Living on the Edge of the Community: Factors Associated with Discontinuation of Community Living Among People with Cognitive Impairment

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Research article

Keywords: cognitive impairment, community-dwelling elderly, discontinuation of community living, housing

DOI: https://doi.org/10.21203/rs.3.rs-87784/v1

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Abstract

Background

The experiences of people with cognitive impairment in the real world have not been fully explored because of methodological difficulties. This study re-accessed people with cognitive impairment identified in a previous epidemiological survey to explore their current situation and the risk factors associated with all-cause discontinuation of community living.

Methods

In 2016, a three-step survey was conducted of 7,614 older residents. In the last step of the survey, a research team visited the homes of 198 participants with a Mini-Mental State Examination score <24. In 2019, we re-accessed these people. We ran a community space in the study area for 3 years to build partnerships with community residents and community workers, and were able to re-access the participants using multiple methods.

Results

We found that 126 (63.6%) participants had continued living in the same community, but 58 (29.3%) had discontinued community living. Of these, 18 (9.1%) had died, 18 (9.1%) were institutionalized, 9 (4.5%) were hospitalized, and 13 (6.6%) had moved out of the community. A multiple logistic regression analysis identified the following risk factors associated with discontinuation of community living: being certified under long-term insurance, needing housing support, and needing rights protection.

Conclusions

Three years after the baseline survey, 29.3% people with cognitive impairment had discontinued community living. Despite having dementia or living alone, older people could continue to live in the community if their needs for housing support and rights protection were met. Both social interventions and medical interventions are important to build age-friendly communities.

Trial registration

UMIN, UMIN000038189, Registered 3 October 2019, https://upload.umin.ac.jp/cgi-open-bin/ctr_e/ctr_view.cgi?recptno=R000043521

Background

Japanese society is rapidly aging, and there is a corresponding increase in the number of people with cognitive impairment. A study that administered the Mini-Mental State Examination (MMSE) to all older residents living in one district of Tokyo (n = 1,319) found that the ratio of those who scored below the cutoff criterion (i.e., 23/24) increased with age (6.0%, 13.4%, and 33.3% in individuals aged 65–74, 75–
The Japanese government have adopted an aging-in-place policy (the New Orange Plan) to improve the living environments of people with dementia by enabling them to continue living in familiar spaces and environments for as long as possible. However, “real-world” outcomes for people with cognitive impairment have not been fully explored because of methodological difficulties.

Gnjidic et al.\(^3\) followed 1,705 community-dwelling older men for 5 years and found that 125 (7.3%) men were institutionalized over the study period. The same study reported that mild cognitive impairment was not a predictor of early institutionalization, but became a significant predictor after 3.4 years of follow-up. However, the participants were limited to men.

Risk factors for institutionalization have been reported when the target population is generalized to all older people, rather than including only those with cognitive impairment. One systematic review\(^4\) identified the following risk factors: older age, low self-rated health status, functional and cognitive impairment, dementia, previous nursing home placement, and a large number of prescriptions. Beswick et al.\(^5\) assessed 89 randomized controlled trials focused on community-based multifactorial interventions to protect community living. They reported that complex interventions, rather than a particular type of intervention, helped older people to continue living at home, and that these interventions could be tailored to meet individual needs and preferences. In Japan, Kazuya\(^6\) reported that informal care was central to community living for people with disability using long-term care. Similarly, Ohwaki\(^7\) found that having friends was an important predictor of continued home care and potentially prevented institutionalization.

In Japan's super-aged society, more people with cognitive impairment continue to live in the community; such individuals account for approximately 33% of people aged 85 years or over. Community living is a basic human right, but there is a research gap concerning the experiences of people with cognitive impairment and protective factors to help this vulnerable population to maintain community living. We identified 198 people who scored < 24 on the MMSE in a baseline survey conducted in 2016 that included all community-dwelling people aged 70 years or over in one Tokyo district.\(^8,9\) The present study aimed to 1) re-access individuals with cognitive impairment from that cohort and explore their current situation; and 2) identify factors associated with all-cause discontinuation of community living.

## Methods

### Methodology

Various methods have been used in Japan to clarify the experiences of community-dwelling older people in the real world. Repeated access to community residents is often obtained using epidemiological surveys. In such surveys, researchers re-access baseline survey respondents. However, it is often difficult to access people who are no longer living in a particular community (i.e., those who have moved to geriatric institutions or died). Attempts to access hospitals or community support centers listed in a baseline survey are often unproductive; the staff of such institutions cannot provide information because
of privacy protection. As a result, conventional social surveys are of limited use in determining real-world outcomes for community-dwelling older people at risk for discontinuation of community living.

To overcome these limitations, we used a community-based participatory research (CBPR) framework. In addition to using conventional mailing and telephone contact to re-access residents, we created a base camp for our research that provided a comfortable place for community residents to spend time, and in which researchers and community workers could collaborate with community residents. Although this center welcomed all residents regardless of age or address, participants from the original study were repeatedly informed about the center. In summary, we acted as both community-service providers and researchers to build trust with stakeholders. We held monthly case conferences with the comprehensive support centers from the catchment area, which enabled us to gather information about our study participants.

Because this was a CBPR study, the sample size was limited as we had to maintain close relationships with the participants. Because our main focus was continuation (or not) of living in the community, in the analysis, we regarded the outcome of discontinuation of living in the community as one variable (i.e., as all-cause discontinuation, which comprised death, institutionalization, hospitalization, and moving away).

Japanese context and setting

In Japan, modernization has led to smaller family sizes, which has resulted in more older people living by themselves. In addition, weakening social ties mean that older people tend to be isolated in the community.

Our study was conducted in Takashimadaira, which is located in the northwest area of metropolitan Tokyo. Takashimadaira contains the largest housing complex district in Japan, which was built during the 1970s. The aging rate (i.e., the percentage of the total population aged ≥ 65 years, a widely used indicator of aging in Japan) of this area is approximately 40%. This rate is the same as the predicted aging rate for 2055, which is when societal aging is expected to plateau. We chose this area because it is considered to resemble the Japanese society of the future. An administrative corporation currently manages the housing complex. Because new residents are not required to have a guarantor (guarantors are customary in Japanese business) many new residents are older people who do not have relatives on whom they can rely for financial support.

Participants

Before the study, we conducted a three-step survey of all community residents who were aged 70 years or over in 2016. Figure 1 shows the participant selection flow. Briefly, in the first step, questionnaires were sent to 7,614 residents, and 5,430 responses were received. In the second step, 2,020 residents completed face-to-face surveys in the community center. This assessment included the MMSE. Those with an MMSE score < 24, which is a commonly used cutoff criterion, were potential participants in the subsequent survey. In the third step, a research team that comprised a certified psychiatrist and a gerontologist or a public health nurse made home visits to 198 participants with cognitive impairment. In 2019, 3 years after
the baseline survey, we re-accessed these 198 people with cognitive impairment (80 men and 118 women).

**Data collection**

To ensure we did not disturb older residents’ community living, we used a stepwise re-access method. First, we mailed letters alerting residents that we would contact them by telephone in a few days. Then, staff with experience in epidemiological research with older people (C.U., a female tenure research fellow who has PhD) telephoned participants to inquire about their current situation. In addition, 62 participants had been helped by our community center and had existing records. Therefore, community center staff who had built face-to-face relationships with residents also telephoned these participants to reassure them that the telephone call was from the research institute and was not crime-related. Information about participants who could not be accessed via mail or telephone was obtained with the help of monthly case conferences in the community comprehensive support centers. Permission to re-access participants in a future survey had been obtained during the baseline survey.

**Measurement**

The main outcome was participants’ current status (i.e., community living, moved to another community, hospitalized, institutionalized, deceased, or unknown).

**Covariates**

The following factors were examined in the baseline survey:

(1) Sociodemographic variables

We used questionnaires to obtain information about participants’ sociodemographic characteristics. Information about long-term care insurance for each participant was obtained from the government.

(2) Cognitive assessment

MMSE\textsuperscript{10,11} assessments were conducted by a psychologist or a public health nurse under the supervision of a psychologist.

(3) Psychological assessment

Depressive symptoms were assessed using the 15-item Geriatric Depression Scale (GDS-15).\textsuperscript{12} The total score ranges from 0 to 15, and scores above 5 are considered to indicate the presence of depressive symptoms. We also assessed participants’ mental well-being using the simplified Japanese version of the World Health Organization (WHO)-Five Well-being Index (S-WHO-5-J).\textsuperscript{13}

(4) Physical health-related assessment
Self-perceived health was measured using a four-point Likert-type scale. Answers of “very good” or “good” were recoded as “good” and other answers as “not good.”

Frailty was assessed using the Kihon Checklist (KCL),\textsuperscript{14} which was developed by the Japanese Ministry of Health, Labour and Welfare. Satake et al.\textsuperscript{15} found that total KCL scores were closely correlated with frailty, as defined in the Cardiovascular Health Study criteria. In this study, we used total KCL score cutoffs of 7/8 and 3/4 to identify frailty and potential frailty, respectively.

(5) Sociological variables

(i) Relationship with the community

We assessed community participation using eight items on attendance of neighborhood associations, social clubs, sport clubs, volunteer clubs, senior clubs, alumni associations, occupational associations, and other social groups. Individuals who answered “no” to all items were considered as not showing any community participation. We also assessed trust among neighbors using the item “Do you trust your neighbors?” which was developed for this study. Responses were on a five-point Likert-type scale. Those who answered “disagree” or “strongly disagree” were regarded as “lack of trust in neighbors”.

(ii) Socioeconomic status

We asked participants about their perceived current socioeconomic status using a five-point Likert-type scale. Individuals who answered “somewhat poor” and “poor” were regarded as having financial disadvantage. We also asked participants to report their annual income range; those who reported < 1,000,000 yen (equivalent to 9,200 USD at a currency rate of 108.12 yen/dollar) were regarded as having a low income. We used this threshold because the average disposable income for older people in Japan is 2,100,000 yen.\textsuperscript{16}

(6) Dementia diagnosis judged by geriatric psychiatric specialists at participants’ homes

The visiting geriatric psychiatric specialist diagnosed participants using the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5).\textsuperscript{17} The final diagnosis was made in an interdisciplinary research meeting in the community center that included more than two certified psychiatrists. We also used the Clinical Dementia Rating (CDR) scale, which is a widely used measure.\textsuperscript{18} Using information obtained from participants, family members (if accessible), and prescriptions (if possible), we also clarified whether participants had received a diagnosis of dementia in a clinical setting. If so, we attempted to obtain details about the neurological basis of the diagnosis.

(7) Need for social support

Participants’ need for social support at home was evaluated on nine domains:\textsuperscript{8} 1) dementia subtype diagnosis, 2) medical check-up for physical conditions, 3) continuous medical care, 4) daily living support, 5) support for family members, 6) housing support, 7) long-term care insurance, 8) financial
support, and 9) rights protection (see supplementary file 1). This evaluation was made by two or more visiting experts.

**Statistical analysis**

There are various reasons for discontinuation of community living because every person has a unique background. As the ultimate aim of our CBPR approach was to develop an inclusive community in which older people can continue to live, we compared descriptive characteristics of participants who continued community living with those who discontinued community living for any reason (moved to another community, hospitalized, institutionalized, and deceased were combined as all-cause discontinuation in the main analysis). Participants with unknown outcomes were excluded from the analysis. T-tests were used for continuous variables and chi-square tests were used for nominal variables. Next, we performed a multiple logistic regression analysis that included factors significant in the bivariate analyses (threshold set at a p-value < 0.05). To avoid multicollinearity, CDR score was not included in the multiple logistic regression analysis because it was clinically obvious that it correlated with dementia diagnosis. We then confirmed that the variance inflation factor was less than 2 for all the independent variables included in the multiple logistic regression analysis. Continuous variables that did not have a cutoff criterion (i.e., MMSE, S-WHO-5-J) were converted into two-item variables and divided into two groups with cutoff points based on the average score. That is, because the average MMSE score was 20.1, the cutoff point was set at 20/21. Similarly, the average S-WHO-5-J score was 8.8, and the cutoff point was set at 8/9. A p-value < 0.05 was regarded as statistically significant.

**Results**

1) Main outcome

Table 1 shows participant characteristics and outcomes. Three years after the baseline survey, 126 (63.6%) of 198 community-dwelling older people with cognitive impairment who were selected from the epidemiological flow had continued living in the same place. Fifty-eight (29.3%) had discontinued community living (all-cause discontinuation). Of these, 18 (9.1%) had died, 18 (9.1%) were institutionalized, 9 (4.5%) were hospitalized, and 13 (6.6%) had moved out of the community. Because of privacy protection, we could not obtain the details of those that had moved out of the community. For example, we heard that one participant had moved some distance to their hometown, which they had not visited for a long time and in which they had no relatives. We suspected that this participant had moved to an institution in their hometown, but we could not confirm this. The remaining 14 (7.1%) participants had missing information.
2) Factors associated with continuation of community living

The results of the bivariate analyses are shown in Table 2. Factors associated with discontinuation of community living were being older, long-term insurance certification, lower MMSE scores (poor cognitive ability), lower S-WHO-5-J scores (poor well-being), poor self-perceived health, frailty, lack of trust of neighbors, DSM-5 dementia diagnosis, higher CDR score (severe stage for clinical rating of dementia), unmet housing support needs, and unmet rights protection needs.
Table 2
Comparison of participants who continued community living and those who did not

| (1) Sociodemographic variables | Continued community living (N = 126) | Discontinued community living (N = 58) | χ² | F value | Missing cases |
|-------------------------------|-------------------------------------|---------------------------------------|----|----------|---------------|
| Age, mean ± SD                | 80.1 ± 5.2                          | 83.1 ± 6.6                            | F(1,182) = 10.96, p = 0.001 | 0        |
| Sex                           | Male                                | 49 (67.1)                             | χ² (1,N = 184) = 0.10, p = 0.748 | 0        |
|                               | Female                              | 77 (69.4)                             |                                            |          |
| Educational years, mean ± SD  | 10.7 ± 2.6                          | 11.4 ± 2.9                            | F(1,175) = 2.55, p = 0.112 | 7        |
| Type of household             | Living alone                        | 55 (67.9)                             | χ² (1,N = 184) = 0.02, p = 0.881 | 0        |
|                               | With others                         | 71 (68.9)                             |                                            |          |
| Married                       | Yes                                 | 59 (71.1)                             | χ² (1,N = 180) = 0.20, p = 0.659 | 4        |
|                               | No                                  | 66 (68.0)                             |                                            |          |
| Long-term care insurance      | Certified                            | 24 (45.3)                             | χ² (1,N = 184) = 18.56, p = 0.000 | 0        |
|                               |                                     | 29 (54.7)                             |                                            |          |

† The values given in parentheses indicate the percentage of cases (n(%)).

MMSE: Mini-Mental State Examination

GDS-15: The 15-item Geriatric Depression Scale

S-WHO-5-J: Simplified Japanese version of the World Health Organization (WHO)-Five Well-being Index

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
|                                      | Continued community living | Discontinued community living | $\chi^2$ | F value | Missing cases |
|--------------------------------------|----------------------------|------------------------------|----------|---------|---------------|
| Not certified                        | 102 (77.9)                 | 29 (22.1)                    |          |         |               |
| (2) Cognitive assessment             |                            |                              |          |         |               |
| MMSE score, mean ± SD                | 20.5 ± 2.8                 | 19.2 ± 4.3                   |          | F(1,182) = 5.73, p = 0.018 | 0 |
| (3) Psychological assessment        |                            |                              |          |         |               |
| Depressive symptoms (GDS-15)         | High risk (≥ 5)            | 62 (65.3)                    | $\chi^2$ (1, N = 175) = 1.06, p = 0.304 | 9 |
|                                      | No high risk (< 5)         | 58 (72.5)                    |          | F(1,177) = 6.23, p = 0.013 | 5 |
| Mental well-being (S-WHO-5-J), mean ± SD | 9.2 ± 3.5                 | 7.8 ± 3.9                   |          |         |               |
| (4) Physical health-related assessment|                            |                              |          |         |               |
| Self-perceived health                | Good                       | 99 (73.9)                    | $\chi^2$ (1, N = 181) = 6.90, p = 0.009 | 3 |
|                                      | Not good                   | 25 (53.2)                    |          |         |               |
| Frailty                              | Healthy (0–3)              | 49 (81.7)                    | $\chi^2$ (2, N = 184) = 11.29, p = 0.004 | 0 |
|                                      |                            |                              |          |         |               |
| † The values given in parentheses indicate the percentage of cases (n(%)). |                            |                              |          |         |               |
| MMSE: Mini-Mental State Examination  |                            |                              |          |         |               |
| GDS-15: The 15-item Geriatric Depression Scale |                            |                              |          |         |               |
| S-WHO-5-J: Simplified Japanese version of the World Health Organization (WHO)-Five Well-being Index |                            |                              |          |         |               |
| DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition |                            |                              |          |         |               |
|                                             | Continued community living (N = 126) | Discontinued community living (N = 58) | $\chi^2$ | F value | Missing cases |
|---------------------------------------------|-------------------------------------|---------------------------------------|----------|---------|---------------|
| Pre-frailty (4–7)                           | 40 (71.4)                           | 16 (28.6)                             |          |         |               |
| Frailty (8–25)                              | 37 (54.4)                           | 31 (45.6)                             |          |         |               |

(5) Sociological variables

(i) Relationship with the community

| Lack of social participation                     | Yes | 41 (70.7) | 17 (29.3) | $\chi^2$ (1,N = 158) = 0.03, p = 0.860 | 26 |
|                                                 | No  | 72 (72.0) | 28 (28.0) |                                      |    |

| Lack of trust in neighbors                      | Yes | 8 (40.0)  | 12 (60.0) | $\chi^2$ (1,N = 170) = 8.34, p = 0.004 | 14 |
|                                                 | No  | 108 (72.0)| 42 (28.0) |                                      |    |

(ii) Socioeconomic status

| Having a financial disadvantage                | Yes | 43 (72.9) | 16 (27.1) | $\chi^2$ (1,N = 176) = 0.71, p = 0.401 | 8  |
|                                                 | No  | 78 (66.7) | 39 (33.3) |                                      |    |

| Annual income                                  | Less than one million yen | 25 (80.6) | 6 (19.4)  | $\chi^2$ (1,N = 170) = 2.93, p = 0.087 | 14 |

† The values given in parentheses indicate the percentage of cases (n(%)).

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GDS-15: The 15-item Geriatric Depression Scale

S-WHO-5-J: Simplified Japanese version of the World Health Organization (WHO)-Five Well-being Index

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
|                          | Continued community living (N = 126) | Discontinued community living (N = 58) | $\chi^2$ | F value | Missing cases |
|--------------------------|--------------------------------------|----------------------------------------|----------|---------|---------------|
| One million yen or more  | 90 (64.7)                            | 49 (35.3)                              |          |         |               |

### (6) Dementia diagnosis

| DSM-5 diagnosis            | Continued community living | Discontinued community living | $\chi^2$ (1,N = 184) = 9.15, p = 0.002 |
|---------------------------|----------------------------|------------------------------|----------------------------------------|
| No Dementia               | 86 (76.8)                  | 26 (23.2)                   |                                        |
| Dementia                  | 40 (55.6)                  | 32 (44.4)                   |                                        |

| Clinical Dementia Rating assessment | Continued community living | Discontinued community living | $\chi^2$ (2,N = 184) = 27.28, p = 0.000 |
|-------------------------------------|----------------------------|------------------------------|----------------------------------------|
| Normal (0)                          | 59 (81.9)                  | 13 (18.1)                   |                                        |
| Mild (0.5 + 1)                      | 65 (67.0)                  | 32 (33.0)                   |                                        |
| Not mild (2 + 3)                    | 2 (13.3)                   | 13 (86.7)                   |                                        |

### (7) Social support needs

| Total needs | Continued community living | Discontinued community living | $\chi^2$ (2,N = 184) = 1.82, p = 0.403 |
|-------------|----------------------------|------------------------------|----------------------------------------|
| 0           | 64 (72.7)                  | 24 (27.3)                   |                                        |
| 1           | 24 (68.6)                  | 11 (31.4)                   |                                        |
| 2+          | 38 (62.3)                  | 23 (37.7)                   |                                        |

| Dementia subtype diagnosis | Continued community living | Discontinued community living | $\chi^2$ (1,N = 184) = 0.49, p = 0.485 |
|----------------------------|----------------------------|------------------------------|----------------------------------------|
| Yes                        | 37 (64.9)                  | 20 (35.1)                   |                                        |

† The values given in parentheses indicate the percentage of cases (n(%)).

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GDS-15: The 15-item Geriatric Depression Scale

S-WHO-5-J: Simplified Japanese version of the World Health Organization (WHO)-Five Well-being Index

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
|                                      | Continued community living (N = 126) | Discontinued community living (N = 58) | $\chi^2$ | F value | Missing cases |
|--------------------------------------|-------------------------------------|---------------------------------------|----------|---------|---------------|
| Medical check-up for physical conditions | Yes                                 | 9 (60.0)                               | 6 (40.0) | $\chi^2 (1,N = 184) = 0.54, p = 0.461$ | 0             |
|                                      | No                                  | 89 (70.1)                              | 38 (29.9) |         |               |
| Continuous medical care              | Yes                                 | 9 (52.9)                               | 8 (47.1) | $\chi^2 (1,N = 184) = 2.10, p = 0.148$ | 0             |
|                                      | No                                  | 117 (69.2)                             | 52 (30.8) |         |               |
| Daily living support                 | Yes                                 | 22 (56.4)                              | 17 (43.6) | $\chi^2 (1,N = 184) = 3.34, p = 0.068$ | 0             |
|                                      | No                                  | 104 (71.7)                             | 41 (28.3) |         |               |

† The values given in parentheses indicate the percentage of cases ($n(\%)$).

MMSE: Mini-Mental State Examination

GDS-15: The 15-item Geriatric Depression Scale

S-WHO-5-J: Simplified Japanese version of the World Health Organization (WHO)-Five Well-being Index

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
|                                | Continued community living (N = 126) | Discontinued community living (N = 58) | $\chi^2$     | F value | Missing cases |
|--------------------------------|--------------------------------------|---------------------------------------|-------------|---------|---------------|
| Support for family members    | Yes                                  | 21 (56.8)                            | 16 (43.2)   | $\chi^2$ (1, N = 184) = 2.95, p = 0.086 | 0              |
|                                | No                                   | 105 (71.4)                           | 42 (28.6)   |         |               |
| Housing support                | Yes                                  | 2 (25.0)                             | 6 (75.0)    | $\chi^2$ (1, N = 184) = 7.32, p = 0.007 | 0              |
|                                | No                                   | 124 (70.5)                           | 52 (29.5)   |         |               |
| Long-term care insurance       | Yes                                  | 32 (71.1)                            | 13 (28.9)   | $\chi^2$ (1, N = 184) = 0.19, p = 0.662 | 0              |
|                                | No                                   | 94 (67.6)                            | 45 (32.4)   |         |               |
| Financial support              | Yes                                  | 4 (50.0)                             | 4 (50.0)    | $\chi^2$ (1, N = 184) = 1.32, p = 0.250 | 0              |
|                                | No                                   | 122 (69.3)                           | 54 (30.7)   |         |               |
| Rights protection              | Yes                                  | 8 (44.4)                             | 10 (55.6)   | $\chi^2$ (1, N = 184) = 5.34, p = 0.021 | 0              |
|                                | No                                   | 118 (71.1)                           | 48 (28.9)   |         |               |

† The values given in parentheses indicate the percentage of cases (n(%)).

MMSE: Mini-Mental State Examination

GDS-15: The 15-item Geriatric Depression Scale

S-WHO-5-J: Simplified Japanese version of the World Health Organization (WHO)-Five Well-being Index

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

Next, we performed a multiple logistic regression analysis that included factors significant in the bivariate analyses (p-values < 0.05). CDR score was excluded as explained in the Statistical analysis section. The
Factors associated with discontinuation of community living were long-term insurance certification, needing housing support, and needing rights protection (Table 3).

Table 3
Factors associated with discontinuation of community living: simultaneous multiple logistic regression analysis

|                          | Odds ratio | 95% confidence interval | P-value |
|--------------------------|------------|-------------------------|---------|
| Age (≥ 80 years)         | 1.67       | 0.73–3.84               | 0.225   |
| Long-term care insurance (Certified) | 3.59       | 1.51–8.53               | 0.004   |
| MMSE (Low score)         | 0.81       | 0.32–2.03               | 0.650   |
| DSM-5 diagnosis (Dementia) | 1.45       | 0.58–3.61               | 0.428   |
| S-WHO-5-J (Low score)    | 1.64       | 0.73–3.64               | 0.229   |
| Self-perceived health (Not good) | 1.74       | 0.63–4.79               | 0.286   |
| Frailty (Frailty)        | 0.91       | 0.33–2.49               | 0.847   |
| Lack of trust in neighbors (Yes) | 3.36       | 0.97–11.67              | 0.056   |
| Need for housing support (Yes) | 6.79       | 1.09–42.25              | 0.040   |
| Need for rights protection (Yes) | 3.53       | 1.06–11.76              | 0.040   |

N = 184

*Number of missing cases = 20

MMSE: Mini-Mental State Examination

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

S-WHO-5-J: Simplified Japanese version of the World Health Organization (WHO)-Five Well-being Index

Discussion

The findings showed that approximately 30% of community-dwelling older people with cognitive impairment discontinued community living over 3 years. Community living is a basic individual right and there is no justification for excluding frail older people from the community. However, our CBPR framework revealed that many older people with cognitive impairment are living on the edge of the community; 30% did not remain in the community after 3 years. Novel approaches to enable community living are essential for super-aged societies.

Dementia, physical frailty, and poor mental well-being (which are the main targets of conventional medical intervention) were not correlated with discontinuation of community living in the multivariate
neither was there a significant correlation between living alone and discontinuation of community living. However, long-term insurance certification, needing housing support, and needing rights protection remained significant factors for discontinuation of community living. Therefore, both social interventions and medical interventions are important to develop age-friendly communities.

The association between long-term insurance certification and discontinuation of community living indicates that high-risk older people experiencing difficulty in continuing community living are receiving long-term insurance. However, despite the assistance provided by long-term insurance, older people with cognitive impairment are moving out of the community.

One study that investigated the ecological relationship between social capital and the proportion of people with cognitive decline in Tokyo found that the proportion of people with cognitive decline was higher in districts with higher social capital. However, trust in neighbors, which is an important component of social capital, was not significantly correlated with discontinuation of community living in the present study (p = 0.056).

Our findings suggest that the implementation of housing support and rights protection is important in developing communities in which older people can continue to live despite having dementia or living alone. Regarding housing support, it is difficult for older people with cognitive decline and physical frailty to live in the same environment, especially if they are living alone. Aging in place does not mean “clinging” to the same place, but rather means having the autonomy to decide where to age. It is important to age in the right place. A reasonable strategy to support community living is to help older people move into appropriate housing, such as group homes or assisted housing, in the same geographical community.

Regarding rights protection, the presence of a social network among residents, which is another component of social capital, is beneficial. However, social networks are weakening. According to a Japanese Cabinet office poll, 35% of citizens have no relationships with their neighbors. As it is not easy for older and frail residents to build social networks, they would benefit from moving to a favorable residential community before old age. Again, aging in the right place is a useful approach. To decide where to live is a basic human right, and any compulsion is never justified.

Our study had some limitations. First, we did not use brain imaging or blood tests to rule out intracranial lesions or other physical conditions that lead to cognitive decline. Second, the study was limited to one Tokyo district. Third, the evaluation of support needs was based on the judgment of visiting experts, not on a validated scale. Finally, our results may have been affected by self-selection bias.

Conclusions

Three years after the baseline survey, 29.3% of people with cognitive impairment had discontinued community living. Despite having dementia or living alone, older people could continue to live in the
community if their needs for housing support and rights protection were fully met. Both social interventions and medical interventions are important for the development of age-friendly communities.

**Abbreviations**

MMSE: Mini-Mental State Examination  
CBPR: community-based participatory research  
GDS-15: The 15-item Geriatric Depression Scale  
S-WHO-5-J: Simplified Japanese version of the World Health Organization (WHO)-Five Well-being Index  
KCL: Kihon Checklist  
DSM-5: Diagnostic and Statistical Manual of Mental Disorders, 5th Edition  
CDR: Clinical Dementia Rating

**Declarations**

**Ethics statement and consent to participate**

The study protocol was approved by the Ethics Committee of the Tokyo Metropolitan Institute of Gerontology (No.1924). Written informed consent was obtained from all participants in the baseline survey.

An overseeing mental health expert (T.O., a certified psychiatrist who have met all of the participants) have ruled that all participants have been deemed capable of ethically and medically consenting for their participation in the research.

**Consent for publication**

Consent for publication was obtained from all participants.

**Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Competing interests**

The authors declare that they have no competing interests.

**Funding**
We have no funding about this study.

Author contributions

CU and TO designed the study, collected data, analyzed data, and wrote the paper. MS, FM, MY, RN, AE, TT, HI, and MO designed the study, collected data, and assisted with writing the paper. SA formulated the research question, designed the study, supervised data collection, and assisted with writing the paper. All authors read and approved the final manuscript.

Acknowledgements

We thank Diane Williams, PhD, from Edanz Group (https://en-author-services.edanzgroup.com/ac), for editing a draft of this manuscript.

References

1. Sakuma N, Ura C, Miyamae F, Inagaki H, Ito K, Niikawa H, et al. Distribution of Mini-Mental State Examination scores among urban community-dwelling older adults in Japan. International Journal of Geriatric Psychiatry 2017; 32(7):718-725.

2. Ministry of Health Welfare and Labor. The new orange plan. Available from URL: http://japanhpn.org/en/1-2/ [Accessed 2020-07-05]

3. Gnjidic D, Stanaway FF, Cumming R, Waite L, Blyth F, Naganathan V, et al. Mild cognitive impairment predicts institutionalization among older men: a population-based cohort study. PLoS One. 2012;7(9):e46061. doi: 10.1371/journal.pone.0046061. Epub 2012 Sep 24.

4. Luppa M, Luck T, Weyerer S, König HH, Brähler E, Riedel-Heller SG. Prediction of institutionalization in the elderly. A systematic review. Age Ageing. 2010 Jan;39(1):31-38. doi: 10.1093/ageing/afp202. Epub 2009 Nov 23.

5. Beswick AD, Rees K, Dieppe P, Ayis S, Gooberman-Hill R, Horwood J, et al. Complex interventions to improve physical function and maintain independent living in elderly people: a systematic review and meta-analysis. Lancet. 2008 Mar; 371(9614): 725-735.

6. Kuzuya M, Hasegawa J, Hirakawa Y, Enoki H, Izawa S, Hirose T, et al. Impact of informal care levels on discontinuation of living at home in community-dwelling dependent elderly using various community-based services. Arch Gerontol Geriatr. 2011 Mar-Apr;52(2):127-32. doi: 10.1016/j.archger.2010.02.016. Epub 2010 Mar 25.

7. Ohwaki K, Hashimoto H, Sato M, Tamiya N, Yano E. Predictors of continuity in home care for the elderly under public long-term care insurance in Japan. Aging Clin Exp Res. 2009 Aug-Oct;21(4-5):323-328.

8. Ura C, Okamura T, Inagaki H, Ogawa M, Niikawa H, Edahiro A, et al. Characteristics of detected and undetected dementia among community-dwelling older people in Metropolitan Tokyo. Geriatrics & Gerontology International 2020; 20: 564-570 https://doi.org/10.1111/ggi.13924
9. Okamura T, Ura C, Sugiyama M, Ogawa M, Inagaki H, Miyamae F, et al. Everyday challenges facing high-risk older people living in the community: A community-based participatory study. BMC Geriatrics 2020;20:68. https://doi.org/10.1186/s12877-020-1470-y

10. Folstein MF, Folstein SE, McHugh PR. Mini-mental state: a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12:189-198.

11. Sugishita M, Hemmi I, Takeuchi T. Reexamination of the validity and reliability of the Japanese version of the mini-mental state examination (MMSE-J). Japan J Cogn Neurosci. 2016;18:168-183.

12. Shah A, Herbert R, Lewis S, Mahendran R, Platt J, Bhattacharyya B. Screening for depression among acutely ill geriatric inpatients with a short geriatric depression scale. Age Ageing 1997 May; 26: 217-221.

13. Inagaki H, Ito K, Sakuma N, Sugiyama M, Okamura T, Awata S. Reliability and validity of the simplified Japanese version of the WHO-five well-being index (S-WHO-5-J). Jpn J Public Health 2013; 60: 294–301.

14. Ministry of Health, Labour and Welfare. The guideline of the comprehensive services for long-term care prevention/daily life support. Available from URL: https://www.mhlw.go.jp/le/06-Seisakujouhou-12300000-Roukenkyoku/0000205730.pdf [Accessed 2020-07-05]

15. Satake S, Senda K, Hong YJ, Miura H, Endo H, Sakurai T, et al. Validity of the Kihon checklist for assessing frailty status. Geriatr Gerontol Int 2016; 16: 709–715.

16. Cabinet Office, Government of Japan. 2017 Annual report on the aging society. Available from URL: https://www8.cao.go.jp/kourei/whitepaper/w-2017/html/zenbun/s1_2_2.html [Accessed 2020-07-05]

17. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5). 5th ed. Washington: American Psychiatric Association; 2013.

18. Morris JC. Clinical Dementia Rating. Neurology. 1993;43:2412–2414.

19. Murayama H, Ura C, Miyamae F, Sakuma N, Sugiyama M, Inagaki H, et al. An ecological relationship between social capital and cognitive decline in Japan: A preliminary study for dementia-friendly communities. Geriatrics & Gerontology International. 2019; 19:950-955

20. Wiles JL, Leibing A, Guberman N, Reeve J, Allen RES. The meaning of aging in place to older people. Gerontologist 2012; 52(3):357-366. https://doi.org/10.1093/geront/gnr098

21. Golant SM. Aging in the right place. Baltimore: Health Professions Press; 2015.

22. Cabinet Office, Government of Japan. The survey on attitude toward social awareness. 2020. Available from URL: https://survey.gov-online.go.jp/r01/r01-shakai/2-1.html [Accessed 2020-07-05]