

原 著

Loss of access to daily necessities and locomotive syndrome
-Nationwide Cross-Sectional Survey on Dietary Environment in Relation
to Difficulty of Shopping for Elderly Living at Home

買物難民とロコモティブシンドローム

- 地域在宅高齢者を対象とした買物難民と健康の現状に関する
全国断面調査から -

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Summary

Background: We examined locomotive syndrome among disadvantaged shoppers to the nearest grocery shop.

Methods: Using the Survey on Difficulty in Shopping and Current Health Conditions in Housebound Elderly conducted on 15,200 housebound elderly subjects in 46 prefectures, valid responses without missing data were obtained from 4,969 respondents and used for the analysis (valid response rate: 38.9%). The survey questionnaire consisted of 31 questions regarding daily life and health conditions. All analyses were separately conducted using the independent variable of whether respondents regularly go grocery shopping or not.

Results: For those regularly going to the grocery shop, the distribution of locomotive syndrome was 471 (20.3%) for non-disadvantaged shoppers, 170 (27.2%) for permanent disadvantaged shoppers, and 108 (27.4%) for disadvantaged shoppers due to shop closure. Multivariate analysis using covariates including public transportation, revealed that the group of permanent disadvantaged shoppers showed significantly more cases of locomotive syndrome (OR: 1.28; 95% CI: 1.02–1.63) than the group of non-disadvantaged shoppers. However, disadvantaged shoppers due to shop closure showed loss of significant associations (OR: 1.29; 95% CI: 0.98–1.69).

Conclusions: The current study indicated the possibility that more disadvantaged shoppers have locomotive syndrome than non-disadvantaged shoppers among those regularly going to grocery shops.

抄録

本研究の目的は、買物難民におけるロコモティブシンドロームについて検討することであった。分析データは、買物難民と健康の現状調査で集められた東京都を除く46道府県在住の15,200人であった。分析項目に欠損の無い4,969名を分析対象とした(分析にまで用いられた回答率38.9%)。調査項目は日常生活と健康状態について尋ねる31項目であった。すべての分析は、本人が買物する群としない群に分けて分析した。

自ら買物をしている者では、閉店による買物難民(108人(27.4%))と以前から買物難民(170人; 27.2%)は、非買物難民(471人; 20.3%)より多かった。多変量モデルでは、以前から買物難民(OR: 1.37; 95% CI: 1.10–1.70)と閉店による買物難民(OR: 1.34; 95% CI: 1.04–1.75)は非買物難民に比べてロコモティブシンドロームが多いという有意な関連がみられた。交通機関を共変量に含めた多変量モデルでは、以前から買物難民(OR: 1.28; 95% CI: 1.02–1.63)は有意にロコモティブシンドロームが多く、閉店による買物難民(1.29; 95% CI: 0.98–1.69)は有意差がみられなかった。

結果 本研究では、普段買物に行く者において、買物難民にはロコモティブシンドロームが多い可能性が示唆された。

Key words: Food desert, Locomotive syndrome, Local food environment, Disadvantaged shopper, Grocery shop

キーワード: フードデザート、ロコモティブシンドローム、地域の食環境、買物難民、食料店

I . Introduction

With the advance of a hyperaging society, the number of marginal settlements is steadily increasing in Japan¹⁾. Marginal settlements force residents to become disadvantaged shoppers, who are kept away from daily necessities by the closure of accessible grocery shops. The Ministry of Economy, Trade and Industry defines disadvantaged shoppers, “kaimono nanmin” (literally, shopping refugees), as elderly people aged 60 and over who have limited access to shopping facilities²⁾. The problem of disadvantaged shoppers is also referred to as the “food desert” problem, which was initially defined as places where people do not have easy access to healthy and fresh foods, particularly among low socio-economic residents in inner cities³⁾. Despite a lack of consensus on the definition of food deserts, efforts to identify areas of concern with respect to limited accessibility to healthy foods are now regarded as critical to a targeted intervention program for promoting healthy food consumption⁴⁾. The problem addressed in Japan was for those in depopulated areas as well as inner cities. The main causes of disadvantaged shoppers among the elderly in Japan are not only biological aging but also the aging of society, such as the closing of shops both in depopulated areas and inner cities, and an increase in the number of elderly single households⁵⁾. The number of small-scale retail stores is on a downward trend and conventional large-scale retail stores are opening in the suburbs, which accelerates the pace of desertification. The number of elderly people who experience inconvenience in day-to-day shopping was estimated to be about six million (16.6% among people aged 65 and over) and is expected to be on the rise⁶⁾.

Older adults are of particular interest since their dietary habits may be more strongly influenced by their neighborhood⁷⁾. Excepting self-sufficient elderly, disadvantaged shoppers supplemented access to daily necessities by using their own car, public transportation including bus and taxi, delivered meals, mobile grocery shops, and neighborhood assistance, resulting in their inactivity. Their inactivity may cause their health to deteriorate, leading to ailments such as locomotive syndrome. Locomotive syndrome

refers to a condition characterized by a decline in the functions of the locomotor system, including the bones, joints, and muscles^{8,9)}. Although a couple of previous studies indicated physical inactivities and food consumption might be risk factors of locomotive syndrome¹⁰⁻¹²⁾, there has been no report on the association of disadvantaged shoppers and locomotive syndrome. Using the Survey on Difficulty in Shopping and Current Health Conditions in Housebound Elderly¹³⁾ conducted on housebound elderly across the country, we examined the association between locomotive syndrome and disadvantaged shoppers.

II . Methods

1. Subjects and survey procedures

The sampled subjects were 15,200 housebound elderly people aged 65 and older as of November 1, 2012, from 46 prefectures, except Tokyo.

The study period lasted from November 1 to December 31, 2012. This study was conducted by The Japanese Society for Dietary Health Promotion (Nihon Shokuseikatsu Kyokai) and by its registered 170,000 dietary-health-promoting volunteers in 1,411 municipalities in all prefectures except for Tokyo. The ad-hoc survey was implemented by distributing a questionnaire entitled “Survey on Dietary Environment in Relation to Difficulty in Shopping and Current Health Conditions of Household Elderly”^{10,13)} and by trained dietary-health-promoting volunteers conducting face-to-face interviews in the subjects’ homes. The volunteers, mostly housewives, are trained to acquire the knowledge and skills needed to maintain a healthy diet, under the supervision of public health centers. Volunteers undergo 48 hours of enrollment training and attend routine seminars four to 12 times a year. For the current study, volunteers were offered one day of interviewer training in each municipal unit. Refer to the previous study for details of the survey¹⁴⁾. The subjects without data deficiency in the analyzed items were used for statistical analysis.

2. Questionnaire items

We select 16 items from the questionnaire consisting of 31 questions regarding daily life and health conditions, including grocery shopping and the

use of food delivery services.

On the basis of the answers to the question concerning the use of a mobile grocery shop and meal delivery, the subjects were classified into two groups: “use” and “no use”. The responses to the questions on the mode of transportation used for shopping, including bicycle, motor bike, car, bus, and taxi, were classified into the group of either “yes” or “no” for each transportation mode. On the basis of the answers to the question regarding access to a grocery shop, the subjects were classified into three groups: “no limitation”, “permanently disadvantaged shopper” and “disadvantaged shopper due to shop closure”.

Those who answered “yes” to the question of whether they are the person to regularly go shopping to the grocery shop were classified as “regularly going to grocery shop” and others were grouped into “not regularly going to grocery shop”. From the answers to the question on the frequency of going out per week, including shopping, the subjects were classified into two groups: “three or more” and “less than three”.

Those who answered “yes” to the question of whether they had diseases of the bones or joints that were being treated were judged to have locomotive syndrome. Hypertension, diabetes, and heart disease were used as covariates because these diseases seemed to be background factors disrupting their health and behavior. Age (65-74, 75-84, ≥ 85), gender, and body mass index (BMI) [kg/m²; calculated from height and weight: <20, underweight; 20-25, normal; and ≥ 25 , obese] were also used as covariates. Height and weight were obtained following the protocol for unmeasurable cases of the National Health and Nutrition Survey in Japan¹⁵⁾. The order of precedence was as follows: 1) those measured at a health check-up that year, 2) those measured using the interviewee’s scales, and 3) those in the interviewee’s memory. The cutoff values for the underweight and obese groups were the BMI for the elderly defined in the second term of the National Health Promotion Movement in the twenty-first century¹⁶⁾.

On the basis of the answers to the question on household composition, the subjects were classified

into three groups: “single household”, including deceased or divorced; “married-couple household”; and “deceased or divorced and living with children”. The subjects who answered “others”, including “married-couple household with children”, were included in “deceased or divorced and living with children” because of the similarity to living with children and the scarcity of samples. Using the answers on the use of national nursing care insurance services, the subjects were categorized into “use”, and “no use”. Those who answered that their pension was their current major source of income were included as “pension”, and those who selected “work (including self-employment)” or “others” as their source of income were categorized into “earned”.

For self-rated health, those who answered “good”, or “rather good” on the five-scale responses to questions about current health conditions were classified into the high group and those who answered “moderate”, “rather poor”, or “poor” were classified into the low group. The statistical power of the explanation of self-rated health was maximized when the moderate condition was categorized into the low group¹⁷⁾. On the basis of the answers to the question regarding the condition of vision and hearing, the subjects were classified into two groups: “poor” and “normal”.

3. Statistical analyses

All analyses were conducted for groups according to whether or not subjects regularly go to grocery shops. The percentage of respondents with locomotive syndrome was calculated for each item. The significance of differences among categories was determined in accordance with the odds ratio (OR) and its 95 % confidence interval (CI) using logistic regression models, setting the presence of locomotive syndrome as the dependent variable and disadvantaged shopper, sex, age, household composition, income resource, certification of need for long-term care, hypertension, diabetes, heart disease, body mass, vision proficiency, hearing proficiency, going out for shopping, use of mobile grocery shop, use of delivered meals, and mode of transportation when grocery shopping, i.e., on foot, by

bicycle, motor bike, car, bus, or taxi, as independent variables. Adjusted OR values were calculated using multivariate logistic regression models: Model 1 includes sex, age, household composition, source of income, body mass, national nursing care insurance services, self-rated health, hypertension, diabetes, heart disease, vision proficiency, hearing proficiency, and frequency of going out; Model 2 is Model 1 with the additions of mobile grocery shop and delivered meals; Model 3 has the further addition of mode of transportation to the grocery shop. The levels of statistical significance were set at $p < 0.05$. The Hosmer-Lemeshow test for the goodness of fit was applied. The statistical tests were conducted using Stata 13¹⁸⁾.

4. Ethical considerations

This survey was carried out in accordance with the Ethical Guidelines for Epidemiological Research of the Ministry of Education, Culture, Sports, Science and Technology, and the Ministry of Health, Labour and Welfare, Japan. Because the subjects were asked about their households and personal affairs, we took all possible measures to protect and manage the subjects' personal data and to dispel the subjects' fears regarding protection of privacy. The interviewers obtained the subjects' consent after fully explaining the purpose of the study and the methods employed, and that participation in the survey was voluntary. The survey and analysis were conducted with the approval of the Ethics Committee of Tokiwa University (No. 100025). We applied for permission to use the data of "Survey on Dietary Environment in Relation to Difficulty in Shopping and Current Health Conditions of Household Elderly", and the application was approved by the chairman of the Japanese Society for Dietary Health Promotion.

III. Results

Survey responses were obtained from 12,782 respondents (crude response rate: 84.1 %). Valid responses without missing data were obtained from 4,969 respondents and used for the analysis (valid response rate: 38.9%).

The number of females was 3,892 (78.3 %; the percentage indicates the proportion of subjects

in relation to the total number of subjects in the analysis). The mean age was 76.1 [standard deviation (SD), 7.0].

Tables 1 and 2 show the distribution of locomotive syndrome with respect to subjects' characteristics and the results of bivariate analysis for groups according to whether or not subjects regularly go to grocery shops. Females accounted for approximately ninety percent of those who go to grocery shops regularly, but among those not going to grocery shops, males and females were equal in number.

Among those going to grocery shops (Table 1), permanent disadvantaged shoppers numbered 626 (18.8%), and disadvantaged shoppers due to shop closure numbered 394 (11.8 %). The prevalence of locomotive syndrome among non-disadvantaged shoppers was 471 (20.3 %), that for permanent disadvantaged shoppers was 170 (27.2 %), and that for disadvantaged shoppers due to shop closure was 108 (27.4 %). Those with permanent poor access to grocery shops (OR: 1.46, 95% CI: 1.19-1.79) and poor access due to shop closure (OR: 1.48, 95 % CI: 1.16-1.89) showed significant risk associations with locomotive syndrome (Table2).

Among those not going to grocery shops (Table 1), permanent disadvantaged shoppers numbered 363 (22.2%), and disadvantaged shoppers due to shop closure numbered 224 (13.7 %). The prevalence of locomotive syndrome was 254 (24.3%) among non-disadvantaged shoppers, 95 (26.2 %) among permanently disadvantaged shoppers, and 73 (32.6%) among disadvantaged shoppers due to shop closure. Permanently disadvantaged shoppers (OR: 1.51; 95% CI: 1.10-2.06) showed significant risk associations with locomotive syndrome (Table3). Disadvantaged shoppers due to shop closure (OR: 1.11; 95% CI: 0.84-1.45) showed no significant risk associations.

Table 2 shows the results of multivariate analysis of locomotive syndrome compared with the characteristics of subjects who regularly go to grocery shops. Permanently disadvantaged shoppers (Model 3, OR: 1.28, 95 % CI: 1.02-1.63) and disadvantaged shoppers due to shop closure (Model 3, OR: 1.29, 95% CI: 0.98-1.69) showed significant risk associations. Among those not regularly going to

grocery shops (Table 3), permanently disadvantaged shoppers due to shop closure (Model 3, OR: 0.90, 95% CI: 0.65–1.23) and disadvantaged shoppers due to shop

closure (Model 3, OR: 1.28, 95% CI: 0.89–1.85) showed no significant associations.

Table 1 Distribution of locomotive syndrome with respect to subjects' characteristics for inhabitants regularly going to grocery shops

		Going to grocery shop			
		Regularly (N=3,335)		Not regularly (N=1,634)	
		N	%	N	%
<i>Demographic characteristics</i>					
Gender	Male	371	11.1%	706	43.2%
	Female	2,964	88.9%	928	56.8%
Age	65–74	1,639	49.1%	561	34.3%
	75–84	1,403	42.1%	701	42.9%
	85 and older	293	8.8%	372	22.8%
<i>Socioeconomic status</i>					
Household	Single	1,481	44.4%	253	15.5%
	Married	1,214	36.4%	642	39.3%
	Living with children	640	19.2%	739	45.2%
Source of income	Earned	250	7.5%	232	14.2%
	Pension	3,085	92.5%	1,402	85.8%
<i>Health condition</i>					
Body mass	Underweight	594	17.8%	327	20.0%
	Average	2,109	63.2%	1,000	61.2%
	Obese	632	19.0%	307	18.8%
Long-term care	Yes	3,170	95.1%	1,325	81.1%
	No	165	4.9%	309	18.9%
Self-rated health	Good	1,649	49.4%	970	59.4%
	Poor	1,686	50.6%	664	40.6%
Hypertension	No	1,930	57.9%	865	52.9%
	Yes	1,405	42.1%	769	47.1%
Diabetes	No	3,068	92.0%	1,431	87.6%
	Yes	267	8.0%	203	12.4%
Heart disease	No	3,083	92.4%	1,416	86.7%
	Yes	252	7.6%	218	13.3%
Vision proficiency	No	1936	58.1%	824	50.4%
	Yes	1399	41.9%	810	49.6%
Hearing proficiency	No	2421	72.6%	973	59.5%
	Yes	914	27.4%	661	40.5%
<i>Shopping background</i>					
Going out	3 times or more	2,133	64.0%	731	44.7%
	Less than 3 times	1,202	36.0%	903	55.3%
Mobile grocery	Not use	3,143	94.2%	1,560	95.5%
	Use	192	5.8%	74	4.5%
Delivered meals	Not use	3,190	95.7%	1,542	94.4%
	Use	145	4.3%	92	5.6%
Transportation for shopping	Not on foot	1,976	59.3%	1,224	74.9%
	On foot	1359	40.7%	410	25.1%
	Not bicycle	2,607	78.2%	1,406	86.0%
	Bicycle	728	21.8%	228	14.0%
	Not motor bike	3,199	95.9%	1,595	97.6%
	Motor bike	136	4.1%	39	2.4%
	Not car	1,829	54.8%	541	33.1%
	Car	1,506	45.2%	1,093	66.9%
	Not bus	3,014	90.4%	1,562	95.6%
	Bus	321	9.6%	72	4.4%
Disadvantaged shoppers	Not taxi	3,176	95.2%	1,556	95.2%
	Taxi	159	4.8%	78	4.8%
	Due to shop closure	394	11.8%	224	13.7%

Table 2 Odds ratios obtained using multivariate logistic regression model of locomotive syndrome for inhabitants regularly going to grocery shops

	Crude OR		Model 1 (N=3,335)		Model 2 (N=3,335)		Model 3 (N=3,335)	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Going out								
3 times or more	1.35	1.14 - 1.60	1.00	0.83 - 1.20	0.97	0.81 - 1.17	0.97	0.81 - 1.17
Mobile grocery								
Use	1.27	0.91 - 1.76	1.00	0.66 - 1.35	0.94	0.65 - 1.35	0.93	0.65 - 1.35
Delivered meals								
Use	1.59	1.11 - 2.28	1.00	0.61 - 1.36	0.91	0.60 - 1.34	0.90	0.60 - 1.34
Transportation for shopping								
Bicycle	0.73	0.59 - 0.90	1.00	0.80 - 1.02	1.00	0.80 - 1.02	1.00	0.80 - 1.02
Motor bike	1.21	0.81 - 1.79	1.00	0.77 - 1.20	1.00	0.77 - 1.20	1.00	0.77 - 1.20
Car	0.66	0.56 - 0.78	1.00	0.83 - 1.05	1.00	0.83 - 1.05	1.00	0.83 - 1.05
Bus	1.27	0.98 - 1.66	1.00	0.79 - 1.07	1.00	0.79 - 1.07	1.00	0.79 - 1.07
Taxi	2.52	1.82 - 3.49	1.00	1.44 - 0.99	1.00	1.44 - 0.99	1.00	1.44 - 0.99
Disadvantaged shoppers								
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Permanently	1.46	1.19 - 1.79	1.00	1.70 - 1.10	1.37	1.10 - 1.70	1.28	1.02 - 1.63
Due to shop closure	1.48	1.16 - 1.89	1.00	1.32 - 1.02	1.34	1.04 - 1.75	1.29	0.98 - 1.69
Hosmer-Lemeshow test $P=0.92$								

Logistic regression model $P=0.88$

OR: Odds Ratio; CI: Confidence Interval

Covariates of Model 1-3: Gender, Age, Household, Source of income, Body mass, Long-term care, Self-rated health, Hypertension, Diabetes, Heart disease, Vision proficiency, Hearing proficiency

Table 3 Odds ratios obtained using multivariate logistic regression model of locomotive syndrome for inhabitants not regularly going to grocery shops

	Crude OR		Model 1 (N=1,634)		Model 2 (N=1,634)		Model 3 (N=1,634)	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Going out								
3 times or more	1.76	1.40 - 2.22	1.00	0.84 - 1.43	1.10	0.85 - 1.45	1.11	0.85 - 1.45
Mobile grocery								
Use	1.40	0.85 - 2.31	1.00	0.67 - 1.89	1.16	0.62 - 1.89	1.08	0.62 - 1.89
Delivered meals								
Use	1.58	1.01 - 2.46	1.00	0.56 - 1.56	0.94	0.55 - 1.55	0.93	0.55 - 1.55
Transportation for shopping								
Bicycle	0.85	0.61 - 1.18	1.00	0.76 - 1.63	1.00	0.76 - 1.63	1.00	0.76 - 1.63
Motor bike	0.86	0.40 - 1.82	1.00	1.18 - 0.52	1.00	1.18 - 0.52	1.00	1.18 - 0.52
Car	0.64	0.51 - 0.80	1.00	1.13 - 0.83	1.00	1.13 - 0.83	1.00	1.13 - 0.83
Bus	1.89	1.16 - 3.07	1.00	1.26 - 0.73	1.00	1.26 - 0.73	1.00	1.26 - 0.73
Taxi	2.20	1.38 - 3.50	1.00	1.44 - 0.85	1.00	1.44 - 0.85	1.00	1.44 - 0.85
Disadvantaged shoppers								
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Permanently	1.11	0.84 - 1.45	1.00	1.15 - 0.61	0.83	0.61 - 1.13	0.90	0.65 - 1.23
Due to shop closure	1.51	1.10 - 2.06	1.00	1.73 - 0.84	1.20	0.84 - 1.70	1.28	0.89 - 1.85
Hosmer-Lemeshow test $P=0.99$								

Logistic regression model $P=0.59$

OR: Odds Ratio; CI: Confidence Interval

Covariates of Model 1-3: Gender, Age, Household, Source of income, Body mass, Long-term care, Self-rated health, Hypertension, Diabetes, Heart disease, Vision proficiency, Hearing proficiency

IV. Discussion

For those regularly going to grocery shops, multivariate logistic regression indicated significant odds ratios of around 1.3 for locomotive syndrome in the group of permanently disadvantaged shoppers and disadvantaged shoppers due to shop closure compared with the group of non-disadvantaged shoppers. In the model with adjustment for transportation (model3), disadvantaged shoppers due to shop closure did not indicate significant odds ratio. Loss of significance of the group of shop closure partly reflects that shop closure might force inhabitants to use transportation and elevate the prevalence of locomotive syndrome among those regularly going out to buy daily necessities. Among those not regularly going grocery shopping, the association of disadvantaged shoppers due to the shop closure was too small to enable a comparison with non-disadvantaged shoppers.

The results of the study indicated that disadvantaged shoppers suffered the double fetters of poor access to daily necessities and locomotive syndrome. Augmented transportation upon the closure of a shop did not offer any protective effect against locomotive syndrome. Furthermore, taxi users showed a risk association with locomotive syndrome. Although there is an explanation of reverse causation that those with locomotive syndrome use taxis, taxi users were subject to the additional burden of expenditure for transportation.

The use of delivered meals and mobile grocery shops had no preventive effect on locomotive syndrome in this study. Perishable foods are heavy to carry for elderly who go shopping by public transportation and on foot. Consequently, they refrain from purchasing perishable foods. As a result, inadequate daily food and nutrient intake is induced. The disadvantaged shoppers have no choice but to purchase food at the remaining approachable shops, where only a limited range of fresh food is available¹⁾. Poor access to grocery shops might have multidimensional adverse effects on health. Disadvantaged shoppers are at the start of a downward spiral to locomotive syndrome.

Shoppers become disadvantaged as a result of social aging as well as individual aging¹⁹⁾. Locomotive syndrome is associated with loss of social capital¹⁴⁾. Accessibility is associated with social exclusion²⁰⁾. With the coming hyperaging society, the number of disadvantaged shoppers will increase rapidly. Because food is a basic necessity for maintaining a healthy and dignified life, food-supply stores, in some aspects, may be considered public facilities²¹⁾.

To prevent locomotive syndrome among disadvantaged shoppers, the primary possible measure is to open shops. Previous studies indicated that the opening of a new store in a food desert area improves access to and the consumption of fruits and vegetables. Neighborhood residents who have better access to supermarkets and limited access to convenience stores tend to have healthier diets and lower levels of obesity²²⁾. However, opening a new grocery shop is difficult. Alternative measures to reduce poor access may be the use of mobile grocery shops and delivered meals, although the current study indicated poor effectiveness against locomotive syndrome. Regionally tailored policies, such as enhancing the access to healthy food outlets or community health centers offering nutrition education and campaigns, could effectively improve public health outcomes by reducing risk factors and efficiently allocating limited resources²³⁾. Among disadvantaged shoppers, users of mobile grocery shops and delivered meals were limited to 10.1 % and 6.8%, respectively, in this study. This shows the possibility of increasing the number of users of these services by providing additional services to promote their physical activity and to provide healthy food menus for the elderly.

Access to daily necessities can be included under the umbrella of basic social security. Support provided by local government to communities with regard to bus transportation is a current progressive measure²⁾. Few local governments have prepared budgets for opening shops using the facilities of a closed shop or for establishing mobile grocery shops, citing limited capacity to develop specific plans and limited resources as their reasons. In local regions where measures to

aid disadvantaged shoppers are needed, the entry of private services has reached 62 %, including services for delivery and taking orders for purchases, and mobile grocery shops. The increase in the number of supplemental services is an opportunity to develop effective measures not only for disadvantaged shoppers but also for the maintenance of health including the prevention of locomotive syndrome.

Limitations of this study

In this cross-sectional study, the causal correlations remained speculative. The questionnaire items were not reviewed for scale validity. The external validity of the results was limited because the subjects were not randomly selected from the general population. Ad-hoc sampling may induce an underestimation of disadvantaged shoppers, who present a possibility of limited sampling. As for the household composition of the subjects, the majority of males lived in married-couple households, whereas many females lived in single households; these results seemed to reflect the household composition of the general elderly population as males die earlier than females, leaving many females to live by themselves. The study subjects are expected to be representative of a standard population.

In this study, those who answered “yes” to the question regarding being currently treated for bone and joint diseases were identified as having locomotive syndrome. However, the severity of the syndrome was not clarified in the questionnaire. Because the prevalence of locomotive syndrome in this study was 10% less than that in a previous study using the self-check list developed by the Japanese Orthopaedic Association for the Japanese general population²⁴⁾, the subjects of our study were not considered to include elderly with severe locomotive syndrome, causing the ORs to be underestimated. Further research applying a diagnostic questionnaire, such as the 25-question Geriatric Locomotive Function Scale, is necessary to quantify the assessment of locomotive syndrome^{25,26)}. Despite these limitations, this study offers value as unique research on 4969 elderly subjects in Japan.

Accessibility of the daily necessities was

evaluated using a self-administered questionnaire. Although previous studies focused on area-based aggregated-level factors of food deserts¹⁹⁻²²⁾, such as the analysis of the relationship between proximity and density of food suppliers in an area, this study provided an individual-level association between health condition and accessibility of food. Uncertainty in the details of the circumstances of disadvantaged shoppers was a significant limitation of the study. Further study is needed to clarify the association using a quantitative measurement of accessibility.

V. Conclusion

The results of this study indicated the possibility that more disadvantaged shoppers have locomotive syndrome than non-disadvantaged shoppers among those regularly going to grocery shops. Daily accessing to a grocery shop might have a key role on prevention of locomotive syndrome.

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