WORK ACTIVITIES AND DEMENTIA

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This paper examines the relationship between mental processing work activities involved in the longest lifetime occupations of individuals and their probability of developing dementia in old age. Our data come from the Health and Retirement Study (HRS) which, for a nationally representative sample of elderly people, contains information about cognitive ability over time and occupation histories. We supplement this data with information from the O*NET database, which details the work activities associated with occupations. Using factor analysis we generate a factor that measures mental processing involved in the longest lifetime occupation of individuals. To analyse the relationship between the mental processing work activities and the risk of developing dementia we use both OLS and fixed effects models. We find that occupations with high loadings in activities involving mental processing reduce the probability of developing dementia in old age.

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1 Introduction

The rising prevalence of dementia is likely to become one of the biggest health challenges in the near future. The main reason for this is the unprecedented increase in life expectancy over the past century which is predicted to continue. For example, it is estimated that the elderly population in the U.S. will almost double from 45 million in 2017 to 70 million in 2030 (Ortman et al., 2014). The main concern with an ageing population is the rise in age-related health problems. One problem that is particularly visible is the rise of neuron-degenerative diseases, including dementia. According to Hurd et al. (2013), the cost of dementia in the US in 2010 was between $157 and $236 billion and predicted to rise. Given there is no cure, the best way to tackle dementia currently is prevention. Thus, it is critical to improve our understanding of the determinants of dementia. Our paper will add to this by focusing on the role the work environment can play in protecting against the development of dementia in old age.

It is well know that there are large differences in the prevalence of dementia across occupation and education levels (Gurland et al., 1999; Shadlen et al., 2006; Andersen et al., 1999; Ruitenberg et al., 2001; Berr et al., 2005). Figure 1 shows how striking the gradient of the prevalence of dementia by education and occupation groups is. While the proportion of men with dementia is close to zero at age 50 for all occupation and education groups, it rises exponentially with age such that over age 85, almost 13% of those who had worked in blue collar occupations have dementia versus 5% in white collar occupations, and 17% of those above age 85 with low education levels have dementia vs 6% of those with high education levels. As we currently do not know why we observe these stark differences across education and occupation groups, we investigate to what extent the work activities within occupations as well as selection into occupations by education is contributing to these trends. It seems likely that the activities performed in one's main occupation may affect one's likelihood of suffering from dementia in old age.

It has been shown that cognitive stimulation can induce the brain to change by forming new connections between brain cells (neurons). Thus, through what is called Neuroplasticity, cognitive stimulation may increase the cognitive reserve of individuals protecting them against developing dementia at all or shifting the onset of dementia to a later age. Cognitive reserve refers to the brain's cognitive resilience to physiological neuronal changes related to the ageing process (Stern, 2002). A higher cognitive reserve leads to a more efficient use of the networks in the brain and improved ability to make use of alternative brain networks. Previous medical literature shows robust evidence that a high cognitive reserve reduces the risk of dementia (Valenzuela and Sachdev, 2006).

Given that people in different occupations are exposed to various degrees of cognitive stimulation at the workplace, it is worth investigating to what extent cognitive demands at work may contribute to the educational and occupational gradient in the prevalence of dementia. Therefore in this paper we examine the relationship between the mental processing activities performed in people's main occupation over their working life and the probability of developing dementia in old age. We use data from the Health and Retirement Study (HRS), which is a longitudinal panel study that surveys a representative sample of approximately 20,000 people age 50 and above in America. We use the unconfidentialised version of the HRS which has detailed information on lifetime occupations and merge to this detailed information regarding work activities usually performed within occupations from the O*NET database. The O*Net data provides information on occupational skills and knowledge required as well as work activities and work context. Our results show that people working in occupations that involve higher degrees of mental processing probabilities of developing dementia in old age. These findings are robust to demographic, education, occupation, industry and work context controls.

Previous clinical studies using small selected samples suggest a clear correlation between certain work activities and cognition (Stern et al., 1992 9 9; Karp et al., 2004; Cobb et al., 1995; Beard et al., 1992; Evans et al., 1997; Gatz et al., 2001). We build on the paper by Fisher et al. (2014) who investigated the association between mental processing on the job and cognition later in life using the HRS and O*Net. While Fisher et al. (2014) focused on cognition and a subset of work activities related to mental processing only, we focus on the actual disease of dementia rather than small changes in cognition. We also consider the potential impact of the whole range of work activities spanning detailed information on physical activities performed, equipment and vehicles operated/controlled, the complex/technical activities accomplished as job outputs, activities related to processing, planning, problem-solving, decision-making, and innovation as well as interactions with others including supervisory activities and information and data gained that are needed to perform one's job.

Our paper makes several important contributions. First, it analyses the path linking mental processing work activities to dementia and attempts to estimate a causal path. Second, it complements the information of mental processing work activities with other work activities involving interacting with others, working with machines and does also consider the work context of individuals. Third, it tests whether work activities affect cognitive reserve or if instead work activities affect other physiological variables related to dementia, such as blood pressure, BMI, etc. Fourth, it employs the HRS, which is a very rich database in terms of the number of participants, the length of time participants are surveyed and the depth and breadth of topics covered. For example, the HRS includes a psychometric screening test for dementia which is medically validated (Crimmins et al., 2011). It also includes genetic information that makes it possible to estimate the poly-genetic risk of individuals to suffer specific diseases. Our paper exploits the richness of this data by examining several specific specifications.

2 Literature Review

Closely related to our work, there is a small literature that examines the relationship between work-related cognitive domains and extreme cognitive deterioration at old age (Dartigues et al., 1992; Stern et al., 1995; Jorm et al., 1998; Bosma et al., 2003; Smyth et al., 2004; Andel et al., 2005; Kröger et al., 2008; Finkel et al., 2009). Most of these compare a group of individuals with dementia to a cognitively healthy matched group, considering the main lifetime occupations and work activities of these individuals. The results of these papers suggest that work activities are highly correlated with dementia in old age. Occupations mainly involving mental processing and interacting with others are related to a lower prevalence of dementia in old age.

Similarly, there exists research that examines the relationship between different work-related cognitive domains and overall cognition in late adulthood (Andel et al., 2007; Fisher et al., 2014). Their results point out that occupations mainly involving mental processing and interacting with others are associated with better cognitive aging. Further, there is a consensus that higher levels of intellectually demanding or socially engaging occupations are associated with higher levels of cognition, while physically demanding occupations are associated with lower levels of cognitive functioning and a steeper rate of decline (Potter et al., 2006; Schooler et al., 1999; Potter et al., 2008).

Rather than occupation-related correlates, others have considered the relationship between education and dementia. Clinical studies have compared the education levels of a sample of individuals who have or at risk of dementia to a sample of healthy counter-parts (Beard et al., 1992; Stern et al., 1992, 9; Cobb et al., 1995; Evans et al., 1997; Gatz et al., 2001; Karp et al., 2004). They consistently find that higher levels of educational achievement attaintment are highly correlated with a lower likelihood of suffering from dementia in old age. Alternatively, some researchers have relied on survey data to analyse the relationship (Zhang et al., 1990; Plassman et al., 1995; Schmand et al., 1997; Letenneur et al., 1999). They also find that the incidence of dementia is much higher among individuals with lower levels of education. It is argued that individuals with higher education have greater cognitive reserve. This works through a selection mechanism, with individual with genetic high cognition levels engaging more into educational activities. It also works through a training mechanism, with highly educated individuals engaging more often in cognitively demanding activities.

Of the previously mentioned literature, it is worth considering the work of Fisher et al. (2014) in more detail. To our knowledge, it is the first paper, thus far, to examine the correlation between work activities and cognition before and after retirement using the HRS. Like us, they make use of the O*NET database (US), which provides information regarding different occupation characteristics in the US. Using O*NET, they generate a scale describing how mental demanding different occupations are. Using latent growth curve analysis they find that mentally demanding occupations are associated with higher levels of cognitive functioning before retirement and a slower rate of cognitive decline after retirement.

Our work has many similarities to that of Fisher et al. (2014), however, we make some important extensions. First, we examine a much more extreme outcome, dementia, while they considered general cognition. It is very likely both outcomes are affected by education and work activities in a different manner. While general cognition is highly dependent on crystallized intelligence, dementia is a disease that can also be attributed to genetic and organic factors. Second, we use different strategies to try to establish a causal link between mental processing activities and dementia. Third, Fisher et al. (2014) only consider the effects of one summarized work-activity variable: mental work demand. We take advantage of the richness of the O*NET database to control for several other work-activities, work context and knowledge required for specific occupations. Fourth, we control for genetic information of individuals that could lead them to suffer specific diseases related to dementia. Lastly, we examine the stratified effects for age and education levels in detail, while Fisher et al. (2014) control for these in a much more general manner.

3 Data

For the analysis we use two different data sets: The Health and Retirement Study (RHS) and the Occupational Information Network database (O*NET). We introduce and describe each of them below.

3.1 Health and Retirement Study

The HRS is a longitudinal study of the economic, health, marital, and retirement decisions of older Americans and is a valuable resource for studying an aging population. It initially surveyed a nationally representative sample of adults aged 51-61 and their spouses - regardless of their age - and in 1998, 2004, and 2010 refresher cohorts were added. The first wave of interviews was undertaken in 1992 and respondents have been re-interviewed on a biennial basis since.

For this project we use the RAND HRS Longitudinal File. This version of the HRS contains clean and homogeneous variables across survey years. The data contains detailed information covering a range of measures including demographics, health, income, employment history, etc. for 12 HRS survey years (1992 to 2014). Wave one of the survey contains variables that are of interest to us but cannot be compared across waves. For this reason, we focus only on waves 2-12. We have panel data spanning more than 20 years, from 1993 to 2014.

An important feature of the RAND HRS version is that it can be merged with other HRS data products. Some of the outcomes in the general release of the HRS are aggregated to maintain confidentiality. For example, occupation is summarized into 20 categories. Given we require detailed occupation information so we can accurately identify work activities, we link in the restricted industry and occupation database of HRS. This data set provides detailed occupational histories for each respondents, with over 1,000 different Standard Occupation System (SOC) codes, and allows us to identify a respondents' main occupation over their lifetime.

Our sample includes males, aged 60 to 85, with complete information regarding their lifetime occupation and the different cognitive tests that screen for dementia. We impose this age restriction to try to focus on a relatively age homogeneous sample. People older than 60 start retiring and people older than 85 start presenting other age-related problems that can interfere with the main results.[1] We only examine males because among the considered generation a higher proportion of females did not work or worked only for short periods of their lives compared to males. As such, the link between work activities and dementia is less clear for women. Our sample consists of 7,947 persons and 43,257 observations. For more information regarding the sample selection see Appendix B.

3.2 O*NET Database

O*NET is an extensive on-line database, developed by the U.S. Department of Labour, that aims to provide information regarding occupational requirements and worker characteristics across many different occupations. It includes information about physical and cognitive requirements for more then 1000 SOC occupation codes. [2] For each occupation, O*NET collects information for the following domains: abilities, interests, knowledge, skills, work activities, work context, work styles and work values. Each of these domains is formed by a group of variables. Each occupation has a specific score for each of these variables. In this work, we are interested in the correlation between activities that are performed in the workplace and people's cognitive ability in old age. The O*NET database allows us to summarize and link work activities to individual's main occupations. This makes it possible to explore how mental processing tasks influence individual's risk of dementia in old age. We describe the linking and summarizing process below.

[1] As a robustness check we include results for other age groups (see Table F.1 in Appendix F) and results are fairly consistent.

[2] O*NET variables are generated following a two-stage design in which: 1. A statistically random sample of businesses expected to employ workers in the targeted occupations are identified. 2. A random sample of workers in those occupations within those businesses are selected. Both sample groups are surveyed using standardized questionnaires and from these, the information for each occupation is built up. The O*NET Data Collection Program provides several hundred ratings, based on responses by the sampled workers to the O*NET questionnaires. It is not feasible to ask each respondent to provide information for all data elements. To reduce the burden on respondents, the questions have been organized into three questionnaires, each containing a different set of questions. The sampled workers in each occupation are randomly assigned one of the three questionnaires. All respondents are also asked to complete a task questionnaire and provide some general demographic information. The final database is developed by occupational analysts using the updated information from workers.

3.3 Key variables

Dementia

Our outcome variable is derived from a cognitive test administered to HRS respondents. The cognitive screening test was developed by Brandt et al. (1988) and validated by Welsh et al. (1993). Each survey wave respondents undergo a cognitive screening test administered over the telephone, making it possible to measure their cognitive evolution over time. The test contains three different sections: i) 10-words immediate and delayed memory test (0-20 points); ii) 7s serial test (0-5 points); and iii) a backward counting test (0-2 points)[3]. Scores on these three sections are combined to produce a scale ranging from 0 to 27, and is increasing in cognitive ability. Typically, cut-off points are used to classify persons at risk of dementia. Crimmins et al. (2011) classifies people with scores ranging from 0 to 6 as suffering from dementia. In Figure 2, we present the distribution of this cognitive test. It highlights that people with dementia are only at the lowest tail, at the left side of this distribution.

For people who have communication problems because they suffer from ill health, cognitive impairment, communication disorders or psychiatric disorders, information is collected through proxy respondents. For our study it is particularly interesting to include these observations as many people with dementia may not be capable of responding themselves. Having a proxy respondent could be thought of as an outcome in itself as it might detect cognitive impairment; however, there are reasons other than cognitive impairment that may require people to have a proxy respondent. Thus, we do not use this as a measure of dementia. We include proxy respondents in our sample, but use a different cognitive screeing for them. For people who have a proxy respondent, we follow Crimmins et al. (2011), who combine three different items to assess likelihood of dementia. They are: i) an assessment of memory, in which the interviewer asks the proxy respondent to rate main respondents memory from excellent to poor (0-4 points); ii) an assessment of activity, in which the interviewer asks the proxy respondent if the main respondent has problems doing the groceries, preparing hot meals, using the phone, handling money and taking their medication (0-5 points); and iii) the interviewer's assessment of the respondents difficulty in answering the survey (0-2 points). These three items are combined to generate a scale that ranges from 0 to 9 for survey years prior to 2000 and from 0 to 11 points following the year 2000. We classify a person as suffering dementia if their score ranges between 5-9 for years prior to 2000 and from 6-11 otherwise.

The thresholds used to classify respondents with dementia are validated by Crimmins et al. (2011). The authors use the Ageing, Demographics and Memory Study (ADAMS), which consists of a stratified random

[3] Immediate and delayed memory: Provide measures for immediate and delayed word recall from a list of word that is presented to the respondent; 7s serial test: Asks the respondents to subtract 7 from the prior number, beginning with 100 for five trials. Correct subtractions are based on the prior number given, so that even if one subtraction is incorrect subsequent trials are evaluated on the given (perhaps wrong) answer; Backward counting test: Examines whether the respondent was able to successfully count backwards for 10 continuous numbers from 20 and 86, respectively. Two points are given if successful on the first try, one if successful on the second, and zero if not successful on either try.

sub-sample of HRS respondents (856 persons), to validate the threshold. Respondents in the ADAMS were selected based on the score on the self- or proxy-cognitive assessment measure and undergo an intensive examination by a nurse and neuropsychology technician who are able to diagnose dementia.[4] Crimmins et al. (2011) finds that the cut-offs he proposes are largely consistent with the results of ADAMS. As such, many papers have already used these cut points (Hsu and Willis, 2013; Sutin et al., 2018,0; Crimmins et al., 2018; Basu, 2013; Clouston et al., 2015; Lièvre et al., 2008; Garcia et al., 2017,0).

Given respondents take the cognitive tests each survey year, it is possible for their diagnosis of dementia to change from wave to wave. In other words, it is possible for them to score below the threshold one wave and above threshold the next. In order to account for this variation at an individual level we modify our measure of dementia to use a more conservative approach. Respondents are classified as having dementia if, after the first wave we diagnose them with dementia, the average of their subsequent scores are below the threshold. This method should help reduce the number of false diagnosis of dementia. Further details can be found in Appendix C.

Lifetime occupation

We are interested in identifying a respondents' lifetime occupation, which is the occupation the respondent had for majority of their working life. This information comes from the restricted industry and occupation database of HRS. This data set is not consistently coded and questions regarding the respondents' lifetime occupation are slightly different across survey years. For this reason, we follow the same approach as Bugliari et al. (2018) in order to identify the lifetime occupation for respondents, while minimising the loss of observations. Further details can be followed in Appendix D.

An issue we face is that the occupations in the O*NET database are slightly different compared to those in the HRS. Additionally, the occupation categories of the HRS vary over time. We follow David and Dorn (2013) who provide a solution to these issues by generating a comparable occupational codes for the HRS and O*NET. This produces 330 unique and comparable occupations codes. Further, from these classifications we generate 11 broad occupation categories following Autor et al. (2010).

Work activities

The O*NET database contains detailed information on the work activities undertaken in each occupation.[5] We run a factor analysis over all work activities. The specific variables and their loadings on the main factors

[4] ADAMS respondents undertake the following psychometric tests: MMSE, Boston naming test, digit span, Symbol Digit Modality Test, animal fluency, word list three trial learning, construction praxis copying, Trail Making Test, Wechsler Memory Scale, Fuld Object Memory Test, Shipley vocabulary test and the Wrat 3 reading test. Diagnosis are determined in basis of detailed neuropsychological assessment and a consensus diagnosis.

[5] Variables related to the work context and knowledge are used in a separate factor analysis. We find five context and six knowledge factors, which we include as controls for some robustness specifications.

are presented in Table 1.[6] We retain three factors based on eigenvalues larger then one and the scree-plot at Appendix E. We standarize these factors with mean zero and standard deviation one. Factor 1 seems to load on work activities that have an underlying theme of interacting with others. These activities are related to occupations such as managers in education and related fields, chief executives, public administrators and legislators and similars. Factor 2 loads heavily on work activities that involve mental processing. These activities are related to occupations such as mathematicians and statisticians, air traffic controllers and similars. While Factor 3 loads on work activities involving machinery. These activities are related to occupations such as heating air conditioning mechanics and refrigerators mechanics, automobile mechanics and repairers and similars. We label these factors: “Interacting with others", “Mental processing", and “Working with machines". For our analysis we are interested in work activities that involve mental processing. As such for the main analysis we will mainly use the second factor that capures mental processing work activities. The other factors will be used as controls of the main analysis. Table 2, presents the occupations with the highest and lowest scores for mental processing activities. The labels of these factors adjust intuitively quite well to the different occ1990dd occupations.

4 Methodology

In this project we examine the relation between mental processing work activities performed in individual’s main lifetime occupation on the probability of developing dementia in old age. We develop several linear probability models in which dementia is the outcome variable and mental processing work activities are the main explanatory variables of interest. For our main results, we estimate OLS and individual fixed effect models.

In a first step, we examine if mental processing work activities are related to the prevalence of dementia in old age and if this relationship is robust to the inclusion of different controls. We estimate OLS models that examine the probability of suffering dementia conditioning on mental processing work activities performed in the main lifetime occupation of individuals. This model is specified as follows:

$$\begin{aligned} Dem_i = \beta_0 + \beta_1 MentalProc'_i + \beta_2 X'_i + \beta_3 Endo'_i + \beta_4 InterMach'_i \\ +\beta_5 Context'_i + \beta_6 Knowledge'_i + \beta_7 Health'_i + \epsilon_{it}. \end{aligned} \tag{1}$$

The dependent variable Dem is a dummy variable equal to 1 if person i has dementia and zero otherwise. $MentalProc$ is a standardized variable measuring the level of mental processing work activities

[6] Details for the factor analysis can be found in Appendix E.

involved in the longest lifetime occupations of individuals. β_1 coefficient of interest. Having a main lifetime occupation with an additional standard deviation in mental processing work activities changes the probability of having dementia in old age in β_1 percentage points.

Once we examine the unconditional correlation between mental processing work activities and dementia, we sequentially add different controls to the model to examine how robust the correlation is. X' is a vector of demographic controls including race, having a proxy respondent, parental education and dummy variables for age, survey year, place of birth, education level, and occupation and industry. We include race, age and country of birth because the literature has established that these variables are strongly related to dementia in old age (Plassman et al., 2007; Lawton et al., 2015; Parlevliet et al., 2016). Having a proxy respondent is included because it could be capturing some impairment related to dementia. Respondents education and parental education are included because, as mentioned at the introduction of this paper, education is strongly related to dementia. Survey year is included to control for potential learning effects that could affect the outcome of the psychometric tests we use to measure dementia. Occupation and industry controls are broad categories relating to the main lifetime occupations of individuals. We include them to be able to consider the effect of work activities within broad occupational groups and industrial sectors. $InterMach'$ is a vector including the factors of interacting with others work activities and working with machines work activities. $Context'$ is a vector of five different work context factors. These make reference to the physical and social factors intrinsic to the nature of the work in different occupations (interpersonal relations, physical conditions, etc.). $Knowledge'$ is a vector that includes six factors of knowledge required for specific occupations. These make reference to organized sets of principals and facts that are necessary for different occupations (administration, biology, construction, chemistry, clerical, etc.). $InterMach'$, $Context'$ and $Knowledge'$ are included to examine the relation of mental processing work activities within occupations with the same interacting with others and working with machines work activities loading's, the same work context and in occupations requiring the same knowledge. Some of these controls are very are highly correlated with mental processing activities, as such they might over-control the results. Still, they make it possible to examine the effects of work activities within similar occupations, performed at similar work contexts and requiring similar types of knowledge. $Endo'$ is a vector of potentially endogenous controls including retirement status, household wealth, retirement status and total number of years worked. $Health'$ is a vector of health controls including body mass index (bmi), having ever smoked and regularly consuming alcohol. $Endo'$ and $Health'$ are included separately and only as a robustness check, because they could be endogenously related to dementia. Finally, ϵ_{it} is an idiosyncratic error term.

The different controls are included in a step-wise manner to control how robust the relation of work activities and dementia is. There are uncontrolled factors that could lead to dementia, such a genetic differences and similarities. In any case, the models are very conservative and we believe their results get close to a causal path.

Given the binary nature of our dependent variable, we test the sensitivity of our results to estimating non-linear, probit and logit models. These non-linear models produce similar results; however, we prefer OLS models because of the ease of interpretation.

In a second step, we use the panel structure of our data to examine how dementia and mental processing work activities relate to the aging process. It could be that certain occupations lead to a earlier or later onset of dementia. We estimate individual fixed-effects models that interact the work activities with age. These models also control for individual time fixed variables such as personality traits and for baseline conditions, such as baseline cognition. This model is specified as follows:

$$Dem_{it} = \alpha_i + \beta_0 Age_{it} + \beta_1 MentalProc_i' * Age_{it} + \beta_2 InterMach_i' * Age_{it} + \beta_3 Educ_i' * Age_{it} + \epsilon_{it}. \tag{2}$$

where Age_{it} is the person's age; $MentProc_i' * Age_{it}$ is a interaction of mental processing work activities with a person's age; $InterMach_i' * Age_{it}$ is a interaction of interacting with others and working with machines work activities with a person's age; $Educ_i' * Age_{it}$ is an interaction between a person's education level and their age; and α_i is an individual-specific effect that controls for unobserved, time-invariant heterogeneity across individuals. This model does not include the main effects of mental processing work activities, other work activities and education, as these are constant within individuals and drop out with the individual fixed effects. This model controls for the baseline cognition of individuals and for genetic, physiological and environmental time-invariant variables. β_1 is our vector of coefficients of interest. This captures the rate of decline to dementia considering different loading in mental processing work activities.

5 Results

5.1 Main Results

Table 3 presents the main results for an OLS with dementia as dependent variable and mental processing work activities as main independent variables, considering different controls. Model (1) does only include the mental processing work activities factors as main interest independent variable. It show a positive significant relationship between mental processing work activities and dementia at old age. Model (2) includes the demographic controls race, age, survey year, place of birth, fathers and mothers education and being a proxy respondent. Model (3) controls for education. The main effects of mental processing work activities remain constant, but it reduces the sizes of their coefficients. Model (4) adds 11 main occupations controls generated by Autor et al. (2010) and 20 main industries controls. Model (5) includes two further work activities factors, interacting with others and working with machines. Model (6) includes five work context factors. These are physical and social factors that influence the nature of work. It includes variables such as manipulating toxic substances, work environments with loud noises or high air pollution levels, etc. These work contextual variables could raise the risk of dementia at old age on their own Power et al. (2016). Overall, mental processing work activities remain constant with a slight reduction in the sizes of its coefficient when adding these controls. Model (7) includes six knowledge controls. Knowledge refers to organized sets of principles and facts applied in general domains such as mathematics, medicine, biology and others. This makes it possible to consider the effect of work activities within professional fields. The results of this specification are consistent with the previous ones, but not significant. A potential explanation for this is knowledge factors to be highly correlated with the work activities factors. For instance, individuals with knowledge in mathematics, statistics and similars will work most likely in activities with heavy loads in mental processing activities. For this reason, we consider this model to over-control the main interest variables. Still, the main results are consistent.

Model (6) is our preferred specification as it provides the most complete relation considering differences in mental processing work activities within individuals with similar demographic characteristics, education level, occupation and industrial sector, work activities and work context. Having a main lifetime occupation with an additional standard deviation in mental processing work activities reduces the probability of dementia at old age in 0,7 percentage points. This might seems a low effect. But in relation to the mean, it supposes a reduction in the probability of having dementia of 17,5%. This hypothetical increase in one standard deviation would be within individuals with similar demographic characteristics, education level, occupation and industrial sector, work activities and work context. To get a clearer image of this, an additional standard deviation in mental processing work activities, for professionals, at the public administration, with the same education level, could be the change from a "School teacher", to a "Operations and systems researcher and analyst".

Stratified results for age group for our preferred model (Model (6) in Table 3) can be found in Table F.4 in Appendix F. The results are bigger and more significant for the older age group. Differences in the prevalence of dementia due to mental processing work activities only start raising at old age. This could be due to the overall higher prevalence of dementia among older individuals.

In Table F.5 in Appendix F, endogenous, health, context and knowledge controls are added to our preferred model (Model 6. in Table 3). Endogenous controls are retirement status of the individuals, household wealth, year of retirement and total number of years worked. Health controls are bmi, having ever smoked or ever drinking. The endogenous, health and context controls do not seem to affect the main results. The results remain constant. This last model is extremely conservative. As such, this specification highlights the robustness of the main results.

Table 4 presents the results of an individual fixed effects model. It examines the rate of decline towards dementia within individuals. The main interest variables are the interactions of the mental processing work activities with age. It controls for intra-individual time fixed elements such as genetics, baseline cognition and other physiological and background information. It does not include most of the controls of Table 3, as these where fixed over time. Model (1) only includes the variable age. It is positively and significantly related with dementia. Model (2) adds the interactions of the mental processing work activities with age. The results are consistent to the ones of Table 3 "Interacting with others" and "Mental processing" are related to a lower rate of decline towards dementia. The results for "Working with machines" are also consistent to the previous results. Model (3) includes the interaction of education with age. Overall, the results remain constant, although a big part of the variability is captured by education. These results suggest that work activities do not only affect the prevalence of dementia, but also the intra-individual rate of decline towards it. Furthermore, even controlling for intra-individual time fixed elements such as genetics, baseline cognition and others, mental processing work activities seem to have an effect over dementia.

5.2 Robustness Checks

Table 5 presents a placebo test, that compares the effect of mental processing work activities over the probability of having dementia for the main respondents and for their spouses[7]. The logic behind this test is that work activities should mainly affect the individuals who perform them. Spouses should be relatively unaffected by the work activities of the main respondents. There could exist some spillover effects. Individuals with work activities with heavy ladings in mental processing could also pursue mental processing activities with their spouses. But in general terms, spouses should be less affected by the work activities that the main respondents perform, respect to the main respondents.

The results of Table 5 present smaller and less significant coefficients for spouses respect to main respondents. The size of its coefficients decreases and it is only significant at a 95% confidence level, while for the main respondents the same variable is significant at a 99% confidence level and its coefficient is bigger. Again we compare these results to the mean of dementia. Relative to the mean, having a main lifetime occupation with an additional standard deviation in "Mental processing" reduces the probability of having dementia in 46% for the main respondent and in 28% for its spouse.

[7] Model (5) in Table 3 for a reduced sample. Only individuals who have a spouse are considered. One regression with the original outcome, dementia of the main respondent. Other regression only changing the outcome, dementia of the spouse.

In general terms the effects are smaller and less significant for spouses respect to main respondents. This suggests that the factors of work activities could be truly capturing the effect of activities performed at the work place. As already suggested, a potential explanation for this siginificant effect for spouse could be main respondents sharing part of their work activities with their spouses.

Two points regarding this robustness can be mentioned. On the one hand, main respondents and spouses could self-select to some extent into similar occupations. It seems reasonable, that individuals having a very intellectually demanding occupation are more likely to have spouses with a similarly intellectually demanding occupations, respect to individuals with mainly physical occupations. This strengthens our results suggesting work activities to have an effect only over main respondents, even considering occupational selection. On the other hand, spouses are by definition only female what could be affecting the results by its own.

Table 6. considers the path of the potential effect of work activities to dementia. It examines if work activities could be affecting the risk of dementia through physiological factors or through cognitive reserve. Mental processing work activities could be affecting overall health of individuals (bmi, blood pressure, etc.), reducing their risk to develop diseases related to dementia such as stroke and heart attack. In a different manner, work activities could affect cognitive reserve. Trough seemingly uncorrelated regressions we estimate the relation of mental processing work activities over dementia and over other health outcomes that can cause dementia, such as heart attack and stroke. Risk of these other health diseases depends mainly on physiological factors. The results present different or non-significant results for the risk factors of dementia. This suggests that work activities could be related to dementia, affecting cognitive reserve and not so much other physiological causes.

6 Discussion

In this project we have examined the effect of mental processing work activities performed during the longest lifetime occupation of individuals over their probability of having dementia at old age. We have used the HRS, which provides information regarding individuals cognitive decline over time. Furthermore we have used the O*NET to generate a group of work activities factors. Our results point out that higher loadings in mental processing work activities are related to a lower probability of having dementia at old age and to a slower decline towards it.

Our results are consistent to the ones found for other countries. Considering the Swedish scenario Andel et al. 2005 concluded that occupations with high loadings in activities involving working with data are correlated with a lower prevalence of Alzheimer's disease. Considering the Canadian scenario Kröger et al.

2008 concluded that occupations with high loadings in activities involving social interactions are correlated with a lower prevalence of dementia. Finally, considering the Netherlands scenario Bosma et al. 2003 concluded that mentally demanding occupations are correlated with a lower prevalence of cognitive impairment. Although there are differences in the definitions for the work activities, in general terms these are minor. As such, our work contributes to confirm their results, adding up evidence for a large database with complementary information.

Our results do also extend the ones of Fisher et al. 2014. Working in an occupation characterized by higher levels of mental demand is associated not only with higher levels of overall cognitive functioning before retirement and a slower rate of cognitive decline after retirement, but also with a lower prevalence of dementia at old age and a slower decline towards it. Furthermore, we consider a wider spectrum of work activities including: "Mental processing", "Interacting with others" and "Working with machines". With this we suggest that in further projects different work activities should be considered, as their effects seem to differ in terms of size and significance.

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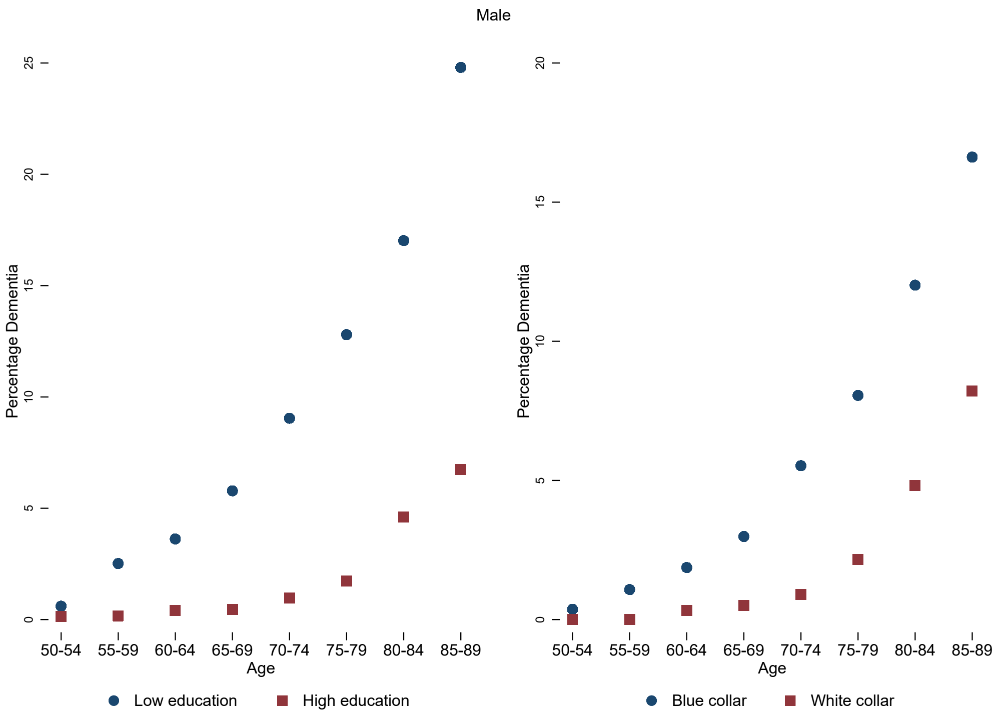
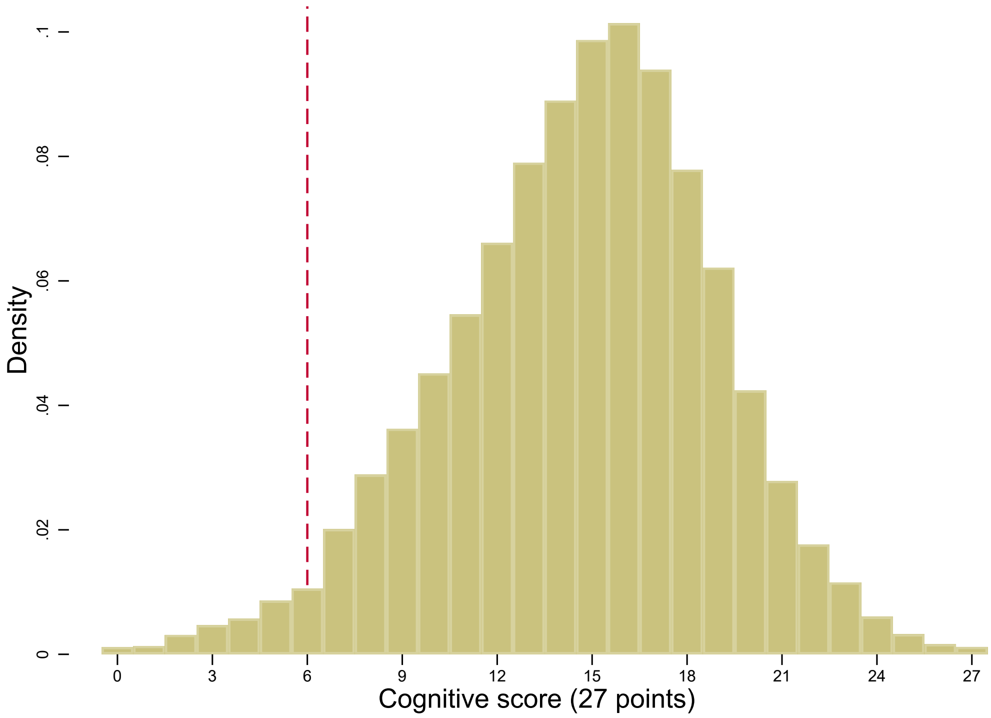
Figures and Tables

Figure 1: Proportion of individuals with dementia for education levels and collar colour occupations



Source: HRS; *Note:* Low education considers no high school and GED. High education considers high school and college or above. Blue-collar occupations involve skilled or unskilled manual labour occupations. White-collar occupations involve professional, managerial, or administrative occupations. Dementia is defined as scoring below a certain threshold in some psychometric tests validated by Crimmins et al. 2011. More details of this variable can be found at appendix c. Similar results are found for females, white-collar and non-white-collar occupations. These results can be found in Figure A.1., A.2. and A.3. in Appendix A. Detailed summary statistics for the proportion of individuals with dementia by age, gender, white-collar occupation or non-white and education levels can be found in Table A.1 in Appendix A.

Figure 2: Distribution of 27 points cognitive test



Source: HRS; *Note:* Vertical dotted line defines threshold for dementia. To the left presents proportion of individuals with dementia. Sample of males aged 60 to 85.

Table 1: Variables of work activities sorted according to the orthogonally rotated variables loadings over factors

	Factor1	Factor2	Factor3	Factor4	Uniqueness
Coaching and developing others	0.89	0.24	-0.01	0.08	0.14
Guiding, directing, and motivating subordinates	0.89	0.16	-0.07	0.25	0.10
Developing and building teams	0.89	0.29	-0.03	0.06	0.12
Scheduling work and activities	0.87	0.32	-0.05	0.02	0.11
Coordinating the work and activities of others	0.87	0.23	-0.05	0.21	0.14
Resolving conflicts and negotiating with others	0.86	0.30	-0.10	-0.07	0.14
Training and teaching others	0.85	0.31	0.03	0.05	0.17
Establishing and maintaining interpersonal relationships	0.84	0.42	-0.13	-0.17	0.07
Developing objectives and strategies	0.83	0.41	-0.09	0.06	0.11
Staffing organizational units	0.82	0.11	-0.14	0.24	0.23
Organizing, planning and prioritizing work	0.76	0.47	-0.14	-0.03	0.16
Monitoring and controlling resources	0.75	0.16	-0.06	0.18	0.33
Selling or influencing other	0.75	0.21	-0.11	-0.24	0.32
Communicating with supervisors, peers or subordinates	0.74	0.51	-0.00	0.04	0.18
Performing for or working directly with the publi	0.74	0.18	-0.01	-0.28	0.24
Communicating with persons outside organization	0.72	0.46	-0.14	-0.26	0.19
Assisting and caring for others	0.71	0.21	0.08	-0.07	0.24
Provide consultation and advice to others	0.70	0.54	-0.10	0.07	0.17
Making decisions and solving problems	0.70	0.58	0.06	0.15	0.12
Thinking creatively	0.65	0.40	-0.11	-0.16	0.26
Performing administrative activities	0.64	0.51	-0.20	0.02	0.28
Judging the qualities of things, services or people	0.60	0.32	-0.01	0.35	0.36
Processing information	0.40	0.82	-0.14	0.04	0.15
Analyzing data or information	0.37	0.78	-0.10	0.21	0.14
Getting information	0.31	0.75	-0.06	0.21	0.28
Interacting with computers	0.44	0.74	-0.21	-0.20	0.17
Documenting/recording information	0.49	0.70	0.01	0.10	0.22
Updating and using relevant knowledge	0.60	0.70	0.10	-0.04	0.13
Performing general physical activities	-0.13	-0.68	0.51	0.11	0.24
Interpreting the meaning of information for others	0.64	0.65	-0.13	-0.07	0.14
Identifying objects, actions and events	0.37	0.65	0.20	0.38	0.26
Evaluating information to determine compliance with standards	0.27	0.61	0.13	0.37	0.39
Handling and moving objects	-0.49	-0.59	0.46	0.16	0.17
Repairing and maintaining mechanical equipment	-0.26	-0.24	0.79	0.12	0.22
Repairing and maintaining electronic equipment	-0.02	0.24	0.77	-0.08	0.33
Inspecting equipment, structures or material	-0.11	-0.13	0.76	0.40	0.21
Operating vehicles, mechanized devices or equipment	0.25	-0.18	0.67	-0.13	0.43
Controlling machines and processes	-0.47	-0.38	0.57	0.29	0.22
Monitor processes, materials or surroundings	0.13	0.21	0.42	0.73	0.22
Drafting, laying out and specifying technical devices, parts and equipment	0.03	0.13	0.37	-0.09	0.25
Estimating the quantifiable characteristics of products, events or information	0.33	0.26	0.12	0.38	0.29

Source: O*NET; *Note:* Main analysis only makes use of three factors. Fourth factor only included for comparison.

Table 2: Ten occupations with best and worse scores for mental processing factor

Mental Processing Occupations	
Highest Factor Scores	**Lowest Factor Scores**
Computer and peripheral equipment operators	Housekeepers, maids, butlers, and cleaners
Mathematicians and statisticians	Operating engineers of construction equipment
Medical scientists	Other mining occupations
Accountants and auditors	Glaziers
Speech therapists	Paperhangers
Dieticians and nutritionists	Excavating and loading machine operators
Physicists and astronomists	Painters, construction and maintenance
Computer software developers	Clothing pressing machine operators
Actuaries	Roofers and slaters
Air traffic controllers	Drywall installers

Source: HRS & O*NET

Table 3: OLS with dementia as dependent variable and mental processing work activity as main interest independent variables

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mental processing	-0.020***	-0.014***	-0.007***	-0.004*	-0.008***	-0.007***	-0.007
	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
Observations	42,756	42,756	42,756	42,756	42,756	42,756	42,756
R-squared	0.01	0.06	0.08	0.08	0.08	0.08	0.08
Demographics	NO	YES	YES	YES	YES	YES	YES
Education	NO	NO	YES	YES	YES	YES	YES
Occupation and Industry	NO	NO	NO	YES	YES	YES	YES
Interacting others and work machines	NO	NO	NO	NO	YES	YES	YES
Context	NO	NO	NO	NO	NO	YES	YES
Knowledge	NO	NO	NO	NO	NO	NO	YES
Mean	0.04	0.04	0.04	0.04	0.04	0.04	0.04

Clustered standard errors at occupational level in parentheses
*** p<0.01; p<0.05; p<0.10

Source: HRS and O*NET; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *Knowledge:* Six factors that add information about organized sets of principles and facts which are necessary for the performance of different occupations (administration, biology, etc.); *Note:* Males aged 60 to 85. Factors in Panel A standardized with mean 0 and standard deviation 1. Main interest variables in Panel B are dummies that define occupations as mainly having work activities interacting with others, mental processing or working with machines. In a similar manner, context and knowledge in Panel B, represent occupations as mainly having context or knowledge defined by one of the different factors.

Table 4: Individual fixed effects model with dementia and mental processing work activity x age as independent variables

VARIABLES	(1)	(2)	(3)
Age	0.0043***	0.0044***	0.0003
	(0.000)	(0.000)	(0.000)
Mental processing x Age		-0.0017***	-0.0006**
		(0.000)	(0.000)
Observations	42,756	42,756	42,756
R-squared	0.02	0.03	0.04
Number of hhidpn	7,927	7,927	7,927
Individual FE	YES	YES	YES
Educ x Age	NO	NO	YES
Mean	0.04	0.04	0.04

Clustered standard errors in parentheses at occupational level
*** p<0.01; p<0.05; p<0.10

Source: HRS and O*NET; *Educ x Age:* Interaction of five main education levels and age; *Note:* Sample of males aged 60 to 85. Factors are standardized with mean 0 and standard deviation 1.

Table 5: OLS with dementia of main respondent and spouse as dependent variable and and mental processing work activity as main interest independent variables

VARIABLES	(1) Male Dem	(2) Spouse Dem
Mental processing	-0.011***	-0.006**
	(0.003)	(0.002)
Observations	25,093	25,093
Demographics	YES	YES
Education	YES	YES
Occupation and Industry	YES	YES
Interacting others and working machines	YES	YES
Context	YES	YES
Mean	0.024	0.014

Clustered standard errors at occupational level in parentheses
*** $p<0.01$; $p<0.05$; $p<0.10$

Source: HRS and O*NET; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *Knowledge:* Six factors that add information about organized sets of principles and facts which are necessary for the performance of different occupations (administration, biology, etc.); *Note:* Males aged 60 to 85 and spouses regardless of age. Factors are standardized with mean 0 and standard deviation 1.

Table 6: OLS with dementia and other dementia related health outcomes as dependent variable and mental processing work activity as main interest independent variables

	(1)	(2)	(3)
VARIABLES	Dementia	Heart Attack	Stroke
Mental processing	-0.008***	-0.005**	-0.000
	(0.002)	(0.002)	(0.001)
Observations	40,342	40,342	40,342
R-squared	0.08	0.00	0.00
Demographics	YES	YES	YES
Education	YES	YES	YES
Occupation and Industry	YES	YES	YES
Interacting others and working machines	YES	YES	YES
Context	YES	YES	YES

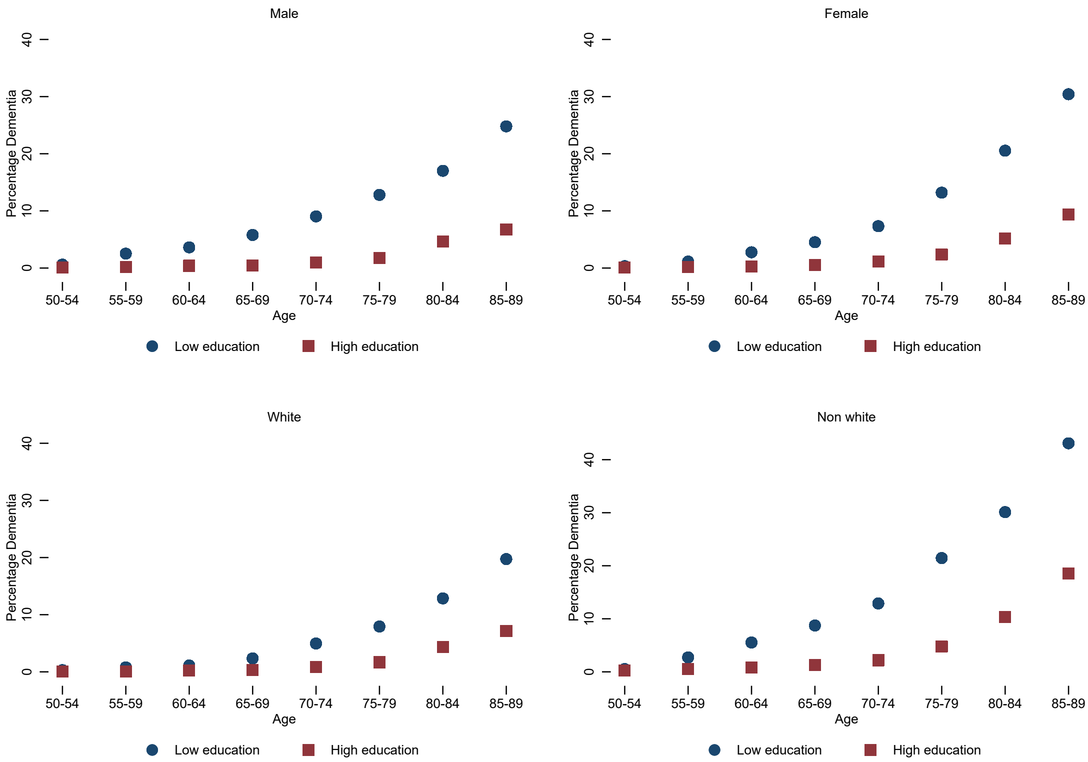
Seemingly unrelated regression standard errors in parentheses
*** $p<0.01$; $p<0.05$; $p<0.10$

Source: HRS and O*NET; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *Knowledge:* Six factors that add information about organized sets of principles and facts which are necessary for the performance of different occupations (administration, biology, etc.); *Note:* Males aged 60 to 85. Factors are standardized with mean 0 and standard deviation 1. Dementia makes reference to the dementia screening variable used for all other results. The other health outcomes make reference to having suffered these conditions since the last interview. For this reason this table presents a reduced sample size respect to the previous ones. With the aim of comparability only observations that have information regarding dementia and the different health outcomes are conserved. These health outcomes consider if the individuals suffered from the disease since the last survey year.

Appendices

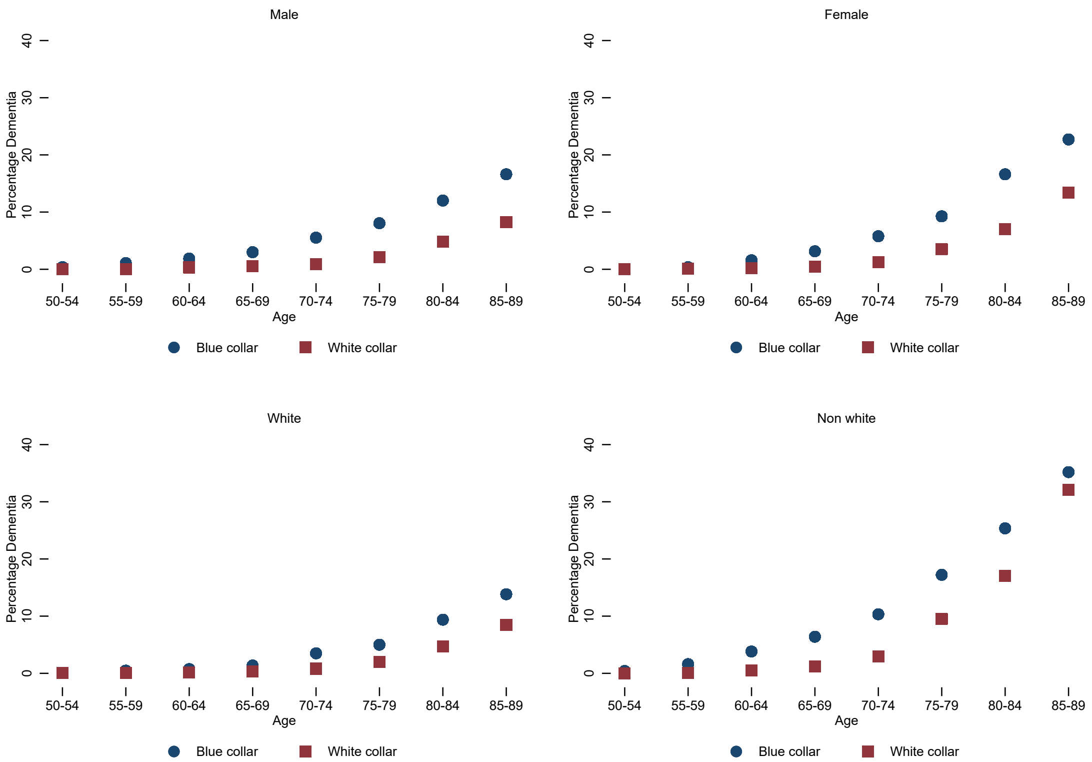
A Extended descriptives

Figure A.1: Proportion of individuals with dementia for education levels



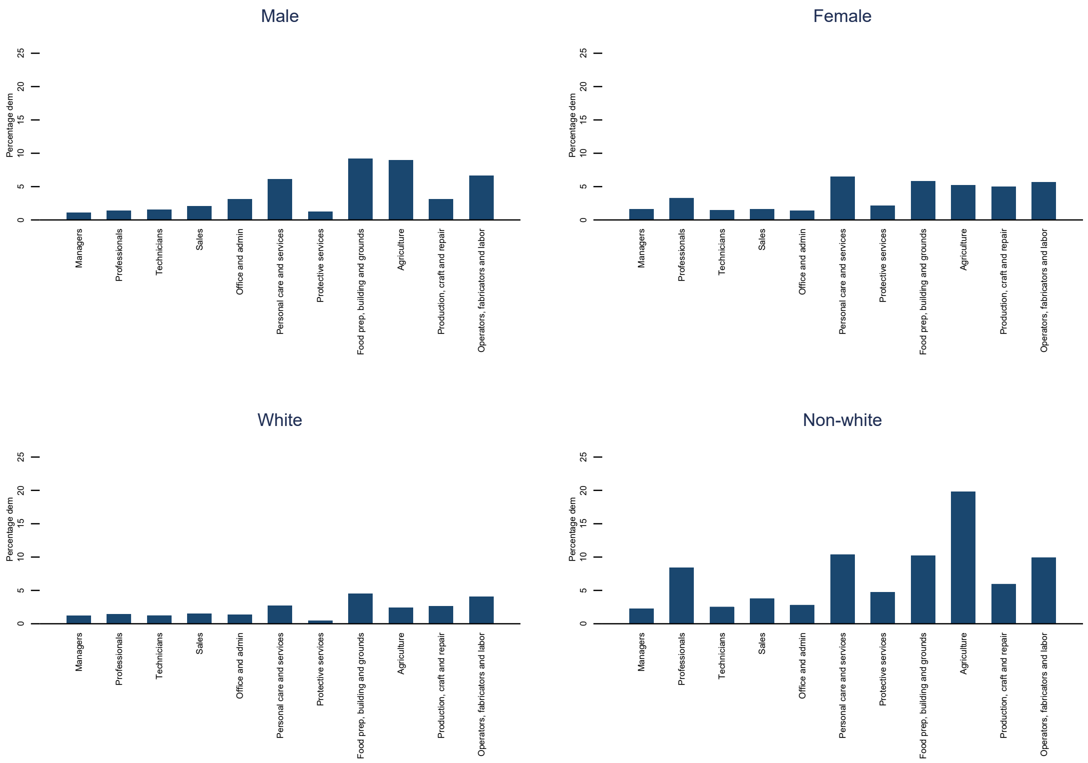
Source: HRS; *Note:* Kernel smoother applied. Vertical dotted lines define age group (60-85) we consider for main specification.

Figure A.2: Proportion of individuals with dementia for collar colour occupations



Source: HRS; *Note:* Kernel smoother applied. Vertical dotted lines define age group (60-85) we consider for main specification.

Figure A.3: Proportion of individuals with dementia for main occupations



Source: HRS; *Note:* Age group 60-85.

Table A.1: Proportion of individuals with dementia for age, gender, race, education levels and collar colour

	Age groups				
	50-60	**60-70**	**70-80**	**80-90**	**Total**
	Percentage of individuals suffering from dementia				
Gender					
Man (n=52,044)	0.63	1.61	4.20	10.02	3.54
(SE)	(0.11)	(0.10)	(0.17)	(0.43)	(0.09)
(95% CI)	[0.42,0.83]	[1.41,1.82]	[3.86,4.54]	[9.17,10.87]	[3.36,3.72]
Woman (n=68,423)	0.26	1.25	3.79	11.54	3.20
(SE)	(0.05)	(0.08)	(0.15)	(0.42)	(0.08)
(95% CI)	[0.17,0.36]	[1.09,1.40]	[3.49,4.09]	[10.71,12.36]	[3.05,3.35]
Total (n=120,467)	0.39	1.40	3.98	10.84	3.34
(SE)	(0.05)	(0.06)	(0.11)	(0.30)	(0.06)
(95% CI)	[0.29,0.49]	[1.28,1.53]	[3.76,4.21]	[10.25,11.43]	[3.23,3.46]
Race					
Non-white (n=27,748)	1.09	3.96	10.40	26.53	7.51
(SE)	(0.16)	(0.21)	(0.39)	(1.04)	(0.18)
(95% CI)	[0.78,1.40]	[3.54,4.37]	[9.63,11.16]	[24.50,28.57]	[7.16,7.87]
White (n=92,719)	0.16	0.54	2.23	7.56	2.09
(SE)	(0.04)	(0.05)	(0.10)	(0.28)	(0.05)
(95% CI)	[0.09,0.23]	[0.45,0.63]	[2.05,2.42]	[7.01,8.11]	[1.99,2.20]
Total (n=120,467)	0.39	1.40	3.98	10.84	3.34
(SE)	(0.05)	(0.06)	(0.11)	(0.30)	(0.06)
(95% CI)	[0.29,0.49]	[1.28,1.53]	[3.76,4.21]	[10.25,11.43]	[3.23,3.46]
Education level					
No high-school (n=31,773)	1.34	4.31	10.22	22.13	8.70
(SE)	(0.20)	(0.22)	(0.33)	(0.73)	(0.18)
(95% CI)	[0.96,1.72]	[3.88,4.74]	[9.57,10.87]	[20.69,23.56]	[8.34,9.05]
High-school (n=38,589)	0.24	0.60	1.85	7.11	1.79
(SE)	(0.07)	(0.07)	(0.14)	(0.45)	(0.08)
(95% CI)	[0.10,0.39]	[0.46,0.74]	[1.58,2.12]	[6.23,7.99]	[1.64,1.94]
Some college and above (n=50,095)	0.06	0.24	1.18	4.89	1.15
(SE)	(0.02)	(0.04)	(0.10)	(0.34)	(0.05)
(95% CI)	[0.01,0.11]	[0.16,0.32]	[0.98,1.37]	[4.24,5.55]	[1.05,1.26]
Total (n=120,457)	0.39	1.40	3.98	10.84	3.34
(SE)	(0.05)	(0.06)	(0.11)	(0.30)	(0.06)
(95% CI)	[0.29,0.49]	[1.28,1.53]	[3.76,4.21]	[10.25,11.43]	[3.23,3.46]
Collar colour					
White collar (n=59,119)	0.03	0.34	1.80	8.02	2.05
(SE)	(0.02)	(0.04)	(0.11)	(0.35)	(0.07)
(95% CI)	[-0.00,0.06]	[0.26,0.43]	[1.59,2.02]	[7.33,8.71]	[1.92,2.17]
Blue collar (n=32,348)	0.74	2.46	6.76	14.53	4.96
(SE)	(0.14)	(0.16)	(0.28)	(0.71)	(0.14)
(95% CI)	[0.47,1.01]	[2.15,2.77]	[6.21,7.31]	[13.14,15.93]	[4.69,5.23]
Pink collar (n=29,000)	0.75	2.21	5.26	14.08	4.23
(SE)	(0.13)	(0.16)	(0.27)	(0.73)	(0.14)
(95% CI)	[0.49,1.01]	[1.89,2.53]	[4.73,5.80]	[12.65,15.51]	[3.97,4.50]
Total (n=120,467)	0.39	1.40	3.98	10.84	3.34
(SE)	(0.05)	(0.06)	(0.11)	(0.30)	(0.06)
(95% CI)	[0.29,0.49]	[1.28,1.53]	[3.76,4.21]	[10.25,11.43]	[3.23,3.46]

Source: HRS

B Sample Construction

Our main sample[8] consists of male aged 60 to 85, for which we have information about their longest lifetime occupation and the score in the cognitive test. The RAND version of the HRS is a sample of 37.495 individuals who participated in different survey years of the HRS (from 1 to 12 survey years). These individuals can be part of the original HRS sample or of any of its refresher cohorts. Each of them can be observed a different number of times (from 1 to 12). These differences in number of observations per individual depend on the cohort when they first participated (more recent cohorts can only be observed a lower number of times) and attrition. Once we expand this database the number of observations increase to 203.219 observations. These consider the multiple answers of a same individual through the different survey years. From this point on, we start restricting the sample to a particular group of individuals.

In first place, only individuals with information regarding their longest lifetime occupation are considered (75.151 observations lost). The reasons for the missing observations at the longest lifetime occupation are: 1. Not having worked at all or not having reported longest lifetime occupation; 2. Individuals reporting longest lifetime occupations with census codes (SOC1980) 900 and 990. These codes do not get transformed to occ1990dd; 3. Individuals reporting longest lifetime occupations with census codes (SOC2000) 123, 650, 691, 692, 693, 884, 950, 980 and 981. These codes do not get transformed to occ1990dd. Although for 2. and 3. we have the information of the longest lifetime occupation of the individuals, we lose this information when trying to get an homogeneous labour code for all survey years with the occ1990dd codification. Nevertheless, these are the smallest part of these lost observations. In second place, we only keep with observations for which we have information about the score in the cognitive test we are interested in (6.779 observations eliminated). The reasons for these missing observations are that the individuals were not asked at a certain cohort. In third place, we only consider man aged 65 or older (82.922 observations lost). Finally, there are 7 occupation codes for which O*NET provides incomplete information. These occupations are "Miscellanious textile machine operators", "Other telecom operators", "Other woodworking machine operators", "Washing, cleaning, and pickling machine operators", "Other precision and craft workers", "Supervisors of guards and physical scientists" and "n.e.c". We exclude individuals with these longest lifetime occupations (177 observations lost). This generates a sample of 7.947 individuals and 43.257 observations. Additionally, for some robustness we consider the spouses of the individuals, for which we have cognitive information. This adds up a sub-sample of 5.489 individuals and 31.268 observations.

[8] Some robustness also include information for the main respondents spouses.

C Recoveries from dementia

Individuals run the cognitive test each survey year. For this reason, it is possible for them to "recover" from their dementia status. In other words, it is possible for them to score at one survey year below the defined threshold that categorize them as having dementia and at the next survey year above. This actually happens quite a lot. Figure C.1 presents the number of individuals that according to the instrument we use, never suffer from dementia, suffer from dementia and eventually recover at some further survey year and suffer from dementia and do not recover at any further survey year. 3.085 individuals are diagnosed with dementia at some survey year. Of these, 1.235 individuals do not present any recovery after first having being been diagnosed with dementia. That is, after having scored under the threshold that defines them as having dementia, they consistently score below the threshold at the subsequent survey years. On the contrary, 1.850 individuals experience some recovery after first having been diagnosed with dementia. After having scored under the threshold that defines dementia, they score above this threshold at some subsequent survey years. This raises the question if these individuals diagnosed with dementia at some survey year suffer all from the same condition. Part of these individuals could have a cognitive status above the one that defines them as having dementia, but after several survey years running the psychometric test, score below the threshold. This could be caused by factors impossible to control for, such as fatigue, emotional state or simply chance. Therefore, it is possible for individuals experiencing recoveries after first having been diagnosed with dementia to have a different cognitive status to the ones never recovering. This is confirmed in Figure C.2, which presents the average cognitive score of individuals before and after first being diagnosed with dementia. Individuals recovering, tend to score consistently above the threshold after first having been diagnosed with dementia. This suggests that individuals recovering from dementia could have a normal cognition and only score below the score because of the previously suggested error. For this reason, it seems reasonable to examine more in detail the definition for dementia, to generate a cleaner measure.

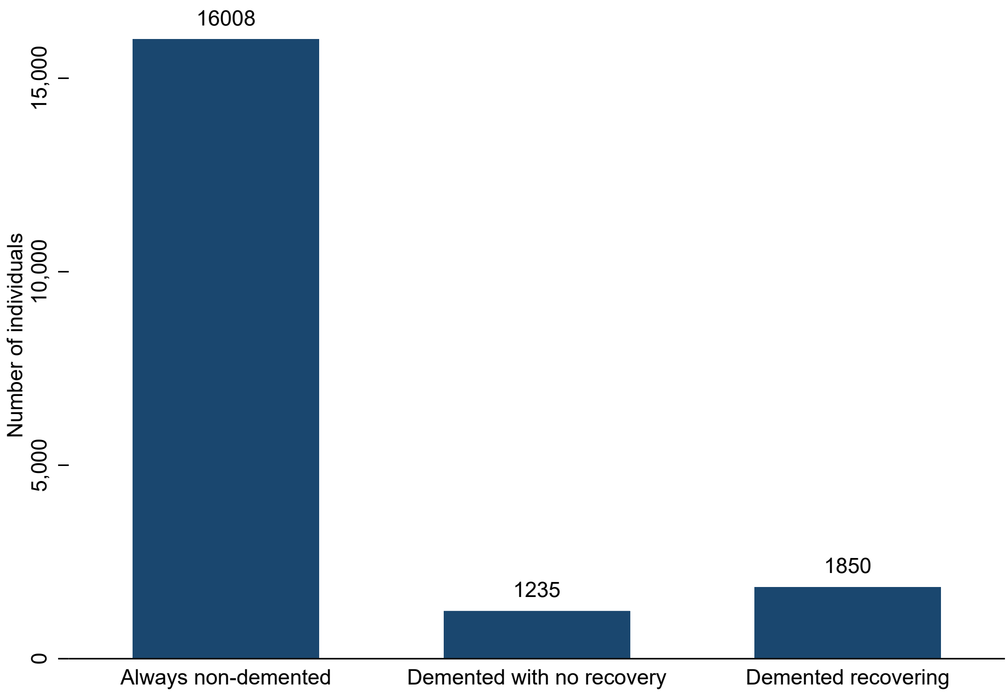
To begin with, we check out if the problem lies in the different definitions for having dementia. As explained in the previous section, individuals can be diagnosed with dementia according to their scores in the cognitive test or a composed score formed by indicators taken from the proxy respondents and the interviewers. Therefore the proportion of individuals diagnosed with dementia with recoveries and without could differ due to the fact of being a normal or a proxy respondent. In order to examine this, we replicate Figure C.1 only for proxy respondents. The results of this can be seen at Figure C.3. Of the 1.850 individuals having dementia with no recovery, 410 (33%) are proxy respondents and of the 1235 individuals having dementia with recovery, 990 (53%) are proxy respondents.

We also examine if there exist big differences in the number of recoveries that individuals experience. Having only one or two recoveries seems to be quite different to consistently scoring above the threshold and at one survey year score below. Figure C.4 presents the number of individuals that experience a different number of recoveries after first being diagnosed with dementia. Most individuals (62%) only present one or two recoveries. For the rest of individuals there exists a high variability in the number of recoveries. As such it is possible that the problem lies only in a part of this sub-sample.

In order to examine these differences in the number of recovery periods, we analyse the average cognitive score before and after first having been diagnosed with dementia, for individuals experiencing a different number of recovery periods. Figure C.5 shows that on the average individuals having only one recovery period score well below the threshold at the subsequent survey years, while individuals having two or more recovery periods on the average score above or very close to the threshold at the subsequent survey years.

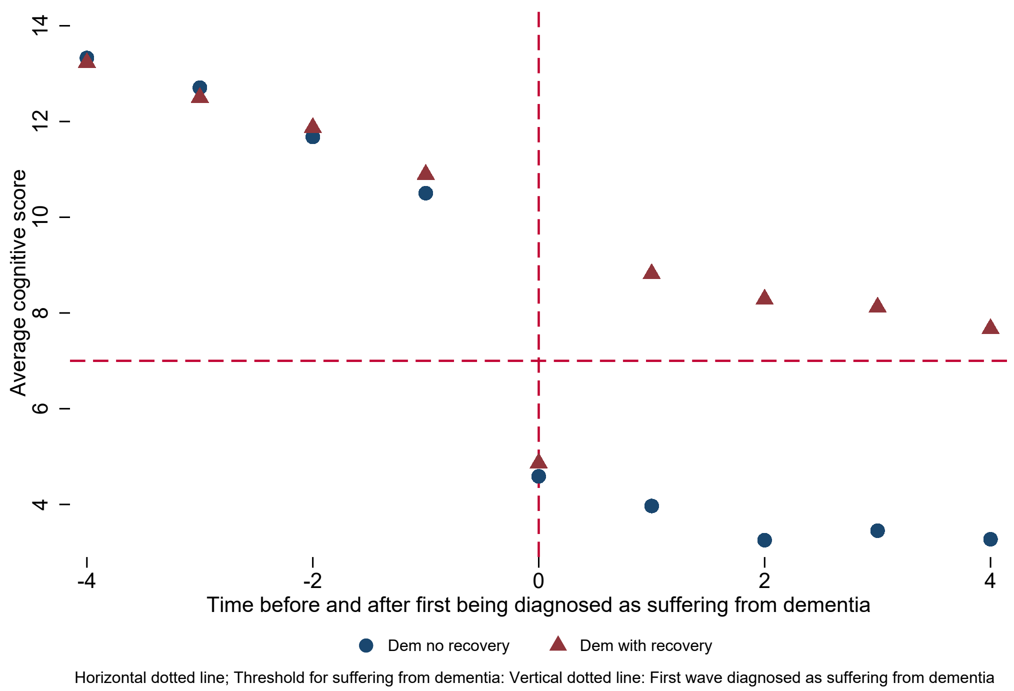
On the view of these figures it can be pointed out that there exist great differences in the number of recoveries for the different individuals and that there also exist great differences in their average scores after having first been diagnosed with dementia. This suggests that a part of the individuals recovering after first being diagnosed with dementia should be considered to have a normal condition, while the other truly suffer from dementia. In order to account for this variation at an individual level we slightly modify the screening instrument for dementia. We classify individuals as having dementia if their average score in the subsequent periods after first having been diagnosed with dementia is below the previously introduced threshold. With this we hope to keep with the largest possible number of observations, but to clean a part of the dubious cases of dementia.

Figure C.1: Number of individuals never-dementia, dementia screened and recovering



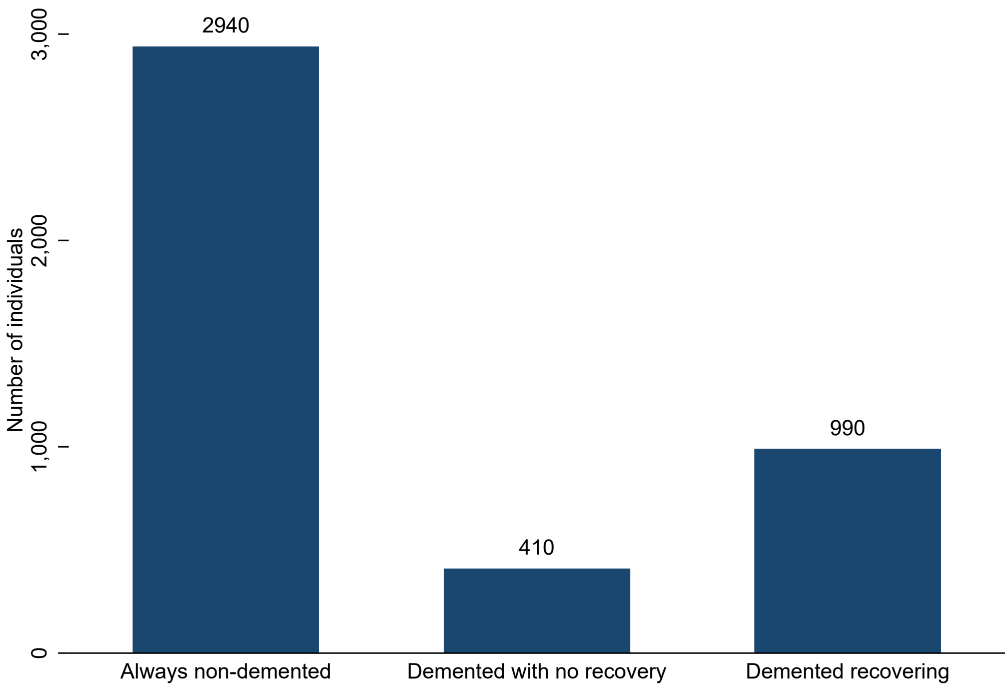
Source: HRS; *Note:* Number of individuals with normal cognition, being diagnosed with dementia and not recovering at any subsequent survey year and being screened with dementia and recovering at some subsequent survey survey year.

Figure C.2: Average cognitive scores before and after first screened of dementia, for recoveries and non-recoveries



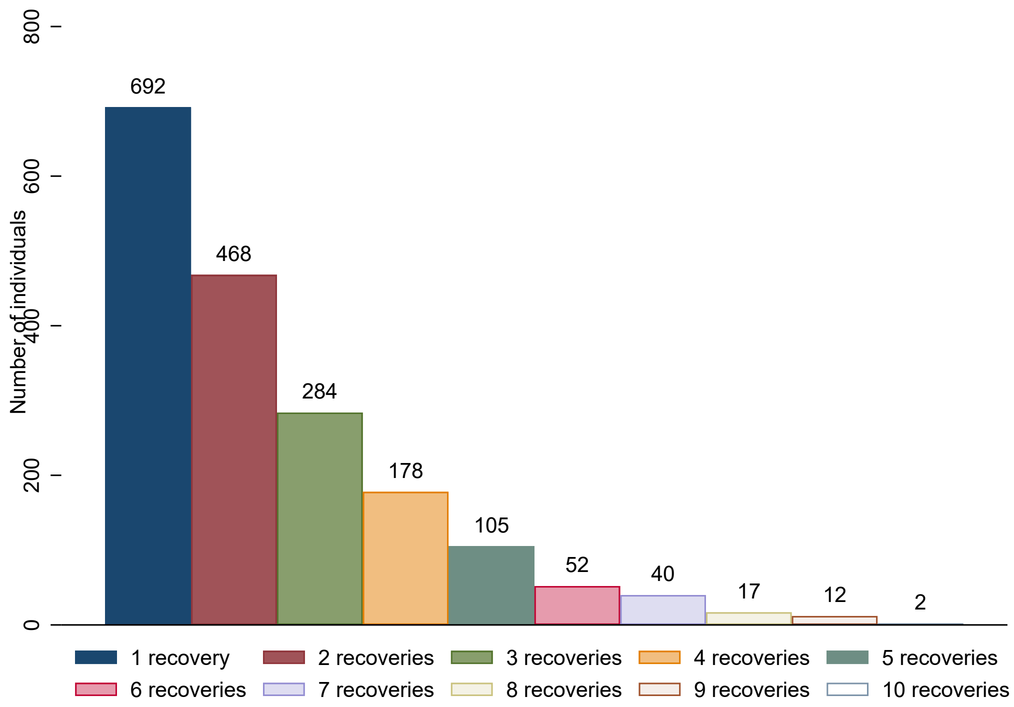
Source: HRS; *Note:* Does not consider proxy respondents. Results have been replicated for these and are very similar.

Figure C.3: Number of proxy individuals never-dementia, dementia screened and recovering



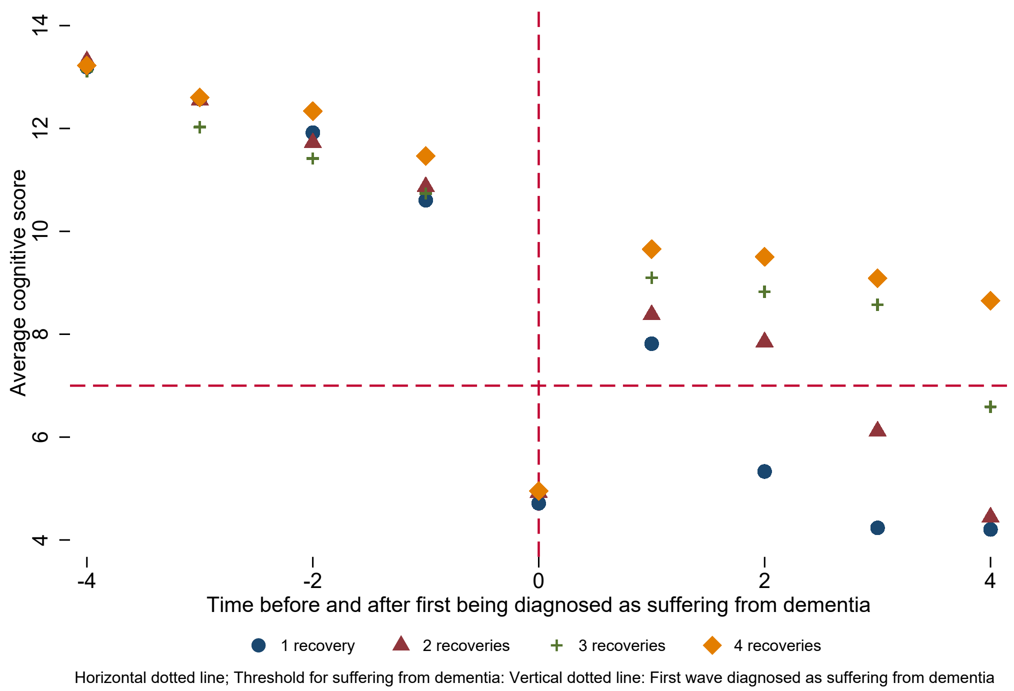
Source: HRS; *Note:* Number of proxy individuals with normal cognition, being diagnosed with dementia and not recovering at any subsequent survey year and being screened with dementia and recovering at some subsequent survey year.

Figure C.4: Number of individuals experiencing 1, 2, ..., 10 recoveries after first screened of dementia



Source: HRS

Figure C.5: Average cognitive score before and after first screened of dementia, for individuals experiencing 1, 2, 3 and 4 recoveries



Source: HRS; *Note:* Does not consider proxy respondents. Results are very similar for them.

D Construction of independent variable

Longest lifetime occupation is the main interest, independent variable. We obtain information regarding this variable from the HRS restricted data of industry and occupation. It is not homogeneously coded and questions regarding longest lifetime occupation are quite different across survey years. For this reason we follow the same approach as Bugliari et al. 2018, in order to generate a measure of longest lifetime occupation across individuals, trying to lose as few observations as possible. This approach is a hierarchical combination of three different variables: 1. Longest lifetime occupation; 2. Last occupation; 3. Current occupation. Last occupation assumes that the last occupation of individuals was their longest lifetime occupation. Current occupation makes it possible to approximate the last occupation of individuals, if these retire in a further survey year. The hierarchical combination goes as follows: Longest lifetime occupation is the preferred variable. If this variable is not observed for some individuals, last occupation is the second best option. If neither of both variables are observed the current occupation of individuals is used.

It is worth noticing that we have information of individuals at different survey years and that longest lifetime occupation is fixed for each individual. For this reason, only observing one of these variables at one survey year is enough to capture the longest lifetime occupation of individuals.

The HRS restricted data of industry and occupation leads to some 1000 SOC occupation codes for the different individuals. It is nearly impossible to interpret any results, for such a large number of categories. We solve this problem following two different alternatives.

We summarize the different occupation SOC codes to some 11 Broad Occupation Categories generated by Autor et al. 2010. These are some well established occupational categories. Their reduced number makes it much easier to interpret the results.

Nevertheless, we do not use most of the variability available by the almost 1000 SOC occupation codes. For this reason, in second place, main work activities factors are generated. For each of the different occupations a score is assigned for the different work activities. The work activities are generated from the O*NET database, following a factor analysis that is summarized in the next section. The factor analysis leads to the three main work activities factors that we label as: 1. Interacting with others; 2. Mental processing; 3. Working with machines. Each individual at our database has a score on these factors, depending on his longest lifetime occupation.

A problem of this analysis is that the occupations considered in the O*NET are a slightly different respect to the ones of the HRS. Additionally, the occupation categories of the HRS vary over time. We solve this problem generating a group of homogeneous occupations for the HRS and O*NET following David and Dorn 2013. We end with 330 occ1990cc homogeneous occupations codes for both databases. The factor analysis at the O*NET is generated for these 330 occ1990cc occupation codes and the generated factors are assigned to the occ1990cc occupation codes in the HRS.

E Factor analysis

The O*NET database offers a large number of variables with occupational information. These are classified in six different groups which consider abilities, interests, knowledge, skills, work activities and work context. Amongst these groups, we keep with variables that make reference to work activities. The reason for this is that we are interested in examining the correlation between the activities performed during the main lifetime occupation of individuals and the likelihood of having dementia at old age. Work activities approach this definition, describing job behaviours occurring on multiple jobs. Work activities are divided in four main domains: 1. Information Input (where and how data required for the job is obtained, 5 variables). 2. Interacting with others (which interactions occur during the performance of the job, 17 variables). 3. Work Output (which physical activities are performed and what equipment is used for the job, 9 variables). 4. Mental Processes (which kind of mental processes are required during the performance of the job, 10 variables). The specific variables in each of these domains can be found in Table 1. We run a factor analysis over all these variables.

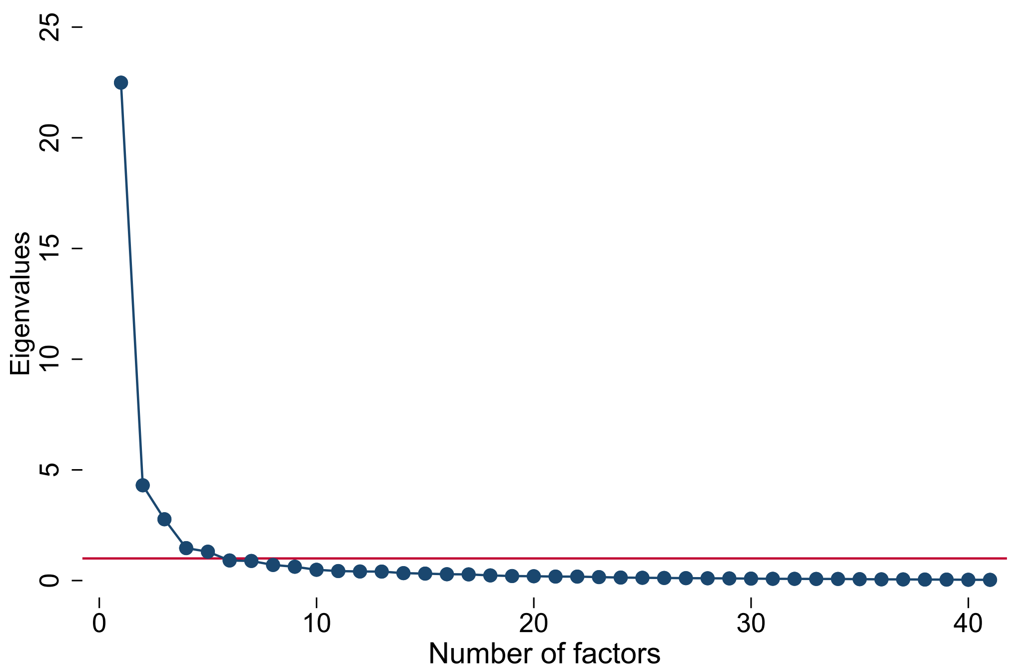
We consider orthogonally rotated factors, because this allows them to correlate with each other. It is possible a same occupation having a heavy work load at different work activities at once or on the contrary having a low work load in all of them. Some occupations are more intensive in general terms than others and therefore can have higher loadings at several work activities. Because of these differences in intensities, there does not necessarily occur a trade off between work activities. As a robustness, in F.3 we present the results of our preferred OLS specification (Model (5) Table 3.) using obliquely correlated factors and including a fourth factor. In general terms, the results do almost not differ respect the ones with oblique rotations and with three factors.

The number of retained factors is chosen considering the loadings of the different variables upon the factors. Table 1., presents sorted loadings of the different orthogonally rotated variables upon the factors. According to it, we retain three main factors. The variables from "Guiding, directing and motivating subordinates" to "Performing administrative activities" mainly load upon Factor 1. The variables from "Processing information" to "Handling objects" mainly load upon Factor 2. The variables from "Repairing and maintaining mechanical equipment" to "Drafting, laying out and specifying technical devices, parts and equipment" mainly load upon Factor 3. It seems reasonable not to include a fourth factor, as only one variable has a heavy load upon it. E.1 shows a scree plot for this analysis. This figure supports the choice of three factors, as the first three factors have Eigenvalues well above 1. The Keiser rule sets as a rule of thumb to retain factors with Eigenvalues greater then 1. According to this, it would also be correct to retain factors 4 and 5. Nevertheless, their values are very close to 1 and therefore we consider it reasonable to exclude them.

The three retained factors can be labelled considering the loadings of the different variables upon them: Factor 1 - 'Interacting with others"; Factor 2 - "Mental processing"; Factor 3 - "Working with machines". The labels for Factors 1 and 3 are quite clean. The label of Factor 2 is more ambiguous. That is because it includes high loadings for mental processing variables, but also for the variables "Performing general physical activity" and "Handling and moving objects". Nevertheless, most variables with heavy loadings upon Factor 2 clearly make a reference to mental processing activities. Additionally, "Performing general physical activity" and "Handling and moving objects" do not have the heaviest loadings upon Factor 2. For these reasons, we consider it appropriate to label Factor 2 as Mental Processing.

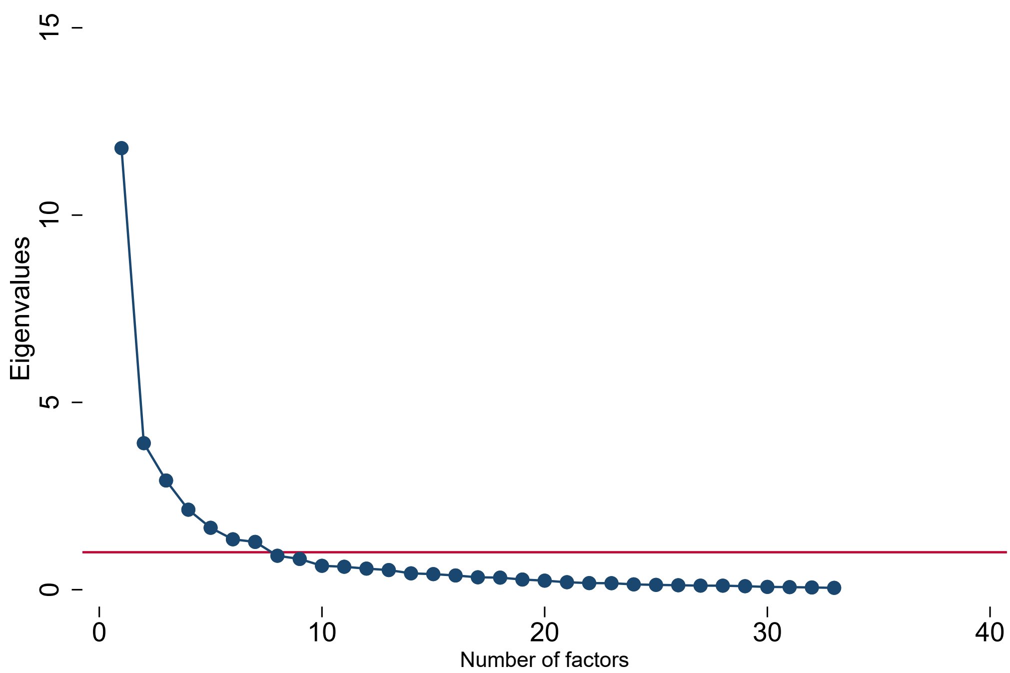
The same analysis is run for work context and knowledge O*NET variables. Work context refers to physical and social factors that influence the nature of work. Knowledge refers to organized sets of principles and fact applying in general domains such as mathematics, medicine, biology, etc. Five factors are generated for work context and six for knowledge. These are included as controls at the regression analysis. Screeplots and sorted loading can be found at figures E.2 and E.3 and tables E.1 and E.2.

Figure E.1: Scree plot of Eigenvalues of each factor of work activities



Source: O*NET

Figure E.2: Scree plot of Eigenvalues of each factor of work related knowledge



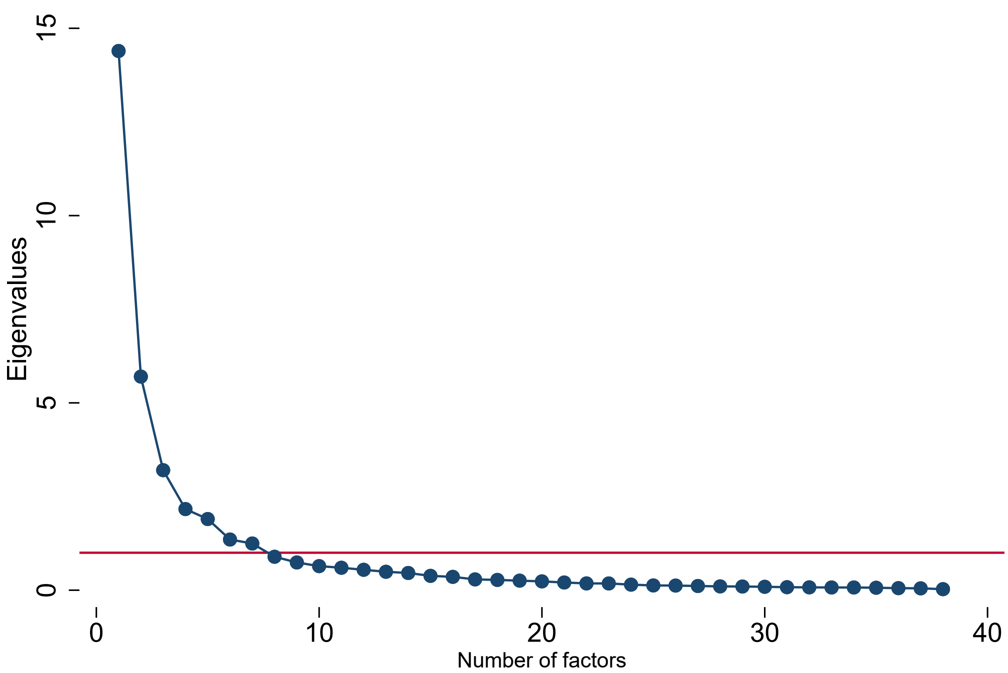
Source: O*NET

Table E.1: Sorted loadings of orthogonally rotated variables of work related knowledge over factors

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Uniqueness
Therapy and counseling	0.92	0.12	-0.11	-0.01	0.05	-0.02	0.13
Psychology	0.87	0.35	-0.09	0.10	0.08	0.12	0.09
Medicine and dentistry	0.84	0.02	-0.03	-0.05	0.13	-0.20	0.17
Sociology and anthropology	0.82	0.25	-0.11	0.14	0.10	0.33	0.11
Philosophy and theology	0.79	0.18	-0.07	0.13	0.07	0.31	0.21
Education and training	0.72	0.48	0.06	0.14	0.17	0.18	0.16
Foreign language	0.55	0.17	-0.18	0.19	0.20	0.24	0.50
Economics and accounting	0.10	0.88	-0.13	0.05	0.15	-0.01	0.17
Administration and management	0.38	0.81	0.01	0.16	0.11	0.05	0.15
Sales and marketing	0.12	0.75	-0.13	0.02	0.07	0.16	0.36
Personnel and human resources	0.46	0.72	-0.05	0.10	0.03	0.03	0.25
Customer and personal service	0.50	0.62	-0.22	0.18	0.09	-0.07	0.26
Clerical	0.22	0.57	-0.27	0.15	0.47	-0.08	0.29
English language	0.50	0.55	-0.08	0.19	0.48	0.18	0.14
Mathematics	0.02	0.55	0.36	-0.01	0.47	-0.07	0.32
Law and government	0.50	0.55	0.03	0.36	0.15	0.00	0.29
Engineering and technology	-0.12	-0.07	0.92	0.06	0.11	-0.06	0.11
Design	-0.09	0.11	0.83	-0.03	-0.03	0.22	0.21
Physics	0.07	-0.28	0.76	0.11	0.25	-0.13	0.19
Mechanical	-0.19	-0.36	0.65	0.02	-0.29	-0.28	0.24
Building and construction	-0.10	-0.05	0.61	0.21	-0.45	0.04	0.33
Production and processing	-0.20	0.17	0.47	-0.32	-0.18	-0.06	0.47
Transportation	0.03	0.15	0.06	0.83	-0.02	-0.10	0.27
Geography	0.09	0.08	0.01	0.75	0.29	0.36	0.20
Public safety and security	0.47	0.22	0.27	0.63	-0.10	-0.18	0.22
Computer and electronics	0.23	0.43	0.19	0.08	0.70	0.07	0.21
Telecommunications	0.22	0.29	0.02	0.49	0.52	0.02	0.32
Communications and media	0.35	0.39	-0.07	0.23	0.51	0.43	0.23
Fine arts	0.12	-0.08	-0.06	-0.18	-0.05	0.75	0.37
History and archeology	0.44	0.14	0.02	0.27	0.15	0.66	0.25
Food production	-0.05	0.21	-0.18	0.09	-0.24	0.10	0.26
Biology	0.59	0.03	0.05	0.04	0.11	-0.05	0.20
Chemistry	0.36	-0.15	0.41	-0.06	0.08	-0.17	0.29

Source: O*NET

Figure E.3: Scree plot of Eigenvalues of each factor of work context



Source: O*NET

Table E.2: Sorted loadings of orthogonally rotated variables of work context over factors

	Factor1	Factor2	Factor3	Factor4	Factor5	Uniqueness
Sitting	-0.86	-0.20	0.09	-0.02	-0.18	0.16
Standing	0.86	0.09	-0.00	0.08	0.09	0.23
Bending, twisting body	0.70	0.22	-0.11	0.20	0.45	0.15
Exposed to minor burns, cutes, bites	0.69	0.26	-0.29	0.30	0.17	0.24
Kneeling	0.67	0.30	-0.13	0.08	0.46	0.21
Exposed to contaminants	0.62	0.41	-0.31	0.30	0.15	0.21
Common protective equipment	0.59	0.24	-0.33	0.35	0.19	0.11
Exposed to hazardous conditions	0.48	0.31	-0.35	0.33	0.26	0.29
Indoors	-0.12	-0.92	-0.02	0.07	-0.17	0.10
Outdoors	0.19	0.89	0.11	-0.12	0.22	0.10
Extremely birght inadecuate lighting	0.35	0.72	-0.04	0.20	0.32	0.20
Hot or cold temperatures	0.49	0.71	-0.16	0.19	0.21	0.15
Exposed to whole body vibration	0.14	0.67	-0.19	0.41	0.21	0.28
Deal with unpleasent or angry people	-0.13	-0.05	0.87	-0.25	-0.10	0.14
Frequency of conflict situations	-0.22	-0.02	0.79	-0.11	-0.03	0.16
Contact with others	-0.19	-0.12	0.74	-0.32	-0.16	0.16
Deal with physically agressive people	-0.07	0.12	0.74	-0.05	-0.09	0.40
Deal with external customers	-0.12	-0.11	0.73	-0.40	-0.16	0.25
Walking	0.46	0.33	0.52	0.03	0.11	0.38
Degree of automation	-0.03	-0.07	-0.18	0.86	-0.07	0.22
Pace determined by speed of equipment	0.22	0.01	-0.28	0.84	-0.06	0.14
Exposed to hazardous equipment	0.46	0.30	-0.33	0.63	0.17	0.15
Sounds, noise levels are uncomfortable	0.44	0.46	-0.14	0.62	0.16	0.16
Using hands to handle control objects	0.47	0.07	-0.45	0.47	0.22	0.18
Exposed to high places	0.16	0.34	-0.10	0.00	0.82	0.16
Climbing	0.34	0.37	-0.18	0.02	0.77	0.12
Balance	0.49	0.36	-0.01	0.09	0.67	0.17
Cramped work space	0.51	0.37	-0.25	0.16	0.54	0.21
Exposed to radiation	0.09	0.03	-0.01	-0.07	0.00	0.33
Exposed to disease or infections	0.21	-0.14	0.24	-0.18	-0.18	0.26
Consequence of error	-0.21	0.07	0.05	0.19	0.20	0.22
Responsible for others health and safety	0.20	0.22	0.40	0.13	0.12	0.21
Importance of being exact or accurate	-0.50	-0.26	-0.15	0.06	0.16	0.34
Specialized protective equipment	0.30	0.29	-0.28	0.08	0.22	0.43
Responsible for outcomes and results	-0.10	-0.09	0.27	0.03	0.10	0.19
Coordinate or lead others	-0.17	-0.05	0.33	-0.09	0.05	0.18
Importance repeating same tasks	-0.03	-0.06	-0.04	0.55	0.25	0.26
Repetitive motions	0.29	-0.12	-0.18	0.50	0.31	0.19

Source: O*NET

F Extended results

Table F.1: OLS with dementia as dependent variable and mental processing work activity as main interest independent for white and blue collar occupations

VARIABLES	(1) White collar	(2) Blue collar
Mental processing	-0.002	-0.007**
	(0.005)	(0.003)
Observations	16,873	25,883
R-squared	0.04	0.09
Demographics	YES	YES
Education	YES	YES
Occupation and Industry	YES	YES
Interacting others and working machines	YES	YES
Context	YES	YES
Mean	0.01	0.05

Clustered standard errors at occupational level in parentheses *** p<0.01; p<0.05; p<0.10

Source: HRS and O*NET; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *Knowledge:* Six factors that add information about organized sets of principles and facts which are necessary for the performance of different occupations (administration, biology, etc.); *Note:* Males. Factors are standardized with mean 0 and standard deviation 1.

Table F.2: OLS with dementia and other non-cognition related health outcomes as dependent variable and mental processing work activity as main interest independent

VARIABLES	(1) Dementia	(2) Arthritis	(3) Cancer	(4) Lung disease
Mental processing	-0.008***	0.001	0.001	0.008
	(0.002)	(0.002)	(0.002)	(0.008)
Observations	40,429	40,429	40,429	40,429
R-squared	0.08	0.01	0.00	0.03
Demographics	YES	YES	YES	YES
Education	YES	YES	YES	YES
Occupation and Industry	YES	YES	YES	YES
Interacting others and working machines	YES	YES	YES	YES
Context	YES	YES	YES	YES
Mean	0.03	0.05	0.03	0.10

Clustered standard errors at occupational level in parentheses *** $p<0.01$; $p<0.05$; $p<0.10$

Source: HRS and O*NET; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *Knowledge:* Six factors that add information about organized sets of principles and facts which are necessary for the performance of different occupations (administration, biology, etc.); *Note:* Males. Factors are standardized with mean 0 and standard deviation 1.

Table F.3: OLS with different definitions of dementia outcome as dependent variable and mental processing work activity as main interest independent and collapsing the data at the individual level

VARIABLES	(1) Dem recover	(2) Dem mean after recover	(3) Dem no recover	(4) Dem collapsed
Mental processing	-0.007***	-0.006**	-0.005***	-0.014**
	(0.002)	(0.002)	(0.002)	(0.006)
Observations	42,756	42,756	42,756	7,927
R-squared	0.08	0.08	0.06	0.10
Demographics	YES	YES	YES	YES
Education	YES	YES	YES	YES
Occupation and Industry	YES	YES	YES	YES
Interacting others and work machines	YES	YES	YES	YES
Context	YES	YES	YES	YES
Mean	0.04	0.03	0.03	0.03

Clustered standard errors at occupational level in parentheses

*** p<0.01; p<0.05; p<0.10

Source: HRS and O*NET; *Dem recover:* Is an outcome variable for dementia that considers the dementia status of individuals for each wave separately. It allows for individuals moving in and out of the dementia status (allows recoveries); *Dem mean recover:* Is an outcome variable for dementia that takes the mean of cognition of individuals cognition after the first wave scoring below the dementia threshold. If the mean after this first wave scoring below the dementia threshold is also below the dementia threshold, individuals are considered to suffer dementia. If the mean is above that threshold, they are considered to have a normal cognition (partially allows recoveries); *Dem no recover:* Is an outcome variable for dementia that considers individuals having a normal cognition if after this first wave scoring below the dementia threshold they score above at some subsequent wave (does not allow recoveries); *Dem collapsed:* Data is collapsed at the individual level. Individuals are considered to ever suffer dementia if at any wave they score below the dementia threshold. For time changing control variables the mean is taken; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *Knowledge:* Six factors that add information about organized sets of principles and facts which are necessary for the performance of different occupations (administration, biology, etc.); *Note:* Males. Factors are standardized with mean 0 and standard deviation 1.

Table F.4: OLS with dementia as dependent variable and mental processing work activity as main interest independent for age groups

VARIABLES	(1) Age<65	(2) Age 65-75	(3) Age>75
Mental processing	-0.001	-0.006*	-0.013**
	(0.002)	(0.003)	(0.005)
Observations	17,122	22,793	12,952
R-squared	0.04	0.07	0.11
Demographics	YES	YES	YES
Education	YES	YES	YES
Occupation and Industry	YES	YES	YES
Interacting others and working machines	YES	YES	YES
Context	YES	YES	YES
Mean	0.01	0.03	0.08

Clustered standard errors at occupational level in parentheses *** p<0.01; p<0.05; p<0.10

Source: HRS and O*NET; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *Knowledge:* Six factors that add information about organized sets of principles and facts which are necessary for the performance of different occupations (administration, biology, etc.); *Note:* Males. Factors are standardized with mean 0 and standard deviation 1.

Table F.5: OLS with dementia as dependent variable and mental processing work activity as main interest independent variables and potentially endogenous controls

VARIABLES	(1)	(2)	(3)
Mental processing	-0.007***	-0.0076***	-0.0076***
	(0.002)	(0.002)	(0.002)
Observations	42,756	42,756	42,756
R-squared	0.09	0.09	0.09
Demographics	YES	YES	YES
Dummies	YES	YES	YES
Education	YES	YES	YES
Occupation and Industry	YES	YES	YES
Interacting others and working machines	YES	YES	YES
Context	YES	YES	YES
Work status	YES	YES	YES
Income and wealth	NO	YES	YES
Health	NO	NO	YES
Mean	0.04	0.04	0.04

Clustered standard errors at occupational level in parentheses
*** p<0.01; p<0.05; p<0.10

Source: HRS and O*NET; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *Knowledge:* Six factors that add information about organized sets of principles and facts which are necessary for the performance of different occupations (administration, biology, etc.); *Endogenous:* Retirement status, household wealth, year retired, total number of years worked; *Health:* Ever smoked, ever drinks, bmi; *Note:* Males aged 60 to 85. Factors are standardized with mean 0 and standard deviation 1.

Table F.6: OLS with dementia as dependent variable and orthogonal and obliquely rotated work activities factors as main interest independent variables

VARIABLES	(1) Otrhogonal rot.	(2) Otrhogonal rot.	(3) Oblique rot.	(4) Oblique rot.
Mental processing	-0.007***	-0.006**	-0.006**	-0.005**
	(0.002)	(0.002)	(0.002)	(0.002)
Observations	42,756	42,756	42,756	42,756
R-squared	0.08	0.08	0.08	0.08
Demographics	YES	YES	YES	YES
Education	YES	YES	YES	YES
Occupation and Industry	YES	YES	YES	YES
Interacting others and working machines	YES	YES	YES	YES
Context	YES	YES	YES	YES
4th Work activity factor	NO	YES	NO	YES
Mean	0.04	0.04	0.04	0.04

Clustered standard errors at occupational level in parentheses

*** $p<0.01$; $p<0.05$; $p<0.10$

Source: HRS and O*NET; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *4th Work activity factor:* The fourth factor of the work activities factor analysis; *Note:* Males aged 60 to 85. Factors are standardized with mean 0 and standard deviation 1.

G Genetics

Table G.1: OLS with mental processing work activity as dependent variable and genetic scores as main interest independent variables

VARIABLES	(1) Mental processing
AD gen.	0.004
	(0.010)
Cog. gen.	-0.004
	(0.010)
Cor. art. gen.	-0.007
	(0.009)
Observations	25,353
R-squared	0.59
Demographic	YES
Education	YES
Occupation and Industry	YES
Context	YES

Clustered standard errors at occupational level in parentheses
*** $p<0.01$; $p<0.05$; $p<0.10$

Source: HRS and O*NET; *Outcome variables:* AD gen - Alzheimer's disease genetic factor; Att dis gen - Attention disorder genetic factor; Cog gen - Cognition genetic factor; Dep gen - Depression genetic factor; Schizo gen - Schizophrenia genetic factor; Autism gen - Autism genetic factor; Bipolar gen - Bipolar genetic factor; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.); *Note:* Males aged 60 to 85. Factors in Panel A standardized with mean 0 and standard deviation 1. Main interest variables in Panel B are dummies that define occupations as mainly having work activities interacting with others, mental processing or working with machines. In a similar manner, context and knowledge in Panel B, represent occupations as mainly having context or knowledge defined by one of the different factors.

Table G.2: OLS with dementia as dependent variable and mental processing work activity and genetic scores as main interest independent variables

VARIABLES	(1)	(2)	(3)	(4)
Mental processing	-0.009***	-0.009***	-0.009***	-0.009***
	(0.003)	(0.003)	(0.003)	(0.003)
AD gen.		0.004**	0.004**	0.004**
		(0.001)	(0.001)	(0.001)
Cog. gen.			-0.002	-0.002
			(0.002)	(0.002)
Cor. art. gen.				-0.000
				(0.001)
Observations	25,353	25,353	25,353	25,353
R-squared	0.09	0.09	0.09	0.09
Demographic	YES	YES	YES	YES
Education	YES	YES	YES	YES
Occupation and Industry	YES	YES	YES	YES
Context	YES	YES	YES	YES
Mean	0.04	0.04	0.04	0.04

Clustered standard errors at occupational level in parentheses
*** $p<0.01$; $p<0.05$; $p<0.10$

Source: HRS and O*NET; *Note:* Males aged 60 to 85. Factors standardized with mean 0 and standard deviation 1; *Outcome variables:* Int. others - Interacting with others; Mental proc. - Mental processing; Work. mach. - Working with machines; *Demographic:* Race, being a proxy respondent and parents education, age, survey year, place of birth; *Education:* Five main education levels; *Occupation and industry*: Eleven main occupations (managers, professionals, etc.) and twenty main industries (public administration, professional related services, etc.); *Interacting others and work machines:* Factors measuring work activities interacting with others and working with machines; *Context:* Five factors that add information about physical and social factors intrinsic to the nature of work at different occupations (interpersonal relations, physical conditions, etc.).