Association between Economic Activity and Cognitive Health: A Population-Based Observational Study

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Abstract: This study investigates whether restricted participation in productive activity is associated with cognitive health in Korea. Furthermore, given the enormous socioeconomic disparities between aging and gender differences in employment, we also examine whether these associations vary by gender and age. Data from the Korean Longitudinal Study of Ageing (KLoSA) from 2006 to 2016 was used and 9,942 subjects were included at baseline in 2006. To analyze the association between restricted economic activity due to health condition and cognitive function, generalized estimating equation (GEE) model and chi-square test were used. Of the 9,942 individuals at baseline in 2006, the odds ratio (OR) of cognitive decline in those in the “very probable” of restricted economic activity was 2.58 times higher (p-value: < 0.0001) compared with “not at all” of restricted economic activity. In a subgroup analysis, ≤ 64 years and ≥ 65 years groups presented similar results. OR of cognitive decline in “very probable” of restricted economic activity was 2.50 times higher (p-value: < 0.0001) compared with “not at all” of restricted economic activity in both groups, respectively. For male and female, OR of cognitive decline in “very probable” of restricted economic activity was 2.77 times higher (p-value: < 0.0001) and 2.40 times higher (p-value: < 0.0001) compared with “not at all” of restricted economic activity, respectively. Our findings highlight association between restriction in economic activity and cognitive function among middle aged and elderly population in Korea. Given the benefits of economic activity, efforts should be made to improve health condition and reduce barriers to participate in economic activity.

Keywords: Activity; economic; elderly; health; restriction

1 Introduction

With a rapid aging population, cognitive impairment is becoming a severe health problem in Korea. Dementia, which could be a result of significant cognitive impairment, is considered as one of the leading causes of increased disability in late life. Furthermore, the prevalence of dementia around the world is expected to increase due to global aging. Notably, a study conducted in 2014 put forth the possibility of a 15.3% reduction in dementia prevalence by 2050 when the key exposures were reduced by 20% [1]. Accordingly, the risk factors associated with dementia should be identified and managed better to reduce its prevalence.

Prior evidence indicates that the cognitive functions related to the frontal lobe are affected the most by aging [2]. The frontal lobe is often related to fluid abilities, such as memory, processing speed and spatial ability, and these abilities tend to decline faster than crystalized functions (e.g., vocabulary, information, and comprehension) [3,4]. Furthermore, although most cognitive functions decline naturally with aging,
because cognitive decline could be a predictor of dementia [5], it is important to identify and understand
the mechanisms involved in cognitive decline.

Social factors, such as socioeconomic status (e.g., unemployment and income), often have a profound
impact on cognitive function [6]. According to recent research, participation in productive activity (e.g.,
paid work, volunteering, and family caregiving) has shown to benefit overall well-being as well as health
outcomes such as mortality, morbidity, and cognitive impairment [7,8]. Participation in such activities could
lead to social contributions that benefit others, and enable better integration to social networks and a sense
of gratification [8]. Also, previous studies indicated a negative association of social integration and social
engagement with cognitive function, mental health and mortality [9–11].

In a 20-year follow-up study from the Suffolk Country Mental Health Project cohort, Strassnig et al.
[12] showed the predictive effect of health limitations in terms of unemployment, independent of other
previously established correlates, including cognition and symptoms. Their results indicated that negative
symptoms and physical limitations attributed to about 30% of the variance in terms of predicting
unemployment. In addition, poor health status [12] including cognition and symptoms [12] was associated
with residential region and, particularly, employment. The importance of poor health status for predicting
outcome was confirmed in a more impaired group [12]. Therefore, the positive effect of productive activity
on cognition may be robust to alternative empirical specifications [13]. Yet, it is still unclear whether
participation or restriction in economic activity will have a protective effect on cognitive function or
accelerate cognitive decline in Korea. Besides, a number of studies have explained the impact of
participation in productive activity on mental health with the role theory, but there has not been a study
focusing on the impact of restricted economic activity on cognitive decline for the Korean population.
Therefore, we contribute to the current research by focusing on whether restricted participation in
productive economic activity is associated with cognitive health in Korea. Furthermore, we extended our
research to consider the longitudinal association between productive activities and cognitive function by
focusing on the impact of restricted participation in productive economic activity on cognitive decline over
time. Lastly, given the enormous socioeconomic disparities between aging and gender differences in
employment, we also examined whether these associations vary by gender and aging.

2 Methods

2.1 Data Source

The data used for the following analyses were derived from the Korean Longitudinal Study of Ageing
(KLoSA) from 2006 to 2016. As a type of study that possesses both the strengths of cross-sectional data
and time series data, KLoSA was constructed by repeatedly surveying the identical content for the same
respondents. Thus, all variables were repeatedly measured from the 1st wave to the 6th wave at multiple
points in time. This biennial survey involves multistage stratified sampling based on geographical areas and
housing types across Korea. Participants were selected randomly using a multistage, stratified probability
sampling designed to create a nationally representative sample of community-dwelling Koreans 45 years
of age and older. Participant selection was performed by the Korea Labor Institute for these rapidly growing
populations, including individuals from both urban and rural areas. In case of refusal to participate, another
subject was selected from an additional, similar sample from the same district.

In the first baseline survey in 2006, 10,254 individuals in 6,171 households (1.7 per household) were
interviewed. There were 292 individuals with cancer. The second survey, in 2008, followed up with 8,675
subjects, who represented 86.6% of the original panel. The third survey, in 2010, followed up with 8,229
subjects, who represented 81.7% of the original panel, the fourth survey, in 2012, followed up with 7,813
subjects, who represented 80.1% of the original panel and the fifth survey, in 2014, followed up with 8,387
subjects (including 920 new subjects), who represented 80.4% of the original panel. The sixth survey, in 2016,
followed up with 9,913 subjects (including 878 new subjects), who represented 79.6% of the original panel.

In this study, we excluded individuals for whom we had incomplete data: 33 individuals who lacked
information on socioeconomic factors and 216 individuals who lacked information on health status and risk
factors in 2006. Finally, 9,942 subjects were included. This study does not need ethical approval because it is not a study using human derivatives, and all subjects are encrypted and cannot be identified (Fig. 1).

2.2 Independent Variables
Restriction on economic activity due to health condition was assessed by self-reported response to the question: “Do you have a problem with your work because of your health condition?” The responses were assigned to 1 of 4 subcategories: “very probable”, “probable”, “probably not” and “not at all”.

2.3 Dependent Variables
2.3.1 Korean Mini-Mental State Examination (K-MMSE)
The study considered a twofold dependent variable, which was measured by using the Korean Mini-Mental State Examination (K-MMSE) as cognitive function. K-MMSE included 11 items in 7 categories of cognitive functions, including orientation for time and place, registration, attention & calculation, recall, language, and visual construction [14,15]. In a previous study, Kang et al. [16] showed that of the cognitive components included in the K-MMSE, Orientation, Attention and Calculation, Recall, and Visual Construction are impaired in dementia patients. The sensitivities of the K-MMSE in detecting dementia were 70–83. Factor analysis indicated that the multiple cognitive components of the K-MMSE can be explained by one or two factors. The K-MMSE was also highly correlated with another brief measure of cognitive functioning, the Blessed Orientation Memory-Information (r = 0.78). The result, however, further suggested that the K-MMSE is relatively insensitive to detect the early stage of dementia, causing an increase in false negatives.

The total score of the measure ranges from 0 to 30; higher the score, better the cognitive function. The validity of K-MMSE was reported elsewhere [14]. We followed the conventional classification criteria for cognitive function, categorizing K-MMSE scores as cognitive decline (K-MMSE ≤ 23), and normal cognitive function (K-MMSE ≥ 24) [14,15].

2.4 Control Variables
2.4.1 Socioeconomic and Demographic Factors
Age groups were divided into three categories: 45–54, 55–64 and ≥ 65 years of age. Education level was categorized into four groups: elementary school or lower, middle school, high school, and college or higher. Gender was categorized as male and female. Marital status was divided into three groups: married, separated or divorced, and single. Residential regions were categorized as Metropolitan (Seoul), urban (Daejeon, Daegu, Busan, Incheon, Kwangju or Ulsan) or rural (not classified as a city). Health insurance was categorized into national health insurance and medical aid.

2.4.2 Health Status and Behavioral Factors
Self-rated health was categorized into five groups: very good, good, normal, bad, and worst, and depressive symptom a week was divided into two groups: yes or no. Smoking status was categorized into three groups: current smoker, former smoker, and never smoker. Alcohol use also was divided into three groups: current drinker, former drinker, and never drinker. Depressive symptoms from responses to the question: “How many days in a week do you have a depressed mood?” were included in the model because 2-week symptoms of depression could not be assessed due to data collection limitations. The response “less than a day” indicated “No” and “a day or two”, “three or four days” and “five days or more” indicated “Yes”. Finally, the number of chronic diseases (consisting of hypertension, diabetes, osteoarthritis, rheumatoid arthritis, cancer, chronic pulmonary disease, liver disease, cardiovascular disease, and cerebrovascular disease) and year dummies during 12 years were included as covariates in our analyses.

2.5 Analytical Approach and Statistics
Chi-square test and a generalized estimating equation (GEE) for logistic regression in binary outcome
were used to handle the association between restriction on economic activity due to health condition and cognitive function. The use of a GEE model was required in order to handle the unbalanced data with correlated outcomes over time. To determine whether the probability of cognitive function changed over time, we included time (year) in the model as a categorical covariate; the regression coefficient was used to estimate both the change in probability of cognitive function and independent variables, annually [17]. For all analyses, statistical significance was set to \( p \leq 0.05 \), two-tailed. All analyses were conducted using the SAS statistical software package, version 9.4 (SAS Institute Inc., Cary, NC, USA).

3 Results

3.1 Prevalence of Cognitive Function

Tab. 1 displays the descriptive statistics of all variables from 2006 to 2016. At baseline 2006, of the 9,942 research subjects included in our study, the prevalence of those with cognitive decline was 24.4% (2,454 participants) and mean of cognitive function was 25.46 (SD: 5.3). Of the total sample population, the number of participants with “very probable” of restriction on economic activity due to health condition was 1,037 (10.4%) and cognitive function was 20.46 (SD: 7.7). Of them, 579 participants (55.8%) had cognitive decline. The number of participants with “probable” of restriction on economic activity due to health condition was 2,290 (23.0%) and cognitive function was 23.92 (SD: 5.6). Of them, 854 participants (37.3%) had cognitive decline (Tab. 1).

3.2 Association between Restriction on Economic Activity and Cognitive Function

Tab. 2 shows the relationship between restriction on economic activity due to health condition and cognitive function adjusted for socioeconomic status, health risk/status behavior and behavioral factors. After adjusting for all of these confounders, the odds ratio (OR) of cognitive decline in those with “very probable” of restriction on economic activity due to health condition was 2.58 times higher (95% Confidence Interval [CI]: 2.26–2.94 \( p \)-value: < 0.0001) compared with those with “not at all” of restriction on economic activity due to health condition and the estimate of cognitive function in those with “very probable” of restriction on economic activity due to health condition was -0.12 (95% CI: -0.13–-0.11 \( p \)-value: < 0.0001) compared with those with “not at all” of restriction on economic activity due to health condition.

OR of cognitive decline in those with “probable” of restriction on economic activity due to health condition was 1.43 times higher (95% CI: 1.29–1.59 \( p \)-value: < 0.0001) compared with those with “not at all” of restriction on economic activity due to health condition and the estimate of cognitive function in those with “probable” of restriction on economic activity due to health condition was -0.01 (95% CI: -0.01–0.00 \( p \)-value: 0.007) compared with those with “not at all” of restriction on economic activity due to health condition. In addition, OR of cognitive decline in those 65 years or older was 4.10 times higher (95% CI: 3.70–4.55 \( p \)-value: < 0.0001) compared with those with 54 years or less and OR of cognitive decline in “never smoker” was 1.16 times higher (95% CI: 1.01–1.21 \( p \)-value: 0.024) compared with those with “smoker”.

3.3 Association between Restriction on Economic Activity and Cognitive Function by Age and Gender

Tab. 3 shows subgroup analysis according to age (≤ 64 years or ≥ 65 years) and gender (male and female). In both age groups, OR of cognitive decline in those with “very probable” of restriction on economic activity due to health condition was 2.50 times higher compared with those with “not at all” of restriction on economic activity due to health condition. In the male group, OR of cognitive decline in those with “very probable” of restriction on economic activity due to health condition was 2.77 times higher (95% CI: 2.25–3.42 \( p \)-value: < 0.0001) and in the female group, OR of cognitive decline in those with “very probable” of restriction on economic activity due to health condition was 2.40 times higher (95% CI: 2.02–2.85 \( p \)-value: < 0.0001) compared with those with “not at all” of restriction on economic activity due to health condition.

4 Discussion

In this population-based prospective study of 9,942 middle aged and older adults at baseline, our
primary purpose was to examine the association between the restriction on economic activity due to health condition, and cognitive decline and cognitive function measured by the Korean Mini-Mental State Examination (K-MMSE) after adjusting for covariates (i.e., socioeconomic status, health risk, and behavioral factors), using a nationally representative database in South Korea. Bi-directional association between economic activity status and impaired physical, mental and/or cognitive health is well recognized [18–20]. Bjelajac et al.’s study [21] showed that the protective factors for good mental health and cognitive functioning in older Croatian workers are being employed, having more education, living with a partner in the household, and being healthier.

In the present study, we found that restriction on economic activity due to health condition was associated with an increased risk of cognitive decline. The most notable result was stronger in men than women. This result could be explained by the role theory and gender expectation in Korea. The role theory provides important perspective in regards to productive aging, and is made of three stages: role loss, role strain, and role enhancement [22]. Role loss postulates that when individuals enter their older age period, the sudden role loss could be experienced. This could be especially so when the individuals are not able to access a new role as they become older. Role loss is often used to explain the psychological loss, brought forth by retirement [8]. In addition, despite the changing family structure in Korea, the traditional high expectation put upon males to provide for the family still exists [23]. Therefore, the results of the present research could be attributed to the specific culture in Korea. In addition, according to the ‘use it or lose it’ hypothesis, the cognitive function of an individual could either be maintained or declined more quickly, depending on how cognitively active an individual stay. Failure to stay cognitively active could accelerate cognitive decline and further increase the risk of dementia [24]. Accordingly, many studies have suggested that restriction in productive activities may potentially trigger cognitive decline and be associated with lower cognitive function [25,26].

This study has various strengths, particularly with its use of a population-based representative sample and the 10-year follow-up database. Also, it advances the knowledge on restricted economic activity or productive activities in Korea. We also used a large nationally representative longitudinal survey data of a well-defined and comprehensively studied sample of middle aged and older adults. This data was analyzed to study the association between restricted economic activity and cognitive function, in an effort to better the generalizability of our results. Therefore, with the rapidly aging population in Korea, restricted economic activity may be a reasonably good predictor of cognitive function.

There are several limitations to this study that should be taken into consideration. First, data was gathered from self-reports of socioeconomic factors as well as health status and risk factors. Although MMSE is a widely used and well validated measure in older adults, respondents’ reports are subjective and are potentially affected by false consciousness and adaptation of resources, because cognition was determined using a cut-off on a self-reported measure of MMSE and not by clinical evaluation. Therefore, self-reported data may be an imperfect indicator of actual behavior. Second, information regarding health status and risk behavior factors was not sufficient. Especially, our analysis of the length and intensity of economic activity participation may not be thorough due to data availability and small number of participants in some economic activity. Furthermore, there might have been unobserved confounders. Therefore, the lack of such information might have resulted in an underestimation of our results in the present study. Finally, although we conducted longitudinal analysis through GEE model, associations between economic activity and cognitive health are subject to reverse-causation problems.”

Nevertheless, despite the underestimation, we found a significant association between restricted economic activity and cognitive function. Finally, although this analysis covered a 12-year period, it might still be too short to see large cognitive declines. As new waves are being added in the future, it is important to reexamine these relationships between restricted economic activity and cognitive function. In the meantime, with longer periods, sample attrition due to mortality and dropout must be carefully evaluated and adjusted as the association may be less apparent due to the fact that those who are less engaged and who have poor cognitive function are more likely to die or dropout.

In conclusion, our findings highlight the association between restriction in economic activity and
cognitive declines among middle aged and elderly population in Korea. This study has implications for policy-makers, health care practitioners, and community advocates. Given the benefits of economic activity, efforts should be made to improve health condition and reduce barriers to participate in economic activity among middle aged and elderly population.

Table 1: General characteristics of subjects included for analysis

|                          | 2006 | 2008 | 2010 | 2012 | 2014 | 2016 |
|--------------------------|------|------|------|------|------|------|
| **Restriction on economic activity due to health condition** |      |      |      |      |      |      |
| Very probable            | 579  | 20   | 458  | 20   | 380  | 18   |
| Probable                 | 854  | 24   | 793  | 24   | 843  | 22   |
| Probably not             | 787  | 26   | 830  | 26   | 1,208| 24   |
| Not at all               | 207  | 28   | 133  | 28   | 166  | 26   |
| **Education level**      |      |      |      |      |      |      |
| ≤ Elementary school     | 2,037| 23   | 1,837| 23   | 1,889| 22   |
| Middle school           | 195  | 27   | 182  | 27   | 313  | 25   |
| High school             | 161  | 28   | 160  | 28   | 313  | 25   |
| ≥ College               | 34   | 28   | 35   | 28   | 82   | 26   |
| **Gender**              |      |      |      |      |      |      |
| Male                     | 654  | 27   | 608  | 26   | 832  | 25   |
| Female                   | 1,773| 25   | 1,606| 24   | 1,765| 23   |
| **Age**                 |      |      |      |      |      |      |
| ≤ 54                     | 179  | 28   | 113  | 28   | 186  | 26   |
| 55–64                    | 437  | 27   | 326  | 27   | 439  | 25   |
| ≥ 65                     | 1,811| 23   | 1,775| 23   | 1,972| 22   |
| **Marital status**       |      |      |      |      |      |      |
| Married                  | 1,398| 26   | 1,277| 26   | 1,617| 25   |
| Separated, divorced      | 1,020| 22   | 926  | 22   | 962  | 21   |
| Single                   | 9    | 27   | 11   | 26   | 18   | 24   |
| **Residential region**   |      |      |      |      |      |      |
| Metropolitan             | 308  | 27   | 298  | 26   | 374  | 24   |
| Urban                    | 652  | 26   | 528  | 26   | 669  | 26   |
| Rural                    | 1,467| 25   | 1,388| 25   | 1,554| 23   |
| **Health insurance**     |      |      |      |      |      |      |
| National health insurance| 2,141| 26   | 1,985| 25   | 2,303| 24   |
| Medical aid              | 286  | 22   | 229  | 22   | 294  | 21   |
| **Self-rated Health**    |      |      |      |      |      |      |
| Very Good                | 39   | 27   | 17   | 28   | 42   | 25   |
| Good                     | 317  | 28   | 215  | 28   | 380  | 26   |
| Normal                   | 665  | 26   | 811  | 25   | 914  | 24   |
| Bad                      | 1,046| 23   | 927  | 23   | 1,003| 21   |
| Worst                    | 360  | 20   | 244  | 19   | 258  | 18   |
| **Number of chronic disease** |      |      |      |      |      |      |
| 0                        | 893  | 26   | 670  | 26   | 732  | 25   |
| 1                        | 827  | 25   | 755  | 25   | 853  | 24   |
| ≥ 2                      | 707  | 23   | 789  | 23   | 1,012| 22   |
| **Smoking status**       |      |      |      |      |      |      |
| Never                    | 1,944| 25   | 1,761| 25   | 1,948| 23   |
| Former smoker            | 168  | 26   | 192  | 26   | 301  | 24   |
| Smoker                   | 315  | 27   | 261  | 26   | 348  | 25   |
| **Alcohol use**          |      |      |      |      |      |      |
| Drinker                  | 2,227| 26   | 1,971| 25   | 2,325| 24   |
| Former Drinker           | 200  | 24   | 243  | 24   | 362  | 23   |
| Never                    | 0    | 0    | 0    | 0    | 0    | 0    |
| **Depressive symptom**   |      |      |      |      |      |      |
| Yes                      | 1,055| 23   | 1,347| 23   | 1,382| 22   |
| No                       | 1,372| 26   | 867  | 27   | 1,215| 25   |
| Total                    | 2,427| 25   | 2,214| 25   | 2,597| 24   |

*p < 0.05; CD: cognitive decline, CF: cognitive function, M: Mean
### Table 2: Adjusted effect between economic activity and cognitive health

| Restriction on economic activity due to health condition | Cognitive decline | Cognitive function |
|---------------------------------------------------------|-------------------|-------------------|
| Very probable   | 2.58 (2.26, 2.94) | < 0.0001          |
| Probable        | 1.43 (1.29, 1.59) | < 0.0001          |
| Probably not    | 1.24 (1.13, 1.36) | < 0.0001          |
| Not at all      | 1.00 (ref)        |                   |

| Education level | Cognitive decline | Cognitive function |
|-----------------|-------------------|--------------------|
| ≤ Elementary school | 4.33 (3.80, 4.94) | < 0.0001          |
| Middle school   | 2.02 (1.76, 2.32) | < 0.0001          |
| High school     | 1.45 (1.27, 1.67) | < 0.0001          |
| ≥ College       | 1.00 (ref)        |                   |

| Gender | Cognitive decline | Cognitive function |
|--------|-------------------|--------------------|
| Male   | 0.73 (0.68, 0.79) | < 0.0001          |
| Female | 1.00 (ref)        |                   |

| Age | Cognitive decline | Cognitive function |
|-----|-------------------|--------------------|
| ≤ 54  | 1.00 (ref)        |                   |
| 55–64 | 1.47 (1.32, 1.63) | < 0.0001          |
| ≥ 65  | 4.10 (3.70, 4.55) | < 0.0001          |

| Marital status | Cognitive decline | Cognitive function |
|----------------|-------------------|--------------------|
| Married        | 0.88 (0.65, 1.19) | 0.409 (0.01 - 0.03) |
| Separated, divorced | 1.40 (1.03, 1.91) | 0.033 (0.06 - 0.04) |
| Single         | 1.00 (ref)        |                   |

| Residential region | Cognitive decline | Cognitive function |
|--------------------|-------------------|--------------------|
| Metropolitan       | 1.00 (ref)        |                   |
| Urban              | 1.17 (1.08, 1.27) | 0.000 (0.02 - 0.01) |
| Rural              | 1.44 (1.34, 1.55) | < 0.0001          |

| Health insurance | Cognitive decline | Cognitive function |
|------------------|-------------------|--------------------|
| National health insurance | 1.00 (1.19, 1.45) | < 0.0001          |
| Medical aid      | 1.31 (1.19, 1.45) | < 0.0001          |

| Self-rated Health | Cognitive decline | Cognitive function |
|-------------------|-------------------|--------------------|
| Very Good         | 1.00 (ref)        |                   |
| Good              | 0.40 (0.48, 0.74) | < 0.0001          |
| Normal            | 0.86 (0.69, 1.06) | 0.162 (0.00 - 0.01) |
| Bad               | 1.37 (1.10, 1.70) | 0.005 (0.05 - 0.04) |
| Worst             | 1.94 (1.52, 2.48) | < 0.0001          |

| Number of chronic disease* | Cognitive decline | Cognitive function |
|---------------------------|-------------------|--------------------|
| 0                         | 1.00 (ref)        |                   |
| 1                         | 1.09 (1.02, 1.16) | 0.012 (0.02 - 0.01) |
| ≥ 2                       | 1.00 (0.94, 1.06) | 0.900 (0.00 - 0.00) |

| Smoking status | Cognitive decline | Cognitive function |
|----------------|-------------------|--------------------|
| Never          | 1.11 (1.01, 1.21) | 0.024 (0.01 - 0.00) |
| Former smoker  | 1.05 (0.96, 1.16) | 0.281 (0.01 - 0.00) |
| Smoker         | 1.00 (ref)        |                   |

| Alcohol use | Cognitive decline | Cognitive function |
|-------------|-------------------|--------------------|
| Drinker     | 0.97 (0.85, 1.11) | 0.630 (0.02 - 0.00) |
| Former Drinker | 0.97 (0.90, 1.05) | 0.485 (0.00 - 0.01) |
| Never       | 1.00 (ref)        |                   |

| Depressive symptom | Cognitive decline | Cognitive function |
|-------------------|-------------------|--------------------|
| Yes               | 1.57 (1.49, 1.65) | < 0.0001          |
| No                | 1.00 (ref)        |                   |

| Year | Cognitive decline | Cognitive function |
|------|-------------------|--------------------|
| 2006 | 1.10 (1.01, 1.20) | 0.031 (0.01 - 0.02) |
| 2008 | 1.11 (1.02, 1.22) | 0.016 (0.01 - 0.02) |
| 2010 | 1.88 (1.72, 2.05) | < 0.0001          |
| 2012 | 1.16 (1.06, 1.26) | 0.001 (0.03 - 0.04) |
| 2014 | 1.05 (0.93, 1.19) | 0.403 (0.00 - 0.01) |
| 2016 | 1.00 (ref)        |                   |
Table 3: Adjusted effect between economic activity and cognitive health by gender and age

| Restriction on economic activity due to health condition | Cognitive decline | Cognitive function | Male | Female |
|---------------------------------------------------------|-------------------|-------------------|------|--------|
| Very probable                                           | 2.50              | 2.40              | 2.77 | 2.02   |
| Probable                                                | 1.41              | 1.40              | 1.49 | 1.23   |
| Probably not                                            | 1.32              | 1.28              | 1.17 | 1.00   |
| Not at all                                              | 1.00              | 1.00              | 1.00 | 1.00   |

*adjusted for all variables

Figure 1: Flow chart for sample selection

Funding Statement: The author(s) received no specific funding for this study.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

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