

# Association between Social Support and Healthy Aging in Older Japanese: The Ohsaki Cohort 2006 Study

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## Research Article

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# Abstract

## Background

Healthy aging has attracted a great deal of attention worldwide with the progression of aging societies. However, few studies have investigated the association between social support and healthy aging. Thus, our study aimed to examine the association of emotional and instrumental social support with healthy aging among older Japanese adults.

## Methods

This community-based prospective cohort study was conducted in Ohsaki City, Japan, and included 8,232 people aged  $\geq 65$  years at the baseline survey in 2006. Based on information obtained from this survey, participants were categorized according to two types of social support: having / lacking emotional social support and having / lacking instrumental social support. The primary outcome was healthy aging (defined as meeting all four of the following criteria: free of disability, free of depression, high health-related quality of life and high life satisfaction), as assessed by a questionnaire survey carried out in 2017. Multiple logistic regression was used to calculate the corresponding odds ratios (ORs) and 95% confidence intervals (95% CIs).

## Results

During approximately 11 years of follow-up, 620 (7.5%) participants attained healthy aging. Compared with participants lacking emotional social support, the multivariable-adjusted OR (95%CI) was 1.60 (1.12–2.29) for those having emotional social support. Compared with participants lacking instrumental social support, the multivariable-adjusted OR (95%CI) was 1.71 (1.32–2.23) for those having instrumental social support. Furthermore, we found that the likelihood of healthy aging was significantly higher in the group that had both types of social support, but not in those with only one compared with those having neither type of social support.

## Conclusions

These findings suggest that both emotional and instrumental social support are associated with healthy aging of older people in Japan.

## 1. Introduction

As aging of the population continues worldwide, more attention is being paid to “successful aging” or “healthy aging”. Longer life provides opportunities for older people to pursue not merely the absence of physical and mental disease but also psychological and social well-being in later life.

Rowe and Kahn first proposed the concept of “successful aging” in 1987 [1], and in 1997 defined successful aging as, “low probability of disease and disease-related disability,” “high cognitive and physical functional capacity,” and “active engagement with life” [2]. In 2015, the World Health Organization (WHO) defined healthy aging as “the process of developing and maintaining the functional ability that enables well-being in older age” [3]. This definition underlines not only functionality but also the enhanced importance of promoting well-being among the aged, including such domains as happiness, satisfaction, and fulfillment [3]. To foster research in healthy aging, the WHO recently announced the ‘Decade of Healthy Aging’ from 2020 until 2030 [4]. Thus, our definition of healthy aging includes both physiological indicators (i.e., free of disability) and factors regarding psychological and social well-being (i.e., free of depression, high health-related quality of life [HRQOL], and high life satisfaction).

Social support is thought to be a protective factor for multiple diseases, including dementia[5–8] and depression [9]. It has been suggested that social support is also related to better well-being, such as in life satisfaction [10–12]. Thus, it is reasonable to speculate that social support may be associated with a greater probability of achieving healthy aging among older adults. A previous study investigated the association between social support and healthy aging in a cohort study of 4497 Norwegians, and explored the factors associated with healthy aging [13]. They found that people with a good (but not moderate) level of social support showed a significantly higher probability of later achieving healthy aging compared with those with poor social support. However, no other evidence exists.

Therefore, the aim of this study was to investigate the association of emotional and instrumental social support with healthy aging, using data from a prospective cohort of community-dwelling older Japanese adults.

## **2. Materials And Methods**

### **2.1. Study participants**

#### **2.1.1 Baseline survey**

The design of the Ohsaki Cohort 2006 Study has been described in detail elsewhere [14]. In brief, the source population was composed of 31,694 men and women aged  $\geq 65$  years living in Ohsaki city in northeastern Japan. The baseline survey was conducted during the period from 1 December 2006 to 15 December 2006. A questionnaire was distributed to individual households by the heads of individual administrative districts and then collected by mail. Among the source population, 23,091 persons who provided valid responses formed the study cohort, and response rate was 72.9%. We further excluded 6,333 people who did not provide written consent for review of their long-term care insurance (LTCI) information, 1,979 who had already been certified as having a disability by the LTCI system before follow-up, five who had died or moved out of the district before follow-up, and 4,827 who had depressive

symptoms or whose responses regarding depression were missing at baseline. Finally, 9,947 participants were followed from 16 December 2006 to 30 November 2017 (Fig. 1).

## **2.1.2 Healthy aging assessment survey (the 2017 Survey)**

During follow-up, 2,645 participants died and 305 were lost because of moving out of the study area. Among the remaining 6,997 survivors, we conducted a health-related questionnaire survey at the end of November 2017 (the 2017 Survey). The questionnaire included self-reported questions regarding depression, HRQOL, and life satisfaction, which were the components used to assess healthy aging. The questionnaires were collected by mail. We further excluded 651 participants who did not return a questionnaire or provide eligible responses, 464 whose responses on components assessing healthy aging were missing, and 295 whose answers on social support were missing at baseline. Finally, the data of 8,232 participants, consisting of 2,645 who died during follow-up and 5,587 who provided valid responses in the 2017 Survey, were included in the statistical analysis (Fig. 1).

## **2.2. Emotional and instrumental social support (exposure)**

Information on social support was obtained at baseline. The degree of social support available to each person was assessed by the following questions [15]. (Q1) “Do you have someone to consult when you are in trouble?”, (Q2) “Do you have someone to talk to about your health when you are in bad physical condition?”, (Q3) “Do you have someone to ask for help with your daily housework?”, (Q4) “Do you have someone to ask to take you to a hospital when you are sick?” and (Q5) “Do you have someone to ask to take care of you when you are in bed with a bad physical condition?”. Each question required an answer of “yes” or “no”. The reliability and validity of the social support questionnaire [15] were tested via correlation with the Japanese version of the abbreviated Lubben Social Network Scale [16, 17]. We considered Q1 and Q2 to yield information on emotional social support, and Q3, Q4, and Q5 to yield information on instrumental social support, using the definition applied in a previous study [18]. Specifically, we categorized participants who answered “yes” to both Q1 and Q2 as having emotional social support (+), and otherwise as lacking emotional social support (-). We also categorized subjects who answered “yes” to all of Q3, Q4, and Q5 as having instrumental social support (+), and otherwise as lacking instrumental social support (-) [19–21]. For both types of social support, people lacking social support were set as the reference group.

## **2.3. Outcome**

### **2.3.1 Definition of healthy aging**

The primary outcome of this study was healthy aging, comprising the following four components: 1) free of functional disability, 2) free of depression, 3) high HRQOL, and 4) high life satisfaction, and only participants who met all four criteria were considered to have healthy aging [22, 23]. Participants who did not meet all four criteria were categorized as having normal aging, even if they had missing values for some of the components [22, 23]

## 2.3.2 Functional disability ascertainment

In this study, we defined incident functional disability as certification under the LTCL system in Japan (Support Level 1 or higher), which uses a nationally uniform standard of functional disability [24–27]. LTCL in Japan is a mandatory social insurance system designed to help frail elderly individuals carry out activities of daily living (ADL). Everyone aged  $\geq 40$  years pays a premium, and everyone aged  $\geq 65$  years is eligible for formal caregiving services. LTCL certification was found to be associated with the ability to perform ADL in a community-based study [28] and has been used previously in epidemiologic studies as a measure of incident functional disability among older individuals [29, 30]. Data regarding incident functional disability, death, or emigration during follow-up were transferred from the Ohsaki City Government through an agreement about the secondary use of data. All data were transferred annually from the Ohsaki City Government each December under the Epidemiologic Research and Privacy Protection agreement.

## 2.3.3 Measurement of depression

Depression was measured both at baseline and in the 2017 Survey via the Depression and Suicide Screen (DSS). The DSS, which was developed in Japanese by Fujisawa et al. [31], is a brief screening instrument for depression and suicidal ideation for the aged. This instrument is composed of the following five items: 1) “Is your life pretty full?”, 2) “Do you still enjoy doing the things you used to do?”, 3) “Do you think it is too much trouble to do the things you used to do?”, 4) “Do you feel that you are a useful person who is needed by others?”, and 5) “Do you feel tired without any specific reason?”. For items 1, 2, and 4, responses of “yes” are scored 0 and responses of “no” are scored 1; and for items 3 and 5, responses of “yes” are scored 1 and responses of “no” are scored 0. The cutoff value of 1 ( $\leq 1$  vs.  $>1$ ) produced satisfactory sensitivity and specificity in detecting depression (i.e., 70.5% and 72.9%, respectively) [31], so we defined a DSS score of  $< 2$  as “free of depression”.

## 2.3.4 Measurement of HRQOL

HRQOL was evaluated using the three-level version of the European Quality of Life-5 Dimensions (EQ-5D-3L) in the 2017 Survey [32]. The EQ-5D-3L consists of the following five dimensions: 1) mobility, 2) self-care, 3) usual activities, 4) pain/discomfort, and 5) anxiety/depression. Each dimension was assessed by a single question with three response levels (no problem, some problems, and extreme problems), thereby allowing for  $3^5$  (i.e., 243) possible health combinations overall. The Japanese version of the EQ-5D-3L was developed by Tsuchiya et al. [33]. The results were coded and converted to a utility value score ranging from  $-0.111$  to  $1.000$ . An EQ-5D-3L score of  $1.000$  represents a state of full health; we defined this score as “high HRQOL”.

## 2.3.5 Measurement of life satisfaction

Life satisfaction was assessed in the 2017 Survey using the Satisfaction With Life Scale (SWLS) developed by Diener et al. [34]; we used the Japanese version, the reliability and validity of which have been verified by Sumino [35]. The SWLS is composed of five items, each of which is scored from 1 to 7 to

indicate agreement, with a possible range from 5 (low satisfaction) to 35 (high satisfaction). We defined an SWLS score of  $\geq 25$  as “high life satisfaction”.

## 2.4. Other variables

Body mass index (BMI) was calculated as the self-reported body weight (kg) divided by the square of the self-reported body height ( $m^2$ ).

The Kihon Checklist was developed by the Ministry of Health, Labour and Welfare of Japan to predict functional decline in community-dwelling older individuals. Regarding the cognitive function score in the Kihon Checklist, respondents were asked about their current cognitive function status using three binary questions, yielding a total score ranging from 0 to 3 points. The validity of the cognitive function score in the Kihon Checklist was confirmed in a previous study using the Clinical Dementia Rating as the gold standard [36]. According to previous studies, we classified individuals with score  $< 3$  on the items for motor function as having better motor function, and those with a score of 0 on the items for cognitive function as having better cognitive function [37, 38].

## 2.5. Statistical analysis

The difference in baseline characteristics according to social support was evaluated using the chi-square test for variables of proportion and the t-test for continuous variables.

Next, we used multiple logistic regression models to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) for both emotional and instrumental social support. Participants lacking social support were set as the reference category. Dummy variables were created for categorical covariates included in the models. For categorical covariates with missing values, a separate category of missing values was created and included in the models [22, 23]. The following models were used to analyze the association between social support and healthy aging. Model 1 was adjusted for sex and age, Model 2 was adjusted for Model 1 plus history of disease (stroke, hypertension, myocardial infarction, arthritis, osteoporosis, cancer, and fall/fracture), smoking status (non-current, current, and missing), alcohol drinking status (non-current, current, and missing), body mass index ( $< 25.0 \text{ kg}/m^2$ ,  $\geq 25.0 \text{ kg}/m^2$ , and missing), daily sleep duration ( $\leq 6 \text{ h}$ ,  $7\text{--}8 \text{ h}$ ,  $\geq 9 \text{ h}$ , and missing), time spent walking per day ( $\leq 0.5 \text{ h}$ ,  $0.5\text{--}1 \text{ h}$ ,  $\geq 1 \text{ h}$ , and missing), education level (age at final graduation from school;  $< 16 \text{ y}$ ,  $16\text{--}18 \text{ y}$ ,  $\geq 19 \text{ y}$ , and missing), and working status (currently working, not currently working, and missing).

We conducted several sensitivity analyses to test the robustness of our results. First, to test whether the results obtained in the main analysis were influenced by cognitive and physical function at baseline, we selected only those with better cognitive and motor function based on the Kihon Checklist ( $n = 4,899$ ). Second, we analyzed the relationship between each question about social support and healthy aging. Third, we conducted analyses using all combinations of emotional social support and instrumental social support, which were (+)/(+), (+)/(-), (-)/(+), and (-)/(-), with (-)/(-) as the reference. Fourth, we conducted stratified analyses by sex and by age ( $< 75 \text{ y}$  and  $\geq 75 \text{ y}$ ). Fifth, we examined the association between social support and each of the four healthy aging components.

All statistical analyses were performed using the SAS software package (version 9.4; SAS Institute, Inc., Cary, NC, USA). All statistical tests were two-sided, and  $P$  values  $< 0.05$  were considered significant.

## 2.6. Ethical issues

We considered the return of a completed questionnaire to imply consent to participate in the study involving the baseline survey data, subsequent follow-up for death and emigration, and the 2017 Survey data. We also confirmed information regarding LTCI certification status after obtaining written consent, along with the questionnaires returned from the participants at the time of the baseline survey. The Ethics Committee of the Tohoku University Graduate School of Medicine (Sendai, Japan) reviewed and approved the study protocols (Ohsaki Cohort 2006 Study: 2006 – 206; 2017 Survey: 2017-1-631).

## 3. Results

In this study, 8,232 participants (48.2% men; mean [standard deviation] age at baseline in 2006, 73.3 [5.7] years) were included in the statistical analysis. During approximately 11 years of follow-up, 620 (7.5%) participants met all the criteria for healthy aging. **Table 1** shows the characteristics of the study participants according to social support. Those lacking emotional social support were more likely to be men, current smokers, current drinkers, to sleep less, and to be physically inactive. Those lacking instrumental social support were more likely to be younger, current smokers, and physically inactive.

**Table 2** shows the association between social support and healthy aging. For both emotional and instrumental social support, those having social support had higher ORs of healthy aging compared with those lacking social support. In Model 1 adjusted for age and sex, the OR (95% CI) was 1.69 (1.19–2.41) for those having emotional social support compared with those lacking emotional social support. Compared with those lacking instrumental social support, the OR (95% CI) was 1.79 (1.38–2.32) for those having instrumental social support. In the fully adjusted Model, compared to those lacking emotional social support, the OR (95% CI) was 1.60 (1.12–2.29) for those having emotional social support. Compared to those lacking instrumental social support, the OR (95% CI) was 1.71 (1.32–2.23) for those having instrumental social support. Regarding the results of sensitivity analysis by selecting only the participants with high motor and cognitive function at baseline (Model 3 in Table 2), the OR (95% CI) was 1.53 (1.01–2.33) in those having emotional social support and 1.53 (1.14–2.06) in those having instrumental social support.

**Table 3** shows the association between the answers to each of the five questions regarding social support and healthy aging. Basically, all five questions were generally associated with healthy aging, with ORs ranging from 1.4 to 1.7. Among the five questions, Q1, Q3, and Q5 were associated with a statistically significantly higher probability of healthy aging, with ORs (95% CIs) of 1.65 (1.12–2.41), 1.79 (1.31–2.45), and 1.61 (1.15–2.25), respectively, in Model 2. The other social support items were also associated with higher probability of healthy aging, with ORs (95% CI) of 1.51 (0.96–2.37) for Q2 and 1.40 (0.93–2.11) for Q4, although not significant.

**Table 4** lists the results of analysis of the association of combined emotional and instrumental social support with healthy aging. Only those who had both emotional and instrumental social support had a significantly higher likelihood of achieving healthy aging, which was 1.59 (1.03–2.44). Participants having only one type of social support (either emotional or instrumental) had no higher likelihood of reaching healthy aging than those who did not have any type of social support.

In the stratified analysis by sex, emotional social support was associated with a significantly increased likelihood of achieving healthy aging in men but not in women (**Supplementary-Table 1**). Also, in the stratified analysis by age, no difference was observed in the main results.

We additionally examined the association between social support and each component of healthy aging (**Supplementary-Table 2**). People having emotional social support showed significantly higher ORs for “free of functional disability” and “high life satisfaction” and showed higher but not significant ORs for “free of depression” and “high HRQOL”. People having instrumental social support showed significantly higher ORs for all components except “high HRQOL”.

## 4. Discussion

The results of the present study revealed that those having social support had a higher probability of achieving healthy aging than those lacking social support. To the best of our knowledge, this study is the first to investigate the association between emotional and instrumental social support and healthy aging in Japan.

We also conducted a sensitivity analysis by excluding those with better cognitive and motor function, but the results did not change substantially, which suggests that the benefits of social support in reaching healthy aging remained even in a relatively healthier population. In addition, we conducted an analysis using the combination of having or lacking emotional social support and instrumental social support. Interestingly, we found that the likelihood of healthy aging increased significantly in the group that had both types of social support but not in those who had only one type.

Only one study has investigated the association between social support and healthy aging, which was a cohort study following 4497 Norwegian participants (mean age: 52.7 y) for 22 years [13]. They measured social support by asking two questions and categorized participants into the three groups of poor, moderate, and good social support. They found that people with good (but not moderate) social support had a significantly higher probability of healthy aging compared with those with poor social support. This observation is generally consistent with ours, where only those with both emotional and instrumental social support had a greater likelihood of healthy aging. We also found that social support was associated with a higher probability of showing each given component of healthy aging. Previous studies have also found that social support may have benefits for multiple health outcomes, such as lower risk of mortality [39, 40], functional disability [41], incident dementia [5–8], and depression [9], as well as a higher probability of life satisfaction [11, 12], which is consistent with the present findings.

This study has several strengths. First, we used a relatively large population-based cohort with a long follow-up period of 11 years. Second, our definition of successful aging considered not only physiological but, crucially, also psychological indicators, which have not been fully considered in previous studies. Third, we confirmed the consistency of our findings by conducting several sensitivity and stratification analyses.

The present study also has some limitations. First, among the four healthy aging components, only functional disability and depression were investigated in the 2006 baseline survey, and the remaining components of HRQOL and life satisfaction are unknown. Second, among the 9,947 participants who were eligible for follow-up, 1,715 were excluded from the 2017 analysis for the reasons of incomplete responses for social support or healthy aging assessment, questionnaire not returned, or invalid responses. Compared with the responders, these people might have received less social support. For instance, it is possible they may have been living alone and had no one to help them. Therefore, the association between social support and healthy aging could have been underestimated. Finally, information about social support is self-reported, which may have led to misclassification of the exposure.

Although Japan is among the countries with the longest life expectancy worldwide, a smaller proportion of older people in Japan have social support compared with those in other high-income countries [42]. Thus, it is possible that some older Japanese people may not have as much social support as they need. The present study suggests that social support has great benefits for healthy aging but is limited to those who have both emotional and instrumental social support. This finding highlights the importance of sufficient social support in the promotion of healthy aging among older adults in an aging society.

## List Of Abbreviations

ADL

activities of daily living

BMI

body mass index

CI

confidence interval

DSS

Depression and Suicide Screen

EQ-5D-3L

3-level version of the European Quality of Life-5 Dimensions

HRQOL

health-related quality of life

LTCI

long-term care insurance

OR

odds ratio

QOL

quality of life

SWLS

Satisfaction with Life Scale

WHO

World Health Organization

## Declarations

### *Ethics approval and consent to participate*

The return of a completed questionnaire was considered to imply consent to participate in the study, including the baseline survey data and subsequent follow-up. Information regarding LTCI certification status was also confirmed after obtaining written consent. The Ethics Committee of Tohoku University Graduate School of Medicine (Sendai, Japan) reviewed and approved the study protocol including the method to obtain informed consent (approval code: Ohsaki Cohort 2006 Study: 2006-206; 2017 Survey: 2017-1-631). Informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

### *Consent for publication*

Not applicable.

### *Availability of data and materials*

Data described in the manuscript, code book, and analytic code will not be made publicly available because private information of participants were included but are available from the corresponding author on reasonable request.

### *Competing interests*

The authors declare that they have no competing interests.

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### *Author contributions*

AN: Conceptualization, Formal analysis, Writing - original draft.

YL: Conceptualization, Formal analysis, Writing – original draft.

SM: Writing - review & editing

TO: Writing - review & editing.

FT: Writing - review & editing.

IT: Conceptualization, Funding acquisition, Resources, Supervision, Writing – original draft.

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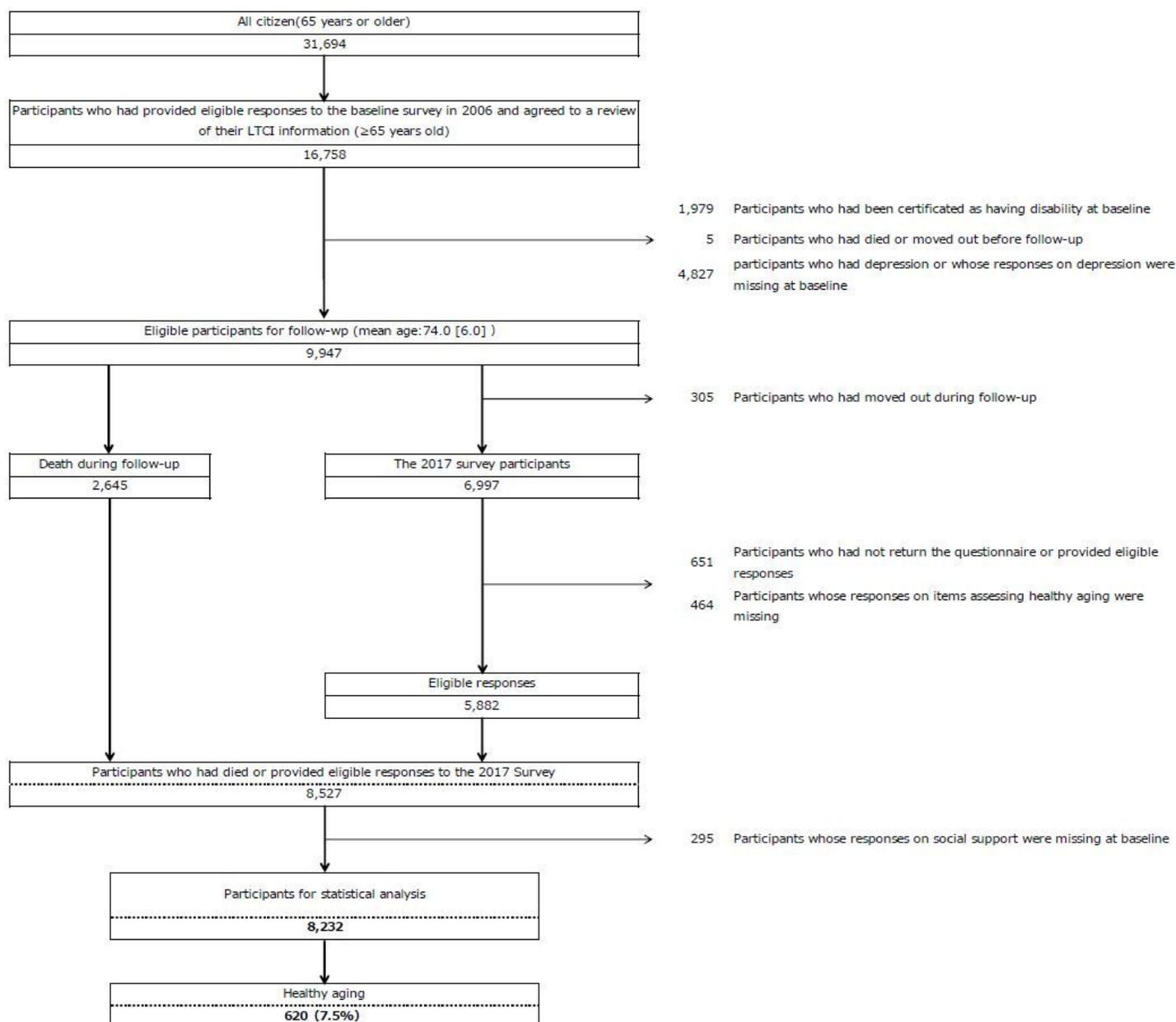
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## Tables

Tables 1 to 4 are available in the Supplementary Files section.

## Figures



## Figure 1

Flowchart of study participants

## Supplementary Files

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