1. Introduction

Japan became a super-aged society in 2016, when the percentage of its older population exceeded 27% [1]. The population began to decline after peaking in 2008. This, in turn, has caused a drop in the working-age population and an increase in the aging population [2]. As a result, with the increase in the number of persons with long-term care needs certification under Japan’s long-term care insurance (LTCI) system [3], the LTCI premium has more than doubled since its inception, and various initiatives emphasizing preventive long-term care have been launched [4].

In preventive long-term care, efforts have been focused on the phase prior to the support needs-certification stage; however, developing and applying effective interventions in earlier studies were difficult because of small sample sizes [5]. Accordingly, developing and executing care management plans to promote the in-
dependence of individuals who have been certified as having support needs may deter the decline of their physical health and postpone their need for long-term care needs certification. In addition, care managers and occupational therapists working in the community should understand what activities of daily living (ADL) should be focused on, to deter a decline in certification of care needs. This is because if occupational therapists can appropriately predict ADL items that lead to care needs certification and intervene accordingly, individuals with support needs could live happily without care needs certification.

According to the Status of Basic Life Survey conducted in 2016 [6], although joint disease, frailty due to old age, and fracture/fall were common reasons for support needs certification, the most frequent reason for care needs was dementia, suggesting the importance of preventing cognitive impairment in persons with support needs. The importance of such an approach was highlighted in a previous longitudinal study, which reported an association between long-term care needs certification and dementia [7]. Recent studies have focused on the association between dementia and ADL [8, 9]. It has been reported that cognitive impairment causes limitations in instrumental ADL (IADL), gradually lowering basic ADL (BADL) functioning (e.g., in the early stage of cognitive decline, individuals often need support with managing money and taking prescribed medications).

Previous reports on factors of long-term care needs certification have included ADL, in addition to physical, mental, and social factors [10, 11]. Although Germany and South Korea, like Japan, have introduced LTCI [12, 13], studies on factors of long-term care needs certification are limited [14, 15], and no studies have examined long-term care needs certification based on ADL in older persons with support needs. Determining which ADL contribute to transition in certification (from support needs to long-term care needs) will help provide effective occupational therapy interventions for older adults with support needs. Since dementia is an important factor in the increase in the number of older adults with care needs [6, 7], we propose a care plan to support the cognitive function of older adults with dementia after analyzing their degree of independence in daily living.

Based on the analysis of certification data, this study first aimed to elucidate whether gender, age, and degree of independence in daily living among older adults with disabilities or dementia affect their certification change (from support needs to long-term care needs) after two years. The reason why the dependent variable was “certification change from support needs to long-term care needs” is that the recovery rate of persons with care needs is considerably lower than that of persons with support needs [16].

Further, to provide suggestions for developing measures to prevent individuals from transitioning to long-term care needs, we performed an analysis based on cognitive function for ADL items that affect certification change. The reason for assessing cognitive condition was that ADL capacity depends on the degree of cognitive condition, and as mentioned above, dementia is the most frequent reason for individuals being categorized as requiring long-term care [6]. Thus, it was hypothesized that given the difficulty to identify early cognitive dysfunction in older persons with support needs, it may be possible to determine it based on IADL.

2. Materials and Subjects

Participants in this study were individuals living in a Japanese city (which we refer to as City A) who completed the 2014 and 2016 LTCI certification surveys. The certification questionnaire was developed by the Japanese Ministry of Health, Labour and Welfare; it surveyed respondents on 74 items: 62 items related to physical, life, cognitive function, psychological and behavioral disorders, and social life, and 12 items related to special medical care.

The LTCI certification process consisted of two stages. First, individuals were placed into one of seven needs categories based on their responses to the certification survey. The first two levels were referred to as support-needs levels 1–2, which consisted of preventive services for individuals with less intensive needs. The remaining five levels were referred to as care-needs levels 1–5, which consisted of services for individuals categorized by disability severity. Second, a committee of physicians and other professionals determined the eligibility of each applicant. The survey data for this study were collected by a medical worker (certified researcher) from City A and met LTCI eligibility. The survey data were collected by trained professionals at the users’ homes and were stored in City A’s database in accordance with an agreement established between City A and the co-researcher’s institution.

A total of 23,818 individuals living in City A completed the certification surveys at two time points: 2014 and 2016. Of the 7,621 older adults who were categorized in the support needs group in 2014, 6,219 (2,555 and 3,664 with support-needs levels 1 and 2, respectively) also completed the certification survey in 2016 and made up the sample for this study. The remaining 1,402 responding were not included because they did not need long-term care certification, had relocated, or died. The individuals certified for long-term care needs in 2016 comprised the changed group and those who remained
certified for support needs made up the unchanged group (Table 1).

3. Method

We categorized and organized the basic attributes of the 2014 participants into two groups: those who required care needs in 2016 and those who remained in need of support (Table 1). Next, we classified and organized the basic attributes of all participants according to the degree of independence in the daily living of older adults with dementia (Table 2). We then sorted and organized the 2014 participants’ activities of daily living scores by the degree of independence in daily living of older adults with dementia (Table 3). After organizing the data, we moved on to the statistical analysis. A series of stepwise logistic regression analyses were performed to identify the factors associated with certification change, and the variables were selected using the backward method. The dependent variable was whether an individual experienced a change in certification from support needs to long-term care needs. In our first analysis using data from the 2014 certification survey, the independent variables were gender, age, degree of independence in daily living among older adults with disabilities, and degree of independence in daily living among those with dementia.

In the second analysis, we identified ADL affecting the likelihood of certification change. Based on previous studies [8–9, 17], items were selected from the certification survey in 2014 to serve as independent variables. The analysis was adjusted for age, gender, and degree of independence in daily living. Multicollinearity was assessed using the variance inflation factor coefficient and correlation analyses. We examined the ADL factors affecting certification change by performing a separate logistic regression for each level of cognitive functioning. Based on the parameters of the Japanese Ministry of Health, Labour and Welfare, the degree of independence in the daily living of older adults with dementia in 2014 was classified into three levels—Independence, I, and II—ranging from more to less independent. Due to the small number of individuals assigned to category III, we excluded it from the analysis. While taking cognitive function into account, independence was further classified into eight levels: Independence, I, IIa, IIb, IIIa, IIIb, IV, and M. Level I is defined as “the patient has some dementia, but can live independently at home and in society”; level II as “although the patient has some symptoms or behaviors disturbing daily living, they can live independently with the attention and support of others (IIa: symptoms or behaviors are present outside the home, IIb: symptoms or behaviors are present at

| Table 1 | Participants’ Baseline Characteristics in 2014 by Group (N = 6,219) |
|---------|-------------------------------------------------------------|
| Items   | Unchanged group   | Changed group   |
| N       | 4,062             | 2,157           |
| Gender  |                   |                 |
| Male    | 908               | 627             |
| Female  | 3,154             | 1,530           |
| Age, years (mean ± SD) | 80.61 ± 6.32 | 82.57 ± 6.48 |
| Support needs |                   |                 |
| Level 1 | 1,821             | 734             |
| Level 2 | 2,241             | 1,423           |
| Care needs |                 |                 |
| Level 1 | 0                  | 0               |
| Level 2 | 0                  | 0               |
| Level 3 | 0                  | 0               |
| Level 4 | 0                  | 0               |
| Level 5 | 0                  | 0               |
| Degree of independence in daily living of older adults with disabilities | | |
| Independence | 2                  | 2               |
| J1       | 74                 | 27              |
| J2       | 1,945              | 802             |
| A1       | 1,128              | 601             |
| A2       | 861                | 677             |
| B1       | 49                 | 44              |
| B2       | 3                  | 4               |
| C1       | 0                  | 0               |
| C2       | 0                  | 0               |
| Degree of independence in daily living of older adults with dementia | | |
| Independence | 2,502              | 734             |
| I        | 1,369              | 1,019           |
| IIa      | 124                | 213             |
| IIb      | 63                 | 184             |
| IIIa     | 4                  | 6               |
| IIIb     | 0                  | 1               |
| IV       | 0                  | 0               |
| M        | 0                  | 0               |

Note: “J1 = [the patient can go out by using public transportation], J2 = [the patient can go out in the neighborhood], A1 = [the patient goes out with assistance and is mostly out of bed during the day], A2 = [the patient goes out infrequently and alternates between sleeping and being out of bed during the day], B1 = [the patient can transfer to the wheelchair, as well as eat and excrete away from the bed], B2 = [the patient transfers to the wheelchair with assistance], C1 = [the patient can roll over], C2 = [the patient cannot roll over], I = [the patient has some dementia but can live independently at home and in society], Ia = [although the patient has some symptoms or behaviors disturbing daily living, they can live independently with the attention and support of others; symptoms or behaviors are present outside the home], Ib = [although the patient has some symptoms or behaviors disturbing daily living, they can live independently with the attention and support of others; symptoms or behaviors are present outside the home], IIa = [the patient has some symptoms or behaviors that disturb daily living and they require care; symptoms or behaviors mainly occur in the daytime], IIb = [the patient has symptoms or behaviors that disturb daily living and they require care; symptoms or behaviors mainly occur at night], IV = [the patient frequently has symptoms or behaviors that disturb daily living and they always require care], M = [the patient has severe mental, behavioral, and psychological symptoms of dementia or severe physical disease, therefore, they require specialized care].
Table 2  Summary of Attributes of Older Adults with Dementia by Degree of Independence

| Items | (Degree of independence in daily living of older adults with dementia) |
|-------|------------------------------------------------------------------|
|       | Independence | I | II | III |
| Number of Older Adults with Dementia by Degree of Independence | 3,236 | 2,388 | 584 | 11 |
| Gender (N) | 766 | 577 | 187 | 5 |
| Male | 2,470 | 1,811 | 397 | 6 |
| Female | 80.53 (6.46) | 82.23 (6.14) | 81.68 (7.00) | 79.27 (7.23) |
| Age, years M (SD) | Support 1 | 1,440 | 883 | 228 | 4 |
| Support 2 | 1,796 | 1,505 | 356 | 7 |
| Degree of independence in daily living of older adults with disabilities (N) | Independence | 3 | 1 | 0 | 0 |
| J1 | 54 | 35 | 12 | 0 |
| J2 | 1,513 | 1,029 | 201 | 4 |
| A1 | 922 | 634 | 173 | 0 |
| A2 | 689 | 654 | 189 | 6 |
| B1 | 52 | 32 | 8 | 1 |
| B2 | 3 | 3 | 1 | 0 |
| C1 | 0 | 0 | 0 | 0 |
| C2 | 0 | 0 | 0 | 0 |

Note. N = [number of people], M (SD) = [mean ± standard deviation]

Table 3  Number of Older Adults with Dementia by Degree of Independence and Scores on Activities of Daily Living in 2014

| Item | Score Range | Degree of Independence |
|------|-------------|------------------------|
|      | 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 | |
| Bathing | 2,467 703 29 37 | 1,745 579 19 45 | 414 152 4 14 | 7 4 0 0 |
| Nail trimming | 1,973 914 349 | 1,362 736 288 | 355 146 83 | 6 4 1 |
| Functional mobility | 3,195 36 5 | 2,363 19 6 | 0 579 5 0 | 0 11 0 0 |
| Mobility | 3,039 188 9 | 2,155 227 6 | 0 527 54 2 | 1 10 1 0 |
| Ability to swallow food | 2,938 298 0 | 2,605 383 0 | 477 107 0 | 8 3 0 |
| Self-feeding | 3,206 26 4 | 2,371 14 3 | 0 580 4 0 | 0 10 1 0 |
| Toilet hygiene (urinary) | 3,184 1 49 | 2 320 8 58 | 2 546 7 30 | 1 8 1 2 |
| Toilet hygiene (fecal) | 3,211 0 23 | 2 352 4 31 | 1 563 3 15 | 3 11 0 0 |
| Brushing teeth/rinsing mouth | 3,192 44 0 | 2,353 34 1 | 556 28 0 | 9 2 0 |
| Face cleaning | 3,171 64 1 | 2,341 46 1 | 565 19 0 | 11 0 0 |
| Combing/styling hair | 3,191 18 27 | 2,359 16 13 | 573 7 4 | 9 1 1 |
| Getting dressed (upper body) | 3,042 11 183 0 | 2,239 9 140 | 0 546 12 26 | 9 2 0 0 |
| Getting dressed (lower body) | 3,064 11 160 1 | 2,270 9 107 | 2 547 14 23 | 0 9 2 0 |
| Frequency of going outdoors | 3,488 559 189 | 1,818 441 129 | 417 105 62 | 6 4 1 |
| Taking prescribed medications | 3,866 370 0 | 1,554 833 1 | 144 437 3 | 5 6 0 |
| Managing money | 3,658 436 142 | 1,641 607 140 | 218 260 106 | 3 5 3 |
| Decision-making ability | 3,003 233 0 0 | 1,346 1,041 1 0 | 109 467 8 0 | 2 7 2 0 |
| Inability to mingle with others | 3,231 2 3 | 2,370 2 16 | 581 0 3 | 10 0 1 |
| Shopping for daily necessities | 4,128 9 748 1,191 | 813 17 475 1,083 | 123 18 75 368 | 1 0 1 9 |
| Preparing meals | 4,197 8 23 1,233 1,303 | 6 9 1,070 237 | 8 5 334 | 3 0 8 0 |

Note. Daily life function consists of the following 20 items: “Bathing,” “Functional mobility,” “Mobility,” “Self-feeding,” “Toilet hygiene (urinary),” “Toilet hygiene (fecal),” “Getting dressed (upper body),” “Getting dressed (lower body),” “Decision-making ability,” “Shopping for daily necessities,” and “Preparing meals” are scored from 1 to 4. “Nail trimming,” “Ability to swallow food,” “Brushing teeth/rinsing mouth,” “Face cleaning,” “Combing/styling hair,” “Frequency of going outdoors,” “Taking prescribed medications,” “Managing money,” and “Inability to mingle with others” are scored from 1 to 3. Higher scores indicate lower daily life functioning and an increased need for assistance.
home”); level III as “the patient has symptoms or behaviors that disturb daily living, and they require care (IIIa: symptoms or behaviors mainly occur during daytime, IIIb: symptoms or behaviors mainly occur at night)”; level IV as “the patient frequently has symptoms or behaviors that disturb daily living, and they always require care”; and level M as “the patient has severe mental, behavioral, and psychological symptoms of dementia, or severe physical disease, and requires specialized care.”

For older adults with disabilities, the Japanese Ministry of Health, Labour and Welfare classifies individuals’ degree of independence in daily living as follows: independence, J1, J2, A1, A2, B1, B2, C1, and C2. Therefore, for our study, patients without disabilities were classified in the Independence category. Level J comprises patients with some disability but are nearly independent (J1: “the patient can go out by using public transportation” and J2: “the patient can go out in the neighborhood”). Level A comprises patients who can live mostly independently at home but need a caregiver to go out (A1: “the patient goes out with assistance and is mostly out of bed during the day” and A2: “the patient goes out infrequently and alternates between sleeping and being out of bed during the day”). Level B patients require some care in their home and spend most of the day in bed (B1: “the patient can transfer to the wheelchair and eat and excrete away from the bed” and B2: “the patient transfers to the wheelchair with assistance”). Level C patients are bedridden and require care for excretion, eating, and dressing (C1: “the patient can roll over,” and C2: “the patient cannot roll over”).

SPSS software version 24 for Windows (IBM Corp, Armonk, NY, USA) was used for the analyses, with a significance level of \( p < 0.01 \). The National Institute of Population and Social Security Research signed a memorandum of understanding with City A concerning the use of its data, which was approved by the appropriate ethics committee (IPSS-TRN#15001-2). Due to a change in affiliation for one of the authors, Saitama Prefectural University signed a new memorandum of understanding with City A. The procedures used to collect the data followed all ethical standards of the Declaration of Helsinki.

4. Results

Table 1 shows individual baseline characteristics and ADL scores for the unchanged and changed groups. Tables 2 and 3 show the attributes and ADL scores for each group of older adults with dementia, respectively, classified according to their degree of independence in daily living. For the entire sample, the attributes affecting change in certification after two years were gender (OR = 0.674, 95% CI = [0.593, 0.766], \( p < 0.001 \)), age (OR = 1.047, 95% CI = [1.038, 1.057], \( p < 0.001 \)), and degree of independence in daily living of older adults with disabilities (OR = 1.312, 95% CI = [1.233, 1.397], \( p < 0.001 \)) or dementia (OR = 2.203, 95% CI = [2.043, 2.374], \( p < 0.001 \)).

| Items                          | Independence  | OR 95% CI      | \( p \) | \( R^2 \) | I          | OR 95% CI      | \( p \) | \( R^2 \) | II         | OR 95% CI      | \( p \) | \( R^2 \) |
|-------------------------------|---------------|----------------|--------|----------|------------|----------------|--------|----------|------------|----------------|--------|----------|
| Bathing                       |               |                |        |          | 1.271     | 1.082–1.493   | < 0.01 |          | 1.321     | 1.140–1.530   | < 0.001 |          |
| Nail trimming                 |               |                |        |          | 1.229     | 1.080–1.399   | < 0.01 |          |           |                |        |          |
| Mobility                      |               |                |        |          | 2.342     | 1.746–3.141   | < 0.001 |          |           |                |        |          |
| Toilet hygiene (urinary)      |               |                |        | 0.054    |           |                |        |          |           |                |        |          |
| Toilet hygiene (fecal)        |               |                |        |          |           |                |        |          |           |                |        |          |
| Taking prescribed medications |               |                |        |          |           |                |        |          |           |                |        |          |
| Managing money                |               | 1.537          | 1.192–1.982 | < 0.001 |           |                |        |          |           |                |        |          |
| Decision-making ability       |               | 1.817          | 1.354–2.437 | < 0.001 |           |                |        |          |           |                |        |          |
| Shopping for daily necessities|               |                |        |          |           |                |        |          |           |                |        |          |
| Preparing meals               |               | 1.088          | 1.024–1.156 | < 0.01 |           |                |        |          |           |                |        |          |

Note. OR = odds ratio, CI = confidence interval. Stepwise logistic regression analysis.
with bathing, mobility, toilet hygiene (fecal), taking prescribed medications, managing money, decision-making ability, and shopping for daily necessities. For the independent group, a certification change was associated with bathing, nail trimming, mobility, managing money, and decision-making ability. In group I, significant factors affecting certification change were bathing, toilet hygiene (urinary), taking prescribed medications, managing money, decision-making ability, and preparing meals. In group II, a certification change was only associated with managing money.

5. Discussion

Our findings indicated that change in certification after two years was associated with gender, age, and degree of independence in daily living of older adults with disabilities and dementia. Certification change to long-term care needs after two years occurred more frequently among men, compared to women. Conversely, previous studies have reported a higher incidence of BADL disorders in women, compared to men [18, 19]. However, research on gender differences in ADL is rare in Japan [20]. In addition, the disparity between our results and those of previous studies may be explained by the fact that the participants of this study required assistance and care, while Japanese men have a higher mortality rate than Japanese women [21]. This study confirmed that men are more likely to experience a certification change from support needs to long-term care needs.

We also found that the degree of independence in daily living of older adults with disabilities or dementia was a significant factor in certification changes. Previous studies have reported that a decline in physical function affects the severity level of long-term care needs certification and frailty progression [22, 23]. Similarly, a decline in cognitive function has been shown to affect changes in long-term care needs [7]. This study confirms that certification change to long-term care needs is affected by the degree of independence in daily living of older adults with disabilities or dementia.

Our findings also suggest that increased support for ADL may reduce LTCI usage. Among older adults with the highest level of independence, impairments in mobility, bathing, nail trimming, managing money, and decision-making were significantly associated with certification change, suggesting that supporting ADL associated with physical function decline may reduce the level of long-term care needs. Managing money is not a fragmentary living behavior, and long-term management is needed. Decision-making involves serious decisions, such as choosing a treatment or care plan. On the other hand, non-serious decisions include where to go out and what to wear. Therefore, decision-making is fundamental for everyday life, which is why a decline in the individual’s decision-making ability implies that they require assistance. Based on our results, we believe that even for independent individuals without dementia symptoms, increased support for IADL is key to reducing LTCI usage.

Furthermore, in group I (individuals with the second-highest level of independence), items that reflected declining capabilities were significantly associated with certification change to long-term care needs. Like the independent group, decision-making, managing money, and bathing, which are important items from the viewpoint of care prevention, were significantly associated with certification change. Additionally, taking prescribed medications, preparing meals, and toilet hygiene (urinary) were associated with the need for nursing care [24, 25]. Taking prescribed medications and preparing meals are IADL prone to decline along with cognitive function and require complex cognitive processing. Toilet hygiene (urinary) may be related to urinary control difficulty as cognitive function declines. An association between cognitive decline and urinary incontinence has been reported in studies of older adults living in the community [26, 27]. Further, biometric studies have reported that the frontal cerebral cortex might be associated with bladder control problems in older people [29, 30].

In group II (individuals with the third highest level of independence), only managing money was linked to certification change. As shown in Table 3, unlike “bathing” and “decision-making ability,” about 20% of participants in the “managing money” category received a partial assistance grade. In other words, we can assume that money management is very difficult for people with declining cognitive function, which may have led to this result. Moreover, managing money was the only significant ADL factor identified across all levels of independence, suggesting that, from a preventive long-term care standpoint, assistance in managing money is important for individuals with support needs. Previous studies have shown that, when declines in BADL occur, IADL deteriorate due to the progression of cognitive impairment [8–9, 30, 31]. These findings are similar to those of ADL associated with certification changes identified in this study.

Cognitive decline affects both IADL and BADL [8–9, 30]. In this study, we identified ADL items that were significantly associated with a change from support needs to long-term care needs and analyzed the results based on the level of cognitive function. Recently, effective approaches to improve older adults’ decision-making
abilities [32], prescribed medication-taking behaviors [33, 34], and money management abilities [35, 36] have been developed. For individuals with long-term care needs certification, it might be useful to provide support for ADL involving complex cognitive processing in addition to those for improving physical functioning. Moreover, developing and implementing effective care management plans may support the independence of older adults with support needs by identifying ADL interventions from occupational therapists using data from certification surveys.

Occupational therapists can use the findings of this study to deter individuals’ transition from support needs to care needs. First, an occupational therapist needs to evaluate the degree of independence in daily living among older adults with dementia and the ADL of individuals with support needs. Next, the presence or absence of high-risk items should be confirmed by comparing the individual’s evaluation results with the results of this study (Table 4). If a risk item is identified, the subject should be given appropriate occupational therapy focusing on improvement of said factor as soon as possible. In the future, we need to clarify the effectiveness of this intervention strategy.

A limitation of this study was its reliance on certification survey data, as it did not provide background information of individuals, which may include factors, such as disease type, educational background, economic status, and family structure, that could affect the severity level of their long-term care needs. Further, we did not obtain data from clinical tools used by physicians to diagnose patients. Therefore, we could not infer causality based on our study design. The number of samples differed greatly between the cognitive function groups independent, I, and II. Given the results of the logistic regression analysis, the power of each test may have differed and affected the results. Although there were several levels of care needs (ranging from 1 to 5), the dependent variable in this study was “care needs”; therefore, some important ADL items might have been overlooked during analysis.

6. Summary and Conclusions

This study examined the effects of ADL on older adults’ certification change from support needs to long-term care needs after two years. The findings showed that ADL affecting certification change varies depending on the level of cognitive functioning. Within levels of cognitive functioning, the ADL associated with certification change among the most independent individuals (level Independence) were bathing, nail trimming, mobility, managing money, and decision-making ability. At the next level of independence (level I) the activities included bathing, toilet hygiene (urinary), taking prescribed medications, managing money, decision-making ability, and preparing meals. At the lowest level of independence (group II), only managing money was associated with certification change. In particular, managing money was considered to be the most important item, as it influences the change in certification in all cognitive categories. When occupational therapists intervene older persons with support needs, they should grasp IADL abilities such as managing money, which requires complex cognitive functions, from an early stage, and this may lead to the reduction of the need for care in older persons with support.

Conflict of Interest

The authors report no conflicts of interest.

Funding

This research received no external funding.

Author Contributions

Study concept and design: A.S., T.T., M.K.; data acquisition: M.K.; data analysis and interpretation: A.S., M.M., H.M.; manuscript writing: A.S., T.T., T.H., M.K.

Acknowledgments

The authors thank the City A residents and government employees who provided the information for this research, as well as Editage (www.editage.jp) for English language editing.

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