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Analysis of the Kokuho Database to Identify Regional Differences Based on Complex Health Data of Latter-stage Elderly

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Abstract

In recent years, the global population has been aging. In Japan, where the aging rate is particularly high, the employment of older workers is increasing in the field of production and logistics. In line with this trend, the number of occupational accidents among the older adult has been increasing, and there is a need to improve the well-being of the older adult. Therefore, the purpose of this study is to identify regional differences in their well-being health status by analyzing questionnaires of Kokuho database (KDB), to pick up towns where new policies should be considered, and to consider future strategies. In this section, we will compare the results of the analysis by township and by individual. In addition, by utilizing a geographic information system to overlay geographic data, the characteristics of the community were extracted. As a result, it was found that older adult need to satisfy many health factors to lead a satisfactory life, and that there are regional differences in the health factors that they satisfy. In addition, characteristics that did not emerge in township levels could be seen in the analysis of individual levels. Furthermore, comparison with other questionnaires showed the usefulness of the KDB.

Keywords: Kokuho database, health checkup, graphic information system, well-being, principal component analysis, latent class analysis

1 Introduction

Recently, the global population has been aging. As of 2022, there are 770 million people aged 65 years and over, with an aging rate of 9.7% [1]. Japan is a super-aging society, with an older adult of 36.27 million and an aging rate of 29.1% as of 2022, which is the highest rate in the global population [2]. The rate of aging is expected to reach 37.7% by 2050 [3].

The aging of the population has led to increased medical and nursing care costs. The average annual medical expenditure for older adults aged 75 and older (latter-stage elderly) In 2018 was 1.6 times higher than those for older adults aged 65 and older (early-stage elderly) [4]. In contrast, the average annual care expenditure for latter-stage elderly was 10 times higher than those for early-stage elderly [4]. Latter-stage elderly patients tend to be relatively frail and to have multiple chronic conditions that require the use of both medical and nursing services. Furthermore, the employment of older workers increases in Japan since 2000 [5]. In addition to the obligation to ensure employment up to the age of 65, it became an obligation to consider measures to ensure employment opportunities up to the age of 70 [6]. Therefore, the number of older workers is also expected to increase. However, the rate of occupational accidents among older workers is higher

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than that among other age groups, and the number of days lost from work tends to be greater in such cases [7]. Falls account for most occupational accidents among older workers [7]. This may be because older workers are unaware of the decline in their physical and mental functions associated with aging, which leads them to take unreasonable actions. Thus, there is a need for countermeasures to address the problems faced by super-aging societies [8]. As one of the policies to solve this problem, the Ministry of Health, Labour and Welfare promotes the improvement of well-being in terms of employment, aiming at creating a society in which workers can lead rich and healthy occupational lives with peace of mind [9]. Well-being is defined as "HEALTH IS A STATE OF COMPLETE PHYSICAL, MENTAL AND SOCIAL WELL-BEING AND NOT MERELY THE ABSENCE OF DISEASE OR INFIRMITY.." [10]. Therefore, local governments need to grasp the health status of the elderly, which is composed of several factors, and provide local services. However, the aging of the population differs from region to region, and appropriate services are not being provided to the elderly. Therefore, local governments are required to numerically demonstrate regional differences in the health status of the elderly to implement new policies.

In this study, the "Questionnaire for latter-stage elderly" is used to determine the well-being of older adult. This questionnaire was recently developed to detect frailty in older adult in healthcare settings, such as hospitals and clinics [11]. Responses to this questionnaire were captured in the Kokuho Database (KDB) system. This system uses various data held by the National Health Insurance Federation and allows statistical information and data on individual health to be analyzed [12]. Health issues in the community can be organized and analyzed using this system. In addition to sex- and age-specific analyses, it is possible to combine medical, health checkup, and nursing care information to gain a multifaceted view of the health status of older adult. While most existing studies have been conducted under limited regional circumstances, this study aims to contribute to the development of local government policies by comprehensively analyzing the factors that contribute to the health of older adult and capturing regional characteristics. Therefore, the purpose of this study was to analyze questionnaires administered to older adult in the latter-stages of life to identify regional differences in their health status. In addition, by comparing the results with those of other surveys, we present the usefulness of the questionnaire for older adult in the latter-stages of life.

2 Target and Data Usage for the Study

2.1 Target of the Study

The target area in this study is Katsushika Ward, Tokyo, with a total population of 464,313 as of December 1, 2022, and an aging rate of 24.5% [13]. Katsushika Ward has 7 daily living areas and 155 townships. Local government in the wards believes that the current daily life areas are not an appropriate classification based on the characteristics of each area and are considering the classification of new areas. Therefore, this study hopes to contribute to the classification of new areas by grasping the characteristics of the region in more detailed categories: by township and by individual. Furthermore, local government feels that there are regional differences in health status, but it is difficult to makes policy development because these differences cannot be shown numerically. Therefore, it is necessary to identify issues by extracting the characteristics of each region in terms of health status.

2.2 Data Usage: Questionnaire for the Latter-stage Elderly

This questionnaire survey is one of the KDB data and is the data (health checkup data) of a medical interview conducted with older adult aged 75 years or older (latter-stage elderly) who came for a health checkup. This survey was established by the MHLW as an alternative to the "standard questionnaire" of the Specific Health Examination, considering the evidence to date, actual insurance program, and burden on older adult who responded [14]. It consists of 15 questions organized into 10 categories (health status, mental health, eating habits, oral function, weight change, exercise and falls, cognitive function, smoking, social participation, and social support) to comprehensively understand the health status based on the characteristics of older adult, including frailty. Table 1 lists the questionnaire contents.

Table 1: Questionnaire for latter-stage elderly and Needs Survey

15-item questionnaire				Care prevention and daily living area needs survey	
No.	**Item**	**Question**	**Assessment**	**Question**	**Assessment**
1	Subjective sense of health	How is your current health condition?	Very healthy/Healthy/ Fair/Unhealthy/Very unhealthy	How is your current health condition?	Very healthy/Healthy/Unhealthy/Very unhealthy
2	Life satisfaction	Are you satisfied with your daily life?	Satisfied/Somewhat satisfied/ Somewhat dissatisfied/Dissatisfied	How happy are you now?	On a scale of 0 to 10
3	Eating habits	Do you eat three meals a day?	Yes/No		
4	Chewing	Do you have difficulty eating hard foods compared to six months ago?	Yes/No	Do you have more difficulty eating hard foods than six months ago?	Yes/No
5	Deglutition	Do you sometimes choke on tea, soup, etc.?	Yes/No	Do you sometimes choke on tea, soup, etc.?	Yes/No
6	Weight change	Have you lost more than 2 or 3 kg in 6 months?	Yes/No	Have you lost more than 2 to 3 kg in 6 months?	Yes/No
7	Walking speed	Do you think you are walking slower than before?	Yes/No		
8	Falling down	Have you fallen in the past year?	Yes/No	Have you experienced a fall in the past year?	Many times/Once/Never
9	Exercise habit	Do you exercise such as walking at least once a week?	Yes/No	Do you walk continuously for about 15 minutes?	I can walk/I can walk, but I don't walk/ I can't walk
10	Forget fulness	Have you been told that you are forgetful, such as "always asking the same thing" by people around you?	Yes/No	Do you feel forgetful?	Yes/No
11	Forget the date	Do you have sometimes to be unable remember what day it is today?	Yes/No	Do you sometimes wonder what day it is today?	Yes/No
12	Smoking	Do you smoke?	Smoked/Not smoked/Quit	Do you smoke cigarettes?	Smoke almost every day/Smoke occasionally/Used to smoke but quit/Never smoked in the first place
13	Going out	Do you go out at least once a week?	Yes/No	Do you go out at least once a week?	Hardly go out/Once a week/2-4 times a week/5 or more times a week
14	Friend	Do you keep in touch with your family and friends?	Yes/No	Are you visiting a friend's house?	Yes/No
15	Social support	Is there someone close to you that you can talk to when you are not feeling well?	Yes/No	Other than family or friends/acquaintances, who do you consult when you have a problem?	Neighborhood association, neighborhood association, senior citizen club/Social welfare council, case worker/Care manager/Doctor, dentist, nurse/Community comprehensive support center, town hall, municipal office/ Other/No such person

Items 1 and 2 were referred to as the subjective evaluation group because they asked about the participants subjective sense of health and life satisfaction. Items 3–15 were called the health evaluation group because they asked whether the participants met the criteria for being

healthy. In this study, data from the 2021 fiscal year were used. The survey was conducted with 32,852 latter-stage elderly residents of Katsushika Ward, of which 28,858 provided valid responses. From these data, we analyzed and compared the results by township and individual. As the number of respondents in each township varied from 0 to 520, Kanamachi Water Purification Plant and Mizumoto Park, which had no residents and respondents, were excluded from the township-level analysis, and the percentage of respondents per question was used for the other townships.

2.3 Data Usage: Care Prevention and Daily Living Area Needs Survey

To demonstrate the usefulness of the "questionnaire for the latter-stage elderly", this study conducts a similar analysis and compares the results with those of the "Needs Assessment for Long-Term Care Prevention and Daily Living Areas (Needs Survey)." This questionnaire is commonly used to assess the health status of older adult and is intended to identify issues faced by the community among individuals aged 65 years and older who do not fall into the categories of those requiring long-term care (Items 1–5). Table 1 shows the questions asked in the Needs Survey in relation to items in the health checkup data. Items 3 and 7 were excluded because they were not similar. As with the health checkup data, Items 1 and 2 were analyzed as the subjective evaluation group and Items 3–15 as the health evaluation group. Questionnaires were collected from 1,724 randomly selected older adult, of whom 1,302 provided valid responses. The number of valid responses in the subjective evaluation group only was 1,570.

3 Analysis at the Township-level

3.1 Investigation of Correlations

Using the health checkup data, we analyzed the health status of older adult in each town and street to understand the current situation in Katsushika Ward. First, the subjective evaluation group was analyzed. As the method of response differed, with subjective sense of health rated on a 5-point scale and life satisfaction rated on a 4-point scale, a correlation analysis was conducted by assigning a higher score to a good rating and obtaining the expected value. The correlation coefficient between the subjective sense of health and life satisfaction was 0.58, indicating a positive correlation. Thus, older adult who feel subjectively healthy are more satisfied with their lives in the community. Among all neighborhoods, Higashimizumoto 4-chome had the highest expected value for subjective sense of health, Higashimizumoto 3-chome had the highest expected value for life satisfaction, and Nishishinkoiwa 2-chome had the lowest expected value for both subjective sense of health and life satisfaction. The relationship between subjective sense of health and fulfilled health factors was then investigated. Health factors were evaluated using the sum of the percentages of older adult who satisfied the health responses in the health evaluation groups. Specifically, the percentage of "no" responses was used for Items 4, 5, 6, 7, 8, 10, and 11; and the percentage of "yes" responses was used for Items 3, 9, 13, 14, and 15. As only the response method for Item 12 on smoking was a 3-point scale, the total percentage of respondents who answered "no" and "quit" was used. The total percentage of respondents for the 13 items was calculated as the total rating of the health factors. The correlation coefficient between the subjective sense of health and fulfilled health factors was 0.45, indicating a positive correlation. Therefore, it can be inferred that older adult who are satisfied with more health factors have a higher

subjective sense of health. The highest total rating for health factors was found in Shiratori 4-chome, whereas the lowest was found in Shiratori 1-chome. These results indicate the differences in the health statuses of townships within the same township. Furthermore, Nishishinkoiwa 2-chome, which had the lowest values for both the subjective sense of health and life satisfaction, had the third lowest total rating for the health factors.

3.2 Extracting Regional Characteristics by Health Factors

The community characteristics were extracted from the health factors in the health assessment group. In township-level analysis, the principal component analyses (PCA) is used because the original data are quantitative and meaningful. The PCA is a statistical analysis method that reduces the number of variables in data to minimize information loss and create a small number of uncorrelated composite variables (principal components) [15]. Thus, it is possible to understand information in a lower dimension through dimensionality reduction and find values that fall outside the major components of multidimensional data. Eigenvalues, proportion of variance, and cumulative proportion are often used to interpret the PCA. Eigenvalues represent the extent to which the total variance in the multivariate data is explained by each principal component. The proportion of variance indicates the amount of information from the original data reflected in the principal components of interest. In the extraction of principal components, those with eigenvalues greater than 1 or cumulative proportion greater than 80% are generally selected. As a result, the eigenvalues exceeded 1 for the first through the sixth components. This indicates that the explanatory power of the original data is low because the proportion of variance of each principal component is small. The results also showed that up to the ninth component was needed to explain about 80% of the original data. Therefore, although the number of dimensions can be reduced from the original data, the number of dimensions remains large even when principal components are used. Therefore, it is difficult to capture the characteristics of an area with township-level data.

Next, we focus on principal components 1 (17.7%) and 2 (12.0%), which had the highest proportion of variance, and categorize the townships by regional characteristics. The values of the principal component loadings, which indicate the correlation between the health factors and the principal components, are shown in Table 2. From Table 2, in the first component, the values of all the components were positive, which could be interpreted as an indicator of health. In the second component, those with high values for each factor "have someone close by I can talk to" and "socialize with family and friends," indicating that they interact with others. However, those with low values for each component included "I go out at least once a week," "I walk no slower than before," and "I go for exercise such as walking at least once a week"; thus, components related to exercise and going out were observed. Therefore, the second component was interpreted as an indicator of a lack of exercise habits. Simultaneously, it could be interpreted that areas without exercise habits were more likely to interact with others.

Next, principal component scores were calculated for each township using principal components 1 and 2 as the new axes, and categorized into four quadrants on a positive and negative axis. These were visualized on a map by GIS and are shown in Figure 1.

Table 2: Loading matrix for each principal component

Cluster name	Principal component	
	First	Second
Eating habits	0.50347	0.34795
Chewing	0.55948	-0.0415
Deglutition	0.46503	-0.06765
Weight change	0.32999	0.31242
Walking Speed	0.28287	-0.39473
Falling down	0.49749	-0.25999
Exercise habit	0.53164	-0.30119
Forgetfulness	0.4482	-0.27486
Forget the date	0.41208	0.38373
Smoking	0.20959	0.28666
Going out	0.37034	-0.57657
Friend	0.40301	0.34659
Social support	0.30166	0.51832

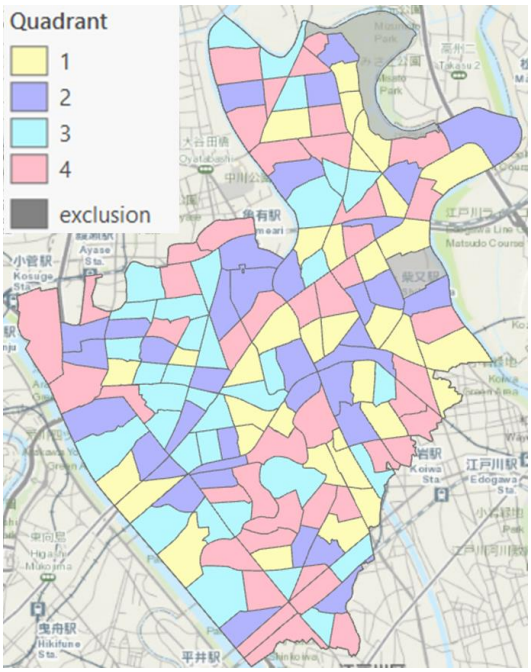

Figure 1: Classification of townships belonging to each quadrant in GIS

Thus, the towns in the first and fourth quadrants in Table 2 were relatively healthy. It can also be inferred that the first and second quadrants are towns where increasing exercise habits improve health. In the third quadrant, the health levels did not increase because factors other than exercise habits were not satisfied. Considering the town characteristics in each quadrant, Okudo 7-chome scored high in both the first and second principal components. Shinjuku 6-chome had the lowest principal component scores for both the first and second principal components. In addition, Shiratori 4-chome showed high scores for the first component but low scores for the second. Shiratori 4-chome, which had the highest total rating of health factors from Section 3.1, was found to be particularly active in terms of exercise compared to the other towns. In terms of principal component scores, Nishishinkoiwa 2-chome had a low score for the first component but a high score for the second. Considering the results in Section 3.1, Nishishinkoiwa 2-chome showed lower results in all subjective sense of health, life satisfaction, and health factors. Also, it showed that the residents were overwhelmingly less active and less likely to exercise than those in the other towns.

However, based on the cumulative proportion of the first and second principal components, these results contain only about 30% of the information of the original data. This is because we deal with data in township levels. Therefore, we conducted a similar analysis on an individual basis and compared the results.

4 Analysis at the Individual-level

4.1 Investigation of Correlations

As in the analysis for each township, health checkup data for FY2021 will be used to analyze the health status of the older adult. First, the subjective evaluation group was analyzed. Unlike analysis at the township levels, the scoring system in the subjective sense of health was used: 5 = very healthy, 4 = healthy, 3 = fair, 2 = unhealthy, and 1 = very unhealthy. The same scores were assigned for life satisfaction, and a correlation analysis was conducted. The correlation coefficient between the subjective health and life satisfaction was 0.45, indicating a positive correlation, which was like the correlation coefficient in township levels. Thus, older adult who feel subjectively healthy are more satisfied with their lives in the community. We then investigated the relationship between the subjective sense of health and health factors that were fulfilled. The total number of health responses completed in the health assessment group was used to evaluate health factors. The specific health responses were the same as those described in Section 3.1. Results showed that the correlation coefficient between the subjective health and fulfilling health factors is 0.30, which was weaker than that in the analysis at the township levels but positive. Thus, older adult who are satisfied with more health factors also have a higher subjective sense of health.

4.2 Extracting Regional Characteristics by Health Factors

The community characteristics were extracted from the health factors in the health assessment group. PCA could not be used, because the data for individuals were categorical. Therefore, latent class analysis (LCA), which could cluster categorical qualitative data with latent variables, was used to analyze the individual levels [16]. The optimal clustering model was selected based on

Bayesian Information Criterion (BIC). These factors determine the goodness of fit of data. The optimal clustering model occurs when the BIC values are the smallest, and the number of clusters is the optimal number of classifications. LCA was performed with a cluster range of 3 to 15, selecting 13 health factors in the health assessment group as Y variables. The results show that cluster 10 with the smallest BIC value is the optimal cluster size. Next, the prior probability of belonging to each cluster and the parameter estimates at each level of the variables are illustrated in Figure 2. Red indicates healthy responses.

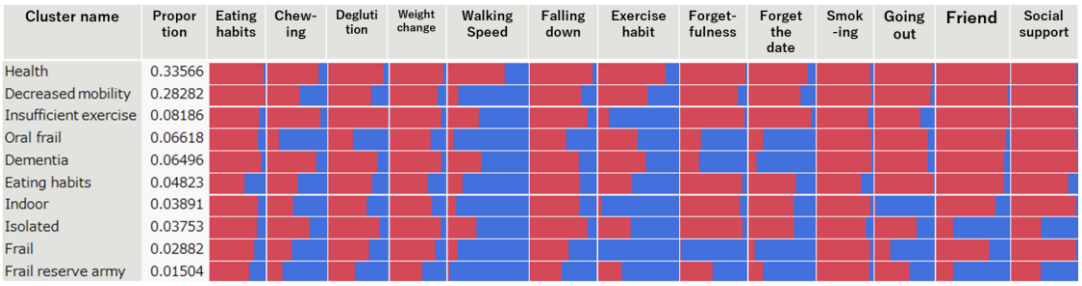

Figure 2: Graph of prior probabilities belonging to each cluster and parameter estimates at each level of the variable in the KDB

Based on Figure 2, we will grasp the characteristics for each cluster and make suggestions for future strategies for each township. For the strategy, we referred to the Ministry of Health, Labour and Welfare's explanation of the questionnaire for the latter-stage elderly [14]:

(1) Health cluster: older adults in this cluster have higher parameter estimates for most health levels, indicating that they are healthier. Towns with a high proportion of this cluster include Hosoda 2-chome, Higashimizumoto 4-chome, and Mizumoto 3-chome. These towns also have higher values for subjective sense of health in Section 4.1.

(2) Decreased mobility cluster: older adults in this cluster are found to have a reduced walking speed. We can also see that the town with the highest percentage of this cluster is Shinjuku 2-chome. It is recommended that this cluster be referred to care prevention classes sponsored by the municipality to improve their motor skills.

(3) Insufficient exercise cluster: older adults in this cluster are found to have no exercise habits such as walking or exercising. It can also be seen that the town with the highest percentage of this cluster is Nishishinkoiwa 2-chome. This is consistent with the results in Section 4.2 The next town with the highest percentage is Shinjuku 2-chome. In this cluster, existing health promotion facilities, municipally sponsored exercise classes, and spontaneous walking should be encouraged.

(4) Oral frail cluster: older adults in this cluster are found to have poor oral function. It can also be seen that the towns with a high percentage of this cluster are Hosoda 2-chome and Higashikanamachi 8-chome. Dental clinics and care prevention classes to maintain and improve oral functions should be recommended for this cluster.

(5) Dementia cluster: older adults in this cluster are found to be cognitively impaired. Towns with a high percentage of this group include Ohanajaya 2-chome and Shinjuku 4-chome. For this cluster, consultation services such as community comprehensive support centers, dementia cafes, and medical institutions with outpatient memory loss clinics should be recommended. In addition, habitual exercise through stretching, aerobic exercise, strength training, brain activation exercise, and behavior modification techniques is also effective.

(6) Eating habits cluster: older adults in this cluster eat less frequently, indicating that they may be undernourished. It can also be seen that the town with the highest percentage of this cluster is Nishimizumoto 4-chome. For this cluster, it is desirable to increase the use of community buses, etc. for food procurement and opportunities to eat together with family, friends, etc.
(7) Indoor cluster: older adults in this cluster have a low percentage of healthy responses in the items of walking speed, exercise habits, and going out. The town with the highest percentage in this cluster is Nishishinkoiwa 2-chome. Other towns in this cluster are Higashi-Tateishi 1-chome, Tateishi 7-chome, Yotsugi 3-chome, Higashiyotsugi 4-chome, Shibamata 3-chome, Higashi-Mizumoto 4-chome, and Takasago 2-chome.
(8) Isolated cluster: older adults in this cluster are found to have less interaction with family, friends, and those close to them. Towns with a high proportion of this cluster include Shinjuku 3-chome, Aoto 8-chome, Minami-Mizumoto 3-chome, Higashi-Mizumoto 6-chome, Higashishinkoiwa 3-chome, Takasago 6-chome, Tateishi 5-chome, Takasago 5-chome, HigashiKanamachi 1-chome, Hosoda 5-chome, Hosoda 5-chome and Higashiyotsugi 2-chome. Except for Takasago 6-chome, Takasago 5-chome, and Mizumoto 1-chome, the analysis by township is consistent in that they have little interaction with people. In these clusters 7 and 8, it is desirable to introduce local activities such as salons, health, sports and hobby clubs, and senior citizen clubs.
(9) Frail cluster: older adults in this cluster are found to have both lower motor and cognitive function and less social participation. It can also be seen that the town with the highest percentage in this cluster is Higashikanamachi 8-chome. It is desirable to refer this cluster to the Community Comprehensive Support Center for consultation on long-term care services.
(10) Frail reserve army cluster: older adults in this cluster are found to have a slightly higher percentage of healthy responses than Frail cluster. We can also see that the town with the highest percentage in this cluster is Takaracho 1-chome. It is desirable to encourage this cluster to participate in care prevention classes, etc. organized by the municipality.

Thus, the KDB questionnaire survey on the health status of older adult provides a comprehensive view of the current status of the community. In addition, we propose strategies for future policies based on the results of township-level analysis.

5 Comparison of Available with Other Questionnaires

5.1 Investigation of Correlations

To demonstrate the utility of the KDB data, a similar analysis was performed on the Needs Survey, and the results were compared. First, the subjective evaluation group was analyzed. Scoring of the subjective sense of health was performed in the same way as described in Section 4.1. We then analyzed the correlation with the level of well-being in older adult. Results showed that the correlation coefficient between the subjective sense of health and life satisfaction was 0.37, which was a weak correlation compared to the results in Section 4.1, but both were positively correlated. We then investigated the relationship between the subjective sense of health and health factors that were fulfilled. To evaluate health factors, we used the number of responses that met the health checkup data, with health responses similar to the way the health checkup data were evaluated. Spe-cifically, Item 8 was responded with “no,” Item 9 with “can and do,” and Item 12 with “used to smoke but quit” and “never smoked in the first place.” In Section 3.1, Item 13 was responded with “yes,” except for “rarely go out,” Item 14 with “yes,” and Item 15 with “no one as such,”

and others. The number of "no" responses was calculated for the items. The correlation co-efficient between the subjective sense of health and fulfilled health factors was 0.48, indicating a stronger positive correlation than that in the results in Section 4.1. These results indicate that both the relationship between the subjective sense of health and life satisfaction and that between the subjective sense of health and fulfilling health factors were positively correlated, which is consistent with the results from the KDB data.

5.2 Extracting Regional Characteristics by Health Factors

Community characteristics were extracted from health factors of the health assessment group. LCA was conducted during the Needs Survey, as described in Section 4.2. LCA was performed with a cluster range of 3 to 15, selecting 13 health factors in the health assessment group as Y variables. The results show that cluster 3 with the smallest BIC value is the optimal cluster size. Next, the prior probability of belonging to each cluster and the parameter estimates at each level of the variables are illustrated in Figure 3. Red indicates healthy responses.

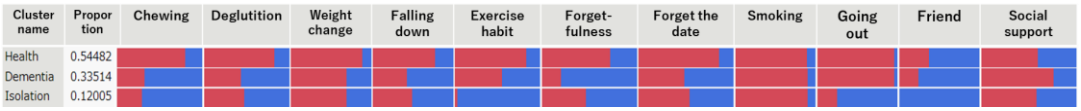

Figure 3: Graph of prior probabilities belonging to each cluster and parameter estimates at each level of the variable in the Needs Survey

Based on Figure 3, we will grasp the characteristics for each cluster and compare with the result of the health checkup data:

(1) Health cluster: older adults in this cluster have higher parameter estimates for most health levels, with most of them having a healthy response rate of 80% or higher. Furthermore, the prior probability of belonging to this cluster is about 0.54, indicating that half of the older adult in Katsushika Ward belong to the health cluster. Compared to the health clusters in Section 5.2, the results are consistent except for Hosoda 2-chome.

(2) Dementia cluster: older adults in this cluster have declining cognitive function. The area with the highest percentage of this cluster was the Shinjuku/Kanamachi area; when compared to the dementia cluster in Section 5.2, only Shinjuku 4-chome matched.

(3) Isolation cluster: older adults in this cluster are not in the habit of exercising, rarely go out, and rarely interact with others. The areas with a high proportion of this cluster were the Takasago-Shibamata and Horikiri/Ohanajaya areas. Compared to the isolated clusters in Section 5.2, Takasago-5-chome, Takasago-6-chome and Hosoda-5-chome were coincident, but most other towns were not included within the same area.

Because the Needs Survey was based on a broad delimitation of seven areas, it was difficult to determine their detailed characteristics. Therefore, the questionnaire for the latter-stage elderly can be analyzed in more detail, considering data on an individual basis. In addition, the health checkup data had approximately 22 times more data than the Needs Survey, as the survey was conducted on older adult who came for health checkups. We believe that it is difficult to collect data for Needs Survey and other surveys of older adult because many questionnaires are answered by mail, and there are many questions to be asked.

6 Conclusions and Future Outlook

In this study, health checkup data from the KDB were analyzed at the township-level and individual-level to grasp region characteristics from the health status of older adult and consider future strategies. Results showed that older adult should fulfill health factors to lead a satisfying life in the region. Appropriate services should be provided to older adult with poor ratings on Items 3–15 of the health checkup data. To analyze the regional differences in health factors, PCA was conducted for township-level analysis and LCA for individual-level analysis. Therefore, the PCA classified townships into 4 categories based on two composite functions: one axis indicating health status and the other indicating the lack of exercise habits. LCA was also used to classify the participants into 10 clusters. Comparing these two results, we found dis-parities in health status among townships in the same area. Future studies should include proposing and implementing new services for areas characterized by health status by analyzing other factors.

Specific examples are presented below:
(i) Shiratori 4-chome: it had the highest total evaluation of health factors met, whereas Shiratori 1-chome had the lowest result, indicating a large difference in the same area, and it was necessary to determine the cause of this difference.
(ii) Shinjuku 2-chome: it had many older adults with declining mobility. In ad-dition, Nishishinkoiwa 2-chome had a lower subjective sense of health, life satisfaction, and health factors than other townships; the cause of this was presumed to be a lack of exercise. Therefore, it is necessary to survey on walking function and to analysis of its relationship with gymnastic facilities.
(iii) Hosoda 2-chome and Higashikanamachi 8-chome: it had declining oral functions. Thus, it is possible that there is no dental hospital nearby; or even if there is one, it is difficult to access. Therefore, it is necessary to investigate the relationship between declining oral functions and dental facilities.
(iv) For towns classified into the Indoor cluster and Isolated cluster in Section 4.2: it is necessary to analyze the location of long-term care prevention facilities and investigate the optimal placement of facilities to promote participation.

In addition, this study conducted a similar analysis and compared the results with a Needs Survey, which currently had been primarily used to study the health status of older adult. Results showed that while the overall health status of older adult as a whole and the regional characteristics within a large area could be determined, detailed regional differences could not be identified. However, health checkup data from the KDB can be analyzed at the township, and its relationship with other medical data can be easily investigated, which is expected to be useful in the future. It is hoped that the results of this study will be useful to the local government of Katsushika Ward in examining the services needed in each community.

References

[1] United Nations Department of Economic and Social Affairs, Population Division, "World Population Prospects 2022: Summary of Results," UN DESA/POP/2022/TR, No. 3 , 2022

[2] Ministry of Internal Affairs and Communications, "Statistical Topics No.132 Statistics on the Elderly in Japan -On the occasion of Respect-for-Senior-Citizens Day-," May. 2023; www.stat.go.jp/data/topics/pdf/topics132.pdf.

[3] Cabinet Office, "White Paper on Aging Society 2022: Entire Edition", May. 2023; www8.cao.go.jp/kourei/whitepaper/w-2022/html/zenbun/s1_1_1.html.

[4] S. Kim, A. Babazono, A. Jamal, Y. Li, and N. Liu, "Comparison of care utilisation and medical institutional death among older adults by home care facility type: a retrospective cohort study in Fukuoka, Japan," BMJ open 2021; doi:10.1136/bmjopen-2020-041964.

[5] D. Kawaguchi, H. Mori, "The labor market in Japan, 2000-2018," IZA Institute of Labor Economics World of Labor, May. 2023; https://doi.org/10.15185/izawol.385.v2.

[6] K. Kudo, "Characteristics of the Elderly's Education at Japanese Small and Medium Sized Enterprises: Using the "Competition for Companies Engaged in the Elderly's Active Participation" as a Case Study," Social Design Review, vol. 14, 2023, pp. 73-83 (In Japanese).

[7] K. Morita et al, "Possible Association between Physical and Cognitive Function and Stumbling and Falling in Elderly Workers," International Journal of Environmental Research and Public Health, vol. 19, no. 13826, 2022.

[8] N. Hamid et al, "Issues and Challenges of Population Aging: Studying from Japan Super-Aging Nation and Malaysia Perspectives", ReAttach Therapy and Developmental Diversities, vol. 6, no. 3, 2023, pp.541-548.

[9] Ministry of Health, Labour and Welfare, "Report of the Employment Policy Study Group Full Text," May. 2023; https://www.mhlw.go.jp/stf/shingi2/0000204414_00003.html.

[10] M. Martínez, M. Grasso, J. Montero, "Regional well-being inequalities arising from healthcare expenditure public policies in Spain," Frontiers in Public Health, vol. 10, no. 953827, 2022, pp. 1-23.

[11] M. Kojima, S. Satake, A. Osawa, H. Arai, "Management of frailty under COVID-19 pandemic in Japan", Global Health & Medicine, vol. 3, no. 4, 2021, pp. 196-202.

[12] All-Japan Federation of National Health Insurance Organizations, "Kokuho database (KDB) system", May. 2023; https://www.kokuho.or.jp/hoken/kdb.html.

[13] Katsushika City, "Households and Population (2022)," May. 2023; https://www.city.katsushika.lg.jp/information/1000083/1005977/1027725.html.

[14] Ministry of Health, Labour and Welfare, "Appendix_Explanation of the questionnaire for the elderly and points to note," May. 2023; https://www.mhlw.go.jp/stf/shingi2/0000204952_00001.html.

[15] J. Black, J. Brand, J. Hay, L. Clark, "Using principal component analysis to explore co-variation of vowels," Language and Linguistics Compass, vol. 17, no. 1, 2022.

[16] N. Khanna, E. Klyushnenkova, A. Kaysin, "Association of COVID-19 With Race and

Socioeconomic Factors in Family Medicine," The Journal of the American Board of Family Medicine, vol. 34, 2021.