Social participation and health over the adult life course: Does the association strengthen with age?

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ABSTRACT

Rationale: Studies have consistently found positive associations between social participation and health, but it is unclear if they vary across the life course. Younger individuals are likely to initiate and benefit from social participation in different ways from older individuals, which may in turn alter its overall influence on health outcomes. Age-varying associations, if present, may then attenuate or amplify the health consequences stemming from changes in social participation over the adult life course. **Objective:** To assess the strength of the association between social participation and health across the life course, and whether it increases with age. **Methods:** I use five waves of panel data (N=11202 person-year observations) from the Americans' Changing Lives Survey, collected over 25 years (1986-2011), to examine the association of formal and informal social participation with (1) the number of chronic health conditions and (2) depressive symptoms, focusing on whether these associations become stronger with age. Growth curve models (stratified by gender) with an accelerated longitudinal design were used to construct age trajectories of the dependent variables. An interaction term was then included to test for age-varying effects for each health outcome. **Results:** Results show that only the association between formal social participation and depressive symptoms grew stronger with age, and only for men. For women, positive associations between social participation and health were found, but seemed to remain consistent over the life course. **Conclusion:** Findings suggest that the social participation and health association over the life course is likely to be contingent on gender, the type of social participation, and the specific health outcome being considered.

KEYWORDS

social participation; gender; depressive symptoms; chronic illness; age trajectories; life course

It is well established that social participation is positively associated with better health outcomes overall (Dahan-Oliel et al., 2008; Leone & Hessel, 2015), but also that it tends to decline with age (Bukov et al., 2002; Lee et al., 2008; Marcum, 2013). To date, most studies tend to assume that salubrious health effects from social participation are consistent over the life course, and thus automatically associate lower levels of social participation with a directly proportional increase in the risk of worse health (e.g., Coyle & Dugan, 2012; Klinenberg, 2016). It is vital to note, however, that if the association between social participation and health varies by age, risks of worse health in later life due to a decline in levels of social participation may either be negated or amplified over time. For instance, if the strength of the association were to increase over the life course, health risks associated with a drop in social participation in later life may be amplified (compared to a drop experienced earlier in life) because of its greater salience as one ages. This underscores the need to understand social participation and its association with health outcomes as a dynamic relationship that unfolds over the life course.

Results from the few studies that do investigate age as a moderator of the social participation and health relationship have been mixed. While some researchers suggest that older adults may not be as affected by a lack of social participation compared to younger adults (e.g., Larson, 1990; Sun, 2017), others seem to find, in contrast, that the effect of social participation on health increases with age (e.g., Lee et al., 2008; Myroniuk & Anglewicz, 2015). It is likely that these mixed results are at least partially due to data limitations.

I therefore investigate whether and how the association between social participation and health changes with age. Analyzing nationally representative longitudinal U.S. data collected over 25

years, I examine depressive symptoms and the number of chronic health conditions as health outcomes. Results suggest that health benefits from social participation are not limited to older adults, providing only partial support for the hypothesis that health effects from social participation change with increasing age.

Background

Linking social participation to health

The presence of social ties and roles play a vital role in integrating people into society, and can influence health outcomes for both the individual and society at large. Most scholars have argued that social participation consists of two main components – formal and informal participation (Levasseur et al., 2010; van Ingen, 2008). Formal social participation entails involvement in formal groups and organizations in the community, while informal social participation refers to the level of contact and time spent with family and friends.

Health benefits from social participation have been consistently found for a wide range of physical and mental health outcomes (Dahan-Oliel et al., 2008; Leone & Hessel, 2015). There is considerable evidence that social participation reduces mortality risk across a variety of geographical and cultural contexts (Agahi & Parker, 2008; Berkman et al., 2004), and is positively associated with subjective health indicators such as quality of life and self-rated health (Dahan-Oliel et al., 2008; Li et al., 2011). Recent studies using longitudinal panel data have also helped to establish evidence for a causal interpretation of the benefits of social participation. These studies demonstrate that social participation can slow both cognitive (C. Haslam et al., 2014) and functional decline (Tomioka et al., 2017), as well as reduce depressive symptoms

(Croezen et al., 2015), amongst other health problems. One reason for this is that social participation promotes a stronger sense of social identity through group membership, which can in turn shape health behavior and promote self-esteem (S. A. Haslam et al., 2009). It is notable, however, that these health outcomes are differentially distributed over the life course (Clarke et al., 2011), which should be accounted for.

Social participation over the life course

The life course perspective recognizes that outcomes at every age are dynamic and cumulative, and resolves that the human experience should be understood across time (Fuller-Iglesias et al., 2009). Sociologists have long recognized that society is structured around chronological age - both formally (in the form of institutionalized age requirements and exclusions) and informally (through perceptions of age-appropriate behavior and roles) (Riley, 1987). This means that individuals from different age groups are likely to occupy a different set of social roles and responsibilities (e.g., marriage, work, retirement) at each stage of the life course, and thus may experience everyday life in markedly dissimilar ways. These differences are further entrenched by societal perceptions and expectations constructed around age boundaries (e.g., too young to get married, too old to go to school) (Chudacoff, 1992).

Therefore, while social participation may primarily be a strategy for older adults to cope with loneliness or to prevent the onset of chronic illness and functional limitations (Goll et al., 2015; Holmes & Joseph, 2011), social participation among the youth tends to be more directed at promoting civic engagement and/or community organization (Driskell, 2017). A younger person is therefore likely to experience social participation (or lack thereof) in a different way from an

older individual (Klinenberg, 2012), and health benefits gleaned from participation may vary as a result.

Prior research around social participation and health, however, has typically been restricted to older adults, without considering how this association may vary for individuals in early or mid-adulthood. A large part of this emphasis on older adults is driven by uncertainties that come with an aging population. Because social participation potentially enables older adults to live longer and remain productive without extended periods of morbidity, policymakers and researchers alike have found it important to craft and test interventions targeted specifically at increasing the level of social participation among older adults (Holmes & Joseph, 2011; Raymond et al., 2013).

Does age moderate the effect of social participation on health?

The proposition that the effect of social participation on health may vary between subgroups is not new. Apart from differences by age, studies have found that salubrious effects of social participation on health within the older adult population are moderated by other factors, such as socioeconomic status and gender. For instance, Ashida et al. (2016) find that social participation was more protective against functional disability for older adults who were more highly educated. Studies conducted in a range of countries have found that men and women benefit from different types of activities considered under the rubric of social participation (Adams et al., 2011; Leone & Hessel, 2015; Li et al., 2011; Takagi et al., 2013).

Yet, the extant literature has essentially glossed over *age* as a key modifier of the association between social participation and health. As highlighted earlier, this gap fails to account for the

fact that social roles and statuses are often structured according to age, in turn affecting the ways in which one perceives and is affected by social participation. For example, Larson (1990) finds that older individuals, compared to younger, are less emotionally disturbed by solitude. An explanation for this is that while individuals are often subject to social and time pressures earlier on in life, older adults are able to see time alone as "a respite from a time in the life course when doing leisure alone was not as viable" (Marcum, 2013, 635). While this intuition expects that the effects of social participation (especially on mental health) will diminish in later life since one gradually learns to cope with 'alone time', it should also be noted that pathways from social participation to health appear to be more pertinent for older adults. For instance, social participation reduces feelings of isolation, partly through enabling role continuity/replacement through continued engagement with familiar others and promoting greater personal mastery (Thoits, 2011). These experiences, however, are more common to older persons (Coyle & Dugan, 2012), who are more likely to face role-identity absences as work and childrearing responsibilities subside in later life. A reduced sense of personal mastery also tends to come with increasing age, due to decreased mobility (Jang et al., 2002).

Given increasing numbers of older adults who live alone in America's aging society – and seldom by choice (Klinenberg, 2001) – factors surrounding the concomitant loss of social roles and physical functioning in later life are likely to outweigh the possibility of enjoying (or coping with) time alone (Larson, 1990). This is in stark contrast to younger adults, who are often more in control of how and when to spend time alone (Klinenberg, 2012). Further, given that a primary way that social participation affects health is through the strengthening of social norms and social identity (S. A. Haslam et al., 2009; Thoits, 2011), social participation may be more

important for the health of older (compared to younger) adults since they are more likely to face losses in social roles and group memberships with fewer chances of regaining them (e.g., going back to work, becoming a parent to a young child again). Consequently, it may be expected that social participation will begin to matter more (rather than less) as one grows older.

To date, most studies considering age trajectories across the adult life span only address how the prevalence of social participation (and not its association with health) changes through the aging process. Some scholars suggest that informal participation decreases with age because one has fewer living friends and family (Ajrouch et al., 2005; Morgan, 1988). Older adults have also been thought to spend less time with others in general, regardless of the activity in question (Marcum, 2013). The socioemotional selectivity theory (Carstensen, 1991) understands this as a move toward a smaller social network and better quality of relationships based around close and friends in later life. On the other hand, others have argued that while forms of participative activities may change through the aging process to adapt to the onset of functional limitations and changes in networks, overall levels of participation tend to remain stable (Bukov et al., 2002). These studies, however, often implicitly assume that the strength of the association between social participation and health remains constant across the life course. Those who engage less regularly in socially participative activities at older ages are thus often perceived as being at greater risk of worse health (e.g., Coyle & Dugan, 2012; Klinenberg, 2016).

Current evidence from studies investigating whether age modifies the effects of social participation on health provide, at best, mixed conclusions. Many of these studies delimit their sample to older adults (i.e. aged 65+), and are mainly concerned with mortality as an outcome.

Most then find support for the hypothesis that the benefits of social participation for health decline with age. For instance, Bowling and Grundy (2009) find in the United Kingdom that social participation reduces the risk of 20-year mortality for those aged between 65 to 85, but not for those above 85 years of age. Analyzing data from a large Chinese sample, Sun (2017) also finds that the protective effects of social participation against 6-year mortality diminishes with increasing age. By contrast, results from a handful of studies analyzing data wide from a wider age range tell a very different story. Lee et al. (2008) find among South Koreans that the association of social participation with self-rated health in fact increases with age. Similarly, Myroniuk and Anglewicz (2015) find in Malawi that participation in monthly social events are associated with better physical health after two years, but only for those aged 45 and above.

Research objectives

Prior research specifically addressing age as a moderator has two key limitations. First, because most studies are limited to older adults, we only have a partial understanding of how social participation affects health over the life course. Thus, while researchers and policymakers are often quick to depict social participation as vital "for older adults", it remains difficult to gauge whether these effects continue from younger ages or suddenly become more pronounced after entering "old age". Second, studies that do include a wider age range are either cross-sectional (e.g. Lee et al., 2008), or have short periods of follow-up (e.g. Myroniuk & Anglewicz, 2015). They therefore do not consider trajectories of health over extended periods, and may be capturing health differences between cohorts instead of by age. This article addresses both these limitations, and contributes to the conversation around social participation and health by seeking

to answer a key research question: Does the effect of social participation on health change with age? I test two broad hypotheses.

Hypothesis One – There is a positive association between social participation and health across the life course

Hypothesis Two – The effect of social participation on health increases with age

To do so, I use longitudinal data collected over 25 years to examine the age trajectories of two health outcomes – (1) the number of chronic health conditions; and (2) the extent of depressive symptoms – and examine how social participation affects the shape of these trajectories. Both these outcomes are becoming increasingly important, as depression remains one of the leading causes of disease burden worldwide (Moussavi et al., 2007), and adults with multiple chronic health conditions are becoming increasingly common (Ward et al., 2014). Social participation is pertinent here because it has been shown to be protective against depression (Croezen et al., 2015; Cruwys et al., 2013) and may delay or prevent the onset of chronic diseases (Holmes & Joseph, 2011).

Data and Methods

Data are from the American Changing Lives survey (House et al., 2005), a nationally representative panel study of adults aged 25 and above in 1986 (N=3617). At baseline, a multistage stratified area probability sample was drawn from the United States population and interviewed face-to-face, with a response rate of 68%. Follow-up interviews were then conducted in 1989 (*N*=2867), 1994 (*N*=2562), 2002 (*N*=1787), and 2011 (*N*=1427) through phone

interviews. Those who were lost to follow-up in subsequent waves were more likely to be older, male, from a minority ethnic group. I analyze data from all five waves of data collection, running analyses on all observations where information on depressive symptoms (10939 person-year observations, baseline $N = 3496$) and number of chronic health conditions (11202 person-year observations, baseline $N = 3617$) are available.

Measures

Dependent variables. Depressive symptoms were measured using the 11-item version of the Center for Epidemiologic Studies Depression (CES-D) Scale, with possible scores on this measure ranging from zero to 22 (as in Kohout et al., 1993). Higher scores indicated more depressive symptoms. For chronic health conditions, an index (or count) of the number of clinically diagnosed chronic health conditions (including heart disease, diabetes, cancer, arthritis, hypertension, stroke, emphysema) based on self-report was created at each wave, and used in the analysis.

Key independent variables. The measures for formal and informal social participation are derived from work in Veroff et al. (1981), and have been used in a number of previous studies analyzing ACL data (e.g. Donnelly & Hinterlong, 2010; Umberson et al., 1996). The inclusion of formal/informal social participation as separate variables is important given that each type has been shown to affect health outcomes differently (C. Haslam et al., 2014). The measure for formal social participation is a standardized index based on responses to two questions: (a) “how often do you attend meetings or programs of groups, clubs, or organizations that you belong to?” and (b) “how often do you usually attend religious services?” Informal

social participation is a standardized index based on another set of questions: (c) “How often do you get together with friends, neighbors, or relatives and do things like go out together or visit in each other’s homes?” and (d) “In a typical week, about how many times do you talk on the telephone with friends, neighbors, or relatives?” Response categories for questions (a), (b), and (c) were: (1) more than once a week; (2) once a week; (3) two or three times a month; (4) about once a month; (5) less than once a month; and (6) never. Response categories for question (d) were: (1) more than once a day; (2) once a day; (3) two or three times a week; (4) about once a week; (5) less than once a week; and (6) never or no phone. These response categories were treated as continuous scores, which were then reverse-coded and summed to create an index score for formal/informal social participation. Lastly, they were standardized (i.e. rescaled to have a mean of zero and variance of one) before including it into the model.

Covariates. Age across all person-year observations ranged from 25 to 95 and older (those aged older than 95 were recoded to 95 due to small sample sizes in that age range). To ease interpretation of estimates, age was centered around its lower limit (i.e., age 25 was set to zero). Following Clarke et al. (2011), respondents were grouped into six ten-year birth cohorts (born 1911 or earlier, 1912-21, 1922-31, 1932-41, 1942-51, and 1952-61). The cohort indicator was included in the model as a continuous variable, as in Yang and Lee (2009), to improve model fit. Sociodemographic variables used in the analysis are race (non-Hispanic white, non-Hispanic African American, other races), education (less than high school, high school diploma, college degree or higher), inflation-adjusted (to 1986 dollars) annual household income in the last 12 months (Less than $10,000, $10,000-29,999, $30,000 and above), marital status (married,

separated/divorced, widowed, never married) and employment status (employed, unemployed, retired, homemaker). All covariates except for race and education were time-varying.

Statistical Analysis

Growth curve models were used to analyze data in an accelerated longitudinal design framework, to estimate the trajectory of depressive symptoms and chronic health conditions by age. The accelerated longitudinal design is especially useful for life course research because it enables longitudinal analysis over a wide age range with a comparatively shorter study time frame, by linking overlapping data from multiple cohorts. Growth curve models can then produce accurate age trajectories by adjusting for cohort differences and taking into account within-person clustering (Raudenbush & Chan, 1992). It can also handle unbalanced designs (or partially missing data) where each person contributes anywhere between 1-5 time points of data (Curran et al., 2010).

All statistical models were weighted to account for sample design and non-response, making the sample representative at each wave of the population ages 25 years and above living in the United States in 1986. Given that both determinants and age trajectories of these health outcomes are likely to differ by gender (Denton et al., 2004; Yang, 2007), models were stratified by gender. To ensure consistency in hypothesis testing via the estimated standard error, a zero weight was assigned for women observations in the model for men and vice versa, so that the full sample is included in calculations of the standard error (see Rao & Molina, 2015) but not the beta coefficients.

A two-level model was used for this analysis, with repeated measurements (level one) nested within individuals (level two). Age was used as the 'growth' variable (i.e. an indication of time), thereby creating a synthetic cohort from ages 25 to 95. Unconditional growth models were first estimated to plot and predict the trajectory of the outcome variables. Non-linearity was addressed by including higher-order terms for age. The same process was then used to account for cohort effects, testing also for interaction effects between cohort and age. Model selection was guided by both the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). A stepwise process was used to determine the final models for each gender and outcome. First, age trajectories for the outcome variable of interest were estimated. Once the best fitting model incorporating age and cohort effects was reached, interaction variables between age and social participation indicators were then included to test for age-varying effects of social participation on the outcome variable. Subsequently, covariates were adjusted for, and non-significant interaction terms dropped to constitute the final model. Random effects were estimated for the intercept and linear age effect only, because models including random effects for higher order terms failed to converge. All covariates were included as dummy variables in the growth curve model.

The full model (tested separately for each gender) can be expressed formally with the following equation, incorporating both fixed and random effects. The outcome variable (Y) at time t is nested within each individual (i):

$$Y_{it} = \pi_{0i} + \beta_1 F_i + \beta_2 I_i + \beta_3 F_i(age-25)_{it} + \beta_4 I_i(age-25)_{it} + \pi_{1i}(age-25)_{it} + \sum_{a=2}^{K} \beta_{5a}(age-25)_{it}^{a} + \sum_{c=1}^{K} \beta_{6c} C_i^c + \sum_{b=1}^{K} \beta_{7b} C_i(age-25)_{it}^{b} + \sum_{q=1}^{q=8} \beta_{8q} \boldsymbol{X}_{qit} + \sum_{v=1}^{v=4} \beta_{9v} \boldsymbol{Z}_{vi} + r_{it} \quad (1)$$

Where beta coefficients represent fixed effects, and equations for the random intercept (π_{0i}) and slope (π_{1i}) may be presented as follows:

$$\pi_{0i} = \beta_{00} + e_{0i} \quad (2.1)$$

$$\pi_{1i} = \beta_{10} + e_{1i} \quad (2.2)$$

In equation (1), the health outcome (Y) is modeled as a function of age, cohort (C), formal social participation (F), informal social participation (I), as well as dummy variables for time invariant (v = 1 to 4) and time-varying covariates (q = 1 to 8). The value of K in each case depends on the shape of the age trajectory that best fits the data according to AIC and BIC (e.g., for a quadratic trajectory, K will equal two). I also reference previous work (Clarke et al., 2011; Gorman & Read, 2006; Liang et al., 2008) to confirm that the shape of these trajectories correspond reasonably to prior findings, before proceeding to test the effects of social participation. Person-level variability around the intercept (e_{0i}) is assumed to be normally distributed with mean zero and variance τ_{00}. Similarly, person-level variability around the slope (e_{1i}) is assumed to be normally distributed with mean zero and variance τ_{11}. Unstructured covariance between e_{0i} and e_{1i} is allowed and denoted τ_{01}. All errors at the person-level are assumed to be independent from

the within-person errors (r_{it}). This model specification has been shown to provide accurate estimates even under an autoregressive process (Murphy & Pituch, 2009), and therefore is likely robust to issues of reverse causality.

Several model checks were also conducted. First, Poisson growth curve models were estimated when number of chronic illnesses (which is a count variable) was used as the outcome, but models failed to converge once random effects were included. Poisson growth curve models excluding random effects produced almost identical results when compared to linear growth curve models. The findings presented are therefore based on linear growth curve models, since they provided more flexibility and consistency within the scope of this paper. Second, alternate model specifications using splines and higher order age terms were tested to reflect the possibility that life stage (rather than age) could moderate the relationship of interest. Based on AIC and BIC however, these models did not provide a better model fit.

Results

Table 1 describes the sample at baseline for all 3617 cases, weighted to account for sampling design. The ACL sample is made up of majority women, Non-Hispanic Whites, with an overall mean age of 47.1. Compared to men, women had more depressive symptoms and chronic health conditions, but also had higher levels of formal and informal social participation. Further, women in the sample were significantly older, less educated, had lower household income, less likely to be married, and less likely to be employed, compared to men.

[Table 1 about here]

Figures 1 and 2 show the age trajectories of depressive symptoms and chronic illnesses estimated from the unconditional growth curve models respectively. Women reported higher depressive symptom scores and more chronic health conditions on average, even though the extent of this gender difference varied over the life course. Inclusion of higher order terms for both age and cohort in the models were guided by model fit indices. The observed trajectories approximate previous findings examining these outcomes over the life course (Clarke et al., 2011; Gorman & Read, 2006; Liang et al., 2008).

[Figure 1 about here]

[Figure 2 about here]

Table 2 displays the results from growth curve models predicting depressive symptoms, using the stepwise process described above. Based on model fit, a quadratic term for age as well as an interaction term between cohort and age was included in the model. Fixed effects here represent the average effect of a variable on the outcome of interest. For men, the interaction term between formal social participation and age remained statistically significant after adjusting for covariates. This indicates that for men, the effect of formal social participation on depressive symptoms changes with age. The main effect of informal social participation was statistically significant at the level of a one-tailed test (i.e., $p<0.10$), but there was no evidence of age moderating this effect. For women, evidence for the protective effect of both informal and formal social participation was found, but these effects were not moderated by age. Because interpretation of interaction effects is difficult especially with continuous variables, a visualization of these

findings is presented in Figure 3. The plot represents graphically the disparities in the age trajectory of an adult with different formal social participation levels (one standard deviation above and below the mean). For men, it can be observed that the gap widens with age, showing that the protective effect of formal social participation increases with age. In contrast, for women, the gap remains consistent across the life course, indicating a constant protective effect of formal social participation across all ages.

[Table 2 about here]

[Figure 3 about here]

Table 3 shows the estimates from the growth curve models with the number of chronic health conditions as an outcome. A cubic term for age and a quadratic term for cohort were included, being the best fitting model among those tested. In unadjusted models, only the main effect for formal social participation was statistically significant. This main effect did not hold for men after adjusting for covariates, but it remained statistically significant for women. These results show that while formal social participation was protective against chronic health conditions for women, its effect did not change with age.

[Table 3 about here]

Discussion

Using five waves of panel data collected over 25 years, this article has sought to clarify whether the effects of social participation on health increases with age, given that previous studies have

produced mixed results. A key strength of this analysis is the use of an accelerated longitudinal design and data from adults across the adult life course, enabling the estimation of health trajectories across a wider age range than in past studies (which have often focused only on older adults). Growth curve models with an accelerated longitudinal design (Raudenbush & Chan, 1992) were utilized to construct these trajectories, and then test the hypothesis that the association of social participation with health is moderated by age. Only partial evidence is found to support this hypothesis.

In terms of depressive symptoms, evidence for the moderating effect of age was found only for the effects of formal social participation among men. A plausible explanation, as Williams (2003) highlights, is that men's sense of self and identity tend to be rooted in work and occupational status. Formal social participation may therefore become more important as men age into later life, by helping to fill role absences and ensuring continuity in the midst of the transition out of employment (Goll et al., 2015). Women do not seem to experience the same process of formal social participation becoming more salient for mental health as they age. Instead, for women, the effects of both formal and informal social participation on depressive symptoms appear to be consistent across the life course. My findings reiterate previous research articulating the benefits of social participation in reducing older adults' depressive symptoms (Croezen et al., 2015; Takagi et al., 2013), but go further to illumine how these effects are distributed in early- and mid-adulthood. Notably, men and women glean different protective effects from formal social participation in earlier stages of life, even though both sexes similarly benefit in later life. Given that social participation tends to be stable over time within individuals (Stansfeld & Marmot, 1992), it may be valuable to promote social participation earlier on in the life course. Greenfield

and Moorman (2017) have recently found that independent of socioeconomic factors, high school extracurricular involvement is positively associated with participation in voluntary associations during later life, supporting the notion that early life interventions may have lasting effects over time. Promoting social participation at earlier points in the life course then becomes important if preventing the onset of depressive symptoms is desired (Cruwys et al., 2013), particularly for women whose mental health may derive not only long-term, but also immediate benefits.

In models predicting the number of chronic health conditions by age, only one statistically significant effect relevant to the hypotheses was found - formal social participation was protective for women, but not for men. Informal social participation did not seem to affect the trajectory of chronic health conditions for either men or women. I offer two preliminary ways to interpret these results. First, the more consistent effect of formal social participation across both depressive symptoms and chronic health conditions is likely linked to its ability to more strongly reinforce a sense of social identity in individuals through group membership. Social identity theory postulates that group identification affects the way in which individuals appraise/respond to physical symptoms, and asserts an influence on health behavior (S. A. Haslam et al., 2009). A number of studies (e.g., C. Haslam et al., 2014; Sani et al., 2012) have previously found that activities enhancing group identification have stronger effects on health outcomes than mere social contact with friends and family. Second, observed gender differences in the effect of formal social participation for chronic health conditions may reflect differences in the way which health information is presented to men and women in formal settings. Smith and Robertson (2008) highlight that while formal health promotion efforts have rightly focused on lived

experiences when working with women, they fail to do so for men. Instead, they argue, these efforts have "tended to interpret masculinity simplistically, equating it with a set of (usually negative) characteristics" (Smith & Robertson, 2008, 284). This may lead to differences in the way health information is received and acted upon, which possibly explains why only women gain (physical) health benefits from formal social participation. Further research is needed to explore and validate the gender differences in these pathways to health.

These findings should also encourage researchers to further explore if, and how, social participation affects the onset of chronic health conditions. While Holmes and Joseph (2011) have proposed in principle that social participation can play an important role in the prevention and management of chronic conditions through health-related social control and the spreading of health information, research exploring the link between social participation and chronic conditions has been scarce. Where available, studies often either posit that chronic health conditions affect social participation (Griffith et al., 2017), or study the effect of social participation among those already suffering from chronic health conditions (Anaby et al., 2011). These studies however, utilize cross-sectional data and are unable to empirically establish a causal direction. The present findings, using longitudinal panel data, are novel and demonstrate that it may be useful to reduce the prevalence of comorbidity in older adults. The exact ways and mechanisms through which social participation may exert its influence in individuals over the long haul, however, needs to be explored in greater depth.

I note several limitations of the present study. First, the indexes used for social participation are constructed using relatively general questions. Information on specific activities (e.g., eliciting

whether contact was mostly with friends, family, neighbors, or relatives) was not collected from respondents. The indexes here however have demonstrated good predictive validity when used in previous studies (e.g. Donnelly & Hinterlong, 2010; Umberson et al., 1996), and are useful because they have been asked of the same individuals over a long period. Second, while I have explicitly modelled age and cohort effects in the trajectory of the outcome variables (i.e. depressive symptoms and chronic conditions) here, it is assumed that the association between social participation and health did not vary by cohort. An interaction effect between social participation was included, but problems with multicollinearity were encountered. Models that included only the social participation-cohort interaction effect (without the social participation-age interaction) had an inferior fit. This is however unlikely to be a problematic assumption, given that social participation has had fairly consistent effects across multiple cohorts of older adults (Adams et al., 2011; Croezen et al., 2015; Holt-Lunstad et al., 2010; Pinto & Neri, 2017).

Overall, these findings provide a more nuanced view of the health-related effects of social participation than has been typically assumed. It is not entirely the case that the effects of social participation are more pronounced at older ages, nor that they are always consistent over the life course. I have shown here that the validity of both assumptions often depends on gender, the type of social participation, as well as the kind of health outcome being considered. Researchers and policymakers should consider these complexities when crafting interventions to promote social participation in older adults, and remain cognizant that processes of social participation and health are spread across the life course.

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Table 1: Weighted Descriptive Statistics at Baseline (N=3617)

Variable	**All** Mean (*SD*) or %	**Men (*N*=1358)** Mean (*SD*) or %	**Women (*N*=2259)** Mean (*SD*) or %	**Difference**[a]
Waves of data per individual (range 1-5)	2.42 (1.30)	2.42 (1.16)	2.43 (1.42)	N.S.
Depressive symptoms score	4.48 (3.97)	3.98 (3.20)	4.92 (4.60)	$p<0.001$
Number of chronic health conditions	0.78 (1.05)	0.68 (0.88)	0.87 (1.19)	$p<0.001$
Formal social participation	0.00 (1.00)	-0.06 (0.89)	0.06 (1.09)	$p<0.01$
Informal social participation	0.00 (1.00)	-0.15 (0.91)	0.14 (1.05)	$p<0.001$
Age (range 25-95)	47.11 (16.44)	45.98 (14.20)	48.12 (18.30)	$p<0.001$
Birth Cohort				
1911 or earlier	6.99	6.08	7.79	$p<0.05$
1912-21	12.46	10.63	14.08	
1922-31	13.76	13.55	13.95	
1932-41	14.55	15.81	13.43	
1942-51	23.22	22.66	23.72	
1952-61	29.02	31.26	27.03	
Race				
Non-Hispanic White	79.24	80.45	78.16	N.S.
Non-Hispanic African American	10.77	9.88	11.57	
Others	9.99	9.67	10.28	
Education				
Less than high school	25.58	24.85	26.24	$p<0.001$
High school diploma	54.69	51.07	57.90	
College degree or higher	19.73	24.08	15.86	
Annual Household Income				
Less than $10,000	19.18	14.35	23.47	$p<0.001$
$10,000-$29,999	40.54	40.81	40.30	
$30,000 or higher	40.28	44.84	36.22	
Marital Status				
Married	69.38	75.74	63.72	$p<0.001$
Separated/Divorced	11.67	8.75	14.28	
Widowed	8.72	3.31	13.55	
Never Married	10.22	12.21	8.46	
Employment Status				
Employed	65.53	77.19	55.15	$p<0.001$
Retired	14.84	16.18	13.64	
Unemployed	7.51	6.16	8.71	
Homemaker	12.13	0.48	22.50	

[a]For dichotomous and continuous variables, Wald tests were used to ascertain the p-value of the difference. For categorical variables, Chi-squared tests were used.

Table 2: Results from Growth Curve Models for Depressive Symptoms

	Men (N=1319)[a] β (SE)				**Women (N=2177)[a]** β (SE)			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Rate of Change								
Age	-0.27***	-0.27***	-0.26***	-0.26***	-0.21***	-0.21***	-0.18**	-0.18***
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Age^2	3e-03***	3e-03***	2e-03***	2e-03***	2e-03***	2e-03***	2e-03**	2e-03**
	(5e-04)	(5e-04)	(5e-04)	(5e-04)	(5e-04)	(5e-04)	(5e-04)	(5e-04)
Cohort	-1.11***	-1.11***	-1.05***	-1.06***	-0.70**	-0.72**	-0.56*	-0.57*
	(0.29)	(0.29)	(0.28)	(0.28)	(0.27)	(0.27)	(0.26)	(0.26)
Cohort x Age	0.02**	0.02**	0.02**	0.02**	0.01+	0.01+	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Fixed Effects								
Formal Social	-	-2e-03	0.05	0.05	-	-0.45***	-0.37**	-0.40***
Participation	-	(0.15)	(0.15)	(0.15)	-	(0.14)	(0.13)	(0.06)
Informal Social	-	-0.07	-0.10	-0.13+	-	-0.03	-0.04	-0.18**
Participation	-	(0.15)	(0.15)	(0.07)	-	(0.15)	(0.15)	(0.07)
Formal Social	-	-8e-03*	-8e-03*	-9e-03*	-	-8e-04	-7e-04	-
Participation x Age	-	(4e-03)	(4e-03)	(4e-03)	-	(3e-03)	(3e-03)	-
Informal Social	-	-1e-03	-1e-03	-	-	-6e-03	-5e-03	-
Participation x Age	-	(5e-03)	(4e-03)	-	-	(4e-03)	(4e-03)	-
Adjusted for Covariates[b]?	NO	NO	YES	YES	NO	NO	YES	YES
Fit Indices								
AIC	25412	25389	25125	25123	31329	31224	30947	30945
BIC	25477	25484	25308	25298	31395	31319	31129	31113

Notes: +p<0.10, *p<0.05, **p<0.01, ***p<0.001. [a]Number reflects baseline sample size. [b]Covariates include race, annual household income, marital status, and employment status. Some coefficients and standard errors appear as zero to the second decimal point because the values are very small.

Table 3: Results from Growth Curve Models for Chronic Health Conditions

	Men (*N*=1358)[a] *β* (*SE*)				**Women (*N*=2259)[a]** *β* (*SE*)			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Rate of Change								
Age	-0.01	-0.01	-0.01	-0.01	-0.02**	-0.02**	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age^2	2e-03***	2e-03***	1e-03***	1e-03***	2e-03***	2e-03***	2e-03***	2e-03***
	(3e-04)	(3e-04)	(3e-04)	(3e-04)	(2e-04)	(2e-04)	(3e-04)	(3e-04)
Age^3	-1e-05***	-1e-05***	-1e-05***	-1e-05***	-2e-05***	-2e-05***	-2e-05***	-2e-05***
	(3e-06)	(3e-06)	(3e-06)	(3e-06)	(3e-06)	(3e-06)	(3e-06)	(3e-06)
Cohort	0.30***	0.29***	0.31***	0.32***	0.36***	0.36***	0.39***	0.39***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.06)	(0.06)	(0.06)	(0.06)
$Cohort^2$	-0.04***	-0.04**	-0.04**	-0.04**	-0.04***	-0.04***	-0.04***	-0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Fixed Effects								
Formal Social	-	-0.06*	-0.05+	-0.02	-	-0.06*	-0.05*	-0.04**
Participation	-	(0.03)	(0.03)	(0.02)	-	(0.03)	(0.02)	(0.01)
Informal Social	-	-1e-03	0.01	0.03	-	3e-03	0.02	0.01
Participation	-	(0.03)	(0.03)	(0.02)	-	(0.03)	(0.03)	(0.01)
Formal Social	-	1e-03	1e-03	-	-	4e-04	4e-04	-
Participation x Age	-	(1e-03)	(1e-03)	-	-	(8e-04)	(8e-04)	-
Informal Social	-	8e-04	4e-04	-	-	-5e-04	-6e-04	-
Participation x Age	-	(1e-03)	(1e-03)	-	-	(8e-04)	(8e-04)	-
Adjusted for Covariates[b]?	NO	NO	YES	YES	NO	NO	YES	YES
Fit Indices								
AIC	11849	11848	11772	11772	15426	15419	15256	15252
BIC	11922	11951	11963	11947	15499	15522	15446	15428

Notes: +p<0.10, *p<0.05, **p<0.01, ***p<0.001. [a]Number reflects baseline sample size. [b]Covariates include race, annual household income, marital status, and employment status. Some coefficients and standard errors appear as zero to the second decimal point because the values are very small.

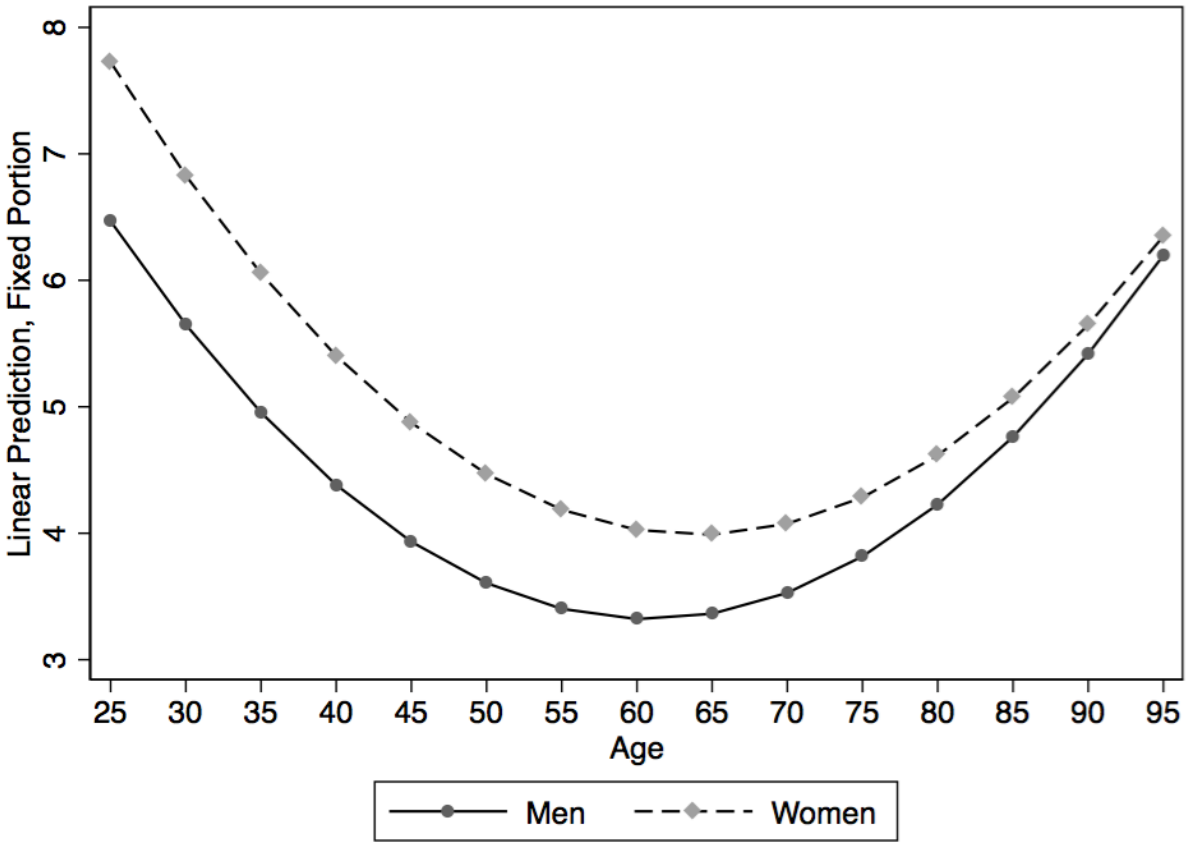

Figure 1. Age trajectory for depressive symptoms from unconditional growth curve models.

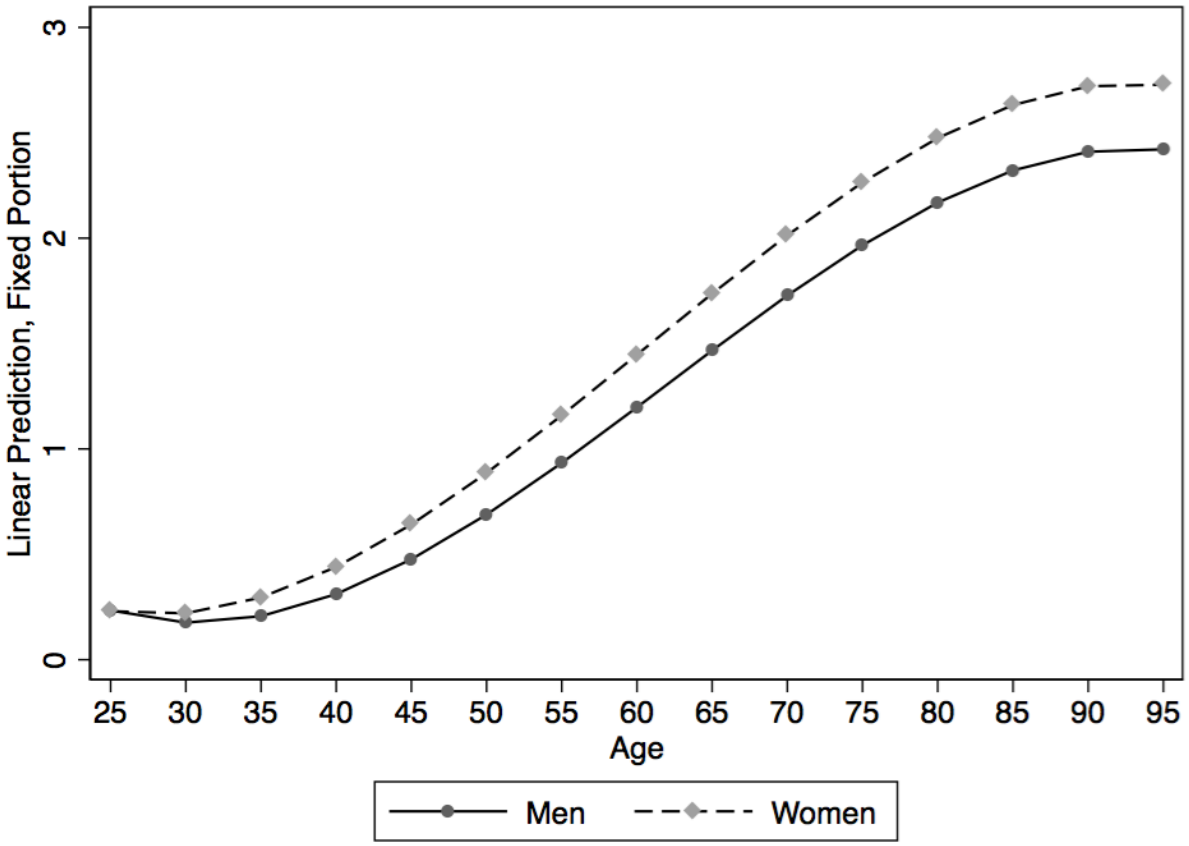

Figure 2. Age trajectory for number of chronic health conditions from unconditional growth curve models.

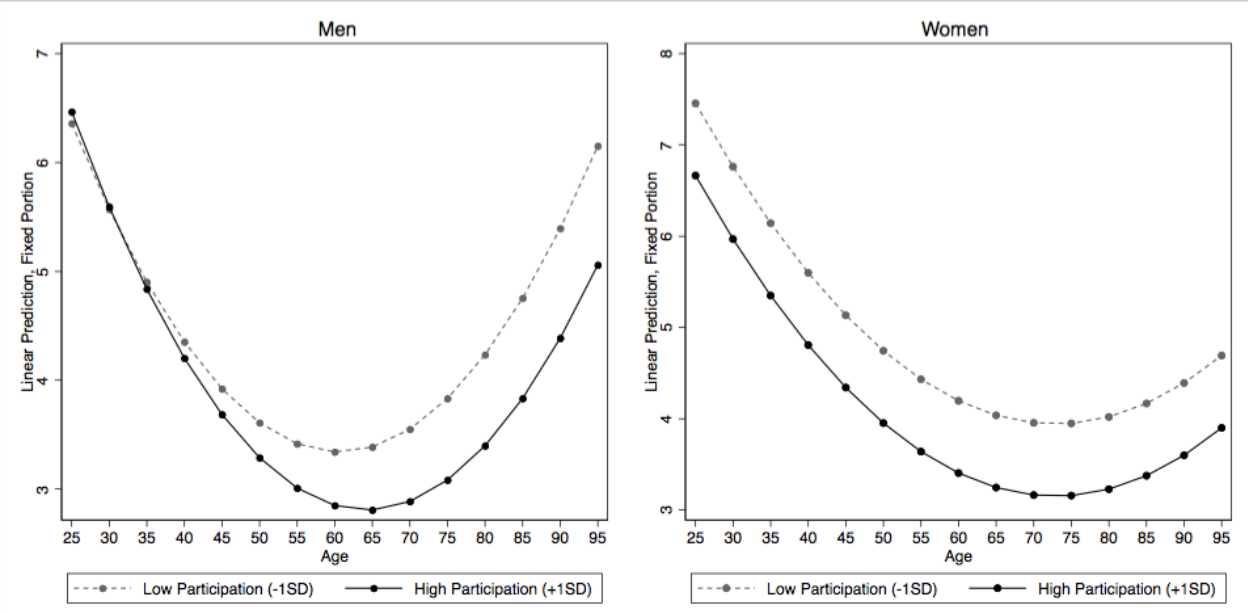

Figure 3. Growth curves for depressive symptoms at different levels of formal social participation, by gender