



Volunteering during early retirement reduces depression

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ABSTRACT

As individuals age, they often face deteriorating health and significant lifestyle changes, including retirement. While retirement can alter individuals' economic and social roles, potentially increasing the risk of depression, involvement in volunteer activities has been found to be beneficial for retirees. Using data from the Health and Retirement Study, we apply the parametric g-formula to simulate an intervention aimed at estimating the effect of volunteering on depression, and to assess the mediating role of limitations in activities of daily living. Our results show that engagement in volunteering reduces the probability of depression by approximately 5% in the whole population, with larger gains among early retirees. The results hold irrespective of gender, and indicate that the benefits are greater for women. Our findings show that about 10% of the positive impact of volunteering on depression operates via a reduction in the likelihood of experiencing limitations in activities of daily living. Therefore, we conclude that the benefits of volunteering extend to improving the overall health of both individuals and the population. Our simulated intervention targeting early retirees may be a viable public health strategy for protecting individuals against depression, while also enabling them to contribute to the public good.

1. Introduction

In 2021 in the U.S., more than 60 million individuals were formally volunteering (about 23.2% of the U.S. population), and were generating services with an estimated economic value of more than \$120 billion (AmeriCorps.gov, 2023). In contrast to spontaneous acts of kindness, formal volunteering is an organized and deliberate means of enhancing the social good (Morrow-Howell, 2010). Volunteering generates substantial social and economic value, as in addition to helping nonprofit organizations function (Sheard, 1995), volunteering promotes social cohesion in society (Ackermann et al., 2023). The benefits of volunteering are not limited to the society and the recipients but extend to the volunteers themselves.

Engaging in social activities has been found to be beneficial for volunteers, especially as they grow old. Volunteering has been associated with increased survival (Rogers et al., 2016), better physical and mental health (Carr et al., 2018; Lim et al., 2023; Musick and Wilson, 2003; Thoits and Hewitt, 2001), improved self-perception of aging (Huo et al., 2021), higher perceived autonomy (Jiang et al., 2021), and a reduced risk of developing limitations in activities of daily living (ADLs)

(Weziak-Bialowolska et al., 2024). Overall, volunteering contributes to increased well-being and life satisfaction, and may thus play a crucial role in mitigating depression in older adults (Thoits and Hewitt, 2001; Weziak-Bialowolska et al., 2024).

Depression is among the leading causes of the global health-related burden (Vos et al., 2020). In the United States, 21.0 million adults, or 8.4% of all adults, had at least one major depressive episode in 2020. Women (10.5%) were more likely than men (6.2%) to experience a major depressive episode (NIH, 2023). Depression is primarily a mood disorder that negatively affects an individual's emotional state, which influences their ability to perform daily tasks such as eating, sleeping, thinking, and working. More generally, depression is associated with role impairment (Kessler et al., 2003).

A substantial body of literature indicates that depression may result from the interplay of individuals' levels of life stress and their genetic and personality vulnerability. Indeed, evidence suggests that when individuals face adverse circumstances, major life changes, stress, illnesses, and medication use throughout their life course, their risk of depression increases (Lupien et al., 2009). Medical conditions that are more common in older age, such as diabetes, cancer, heart disease, and

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Parkinson's disease, often co-occur with depression (Agustini et al., 2020) and exacerbate each other's consequences. The increased risk of depression at older ages is not solely due to declining health, but also relates to significant life stage changes. Retirement is a major transition later in life that brings significant changes in individuals' economic and social roles (Wang et al., 2011), potentially exposing new retirees to an increased risk of depression.

The loss of the work role may lead to an identity crisis and a loss of purpose, increasing the risk of depression. On the other hand, being free of work commitments may allow individuals to spend more time with family and friends, provide childcare (Eibich and Siedler, 2020), do physical exercise, enjoy leisure activities (Eibich, 2015), or contribute to society through beneficial activities (Eibich et al., 2022; Hämäläinen et al., 2024; Zhu, 2021). Nonetheless, depression itself is a significant risk factor for early retirement (Lee and Smith, 2009). Adjusting to new economic and social roles, along with the physical and psychological changes that come with aging, is essential for maintaining well-being in post-retirement life. The success of these adjustments relies on various resources—such as financial, health, social, and emotional support—and on how these resources change during the transition to retirement, as they are critical for meeting individual needs.

The resource-based dynamic framework (Wang et al., 2011) is particularly suited to study this process, as it offers a comprehensive perspective, emphasizing that the adjustment process is influenced by the fluctuations of these resources throughout the retirement transition and does not depend on life stages. Different alternative frameworks exist, each with limitations compared to the resource-based dynamic framework. The life-course approach offers a broad perspective on retirement adjustment but lacks specific hypotheses about variable impacts (Wang, 2007). Stage theory provides specific predictions about how individuals adjust to retirement, emphasizing its dynamic nature. However, this specificity misses the variability existing in real-life situations, resulting in limited empirical support (Wang et al., 2011). Role theory views retirement as a transition that weakens work roles while strengthening family and community roles (Wang et al., 2011). In contrast, the resource-based dynamic framework focuses on changes in resources and their interdependence rather than just roles, and allows for a nuanced analysis of how changes in different resources contribute to mental health outcomes during retirement. Therefore, it is particularly well-suited to examining the implications of volunteering on mental health among early retirees, as it takes into account the interplay of social, financial, and emotional resources in this context.

Early and unplanned retirement is associated with an increased risk of depressive symptoms (Abrams et al., 2021). Such circumstances often result from organizational downsizing, making them similar to involuntary job loss (Fisher et al., 2015). This can lead to inadequate financial resources, which is a significant factor closely associated with mental health issues (Brand, 2015; Gallo et al., 2000). Furthermore, early retirement due to health issues is often linked to increased depressive symptoms. Early retirees, particularly those who retire involuntarily, may experience reduced social engagement, due to declining health, which can contribute to heightened depressive symptoms (Li et al., 2021). On the positive side, post-retirement volunteer work is associated with social resources (Musick and Wilson, 2003), which play an important role in the quality of retirement adjustment (Wang et al., 2011). For example, volunteer work and leisure activities facilitate adjustment to retirement, and generally support better mental health at older ages (Matthews and Nazroo, 2021). These interconnected factors suggest that early retirees may experience a greater risk of depression compared to those retiring at normative ages. This makes early retirees an especially interesting group for examining the potential benefits of volunteering on mental health.

Gender differences exist, with women who experience an involuntary job loss being more likely than men to suffer from depression (Gallo et al., 2000). A wife's depression might be aggravated by her husband's retirement (Xiong et al., 2024), especially if the wife anticipates

retirement having to care for her husband (Szinovacz and Davey, 2004). The impact of an early or a late exit from the workforce on an individual's risk of depression may be influenced by their level of education. For example, retirees with higher education often experience better financial stability (Atalay and Barrett, 2022), which can lead to reduced stress when leaving the workforce, whether they do so early or late. However, their decision to work may not be driven solely by financial reasons; many seek personal fulfillment as well. This desire for personal satisfaction can affect how their transition out of the labor force impacts their mental well-being. Low-educated individuals, by contrast, are disproportionately affected by involuntary early retirement, which is linked to a significant increase in depressive symptoms (Abrams et al., 2021).

In sum, the consequences of retirement and individual circumstances interact to manifest as health problems that contribute to increasing disparities, with individuals who retire early and involuntarily being at a substantial disadvantage.

The same resource-based dynamic framework suggests that volunteering can help retirees cope better with the mental health challenges of early retirement. Engaging in volunteer activities can benefit early retirees in various ways, including by offering them access to social opportunities; encouraging them to maintain and learn new skills; and improving their well-being by providing them with a sense of achievement, purpose, and community. Some volunteer activities require physical effort, which can be beneficial for retirees' physical health.

1.1. Volunteering and activity limitations

Volunteering can reduce the risk of depression through its effects on physical health. By helping older individuals stay active, strengthen social connections, and meet new people, volunteering enhances both informal and formal support networks, contributing to physical and emotional well-being (Choi et al., 2016). Additionally, it reduces the risk of developing limitations in ADLs (Weziak-Białowolska et al., 2024). Volunteering among older adults is linked to increased participation in preventive health measures, such as flu vaccines, cholesterol tests, and cancer screenings (Kim and Konrath, 2016), suggesting it may encourage healthier behaviours.

Volunteering positively impacts self-esteem, sense of control, psychological well-being, and life satisfaction, mitigating the psychological challenges that often accompany functional limitations. Volunteering protects against the debilitating effects of chronic conditions like heart disease, diabetes, and arthritis (Kail and Carr, 2016), which can impair ADLs. Engaging in volunteer activities in later life can slow the progression of physical disability (Carr et al., 2018), especially in case of activities involving increased physical activity (Pillemer et al., 2010). Women benefit from volunteering at both low and high levels, showing a significant reduction in disability progression, while men only experience benefits from volunteering when they engage at a higher intensity (Carr et al., 2018).

The positive effects of participating in volunteer activities are amplified by the community network. Initiatives led by volunteers, like walking groups, can encourage physical activity in communities with poor health profiles (Hanson et al., 2016). Volunteering seems to help older adults maintain a regular cortisol pattern, potentially preventing disruptions caused by stress related to functional disabilities (Huo et al., 2021).

More generally, volunteering is associated with a more positive perspective and more positive attitudes toward growing older (Huo et al., 2021). Such attitudes can buffer the stress and fear associated with aging by motivating elderly individuals to take better care of themselves and encouraging health care use, making better lifestyle choices such as regular exercising, which can, in turn, lead to improved physical and mental health (Ohrnberger et al., 2017). The magnitude of the positive impact of volunteering on health seems to depend more on the continuity of engagement than across sociodemographic and health

circumstances (Matthews and Nazroo, 2021). These factors are themselves predictors of participation in volunteering among elderly individuals (Erlinghagen, 2010; Hämmäläinen et al., 2024).

1.2. Activity limitations and depression

A substantial body of literature shows a connection between physical and mental health, with particular emphasis on the impact of physical impairment on mental well-being, especially depression. For instance, Gayman et al. (2008) show that physical limitations are associated with subsequent increases in depressive symptoms. Functional limitations, measured through ADLs, have been linked to the onset of depression, with patterns varying across race, gender, and socioeconomic status (Schieman and Plickert, 2007).

Gender plays a critical role in this relationship (Caputo and Simon, 2013). Women tend to report higher rates of both functional limitations and depression than men and exhibit a greater increase in depressive symptoms in response to these limitations, reflecting large gender disparities. Physical limitations can increase pain, which, combined with social stress, negatively affects the risk of depression (Gayman et al., 2008). Social and cultural factors may increase women's vulnerability to the psychological effects of physical limitations. For example, in the U.S. society, it is often expected that women should be the main caregivers (Ridgeway, 2011). Therefore, the inability to meet personal, social, familial, and occupational expectations can trigger depressive symptoms.

Moreover, functional limitations can reduce psychological and social resources, such as perceived social support and self-esteem, further worsening depression (Yang, 2006). Functional limitations are often conceptualized as chronic stressors that lead to depression, with differences in coping strategies and social roles affecting men and women differently, with consequent differences in the severity of their depressive symptoms related to functional limitations (Caputo and Simon, 2013).

In summary, the association between functional limitations and depression is not strictly unidirectional and may share underlying risk factors (Dapp et al., 2021; Hirvensalo et al., 2007). However, the impact of functional limitations on depression appears both stronger and more immediate (Gayman et al., 2008), with women facing an elevated risk.

1.3. The current study

The evidence from previous studies regarding the impact of volunteering on reducing depression in old age is inconclusive. Our study takes a new approach to investigating whether volunteering reduces depression among early retirees. This is especially important as the labor force in Western countries is aging and shrinking. Volunteering could be seen as an alternative for older individuals who do not want to or are unable to re-enter the labor market after retirement. We aim to provide new insights into the relationship between volunteering and depression, and to advance our knowledge on this relationship by examining limitations in ADLs as a potential causal mediator. Limitations in ADLs may mediate the relationship between volunteering (the exposure) and depression (the outcome), but might also confound the relationship between subsequent volunteering, depression, and time-varying covariates, such as comorbidities or labor market outcomes. As this intermediate confounding makes it difficult to determine the indirect effect of volunteering via limitations in ADLs on depression, it is important to address it in causal analyses.

Using a counterfactual approach by applying the parametric g-formula to data from the Health and Retirement Study (HRS), we simulate scenarios that allow us to contribute to the literature by addressing the following research questions: 1) Does volunteering during early retirement years reduce the risk of depression? 2) Does gender play a moderating role in the effect of volunteering on depression? 3) To what extent does the effect of volunteering operate through limitations in ADLs?

2. Data & methods

2.1. Analytical sample and variables

We used data from the Health and Retirement Study (HRS), a biennial survey representative of the U.S. population over age 50, which has been running since 1992. In our analysis, we used the RAND HRS Longitudinal File 2018 (Version 2) Health and Retirement Study. (2022), focusing on waves 4 to 14, beginning with the first wave that consistently collected the measures of interest and concluding prior to the COVID-19 pandemic. We restricted the sample to respondents aged 50 to 79 who had not retired before entering the study and had no missing data on other covariates, to leverage the longitudinal component of the data from 1998 to 2018. This design allows us to track employed individuals and observe the age at which they (early) retire, along with their volunteering behavior and the changes in other resources before and after early retirement.

The HRS provides high-quality data relevant to our analysis, including retrospective data on early-life environment and educational attainment, as well as biennial data on depression, health, marital status, volunteering and labor force participation with a low incidence of missing cases, consistently below 5%, which we excluded from our sample.

2.2. Outcome

Our outcome is derived from a binary translation of the widely-used eight-item Center for Epidemiological Studies Depression Scale (CES-D 8) for evaluating depression. This scale scores from zero to eight, with a score of three or above indicating high depressive symptoms (Steffick, 2000), and establishing the threshold for our binary indicator. In an alternative specification, we utilized an indicator of depression. Specifically, we used an indicator of the feelings of depression occurring much of the time during the week prior to the interview, as the outcome. This indicator comes from a single item on the CES-D 8 scale. We found that the results we obtained were qualitatively similar.

2.3. Primary exposure(s)

The primary exposure is a binary indicator that is equal to one when individuals participate in formal volunteer activities (through religious, educational, health-related, or other charitable organizations) for at least 100 h per year, and that is equal to zero otherwise.

2.4. Main covariates

We model and account for time-varying variables, including age, labor force status (employed, unemployed, retired, not in the labor force), the number of people in the household (one, two, three or more), partnership status (not partnered/not married), income quartile, the number of limitations in ADLs (none, one, two or more), and the number of comorbidities (none, one, two or more) the respondent ever had. These comorbidities include stroke, diabetes, heart problems, psychological problems, cancer, arthritis, and respiratory diseases. We also account for "non-paid help activity" via a binary variable indicating whether the respondent has dedicated at least 100 h in the last year to unpaid assistance to friends, neighbors, or out-of-household relatives (zero for "no").

2.5. Time-constant characteristics

We take into account gender (men, women); race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other), birth cohort (AHEAD – CODA – HRS, WB – EBB, MBB-LBB, EGENX), educational attainment (less than high school/GED, high school, some college, college and above), childlessness, baseline occupation (professional,

manual, service), family socioeconomic status during childhood (poor, average, well-off), census region (Northeast, Midwest, West, South, other), and religious preference (Catholic, Jewish, Protestant, other, none).

2.6. Analytical strategy

We use a counterfactual approach based on the longitudinal parametric g-formula (Robins, 1986) to create a simulated scenario (often referred to as an “intervention”) in which individuals in early retirement, i.e., individuals who retire at an age younger than age 65, volunteer until they turn age 70. We chose this age threshold based on the idea that volunteering can serve as a substitute for employment. Labor force participation is typically almost null for individuals above this age. Through this simulated scenario, we aim to examine the cumulative impact of continuously volunteering from early retirement through age 70 on depression among early retirees.

The relationship between volunteering and depression is dynamic and complex. There might be feedback effects between volunteering and depression, that is, they might affect each other, which creates estimation problems in standard regression settings (Imai and Kim, 2019). Modeling this relationship is further complicated when more variables are involved. For example, volunteering may induce early retirement through limitations in ADLs that can indirectly contribute to depression, thereby mediating the effect of volunteering on depression. However, volunteering may also be affected by depression and retirement status. Furthermore, at different points in time the outcome can also play the role of a confounder, as well as the role of a mediator. In other words, while depression may influence other variables over time, acting as a “confounder” of the relationship between volunteering and limitations in ADLs, depression might act as a “mediator” at other points in time. Therefore, standard regression models are not well-suited for this analysis, as they may yield biased results (Buckley et al., 2015; Picciotto and Hertz-Picciotto, 2015). Instead, the g-formula can account for time-varying confounders affected by previous exposures, and more generally allows to adjust for various sources of bias (Buckley et al., 2015; Keil et al., 2014).

We perform our analyses according to the direct acyclic graph (DAG) in Fig. 1. The relationships depicted in the DAG follow a cross-lagged design, which we implement using the parametric g-formula to reduce potential biases from reverse causation. In the cross-lagged models, variables at age t affect variables at age $t+1$, which helps us track how variables influence each other over time. The g-formula ensures that we account correctly for past outcomes when estimating current effects by modeling the joint distribution of the exposure and the outcome over time. This approach allows us to estimate the effect of volunteering on depression while controlling for potential feedback loops between the

exposure and outcome.

The algorithm description of the parametric g-formula that follows the DAG can be summarized in the following steps: 1) fit the multivariate models to the empirical data following the DAG; 2) define the intervention and mediation scenarios; 3) reproduce the observed data by keeping the baseline and the first time point and then simulate the follow-up times; 4) implement the interventions by simulating a scenario in which early retirees volunteer until age 70; and 5) contrast the natural course and the intervention scenario to assess the effect of volunteering on depression.

In step 1, we model the categorical variables through either logistic regressions or multinomial models, and the continuous variables with linear regression models. We predict probabilities and conditional expectancies from these models, which we then use to simulate the value of the corresponding variables for each individual at each age, drawing from the appropriate probability distributions. The simulated data that resemble the observed data are called the “natural course.” The intervention scenario is generated using the same procedure, but in the simulation, it is assumed that individuals who retire earlier than at age 65 volunteer until they reach age 70. The fixed value for volunteering has a cascading effect on the outcome, directly affecting depression and spreading its effects across all the simulated variables. We obtain confidence intervals using non-parametric bootstrap by resampling the analytical sample 500 times (Hernan and Robins, 2020; Keil et al., 2014). The resampling procedure preserves the longitudinal structure of the data. Within each bootstrap we conduct the simulation 50 times to reduce the variability due to the Monte Carlo simulations.

Contrasting the interventions to the natural course, we estimate the total effect (TE), which allows us to measure the impact of volunteering on depression. The TE is an unconditional estimate, a population-level measure. To assess the heterogeneity of the TE across different population subgroups, we estimate the TE by gender and educational attainment, and within racial/ethnic groups. Next, we perform mediation analysis to identify the factors or “pathways” through which volunteering affects depression. In particular, we evaluate whether and the extent to which disability, measured as limitations in ADLs, mediates the effect of volunteering on depression. Specifically, we estimate the indirect effect (IE) of volunteering on depression through the pathway of limitations in ADLs, and the direct effect (DE) of volunteering on depression through pathways other than limitations in ADLs. The decomposition of the TE in the direct effect (DE) and the indirect effect (IE) follows the definition provided in Wang and Arah (2015).

3. Results

The analytical sample consists of over 80,000 person-waves observed from 1998 to 2018, with individuals entering the sample while

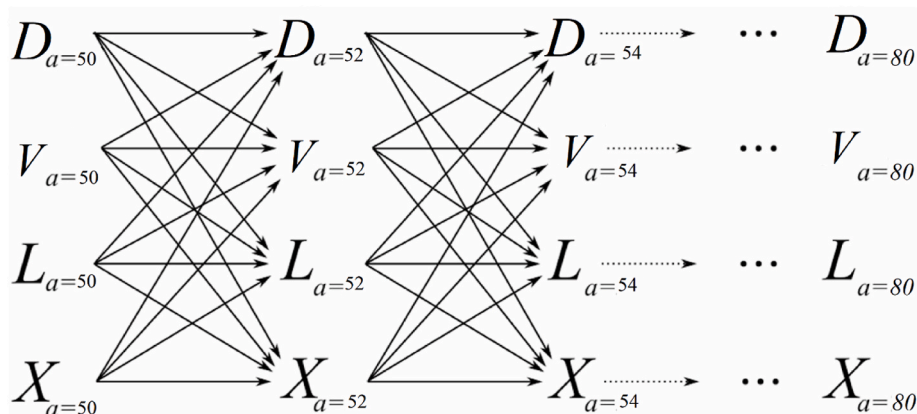


Fig. 1. Simplified directed acyclic graph (DAG) showing the age to age cross-lagged structure, whereby depression (D), labor force participation (L), and time-varying confounders and mediators (X) are associated across ages (a) 50 to 80.

employed. Their main characteristics are described in Table 1. Among those who suffer from depression, only 7.4% volunteer for more than 100 h per year, while the corresponding share for individuals not suffering from depression is 13.5%. The percentage of volunteers decreases as the number of limitations in ADLs increases. While 13% of individuals with no limitations in ADLs participate in volunteering, only 7% of those with two or more limitations in ADLs volunteer. People with higher education levels are more likely to volunteer, with over 21% of those with a college degree or higher participating in volunteer activities, compared to less than 5% of those with less than a high school degree. The share of volunteers is higher among retirees than among individuals who are participating in the labor force or who have left the labor market due to disability. Volunteering is also more common among individuals who help more frequently. There are no significant gender differences among volunteers, but the frequency of volunteering is higher among White and Black individuals than among Hispanics.

Fig. 2 shows the results from the natural course with 95% confidence intervals plotted against the observed prevalence of depression by age in the analytical sample from the HRS data. Overall, the simulated natural course scenario appears to adequately approximate the age distribution of the outcome, as despite the irregular observed distribution, the simulated distribution almost always contains the observed data within the 95% bands. Moreover, most importantly, the simulated data appropriately describes the observed depression patterns by age and gender. The share of the sample reporting depression is 17% at age 50, declines to below 15% at age 65, and then increases to 18% at around age 80. Fig. 2 also suggests that around the statutory retirement ages, there are no discontinuities in the depression pattern, with depression declining until age 70. The age pattern of depression is similar for men

and women, although the level is (about 5 percentage points) higher for women.

3.1. Volunteering as an alternative to early retirement

We assess the effect of volunteering on depression among early retirees. That is, we evaluate the effect of a hypothetical intervention that makes retirees younger than age 65 engage in formal volunteering (100+ hours per year). Assuming individuals volunteer until they reach age 70 affects all the related time-varying variables in a cascading fashion. That is, unlike in standard regression models, the volunteering intervention is not implemented by keeping “everything else equal,” but rather by simulating what would happen to depression levels if individuals in early retirement volunteered, which also has implications for physical health and functional limitations as well as for all of the other characteristics that vary with time and are related to volunteering and depression. In the analytical sample, early retirees constitute approximately one-third of the total population and contribute roughly one-third of the total person-waves.

The results of the intervention are plotted by age in Fig. 3. In the upper panel, the age trajectory resulting from the intervention scenario is compared to the corresponding trajectory in the natural course, by gender. The lower panel displays the age trajectory, by gender, of the difference in depression prevalence between the natural course and the intervention, that is, the total effect (TE) of the intervention.

Despite the variation by age and gender, the results indicate that volunteering reduces depression. Averaging across the age trajectories, the intervention causes a reduction in the prevalence of depression in the population of about 5% (-0.009 pp; 95% CI: -0.012, -0.004), with a 4.2% reduction among men (-0.006 pp; 95% CI: -0.011, -0.002) and a 5.5% reduction among women (-0.011 pp; 95% CI: -0.015, -0.006). While the beneficial effects of volunteering appear to be modest, it is important to emphasize that these estimates refer to the entire population. This intervention, however, is aimed specifically at early retirees, which make up a small subgroup of the overall population.

Fig. 4 shows the age and gender trajectories of the difference in the probability of having depression between the natural course and the simulated intervention, that is, the treatment effect on the treated (ATT – the effect of volunteering on depression among individuals who retired earlier than at age 65).

Similar to the TE, volunteering until age 70 has beneficial effects on depression for both men and women, with these effects persisting beyond ages 76–77. At older ages, the effects remain positive but show greater variability. These long-term effects stem from the cumulative benefits of volunteering, both directly and indirectly, on depression. Averaging across ages, the intervention causes a reduction in the prevalence of depression of about 10.6% (-0.020 pp; 95% CI: -0.030, -0.011) among the treated, with a 9.2% reduction among men (-0.015 pp; 95% CI: -0.027, -0.004) and an 11.6% reduction among women (-0.025 pp; 95% CI: -0.034, -0.013).

3.2. Mediation

To better understand how volunteering reduces depression, we explored the role of limitations in ADLs as a mediating factor in this relationship. Our findings, in Table 2, indicate that limitations in ADLs account for 11% of the TE of volunteering on depressive symptoms, with no large gender differences. In other words, 11% of the TE of volunteering on depression is attributable to a reduced likelihood of developing limitations in ADLs until early retirees age 70. Therefore, while limitations in ADLs represent just one contributing factor, they still play a role in the relationship between volunteering and depression, even though most of the impact is due to other factors.

Table 1
Key descriptive statistics of the analytical sample by volunteer hours.

| | Volunteer hours ≥ 100+ (%) | Volunteer hours <100+ (%) | n |
|---|-------------------------------|------------------------------|--------|
| Total | 12.5 | 87.5 | 81,462 |
| Depression (CES-D 8 ≥ 3) | | | |
| Not depressed | 13.5 | 86.5 | 67,516 |
| Depressed | 7.4 | 92.6 | 13,946 |
| Age | | | |
| Mean | 53.3 | 52.5 | |
| Gender | | | |
| Men | 12.3 | 87.7 | 36,236 |
| Women | 12.6 | 87.4 | 45,226 |
| Race/ethnicity | | | |
| Whites | 13.3 | 86.7 | 54,437 |
| Blacks | 13.6 | 86.4 | 14,300 |
| Hispanics | 6.4 | 93.6 | 9,948 |
| Other | 11.1 | 88.9 | 2,777 |
| Education | | | |
| LTHS/GED | 4.4 | 95.6 | 14,480 |
| HS | 8.6 | 91.4 | 22,996 |
| Some college | 12.9 | 87.1 | 21,616 |
| College+ | 21.3 | 78.7 | 22,370 |
| Labor force status | | | |
| Employed | 11.1 | 88.9 | 46,575 |
| Retired | 14.8 | 85.2 | 31,422 |
| Unemployed | 11.6 | 88.3 | 1,628 |
| NILF or disabled | 8.6 | 91.4 | 1,837 |
| Help to friends, relatives, neighbors, 100+ hours | | | |
| No | 10.4 | 89.6 | 72,668 |
| Yes | 29.8 | 70.2 | 8,794 |
| Comorbidities | | | |
| 0 | 12.4 | 87.6 | 26,282 |
| 1 | 12.6 | 87.4 | 28,599 |
| 2+ | 12.4 | 87.6 | 26,581 |
| Limitations in ADLs | | | |
| 0 | 12.8 | 87.2 | 74,080 |
| 1 | 10.1 | 89.9 | 4,260 |
| 2+ | 6.8 | 93.2 | 3,122 |

Note: This table is limited to the key variables in our sample. The full table is available in the appendix.

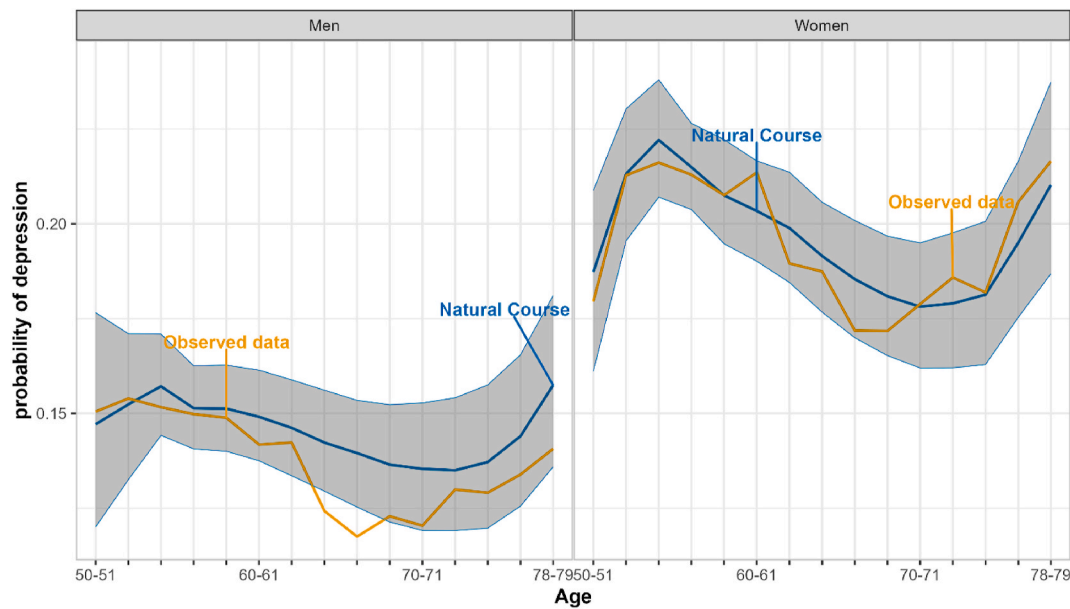


Fig. 2. Age pattern of depression - natural course (simulated) vs. observed depression.

3.3. Dynamic intervention

Engaging in volunteer activities at older ages is feasible if people are healthy enough to participate in such activities. To reflect this prerequisite and to make the simulated intervention more realistic, we simulated a different intervention scenario. In this simulation, retirees younger than age 65 engage in volunteer activities until they reach age 70, but only if they are physically capable of participating; that is, we assume that only individuals with no limitations in ADLs volunteer, and make the intervention dynamic, as people's disability levels may change over time. The results show a reduction in depression of about 4.2% (−0.007 pp; 95% CI: −0.010, −0.004) in the total population, with a 3.5% reduction among men (−0.005 pp; 95% CI: −0.009, −0.001) and a 4.7% reduction among women (−0.009 pp; 95% CI: −0.013, −0.005); complete results are available in Table 5a in the appendix. The results obtained from the dynamic intervention are very similar to those from the volunteering intervention, regardless of the presence of limitations in ADLs. This indicates that volunteering during early retirement is not only feasible and effective in reducing depression, but is also beneficial for physical health, lowering the likelihood of developing limitations in ADLs and delaying their onset.

4. Discussion

Previous studies suggest that early and unplanned retirement is associated with a higher risk of depressive symptoms, similar to the effects of involuntary job loss. Engaging in post-retirement volunteer work, on the other hand, has been found to provide resources that support better retirement adjustment and improved mental health. Our study shows that volunteering during early retirement reduces the risk of depression, irrespective of gender. Therefore, early retirees who engage in volunteering continue to contribute to society, and remain in good health longer.

Our findings suggest that the benefits of volunteering among early retirees extend to the general population. To put the results into perspective, in 2020, there were approximately 105 million individuals aged 50 to 79 in the U.S., and about 11% were living with depression. Therefore, the reduction of 0.009 in the probability of depression resulting from the simulated intervention means that out of the roughly 11 million elderly individuals living with depression—of which 6.5 million were women—around 900,000 fewer people experience

depression, with two-thirds of this reduction attributed to women.

We also found that the positive effects of volunteering on depression are mediated by its impact on limitations in ADLs, demonstrating broader health benefits beyond reducing depression. Specifically, volunteering helps delay and lower the risk of developing ADL limitations, consistent with previous research (e.g. Carr et al., 2018; Hanson et al., 2016; Kail and Carr, 2016; Weziak-Bialowolska et al., 2024). While prior studies have established a link between volunteering and reduced depression in Europe and the U.S., they did not explicitly address intermediate confounding or reverse causation. Nonetheless, the consistency of these findings across varied social, economic, and policy contexts suggests a causal relationship. Expanding on this evidence, our study demonstrated a reduction in depression through a simulated intervention involving volunteering, accounting for potential confounders and highlighting the mediating role of ADL limitations.

Volunteering during retirement enhances individual well-being reducing depressive symptoms, contributing to maintain physical health and fostering a sense of purpose, while also generating significant economic and social value. In 2021, more than 60 million formal volunteers generated economic value of more than \$120 billion (AmeriCorps.gov, 2023). In the US, various initiatives encourage volunteering among older adults. Important federal programs for those aged 55 and older include the Foster Grandparents Program, which gives stipends to low-income adults mentoring disadvantaged youth; the Senior Companion Program, supporting seniors who assist frail individuals; and the Retired and Senior Volunteer Program (RSVP), which promotes diverse volunteer activities like tutoring and disaster assistance. Morrow-Howell et al. (2018) review a broader range of initiatives that highlight these and other volunteer opportunities available for seniors.

As governments delay statutory retirement ages, it is essential to recognize the potential reduction in volunteer participation and address it preventively. Beyond its economic benefits, volunteering supports nonprofit organizations (Sheard, 1995) and fosters social cohesion (Ackermann et al., 2023), and thus contributes to a more united and supportive society.

Volunteering helps mitigate health and social risks associated with retirement by offering engagement, routine, and meaningful interactions. Therefore, policies that support and incentivize volunteering can enhance societal well-being. However, as governments increase statutory retirement ages, the availability of volunteers may decline. In

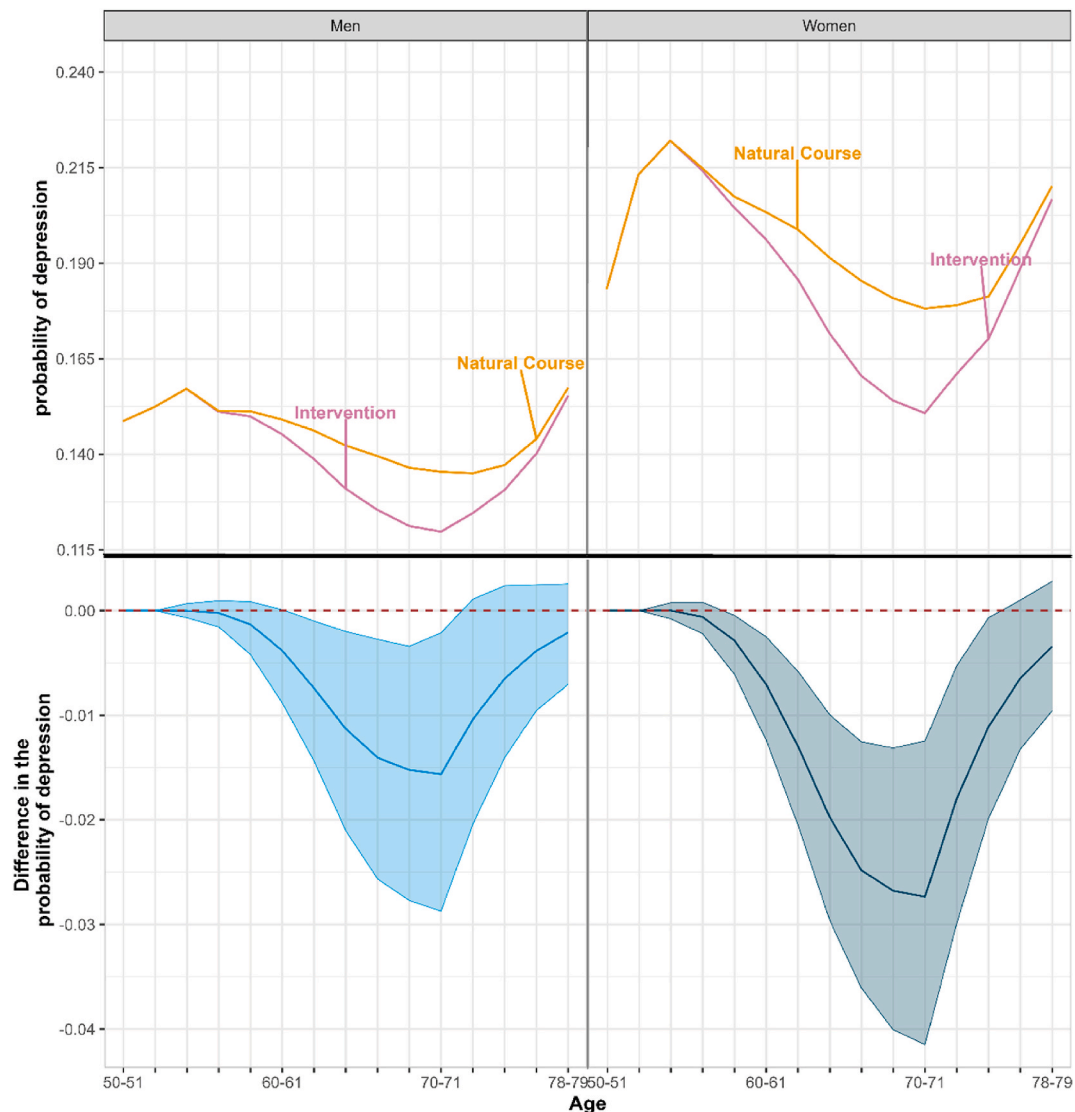


Fig. 3. Natural course vs. intervention scenario (upper panel) and their difference by age, with 95% CI (lower panel).

the U.S., the federal government increased the full statutory retirement age to 67 for individuals born in 1960 to sustain the welfare system. Yet, evidence suggests that incentivizing individuals to retire at older ages does not always translate into longer working lives (Dudel and Myrskylä, 2017). If people start to retire at older ages, the availability of volunteers may be reduced (Zhu, 2021).

Our findings support the idea of implementing policies to encourage volunteering during early retirement. While a policy targeting the entire population might be challenging to design and the benefits of mandatory interventions uncertain, promoting volunteering among early retirees without ADLs limitations could yield comparable benefits across the broader population. This targeted approach appears more feasible and reduces the potential for spillover effects. Given that volunteering is a “social” intervention that does not involve medication, and the indirect benefits of reduced limitations in ADLs, it appears the effects of volunteering are largely beneficial.

The main question that arises in this context is whether volunteering reduces depression among early retirees, or is just the result of selection. The resource-based dynamic framework (Wang et al., 2011) suggests that volunteering enhances individual life satisfaction and increases well-being. We expanded our analysis to compare the impact of volunteering on depression between early retirees and individuals who retire at age 65 or older. Our findings indicate that the ATT for those retiring at

65 or older is similar to that for early retirees. This suggests that volunteering has mental health benefits for both groups (results are available in the supplementary material). To assess the robustness of our results, we also restricted the sample to the period 2004–2018 (to observe individuals aged 50 up to age 64 – just before normal retirement). Results are very close to those obtained in the full sample, but more uncertain due to a smaller sample size.

The implementation of our proposed intervention to increase volunteering among early retirees must address potential challenges and include strategies that involve government support, corporate participation, and individual incentives. One of the most important aspects to consider is how to enable older adults to easily access and participate in volunteering activities. For retirees with mobility or transportation issues, expanding home-based volunteer options is essential. Introducing incentives could effectively motivate more retirees to participate in community service, particularly those with irregular work histories and low pension incomes. These incentives may include educational credits, stipends, but also indirect benefits from volunteering, such as opportunities for social interaction and skill development. Collaboration with the corporate sector is crucial for promoting volunteering. Companies can create programs to increase employee participation, encouraging ongoing involvement post-retirement. Policymakers could offer incentives like subsidies or tax credits to motivate businesses to implement

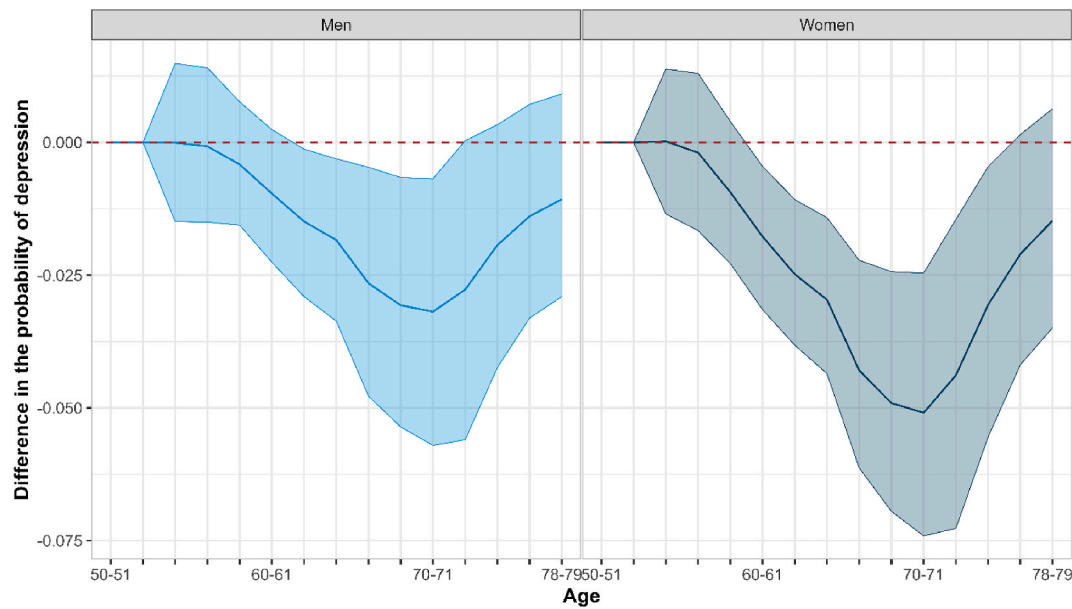


Fig. 4. Difference in the probability of depression between the natural course and the simulated intervention among the treated (ATT) with 95% CI, by gender.

Table 2
Decomposition of TE in DE and IE through ADLs with CI, by gender.

| gender | TE | 2.5% | 97.5% | DE | 2.5% | 97.5% | IE | 2.5% | 97.5% |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Total | -0.009 | -0.013 | -0.004 | -0.008 | -0.011 | -0.004 | -0.001 | -0.003 | 0.001 |
| Men | -0.006 | -0.011 | -0.002 | -0.006 | -0.010 | -0.001 | -0.001 | -0.003 | 0.002 |
| Women | -0.011 | -0.015 | -0.006 | -0.010 | -0.014 | -0.005 | -0.001 | -0.003 | 0.002 |

volunteer time policies, including paid or unpaid leave for community service.

In additional analyses, we explored the moderating role of race and education. Our findings, available upon request, support the existing evidence that disadvantaged individuals, including those who are the least educated and from racial minorities and are less likely to participate in volunteer activities, experience greater benefits (see Carr et al., 2015). Future studies should further examine the heterogeneity of the effects of volunteering. Research should explore how job-related fulfillment influences volunteer motivation and its subsequent impact on depression, alongside the role of health disparities. More research is also required to understand how psychological attitudes affect the relationship between volunteering and depression, as well as to clarify the role of community networks. It would also be valuable to examine how outcomes may differ depending on the type of volunteering activity.

4.1. Limitations

This study unavoidably has some limitations. Our measure of volunteering frequency is broad, as we lack detailed data on its intensity or the specific activities participants engaged in. It may also be subject to measurement error since it relies on recall data. Furthermore, we cannot assess the long-term effects of volunteering before age 50 on depression with the current data, which may slightly overestimate the positive effect. However, any related bias is expected small, as volunteering during the studied ages likely mediates most long-term effects. Another limitation is the potential healthier selection of employed individuals, who may have lower dropout rates due to mortality or non-response. This could lead to an overestimation of the causal effects of volunteering.

4.2. Methodological considerations

Our analytical approach relied on three key assumptions to ensure the accurate identification of causal effects: positivity, consistency, and exchangeability. Positivity implies that every participant in our research had a non-zero probability of receiving the intervention, which was to volunteer. In our analytical sample, this was not particularly problematic. We also simulated an intervention specifically for “healthy” individuals to ensure that the intervention was feasible, and we obtained similar results. There are various factors that might influence why individuals choose to volunteer. These factors can include personal motivations or individual factors, family influence or family ties, as well as the influence of the larger community or community characteristics. The consistency assumption states that the intervention must be clearly and consistently defined to accurately reflect the effect of volunteering on depression.

Our simulated intervention was based on an observational experiment, not a policy measure. As such, the simulated scenario tried to mimic societal conditions using a simplified model of volunteering behavior that captured its observed distribution in society. Thus, our simulation is likely to be of major interest to policymakers, social scientists, and community organizers (VanderWeele and Hernan, 2013), as it can help them in shaping more effective social policies, promoting societal engagement, and developing strategies aligned with people’s natural tendencies to volunteer. The exchangeability assumption required us to control for all relevant confounders so that volunteers and non-volunteers could be compared conditional on measured covariates. Our study, like all observational studies, is not free from potential problems due to residual confounding, that is, due to unobserved or inaccurately measured variables. Therefore, when trying to estimate causal effects, we cannot be entirely certain that bias has been eliminated. However, to enhance the credibility of our results, we conducted a dynamic intervention and used a different variable to measure

depression in an alternative model, and restricted the analysis to fewer waves. These alternative approaches yielded similar results, which further supports the validity of our findings.

In summary, our findings indicate that supporting workers who are leaving the workforce early and encouraging them to engage in volunteering is an important strategy for promoting well-being among Americans of retirement age and contributing to the greater good. Even if the effect of volunteering on depression appears to be small, the overall impact remains highly beneficial considering the indirect effect through the reduced risk of developing limitations in ADLs paired with the benefits to the community, the social and economic value of which is undebatable.

CRedit authorship contribution statement

Angelo Lorenti: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Alessandra De Rose:** Writing – review & editing, Conceptualization. **Filomena Racioppi:** Writing – review & editing, Conceptualization.

Ethics approval

This study uses only secondary data analysis of the publicly available data in the Health and Retirement Study, a longitudinal project sponsored by the National Institute on Aging (NIA U01AG009740) and the Social Security Administration. Ethical approval for the Health and

Retirement Study was obtained from the University of Michigan Institutional Review Board.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2025.117790>.

Appendix

Table 3a
Descriptive statistics of the analytical sample by volunteer hours.

| | Volunteer hours ≥ 100+ (%) | Volunteer hours <100+ (%) | n |
|--------------------------------|-------------------------------|------------------------------|--------|
| Total | 12.5 | 87.5 | 81,462 |
| Depression (CES-D 8 ≥ 3) | | | |
| Not depressed | 13.5 | 86.5 | 67,516 |
| Depressed | 7.4 | 92.6 | 13,946 |
| Age | | | |
| Mean | 53.3 | 52.5 | |
| Gender | | | |
| Men | 87.7 | 12.3 | 36,236 |
| Women | 87.4 | 12.6 | 45,226 |
| Race/ethnicity | | | |
| Whites | 13.3 | 86.7 | 54,437 |
| Blacks | 13.6 | 86.4 | 14,300 |
| Hispanics | 6.4 | 93.6 | 9,948 |
| Other | 11.1 | 88.9 | 2,777 |
| Education | | | |
| LTHS/GED | 4.4 | 95.6 | 14,480 |
| HS | 8.6 | 91.4 | 22,996 |
| Some college | 12.9 | 87.1 | 21,616 |
| College+ | 21.3 | 78.7 | 22,370 |
| Family wealth during childhood | | | |
| Poor | 11.3 | 88.7 | 21,968 |
| Average | 12.5 | 87.5 | 52,872 |
| Well-off | 15.9 | 84.1 | 6,622 |
| Cohort | | | |
| AHEAD-CODA-HRS | 12.2 | 87.8 | 24,960 |
| EGENX | 13.7 | 86.3 | 387 |
| MBB-LBB | 12.1 | 87.9 | 20,414 |
| WB-EBB | 12.8 | 87.2 | 35,701 |

(continued on next page)

Table 3a (continued)

| | | Volunteer hours ≥ 100+ (%) | Volunteer hours <100+ (%) | n |
|---|------------------|-------------------------------|------------------------------|--------|
| Region | Northeast | 12.0 | 88.0 | 12,112 |
| | Midwest | 12.9 | 87.1 | 19,133 |
| | South | 12.0 | 88.0 | 33,724 |
| | West | 13.1 | 86.9 | 16,381 |
| | Other region | 16.1 | 83.9 | 112 |
| Baseline Occupation | Professional | 19.5 | 80.5 | 27,070 |
| | Services | 10.0 | 90.0 | 35,671 |
| | Manual | 6.9 | 93.1 | 18,721 |
| Religion | Protestant | 14.4 | 85.6 | 48,060 |
| | Catholic | 9.3 | 90.7 | 21,882 |
| | Jewish | 13.8 | 86.3 | 1,520 |
| | None/no pref. | 8.5 | 91.5 | 8,049 |
| | Other | 16.0 | 84.0 | 1,951 |
| Childless | No | 12.4 | 87.6 | 75,341 |
| | Yes | 13.8 | 86.2 | 6,121 |
| Married/in a partnership | No | 10.8 | 89.2 | 25,010 |
| | Yes | 13.2 | 86.8 | 56,452 |
| Labor force status | Employed | 11.1 | 88.9 | 46,575 |
| | Retired | 14.8 | 85.2 | 31,422 |
| | Unemployed | 11.6 | 88.3 | 1,628 |
| | NILF or disabled | 8.6 | 91.4 | 1,837 |
| Income quartiles | q1 | 6.8 | 93.2 | 11,740 |
| | q2 | 10.0 | 90.0 | 17,192 |
| | q3 | 13.0 | 87.0 | 23,170 |
| | q4 | 15.8 | 84.2 | 29,360 |
| Number of people in HH | 1 | 11.9 | 88.1 | 14,976 |
| | 2 | 13.2 | 86.7 | 41,631 |
| | 3+ | 11.5 | 88.5 | 24,855 |
| Help to friends, relatives, neighbors, 100+ hours | no | 10.4 | 89.6 | 72,668 |
| | yes | 29.8 | 70.2 | 8,794 |
| Comorbidities | 0 | 12.4 | 87.6 | 26,282 |
| | 1 | 12.6 | 87.4 | 28,599 |
| | 2+ | 12.4 | 87.6 | 26,581 |
| Limitations in ADLs | 0 | 12.8 | 87.2 | 74,080 |
| | 1 | 10.1 | 89.9 | 4,260 |
| | 2+ | 6.8 | 93.2 | 3,122 |

Table 4a
TE and ATT with 2.5 and 97.5 CI, by gender.

| set | gender | Theta | 2.5% | 97.5% |
|-----|--------|--------|--------|--------|
| TE | Total | -0.009 | -0.012 | -0.004 |
| TE | Men | -0.006 | -0.011 | -0.002 |
| TE | Women | -0.011 | -0.015 | -0.006 |
| ATT | Total | -0.020 | -0.030 | -0.011 |
| ATT | Men | -0.015 | -0.027 | -0.004 |
| ATT | Women | -0.025 | -0.034 | -0.013 |

Table 5a
TE obtained contrasting the natural course with the scenario with early retirees volunteering until age 70 irrespective of the presence of limitations in ADLs vs. TE obtained contrasting the natural course with the dynamic intervention scenario in which retirees volunteer only when they have no limitations in ADLs, with 2.5 and 97.5 CI, by gender.

| gender | SET | Theta | 2.50% | 97.50% |
|--------|--------------------------------|--------|--------|--------|
| Total | TE | -0.009 | -0.012 | -0.004 |
| | TE in the dynamic intervention | -0.007 | -0.010 | -0.004 |
| Men | TE | -0.006 | -0.011 | -0.002 |

(continued on next page)

Table 5a (continued)

| gender | SET | Theta | 2.50% | 97.50% |
|--------|--------------------------------|--------|--------|--------|
| Women | TE in the dynamic intervention | −0.005 | −0.009 | −0.001 |
| | TE | −0.011 | −0.015 | −0.006 |
| | TE in the dynamic intervention | −0.009 | −0.013 | −0.005 |

Data availability

Code will be made available upon request. Interested researchers can obtain the data and fully replicate all our findings using the code we provide.

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