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Mental retirement and health selection: Analyses from the U.S. Health and Retirement Study

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ABSTRACT

Background: Research has recently suggested that retirement may decrease cognitive engagement, resulting in cognitive aging. Few studies have systematically documented whether or how selectivity into retirement shapes the relationship between retirement and cognitive aging.

Methods: We draw on data from the Health and Retirement Study (1998–2012) to examine the relationship between cognition and retirement for 18,575 labor force participants. Longitudinal regression discontinuity modeling was used to examine performance and decline in episodic memory. Models differentiated three forms of selection bias: indirect and direct selection as well as reverse causation. To further interrogate the disuse hypothesis, we adjust for confounding from health and socioeconomic sources.

Results: Results revealed that individuals who retired over the course of the panel were substantially different in terms of health, wealth and cognition when compared to those who remained employed. However, accounting for observed selection biases, significant associations were found linking longer retirement with more rapid cognitive decline.

Discussion: This study examined respondents who were in the labor force at baseline and transitioned into retirement. Analyses suggested that those who retired over the course of the panel had worse overall functioning, but also experienced more rapid declines after retirement that increased the rate of aging by two-fold, resulting in yearly losses of 3.7% (95% CI = [3.5, 4.0]) of one standard deviation in functioning attributable to retirement. Results are supportive of the view that retirement is associated with more rapid cognitive aging.

Five-million Americans have dementia and 15.5 million others care for those with the disease (Alzheimer's Association, 2015). While dementia is an onerous, life-changing disease, it is the end result of years of progressive neuropathological changes prior to reaching diagnostic criteria (Bruscoli and Lovestone, 2004). Cognitive declines often occur across a number of domains including memory, executive functioning, fluency, and mental status (Richards and Deary, 2014), and can thus have broader ripple effects well before disease onset. Cognitive declines are costly, diminishing functioning across a broad range of abilities, including the ability to self-manage healthcare (Clouston et al., 2016; Jack et al., 2010; Murray et al., 2011). As such, there is a need to identify mechanisms that influence cognitive decline, as these could carry substantial long-term benefits.

Retirement has been put forward as a potential cause of cognitive aging, under the assumption that retirees leave employment that requires regular “use” of cognitive skills, to enter “mental retirement” (Rohwedder and Willis, 2010), during which time they may slowly “lose” cognitive capability (Hultsch et al., 1999; Rohwedder and Willis, 2010). To date, much evidence has established an association between retirement and lower cognitive functioning in both Europe and the United States, but inconsistencies remain across data sources and measures of cognition. Rohwedder and Willis (2010) used cross-sectional data from the United States (U.S.) and Europe and relied on cross-national variation in pension eligibility ages as an instrument for retirement status to find that not working was associated with large

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reductions in verbal recall. Bingley and Martinello (2013) showed that this effect was overstated, as it did not account for correlations between pension eligibility and variation in educational attainment across nations. Supporting such a notion, cross-sectional studies accounting for education have consistently shown smaller negative effects (Mazzonna and Peracchi, 2012). Coe et al. (2012) further suggested that this effect may not be evident in all worker groups: using pooled cross-sections of the U.S. Health and Retirement Study (HRS) and instrumenting for retirement status with offers of early retirement the authors found that duration spent in retirement had no impact on cognition for white-collar workers and that retirement may actually *benefit* cognition for blue-collar workers. Bonsang et al. (2012) utilized Social Security eligibility ages as instruments for retirement to analyze the HRS, and found that not working was associated with reduced verbal memory and that the effect occurs shortly after retirement but does not accumulate with time. On the other hand, Celidoni et al. (2013) used longitudinal data from the Survey of Health, Ageing, and Retirement in Europe (SHARE), and found that duration spent in retirement, not retirement status alone, was associated with an increased likelihood of large (>20%) declines in verbal memory. However, using the same SHARE data, Bianchini and Borella (2015) found that retirement had a net *positive* effect on verbal memory when allowing for non-linear effects of age on cognition. Using a relatively novel approach, Wickrama and O'Neal (2013) drew on HRS data to model how a change in work status from 1998 to 2002 impacted subsequent cognitive aging using growth curve analyses, and found that those who transitioned to retirement displayed greater deterioration in verbal learning than those who continued to work.

Taken together, it seems that retirement is linked to cognitive aging, but that a number of inconsistencies remain. Notably, many studies rely on instrumental variable approaches to establish a causal relationship between retirement and cognition, which may be a source of some of these documented inconsistencies. Instrumentation is used when trying to remove bias due to unobserved heterogeneity and endogeneity (Angrist and Krueger, 2001); yet, it has drawbacks. First, it can mask the specific form of heterogeneity; in many studies “unobserved heterogeneity” includes a laundry list of types of bias including, for example, confounding and selection bias. So while instrumentation may help account for various sources of bias, it does little to aid in identifying or understanding them. Additionally, analyses can be fundamentally flawed if any secondary pathway links instrumental variables to outcomes. In the study of retirement and cognition, researchers almost exclusively rely on differences in pension eligibility or retirement ages as instruments; however, pension and retirement ages often correlate with more generous retirement benefits or social transfers that may influence not only retirement but also unemployment, a status that has long been independently and consistently associated with increased stress, greater depression, and lowered cognition (Clark et al., 2001; Hessel et al., 2015). Crucially, data from the Organization of Economic Cooperation and Development (2015) suggests that maximal unemployment insurance benefits are associated with both retirement age ($r = -0.29$) and pension age ($r = -0.35$), a level of association that is similar to that between pension spending and retirement age ($r = -0.28$) and larger than that of unemployment insurance and unemployment rate ($r = -0.15$). As such, retirement age policies may not be appropriate instruments for analyses when unemployment is also a possible confounder.

1. Methodological considerations

Longitudinal analyses, on the other hand, allow us to specifically differentiate sources of bias. For example, prior work has highlighted the role of time-invariant factors such as education, age, sex, poverty, and stress, as well as other hallmarks of aging, including physical functioning and prevalent chronic disease burden, as confounders. Clarifying timing of factors may additionally help to specify the relationships between each construct. For example, those who retire may do so in part because of incident health problems, such as stroke, that are known to cause decreased cognition (Spiro and Brady, 2011). Thus, selection bias results from differences in pre-retirement characteristics that may influence both the risk of retirement and lower cognitive functioning. These forms of bias can be formally differentiated into indirect and direct selection (Goldman, 2001), as well as reverse causation, as discussed below.

Indirect selection is the most commonly discussed form of selection bias and occurs when individual characteristics related to the outcome but not a part of the outcome influence the propensity for retirement. For example, indirect selection may occur if worse physical health both influences timing of retirement (Jokela et al., 2010), and increases the risk of cognitive decline (Gorelick et al., 2011). Conversely, those who retire may have spent their lives investing in human capital and building wealth, resulting in higher socioeconomic status and less risk of distal outcomes.

In contrast, *direct selection* occurs when individuals differ specifically in the *outcome of interest* in a way that influences the main independent variable of interest. For example, those who have the opportunity to retire may have spent substantial portions of their lives building cognitive reserve (Clouston et al., 2012; Glymour et al., 2008), defined as resilience to exposures and aging gained through long-term investments in human capital (Glymour et al., 2012; Richards and Sacker, 2003; Scarmeas and Stern, 2003; Stern, 2002, 2009; Valenzuela and Sachdev, 2005). Indeed, many retirees may be advantaged in that they have secured pensions and accumulated wealth sufficient to provide retirement security (Banks and Oldfield, 2007; Van Rooij et al., 2012), indicative of a healthy retiree effect. Furthermore, those at risk of retirement are first and foremost employed, a fact that may be determined in part by cognitive ability (Deary and Johnson, 2010). On the contrary, those who retire may do so because they are unwilling, unable, or uninterested in working for longer periods of time resulting in healthy survivor effects.

The second form of direct selection, most appropriately called *reverse causation*, may exist if increased rapidity of cognitive decline results in increased risk of retirement. As noted above, cognitive decline can influence a number of non-cognitive domains of functioning including, for example, emotional disturbances (Shalev et al., 2014) or decreased capacity to understand instructions (Murray et al., 2011) suggesting that individuals may be retiring in part because of reductions in cognitive capacity. Yet, other factors may be ongoing. For example, everyday stress, a known predictor of cognitive aging (Munoz et al., 2015), may decrease substantially when workers make the mental transition towards retirement, thereby resulting in a *cognitive return to retirement*.

2. Objective

The objective of this study is to use longitudinal regression discontinuity methods to determine whether there is evidence for a longitudinal relationship between retirement and cognitive aging and if selective factors, specifically baseline cognitive status or pre-retirement cognitive changes, explain associations between retirement and cognition.

2.1. Hypotheses

Fig. 1 provides a graphical interpretation of potential longitudinal associations between retirement and cognition. Under a