Article

Prevalence of Social Isolation in Community-Dwelling Elderly by Differences in Household Composition and Related Factors: From a Social Network Perspective in Urban Japan

**Kyoko Shimada, MS[1,5],
Sachiko Yamazaki, PhD[1,2],
Kyoko Nakano, MD, PhD[1],
Alain Mayindu Ngoma, MD, PhD[3],
Ryutaro Takahashi, MD, PhD[4],
and Seiji Yasumura, MD, PhD[1]**

Abstract

Objective: The aim of this study was to measure the prevalence of social isolation in community-dwelling elderly and related factors based on household composition differences. **Method:** We used the six-item Lubben Social Network Scale to measure social isolation in 2,000 individuals. Multiple

---

[1]Fukushima Medical University, Fukushima-shi, Fukushima, Japan
[2]Bunkyo Gakuin University, Fujimino-shi, Saitama, Japan
[3]McGill University, West Montreal, Quebec, Canada
[4]Tokyo Metropolitan Institute of Gerontology, Itabashi-ku, Tokyo, Japan
[5]Den-En Chofu University, Kawasaki-shi, Kanagawa, Japan.

Corresponding Author:
Kyoko Shimada, MS, Department of Public Health, School of Medicine, Fukushima Medical University, 1 Hikariga-Oka, Fukushima-Shi, Fukushima 960-1295, Japan. (Present: Kyoko Shimada, MS, Department of Human Welfare, Den-En Chofu University, 3-4-1 Higashiyurigaoka, Asao-ku, Kawasaki-shi, Kanagawa 215-8542, Japan.)
Email: shimada@dcu.ac.jp

logistic regression analysis was performed to examine factors related to social isolation with household composition after adjusting for gender and age. **Results:** The prevalence of social isolation was 31.0% for elderly living alone and 24.1% for those living with family. For both, poor mental health and lack of social support from nonfamily members were associated with social isolation risk. For elderly living with family, low intellectual activities and poor health practice were associated with social isolation risk. **Discussion:** This study showed high prevalence of social isolation. For prevention, promoting mental health and encouraging them to make friends may be important. For elderly living with family, promoting intellectual activities and good health practice is recommended.

Introduction

In Japan, with changes in household composition, increase in the number of elderly households, shift toward a nuclear family, and reduction in community interactions, various problems have arisen due to social isolation, including dying alone (Cabinet Office, Government of Japan, 2012). When elderly people go through experiences such as worsening health, retirement, children leaving the nest, and the death of friends or life partners, they may fall into social isolation. It is therefore desirable to establish a support strategy to address this issue. Previous studies have highlighted social isolation as being related to suicide (Cornwell & Waite, 2009) and reduced well-being (Chappell & Badger, 1989) while in addition affecting death rates (LaVeist, Sellers, Brown, & Nickerson, 1997), and the World Health Organization (WHO) has called for its prevention (WHO, 2002).

Social Isolation

Social isolation is an objective measure related to lack of social contacts with family and community, whereas loneliness is a subjective feeling pertaining to lack or loss of social contacts (De Jong Gierveld, Van Tilburg, & Dykstra, 2006; Townsend, 1963). Furthermore, there are many other operational definitions for measuring social isolation, such as defining "persons living by themselves with no visitors for the past week, and having absolutely no interaction with humans the previous day. (p. 261)" (Townsend, 1968) or combining

"living alone" and "absence of interactions with friends or neighbors," among others (Chappell & Badger, 1989; Kawai, 2002; LaVeist et al., 1997). Furthermore, Nicholson (2009) defined social isolation as "a state in which the individual lacks a sense of belonging socially, lacks engagement with others, has a minimal number of social contacts and they are deficient in fulfilling and quality relationships.(p. 1346)" However, there are no set criteria or conditions, and they vary as much as the researchers. Thus, there is a need for more focus on social isolation assessment and a better understanding of related risk factors, which will provide paths for effective intervention (Nicholson, 2012).

As Japan has an aging population, an increase in the number of elderly living alone was observed, which contributes to problems related to isolation. Recently in Japan, several reports focused on the social isolation associated with living alone (Kawai, 2002; Saito, Shimizu, & Takei, 2010; Saito, Shimizu, Yamaguchi, & Takei, 2009). Social isolation is operationally defined as people living alone who have poor social networks (Kawai, 2002) or the state of having poor face-to-face interactions with others (E. Kobayashi et al., 2011; Saito, Fujiwara, et al., 2010; Saito, Shimizu, & Takei, 2010; Saito et al., 2009), in other words, low frequency of contact with people other than those living with family (E. Kobayashi et al., 2011; Saito, Fujiwara, et al., 2010; Saito, Shimizu, & Takei, 2010; Saito et al., 2009). Saito, Fujiwara, et al. (2010) measured only the frequency of contact with people other than those living with family members, meaning that they excluded individuals living with family. In previous community-based studies pertaining to elderly people living with others and their social isolation, "the frequency of interaction with people other than living with family members, such as family members living separately, friends, and neighbors" was observed and studied in Japan (E. Kobayashi et al., 2011, p. 448; Saito, Fujiwara, et al., 2010, p. 787). However, this type of measurement did not consider the relationship with people living with family, meaning that we do not have a complete understanding of social isolation.

Household Composition

In Japan, 75.7% of persons aged 65 years or older lived with others (Graphical Review of Japanese Household, 2010). In Okayama Prefecture, Japan, among the elderly who died from unknown cause and underwent autopsy, about half were living with their family (Matsuzawa et al., 2009). This shows that even when elderly person are living with family, they may die without anyone caring. In recent years in Japan, more cases of suicides have been reported among elderly individuals living with family compared with those living alone (Cabinet Office, Government of Japan, 2012). This situation may

reflect a potential problem in some elderly living with family. Saito, Fujiwara, et al. (2010) recommended examining social isolation among not only people living alone but also those living with family. In addition, E. Kobayashi et al. (2011) reported that elderly adults living with family were not necessarily safer. Therefore, any examination of social isolation must not be limited to elderly living alone but must also include elderly living with family.

Recently in Japan, several reports focused on the social isolation associated with living alone (Kawai, 2002; Saito, Shimizu, & Takei, 2010; Saito et al., 2009) and only very few reported on people living with family. The scale we used is different, but there is a report that examined the social isolation of living alone and living with family (Saito, Fujiwara, et al., 2010). Both of these types of social isolation had the commonalities of sex, whether children were living in the neighborhood, economic status, and physical movement ability. Marital status was the only factor associated with social isolation unique in elderly persons living alone (Saito, Fujiwara, et al., 2010). Findings regarding living alone and living with family are scarce. Thus, we believe that there is a need to examine further the physical, psychological, and social factors, and it is important to analyze the social isolation associated with living alone and living with family separately. The factors responsible for social isolation may differ between these conditions.

Social Network Perspective

The six-item Lubben Social Network Scale (LSNS-6; Lubben et al., 2006) can be used to measure social isolation even in people living with others. The LSNS-6 was developed with a focus on social networks in close relationships. The LSNS-6 has three subscales that relate to "family and relatives" and "friends." A low total score of less than 12 indicates that a person has limited social network and is at a high risk for social isolation (Kurimoto et al., 2011; Lubben et al., 2006). The prevalence of social isolation measured using the LSNS-6 in elderly people living within a community was 20% in Hamburg (Germany), 11% in Solothurn (Switzerland), 15% in London (England; Lubben et al., 2006), and 17% in British Columbia (Canada; K. M. Kobayashi, Cloutier-Fisher, & Roth, 2009). Lubben et al.'s (2006) participants were older than 65 years of age, had low activities of daily living (ADL), and were admitted to care facilities; those with cognitive impairment were excluded. Iliffe et al.'s (2007) participants were nondisabled population aged 65 years and above. In addition, K. M. Kobayashi et al.'s (2009) participants were over the age of 65 years, and approximately 50% urban and 50% rural. In Western countries, several community-based studies were undertaken to investigate the risk factors for social isolation using the LSNS-6 in

British Columbia (K. M. Kobayashi et al., 2009) and London (Iliffe et al., 2007). Social isolation was associated with men, poor health, and social factors such as low income (Iliffe et al., 2007; K. M. Kobayashi et al., 2009). These reports were cross-sectional and did not report the causal relationship between social isolation and risk factors.

In Japan, the LSNS-6 has been used on participants aged 55 years or older (Kurimoto et al., 2011) but not on those aged 65 years or older, and to the best of our knowledge. There have been no studies on people aged 65 years or older living in the community to investigate the prevalence of and factors related to social isolation.

The aim of this community-based study was to measure prevalence of social isolation in elderly people using the LSNS-6 and examine related factors for two types of household composition: living alone and living with family. Knowledge from this study will help to delineate preventive measures against social isolation among high-risk individuals.

Method

Participants and Procedure

This study targeted 2,000 individuals between 65 and 84 years of age living in K Ward of Tokyo as of October 2011. We used random sampling stratified by age and gender, using data from the Basic Resident Register. The investigation was conducted from December 1 through December 14, 2011. Participants were surveyed using a self-administered questionnaire sent by mail. Overall, we received responses from 1,199 participants (response rate: 60.0%). After excluding those who were hospitalized/institutionalized or who required long-term care or assistance (as certified by the Ministry of Health, Labor and Welfare), as well as those lacking data among the variables of interest (LSNS-6 and household composition), 1,013 individuals were available for analysis. The Ethics Committee of Fukushima Medical University approved this study.

Investigation Items

The LSNS-6 total scale score is an equally weighted sum of the six items, with scores ranging from 0 to 30, where a total score of less than 12 is defined as being at risk of social isolation (Kurimoto et al., 2011; Lubben et al., 2006). As the LSNS-6 comprises only six questions with regard to the number and nature of an individual's social network, these are easy to answer for the elderly individuals. The scale items that deal with kinship include the following:

1. How many relatives do you see or hear from at least once a month?
2. How many relatives do you feel at ease with that you can talk about private matters?
3. How many relatives do you feel close to such that you could call on them for help?

These three scale items were repeated with respect to nonkin ties by replacing the word *relatives* with the word *friends*:

4. How many of your friends do you see or hear from at least once a month?
5. How many friends do you feel at ease with that you can talk about private matters?
6. How many friends do you feel close to such that you could call on them for help?

Each LSNS-6 question is scored on a 0-to-5 scale (0 = *none*, 1 = *one*, 2 = *two*, 3 = *three or four*, 4 = *five to eight*, 5 = *nine or more*). The total score is an equally weighted sum of these six questions with scores ranging from 0 to 30.

The items investigated were as follows: age, gender, family composition, primary nursing care requirement authorization; the Japanese version of the WHO-Five Well-Being Index (WHO-5-J; Awata et al., 2007); self-rated health, height, weight, Motor Fitness Scale (MFS; Kinugasa & Nagasaki, 1998); Tokyo Metropolitan Institute of Gerontology (TMIG) Index of Competence: (instrumental activities of daily living [IADL], intellectual activities, social roles; Koyano, Shibata, Nakazato, Haga, & Suyama, 1991); three cognitive function items of the basic checklist of the Ministry of Health, Labor and Welfare; seven health practices (Belloc & Breslow, 1972); absence/presence of ailments; social support from cohabiting family members or others (Noguchi, 1991); and frequency of going out (Yasumura, 2006).

The WHO-5-J is a simple mental health index made up of five items scored from 0 to 25 points, with a higher score indicating a higher state of mental health. A score of below 13 or scoring 0 or 1 to any of the five items indicates low mental health state and warrants further assessment to confirm depression using the International Classification of Diseases-10 criteria. Regarding subjective health, participants were asked to rate their health on a four-point scale, and we categorized the first two points as "healthy" and the last two as "not healthy." The MFS asks yes/no questions of six items related to mobility, four items related to strength, and four items related to balance, with possible scores ranging from 0 to 14 points. Based on the Lawton's model of competence, the TMIG Index of Competence was developed by

reflecting the actual living conditions of community-dwelling elderly in Japan, to measure the degree of independence in life functions. Its subscales are the five items of IADL, four items of intellectual activities, and four items of social role. Possible scores range from 0 to 13 points and participants were asked to respond "yes" or "no" to questions. Regarding cognitive function, elderly participants were asked to respond simply "yes" or "no" to three questions for a possible score of 0 to 3 points. The seven health practices items—not having smoked cigarettes, regular physical activity, moderate or no use of alcohol, 7 to 8 hr of sleep/day regularly, maintaining proper weight, eating breakfast, and not eating between meals—were scored from 0 to 7 points. Participants were asked to respond "yes" or "no" to the questions. For social support, we used modified version scale for elderly developed by Noguchi comprising eight items. Participants were asked to answer yes/no to whether there was a person who supported them, either a cohabiting family member, or someone else. For frequency of going out the home, participants were asked whether or not they went outside one or more times per week.

Analysis Method

The "social role of TMIG index of Competence" was excluded from the analysis because of conceptual similarity with the LSNS-6. Furthermore, because "living with family members" on the social support index does not apply to elderly living alone; it was excluded from the analysis. Regarding analysis methods, for a bivariate analysis of social isolation and other variables separately for elderly living alone and those living with family, a chi-squared test, *t* test, and Mann–Whitney *U*-test were performed. For multivariate analysis, multiple logistic regression analysis was performed adjusting for gender and age for elderly living alone and those living with family. Significant variables from the univariate analysis were used as explanatory variables, and social isolation as the outcome. All statistical analysis was carried out with SPSS17.0J for Windows (SPSS Japan Inc., Tokyo). A level of $p < .05$ was considered significant.

Results

Figure 1 displays the LSNS-6 scores distribution by household composition among elderly living alone and those living with family. The prevalence of social isolation was 31.0% for elderly living alone and 24.1% for those living with family (Table 1). Of the elderly living alone, 32.8% were males and the average age was 73.0 (±4.7) years old, whereas among those living with family, 49.7% were males and the average age was 72.4 (±4.9) years old. For
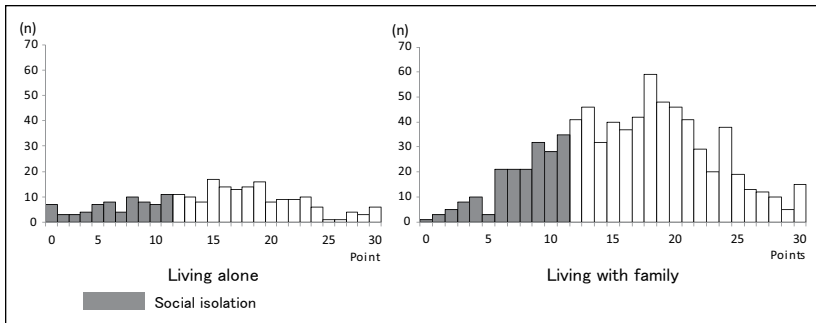
Figure 1. LSNS-6 score distribution by household composition.
Note. LSNS-6 = six-item Lubben Social Network Scale.

both groups, median scores for the WHO-5-J, IADL, and the seven health practice were 17, 5, and 5, respectively. Nearly 80% were healthy, based on the subjective health evaluation questionnaire (Table 1).

Using bivariate analysis, WHO-5-J ($p < .001$), self-rated health ($p < .001$), MFS ($p < .001$), IADL ($p < .001$), intellectual activities ($p < .001$), cognitive function items from the basic checklist ($p < .005$), seven health practice ($p < .001$), absence/presence of mental or psychological illness ($p < .001$), social support from persons other than cohabiting family ($p < .001$), and going out the home ($p < .001$) were significantly associated with social isolation for living with family status. Regarding living alone status, gender ($p < .002$), WHO-5-J ($p < .001$), and social support from persons other than cohabiting family ($p < .001$) showed significant association with social isolation (Table 2).

Result of the multivariate analysis was presented in Table 3. For people living with family, WHO-5 (OR = 0.93, 95% CI = [0.88, 0.98]), social support from persons other than the cohabiting family (OR = 0.67, 95% CI = [0.60, 0.75]), intellectual activities (OR = 0.69, 95% CI = [0.52, 0.91]), and the seven health practices (OR = 0.78, 95% CI = [0.63, 0.98]) were associated with being socially isolated. However, for people living alone, WHO-5 (OR = 0.92, 95% CI = [0.86, 0.98]) and social support from persons other than the cohabiting family (OR = 0.67, 95% CI = [0.56, 0.80]) were associated with being socially isolated. That is, a one-point drop in the scores for mental health and for social support from persons other than cohabiting family increased the risk of social isolation by 1.09 and 1.50 for elderly living alone, and 1.08 and 1.50 (reciprocal number) for elderly living with family, respectively. For only those living with family, each one-point drop in the scores for intellectual activities and for the seven health practices increased the social isolation risk by 1.46 and 1.28 (reciprocal number), respectively.

Table 1. Characteristics and Comparison by Household Composition.

	Living alone (*n* = 232)	Living with family (*n* = 781)	
	n (%)	*n* (%)	*p* value
Social isolation (0-11)	72 (31.0)	188 (24.1)	.040
Gender (male)	76 (32.8)	388 (49.7)	<.001
Age (65-84)[a]	73.0 ± 4.7	72.4 ± 4.9	.044
WHO-5-J (0-25)[b]	17 (0-25)	17 (0-25)	.093
Self-rated health (not healthy)	54 (23.4)	152 (19.6)	.227
Motor Fitness Scale (0-14)[b]	11 (0-14)	12 (0-14)	.028
Instrumental Activities of Daily Living (0-5)[b]	5 (0-5)	5 (0-5)	<.001
Intellectual activities (0-4)[b]	4 (0-4)	4 (0-4)	.985
Basic checklist cognitive function (meets all)	3 (1.3)	32 (4.1)	.040
Seven health practices (0-7)[b]	5 (1-7)	5 (1-7)	.297
Stroke (yes)	4 (1.8)	30 (4.0)	.146
High blood pressure (yes)	105 (47.7)	349 (46.5)	.759
Angina/myocardial infarction (yes)	15 (6.8)	66 (8.9)	.407
Osteoporosis (yes)	36 (16.4)	80 (10.7)	.025
Diabetes (yes)	38 (17.2)	112 (15.0)	.459
Mental or psychological illness (yes)	19 (8.6)	29 (3.9)	.007
Support from other than cohabitating family members (0-8)[b]	7 (0-8)	6 (0-8)	.533
Frequency of going out (homebound)	5 (2.2)	30 (3.9)	.305

Note. N varies due to some missing values.
[a]Mean ± *SD*.
[b]Median (minimum-maximum).

Discussion

Prevalence of Isolation

The overall prevalence of social isolation in this study was 25.7%, including 31.0% for living alone status and 24.1% for living with family status. Previous studies from Japan and other countries reported various overall prevalence of social isolation. Kurimoto et al. (2011) used LSNS-6 and reported a prevalence of 19.4% among 55 years and above in a community in Tohoku region, Japan. Age differences and result of regional city, stratification by household composition might explain the difference. In our study, elderly were stratified based on the household composition whereas in the study by Kurimoto et al., they were not. While the participants in our study ranged from 65 to 84 years of age, Kurimoto et al.'s (2011) study included individuals who were late middle-aged and employed with broader social networks. In addition, compared with other studies conducted elsewhere using the LSNS-6 (Hamburg 20%, Solothurn 11%, London 15%; Lubben et al., 2006), our study revealed

Table 2. Social Isolation and Nonsocial Isolation Comparison by Household Composition.

	Living alone			Living with family		
	Social isolation	Nonsocial isolation	*p* value	Social isolation	Nonsocial isolation	*p* value
	(*n* = 72)	(*n* = 160)		(*n* = 188)	(*n* = 593)	
WHO-5-J (0-25)[a,b]	13 (0-22)	18 (0-25)	<.001	14 (0-25)	18 (2-25)	<.001
Self-rated health (not healthy)[d]	22 (31.0)	32 (20.0)	.091	63 (33.5)	89 (15.1)	<.001
Motor Fitness Scale (0-14)[a,b]	11 (0-14)	12 (2-14)	.095	11 (0-14)	12 (1-14)	<.001
Instrumental Activities of Daily Living (0-5)[a,b]	5 (0-5)	5 (3-5)	.377	5 (0-5)	5 (0-5)	<.001
Intellectual activities (0-4)[a,b]	4 (0-4)	4 (0-4)	.090	3 (0-4)	4 (0-4)	<.001
Basic checklist cognitive function (meets all)[d]	1 (1.4)	2 (1.3)	1.00	15 (8.0)	17 (2.9)	.005
Seven health practices (0-7)[a,b]	5 (1-7)	5 (1-7)	.112	4 (1-7)	5 (1-7)	<.001
Stroke (yes)[d]	2 (2.9)	2 (1.3)	.589	7 (38)	23 (4.0)	1.00
High blood pressure (yes)[d]	38 (55.9)	67 (44.1)	.111	86 (47.3)	263 (46.3)	.865
Angina/myocardial infarction (yes)[d]	6 (8.8)	9 (5.9)	.402	21 (11.6)	45 (8.0)	.175
Osteoporosis (yes)[d]	9 (13.4)	27 (17.8)	.553	15 (8.2)	65 (11.5)	.270
Diabetes (yes)[d]	15 (22.1)	23 (15.0)	.246	25 (13.8)	87 (15.3)	.720
Mental or psychological illness (yes)[d]	5 (7.4)	14 (9.2)	.798	15 (8.2)	14 (2.5)	.001
Support from other than cohabiting family members (0-8)[a,b]	4 (0-8)	7 (0-8)	<.001	3.5 (0-8)	7 (0-8)	<.001
Frequency of going out (homebound)[d]	3 (4.2)	2 (1.3)	.175	16 (8.5)	14 (2.4)	.001

Note. N varies due to some missing values.
[a]*t* test, Mann–Whitney *U*-test.
[b]Median (minimum-maximum).
[c]Mean ± *SD*.
[d]Chi-square test.

a higher prevalence of social isolation for both living alone and living with family status. Indeed, according to a survey by the Organisation for Economic Cooperation and Development (OECD; 2005) called Society at a Glance 2005 OECD Social Indicators, with 34 member countries, Japan ranked last out of 20 countries for having absolutely no relationships with friends/colleagues or people in religious/sports/cultural groups, with 15.3% of the responses. Although the ages of the respondents in the OECD survey were not limited to elderly, this highlights the lack of personal interaction of Japanese people. In addition, OECD data have shown that people have fewer interactions with others in Japan than they do in other countries, confirming that the percentage of social isolation is higher in Japan than in Europe and the United States. Furthermore, some studies have shown that elderly people in Japan tend to have close relationships limited to spouses and children whereas in the United States, such a close relationships commonly extend to

Table 3. Multiple Regression Analysis: Risk of Social Isolation by Household Composition.

	Living alone		Living with family	
	OR	95% CI	OR	95% CI
WHO-5-J (0-25)	0.92	[0.86, 0.98]	0.93	0.88-0.98
Self-rated health (not healthy)		—	1.78	0.94-3.35
Moter Fitness Scale (0-14)		—	1.02	0.91-1.14
Instrumental Activities of Daily Living (0-5)		—	0.84	0.56-1.26
Intellectual activities (0-4)		—	0.69	0.52-0.91
Basic checklist cognitive function (meets all)		—	0.40	0.12-1.27
Seven health practice (0-7)		—	0.78	0.63-0.98
Mental or psychological illness (yes)		—	0.46	0.15-1.38
Support from other than cohabitating family members (0-8)	0.67	[0.56, 0.80]	0.67	0.60-0.75
Frequency of going out (homebound)		—	0.80	0.25-2.52

Note. OR = odds ratio; CI = 95% confidence interval. Adjusted for gender and age.

relatives (Fujisaki, 1998). Thus, it is likely that elderly people in Japan are satisfied with interactions with family living together. Consequently, there are fewer interactions with others and a narrower social network among elderly in Japan than those of the same age group in the United States.

When stratified by household composition, our study found a higher prevalence of social isolation in elderly individuals living alone than those living with family. In contrast, the prevalence of social isolation measured by Saito, Fujiwara, et al. (2010), who assessed the frequency of interaction with people other than family members in Japan, was 24.1% for those living alone and 28.7% for those living with family. The difference might be due to the differences in measurement. Saito, Fujiwara, et al. (2010) measured only the frequency of contact with people other than family members living together. However, in our study, we also considered contact with family members who were living together.

Factors Related to Social Isolation by Household Composition

When we evaluate these results, there are shared factors related to social isolation for elderly living alone and those living with family and these factors highlight the necessity to take steps to prevent social isolation in community-dwelling elderly, regardless of household composition.

A previous study using the LSNS-6 (Iliffe et al., 2007) reported a relationship between social isolation and depression tendency, and this is in agreement with our findings. Furthermore, Harlow, Goldberg, and Comstock (1991) reported that having more friends was consistently associated with

lower levels of depressive symptomatology, which is in accordance with our findings. In addition, using their own isolation scale, Roberts, Kaplan, Shema, and Strawbridge (1997) reported that social isolation could predict depression. The scale differed from the LSNS-6 as there was no family and friend subscale, and the measurement asked for the number of close family and friends unitarily. Even when living with other family members, persons who have few conversations and interactions with other people may have fewer opportunities to alleviate their stress and anxiety by expressing them, and this could cause a poor mental health. The elderly who have few friends or family members with whom they feel close to may fall in that state. Furthermore, people with a poor mental health may have difficulty maintaining good relationships with family and friends, resulting in reduced interactions. Therefore, steps should be taken to prevent social isolation, which, in turn, will help promote mental health.

Our study showed that social isolation was associated with low social support from people other than family members. Similar results were obtained in a longitudinal study with women with breast cancer, which reported a high risk of death among socially isolated individuals, who did not have support other than cohabiting family members. The study used the Berkman–Syme Social Networks Index for measuring social isolation. The discussion of study highlighted the lack of care or nursing by close relatives, friends, or children living together (Kroenke, Kubzansky, Schernhammer, Holmes, & Kawachi, 2006). Using the LSNS-6, a report showed a relationship between social isolation and lack of emotional and instrumental support (Blozik et al., 2009). For elderly living with family, it is likely that limiting interaction to only family members might have reduced interactions with friends and relatives, thus preventing them to receive social support from other than cohabiting family members.

Furthermore, while this study reported a median score of 12 out of a possible 14 points on the MFS, another study reported an average score of 10 points for participants desiring to participate in exercise group activities for community-dwelling elderly people from 70 to 84 years of age in Japan (Gotou, Niu, & Nagatomi, 2010). The higher score obtained in our study might be indicative of independence and an overall good physical strength. Therefore, family members and other people with whom elderly people interact in their daily lives might be just monitoring instead of actually providing care, which such socially isolated people may be regarded as being unable to obtain social support. In addition, a previous study using the LSNS-6 in British Columbia on social isolation and social support from persons other than family members through home visit care, and so on, found no relationship between the two (K. M. Kobayashi et al., 2009). However, their

participants were elderly persons who likely had home visit care and their level of independence was different from that of our participants, which may have led to a different result.

In this study, low intellectual activities and poor health practices were identified as factors related to social isolation of elderly living with family. There are no reports of related intellectual activity and social isolation. Intellectual activity includes (a) being able to complete pension paperwork or other paperwork, (b) reading newspapers, (c) reading books or magazines, and (d) showing interest in articles or magazines about health. Although a clear explanation for this relationship has yet to be established, possible pathways could be suggested. In Japan, Iwasa, Masui, Gondo, Kawai, and Inagaki (2010) reported that intellectual activity might be related to openness. Openness refers to the level of intellectual curiosity. If elderly persons with a low level of intellectual curiosity reduce interactions with others, they are at risk of social isolation even when living with family. Despite these speculations, we believe that our findings deserve attention and need to be explored in future studies.

Earlier studies have demonstrated a relationship between the LSNS-10 and health practice (Lubben, 1988), and this was shown in this study as well. In addition, we found a relationship between the abbreviated LSNS-6 and seven health practices. The lifestyle differences between elderly people and living with family members may lead to a disconnect with each other, decrease interactions, and cause social isolation of elderly people.

In this study, several differences in factors related to social isolation between elderly living alone and those living with family were considered to be due to differences in their background. Such differences in related factors may have been stemmed from mutual interactions, good or bad relationships between the elderly persons and their cohabitants, or conditions of shared households. Larger scale data may help reveal factors behind social isolation. Although not shown in the results, the persons who lived with a family and who had social isolation came to have a high family score on the LSNS-6 and a significantly decreased friend score.

As for cognitive function and self-rated health, we found a relationship in this study by bivariate analysis for social isolation of elderly living with family but not in multivariate analysis. Previous studies demonstrated associations between social isolation and cognitive function (Iliffe et al., 2007) and self-rated health (Iliffe et al., 2007; Kobayashi, Cloutier-Fisher, & Roth, 2009) in the multivariate analysis using the LSNS-6. The differences in results of cognitive function between the previous studies and ours were probably due to a difference in accuracy in the scale as we used a three-item scale. While self-rated health was not discussed in this article, a slight

positive correlation was observed between mental health state and self-rated health. We thought that the results of previous studies were different due to the strong relationship between social isolation and mental health state.

A better understanding of the factors related to social isolation is likely to provide public health professionals with opportunities for effective and targeted interventions (Nicholson, 2012). Thus, to provide support for preventing social isolation in community-dwelling elderly people regardless of household composition, it is important to maintain and promote mental health, to deepen relationships with old friends, and to provide support through social or cultural activities. For elderly people who live with others, and for their family as well, maintaining and promoting intellectual activities and in addition providing support for desirable health practice while providing health-related information are needed.

Limitations

The scope of this study was limited because findings were restricted to one district of an urban area in Japan. This study was based on cross-sectional data; therefore, we could not establish causality. Caution is advised when generalizing these findings.

Regarding individuals living with elderly, there was a mix of married couples, parents, and children or some elderly lived in multigenerational households, suggesting a variety of relationships with living partners and a diversity of social isolation in individuals living with others. Therefore, further study is needed because socially isolated individuals have narrow social networks, and this study did not measure how satisfied these individuals were with limited interactions with family or friends.

Significance of This Study and Future Research

In Japan, this was the first study to use the LSNS-6 to determine the prevalence of social isolation by household composition and to investigate related factors. This study revealed poor mental health and lack of social support from other than cohabitating family members as factors related to social isolation in elderly living alone and those living with family. In addition, low intellectual activities and poor health practice were associated with social isolation in elderly living with family.

It is hoped that large-scale and longitudinal studies will be conducted to investigate social isolation in detail and to examine cause–effect relationships behind social isolation.

Acknowledgment

Declaration of Conflicting Interests

Funding

References

Awata, S., Bech, P., Koizumi, Y., Seki, T., Kuriyama, S., Hozawa, A., . . .Tsuji, I. (2007). Validity and utility of the Japanese version of the WHO-Five Well-Being Index in the context of detecting suicidal ideation in elderly community residents. *International Psychogeriatrics*, *19*, 77-88.

Belloc, N. B., & Breslow, L. (1972). Relationship of physical health status and health practices. *Preventive Medicine*, *1*, 409-421.

Blozik, E., Wagner, J. T., Gillmann, G., Iliffe, S., von Renteln-Kruse., W., Lubben, J., . . .Clough-Gorr, K. M. (2009). Social network assessment in community-dwelling older persons: Results from a study of three European populations. *Aging clinical and experimental research*, *21*, 150-157.

Cabinet Office, Government of Japan. (2012). *Chapter 1 situation on aging annual report on the aging society* Section 2 Existing State and Trends of Elderly People and their Environment: *2012*. Retrieved from http://www8.cao.go.jp/kourei/english/annualreport/2012/pdf/1-2-1.pdf;http://www8.cao.go.jp/kourei/english/annualreport/2012/pdf/1-2-6.pdf

Chappell, N. L., & Badger, M. (1989). Social isolation and well-being. *Journal of Gerontology*, *44*, 169-176.

Cornwell, E. Y., & Waite, L. J. (2009). Measuring social isolation among older adults using multiple indicators from the NSHAP study. *The Journals of Gerontology, Series B: Psychological Sciences & Social Sciences*, *64*, 38-46.

De Jong Gierveld, J., Van Tilburg, T., & Dykstra, P. A. (2006). Loneliness and social isolation. In A. Vangelisti & D. Perlman (Eds.), *Cambridge handbook of personal relationships* (pp. 485-499). Cambridge, UK: Cambridge University Press.

Fujisaki, H. (1998). *Elderly, family and social network* (Modern family Issues Series: 4) (pp. 22-35). Tokyo, Japan: Baifukan. (In Japanese)

Gotou, T., Niu, K., & Nagatomi, R. (2010). Prevention of decline in subjective physical functioning of older people by regular participation in a community based exercise group. *Japanese Journal of Geriatrics*, *47*, 601-610. (In Japanese)

Graphical Review of Japanese Household. (2010). *From Comprehensive Survey of Living Conditions: Ministry of health, labour and welfare's secretariat information*. Retrieved from http://www.mhlw.go.jp/toukei/list/dl/20-21-01.pdf

Harlow, S. D., Goldberg, E. L., & Comstock, G. W. (1991). A longitudinal study of risk factors for depressive symptomatology in elderly widowed and married women. *American Journal of Epidemiology*, *134*, 526-538.

Iliffe, S., Kharicha, K., Harari, D., Swift, C., Gillmann, G., & Stuck, A. E. (2007). Health risk appraisal in older people 2: The implications for clinicians and commissioners of social isolation risk in older people. *The British Journal of General Practice*, *57*, 277-282.

Iwasa, H., Masui, Y., Gondo, Y., Kawai, C., & Inagaki, H. (2010). The five-factor model of the personality and higher-level competence decline among Japanese community-dwelling older adults. *Japanese Journal of Gerontology*, *31*, 449-457. (In Japanese)

Kawai, K. (2002). Social isolation, security and welfare problems among the elderly in urban areas, focusing on the living conditions of the single-living elderly in Minato Ward, Tokyo. *Shakai Seisakugaku*, *7*, 118-131. (In Japanese)

Kinugasa, T., & Nagasaki, H. (1998). Reliability and validity of the Motor Fitness Scale for older adults in the community. *Aging: Clinical and Experimental Research*, *10*, 295-302.

Kobayashi, E., Fujiwara, Y., Fukaya, T., Nishi, M., Saito, M., & Shinkai, S. (2011). Social support availability and psychological well-being among the socially isolated elderly differences by living arrangement and gender. *Japanese Journal of Public Health*, *58*, 446-456. (In Japanese)

Kobayashi, K. M., Cloutier-Fisher, D., & Roth, M. (2009). Making meaningful connections: A profile of social isolation and health among older adults in small town and small city, British Columbia. *Journal of Aging and Health*, *21*, 374-397.

Koyano, W., Shibata, H., Nakazato, K., Haga, H., & Suyama, Y. (1991). Measurement of competence: Reliability and validity of the TMIG Index of Competence. *Archives of Gerontology and Geriatrics*, *13*, 103-116.

Kroenke, C. H., Kubzansky, L. D., Schernhammer, E. S., Holmes, M. D., & Kawachi, I. (2006). Social networks, social support, and survival after breast cancer diagnosis. *Journal of Clinical Oncology*, *24*, 1105-1111.

Kurimoto, A., Awata, S., Ohkubo, T., Tsubota-Utsugi, M., Asayama, K., Takahashi, K., . . .Imai, Y. (2011). Reliability and validity of the Japanese version of the abbreviated Lubben Social Network Scale. *Japanese Journal of Geriatrics*, *48*, 149-157. (In Japanese)

LaVeist, T. A., Sellers, R. M., Brown, K. A., & Nickerson, K. J. (1997). Extreme social isolation, use of community-based senior support services, and mortality among African American elderly women. *American Journal of Community Psychology*, *25*, 721-732.

Lubben, J. E. (1988). Assessing social networks among elderly populations. *Family & Community Health*, *11*, 42-52.

Lubben, J. E., Blozik, E., Gillmann, G., Iliffe, S., von Renteln Kruse, W., Beck, J. C., & Stuck, A. E. (2006). Performance of an abbreviated version of the Lubben Social Network Scale among three European community-dwelling older adult populations. *The Gerontologist*, *6*, 503-513.

Matsuzawa, A., Tamiya, N., Yamamoto, H., Yamazaki, K., Motozawa, M., & Miyaishi, S. (2009). The background factors of the deaths of elderly people using forensic autopsy cases in Japan: The prevention of solitary deaths. *Journal of Health and Welfare Statistics*, *56*(2), 1-7. (In Japanese)

Nicholson, N. R. (2009). Social isolation in older adults: An evolutionary concept analysis. *Journal of Advanced Nursing*, *65*, 1342-1352.

Nicholson, N. R. (2012). A review of social isolation: An important but underassessed condition in older adults. *Journal of Primary Prevention*, *33*, 137-152.

Noguchi, Y. (1991). The concept and measurement of social support for the elderly. *Shakai Rounengaku*, *34*, 37-48. (In Japanese)

Organisation for Economic Cooperation and Development. (2005). *Social cohesion indicators. Society at a glance 2005 OECD social indicators*. Retrieved from http://www.oecd-ilibrary.org/social-issues-migration-health/society-at-a-glance-2005/social-cohesion-indicators_soc_glance-2005-8-en

Roberts, R. E., Kaplan, G. A., Shema, S. J., & Strawbridge, W. J. (1997). Does growing old increase the risk for depression? *The American Journal of Psychiatry*, *154*, 1384-1390.

Saito, M., Fujiwara, Y., Kobayashi, E., Fukaya, T., Nishi, M., & Shinkai, S. (2010). Prevalence and characteristics of social isolation in the elderly in a dormitory suburb according to household composition. *Japanese Journal of Public Health*, *57*, 785-795. (In Japanese)

Saito, M., Shimizu, Y., & Takei, S. (2010). Relationship between the trajectory of living alone and social isolation of the elderly in an urban area. *Japanese Journal of Gerontology*, *31*, 470-480. (In Japanese)

Saito, M., Shimizu, Y., Yamaguchi, M., & Takei, S. (2009). Prevalence and characteristics of the socially isolated elderly in a large urban area. *Japanese Journal of Social Services*, *50*, 110-122. (In Japanese)

Townsend, P. (1963). Isolation, loneliness, and the hold on life. In: Townsend P. (Ed.), *The family life of old people: An inquiry in East London*, (pp. 188-205). Harmondsworth, London: Penguin Books.

Townsend, P. (1968). Isolation, desolation, and loneliness. In E. Shanas, P. Townsend, & D. Wedderburn (Eds.), *Old people in three industrial societies* (pp. 258-287). London, England: Routledge.

World Health Organization. (2002). *Active ageing: A policy framework*. Geneva, Switzerland: Author.

Yasumura, S. (2006). Prevention and support of homebound elderly in the new long-term care insurance system. *Japanese Journal of Gerontology*, *27*, 453-459. (In Japanese)