289	30.1%	509	53.0%	162	16.9%	960	100.0%
Average nursing care level (2–3)	438	38.5%	593	52.1%	108	9.5%	1139	100.0%
Average nursing care level (3–)	145	39.6%	210	57.4%	11	3.0%	366	100.0%
Total	1048	36.7%	1493	52.3%	312	10.9%	2853	100.0%

TABLE 4 Population over 75 years old, average long-term care level, and residents' average long-term care level of REPS in each prefecture

Name of prefecture	Population over 75 years old ①	Number of Dwelling Units ②	②/① (%)	Residents' Average degree of long-term care level ③	Average degree of long-term care level ④	③ - ④
Hokkaido	557,836	19,604	3.51%	1.57	1.91	-0.34
Aomori	141,677	2,668	1.88%	2.10	2.32	-0.22
Iwate	139,505	1,998	1.43%	2.23	2.22	0.01
Miyagi	207,996	3,678	1.77%	1.76	2.07	-0.31
Akita	122,295	1,845	1.51%	1.82	2.25	-0.43
Yamagata	118,551	1,390	1.17%	1.97	2.30	-0.33
Fukushima	189,009	3,064	1.62%	1.98	2.13	-0.15
Ibaragi	278,869	5,364	1.92%	2.44	2.19	0.25
Tochigi	177,493	4,465	2.52%	2.08	2.15	-0.07
Gunma	190,570	5,141	2.70%	2.75	2.20	0.55
Saitama	686,281	14,051	2.05%	2.16	2.10	0.06
Chiba	599,437	11,466	1.91%	1.96	2.03	-0.07
Tokyo	1,126,533	14,718	1.31%	1.52	2.09	-0.57
Kanagawa	823,677	13,078	1.59%	1.56	2.09	-0.53
Yamanashi	83,597	1,557	1.86%	2.56	2.43	0.13
Niigata	237,652	3,019	1.27%	1.67	2.24	-0.57
Toyama	111,877	2,288	2.05%	2.15	2.20	-0.05
Ishikawa	109,084	1,751	1.61%	1.58	2.14	-0.56
Fukui	76,739	1,564	2.04%	1.68	2.26	-0.58
Nagano	219,834	3,382	1.54%	2.11	2.16	-0.05
Gifu	206,989	3,073	1.48%	2.14	2.16	-0.02
Shizuoka	373,716	5,109	1.37%	1.82	2.07	-0.25
Aichi	662,847	10,097	1.52%	1.94	2.00	-0.06
Mie	183,130	5,970	3.26%	2.25	2.11	0.14
Shiga	120,315	2,325	1.93%	2.19	2.09	0.10
Kyoto	257,720	5,405	2.10%	2.13	2.06	0.07
Osaka	875,375	27,236	3.11%	2.59	2.01	0.58
Hyoto	541,987	14,433	2.66%	2.11	1.93	0.18
Nara	145,486	2,509	1.72%	2.12	2.03	0.09
Wakayama	107,025	2,982	2.79%	2.61	2.02	0.59
Tottori	56,541	1,812	3.20%	1.38	2.16	-0.78
Shimane	74,810	1,781	2.38%	2.13	2.09	0.04
Okayama	190,437	3,555	1.87%	2.17	2.05	0.12
Hiroshima	274,177	7,332	2.67%	1.85	2.00	-0.15
Yamaguchi	158,301	3,385	2.14%	1.82	2.01	-0.19
Tokushima	79,111	2,341	2.96%	2.27	2.10	0.17
Kagawa	98,018	2,499	2.55%	2.01	2.02	-0.01
Ehime	145,262	4,401	3.03%	2.50	2.06	0.44
Kochi	80,591	1,022	1.27%	1.93	2.24	-0.31
Fukuoka	459,150	8,892	1.94%	1.68	1.97	-0.29
Saga	78,905	571	0.72%	1.61	1.92	-0.31
Nagasaki	142,299	3,089	2.17%	1.79	1.97	-0.18
Kumamoto	178,097	3,070	1.72%	1.44	2.08	-0.64
Oita	123,440	2,166	1.75%	2.00	2.12	-0.12
Miyazaki	113,549	1,098	0.97%	1.66	2.20	-0.54
Kagoshima	166,868	2,467	1.48%	1.99	2.17	-0.18
Okinawa	103,556	2,442	2.36%	2.50	2.35	0.15
Ave.	259,494	5,259	2.01%	2.01	2.12	-0.11

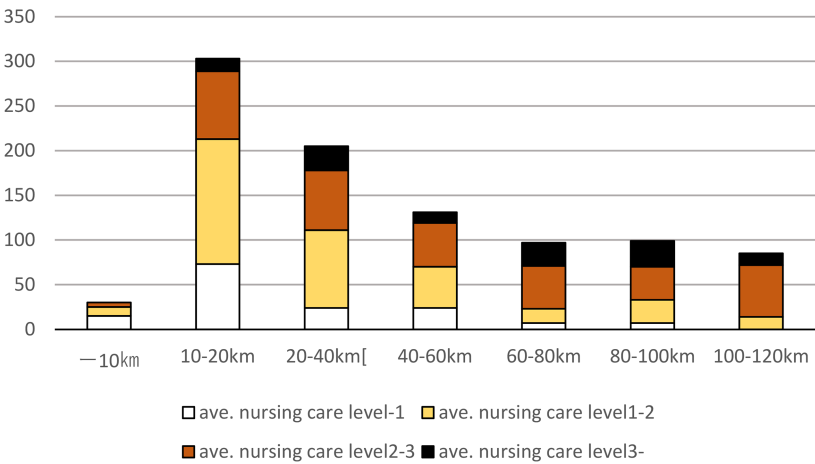


FIGURE 4 Distance from Tokyo Station and average long-term care level in residences for elderly people with services

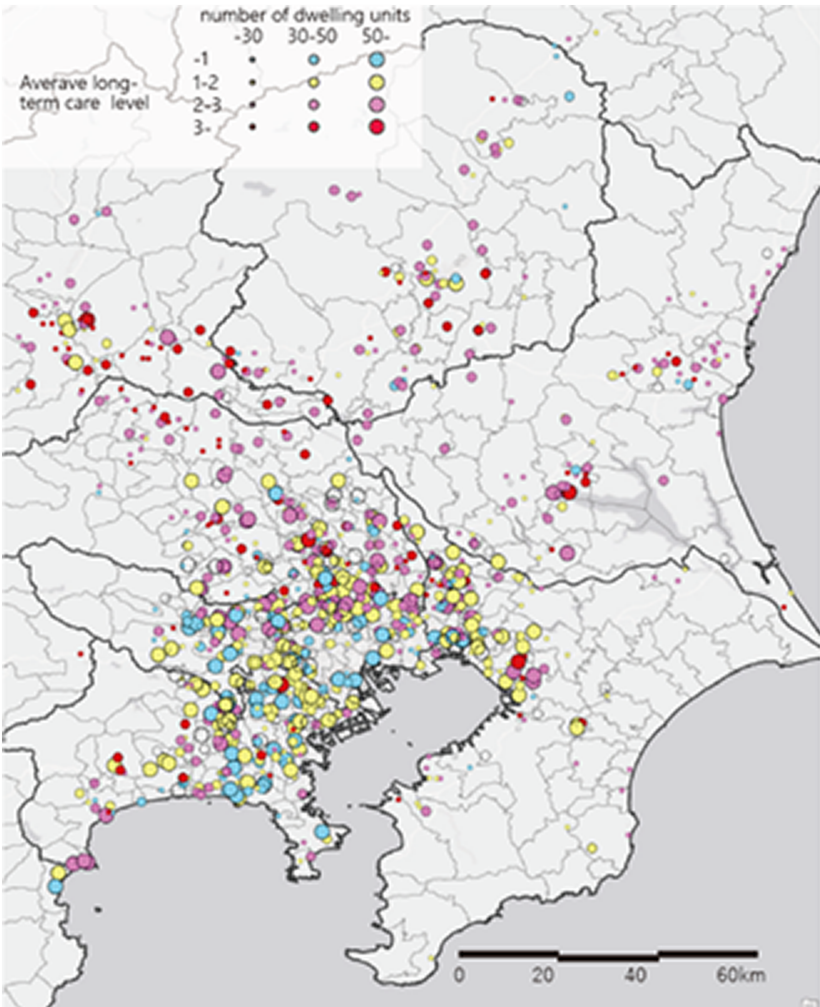


FIGURE 5 Distribution of residences for elderly people with services in the Greater Tokyo area based on the number of dwelling units

calculated based on the ISS management information. Finally, the mean nursing care level of REPS residents was compared with the mean nursing care level in the corresponding prefecture to determine whether the mean nursing care level of

REPS residents was higher or lower than the prefectural level (Table 4: ③–④). The results showed that the proportion of REPS to the very elderly population was 2% on a national scale. In prefectures

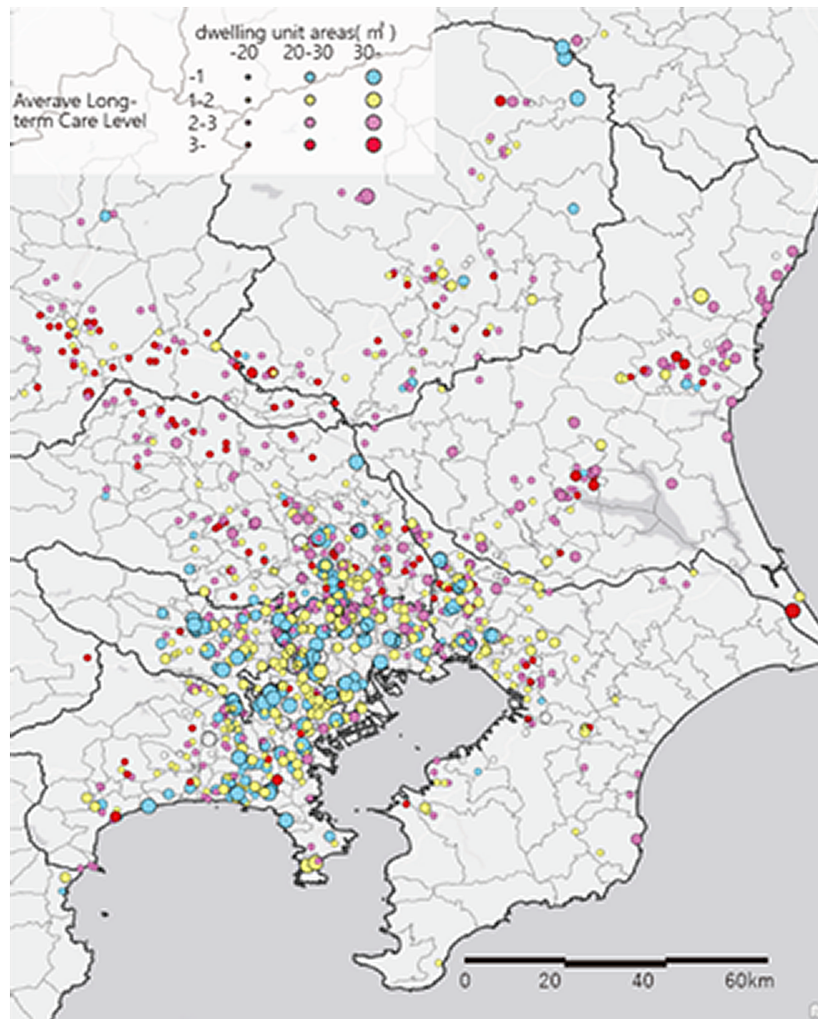


FIGURE 6 Distribution of residences for elderly people with services in the Greater Tokyo area based on dwelling unit areas

with a higher REPS proportion, the mean nursing care levels of REPS residents were higher than those in the respective prefectures. For instance, in the Kinki and Shikoku regions, many REPS were constructed in proportion to the very elderly population, and at the same time, the mean nursing care levels of REPS residents were higher than those in the respective prefectures. In the Tokyo metropolitan area, where slightly less than 30% of the REPS in the entire nation are situated, the proportions of REPS to the advanced elderly population were as low as 1.3% and 1.6% in Tokyo and Kanagawa, respectively. Furthermore, the mean nursing care levels of REPS residents were 1.52 and 1.56, respectively, which were lower than those in the respective prefectures. Contrastingly, in Ibaraki, Gunma, Saitama, and Yamanashi prefectures, where the proportion of REPS constructed for the very elderly population was higher than 2%, the mean nursing care levels of REPS residents were higher than those in the respective prefectures. For example, in Ibaraki, the mean nursing care level of REPS residents in the prefecture was 2.75, which was considerably higher than the prefectural elderly average of 2.2.

The above results demonstrated that elderly people requiring higher levels of nursing care were more likely to be accommodated in REPS in prefectures with a higher proportion of REPS to the very elderly population. Conversely, the nursing care

level of REPS residents was relatively lower in prefectures with a lower proportion of REPS to the very elderly population.

5. Mean Nursing Care Levels of REPS Residents in Different Distance Zones

In some prefectures, the mean nursing care level required by REPS residents was higher than the mean nursing care level required in each prefecture. This might be partially attributed to elderly people who need nursing care from another prefecture and cross the prefectural border to be accommodated in that prefecture. To determine whether this was true, the locations of REPS in the Tokyo metropolitan area were classified into different distance zones and the characteristics of REPS situated in these different distance zones were tallied using ArcGIS (Figure 4). The results showed that as the distance from central Tokyo increased, the number of REPS housing residents with lower care levels decreased, whereas the number of REPS housing residents with higher care levels increased. Moreover, the further a REPS was located from central Tokyo, the fewer the dwelling units and the smaller the exclusive area tended to be.

The widespread distribution of REPS locations around Tokyo was mapped using the GIS to visualize the relationships between

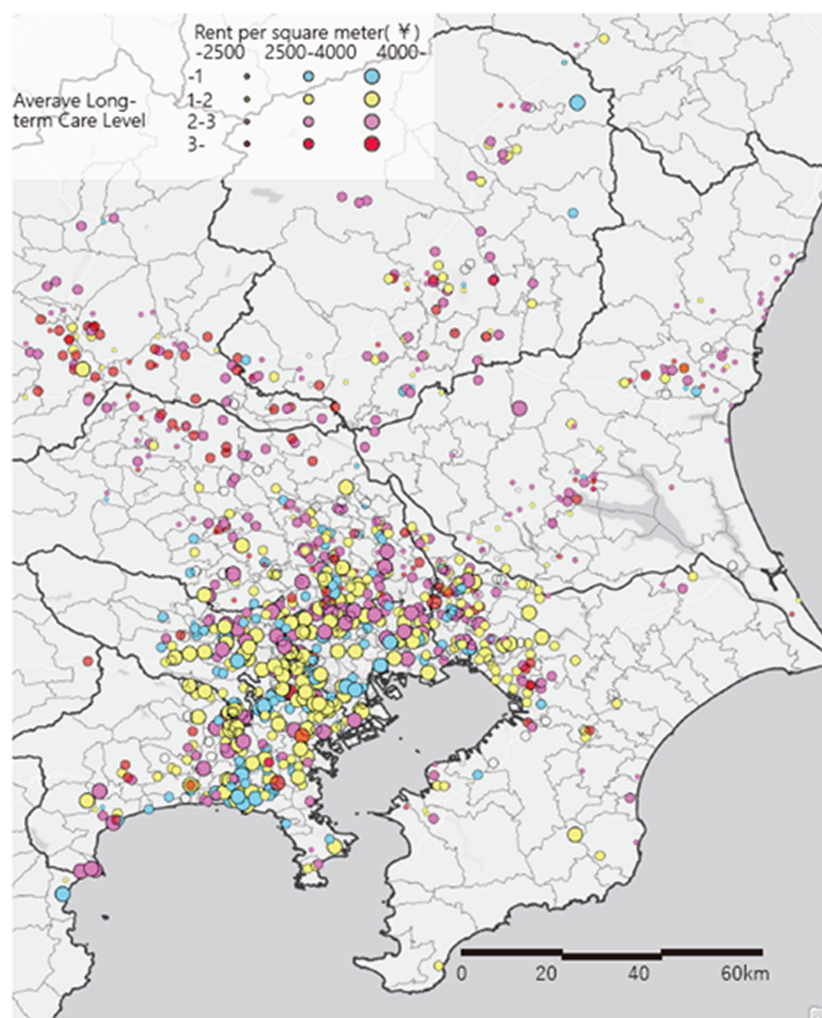


FIGURE 7 Distribution of residences for elderly people with services in the Greater Tokyo area based on rent per square meter

nursing care level and the number of dwelling units (Figure 5), nursing care level and exclusive area (Figure 6), and nursing care level and rent per m^2 (Figure 7). This revealed that REPS intended for highly independent elderly residents were distributed in convenient and easily accessible locations within a 60-km radius of central Tokyo, and these residences had larger dwelling spaces, more dwelling units, and higher rent. Conversely, as the distance from central Tokyo increased beyond 60 km, the REPS for elderly residents requiring nursing care increased, and these residences tended to have a smaller exclusive area, fewer dwelling units, and lower rent.

These results validate the hypothesis that the mean nursing care level of the elderly among REPS residents in Gunma, Ibaraki, and Yamanashi was lower than the average in the respective prefectures because elderly citizens in Tokyo and Kanagawa, where demand for REPS outstripped supply, had migrated extensively in search of REPS with affordable rent.

6. The Reality of Attached Nursing Care Services

What impact did such an extensive migration of elderly people requiring nursing care have on the hardware and software aspects of a REPS? At a REPS, the staff members responsible for monitoring and caregiving are stationed during the day. In

principle, however, the staff members responsible for nursing care are not exclusive REPS employees; instead, they often provide nursing care services to the general public from their establishment on the first floor of a REPS building or in an attached building adjacent to or near a REPS building. Based on the management information, the state and types of such nursing care facilities attached to REPS were investigated nationwide (Table 5). The results showed that only 1702 REPS (22.95%) had no attached nursing care service facilities, whereas a little less than 80% of REPS had 1.67 nursing care service facilities on average. Based on the type of attached nursing care service, daycare was the most common, with 3129 daycare facilities for 43.7% of REPS facilities. The second most common was homecare (2997 facilities, 40.9%), followed by care planning (1878 facilities, 25.4%). The relationships between location and the attachment of daycare and homecare facilities are analyzed in the section below.

7. Distance from Central Tokyo and Attached Nursing Care Services

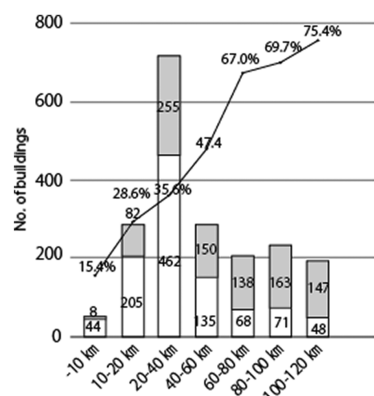
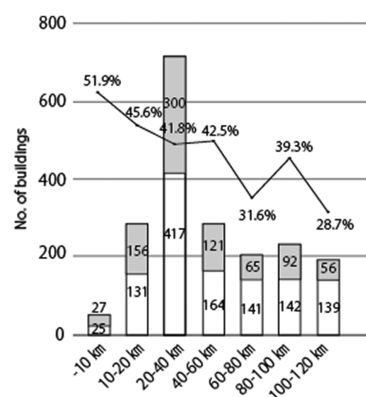
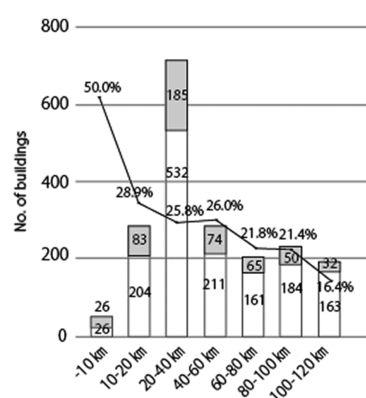
The distribution of REPS-attached daycare and homecare facilities in the Tokyo metropolitan area was tallied using ArcGIS. The results showed that the rate at which daycare facilities were

TABLE 5 Nursing care facilities attached and affiliated to REPS

Care services	Attachment of the services	Ratio (%)
Outpatient day long-term care (day service)	3129	43.7
Home-visit long-term care	2997	40.9
In-home long-term care support	1878	25.4
Home-visit nursing	664	9.0
Multifunctional long-term care in a small group home	615	8.5
Other services	445	8.0
Food service facilities	369	5.0
Clinic	318	4.7
Regular visiting/On demand home-visit long-term nursing care	293	4.0
Short-term admission for daily life long-term care	291	4.0
Communal daily long-term care for a dementia patient	205	2.8
Outpatient rehabilitation (day care)	194	2.7
Rental service of equipment for long-term care covered by public aid	111	1.5
Multifunctional long-term care in a small group home with home-visit nursing	88	1.2
Hospital	75	1.2
Outpatient long-term care for a dementia patient	74	1.0

attached increased as the distance from central Tokyo increased (Figure 8). Conversely, the rate of attachment of homecare and care planning facilities decreased (Figures 9 and 10).

To identify locations with significantly more or fewer day-care and homecare facilities, a hotspot analysis designed to clarify localized spatial correlation was performed. Hotspot analysis is a statistical technique for identifying significant spatial clusters from low/high-value spots using lightweight calculations such as Getis-Ord Gi* [Note 8]. Consequently, cold spots for daycare facilities were observed in the urban areas, whereas many hot spots were observed in Yamanashi, Gunma, northern Saitama, and Ibaraki, indicating that REPS-attached daycare facilities were more common in the periphery of the Tokyo metropolitan area (Figure 11). Contrastingly, hot spots for REPS-attached homecare facilities were more commonly

**FIGURE 8** Residences for elderly people with services with Day Service Center for the elderly, based on distance from Tokyo Station**FIGURE 9** Residences for elderly people with services with home-visit long-term care, based on distance from Tokyo Station**FIGURE 10** Residences for elderly people with services with in-home long-term care support, based on distance from Tokyo Station

noted within the commuting range of central Tokyo, including Tokyo, Kanagawa, and Chiba. On the contrary, cold spots for homecare facilities were primarily distributed in areas abundant in hot spots for daycare facilities, showing a stark contrast (Figure 12).

The above results illustrated the present situation where REPS residents in areas distant from central Tokyo were receiving nursing care via daycare facilities, whereas residents in areas close to central Tokyo were receiving nursing care via homecare facilities. It was revealed that the types of care services provided at REPS differed depending on the location. One possible explanation for this is that daycare services are more efficient than homecare services in dispensing nursing care because one caregiver can look after multiple elderly people in the former, as opposed to the latter, in which one-on-one caregiving is the norm. Hence, establishing daycare facilities is more cost effective from the perspective of business efficiency. Another possible explanation is that while securing space for daycare facilities is easier in suburban areas with low rent, establishing daycare facilities in expensive urban areas is more difficult because of the need to acquire the necessary floor space. Additionally, as mentioned above, REPS in urban areas accommodate relatively spry elderly residents; therefore, homecare services that support daily living at home may be preferred.

Similarly, the types of nursing care services provided differed depending on the distance from central Tokyo. However, daycare facilities are places where elderly people are

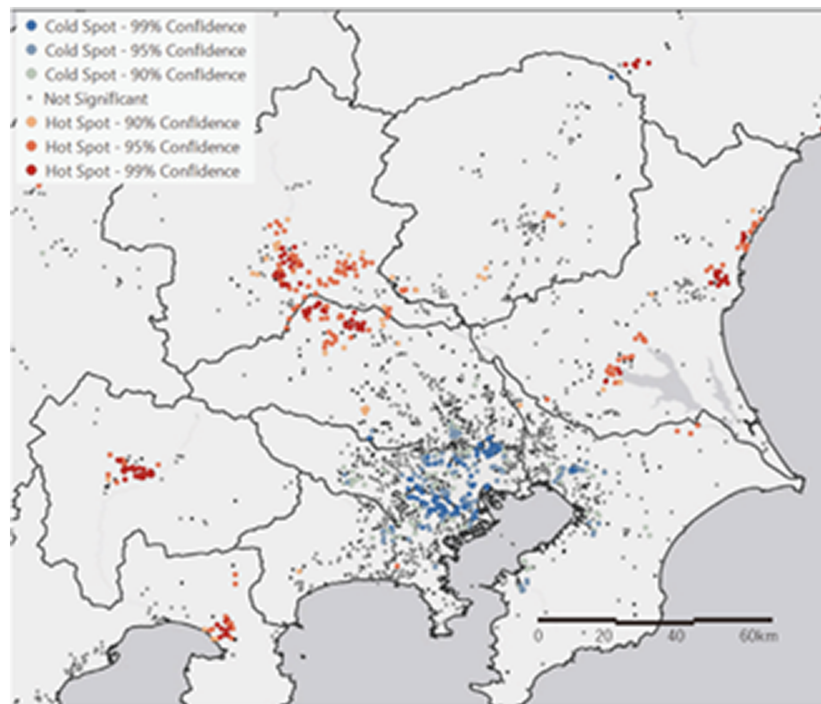


FIGURE 11 Hot and cold spots of residences for elderly people with service with daycare services in Tokyo metropolitan area

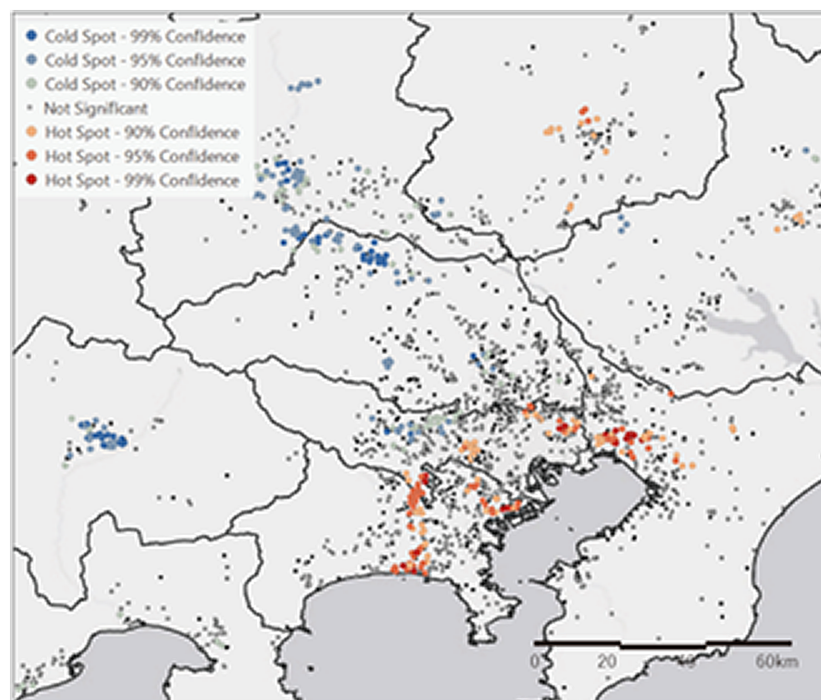


FIGURE 12 Hot and cold spots of residences for elderly people with service a home-care facility in Tokyo metropolitan area

temporarily cared for during the day to allow their caregivers to take a break; these facilities are not designed to provide nursing care in the daily lives of elderly people. Therefore, further discussion is needed about REPS, where single elderly residents are forced to visit attached and affiliated daycare facilities for nursing care because of the unavailability of care within their domicile.

8. Characteristics of REPS Locations by Male-to-Female Ratio

A histogram was created based on the number of male and female residents included in the management information, showing the male ratio of the residents in 3261 REPS nationwide (Figure 13).

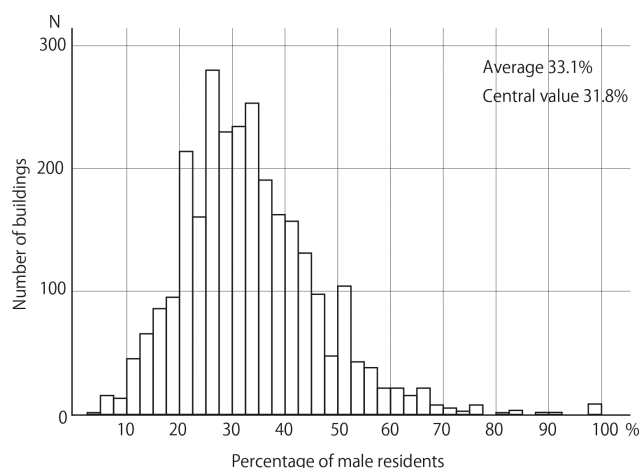


FIGURE 13 Number of residences for elderly people with service based on percentage of male residents

TABLE 6 Characteristics of REPS based on the percentage of male residents

	Percentage of males		
	<30%	30%–50%	50%–
Percentage of males	22.5	38.6	61.1
Number of males	7.3	12.5	13.8
Average age of residents	85.3	83.4	79.9
Nursing care level	1.96	2.06	2.35
Walking time from the station (minutes)	12.3	12.8	16.3
Time after bus drop-off (minutes)	4.1	4.3	4.6
Average square meter (m ²)	21.9	21.8	20.7
Number of housing units	35.2	36.4	29.4
Average house rent (Yen)	65 413.6	60 578.5	51 447.1

Consequently, the mean male ratio of REPS residents was 33.15% nationwide, indicating that women were the majority (66.85%). This is probably attributed to women having a longer life expectancy than men. Nevertheless, there were some Our translation at this instance is as per the source text. Is this “male-to-female ratio”? Two items are required for comparison in a ratio. Please check and revise accordingly at all similar instances. REPS with a higher male ratio. Here, REPS were divided into three groups based on the male ratio (<30%, 30%–50%, and ≥50%), and the data listed in the registration information were tallied (Table 6).

The results showed that residents at REPS with a higher male ratio typically had a younger mean age but a higher mean nursing care level, and these REPS were poorly accessible by public transportation, had a smaller exclusive area, fewer dwelling units, and lower rent per m².

Regarding REPS with a higher male ratio in the Tokyo metropolitan area, the REPS with an exceptionally high male-resident ratio were distributed in Saitama, Gunma, Tochigi, and Ibaraki prefectures (Figure 14); for instance, the percentage of REPS with a male ratio exceeding 50% was 24.7% in Ibaraki, 28.8% in Gunma, 19.3% in Saitama, and 11.7% in Chiba, which were considerably higher than the national average of 7.7%. Contrastingly, it was lower than the national average in Tokyo and Kanagawa at 4.0% and 4.3%, respectively (Table 7).

The above results suggested that elderly men requiring nursing care and with low copayment ability had partially migrated to REPS situated in the periphery of the Tokyo metropolitan area.

9. Conclusion and Discussion

The distribution of REPS in the Tokyo metropolitan area was mapped based on the nursing care levels listed in the management information extracted from the government-run ISS. Consequently, the mapped distribution revealed that the types of REPS differed between convenient urban areas close to central Tokyo and distant suburban areas. Specifically, REPS in urban areas accommodated more residents who are independent, had

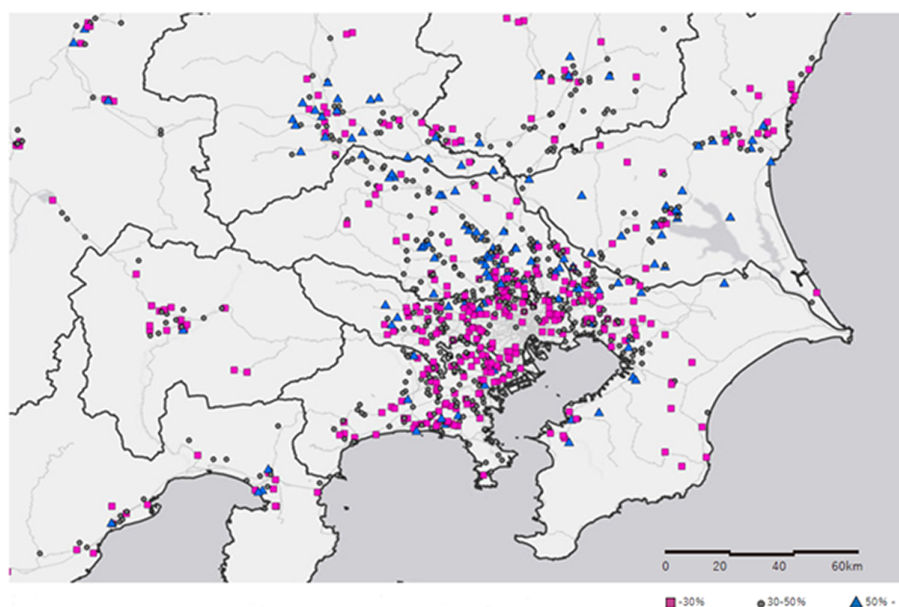


FIGURE 14 Location of residences for elderly people with service in the Greater Tokyo area by percentage of males

TABLE 7 Proportion of male residents in REPS by prefecture

Percentage of Male Residents (%)	-30%	30-50%	50%+
Hokkaido	50.3	44.8	4.9
Aomori	49.0	41.2	9.8
Iwate	54.5	41.0	4.5
Miyagi	36.2	57.4	6.4
Akita	38.5	57.7	3.8
Yamagata	41.7	58.3	0.0
Fukushima	36.2	46.8	17.0
Ibaragi	29.2	46.1	24.7
Tochigi	36.6	53.6	9.8
Gunma	30.3	40.9	28.8
Saitama	24.9	55.8	19.3
Chiba	42.3	46.0	11.7
Tokyo	51.1	44.9	4.0
Kanagawa	41.3	54.4	4.3
Yamanashi	53.1	43.8	3.1
Niigata	36.9	53.1	10.0
Toyama	37.0	63.0	0.0
Ishikawa	30.0	70.0	0.0
Fukui	60.0	40.0	0.0
Nagano	38.5	53.8	7.7
Gifu	55.6	35.5	8.9
Shizuoka	37.0	52.0	11.0
Aichi	48.3	45.9	5.8
Mie	50.9	43.8	5.3
Shiga	57.1	37.2	5.7
Kyoto	64.0	32.0	4.0
Osaka	49.1	44.5	6.4
Hyoto	50.7	44.8	4.5
Nara	40.7	55.6	3.7
Wakayama	59.5	32.4	8.1
Tottori	25.0	75.0	0.0
Shimane	52.2	39.1	8.7
Okayama	59.5	35.7	4.8
Hiroshima	60.7	36.0	3.3
Yamaguchi	77.0	23.0	0.0
Tokushima	44.4	55.6	0.0
Kagawa	56.0	40.0	4.0
Ehime	39.5	55.8	4.7
Kochi	53.8	38.5	7.7
Fukuoka	57.1	41.5	1.4
Saga	50.0	50.0	0.0
Nagasaki	43.3	53.4	3.3
Kumamoto	65.1	30.2	4.7
Oita	50.0	50.0	0.0
Miyazaki	57.1	42.9	0.0
Kagoshima	68.2	31.8	0.0
Okinawa	38.1	52.4	9.5
Ave.	47.4	46.5	6.1

$$G_i^* = \frac{\sum_{j=1}^n w_{ij}x_j - \bar{x} \sum_{j=1}^n w_{ij}}{S \sqrt{\frac{\ln \sum_{j=1}^n w_{ij}^2 - (\sum_{j=1}^n w_{ij})^2}{n-1}}}$$

$$\bar{x} = \frac{\sum_{j=1}^n x_j}{n} \quad s = \sqrt{\frac{\sum_{j=1}^n x_j^2}{n} - (\bar{x})^2}$$

FIGURE 15 Figure of the equation of calculation of Getis-Ord G_i^* [Note 8]

and an exclusive area smaller than 20 m² and provided nursing care via attached daycare facilities. In these suburban prefectures, the mean nursing care levels of REPS residents were higher than those in the other prefectures. This was probably because they accommodated elderly people requiring higher levels of nursing care from urban prefectures, including Tokyo. This situation, in which elderly people requiring nursing care migrated to prefectures in the periphery of the Tokyo metropolitan area, may reflect the fact that these people opted to mitigate medical expenses, including copayments for nursing insurance, rather than staying in familiar neighborhoods. Unlike community-based services, which are restricted to particular localities, the characteristics of REPS as residences are taken into consideration. However, the situation in which low-income, elderly people requiring nursing care are forced to leave familiar neighborhoods may lead to social segregation based on the income and nursing care level of the elderly. Measures must be taken to establish affordable accommodations with monitoring services as safety net housing in urban areas by utilizing existing vacant buildings, and such services should be covered by nursing insurance.

A male-to-female ratio analysis of REPS residents revealed that REPS with a higher male-resident percentage were distributed in the periphery of the Tokyo metropolitan area. REPS with a higher male ratio were characteristically situated in relatively inconvenient locations with lower rent, and the residents tended to be relatively younger with higher nursing care levels. This revealed that low-income, elderly men requiring nursing care opted to relocate to remote areas with poorer conditions in order to be accommodated in REPS. These results also indicate the need to extensively explore REPS in the Tokyo metropolitan area.

From the perspective of nursing care, highly independent residents were supported by homecare facilities attached to REPS in urban areas, whereas elderly residents requiring high levels of nursing care were cared for at daycare facilities at many REPS in remote areas. Therefore, the types of nursing care provided by REPS differed depending on location. One possible explanation for this situation is that securing floor space for daycare facilities in urban areas with high land prices is expensive. Another explanation is that REPS can be operated more efficiently with fewer staff members in remote areas, and the same REPS staff members can be employed to work at daycare facilities. However, the original intention of daycare facilities was to mitigate the burden on caregiving families. Therefore, further discussion will be necessary to determine whether it is appropriate to support single elderly people requiring high levels of nursing care at daycare facilities when the overwhelming majority of REPS residents are from single households.

Acknowledgments

The Senior Housing Association graciously agreed to let us use the registration and management information on REPS, and Mr. Yuta

more dwelling units, had spacious areas larger than 30 m², and provided homecare services. In suburban areas, on the contrary, more REPS had only approximately 30 dwelling units

Kuchiba (a Master's student at Kyoto University Graduate School at the time of this study) cooperated with us in data analysis. We extend our gratitude to them before concluding this report.

Disclosure

The authors have no conflict of interest to declare.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Notes

Note 1) In Reference [2], the program points out the importance of appropriate placement based on the location of regional facilities.

Note 2) Reference [3] is a result of the Ministry of Health, Labor and Welfare's annual implementation of elderly housing trends and issues, including paid nursing homes, as part of the elderly care business since the H27 fiscal year, in order to grasp the situation.

Note 3) Generally, the Tokyo metropolitan area is defined as one capital and seven prefectures, including Yamanashi Prefecture, in the Kanto region, which consists of one capital and six prefectures (Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, and Kanagawa). In this study, GIS analysis was conducted within a range of 120 km from Tokyo Station, but other than Figure 13, the figures show the main parts of the Tokyo metropolitan area, as it would be too large to include the entire range.

Note 4) It can be seen from Table 4 that approximately 30% of REPS are distributed in the Tokyo metropolitan area. By the way, Osaka Prefecture has the highest number of REPS in the country, accounting for 10% of the total facilities nationwide.

Note 5) The analysis was conducted after obtaining permission to use the information provided by the National Association of Elderly Housing (NAEH), a non-profit organization responsible for managing the registration and operation information of REPS across the country.

Note 6) The CSV Address Matching Service is a service provided by the University of Tokyo, which performs address matching processing on CSV format data that includes address and place name fields, providing latitude and longitude or public survey coordinate system coordinates. The service can be accessed at <http://newspat.csis.u-tokyo.ac.jp/geocode-cgi/geocode.cgi?action=start>. The confirmation date for this information was October 15, 2019.

Note 7) The value of the average care level was determined by calculating the weighted average of the residents, using 0 for general independence, 0.375 for requiring support, and the respective numerical values for care levels 1 to 5.

Note 8) The Getis-Ord G_i^* statistic is calculated using the formula below (Figure 15). Here, n represents the number of point data, x_j is the attribute value of point data, $\bar{x}$ is the mean attribute value, and w_{ij} is the spatial weight matrix between point data i and point data j . A fixed distance band concept was adopted for the spatial relationship that influences the spatial weight matrix, and it was set so that point data within a 5 km radius would influence each other. This translation will be used as a note in a research paper.

References

- 1 Ministry of Land, Infrastructure, Transport and Tourism. Current status of residences for elderly people with services. December 2020. Accessed January, 2021. <https://www.mlit.go.jp/jutakukentiku/house/content/001381203.pdf> (in Japanese).
- 2 Inoue Y. Considerations in housing for the elderly with life support services, integrated community-based care system, *Q Soc Secur Res*. 2014;**50**(3):283–294 (in Japanese).
- 3 NHK. *Close-up Gendai* “There are vacancies in nursing homes” (original Broadcast March 2017, on-demand viewing September 2019) (in Japanese).
- 4 PwC Japan. *Survey Research on Diversification of Management Practices in Housing for the Elderly*. 2020:145 (in Japanese).
- 5 Suzuki H, Miyazaki Y. The entry reasons and the residential mobility of elderly residents in the elderly housing with supportive services—for the resident support services in regional inclusive care. *J Archit Plann Environ Eng (Trans AIJ)*. 2018;**44**:179–190 (in Japanese).
- 6 Nagahama M, Kinukawa M, Yamaguchi K, Shigaki T. A study on the floor plan composition of elderly housing with supportive services from plan analyses. *J Archit Plann (Trans AIJ)*. 2016;**81**(720):271–279 (in Japanese).
- 7 Sannomiya M, Hwang B, Suzuki Y. The consideration of the mismatch between the quality level of the dwelling unit and the health condition of residents in the elderly housing with supportive services. *J Archit Plann Environ Eng (Trans AIJ)*. 2018;**44**:199–208 (in Japanese).
- 8 Ministry of Land, Infrastructure, Transport and Tourism. Study Group on the Development of Residences for elderly people with services, etc., 2nd Meeting Materials. Accessed January 2020. https://www.mlit.go.jp/jutakukentiku/house/house07_hh_000119.html (in Japanese).
- 9 Japan Senior Citizen Housing Association. Housing Information System for Residences for elderly people with services. <https://www.satsuki-jutaku.jp/> (in Japanese).

How to cite this article: Miura K, Yasuda K. Distribution characteristics of residences for elderly people with services in the greater Tokyo area based on the residents' care level. *Jpn Archit Rev*. 2023;**6**:e12393. <https://doi.org/10.1002/2475-8876.12393>