



Title	Association of changes in behavioral activities on mental and physical health among age-specific Japanese older adults : a cohort study [an abstract of dissertation and a summary of dissertation review]
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## 学位論文内容の要旨

博士の専攻分野の名称 博士（医学） 氏名 Shan Yifan

### 学位論文題名

Association of changes in behavioral activities on mental and physical health among age-specific Japanese older adults: a cohort study

(特定年齢の日本人高齢者における行動活動の変化と心身の健康との関連性：コホート研究)

**Background and purpose:** People worldwide are living longer. The proportion of people aged 60 and over will increase from 12.8% in 2020 to 21.6% in 2050 worldwide. Japan has one of the highest levels of ageing rate in the world. The proportion of Japanese people over 65 years is expected to increase to 37.7% in 2050 from 28.8% in 2021. Ageing populations are vulnerable to develop common conditions, such as depression and disability. The prevalence of late-life depression increased with age both worldwide and Japan. Life expectancy (LE) and healthy life expectancy (HALE) increased with years, but the increase in HALE has not kept pace with the growth in LE. The reason may be caused by the number of increased years lived with disability (YLDs). Therefore, as depression and disability in older adults become an increasing significant component of disease burden and health expenditure, it is essential to take measures to protect them from depressive disorders and prolong their disability-free survival times. Lack of behavioral activities (social, physical activities) is a common risk factor for depressive disorders and functional disability among older adults. However, as people age, behavioral activities are more likely to be changed due to changes in social and physical environments. Changes in behavioral activities in older adults may extend in a positive direction (increase or maintain in a higher level), or flourish in an adverse direction (decrease or maintain in a lower level). Given this, the present study assumes that positive change in behavioral activities in older adults can be an effective strategy to prevent the development or improve the prognosis of depressive symptoms and disability. Therefore, I hypothesized that

1. Changes in behavioral activities are associated with the temporal evolution of depressive symptoms. Among all three behavioral activities, changes in social activities may substantially affect depressive symptoms.
2. In the association between changes in social activities and depressive symptoms, the effect of types and combinations of social activities on the onset/persistence of depressive symptoms are different.
3. Among depressed older adults, higher levels of social activities can protect them from disability. Thus, an increased or continued regular frequency of social activities is expected to postpone the incident functional disability and prolong the disability-free survival time among depressed older adults.

**Subjects and Methods:** Study participants aged 64/65 between 1996 to 2005 were selected from the New Integrated Suburban Seniority Investigation (NISSIN) project, an ongoing, age-specific cohort study. Behavioral activities (social activities, daily walking, and exercise habits) were measured by self-reported questions. Social activities were assessed by a set of questions in social-related, learning, and personal activities; daily walking by one question on daily walking time; and exercise habits by one question on weekly exercise frequency. Changes in behavioral activities were classified into continued low frequency (CLF), continued regular frequency (CRF), increased frequency (IF), and decreased frequency (DF). Depressive symptoms were assessed using the 15-item Geriatric Depression Scale, a score  $\geq 6$  is indicative of depressive symptoms. Functional disability was defined according to Japan's Long-term Care Insurance System (LTCI). There are seven levels of LTCI certification, support levels 1-2 and care levels 1-5. Mild disability was defined as people need support levels 1-2 and care level 1; severe disability was defined as people need care levels 2-5. Risk ratios, hazard ratios, 25<sup>th</sup> percentile differences and their 95% confidence

intervals were calculated by modified Poisson regression models, cox proportional hazard models, and Laplace regression models, respectively.

### **Results:**

1. In the association between changes in behavioral activities and depressive symptoms, participants without depressive symptoms at baseline and engaged in all three behavioral activities at a CRF, social activities and daily walking at an IF, and a greater variety of behavioral activities at CRF were less likely to have depressive symptoms onset at follow-up. Although this negative association also showed among participants with depressive symptoms at baseline, there is no significant difference.
2. In the association between changes in social activities and depressive symptoms, participants with CRF or IF of all types of social activities, and with a combination of multiple social activities maintaining the same frequency or increase the number of regular frequency activities were less likely to develop depressive symptoms. This association did not show statistical significance in the persistence of depressive symptoms among participants with depressive symptoms at baseline.
3. Among depressed older adults, an IF of learning activities not only reduced the risk of developing mild disability and prolonged their disability-free survival time. A CRF of learning activities also showed a reduced risk of developing severe disability and a prolonged disability-free survival time. Still, this association was not significant after controlling all the confounding factors.

### **Discussion:**

1. Participating in behavioral activities that people get positive personal interaction broadens older individuals' social lives, increases their confidence, self-efficacy, and self-esteem, and then brings protective effects on depression. Daily walking for recreational purposes, rather than utilitarian purposes, was strongly associated with a reduction in the risk of developing depression. The maintenance, rather than increase, of exercise could protect older adults from depression. As exercise-related improvements to the capacity for vascular hippocampal plasticity that exert antidepressant effects decreased with age, which may not be entirely beneficial for preventing depressive symptoms among older adults.
2. The effect size of the negative relation between CRF or IF of social activities and depressive symptoms varied across different types of social activities, which confirmed that a higher level of perceived emotional support could protect people from depressive symptoms, whereas a lower level is associated with the presence or development of depressive symptoms. There are cumulative and compensatory effects among different types of social activities influencing depressive symptoms, which means a gain in certain activities may compensate for losses in other activities.
3. Increased learning activities help depressed older adults get benefits for their cognitive function and then protect them from disability. However, for people with much severe disability, it seems that only maintaining higher frequency of learning activity would reduce the risk of disability. Future studies still need to demonstrate this association, because the lower prevalence of severe disability in our study may cause underestimation.

### **Conclusions:**

1. Consistent and regular participation in one or more behavioral activities was negatively associated with the onset of depressive symptoms.
2. In different types of social activities, personal activities were more manifest in preventing depressive symptoms, regardless of depressive status at baseline. Also, an engagement in a combination of all three social activities was negatively associated with the onset of depressive symptoms.
3. Among depressed older adults, an increased frequency of learning activities could significantly reduce the risk of mild disability and prolong their disability-free survival time.

In conclusion, older adults should make positive behavioral changes to protect them from future disease onset or improve the prognosis of the disease.