Social connectedness, functional capacity, and longevity: A focus on positive relations with others

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ABSTRACT

Rationale: A large literature links social connectedness to health, but there is growing recognition of considerable nuance in the ways social connectedness is defined, assessed, and associated with health.

Objective: This study centers on positive relations with others – a measure derived from philosophical notions of the components of a "good life" – and the extent to which it predicts functional limitations and mortality using data from the national, longitudinal Mid-Life in the United States (MIDUS) study. We also assess whether these associations are independent of two common measures of social connectedness: social integration and social support.

Methods: Data on social connectedness came from the first wave of MIDUS (1994–1996), self-reported functional limitations were from the first (MIDUS 1) and third (MIDUS 3; 2013–2014) waves, and mortality data through 2022 were obtained from the National Death Index.

Results: Linear regression analyses showed that higher scores on positive relations with others predicted significantly less increase in functional limitations over time, and logistic regression models showed reduced probability of onset of functional limitations between MIDUS 1 and MIDUS 3 in those scoring higher on positive relations with others. Mortality was also significantly lower in those with higher scores on positive relations with others. All models adjusted for demographic and health characteristics, and all associations were robust to the inclusion of social integration and social support in the models.

Conclusions: These results show that positive relations with others, a component of a well-lived life that describes sustained investment in social relationships that are mutual and trusting, is associated with two key health outcomes in aging adults: functional limitations and longevity. That these associations are independent of social integration and social support suggests a unique role for this formulation of social connectedness in the health of aging adults.

1. Introduction

In his book *Politics*, Aristotle argued that human beings are social "by nature," and that an individual who lives outside of society is not "self-sufficing" (Aristotle, 1905/335-323). A large literature stemming from multiple disciplines (e.g., sociological perspectives on social integration, psychological conceptualizations of social support) documents social connection as a consistent predictor of better health, including greater longevity (Berkman et al., 2000; Cohen, 2004; Holt-Lunstad et al., 2010). The primary aim of the present study is to expand current conceptualizations of social connection to include cultivation of *positive relations with others* as a related, though distinct, formulation with unique contributions to health and longevity. Specifically, we first assess the extent to which an established construct, positive relations with others (Ryff, 1989; Ryff and Keyes, 1995), is associated with two key aging-related health outcomes: functional limitations and mortality. Second, we assess the degree to which positive relations with others predicts each outcome independently of measures of social integration and social support. Our aim is to better understand whether these conceptually distinct dimensions of social connectedness are also distinct in their associations with health in aging adults.

For the purposes of this study, we adopt the conceptual framing used

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by Holt-Lunstad (2018) grouping different aspects of social connectedness into three categories: structural, functional, and quality. Structural aspects of social connectedness are typically represented through quantitative assessments identified as social integration, e.g., connections to social institutions (such as marriage), size and diversity of social networks, and frequency of contact with these connections. In contrast, functional features of social connectedness reflect actual or perceived availability of resources that others can provide (e.g., social support). Lastly, measures of quality are increasingly recognized as another component of social connection and include satisfaction with relationships and evaluations of pleasure or conflict in interpersonal interactions. From this broader conceptual framework of social connection, we focus our attention primarily on the structural (i.e., social integration) and functional (i.e., social support) aspects of relationships in light of their well-established and longstanding connections to health.

1.1. Positive relations with others and health

Social connections are highlighted in most philosophical perspectives on essential components of a 'good life' (Tiberius, 2013). In addition to works by Aristotle, for example, Becker (1992) and Nussbaum (2011) include mutual love, reciprocal concern or affection for others, and the ability to live with and for others as essential to human well-being. Ryff and Keyes (1995) identified and operationalized six central elements of human thriving, among them Positive Relations with Others: the extent to which individuals form and nurture warm, trusting relationships. Positive relations with others, as conceptualized and operationalized, affords a distinct representation of social connectedness that goes beyond quantitative connections to other people (structural) and perceptions of being able to count on others in times of need (functional). Central to the concept of positive relations *with* others is the characterization of "self" as an active participant in shaping interpersonal relationships over time (Ryff, 1989; Ryff and Keyes, 1995). This conceptual formulation of self in relationships with others evokes a level of individual skill and agency to cultivate, navigate, and maintain enduring ties rooted in mutual fulfillment and shared meaning. Importantly, reference to "others" is not consistently presented across items used to represent this construct. Specifically, items include reference to "friends," "family members and friends," or simply "others," permitting a liberal definition of close relationships that are nurtured over time.

A limited number of studies have examined links between positive relations with others and physical health with available evidence suggesting associations with better health (Elliot et al., 2018; Friedman and Ryff, 2012; Phelan, 2010). Germane to the goals of the current study is one report that found that greater positive relations with others predicted fewer functional limitations in a cross-national comparison of US and Japanese samples (Choi et al., 2020). We hypothesize that greater positive relations with others will be associated with greater longevity and more favorable profiles of functional capacity over time.

1.2. Social integration, social support, and health

Consistent with our second aim, we examine the associations between positive relations with others and health while accounting for structural and functional aspects of social connectedness, notably social integration and social support. Stemming from Durkheim's seminal work on social cohesion and suicide (Berkman et al., 2000; Durkheim, 2005/1897), social integration focuses on connections to social institutions and has been operationalized largely in structural ways for quantitative research. Typical measures include marital status, frequency of contact with members of social networks, and memberships in religious and/or other social institutions (Berkman et al., 2000). Social integration has been robustly linked to mortality risk in a frequently-cited meta-analytic review of 148 published studies (Holt-Lunstad et al., 2010). Social integration has also been linked to

functional capacity, with high or increasing levels of social engagement predicting fewer subsequent functional limitations in community samples (James et al., 2011; Shankar et al., 2017; Thomas, 2011).

Social support also is among the most well-documented social influences on health outcomes (Cohen & Syme 1985; Cohen, 2004; House et al., 1988; Uchino, 2006). Conceptualizations of social support generally take two primary forms: received and perceived support (Uchino, 2009). Received support encompasses emotional and instrumental aid that is provided by others, most often in response to adversity. Perceived support, in contrast, represents social resources believed to be accessible if called upon. Importantly, support that is perceived to be available is associated with health outcomes with greater consistency than is support that is received from others.

There is a well-established association between social support and mortality, demonstrated in two meta-analytic studies (Holt-Lunstad et al., 2010; Shor et al., 2013). In each meta-analysis, reductions in mortality risk were reported for people with greater support compared to those with less support. Social support is also associated with functional limitations, though this association can differ based on the type of support investigated. For instance, higher perceptions of support from an individual's marital partner (Ryan et al., 2014), and anticipated (perceived) support from one's neighbors (Shaw, 2005), were cross-sectionally associated with fewer functional limitations. Conversely, in a study of support received by older adults, greater receipt of instrumental support was associated with lower functional capacity (Suanet et al., 2020). In the current study we primarily focus on perceived availability of support, both because it has historically shown more robust connections to health and because it is better matched to the way positive relations with others is assessed, where items center on perceptions related to social relationships.

1.3. Current study

With these three formulations of social connectedness as predictors, we focus on two signature age-related health outcomes: longevity and functional capacity. For the latter we use a measure of the extent to which multiple aspects of mobility are limited by health issues. Mobility limitations are the most prevalent type of disabling condition in the United States affecting more than 34 million people (Varadaraj et al., 2021), and the onset of limitations in people who previously had none or declines in mobility over time are associated with a range of adverse outcomes, including falls, cognitive decline, disability, and mortality (Heiland et al., 2016; Keeler et al., 2010; Musich et al., 2018; Rajan et al., 2015). Onset and progression of limitations have been shown to be distinct processes (Zimmer and House, 2003), and for that reason we assess both increases in mobility limitations over time and the transition to having one or more limitations (i.e., onset of limitations). We hypothesize that higher baseline levels of positive relations with others will predict more favorable outcomes. A second aim is to determine whether associations between positive relations with others and health are independent of social integration and social support, both of which have far more established associations with health (Berkman et al., 2004; Holt-Lunstad et al., 2010, 2015). A recent report showed that social integration, social support, and positive relations with others were all associated cross-sectionally with peripheral markers of inflammation (Elliot et al., 2018). However, each aspect of social connectedness was analyzed independently, leaving open the question of whether their associations are unique or overlapping. We therefore sharpen the focus on positive relations by determining whether associations with functional limitations and mortality are independent of social integration and social support.

2. Methods

2.1. Participants

Data for the current study are from the first and third waves of data collection from the longitudinal Mid-life in the United States (MIDUS) study, a national survey of the physical and mental health of middle-aged and older adults; mortality data are from the National Death Index through 2022. The first wave of MIDUS (N = 7108) comprised a national probability sample of non-institutionalized English-speaking adults (n = 3487) living in the co-terminus United States and recruited by random digit dialing (RDD). A sample of monozygotic and dizygotic twin pairs (n = 1914) was also recruited from a national twin registry. Additional data came from siblings of RDD respondents (n = 950) and oversamples from five metropolitan areas (n = The first wave of MIDUS data collection (MIDUS 1) was completed in 1995–1996, and two follow-up studies (MIDUS 2 and MIDUS 3) were completed in 2004–2006 and 2013–2014, respectively. Mortality-adjusted retention was 75% from MIDUS 1 to MIDUS 2 and 77% from MIDUS 2 to MIDUS 3. All respondents completed telephone interviews and self-administered questionnaires at all three waves. The time elapsed between MIDUS 1 and MIDUS 3 participation ranged from 17 to 19 years with a mean of 18.02 years. The current analyses of functional limitations were limited to date from MIDUS 1 and MIDUS 3 in order to maximize the length of the follow-up period with which to observe change in and onset of limitations.

2.2. Functional limitations

Respondents were asked how much their health limited their ability to bend, kneel, or stoop; lift or carry groceries; climb one flight of stairs; climb several flights of stairs; walk one block; walk several blocks; and walk more than a mile. Response options ranged from 1 = Not at all to 4 = A lot. Item scores were averaged (range = 1–4), and this continuous variable was used in models assessing initial levels of and change in limitations over time. For assessment of the *onset* of limitations between MIDUS 1 and MIDUS 3 in those with no baseline limitations, individual scores at both waves were recoded into dichotomous variables such that those with responses of "not at all" for all items were recoded as 0 and those with at least one limitation were recoded as 1. Logistic regression models estimated the odds of new functional limitations between MIDUS 1 and MIDUS 3 using a sample limited to respondents with a score of 0 at MIDUS 1 (i.e., with no baseline limitations). This strategy is designed to capture the transition from no health-related mobility limitations to some level of limitation due to health issues, a transition that is linked to a range of adverse outcomes.

2.3. Mortality

Mortality data for the MIDUS sample were obtained from a search of the National Death Index through the end of 2022. In total, 2459 respondents had died since study inception. A dichotomous variable (1 = deceased) was used in all analyses.

2.4. Social relationships

Positive Relations with Others was assessed using the 3-item version of Ryff's Psychological Well-Being (PWB) scales (Ryff, 1989; Ryff and Keyes, 1995) from MIDUS 1. The three items were "Maintaining close relationships has been difficult and frustrating for me" (reverse-scored), "People would describe me as a giving person, willing to share my time with others," and "I have not experienced many warm and trusting relationships with others" (reverse-scored). Response options ranged from 1 = strongly disagree to 7 = strongly agree, and item scores were averaged into an overall scale score for analyses (range 1–7). The original scale consisted of 20 items, although a shorter 7-item version has

become widely used (Ryff, 2014). The specific items for the 3-item version of the scale used in MIDUS 1 were selected for conceptual coverage rather than high internal consistency, and as a result internal consistency was modest (α = 0.63).

Social integration. The social integration measure was based on recent work using MIDUS data and showing links between social integration and inflammation (Elliot et al., 2018). Participants indicated whether they were in a marriage or marriage-like relationship (1 = yes), frequency of contact with non-resident family members and with friends (1 = at least weekly contact with both), frequency of attending religious or spiritual services (1 = at least once a month), and frequency of attending meetings of unions or professional groups, sports or social groups, or other groups not related to participants' jobs (1 = attendance at any group meetings at least once a month). Scores were totaled for an overall measure of social integration (range 0–4) that was included in all analyses.

Social support was assessed using the average score from 12 items; 4 asked about family members, 4 asked about friends, and 4 asked about spouse or partner: "Do [members of your family][friends][spouse/partner] really care about you?", "How much can you open up to them if you need to talk about your worries?", "How much can you rely on them for help if you have a serious problem?", and "How much do they understand the way you feel about things?" Response options ranged from 1 = not at all to 4 = a lot, and responses were averaged across all sources of support (range 1–4) for analyses, the same approach used by Elliot et al. (2018). Internal validity for these items was high (α = 0.86).

2.5. Covariates

We controlled for factors that represented potential confounds, including age (range: 20–75 years; continuous), sex (1 = women, 0 = men), race/ethnicity (1 = nonwhite, 0 = white), educational attainment (dummy coded: high school degree or GED (reference group); some college; college or more), total household income (top-coded at $300,000), and chronic conditions. Chronic conditions were assessed using a set of 26 self-reported conditions (e.g., heart disease, cancer, hypertension), each one weighted by its propensity to be disabling based on scores from the multimorbidity weighted index (Wei et al., 2016) and then summed (index score range −0.07-55.9).

2.6. Statistical analyses

The analytical sample for mortality analyses included MIDUS 1 participants with data on all variables (N = 6146), representing 85% of the full sample. Data were missing for all but three of the variables, and percent of missing cases ranged from 3% to 16%. Preliminary analyses showed negligible differences between models with imputed and unimputed data with listwise deletion, so for simplicity unimputed data were used for all analyses. The analytical samples for analyses involving mobility limitations included MIDUS 1 respondents who provided data for MIDUS 3, and these were smaller due to sample attrition between MIDUS 1 and MIDUS 3. For analyses of change in limitations over time using the continuous variable for limitations, the analytical sample was 2606. For analyses of incident limitations, the analytical sample was limited to participants with MIDUS 3 data who reported no limitations at MIDUS 1 (n = 1058).

To determine associations between the three aspects of social connection and functional limitations, we estimated a series of linear and logistic regression models. Linear regression models predicted magnitude of increase in functional limitations (continuous variable) between MIDUS 1 and MIDUS 3 as a function of social connectedness and covariates (n = 2606). Logistic regression models were used to estimate the odds of incident limitations between MIDUS 1 and MIDUS 3 among those respondents reporting no functional limitations at MIDUS 1 (n = 1058). To assess mortality risk, logistic regression models were used to estimate probability of mortality between MIDUS 1 and the end

of 2022 based on the National Death Index, a 26–27 year follow-up period (N = 6146). Results from logistic regression models are shown as average marginal effects (AMEs) as these can be more directly interpreted than odds ratios.

In all analyses, an initial model including all covariates and positive relations with others was estimated. Social integration and social support were then added (Model 2) to assess the independent contribution of positive relations to changes in functional limitations and mortality probability over and above social factors with more established associations with health and longevity. To account for shared familial and genetic influences in the MIDUS twin sample, all models were estimated using a clustered sandwich estimator and robust standard errors in Stata 16.

3. Results

Descriptive statistics and correlations among variables are shown in Table 1. For the mortality sample, average age was just under 47 years at MIDUS 1, and the majority of respondents were women, white, and had completed at least some college education. In spite of attrition in the longitudinal sample for mobility analyses, the descriptive statistics were comparable to the mortality sample, with the exception that a larger proportion were female, white, and college educated, and the mean household income was higher. Correlational analyses showed that higher scores on the positive relations with others scale were associated with being older, female, more highly educated, and having fewer chronic conditions and functional limitations. Positive relations was also moderately correlated with social integration ($r = 0.28$) and social support ($r = 0.46$; data not shown). The same pattern of correlations was observed in the longitudinal mobility sample (results not shown).

Table 1

Descriptive statistics and correlation matrix for analyses of mortality (N = 6146). Except where noted, all variables are from MIDUS 1.

	Mortality sample (N = 6146)	Range	%	Mobility sample (n = 2606)	%
Variable	Mean (SD)			Mean (SD)	
Age	46.9 (12.9)	20–75		46.2 (11.3)	
Sex (% Female)			51.6		55.3
Race (% nonwhite)			9.3		5.7
Education					
High School/ GED			38.1		30.3
Some college			30.2		29.7
College +			31.7		40.0
Household income (median)	$55,000.00 ($64,935.23)	$0 – $300,000.00		83,085.74 (67,881.9)	
Chronic conditions index	1.3 (2.6)	−0.07–32.9		1.1 (2.2)	
Mobility limitations (MIDUS 1)	1.4 (0.7)	1–4		1.3 (0.5)	
Mobility limitations (MIDUS 3)	1.7 (0.9)	1–4			
Positive relations with others	5.4 (1.4)	1–7		5.6 (0.7)	
Social support	3.4 (0.5)	1–4		3.4 (0.4)	
Social integration	2.4 (1.0)	0–4		2.5 (1.0)	
Mortality (through 2022)			31.0		

3.1. Social connectedness and functional limitations

An initial cross-sectional linear regression model adjusting for age, gender, race/ethnicity, and education showed that positive relations with others was significantly inversely associated with functional limitations at MIDUS 1 [b = −0.22, $p < .001$] (data not shown).

Table 2 shows the results of linear regression models estimating the association between positive relations with others and change in functional limitations between MIDUS 1 and MIDUS 3. Higher initial scores on the positive relations with others scale were significantly associated with less decline in functional limitations over time. This association was robust to the inclusion of demographic and health covariates (Model 1) and to the addition of social support and social integration (Model 2). Greater social support was also independently and significantly associated with fewer functional limitations over time. All covariates, except for race/ethnicity, were significantly associated with change in functional limitations, with older age, women, and higher chronic conditions scores all positively associated with longitudinal increases in limitations; greater educational attainment was linked to fewer limitations over time.

Table 3 shows the results of logistic regression models estimating the probability of incident functional limitations between MIDUS 1 and MIDUS 3; the analytical sample was limited to respondents reporting no limitations at MIDUS 1. Results showed that a 1-standard deviation (SD) increment in initial score on the positive relations with others scale predicted an estimated 0.03 lower probability of developing any limitation over time after adjustment for covariates, social support, and social integration. In contrast, neither social support nor social integration was significantly associated with probability of incident limitations.

3.2. Mortality

As shown in Table 4, results from the logistic regression model showed that higher baseline positive relations with others was associated with lower mortality probability over time ($p < .001$; Model 1). Specifically, each 1-SD increment in positive relations (roughly 4 points) was associated with a 0.02 decrease in mortality probability, controlling for age, gender, race/ethnicity, education, and chronic illness. Predicted probabilities for +1/-1 SD on positive relations with others were 0.29 and 0.34, respectively, showing that high scores were associated with a 13% lower probability of mortality compared to low scores ($p < .001$). After adding the social integration and social support variables (Model 2), mortality probability associated with a 1-SD increment in positive relations with others remained 0.02 ($p = .004$). Social integration was

Table 2

Linear regression models predicting change in functional limitations between MIDUS 1 and MIDUS 3 (N = 2606).

Variable	Model 1	Model 2
Positive relations with others	−0.03** [-0.05,-0.01]	−0.01* [-0.01,-0.00]
Social support		−0.08* [-0.16,-0.01]
Social integration		0.01 [-0.01,0.04]
Age	0.02*** [0.02,0.02]	0.02*** [0.02,0.02]
Women	0.08** [0.02,0.13]	0.08** [0.02,0.14]
Nonwhite	−0.09 [-0.11,0.02]	−0.09 [-0.20,0.02]
Education (HS/GED = Ref.)		
Some college	−0.11** [-0.19,-0.04]	−0.12** [-0.19,-0.04]
College or more	−0.28*** [-0.35,-0.21]	−0.28*** [-0.35,-0.21]
Household income (x1000)	−0.00*** [-0.00,-0.00]	−0.00*** [-0.00,-0.00]
Chronic conditions index	0.03*** [0.01,0.04]	0.03*** [0.01,0.04]

***$p < .001$; **$p < .01$; *$p < .05$.
Note: The continuous variable for limitations was used in these analyses. All models are adjusted for baseline (MIDUS 1) levels of functional limitations. Unstandardized regression coefficients shown.

Table 3
Logistic regression models predicting incidence of one or more new functional limitations between MIDUS 1 and MIDUS 3 (N = 1058).

Variable	Model 1	Model 2
Positive relations with others	−0.03* [-0.06,-0.01]	−0.03# [-0.06,-0.00]
Social support		−0.01 [-0.04,0.02]
Social integration		0.01 [-0.02,0.04]
Age	0.16*** [0.14,0.19]	0.16*** [0.14,0.19]
Female	0.05 [0.00,0.11]	0.05 [0.00,0.11]
Nonwhite	−0.04 [-0.17,0.08]	−0.05 [-0.17,0.08]
Education (HS/GED = Ref.)		
Some college	−0.11** [-0.19,-0.04]	−0.12** [-0.19,-0.04]
College or more	−0.16*** [-0.23,-0.09]	−0.16*** [-0.23,-0.09]
Household income (x1000)	−0.04** [-0.07,-0.01]	−0.04** [-0.07,-0.01]
Chronic conditions index	0.04** [0.02,0.07]	0.04** [0.02,0.07]

***$p < .001$; **$p < .01$; *$p < .05$; #$p = .05$.
Note: Sample is constrained to participants who reported no functional limitations at MIDUS 1. Average marginal effects (AMEs) and 95% confidence intervals are shown. AMEs are based on a 1 standard deviation increase for continuous variables and the difference between categories for categorical variables.

Table 4
Logistic regression models predicting probability of mortality (N = 6146).

Variable	Model 1	Model 2
Positive relations with others	−0.02*** [-0.03,-0.01]	−0.01** [-0.02,-0.01]
Social support		−0.00 [-0.01,0.01]
Social integration		−0.02*** [-0.03,-0.01]
Age	0.25*** [0.24,0.26]	0.25*** [0.24,0.26]
Women	−0.07*** [-0.09,-0.06]	−0.07*** [-0.09,-0.06]
Nonwhite	0.01 [-0.03,0.04]	0.01 [-0.03,0.04]
Education (HS/GED = Ref.)		
Some college	−0.03** [-0.05,-0.01]	−0.03* [-0.05,-0.01]
College or more	−0.08*** [-0.10,-0.06]	−0.08*** [-0.10,-0.03]
Household income (x1000)	−0.03*** [-0.04,-0.02]	−.02*** [-.03,-.01]
Chronic conditions	0.04*** [0.03,0.05]	0.04*** [0.03,0.05]

***$p < .001$; **$p < .01$.
Note: Average marginal effects (AMEs) and 95% confidence intervals are shown. AMEs are the change in probability of mortality associated with a 1 standard deviation increase for continuous variables and the difference between categories for categorical variables.

also significantly associated with mortality; a 1-SD increment in baseline social integration score was associated with a 0.02 reduction in probability of mortality ($p < .001$).

3.3. Supplemental analyses

To examine potential variability in key associations by gender and age, two interaction terms (age x positive relations; gender x positive relations) were added separately to Model 2 in each of the analyses. Neither interaction term was significantly associated with change in functional limitations or in probabilities associated with either incident limitations or mortality risk (data not shown).

4. Discussion

Our investigation of social connectedness as a predictor of longitudinal profiles of functional capacity and longevity in a national sample of middle-aged and older adults positions positive relations with others as an important determinant of health. Specifically, positive relations with others was associated with slower accumulation of mobility limitations overall and reduced cross-time probability of incident limitations. Notably, greater positive relations with others also predicted reduced probability of mortality over a 26–27 year follow-up period. Among the three domains of social connectedness that we tested,

positive relations with others was the only one that predicted all three outcomes. The results for positive relations extend earlier work documenting links between positive relations with others and functional capacity in MIDUS and its Japanese companion study, MIDJA (Choi et al., 2020) by showing that positive relations is prospectively related to changes in functional capacity. Moreover, while there have been many studies linking the Ryff Psychological Well-Being scales in aggregate and purpose in life specifically to mortality risk (Ryff, 2014; Trudel-Fitzgerald et al., 2021), to the best of our knowledge this is the first study to show that greater positive relations with others predicts lower probability of mortality.

4.1. Positive relations with others as a unique domain of social connectedness

Importantly, we tested the extent to which positive relations with others was linked with functional capacity and survival independent of social integration and social support. Associations between positive relations with others and health outcomes were robust to the inclusion of measures of social support and social integration in all models. Earlier work using MIDUS data showed that social integration, social support, and positive relations with others were individually related to inflammation, but the present study was able to determine their independent contributions to longevity and functional capacity by including the three domains together in the same models. The present findings thus provide empirical support that positive relations with others captures a unique aspect of the link between social connectedness and health that is not fully accounted for by social support and social integration.

Conceptually, positive relations with others aligns with established domains of social connection through affirming the existence of valued social ties (social integration) fortified through interpersonal exchanges of reliable care and concern (social support) (Berkman et al., 2000). Significant, albeit moderate, correlations among these three indicators of social connectedness confirm an expected conceptual and measurement overlap. As a distinct domain of social connectedness, however, we contend that positive relations with others denotes effortful investment in cultivating meaningful connections with social partners that are mutually rewarding and endure over time. In this way, ties to others characterized as positive relations comprise individuals' experiences of meaningful, mutual, and lasting connections with others that may not be fully represented through contemporaneous engagement with social partners and groups (i.e., integration) or access to readily available aid (i.e., support). Additionally, positive relations with others also can be distinguished from another domain of social connection, relationship quality (Holt-Lunstad, 2018). Conceptualizations of relationship quality vary, but often involve evaluation of connection with a specific partner, such as a spouse, and convey the perceived balance of positive (e.g., support, feeling loved and cared for) to negative (e.g., strain, feeling neglected) relational dynamics (Robles et al., 2014). Although the label of "positive" relations may connote a general evaluation of the tenor of one's ties to others, as we have argued, conceptualization of positive relations with others is derived from philosophical underpinnings that emphasize actively *nurturing* connections with meaningful social partners as part of a life well lived.

4.2. Health benefits of positive relations with others

Overall, our findings are consistent with an established literature demonstrating health-protective effects of social relationships (Holt-Lunstad et al., 2010). With regard to associations with health outcomes, as noted earlier, only positive relations with others contributed to both functional capacity and survival in our investigation. In contrast, social support was only associated with functional capacity, and social integration only predicted survival. This pattern of findings is consistent with prior work indicating that structural aspects of relationships are more strongly linked to survival than are functional aspects

(Holt-Lunstad et al., 2010). As described herein, positive relations also can be considered as a complex formulation of social connection comprising elements of structure and function with clear links to survival.

In light of these findings, we encourage further investigation to more fully elucidate potential pathways through which positive relations, social support, and social integration operate as health-protective interpersonal resources. For instance, inflammation is a candidate mechanism among biological pathways with evidence of an inverse association with social support and with social integration across multiple studies (Kiecolt-Glaser et al., 2010; Loucks et al., 2006; Uchino et al., 2018). Likewise, both positive relations with others and social support predicted lower levels of IL-6 (but higher levels of C-reactive protein) (Elliot et al., 2018; see also Friedman and Ryff, 2012). Past literature has also linked both positive relations and social support to health outcomes such as cardiovascular functioning (Ong and Allaire, 2005) and to restorative health behaviors, such as optimal quantity and quality of sleep (Hamilton et al., 2007; Kent de Grey et al., 2018; Leger et al., 2020; Phelan, 2010). There are a number of intriguing next steps for future research. The current study suggests that these different domains of social connection (integration, support, and positive relations) may differ in their contributions to functional capacity and longevity. One important next step will be to extend this type of inquiry to additional health outcomes. Another important step is to examine whether the set of biological and behavioral pathways by which each domain of social connection predicts health outcomes is unique. In other words, it is possible that each domain may activate a unique set of biological or behavioral responses, which in turn, is linked to discrete health outcomes.

4.3. Limitations and conclusions

There are limitations to the current study that contextualize the results. First, the measures were largely self-reported, leaving open the possibility that individuals' ratings on social connectedness and perceptions of their functional abilities, for example, may have been influenced by underlying response tendencies or unmeasured variables. Nevertheless, the results show that positive relations with others was only modestly correlated with social support and social integration and had independent associations with the outcome measures. Moreover, baseline social connectedness predicted changes in health outcomes over a long period of time, and analyses of functional limitations adjusted for baseline status, all of which increase confidence that observed associations were not substantially influenced by potential bias at baseline. Second, social connectedness and health are likely to exert bidirectional influences on one another. Poor health in aging adults, for example, is associated with decreased participation in social activities (Bukov et al., 2002) and withdrawal from non-kin social networks (Li and Zhang, 2015). That said, existing theoretical and empirical evidence strongly implicates social connectedness as a key influence on health (US Surgeon General, 2023), even if this association is bi-directional. Finally, while MIDUS recruited a national sample, the first wave of the study had a higher proportion of White respondents than the national average (Brim et al., 2004). The present results may not generalize to more racially and ethnically diverse populations. Against these limitations are notable strengths, including the large, national MIDUS sample, the use of well-established and theoretically informed measures of social connectedness, and longitudinal assessments over long follow-up periods.

There is growing appreciation of the complexity that characterizes associations between social connections, broadly construed, and diverse health outcomes. To this literature we now add positive relations with others, a construct grounded in philosophical representations of a 'good life' as an important factor influencing multiple aspects of health. Our findings suggest that investment in meaningful connections over time yields better health and greater longevity in later years of life and does

so in ways and/or for reasons that are not fully captured by standard measures of structural and functional aspects of social connectedness.

Data availability

MIDUS data are publicly available through the Interuniversity Consortium for Political and Social Research (ICPSR

References

Aristotle. (1905/335-323). Aristotle's Politics (B. Jowett, Trans.). In. Oxford: Clarendon Press.

Becker, L.C., 1992. Good lives: prolegomena. Soc. Philos. Pol. 9 (2), 15–37.

Berkman, L.F., Glass, T., Brissette, I., Seeman, T.E., 2000. From social integration to health: Durkheim in the new millennium. Soc. Sci. Med. 51 (6), 843–857.

Berkman, L.F., Melchior, M., Chastang, J.-F., Niedhammer, I., Leclerc, A., Goldberg, M., 2004. Social integration and mortality: a prospective study of French employees of electricity of France–Gas of France: the GAZEL cohort. Am. J. Epidemiol. 159 (2), 167–174. https://doi.org/10.1093/aje/kwh020.

Brim, O.G., Ryff, C.D., Kessler, R.C. (Eds.), 2004. How Healthy Are We? A National Study of Well-Being at Midlife. Chicago University Press.

Bukov, A., Maas, I., Lampert, T., 2002. Social participation in very old age: cross-sectional and longitudinal findings from BASE. Berlin Aging Study. J. Gerontol. B Psychol. Sci. Soc. Sci. 57 (6), P510–P517. https://doi.org/10.1093/geronb/57.6.p510.

Choi, J.H., Miyamoto, Y., Ryff, C.D., 2020. A cultural perspective on functional limitations and well-being. Pers. Soc. Psychol. Bull. 46 (9), 1378–1391.

Cohen, S., 2004. Social relationships and health. Am. Psychol. 59 (8), 676–684. https://doi.org/10.1037/0003-066X.59.8.676.

Durkheim, E., 2005/1897. Suicide: A Study in Sociology. Routledge.

Elliot, A.J., Heffner, K.L., Mooney, C.J., Moynihan, J.A., Chapman, B.P., 2018. Social relationships and inflammatory markers in the MIDUS cohort: the role of age and gender differences. J. Aging Health 30 (6), 904–923. https://doi.org/10.1177/0898264317698551.

Friedman, E.M., Ryff, C.D., 2012. Living well with medical comorbidities: a biopsychosocial perspective. J. Gerontol. B Psychol. Sci. Soc. Sci. 67 (5), 535–544. https://doi.org/10.1093/geronb/gbr152.

Hamilton, N.A., Nelson, C.A., Stevens, N., Kitzman, H., 2007. Sleep and psychological well-being. Soc. Indicat. Res. 82 (1), 147–163. https://doi.org/10.1007/s11205-006-9030-1.

Heiland, E.G., Welmer, A.K., Wang, R., Santoni, G., Angleman, S., Fratiglioni, L., Qiu, C., 2016. Association of mobility limitations with incident disability among older adults: a population-based study. Age Ageing 45 (6), 812–819. https://doi.org/10.1093/ageing/afw076.

Holt-Lunstad, J., 2018. Why social relationships are important for physical health: a systems approach to understanding and modifying risk and protection. Annu. Rev. Psychol. 69, 437–458. https://doi.org/10.1146/annurev-psych-122216-011902.

Holt-Lunstad, J., Smith, T.B., Baker, M., Harris, T., Stephenson, D., 2015. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. Perspect. Psychol. Sci. 10 (2), 227–237. https://doi.org/10.1177/1745691614568352.

Holt-Lunstad, J., Smith, T.B., Layton, J.B., 2010. Social relationships and mortality risk: a meta-analytic review. PLoS Med. 7 (7) https://doi.org/10.1371/journal.pmed.1000316.

James, B.D., Boyle, P.A., Buchman, A.S., Bennett, D.A., 2011. Relation of late-life social activity with incident disability among community-dwelling older adults. J. Gerontol.: Series A 66A (4), 467–473. https://doi.org/10.1093/gerona/glq231.

Keeler, E., Guralnik, J.M., Tian, H., Wallace, R.B., Reuben, D.B., 2010. The impact of functional status on life expectancy in older persons. J. Gerontol.: Series A 65A (7), 727–733. https://doi.org/10.1093/gerona/glq029.

Kent de Grey, R.G., Uchino, B.N., Trettevik, R., Cronan, S., Hogan, J.N., 2018. Social support and sleep: a meta-analysis. Health Psychol. 37 (8), 787.

Kiecolt-Glaser, J.K., Gouin, J.P., Hantsoo, L., 2010. Close relationships, inflammation, and health. Neurosci. Biobehav. Rev. 35 (1), 33–38.

Leger, K.A., Blevins, T.R., Crofford, L.J., Segerstrom, S.C., 2020. Mean levels and variability in psychological well-being and associations with sleep in midlife and older women. Ann. Behav. Med. 55 (5), 436–445. https://doi.org/10.1093/abm/kaaa069.

Li, T., Zhang, Y., 2015. Social network types and the health of older adults: exploring reciprocal associations. Soc. Sci. Med. 130, 59–68. https://doi.org/10.1016/j.socscimed.2015.02.007.

Loucks, E.B., Sullivan, L.M., D'Agostino, R.B., Sr ., Larson, M.G., Berkman, L.F., Benjamin, E.J., 2006. Social networks and inflammatory markers in the framingham heart study. J. Biosoc. Sci. 38 (6), 835–842.

Musich, S., Wang, S.S., Ruiz, J., Hawkins, K., Wicker, E., 2018. The impact of mobility limitations on health outcomes among older adults. Geriatr. Nurs. 39 (2), 162–169. https://doi.org/10.1016/j.gerinurse.2017.08.002.

Nussbaum, M.C., 2011. Creating Capabilities the Human Development Approach. Harvard University Press. https://doi.org/10.2307/j.ctt2jbt31.

Ong, A.D., Allaire, J.C., 2005. Cardiovascular intraindividual variability in later life: the influence of social connectedness and positive emotions. Psychol. Aging 20 (3), 476–485.

Phelan, C.H., 2010. Psychosocial predictors of changing sleep patterns in aging women: a multiple pathway approach. Psychol. Aging 25. https://doi.org/10.1037/a0019622.

Rajan, K.B., Hebert, L.E., Scherr, P.A., Mendes de Leon, C.F., Evans, D.A., 2015. Rate of cognitive decline before and after the onset of functional limitations in older persons. J. Gerontol.: Series A 70 (10), 1221–1225. https://doi.org/10.1093/gerona/glv062.

Robles, T.F., Slatcher, R.B., Trombello, J.M., McGinn, M.M., 2014. Marital quality and health: a meta-analytic review. Psychol. Bull. 140 (1), 140–187. https://doi.org/10.1037/a0031859.

Ryff, C.D., 1989. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. J. Pers. Soc. Psychol. 57 (6), 1069–1081.

Ryff, C.D., 2014. Psychological well-being revisited: advances in the science and practice of eudaimonia. Psychother. Psychosom. 83 (1), 10–28. https://doi.org/10.1159/000353263.

Ryff, C.D., Keyes, C.L., 1995. The structure of psychological well-being revisited. J. Pers. Soc. Psychol. 69 (4), 719–727. https://doi.org/10.1037/0022-3514.69.4.719.

Shankar, A., McMunn, A., Demakakos, P., Hamer, M., Steptoe, A., 2017. Social isolation and loneliness: prospective associations with functional status in older adults. Health Psychol. 36 (2), 179.

Shaw, B.A., 2005. Anticipated support from neighbors and physical functioning during later life. Res. Aging 27 (5), 503–525. https://doi.org/10.1177/0164027505277884.

Suanet, B., Aartsen, M.J., Hoogendijk, E.O., Huisman, M., 2020. The social support–health link unraveled: pathways linking social support to functional capacity in later life. J. Aging Health 32 (7–8), 616–626. https://doi.org/10.1177/0898264319841949.

Thomas, P.A., 2011. Trajectories of social engagement and limitations in late life. J. Health Soc. Behav. 52 (4), 430–443. https://doi.org/10.1177/0022146511411922.

Tiberius, V., 2013. Recipes for a Good Life: Eudaimonism and the Contribution of Philosophy.

Trudel-Fitzgerald, C., Kubzansky, L.D., VanderWeele, T.J., 2021. A review of psychological well-being and mortality risk: Are all dimensions of psychological well-being equal?.

Uchino, B.N., 2006. Social support and health: a review of physiological processes potentially underlying links to disease outcomes. J. Behav. Med. 29 (4), 377–387. https://doi.org/10.1007/s10865-006-9056-5.

Uchino, B.N., Trettevik, R., Kent de Grey, R.G., Cronan, S., Hogan, J., Baucom, B.R., 2018. Social support, social integration, and inflammatory cytokines: a meta-analysis. Health Psychol. 37 (5), 462.

US Surgeon General, 2023. Our Epidemic of Loneliness and Social Isolation: the US Surgeon Genera's Report on the Healing Effects of Social Connection and Community. https://www.hhs.gov/sites/default/files/surgeon-general-social-connection-advisory.pdf.

Varadaraj, V., Deal, J.A., Campanile, J., Reed, N.S., Swenor, B.K., 2021. National prevalence of disability and disability types among adults in the US, 2019. JAMA Netw. Open 4 (10), e2130358-e2130358. https://doi.org/10.1001/jamanetworkopen.2021.30358.

Wei, M.Y., Kawachi, I., Okereke, O.I., Mukamal, K.J., 2016. Diverse cumulative impact of chronic diseases on physical health-related quality of life: implications for a measure of multimorbidity. Am. J. Epidemiol. 184 (5), 357–365. https://doi.org/10.1093/aje/kwv456.

Zimmer, Z., House, J.S., 2003. Education, income, and functional limitation transitions among American adults: contrasting onset and progression. Int. J. Epidemiol. 32 (6), 1089–1097. https://doi.org/10.1093/ije/dyg254.