学 位 論 文 の 要 旨

氏名　元廣 惇

学 位 論 文 名　Environmental Factors Affecting Cognitive Function Among Community-Dwelling Older Adults: A Longitudinal Study

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著 者 名　Atsushi Motohiro, Takafumi Abe, Kenta Okuyama, Keiichi Onoda,Tomoko Ito, Minoru Isomura, Toru Nabika, Shunichi Kumakura.

論 文 内 容 の 要 旨

INTRODUCTION

Dementia is a significant problem of public health in aging societies worldwide. Not only does it disrupt lives of affected individuals, their caregivers and families, but also it imposes a substantial economic burden on the society. Dementia affects approximately 50 million people worldwide, and this number is expected to reach 82 million by 2030.

Although previous studies focused on effects of personal factors such as lifestyle and health status on cognitive decline, physical environmental factors such as air pollution, occupational exposure and stress drew more attention as physical environmental factors relevant to cognitive function recently. Therefore, to achieve primary prevention of dementia in high-risk communities, it is important to know environmental factors useful for predicting cognitive decline.

In recent years, the geographic information system (GIS) was applied in studies on the relationship between geographical as well as social environmental factors and health-related outcomes, and was proven to be useful in the field of public health. As a result, several cross-sectional studies examined the relationship between various physical environmental factors and cognitive function. For example, it has become clear that social cohesion, sidewalk environment in neighborhood and proximity to nearby facilities affect cognitive function of the elderly residents. However, most studies were done in city areas and therefore insufficient information is available on how physical environmental factors affect long-term cognitive decline in the elderly in rural areas.

In this study, we examined various factors that would contribute to cognitive decline among the elderly living in a rural area, with the aim to develop effective strategies against progression of dementia. In particular, we focused on physical environmental factors in a rural area in Japan.

MATERIALS AND METHODS

This four-year follow-up study was conducted using data collected as a part of the Shimane CoHRE Study in Shimane Prefecture, in which risks of lifestyle-related diseases are explored using data concerning medical history, lifestyle, physical ability and cognitive function collected during annual municipal health examinations. The participants were required 1) to be 60 years or older at the first examination performed in August 2014, and 2) to have a medical record of a follow-up examination performed in October 2018. After excluding those with missing data (n = 55), the total sample size was 485 (218 males and 267 females).

Cognitive function was assessed using an application called the Cognitive Assessment for Dementia, iPad version 2 (CADi2). Scores ranged from 0 to 10 and higher scores indicated better cognitive function. Cognitive decline was defined as the score ≤ 7 and analyzed as a dichotomous variable (normal vs. low cognitive function).

Using a GIS (ArcGIS Pro.2.0, Esri Japan), we measured elevation (altitude), hilliness (steepness of land slope), residential density, and proximity to the nearest community center. We categorized each of the parameters into quartile groups in analyses of the effects on cognitive function.

Following covariates were analyzed as potential factors influencing cognitive function; sex (male vs. female), age (in years), body mass index (BMI), hypertension (defined as those undder antihypertensive treatment and/or systolic blood pressure > 140 mmHg and/or diastolic blood pressure > 90 mmHg), and depression (defined as those with the Zung Self-Rating Depression Scale > 40).

We used a generalized estimating equation to evaluate effects of physical emvironmental factors listed above on the congnitive function (normal vs. low) in 2018 under a non-adjusted model (model 1) and a model adjusted for sex, age, BMI, hypertension, depression, and cognitive function at the baseline in 2014 (Model 2). As we observed multi-collinearity among environmental variables ($r > 0.32$, $p < 0.001$), the environmental factors were included in the model one by one.

The study protocol was approved by the Research Ethics Committee of Shimane University.

RESULTS AND DISCUSSION

The median age of the participants was 70.0 [inter quartile range (IQR); 66.0-75.0] years, and the media BMI was 21.6 (IQR; 19.9-23.8) kg/m^2. Of all the participants, 55 (11.3%) had cognitive decline at the baseline, and 240 (49.5%) and 91 (18.8%) had hypertension and depression, respectively. At the follow-up in 2018, 56 (11.5%) showed low cognitive function.
In Model 2 (an adjusted model), both elevation and hilliness showed a significant increase of an odds ratio (OR) in the fourth quartile when compared with the first quartile (adjusted OR was 2.58 and 1.93, respectively). These observations implied that geographical environment in mountaneous areas imposed a high risk of cognitive decline on residents probably through limiting mobility and physical activity. In contrast, it was of interest that residential density showed a significant decrease of the OR in the second quartile when compared with the first quartile (adjusted OR was 0.36). This might indicate that a modest population density (not too high nor too low) was important to keep cognitive function in residents. Distance to the community center gave no significant increase in cognitive function.

CONCLUSION

Geographical environment of residential areas might influence cognitive function of the elderly living in rural areas.