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Yumi Nakano, Atsumi Omukai, Taro Mori

yuminakano@gmail.com, atsumi.omukai@gmail.com, mori.taro@eng.hokudai.ac.jp

HU, Sapporo, Japan

RESEARCH ON DEPRIVATION SCALE FOR LIVING ENVIRONMENT IN COLD CLIMATE REGION

Abstract. The situation is that low-income householders in cold climate areas are unable to afford basic energy services due to a combination of high energy expenditure and low energy efficiency of their homes. Such a problem is called Fuel Poverty. The definition of Fuel Poverty is as which needs to spend more than 10% of its income on all fuel use and to heat its home to an adequate standard of warmth. But this definition affected by household's annual income, especially elderly people whose income decreases after retirement are more likely to be consider Fuel Poverty. In order to supplement the definition based on annual income, in this study we analyzed deprivation indicators for questionnaire surveying the living environment and living conditions in cold climate regions.

Keyword: living environment, Fuel poverty, Deprivation scale, cold climate region, Energy consumption, Questionnaire survey, low-income household

Introduction

In a cold climate region, a large heating cost is required compared to a warm region. In addition, households living in poor quality homes pay more for heating to keep the room temperature comfortable. Lack of heating can lead to poor quality of life, especially for the elderly and children, which may have adverse health effects. Such a problem is called Fuel Poverty (hereinafter called "FP"). The research and countermeasures are underway mainly in UK. The definition of FP is "Householders, fuel poverty is defined as which needs to spend more than 10% of household income on all fuel use in order to maintain heating home to an adequate standard of warmth." [1]. But this definition affected by income, especially elderly people whose income decreases after retirement are more likely to be consider as FP. However, this does not take into account the impact on living caused by factors other than the presence or absence of savings, the presence or absence of a home, and the result of salary, and therefore cannot accurately reflect the quality of their life. In addition, it is difficult to collect detailed property data such as savings, which places a heavy burden on the subjects. The aging rate in Hokkaido is higher than in the whole country, and the population aged 65 and over is close to 30% [2].

In order to supplement the definition based on annual income, in this study we analyzed deprivation indicators for surveying the living environment and living conditions in cold climate regions.

1. Deprivation Scale

1.1 Definition of Deprivation Scale

The deprivation scale is to directly ask the person's living situation, such as "whether you can eat three meals a day" or "whether you have a bicycle" and add up the number of items that are not satisfied. This is to try to determine the degree of household poverty. Usually, income data is used to calculate FP, but income data itself cannot completely represent the standard of living of a household. The deprivation scale complements the poverty scale based on such income data. With the deprivation scale, it is possible to directly ask the quality of their life, so that it is possible to investigate the status of households that cannot be grasped only by income data. The deprivation scale is also effective in reducing the burden on the respondents to be surveyed, since it is not necessary to collect detailed income data.

1.2 Calculation method for Deprivation Scale

Since the deprivation scale is calculated by adding the number of missing questions, it is not necessary to collect data such as household income. In addition, since the number of questions of the deprivation scale greatly influence the scale, the selection of the question is important.

2.Survey

2.1 Survey Outline

A questionnaire survey was conducted to understand the living environment and living conditions of residents in Hokkaido. I show the survey outline (Table 1). The questionnaire was distributed to all households in City A in December 2019 with the cooperation of the city. The number of copies distributed was 1,650, and the collection rate was 17.58% (290 copies).

Table 1 The Survey Outline

Survey Region	All household in City A
Distribution Time	Decbember 2019
Number of Distribution	1650
Number of Responses	290
Respons Rate	17.58%
Survey Content	Responded characterstic, Situation of indoor enviroment, Heating system, Energy costs, Deprivation scale

2.2 Responded characteristic

I show the aging rate of City A (Figure 1). The aging rate of City A is the highest among the municipalities in Hokkaido, reaching nearly 50%. I show the aging rate of respondents (Figure 2). Also, in this questionnaire survey, there were many elderly respondents, and 67% of the respondents were elderly. The households with elderly people (over 65 years old) and the annual household income of all res

pondents (Figure 3). As can be seen from Figure 3, elderly respondents tended to have lower household income.

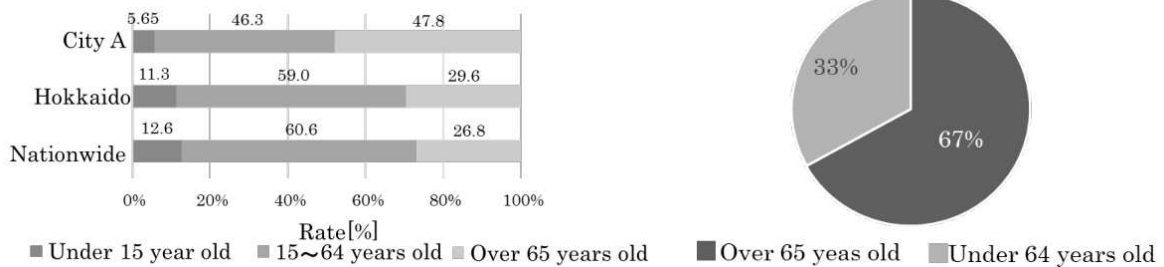


Figure 1 Aging rate of City A

Figure2 Aging rate of Response

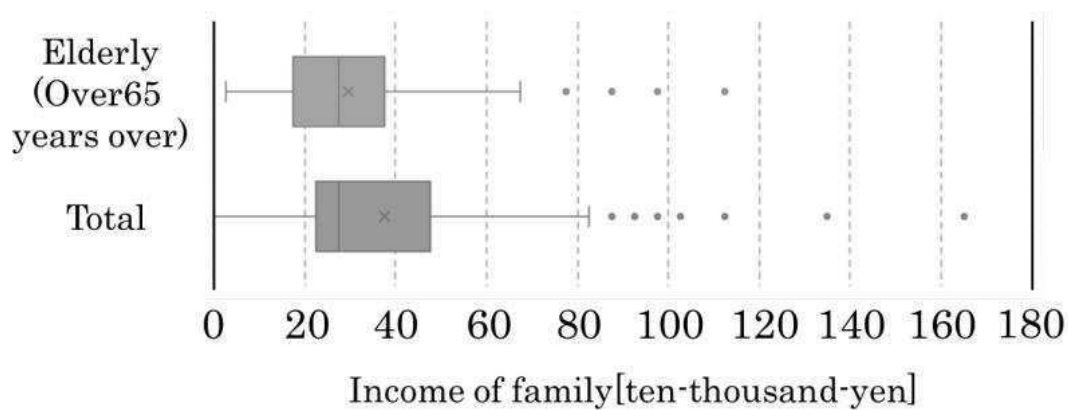


Figure 3 Income of Family

3. Understanding the actual FP status using deprivation indicators

3.1 The number of deprivation scale

The items of the deprivation scale were selected in addition to those used for ordinary poverty surveys, as well as those related to the living environment so that

the respondents' lives could be grasped (Table 2). In selecting the questions, the deprivation scale proposed for the child poverty survey [3] was referred to. The percentage of households with a deprivation scale of 3 points or more out of 13 points and households with a score of 2 points or less (Figure 5). In this survey, 20% of the respondents scored

3 points or more. 6% of households answered that they could not pay for fuel for heating, and 16% of households answered that they could not buy the food they needed (Figure 6). 14% of households answered that they could not buy clothing needed by their families. Less than 10% of households said they would not turn on heating when they felt cold. From those results, it can be seen that fuel cost for heating at home is difficult to reduce and heating is indispensable in daily life. In addition, other questions with a high deficiency rate include "keep using old heating equipment" and "wear socks repeatedly".

Table 2 Questions of Deprivation

a. Food poverty	h. Leave mold
b. Clothing poverty	i. Leave condensation
c. Cant pay for heating bill	j. Leave air dirt and stench
d. Replacement of heating equipment	k. Leave messy room
e. Don't turn on heating	l. Cold shower room
f. Use of auxiliary heating equipment	m. Clouse layering
g. Leave the room dry	

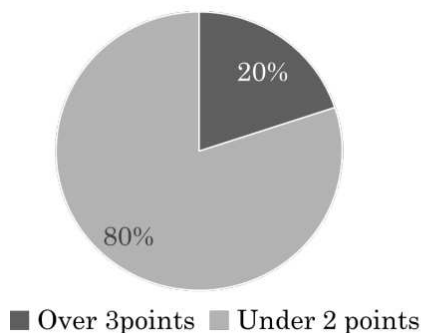


Figure 5 Deprivation Scale

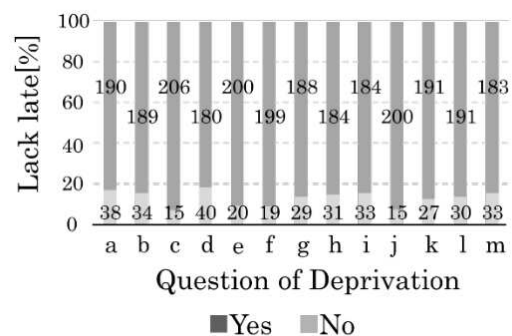


Figure 6 Lack Rate of Deprivation Scale by question

Table 3 Result of Multiple Logistic Regression Analysis

Explanatory variable	Group	Adjusted Odds Ratio (p-value)
Number of Family	More than two person	1.00
	Single-person household	2.31* (p=0.090)
Indoor thermal environment on daytime in winter	Good~Comfortable,	1.00
	Not good~Uncomfortable	5.49** (p=0.0011)
Gas fan heater	Non-use	1.00
	Use	15.19* (p=0.078)
Air conditioner	Non-use	1.00
	Use	3.50* (p=0.068)
Age of a building	After 1991	1.00
	Before 1990	1.50 (p=0.44)
Type of window	Double glass, Low-e glass	1.00
	Single glass	0.74 (p=0.52)
Heating system	All room heating system	1.00
	Unit heating system	0.92 (p=0.89)
Annual income	Over 150 thousand yen	1.00
	Under 150 thousand yen	0.65 (p=0.49)
Desire to moving	No	1.00
	Yes	0.60 (p=0.32)
Hot water panel heater	Non-use	1.00
	Use	1.63 (p=0.50)
Pellet stove	Non-use	1.00
	Use	0.0000010 (p=0.99)
Building size	Small, Big	1.00
	Right-size	1.013 (p=0.96)
Wood stove	Non-use	1.00
	Use	8.62 (p=0.15)
** : p < 0.005, * : p < 0.1		

3.2 Input variables and Statistical Processing Methods

Multiple logistic regression analysis was calculated using the deprivation scale as the objective variable. The significance level was set as $p = 0.05$, and then the odds ratio was calculated. The baseline of the deprivation scale was set 3 points.

3.3 Causes of High Deprivation Scale

In the adjusted odds ratio for the number of households, it was 2.31 ($p < 0.10$) for single-person households (Table 3). This is probably because in City A, which has many elderly households, the smaller the number of households, the lower income and the more difficult it becomes to live. The odds ratio of the thermal environment during the daytime in winter was 5.49 ($p < 0.05$) for households who answered that they were somewhat uncomfortable to uncomfortable. This is considered to be because the thermal environment in the daytime deteriorated due to the poor performance of the house, and as a result, the heating cost was putting pressure on life. The odds ratio for the use of gas fan heaters and air conditioners was 15.19 ($p < 0.1$) and 3.50 ($p < 0.1$). This is probably because households that use gas or electricity for heating cost more to heat than households that use oil.

4. Conclusion

In this study, we analyzed deprivation scale for poverty research in cold climate regions to supplement the general definition and calculation method of Fuel Poverty, which is being researched and researched mainly in the UK. The lack rate of deprivation scale shows that heating is indispensable in City A, and heating costs are deteriorating quality of life, such as the inability to buy food and clothing needed to squeeze households. Multiple logistic regression analysis shows that households living alone or living in poor daytime thermal environments, or households that use gas appliances such as gas fan heaters or air conditioners that require high heating costs are deprived. And it turned out that the scale is likely to be high.

Reference

1. Department of Energy & Climate Change : The UK Fuel Poverty Strategy 2001, - URL: https://www.storiesofchange.ac.uk/system/files/upload_136 (accessed 2020.1)
2. Ministry of Internal affairs and Communication : The number of population based on basic resident register research, Demographic movement and the number of households 2017. -URL: <https://www.e-stat.go.jp/stat-search/files?page=1&toukei=00200241&tstat=000001039591> (accessed 2020.1).
3. Abe Sayaka : Constructing a Deprivation Scale for Japan : an Index to Supplement the Relative Poverty Rate, Quarterly publication • National Institute of Population Research, Vol.40, No.4, pp.360~371, 2014

Накано Юми, Атцуми Омукай, Таро Мори
yuminakano@gmail.com, atsumi.omukai@gmail.com, mori.taro@eng.hokudai.ac.jp
Университет Хоккайдо, Саппоро, Япония

ИССЛЕДОВАНИЕ ШКАЛЫ ДЕПРИВАЦИИ ДЛЯ ЖИЛОЙ СРЕДЫ В РЕГИОНЕ С ХОЛОДНЫМ КЛИМАТОМ

Абстракт. В настоящее время позволить себе базовые энергетические услуги из-за сочетания высоких энергозатрат и низкой энергоэффективности их домов. Эта проблема называется “Топливная Бедность” и заключается в том, что более 10% доходов тратятся лишь на нагрев жилища до приемлемой температуры. Попадание под это определение зависит от годового дохода домовладельцев, в особенности это затрагивает пожилых людей, чей доход после выхода на пенсию сокращается. Для дополнения вышесказанного, мы провели анкетирование, зафиксировав и проанализировав показатели депривации среды обитания, а также условия жизни в регионах с холодным климатом.

Ключевые слова: жилая среда, топливная бедность, шкала депривации, регион с холодным климатом, потребление энергии, анкетирование, домохозяйства с низким доходом, домохозяйства с низкими доходами в районах с холодным климатом не могут с низким доходом.