



# Combined effect of self-reported hearing problems and level of social activities on the risk of disability in Japanese older adults: A population-based longitudinal study



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## ABSTRACT

**Background:** We used longitudinal cohort data to investigate whether hearing problems and low levels of social activity lead to a higher incidence of disability among community-dwelling older adults.

**Methods:** Participants were 4576 older adults (47.8% male, mean age 75.9 years) who met the study inclusion criteria. Longitudinal data on the incidence of disability were monitored monthly. Disability was defined as Japanese long-term care insurance certification for personal support or care for 2 years following the baseline assessment. Hearing problems were measured using the Hearing Handicap Inventory for the Elderly and for Adults - Screening version. Participants completed a questionnaire that included five questions on daily social activities.

**Results:** In the adjusted model that included potential covariates, participants with co-occurring hearing problems and low participation rates in social activities were at higher risk of developing a disability than participants without hearing problems and low levels of social activity (hazard ratio [HR] = 2.13, 95% confidence interval [CI]: 1.31–3.45). The second highest risk of developing a disability was found for those with low levels of social activity alone (HR = 1.98, 95% CI: 1.26–3.11), and the third highest for those with hearing problems alone (HR = 1.38, 95% CI: 1.07–1.77).

**Conclusions:** Hearing problems and a lack of social activity were independent risk factors for developing a disability. Co-occurring hearing problems and low levels of participation in social activities represented the largest risk factor for disability.

## 1. Introduction

The prevalence of hearing impairment increases with age. Although more than half of individuals aged over 70 years have a hearing impairment, only a minority receive treatment [1]. Hearing impairment has been demonstrated by epidemiologic studies to be associated with poorer outcomes in terms of physical functioning, disability, depression, quality of life, cognitive impairment, incident dementia, and communication difficulty [2–6]. These relationships may be explained by concurrent vestibular dysfunction [7], a shared pathologic etiology (e.g., microvascular disease or inflammation), or decreased awareness

of the auditory environment and the effects of increased loneliness, isolation, and cognitive load [8]. Sensory input provides signals that are used by the brain when listening to speech or music, participating in social activities with other people, and responding to environmental sounds in a range of daily life. When sensory inputs are decreased, short-term consequences to brain functioning can result, with long-term deficiency affecting brain neuroplasticity [9].

Importantly, the interactions of auditory and age-related cognitive decline are evident in daily life through participation in social activities, the maintenance of social relationships, and the general communication of older adults with hearing problems [9]. Hearing impairment

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may cause disaffection and embarrassment in social interactions [10], and people with hearing problems may avoid situations that require meeting and talking with someone [11]. Indeed, self-reported hearing difficulty has been associated with lower levels of social participation [12]. A previous study of 10,000 adults aged 70 years or older found that people with hearing problems were less likely to participate in social activities such as visiting friends, attending church, and going to the cinema [12]. Furthermore, self-reported hearing difficulties have also been shown to be associated with social loneliness in adults aged 55–85 years [13].

Thus, there is strong evidence for a relationship between impairment and lower levels of social participants. Further, both hearing impairment and decreased participation in social activities are associated with adverse health outcomes. However, research has not yet examined longitudinally whether concurrent hearing problems and decreased participation in social activities are associated with the incidence of disability among older adults. Thus, we used longitudinal cohort data to investigate whether concurrent hearing problems and low participation in social activities lead to higher incidence of disability in older Japanese adults.

## 2. Methods

### 2.1. Participants

The participants were recruited from a sub-cohort of the National Center for Geriatrics and Gerontology Study of Geriatric Syndrome. This sub-cohort targeted all older adults aged 70 years or more on January 1, 2013, who lived in Nagoya's Midori ward, Aichi Prefecture, Japan; and all were without long-term-care needs or support at the start of the study. An invitation letters for the baseline assessment was sent to all older adults ( $n = 24,271$ ), 5257 of them participated in it. After the baseline assessment, participants' health status, including incidence of disability as assessed by Japanese long-term care insurance (LTCI), death, and moving to another city were monitored monthly. The current study included 4576 participants, excluding 681 individuals based on the following criteria: (1) a history of Parkinson disease ( $n = 18$ ), Alzheimer disease ( $n = 24$ ), or stroke ( $n = 356$ ); (2) requiring support or care by the LTCI system at baseline ( $n = 21$ ); (3) disability in basic activities of daily living (ADL;  $n = 8$ ); (4) missing values at baseline assessment ( $n = 178$ ); and (5) missing follow-up data ( $n = 76$ ) (Fig. 1). The study protocol was developed in accordance with the Declaration of Helsinki and was approved by the ethics committee of the National Center for Geriatrics and Gerontology. Prior to study participation, informed consent was obtained from all participants.

### 2.2. Onset of disability

Participants were followed monthly to monitor the incidence of care needs according to the LTCI system for 2 years following the baseline assessment. The Japanese government implemented a mandatory LTCI system in 2000 for promote the independence of older adults. Eligibility for the certification of LTCI is as follows. Older adult the municipal government to request official certification of the care needs. After the application, a trained local government official visits the home to assess the nursing care needs on current physical and mental status (e.g. difficulties in sitting-up, joint contracture of limbs, maintaining sitting or standing position, transferring from one place to another, walking, bathing, dressing, etc.) of the older adults. After this official completes the assessment, the applicant is assigned to one of the levels of care required. The LTCI classification of "Support Level 1 or 2" indicates that a person is in need of assistance to support ADL, and the "Care Levels 1 through 5" classification indicates a need for continuous care [14]. In the present study, we defined disability as an LTCI certification at any level, and we defined disability onset as the point when a participant was certified by the LTCI as requiring care.

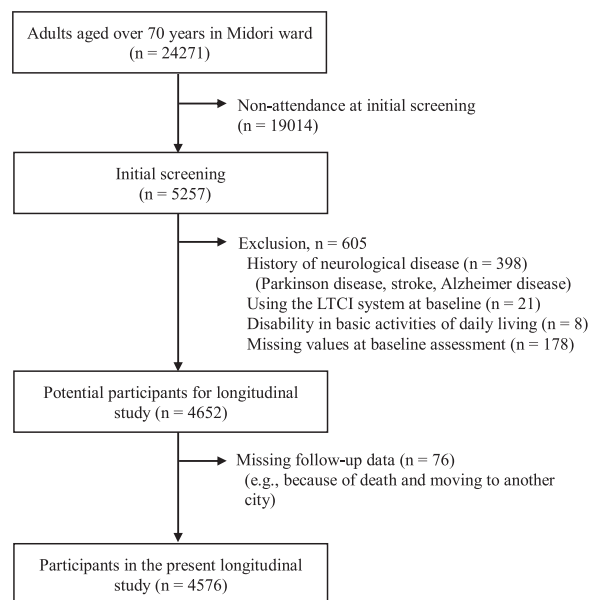


Fig. 1. Flowchart of the participant recruitment process (LTCI, long-term care insurance).

### 2.3. Assessment of self-reported hearing problems

Participants completed the Hearing Handicap Inventory for the Elderly and for Adults - Screening version (HHIE-S) [15]. This version of the inventory comprises 10 items selected from the 25-item version of the HHIE. The HHIE-S questionnaire is designed to measure hearing handicap. In the present article, the outcomes of the HHIE-S are described as measurements of activity limitations and participation restrictions. The HHIE-S 10 items are divided into two subscales: one that explores emotional consequences and one that explores social or situational effects. Each item has three response options: "yes" (score = 4), "sometimes" (2), and "no" (0). Total HHIE-S scores greater than 8 were considered to indicate the presence of a handicap [16].

### 2.4. Participation in social activities

Participants completed a questionnaire including five questions regarding daily social activities: (1) "Can you use public transportation (bus or train) by yourself?"; (2) "Are you able to shop for daily necessities?"; (3) "Do you visit the homes of friends?"; (4) "Are you sometimes called on for advice?"; and (5) "Do you meet someone in person and have a face to face conversation with them?" Participants responded with "yes" or "no" to each of these questions. Questions 1–4 were taken from the Kihon-Checklist, a self-report comprehensive health checklist developed by the Japanese Ministry of Health, Labour and Welfare [17], and question 5 was taken from a previous study [18].

### 2.5. Covariates

A face-to-face interview was performed to obtain information for medical history including hypertension, diabetes, heart disease, depression and osteoporosis (yes or no). In particular, they were asked about their age, sex, educational history, and smoking status (never, previous, or current). To assess the frequency of physical exercise, participants were asked, "How many days per week do you do physical exercise?" Participants were categorized into those who exercised  $\leq 1$  day, 2–4 days, and  $\geq 5$  days a week. Global cognitive function was assessed using the Mini-Mental State Examination (MMSE) [19].

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