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学位論文題目	The falls and the factors affecting the falls among the community-dwelling older adults in Okikamuro and Iwasaki, Japan (沖家室村・岩崎村在住高齢者の転倒と転倒関連要因)
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論文の内容の要旨

(目的)

In Japan today, maintenance of an independent life style without compromising quality of life (QOL) has become a critical issue. When the author visited Okikamuro Island for the first time, the islanders appeared to be very active and energetic. At first, she thought that there was a special reason for this, such as ethnic and /or historical factors ; however, the islanders didn't have any special background other than their long history. Thus, the author decided to conduct a basic study in order to identify what factors, if any, kept the islanders so healthy and active.

It is said that 30% to 50% of community-dwelling older adults (65 years old and older) fall at least once a year, and falls also cause significant psychological distress. A fall often leads to a fear of falling, and the individual becomes more housebound and depressed, decreasing their QOL. A decrease in fall incidence among the older adults also represents a potential savings in health care costs, in addition to discomfort and disability averted.

This cross-sectional study aims to identify the relationship between fall risk and time spent outdoors, frequency of falls, body mass index (BMI), and other factors such as chronic illnesses, including diabetes (DM) and hyper-tension (HTN), among the older adults in two rural Japanese communities. The ultimate goal is to promote greater independence through fall incidence reduction among older adults.

(対象と方法)

A total of 207 subjects aged 65 years old and up, (average age : 77.4, range : 65-92) in two communities, Okikamuro Island (Okikamuro) in Yamaguchi Prefecture and Iwasaki Village (Iwasaki) in Aomori Prefecture, were enrolled in this study. Both Okikamuro and Iwasaki have long histories, 400 and 600 years, respectively. The major industries in both communities are fisheries and agriculture. In both communities, people have traditionally used eastern-style toilets,

tatami mats, and futon bedding, all of which require repeated squatting, kneeling, and standing for use.

In Okikamuro (latitude N33°54'), the average age of the subjects (n= 104) who participated in this study was 78.7 years old (SD : 10.3), and 43% of them lived alone. Thirty-four of the subjects in this study were men, and 70 were women. The oldest active fisherman was 88 years old and the oldest woman working in the fields was 92 years old.

The second site, Iwasaki (latitude N40°38') selected as a reference site. Iwasaki's older adults population is higher than the national average at 34% as of 2006 (national average : 20.8%), and the older adults were equally independent, often working into advanced age. The average age of the subjects (n=103) who participated in this study was 76.0 years old (SD : 9.2), and 22% lived alone. Twenty-four of the subjects in this study were men and 79 were women.

From 2004 to 2007, fact-finding interviews asking about time spent out-doors daily, fall history over 12 months, and medical history were conducted at both locations. The interviews were conducted on a one-on-one basis at a community hall and/or at the subjects' homes (based on subject's preference). All subjects were volunteers. Additionally anthropometric measurements, bone density measurements (ankle), grip strength measurements, blood pressure measurements, dementia assessments (Reisberg's The Global Deterioration Scale), and fall risk assessments (Hendrich II Fall Risk Model : 5 points and greater indicates high risk for falls, used with written permission) were performed. A fall was defined in this study as "an event, which results in a person coming to rest inadvertently on the ground or other lower level". Data was analyzed employing SPSS 15.0J window and Microsoft Excel 2007.

Ethical considerations : The permission for this study was obtained from Tsukuba University Ethics Committee.

(結果)

In Okikamuro, 1.9% of the subjects reported that they had at least one fall during the last 12 months, and 20.6% of Iwasaki's older adults reported that they experienced at least one fall. Fall incidence ($p<.001$), hypertension (HTN) group ($p<.05$), and BMI 25 and greater group ($p<.01$) was significantly lower in Okikamuro (Fisher's exact test). In Iwasaki, the subjects who were under medical care for orthopedic problems, had a higher incidence of falls ($p<.01$) (Fisher's exact test). An average fall risk point was 1.25 (± 1.26) in Okikamuro ; this was significantly lower than Iwasaki's which was 1.63 (± 1.35) ($p<.05$). In Okikamuro, fall risk points rose with age ($r=.40$, $p<.001$) and as fewer hours were spent outdoors ($r= -.20$, $p<.05$) (Pearson's product moment correlation).

During the summer season (April-September), Iwasaki's older adults spend more time outdoors than those in Okikamuro (3.5 hours/day vs. 2.7 hours/day) ; however, a major difference was noted during winter. In Iwasaki, older adults spent an average 1.5 hours outdoors primarily for snow removal work, which is inevitable in this area. On the other hand, Okikamuro's older adults spent an equal amount of time outdoors throughout all seasons (2.7 hours/day), and thus spent longer hours outdoors during winter ($p<.001$).

Okikamuro islanders did not experience significant weight change throughout the seasons. By contrast, both men and women in Iwasaki, 81.3% and 66.7% respectively, gained weight in the winter (average weight gain of 1.83kg in men and 1.97kg in women). However, this was not statistically significant ($p=.232$, $SD=1.11$).

Women in Okikamuro showed a lower average body mass index (BMI) compared with Iwasaki's women in all age categories. In Okikamuro, 12.8% of women had BMIs of 25 or higher, whereas in Iwasaki the same number was 34.2%. Of this 34.2%, 18.5% had BMIs of 30 or higher, while no women in Okikamuro had a BMI greater than 30. In other words, 6.3% of all subjects in Iwasaki had BMIs 30 or higher, almost 2.5 times more than the national average (2.5%). In Okikamuro, the number of older adults with a BMI of 25 or higher was significantly lower than in Iwasaki ($p < .01$). After categorizing BMI into three groups (below 25, 25-29, and 30 and over), the correlation with fall risk point was analyzed (multiple comparison-Tukey method). Individuals with BMI's of 30 and higher had a higher fall risk point in Iwasaki ($p < .05$). Comparing the "BMI under 25" group and the "BMI over 25" group showed that the former spent significantly longer hours outdoors in Okikamuro ($p < .05$). However, in this respect, no significant differences were presented in Iwasaki. No correlations were evident between BMI, fall risk point, age, and hours spent outdoors in Okikamuro, while the Iwasaki data suggested a correlation between fall-risk point and BMI ($r = .231$, $p < .05$).

In Okikamuro, 22.0% of older adults were under medical care for HTN while 56.0% were under medical care in Iwasaki, and this was statistically significant ($p < .05$). In Okikamuro, 3.0% of older adults were under medical care for diabetes (DM) while this was true of 12.6% of older adults in Iwasaki ($p < .05$). This suggests that Iwasaki's older adults may have a higher incidence of DM. In Okikamuro, male subjects who were receiving medical care for HTN and DM, showed a tendency to have a higher fall risk, though this was not statistically significant ($p < .10$) (t-test).

(考察)

In this study, a significant difference was noted in hours spent outdoors during the winter : 2.7 hours (mean) in Iwasaki ($p < .001$). In comparison, figures for fall incidence were 1.9% in Okikamuro and 20.6% in Iwasaki ($p < .001$), although this number is still lower than the 30% average in the U.S. (Stel et. al, 2003). In Iwasaki, the severe winter obviously interferes with outdoor activities, and consequently, this may contribute to a greater number of older adults with weight gain during the winter, orthopedic problems, HTN, and DM. As the studies done by Holick (2004), Okuno et.al (2007), and other researchers on vitamin D, sunlight, and bone health indicate, there is a strong relationship between vitamin D and bone health, balance, ambulation, and etc. In Okikamuro, there is no snow throughout the winter, the amount of sunlight is much greater than in Iwasaki, and older adults in Okikamuro spend more time outdoors. These factors may contribute to the fact that there was only one person who reported a fall resulting in serious injury, and significantly fewer older adults under medical care for orthopedic conditions compared to the subjects in Iwasaki who experience a long winter with less sunlight.

In Okikamuro, three factors seemed to increase fall risk point : being a man, receiving medical care for hypertension, or receiving care for diabetes. However, the results were not statistically significant ($p < .10$). By adding more samples and also conducting an additional cohort study, the author may be able to confirm the trend more substantively. As to the relationship between fall risk point and age as well as hours spent outdoors, fall risk point increased with age, and as fewer hours were spent outdoors. However, since this was a cross-sectional study, these correlations were not conclusive as to which factor is the initial trigger : hours spent outdoors or fall risk point. The same comment can be made as to the older adults with orthopedic problems in Iwasaki : those with fall experiences indicated a higher fall risk point, yet, it is difficult to determine whether falls caused orthopedic problems or if they fell because of orthopedic problems. Both factors may be interacting.

Limitations : As the design of this study was cross-sectional, we must avoid discussing the causality solely based on the data obtained from this study. This study also did not provide an in-depth assessment of each fall, such as time, associated activity, and other detailed circumstances surrounding the fall.

審 査 の 結 果 の 要 旨

平成 22 年 8 月 17 日、博士（ヒューマン・ケア科学）学位論文審査委員会において、審査委員全員出席のもと最終試験を行い、論文について説明をもとめ、関連事項について質疑応答を行った。その結果、タイトル中の "in rural Japan" を "in Okikamuro and Iwasaki, Japan" とすべきであるなど、若干の修正が求められたが、改訂版作成を条件に、審査委員全員によって合格と判定された。平成 23 年 1 月 5 日、改訂版を受理し、適切な改訂が行われていることを審査委員全員が確認した。

よって、著者は博士（ヒューマン・ケア科学）の学位を受けるに十分な資格を有するものと認める。