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Spatial Weighting to Explore Priority Districts for Older Adult Classes in Age-friendly Smart City

Sun-Bi Um*

Dept. of Social Welfare, Pusan National University, 46241, 2, Busandaehak-ro 63beon-gil, Geumjeong-gu, Busan, Republic of Korea

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We explored priority districts for older adult classes using a spatial weighting technique in an age-friendly smart city initiated by the World Health Organization (WHO) and the Korean government. In the past, the target districts for establishing older adult classes for people aged 60 years and above in South Korea were determined on the basis of the experience or intuition of business operators or the empirical knowledge of a few experts. A hotspot map provides a basis for the public to evaluate the area-wide distribution of older adult classes. Exploring priority districts based on geographically weighted regression (GWR) could offer objective and quantitative evidence for the location feasibility of older adult classes rather than the existing text-based data. The priority ranking presented by each administrative district plays a crucial role in arranging older adult classes in consideration of the unique characteristics of an age-friendly smart city, such as the central business district or outskirts of a metropolitan city. Although South Korea has been selected as a case study for this paper, exploring priority districts for older adult classes utilizing a spatial weighting technique is relevant to other countries attempting to introduce wearable healthcare devices connected to a body sensor network (BSN) for people aged 60 years and above in age-friendly smart cities.

1. Introduction

The proportion of the population aged 65 years and above in South Korea (hereafter Korea) was 16.5% in 2021. Additionally, Korea is expected to become a super-aged society by 2025 according to the United Nations standard, i.e., people aged 65 years and above accounting for more than 20% of the total population.(1) Korean society has been focusing on improving the quality of life over a prolonged lifespan while considering the increase in the proportion of older people in the population.(2,3) However, Korea has been ranked first among the Organization for Economic Co-operation and Development (OECD) countries for the suicide rate of older adults for over a decade.(4) In addition, the overall poverty rate among older adults in Korea is the highest among the OECD countries.(5)

*Corresponding author: e-mail: sunum17@pusan.ac.kr
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The Global Network for Age-friendly Cities and Communities (GNAFCC) is a project promoted by the World Health Organization (WHO) since 2006 to respond more effectively to the global trends of aging and urbanization.(6) As of January 2022, 1,333 cities in 47 countries have joined and are active under the GNAFCC guidelines. As of January 2022, 37 local governments in Korea are active members of GNAFCC.(7) GNAFCC presents eight core sector guidelines for age-friendly cities. The lifelong learning of older adults is emphasized in five out of eight sectors: social participation; respect and social inclusion; civic participation and employment; communication and information; and community support and health services. As part of a policy tool to build age-friendly cities, the central and local governments in Korea are promoting the establishment of education facilities that are expected to help prolong a healthy, independent life. The older adult class program in Korea provides the knowledge and information necessary for older adults to lead a healthy life by operating educational programs at least once a week (Article 2 Section 3 of the Older Adult Welfare Act, Korea).

In August 2021, Busan Metropolitan City (hereafter Busan) was the first to enter a "super-aged society" among the seven metropolitan cities in Korea, with the proportion of adults aged 65 years and older exceeding 20% (aged society: 14–20%).(8) The transition from an aged society to a super-aged society took 154 years, 79 years, and 75 years in the advanced western countries of France, Italy, and Germany, respectively. In Japan, the period required for the same transition was 36 years since the aging rate was relatively high. Busan has the historical record of transitioning from an aged society to a super-aged society in the shortest time in the world of only five years.(9) Busan joined GNAFCC in 2016, and the Busan official website of GNAFCC emphasizes that the city is operating lifelong learning centers across the city.(10) For this reason, the Korean government designated Busan as a pilot smart city to lead the health management of older adults using sensor technology.

The older adult class program is financially subsidized by the local government in accordance with the Older Adult Welfare Act of Korea. Consequently, older adult classes are unevenly distributed by region, as they have not been established in consideration of the regional balance of services according to the number of older adults residing within a certain area but of the subsidy-based spending capacity of local governments. This regional imbalance has weakened the role of older adult classes in realizing an age-friendly smart city, although those living in local communities with classes have enrolled in them. Local welfare institutions provide data on the regional distribution of older adult classes. However, the service is operated at a level to guide the status of older adult classes in an administrative district rather than to provide a user-friendly interface. Moreover, relying on a primitive data-sharing service, it offers text-format data completely dependent on the manual labor of the person in charge.

The current information delivery method remains at a level that shows the fragmented operating status of older adult classes in a specific administrative district. A significant limitation exists in obtaining area-wide visual information, such as the increase or decrease in the number of older adult classes by population density. Text-oriented data for older adult classes expose many limitations in welfare work, in which it is essential to secure a regional balance based on area-wide visual-spatial information. To this end, spatial weighting for efficient resource allocation has been established as a standardized approach. Previous studies have used spatial weighting in various applications, such as landscape ecology, urban population estimation, and heat vulnerability interpolation.[11–13] Empirical analysis related to the regional supply and demand of older adult welfare services has been conducted for a long time to prevent the omission or duplicate provision of services.[14,15] One study showed that it was cost-effective to highlight the equity of welfare services as a matter of spatial justice.[16] A subject closely related to this study was the investigation of the accessibility of welfare service facilities using a geographic information system (GIS).[17–19]

Moreover, it is difficult to find a case that suggests a policy alternative for the efficient distribution of older adult classes through the empirical verification of the correlation between the spatial distribution of welfare facilities and the population density. In the welfare delivery system for older adult classes, there is a lack of research on spatial weighting in connection with the population density from the perspective of welfare service users. Furthermore, it is difficult to find previous studies on an interdistrict geographically weighted regression (GWR) approach that would enable experts in older adult welfare to understand the severity of regional imbalances for older adult classes. Since the spatial weighting for the distribution of older adult classes has not been theoretically verified, academic research in this field is assumed to have proceeded at the level of presenting ideas. In this regard, we explore the priority districts for education facilities in an age-friendly smart city by utilizing a spatial weighting technique that performs a GWR analysis between the population density and the spatial concentration of older adult classes in an administrative district.

2. Materials and Methods

In analyzing older adult classes at the community level, the case study area is classified according to the hierarchy of administrative boundaries such as counties, districts, cities, metropolitan cities, and provinces. A metropolitan city in Korea has the authority to enact local ordinances related to residential, commercial, and business areas and the authority to plan land use, such as smart-city-related infrastructure. The city of Busan (Fig. 1) has 20 administrative districts that are markedly different in population density and the number of older adult classes (Table 1). Therefore, the 20 administrative districts are considered to satisfy a key condition for evaluating the priority of establishing older adult classes.

Busan is investing heavily in smart health care as a key element of a smart city. In particular, as part of the smart city project, Busan announced the 15-min city project in July 2022. Forty cities worldwide, including Paris, Barcelona, and London, are already implementing the 15-min city project as a new urban planning eutopia.[20] This is to minimize the time wasted by older adults traveling to hospital by using advanced smart technology combined with wearable mechanical and biochemical sensors connected to a body sensor network (BSN).[21] With the development of IT technology, it has become possible to receive real-time care from medical staff anytime and anywhere by using portable personal health devices. In this regard, as part of the age-friendly smart city project, a BSN in Busan is planned to be established where health data can be exchanged between patients and medical personnel anytime and anywhere by utilizing micro-electro-mechanical systems (MEMS) medical sensors and communication

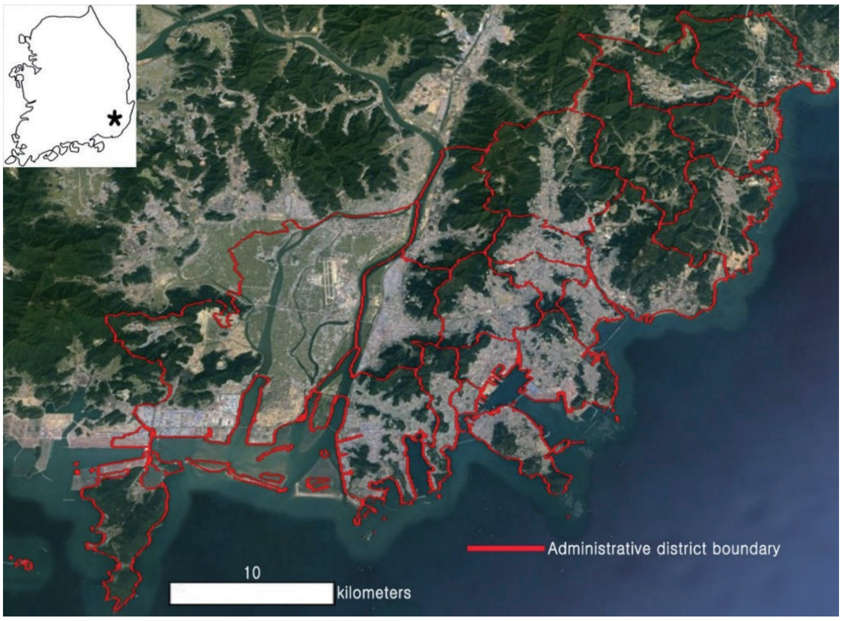

Fig. 1. (Color online) Study area of Busan, Korea shown in Google Earth satellite imagery, whose location in Korea is shown in the inset.

Table 1
Descriptive statistics of the 20 administrative districts in Busan.

	Population ≥60 years	Population density (%)*	Administrative district area (%)**	Number of older adult classes
Total	982787	100.00	100.00	164
Jung-gu	15330	1.56	0.35	0
Seo-gu	37916	3.86	1.84	4
Dong-gu	32352	3.29	1.22	6
Yeongdo-gu	43778	4.45	1.86	12
Busanjin-gu	104051	10.59	3.88	18
Dongnae-gu	74532	7.58	2.17	13
Nam-gu	77814	7.92	3.43	13
Buk-gu	80354	8.18	5.16	19
Haeundae-gu	106612	10.85	6.72	19
Saha-gu	91567	9.32	5.33	8
Geumjeong-gu	72209	7.35	8.52	13
Gangseo-gu	27367	2.78	23.56	5
Yeonje-gu	60101	6.12	1.56	13
Suyeong-gu	54410	5.54	1.32	7
Sasang-gu	62998	6.41	4.71	11
Gijang-eup	16281	1.66	5.10	2
Cheolma-myeon	3483	0.35	7.02	1
Jeonggwan-eup	12714	1.29	4.97	0
Jangan-eup	3266	0.33	6.63	0
Ilgwang-eup	5652	0.58	4.65	0

*Percentage of population aged 60 and over (as of October 2021) residing in a certain administrative district divided by total population aged 60 and over in Busan.
**Percentage of each administrative district area divided by total area of Busan.

technology.[22] Therefore, we used Busan as an experimental target to analyze priority districts for older adult classes in an age-friendly smart city. The geographical location of the study area is in the east–west section of 128°45’38–129°18’27 longitude and the north–south section of 35°23’24–34°58’59 latitude.

The administrative district map of Busan was obtained from the National Geospatial Information Portal in Korea.[23] ArcGIS 10.5 was used for hotspot generation and GWR analysis. Population data were obtained from the Korean Ministry of Interior and Safety.[24] Data for older adult classes (as of October 2021) were obtained from the public data portal in Korea.[25] The locations of older adult classes indicated as addresses were converted into longitude and latitude coordinates using the Geocoder-Xr geocoding tool.[26] In general, traditional statistical methods, such as ordinary least squares, present a single regression coefficient throughout a study area. Thus, the effects of the variables were interpreted identically throughout the study area, although there are 20 administrative districts in this study. However, if spatial heterogeneity exists among the 20 administrative districts, the relationship between the dependent and independent variables cannot be interpreted identically throughout the study area. Therefore, the GWR method was applied to quantitatively confirm the spatial interaction between the population density and the distribution of older adult classes.

In welfare research, population density is typically defined as a demand variable in welfare services for older adults, while the regional distribution of welfare facilities is a supply factor.[27] The Korean government specifies a standard for establishing one social welfare center per 100000 people. Administrative regions in Korea are classified into three groups based on population size: counties (less than 50000), cities (more than 50000), and metropolitan cities (more than 1000000). In this regard, the central government allocates the national budget to each local government’s welfare services according to the population size. The majority of older adult welfare services are funded by the local government. Therefore, the financial status of each local government is a decisive factor in maintaining the regional balance of welfare services. If the spatial concentration of older adult classes does not match the population density of direct or potential users of social services, the inefficient distribution of the government budget results in discrimination in accessing older adult social services. Thus, the population size is the most representative indicator of the welfare administrative demand for local governments. Article 24 of the Enforcement Rule of the Older Adult Welfare Act stipulates that a person aged 60 years or older is eligible to use older adult classes. Therefore, the population density of individuals aged 60 years and older for each administrative district was used as an independent variable in the GWR.

The spatial concentration of older adult classes in each administrative district provides basic data on relevant services offered to people in the local community. A spatial cluster is typically called a hotspot, which describes a group of points or regions with a higher value than its surroundings.[28] A hotspot analysis was performed to analyze the spatial similarity and clustering patterns of older adult classes in an administrative district. The average Getis-Ord Gi Z-score, presented as 518 grids in the entire study area, was derived for each administrative area using the zonal statistics function. The results of the hotspot analysis were used to check whether there were obstacles in terms of accessibility for consumers living in an age-friendly smart city willing to use the services for older adults.

Through the GWR analysis of the relationship between the hotspot *Z*-score and the population density, the spatial weighting coefficient was derived by quantifying the relative effect of the population density on the spatial concentration of older adult classes. In addition, a verification procedure using standardized residual analysis was performed to confirm that the observed values were larger than the predicted values estimated from the regression model.(29) When the GWR local coefficient in the coldspot districts was presented as a value higher than the average of the study area, the spatial concentration of older adult classes showed a strong correlation with the population density. Consequently, the supply of welfare services for older adults in this administrative district was not spatially related to the demand, indicating an imbalance in the services for older adults. Therefore, the GWR local coefficient was used as a spatial weighting index to evaluate the priority when establishing older adult classes, targeting administrative districts with severe imbalances between supply and demand.

3. Results

Figure 2 shows the Getis-Ord Gi analysis results for the older adult classes. The map shows the hotspots (in red) where the variables are concentrated in a specific area. The blue areas represent the coldspots where the older adult classes are distributed over a wide area. Despite its

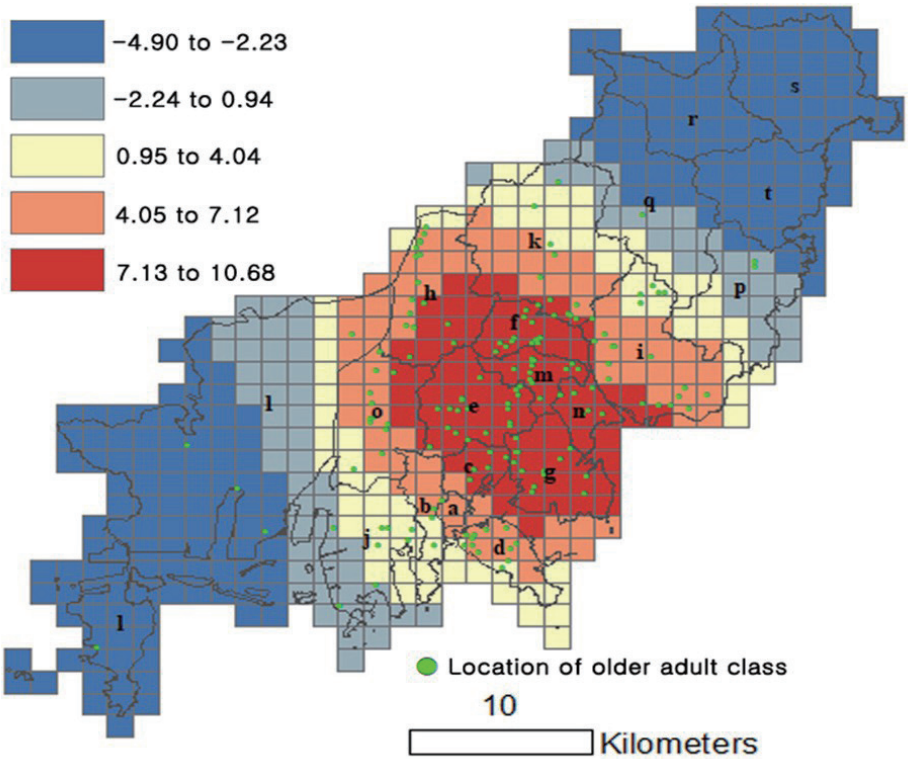

Fig. 2. (Color online) Hotspot and coldspot map of older adult classes presented as 518 grids (Getis-Ord Gi Z-score). (a) Jung-gu, (b) Seo-gu, (c) Dong-gu, (d) Yeongdo-gu, (e) Busanjin-gu, (f) Dongnae-gu, (g) Nam-gu, (h) Buk-gu, (i) Haeundae-gu, (j) Saha-gu, (k) Geumjeong-gu, (l) Gangseo-gu, (m) Yeonje-gu, (n) Suyeong-gu, (o) Sasang-gu, (p) Gijang-eup, (q) Cheolma-myeon, (r) Jeonggwan-eup, (s) Jangan-eup, and (t) Ilgwang-eup.

small area, classes for older adults are concentrated in the central business district (Table 2). However, there are only a few classes for older adults in the administrative districts on the city's outskirts, despite the large area. Nam-gu (Fig. 2) showed the highest concentration (mean *Z*-score: 9.29, Table 3) of older adult classes in Busan, while Jeonggwan-eup (Fig. 2) showed the lowest concentration (mean Z-score: −4.44). The low concentration of classes indicates that consumers find it difficult to access classes in this area. Jeonggwan-eup, Jangan-eup, and Ilgwang-eup (Fig. 2) are identified as representative coldspots with no older adult classes. Gangseo-gu, located at the western end of Busan (Fig. 2), has five class programs for older adults, but it is classified as a coldspot because of its large administrative area.

Class programs for older adults in the age-friendly smart city of Busan are implemented through citizen participation using a voluntary bottom-up approach. It is not mandatory for the local government to operate classes using a top-down approach to ensure equity in the provision of welfare services in an age-friendly smart city. In contrast, the bottom-up approach focuses on operating older adult classes according to the principle of voluntary supply and demand, while spatial equity based on the top-down approach focuses on balancing older adult welfare services among administrative districts. As a result of the establishment of older adult classes based on the principle of voluntary bottom-up supply and demand, there are no older adult classes in the administrative districts located in the easternmost part of Busan, as shown in Fig. 2 (Jeonggwan-eup, Jangan-eup, and Ilgwang-eup). The hotspot map shows that it is necessary to actively promote the establishment of a class program for older adults based on the principle of an equitable distribution between administrative districts, not only the principle of supply and demand.

The spatial correlation between welfare supply and demand was determined using the hotspot index as the supply factor and the population density of the administrative district as the demand factor for older adult classes. The results showed a high correlation (adjusted R^2=0.85) between these two variables (Fig. 3 and Table 3). Such a high GWR coefficient of determination validates the population density as the most representative indicator of administrative welfare demand in

Table 2
Spatial distribution characteristics of hotspots and coldspots in administrative districts.

	Hotspots	Coldspots
Administrative districts	Dong-gu, Nam-gu, Suyeong-gu, Busanjin-gu, Yeonje-gu, Dongnae-gu	Gangseo-gu, Jeonggwan-eup Jangan-eup, Ilgwang-eup
Z-score range	7.13 to 10.68	−4.90 to −2.23

Table 3
Descriptive statistics for hotspot Z-score (dependent variable) and density of population aged 60 and over (independent variables) used in GWR.

	Min	Mean	Max	Standard deviation
Hotspot Z-score*	−4.442	3.76	9.294	4.79
Population density**	64	2328	5720	1810

*Average Z-score for each administrative district calculated by applying zonal statistics function for Getis-Ord Gi Z-score presented as 518 grids (Fig. 2) in entire study area.
**Population aged 60 and over per square kilometer.

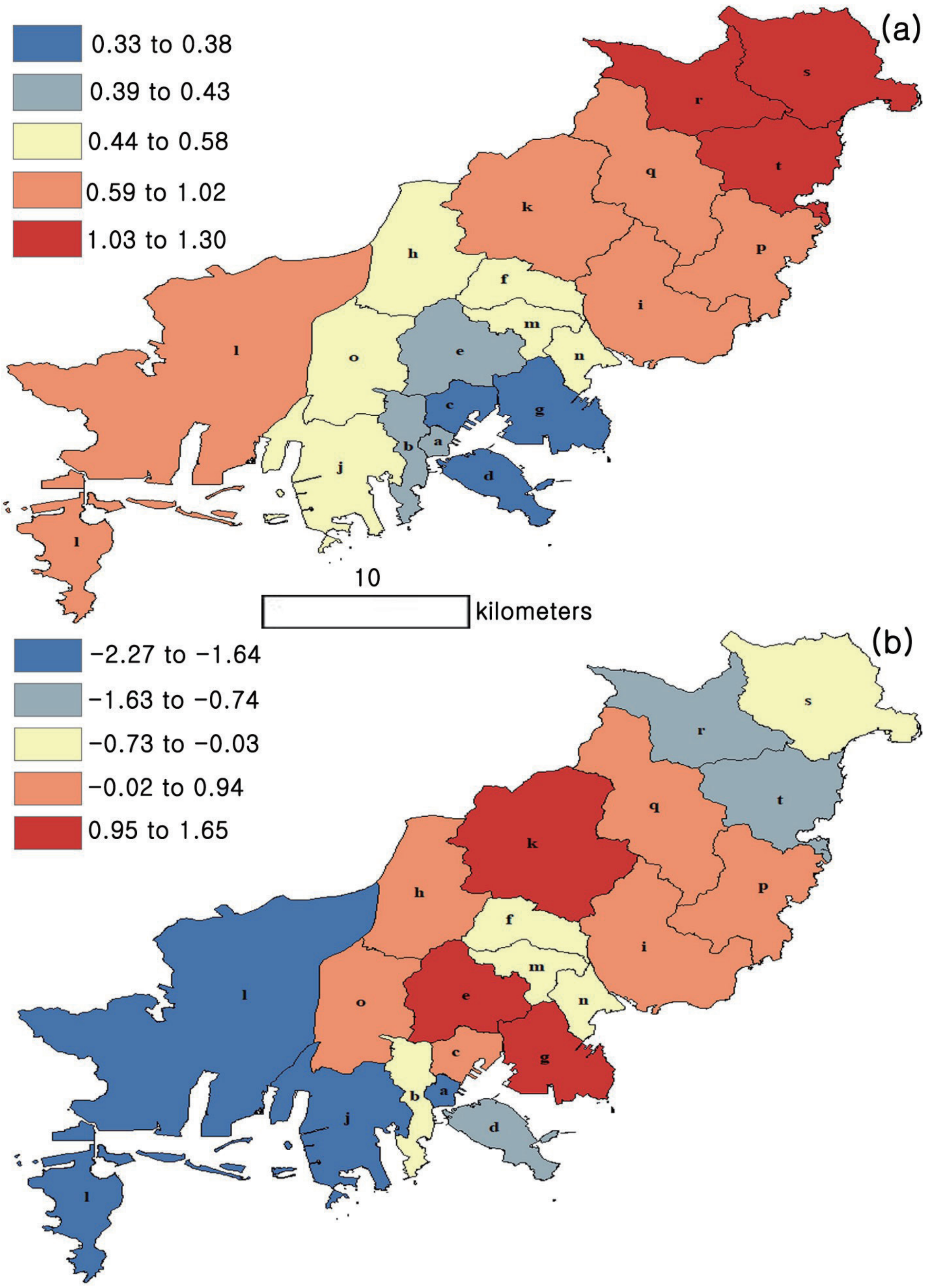

Fig. 3. (Color online) Validation of spatial weighting coefficient: (a) GWR standardized local coefficient and (b) standardized residual (names of administrative districts presented in Fig. 2).

Busan. This also confirms that hotspots in the distribution of older adult classes are representative indicators of welfare services as supply factors.

However, the population density of many administrative districts (standardized local coefficient = 0.33 to 0.43) did not adequately explain the class program density. These regions are administrative districts located in the core central business district [Fig. 3(a)] of Busan. The local governments in these administrative districts were able to invest heavily in older adult classes because they could secure sufficient tax revenue from wealthy residents. Therefore, such a low local coefficient was derived because too many classes for older adults were supplied relative to the population density and supply and demand were not matched.

Traditionally, the predictive suitability of the global GWR model (adjusted R^2) is validated on the basis of variables presented in the regression summary report,(30) such as the Akaike Information Criterion (AIC). However, in this study, it was necessary to verify the suitability of the local regression coefficients to derive the spatial weighting values for each administrative district. Therefore, the verification was performed using the standardized residuals for each administrative district. In addition, the presentation of global Moran's I or local Moran's I coefficient in GWR analysis has been established as a standardized practice to verify the spatial autocorrelation for each variable.(31) The high global GWR coefficient (adjusted R^2 of 0.85) in this study could be derived because the hotspot Z-score of older adult classes and the population density had a high spatial autocorrelation.

In this study, rather than verifying spatial autocorrelation for each variable, quantitative evidence for spatial autocorrelation was presented on the basis of the result (adjusted R^2 of 0.85) of the GWR analysis. Furthermore, we visually checked whether the independent and dependent variables satisfied the premise of spatial autocorrelation through the distribution of the standardized residuals.(32) The administrative districts with standardized residuals outside the range of ±2 values were considered as outliers. Except for Jung-gu, the standardized residuals of the local GWR model do not deviate from the absolute value of ±2 among 19 administrative districts.

When estimating the priority districts, it was necessary to identify areas where the standardized residuals are underestimated to ensure the reliability of the spatial weighting because the observed values are larger than the values predicted by the regression model (Table 4). In addition, administrative districts where the standardized residuals were overestimated should be identified because the observed values were smaller than the predicted values. For example, the darker red areas in Fig. 3(b) indicate that the estimated observation value is higher than the value predicted from the standardized local coefficient, whereas the blue areas represent an estimated observation value lower than the value predicted from the actual model. In addition, the yellow color represents administrative districts with little difference between the value predicted from the model and the estimated observation value.

The two variables used in the GWR analysis were statistically significant in the 20 administrative districts. Jung-gu [Fig. 3(b)] has the highest population density (5720 per km^2) in Busan. However, there were no older adult classes in Jung-gu, making this district an outlier compared with neighboring administrative districts. Moreover, the standardized residual of

Table 4
Results of GWR between hotspot Z-score and population density.

	Min	Mean	Max	Standard deviation
Standardized local coefficient	0.326	0.672	1.301	0.29
Standardized residual	−2.27	−0.04	1.64	1.07
Adjusted R^2 = 0.85, P-value = 0.01, AIC = 32.46				

Jung-gu (−2.27) exceeded the allowable range of ± 2. Furthermore, relatively high negative standardized residuals appeared in Gangseo-gu [Fig. 3(b)], classified as a coldspot, while high positive standardized residuals (0.95 to 1.65) appeared in administrative districts classified as hotspots (Busanjin-gu, Nam-gu, Geumjeong-gu), as shown in Fig. 3(b). The standardized residual [Fig. 3(b)] showed that the model's predicted values were constant, and it was reliant on the dependent variable (without deviating from the allowable range of ± 2). Therefore, statistical validity was ensured, demonstrating that a standardized local coefficient can be used to determine the priority districts when establishing older adult classes.

4. Discussion

The spatial weighting presented as GWR standardized local coefficients can be used to derive relative comparative values contained in the data without listing all the attributes of the spatial objects to be analyzed when determining the relationship between population density and older adult class density in an administrative district (Table 5). Spatial weighting reduces the amount of data required to interpret its meaning and allows us to identify the relative attributes of the comparison variable using the calculated regression coefficient.(11) The three administrative districts (Jeonggwan-eup, Jangan-eup, and Ilgwang-myeon, as shown in Fig. 3) identified as coldspots and located on the northeastern outskirts of the study area have a strong correlation between the concentration of older adult classes and the population density because no older adult classes were established there owing to the low population density. In the case of Jangan-eup, located on the outskirts of the most northeastern part of Busan (Fig. 3), the strongest

Table 5
Priority districts when establishing older adult classes.

	Number of classes	Hotspot Z-score	Local coefficient	Population density per km^2	LQ	Establishment priority
Jangan-eup	0	−4.28	1.30	64	0.00	1
Jeonggwan-eup	0	−4.44	1.24	333	0.00	2
Ilgwang-eup	0	−1.70	1.15	158	0.00	3
Cheolma-myeon	1	−4.13	1.02	65	1.72	4
Gijang-eup	2	−0.17	0.93	415	0.73	5
Geumjeong-gu	13	3.94	0.80	1103	1.09	Hotspot
Gangseo-gu	5	−1.97	0.78	151	1.09	6
Haeundae-gu	19	5.27	0.73	2063	1.07	Adequate
Dongnae-gu	13	8.48	0.58	4468	1.03	
Buk-gu	19	6.73	0.54	2025	1.41	
Saha-gu	8	1.27	0.53	2233	0.52	
Sasang-gu	11	5.71	0.52	1740	1.04	
Yeonje-gu	13	9.16	0.51	5025	1.29	
Suyeong-gu	7	8.81	0.50	5355	0.77	
Seo-gu	4	4.74	0.43	2685	0.64	
Busanjin-gu	18	9.23	0.42	3487	1.04	
Jung-gu	0	6.15	0.39	5720	0.00	
Dong-gu	6	8.39	0.38	3456	1.12	
Nam-gu	13	9.29	0.36	2952	1.01	
Yeongdo-gu	12	4.77	0.33	3066	1.65	

local coefficient (1.30) among the 20 administrative districts was derived because it is difficult to share older adult classrooms operating in the surrounding administrative districts. Therefore, it is reasonable to give top priority to Jangan-eup. As class programs for older adults are public goods, spatial equity must be achieved to enable that everyone can easily receive an appropriate amount of service. Furthermore, older adult classes can play a key role in realizing an age-friendly smart city. From this perspective, the five districts (Table 5) identified as coldspots and located on the northeastern outskirts of the study area are judged as administrative districts occupying the first to fifth places in terms of establishment priority.

Despite being identified as a coldspot (Fig. 3), Gangseo-gu had five older adult classes, and its regression coefficient indicated a strong correlation because of the large area of Gangseo-gu, occupying 23.56% (Table 1) of the total area of Busan. Therefore, it is reasonable to give Gangseo-gu the sixth place of establishment priority to correct the imbalance in the distribution of welfare infrastructure. Geumjeong-gu (Fig. 3), identified as a hotspot, showed a relatively strong correlation in the GWR regression because the number of older adult classes corresponded to the high population density. However, it was unnecessary to include Geumjeong-gu as a priority district because a significant number of class programs for older adults were already operating there.

The location quotient (LQ) is an index calculated by comparing the density of older adults relative to the population residing in Busan with the density of older adult classes in a specific district.[33] For example, an LQ of 1 implies that the ratio of the target population in a specific area is the same as the ratio of older adult classes to the total population of Busan. In the case of Jung-gu (Fig. 3), the LQ was calculated as 0 because there were no older adult classes. According to the LQ, Jung-gu is the district with the top priority when establishing older adult classes. The spatial concentration of older adult classes is very high in Jung-gu, as a significant number of older adult classes are distributed in neighboring districts. In this regard, the local coefficient indicated a positive correlation (0.39) between the density of older adult classes relative to the population. However, the LQ was calculated as 0 because it did not reflect the density of older adult classes in the surrounding districts. Therefore, even if no additional older adult classes were arranged in Jung-gu, it would not cause an unequal distribution of social services in terms of accessibility. Rather, welfare beneficiary residents would be concentrated in a specific area if an additional older adult class was placed here. In the case of Cheolma-myeon (Fig. 3), there was only one older adult class. However, owing to the low population density, Cheolma-myeon had the highest LQ (1.72) among the 20 administrative districts of Busan. Although many previous studies have reported the adequacy of the LQ for ensuring a balanced distribution of welfare facilities,[34,35] this approach may have limitations if the spatial weighting approach is not used, as in this study. Therefore, the evaluation of the welfare service priority based on spatial weighting in this study is expected to function as an objective and effective model in the decision-making process of administrative districts regarding welfare services.

This study has several limitations that could not be solved in a single research paper. As a result of limiting the scope of the study according to current Korean laws, there is a risk of oversimplifying the variables that affect the locations of older adult classes. Considering this point, in follow-up studies, it will be necessary to analyze the effects of various variables, such as the socioeconomic status, cultural environment, and travel distance, on the location of the older adult classes. This study was conducted in only one experimental area in a short period of time owing to the limitations of academic research. Since the study area was limited to Busan, the boundary of the study area was clear, and the research output was derived under relatively ideal conditions. In follow-up studies, it will be necessary to ensure statistical significance by deriving spatial weights for more experimental areas.

5. Conclusions

The city of Busan has proposed a plan to manage the health of older adults in real time in connection with sensor-based community care. This means that future medical services in a global hub of an age-friendly smart city will be tailored to preventive predictions based on citizen participation rather than treatment-oriented existing hospitals. For this purpose, older adult classes are emerging as an important medium that can educate the beneficiaries of smart sensor technology such as electrocardiograms and galvanic skin response devices connected to a BSN.

In this regard, the results of this study are significant in that we have performed basic research on the feasibility of the concept, implementation procedure, verification structure, and operational ranking model for the target district, assuming that the government agencies related to older adult welfare will implement a public-friendly information system for older adult classes in age-friendly smart cities. On the basis of the results, we were able to propose suggestions to solve most of the problems raised by the unequal distribution of older adult classes so that welfare workers related to older adult classes can positively recognize the reality of spatial weighting. Using the results of this study, individual local governments will be able to explore the priority districts when establishing older adult classes in line with their administrative goals and regional characteristics.

This study provides a compromise between private and public interests through exploring the priority districts in an age-friendly smart city, rather than relying on an individual's intuition on the feasibility of class programs. If an information system for older adult classes based on spatial weighting is introduced to welfare practices in age-friendly smart cities, then the public accessibility of data on older adult classes is expected to be greatly improved owing to the availability of the classes at the level of administrative districts. Furthermore, applying welfare services using spatial weighting to the eight core sectors of an age-friendly city, as presented by GNAFCC, such as outdoor spaces and buildings, transportation, and housing, will help increase the popularity of GISs, because the public will be able to access welfare information much more easily than at present.

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