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Retirement and Cognitive Function in Later Life

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Abstract

Considerable attention has been paid to identifying modifiable factors that may support or facilitate healthy cognitive aging. Although some form of cognitive decline appears to be an inevitable affliction of old age, its progression can be relatively slow and might not result in any impairment of a person's well-being or ability to function on a daily basis. More serious forms of cognitive decline, however, have profound adverse effects on various aspects of life including financial planning for retirement, medical treatment adherence, and the planning of sequential activities. The list of potential risk factors for increased rates of cognitive decline is long and diverse, ranging from genetic factors over medical comorbidities to lifestyle and psychosocial factors. Identifying risk factors and developing strategies to maintain high levels of cognition have thus emerged as key public health priorities associated with population aging. One such factor could be the transition into retirement; the age at which this happens and the conditions surrounding retirement. We synthesize the evidence to date, paying particular attention to several dimensions of heterogeneity, including the cognitive domain under study, retiree sociodemographic characteristics, type of employment prior to retirement, and country-setting. We also motivate new areas of study and data opportunities for further understanding this key relationship.

Keywords: Cognitive aging, cognitive decline, retirement, risk factors, public health, sociodemographic characteristics

JEL codes: J14, I14, J26

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Cognitive impairment is a leading cause of disability and mortality in high-income countries (Kochanek 2024; WHO 2020). It is also very costly, for both family and friends, who provide the majority of care for people with self-care needs, and for federal and local governments, who pay for most of the necessary health care and a varying degree of long-term care services (Congressional Research Service 2023a). While some declines in specific cognitive abilities are expected as individuals age (Harada et al. 2013), impairment exceeding what is typical can have profound adverse effects on various aspects of life, including management of finances (Han 2015; Nicholas 2021; Stewart 2019), medical treatment adherence (Barthold 2021; El-Saifi 2018), and the planning of sequential activities. Risk factors for cognitive impairment are numerous and varied and include genetic predispositions, environmental exposures, physical and mental health conditions, and lifestyle factors (Livingston et al. 2020). Yet age remains the strongest risk factor for cognitive impairment and as the age distribution in high-income countries becomes increasingly weighted towards older adults, the number of people living with cognitive impairment in these countries and the associated costs are expected to surge (Global Burden of Disease Dementia Forecasting Collaborators 2022). Researchers and policymakers have consequently focused their attention on modifiable risk factors that may prevent, delay the onset of, or slow the progression of cognitive impairment. One such factor is the transition from work into retirement, and the age at which people make this transition.

Why might retirement be related to cognitive functioning?

One theoretical framework for understanding a possible causal relationship between retirement and cognitive functioning is cognitive reserve. This framework posits that individuals differ in the vulnerability of their cognitive capabilities to underlying brain degeneration arising from aging, disease, or trauma (Stern et al. 2020). Vulnerability is determined by a combination of innate characteristics and the accumulation of exposures over the lifetime to intellectually, physically, and socially stimulating experiences that alter the flexibility and efficiency of an individual's cognitive processes (Stern et al. 2020). An individual with high cognitive reserve, for example, may have brain pathology indicative of Alzheimer's disease but exhibit normal cognitive functioning because the adaptability of their cognitive processes has allowed them to develop effective work arounds. Per the cognitive reserve framework, an individual's occupation, or more specifically the content and working conditions involved with their occupation, contributes significantly to their lifetime exposures given the sheer amount of time a typical person spends working (nearly one-third of the average person's waking hours in adulthood).

A related theoretical framework, known as the "use it or lose it" hypothesis or the broader cognitive enrichment theory, suggests that cognitive processes that are not exercised will degrade over time (Hertzog 2008; Hultsch 1999; Salthouse 2006). Consequently, regular intellectual, physical, and social stimulation are necessary to maintain cognitive health. Per this framework, the cessation of work may change the types and amounts of stimulation to which an individual is exposed on a regular basis. For example, a person with a cognitively demanding job might find themselves with fewer opportunities in retirement to engage with cognitively challenging tasks. On the other hand, a person with a tedious desk job might have more time available in retirement to participate in activities that they find intellectually and physically engaging. This framework highlights the heterogeneity in the effect of retirement based on the cognitive tasks in both working and retirement life.

People are also exposed through their occupations to environments and working conditions that may have a direct impact on their cognitive health. For example, metal workers and machinists may be exposed to heavy metals, which can accumulate in the brain with neurotoxic effects (Caito 2015; Vasefi 2020). Military service members are at particularly high risk of traumatic brain injury (Howard et al. 2022). These injuries cause temporary or permanent impairments in cognitive functioning, but also lead to a higher subsequent risk of dementia (Barnes et al. 2018).

Finally, working conditions may affect an individual's physical and mental well-being, both of which are integral to cognitive health. It is estimated that more than one in five cases of dementia in the US and Europe are attributable to physical inactivity (Norton et al. 2014), and office-based jobs often involve extended periods of sitting throughout the day. Many individuals also have consistently atypical work schedules involving night shifts or long working hours. Atypical schedules are associated with sleep disturbances that are, in turn, risk factors for cognitive impairment (Leso et al. 2021). Work-related stress is common and has been found to be associated with both physical and mental health outcomes, including depression, anxiety, and coronary heart disease, outcomes that are themselves associated with an increased risk of cognitive impairment and dementia (Jamal 2000; Restrepo 2019).

Time Use Before and After Retirement

The relationship between retirement and cognitive health, as highlighted in the theoretical models, is complicated by what one does with their time, both before and after retirement. Jobs vary in terms of the physical activity and schedules, highlighted above, but also in terms of their job strain and stress, psychological demands and mental stimulation, and their degree of control over their daily tasks. While these factors can be examined in stratified regression analysis, what one does after retirement is typically more of a choice, and often not observed in datasets that also capture cognition information. According to 2023 data from the American Time Use Survey, retirees between ages 65 and 74 enjoy nearly seven hours of leisure time per day (US Bureau of Labor Statistics 2024). What they decide to do with their time could have large impacts on their physical and cognitive health. American Time Use Survey data suggest that as a group, as people enter retirement age you see increases in sleeping hours and an increase in time spent on sports and leisure, although increases in caregiving are also apparent (US Bureau of Labor Statistics 2024). Television watching remains the dominant leisure activity for retirees. Individuals age 65 to 74 watch an average of 3.82 hours of TV on weekdays and an average of 4.48 hours of TV on weekends, and that continues to increase with age. We do not know if the patterns of activities selected in retirement vary based on the age of retirement or reason for retirement.

The Pathways to Retirement

There are many ways to retire. For some, it is a long-awaited milestone, carefully timed and planned for. For others, unanticipated opportunities arise that change their desire to work. These opportunities could come from the employer, such as a "golden parachute", or a financial incentive to retire earlier than originally planned, or from outside forces, such as wanting to be an active grandparent, or a volunteer opportunity that requires relocation or substantial time commitment. For others, retirement is due to a change in their ability to work. This could be in the form of mandatory retirement ages, which are prevalent in Europe and parts of Asia, or due to health declines that prevent them from working, or health conditions of loved ones who need time-intensive care or just change one's desire to work to spend more time with their family members.

Not only do the reasons behind the timing of retirement vary, but the way in which one retires can vary. One can stop working abruptly, gradually reduce hours, switch jobs or careers first, presumably to a job with fewer hours, lower stress or responsibilities, a phenomenon known as "bridge jobs." Earlier work found that nearly half of retirees had a nontraditional retirement path, with over a quarter returning to work (Maestas 2010). This variation in the pathway to retirement can make defining the moment of retirement or years spent in retirement difficult. Should it be the last day one had paid work, or when they stepped down their responsibilities? Individuals themselves vary in how they answer the question in surveys, with some answering the first and others the latter.

For homemakers, it is especially hard to define the timing of retirement. What does retirement mean when one does not work in the paid labor market? Should this be determined based on the age of the youngest child? When the spouse retires? This difficulty has led some researchers to study the relationship between retirement and health or cognition in men, who have historically higher labor force participation rates than women and whose "end of the working life" is easier to define through paid labor market definitions. When studying the effect of retirement on women, one must keep in mind the selection into work and how that has changed over time as the female labor market participation rates have increased.

Heterogeneity

Researchers do not frequently have complete information on cognitive demands over time, or plans or intentions on retirement timing, which limit the ability to really identify all the nuance around retirement and how it is linked to cognitive decline. However, many of these determinants are correlated with observable characteristics, such as sex, educational attainment, occupation and industry. These observable characteristics are often then used as moderators in research studies, or as stratifying variables to understand the heterogeneity in the relationship between retirement and cognition. However, it is important when interpreting the literature to know that these are proxies for several potential underlying factors, and thus may not be directly related to the factor itself. For example, the relationship between retirement and cognition has been found to differ based on sex (Atalay 2019; Oi 2019); yet there is likely not a biological underpinning for this heterogeneity. More likely, it is based on sociological factors, such as selection into work, cognitive demands and expectations before and after paid work.

How to Measure Cognitive Functioning

There are several ways of assessing cognitive functioning, each with its own strengths and weaknesses. To identify people whose cognitive impairment has become symptomatic, diagnosis codes for mild cognitive impairment (MCI) and Alzheimer's disease and related dementias (ADRD) found in medical record and administrative data may be used. A primary strength of this approach is that diagnosis codes are collected as a routine part of health care delivery and thus are available at the population-level, facilitating population-based studies. However, both MCI and ADRD are underrecognized by physicians, so diagnosis codes tend to identify people with moderate to severe disease (Bradford 2009; Chodosh 2004; Valcour 2000). The likelihood and timing of a diagnosis is also dependent on demographic and socioeconomic characteristics. For example, non-Hispanic Blacks and individuals with lower levels of educational attainment are more likely to have a missed or delayed diagnosis (Amjad 2018; Gianattasio 2019; White 2021). Finally, receipt of a diagnosis is dependent on health care utilization, so individuals with poor access to care or infrequent contact with the health care system are likely to be missed.

Formal, in-person clinical assessments of cognitive functioning are another means of identifying individuals with symptomatic cognitive impairment. This approach often involves adjudication of diagnoses by a team of clinicians and is considered a gold standard for case identification. However, it is also resource- and time-intensive, so has generally been limited to smaller cohort studies (e.g., the Aging, Demographics, and Memory Study supplement to the

Health and Retirement study) or to referral-based or volunteer case series (e.g., Alzheimer's Disease Research Center participants). Consequently, selection bias and sample size issues frequently hamper analyses using this approach.

Finally, a variety of shorter instruments have been developed to assess cognitive performance or screen for cognitive impairment. These instruments are designed to be administered in person (some have been adapted for telephone administration) by trained lay people and are thus ideal for use in large population-based studies. However, because each instrument uniquely captures performance on one or more cognitive domains (e.g., processing speed, attention, episodic memory, verbal fluency), comparability of scores across instruments is limited. Additionally, the screening instruments are designed to detect major deviations from normal cognitive functioning and so exhibit little variation among individuals with no impairment. Ideally, these assessments should be administered repeatedly over time to determine longitudinal trends in cognitive functioning, allowing researchers to tease apart the direction of causality when studying the relationship between retirement and cognitive functioning.

Current Literature

We conducted a systematic literature review to examine current evidence on the association between retirement and cognitive function. We discuss the role of retirement in cognitive outcomes, and how occupational characteristics, pre- and post-retirement activities, and other factors may mediate outcomes.

Our search strategy included three categories of terms: terms for retirement *and* terms for cognitive function or decline *and* terms for study design. The search was carried out in four databases: PubMed, Embase, EconLit, and PsycINFO. The full search strategy for PubMed is in

Supplemental Table 1. Searches were executed in July 2024, and 3,717 unique articles were identified for review.

Articles had to meet both of the following criteria to be included: (1) retirement is the primary exposure; and (2) primary outcomes include measures of cognitive function or decline (not including psychological health). We limited the search results to studies published in English, but did not include any geographic or publishing date restrictions. Qualitative studies, review articles, conference abstracts, and commentaries were excluded.

Two authors independently reviewed the titles and abstracts of all identified articles for our inclusion and exclusion criteria. In the case of any disagreements, the third author made a final decision. After title and abstract review, 140 studies were identified for a full text review. Following a full text assessment, 42 articles met all criteria and were included in the review. Common reasons for exclusion included: wrong outcomes, wrong exposure, or general irrelevance (e.g., many studies used datasets like the Health and Retirement Study, but did not focus on retirement). Supplemental Figure 1 displays a flow chart of the search and review process.

All authors participated in assessing the included studies for risk of bias. We classified each study's risk of bias as low, medium, or high. A principal concern when evaluating risk of bias in this topic is to evaluate how the study design addressed the endogeneity of retirement and health—that is to say, whether the methods account for the potential for poor health or cognitive function to influence the retirement decision, rather than be caused by it.

Low risk of bias studies employed rigorous causal inference designs, whereas high risk studies were primarily descriptive with minimal controls in regression. Articles with medium risk of bias fell in between, using a robust set of controls, or methods that help to ensure comparability between the "treatment" and "control" groups, such as propensity scores. We determined that 12, 26, and four articles had a low, medium, and high risk of bias, respectively. When drawing conclusions across papers below, we emphasize results from studies with a low risk of bias. Table 1 describes each study's characteristics, major findings, and risk of bias.

Researchers vary in how they evaluate the effect of retirement. Many studies simply used the transition into retirement as the exposure (26 studies). Other studies considered the impact of timing or duration of retirement (17 studies). Additionally, the exact measure of cognitive function differs across studies. Thirty-eight studies used assessments of memory, executive function, verbal fluency and numeracy, and/or information processing speed. This is because most studies used longitudinal survey data and took advantage of cognitive exams administered to participants across waves. It is important to note that even among these assessments, there is substantial variation in the domains of cognition being examined and the test used. Studies also differed in whether they chose to study a flat change in cognitive function, or the pre- and post-retirement rate of cognitive decline. In addition, five studies used a diagnosis of dementia or Alzheimer's disease as an outcome. Analysis methods also differed: 27 studies used longitudinal data, 12 studies used quasi-experimental methods (11 studies used instrumental variables, and one used regression discontinuity design), and three studies were cross-sectional. For the instrumental variable analyses, nine used pension eligibility ages as a primary instrument, one used offers of early retirement windows, and one used a marriage bar for women.

Study settings and populations also differed. Almost all studies examined populations in the U.S. and Western Europe. Most studies were national (27 studies) or international (nine studies), but some (seven studies) were constrained to smaller regions of a country. Additionally, many studies included a broad population. However, four studies included only males, two studies looked exclusively at women, and four studies focused on one occupation group. Eight studies examined differential effects of retirement by gender, race, education level, or post-retirement activities.

Eighteen studies assessed the role of occupation type or characteristics on retirement outcomes. The most common job characteristics studied were control, demands, physical burden, and complexity. Three studies evaluated how cognitive outcomes differ by the kind of retirement, comparing individuals who retired fully versus those who continued to hold a part-time job or later returned to work.

Across these outcomes, exposures, settings, and populations, results of studies are rather mixed. When retirement is treated as a single exposure, most (20 studies) find a significant reduction in cognitive function following retirement (Andel 2023; Atalay 2019; Clouston 2017; Denier 2014; Jung 2022; Mazzonna 2012; Rohwedder 2010; Roberts 2011; Wickrama 2013; Xue 2018). However, six studies find no significant effect of retirement on cognition (Coe 2011; Lee 2019; Mizuochi 2022; Romero-Starke 2019). When retirement is assessed as a continuous treatment with effects that accumulate over time, results are similarly inconsistent. Fourteen studies find that delaying retirement is associated with cognitive benefits (Dufoil 2014; Grotz 2016; Hale 2021; Macken 2021; Sundstrom 2020), or that longer retirement periods are associated with greater cognitive decline (Celidoni 2017; Kajitani 2017; Mazzonna 2017; Mosca 2018). However, three studies find no significant relationship between retirement timing or duration and cognition (Baumann 2022; Coe 2012; Grotz 2015). No matter how retirement was examined, studies that accounted for the endogeneity of health and retirement, and controlled for factors like education level and gender, were more likely to report no significant effects.

Rohwedder and Willis (2010) were among the first researchers to employ a quasi-experimental design to examine the causal impact of retirement on cognitive health, using cross-country pension eligibility ages in Europe and the US for instrumental variable analysis. They find a large, immediate decline in memory due to retirement, among individuals who retire due to reaching their pension eligibility age. For instrumental variable analyses that produce a local average treatment effect, estimates are only accurate for the population affected by the instrument. In this case, that population is comprised of people induced to retire due to pension eligibility. Since their study was published, many other researchers have iterated on their methodology, with two studies taking advantage of other instruments. Additionally, Rohwedder and Willis only include one covariate: age. Later studies have pointed out the importance of accounting for education, which, it turns out, is responsible for a large negative bias in their results (Bingley 2013; Jung 2022). Additional factors like gender and occupation have also been shown to moderate the relationship between retirement and cognitive function (Coe 2011; Kajitani 2017).

Coe and Zamarro (2011) also use international variation in pension policies as an instrument, though only in Europe. They control for education and family structure and exclude participants with certain health conditions. In contrast to Rohwedder and Willis, Coe and Zamarro find no significant effect of retirement on cognitive function. Both of these studies are limited by relying on cross-sectional data.

Similar to Rohwedder and Willis (2010) and Coe and Zamarro (2011), Mazzonna and Peracchi (2012) use pension eligibility ages across Europe for an instrumental variable analysis. However, Mazzonna and Peracchi also leverage within-country variation in pension legislature, as policies evolved in the 1990s, and include two waves of data rather than one. They also account for attrition in their sample and retesting effects (i.e., the way participants may learn from their experience completing cognitive assessments in previous waves), and control for education. With these new controls, they find that the rate of cognitive decline increases post-retirement. They also break out the results by gender and find larger declines after retirement for women than men. However, it is likely that this result is driven by biased sampling of women in their sample.

Additionally, Bonsang et al. (2012) use Social Security eligibility ages in the United States as an instrument. To control for individual heterogeneity— including education, gender, and occupation— they employ a fixed-effects estimator. In line with Rohwedder and Willis, they find a negative causal impact of retirement on cognitive functioning. They also observe that most of the decline occurs shortly after retirement, rather than after an extended period.

These four studies evaluated retirement as a single exposure. However, the effect of retirement on cognitive function may increase over time. Some studies have considered the possible dose-dependent effects of retirement. For example, Mazzonna and Peracchi (2017), using similar methods to their previous study but with a different specification of retirement, find that each year spent in retirement decreases cognitive abilities by six percent of a standard deviation. However, for those who retired from very physically demanding jobs, retirement resulted in an immediate increase of half a standard deviation for cognition.

Mosca and Wright (2018) use the removal of the marriage bar for women in Ireland as an instrument to determine the effect of retirement length on cognition. The marriage bar was a legal requirement that women retire upon marriage and resulted in many women spending a large portion of their lives in retirement. They find that each additional year in retirement leads to a mild decrease in cognitive function. It is important to note that the instrument used by Mosca and Wright (2018) induced retirement at ages much younger than typical pension eligibility ages.

In contrast, Coe et al. (2012) find no significant effect of retirement length on cognition for white-collar workers, and positive effects for blue-collar workers, when using offers for early retirement in the US as an instrument. The results for blue-collar workers align with Mazzonna and Peracchi's (2017) findings.

Some studies examine heterogeneity in the effects of retirement on cognitive function. In addition to Coe et al. (2012) and Mazzonna and Peracchi (2017), two quasi-experimental studies study the role of job characteristics in the relationship between retirement and cognition. Kajitani et al. (2017), using pension eligibility ages for men in Japan as an instrument, find that more complex careers, especially ones involving data manipulation, are protective against post-retirement decline. Similarly, Jung et al. (2022) observe that increasing cognitive demand reduces cognitive decline after retirement for men when Social Security eligibility ages in the U.S. are used as an instrument. In contrast to Coe et al. and Mazzonna and Peracchi, Jung et al. and Kajitani et al. find negative or no relationships between physical demand of a job and cognitive function after retirement.

Mizuochi and Raymo (2022) is the only quasi-experimental study to examine how different retirement pathways affect the role of retirement in cognitive function. Using pension eligibility ages for Japanese workers for an instrumental variable analysis, they find that the only retirement pathway to negatively influence cognition is staying with the same employer after partial retirement. Full retirement, or partially retiring but working with a new employer, were not related to cognitive function.

Finally, most studies have either only used single-gender samples or reported results for different genders together. However, in addition to Mazzonna and Peracchi (2012), two quasi-experimental studies have differentiated the effects of retirement between men and women. Oi (2019), using Social Security eligibility ages in the United States, observes that the negative effect of retirement on overall cognition, as well as some cognitive subdomains, is only significant for women. However, for immediate and delayed memory, retirement had a significant effect on cognitive function for men and women.

However, in contrast to those Oi (2019) and Mazzonna and Peracchi (2012), Atalay et al. (2019) finds that retirement's effect on cognition is only significant for men. Using Australian pension eligibility ages, they find that men experience a larger immediate decline in cognitive function compared to women. Additionally, the effect of each additional year of retirement on cognition is only significant for men.

Discussion

Overall, the extant literature provides two bodies of research addressing the relationship between retirement and cognitive functioning. One body, largely from the economics literature, provides empirical evidence of the causal effect of retirement on cognitive functioning, relying almost universally on an instrumental variables approach to address reverse causation (i.e., declining cognitive functioning inducing retirement). Findings from these studies were inconclusive, with some showing no effect of retirement on cognition, others showing a negative effect, and a couple showing a positive effect. Findings did suggest important heterogeneity based on gender and the cognitive demands associated with the occupation that individuals were retiring from. Though methodologically rigorous, this body of research used a relatively limited set of cognitive measures, usually estimated an immediate, one-time shift in cognitive functioning at the time of retirement or shortly after, and offered little exploration of possible mechanisms underlying the relationship.

The second body of research generally used longitudinal data to capture cognitive functioning before and after the transition into retirement. Findings in these studies were also mixed, but far more likely to suggest that retirement is associated with a decline in cognitive functioning and that earlier age at retirement is particularly detrimental. As with the first body of research, these studies showed heterogeneity in the association based on gender and occupational characteristics. While these studies examined a broader range of cognitive outcomes, including risk of dementia, and provided more data on possible mechanisms, they were unable to rule out the possibility that changes in cognitive functioning prior to retirement were driving their results.

The existing literature also provides some evidence in support of and some at odds with the theoretical cognitive frameworks. The cognitive reserve framework suggests that cognitively demanding occupations will contribute to the development of higher cognitive reserve or increased adaptability of underlying cognitive processes. Under this framework, individuals with cognitively demanding occupations are expected to be somewhat protected from cognitive decline in retirement, exhibiting either a slower rate of decline in cognitive functioning or a lower risk of MCI or dementia. The use it or lose it hypothesis, on the other hand, would suggest a faster rate of decline or higher risk of impairment among individuals retiring from cognitively demanding work since enriching activities in retirement are unlikely to sufficiently replace the cognitive demands of work. Additionally, higher levels of participation in enriching activities in retirement should be associated with a slower rate of decline. Because these frameworks are predicated on occupational characteristics and time use before and after retirement, only the minority of studies that included measures of these variables provide any evidence. Findings from the four studies in the economics literature with pertinent data were consistent with the use it or lose it theory, but were mixed on their support of the cognitive reserve theory. Findings from the second body of research was similarly supportive of the use it or lose it theory and mixed on the cognitive reserve theory.

Economics literature offers the most robust evidence to date of a causal relationship between retirement and cognitive functioning, but readers must understand the limitations of the estimates produced from these studies. Most instrumental variables analysis yields an estimate of the local average treatment effect; in other words, it provides precise estimates for those whose retirement behavior changes due to the instrumental variable, but is silent on the effect of retirement among other individuals. All but two of the economics studies used social security policies, specifically ages of eligibility for benefits, as the instruments, meaning the majority of estimates were for those whose planned retirement was induced by their government social security systems. These estimates may be extremely informative for policymakers considering social security reforms. However, they do not reflect the retirement pathways for the majority of individuals. The percent of individuals claiming social security and ending employment right at age 62 has been declining over time (Waldron 2020), with less than one-third of new benefit claims occurred at age 62 (Congressional Research Service 2023). As the gain from delaying one year of benefits becomes closer to actuarially fair, retirement behavior changes. These changes also makes this source of variation less reliable for identification for relationships such as these.

One additional limitation of the existing literature pertains to the cognitive endpoints that are commonly used. Most studies use scores on one or more cognitive assessments as the outcomes. While valid and important, there is a challenge in translating resulting estimates of effects and associations into meaningful terms for policymakers and laypeople. Are these estimates clinically meaningful? What do they mean for independent functioning or future risk of cognitive impairment and dementia? Additional studies are needed that combine methodological rigor with an examination of symptomatic cognitive impairment or cognitive decline that impairs functioning as endpoints.

New Opportunities

Luckily, data infrastructure has been rapidly improving, allowing researchers to continue to improve our understanding of the effect of retirement on cognition.

Measures of cognitive function/dementia: There has been widespread improvement and inclusion of more nuanced measures of cognitive function. The Harmonized Cognitive Assessment Protocol (HCAP), a battery of tests that measures cognitive function in older people, has been instituted in several longitudinal and international studies, allowing for comparisons of cognitive function and dementia risk over time and across countries. Chile, China, England, India, Mexico, South Africa, and the United States all have HCAP surveys in place; planned HCAP studies include: Dominican Republic, Denmark, Czech Republic, Germany, France, Italy, Ireland, Lebanon, Nepal, Northern Ireland, and Puerto Rico (National Institutes of Health 2025). This innovation and standardization will help the fundamental concern of reverse causality, of heath and cognition influencing retirement timing, and retirement itself influencing health and cognition.

Measures of Employment/retirement: The Health and Retirement Study remains one of the few studies that link to administrative earnings information from the Social Security Administration, reliably capturing complete formal paid work history since 1951. While there is a large anonymized database of tax records that is used in economic research, the IRS Databank, it currently remains unlinked to health or cognition data. Most surveys rely on self-reported measures.

Dementia cohort studies are increasingly able to help address this research question. These studies often have unparalleled information on cognition and adjudicated dementia diagnosis by a panel of experts. Given the importance of lifetime risk factors for dementia, many are adding sociodemographic information as well as life and work histories, allowing for further detangling of the role work and retirement play in cognitive decline, with the caveat of individuals who volunteer to participate in dementia cohort studies have not typically been nationally-representative, although significant efforts are underway to help improve that as well. Further, given that the current therapies are for individuals in the pre-clinical stages of Alzheimer's disease, efforts are underway to decrease the age of enrollment, increasing the likelihood of observing retirement behavior while in the cohort.

HRS-Family of Surveys: The Health and Retirement Study (HRS) and its "family" of surveys designed to provide detailed information about aging and health around the world, continues to grow. Starting in the US in 1992, the family has now grown to over 35 countries around the world (Gateway to Global Aging 2025).

Data Aggregators: In addition to the HRS-family surveys, there are numerous international aging studies that could lend their data to this, and other, timely research questions. The ARC Centre of Excellence in Population Ageing Research (CEPAR), based at the University of New South Wales, has aggregated aging surveys from around the world (CEPAR 2025).

Many agencies are working to increase access and comparisons across dementia cohort studies to better leverage the data investment. The NIA-funded Alzheimer's Disease Research Centers (ADRC) cohorts have been using Uniform Dataset Protocol (UDS) and the National Coordinating Center (NACC) to increase access and comparability across measures (The National Institute on Aging Genetics of Alzheimer's Disease Storage Site 2025). The Alzheimer's

Association has put together the Global Alzheimer's Association Interactive Network (GAAIN), which allows researchers to search and aggregate among 70 different data partners from across the world (with a strong representation of the US and European countries). The Connecting Cohorts to Diminish Alzheimer's Disease (CONCORD-AD) collaboration network was created to bring together global resources and expertise, to generate insights and improve understanding of the natural history of AD, to inform design of clinical trials in all disease stages, and to plan for optimal patient access to disease-modifying therapies once they become available. The network brings together expertise and data insights from 7 cohorts across Australia, Europe, and North America. Notably, the network includes populations recruited through memory clinics as well as population-based cohorts, representing observations from individuals across the AD spectrum.

Finally, while still lagging Nordic countries, there are new opportunities to link US datasets in various settings. For example, the NIH has created the LINKAGES program, which allows researchers to link their own data with administrative claims data from the Centers for Medicare and Medicaid (CMS) to gain access to information on dementia and cognitive impairment diagnoses. As cognitive screening becomes more widespread, such as through the Medicare Annual Wellness Visit, these could be more reliably translated into diagnosis codes than in the past, as well as provide detailed information on cognition through the use of electronic medical records. The 34 Federal Statistics Research Data Centers (FSRDC), hosted by the Census Division, hosts a wide variety of national and nationally-representative data that are linkable in secure computing environments, which would allow researchers to link administrative or survey data from a wealth of sources to create the dataset needed.

Conclusion

The existing evidence on the relationship between retirement and work tends to support the "use it or lose it" hypothesis, and that retirement tends to be bad for cognitive health. However, the evidence is far from convincing. Studies document substantial heterogeneity in this relationship, even among the small fraction of the population that they are the most relevant for. Very few studies with a rigorous design examine cognitive trajectories post retirement, as opposed to a point-in-time measure of cognition, and very few look at the outcome that is perhaps of the most interest, independent functioning. While our data infrastructure is improving to help us answer these key questions, our experiences of and activities around retirement are changing just as quickly, raising concern about the generalizability of these findings to later generations.

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Supplemental Figure 1