

Psychosocial Protective Factors in Cognitive Aging: A Targeted Review

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Abstract

Objective: The lack of disease-modifying pharmacological agents for dementia highlights the critical importance of prevention, but known modifiable factors (e.g., education, physical health and health behaviors, depression, and social isolation) do not fully represent potential intervention targets. Positive psychosocial factors predict cognitive aging outcomes above and beyond known risk factors and may also correspond to upstream determinants that open up new avenues for prevention and intervention, as well as for reducing racial/ethnic inequalities in dementia. In this brief report, I summarize contemporary evidence for three positive psychosocial factors that appear to be particularly relevant to cognitive aging: perceived control, religious involvement, and social relations.

Methods: Targeted review and synthesis of published studies.

Results: Each of the multidimensional constructs appears to contain “active ingredients” that could help to optimize cognitive aging through disparate mechanisms. Although historically marginalized racial/ethnic groups face disproportionate barriers to accessing certain psychosocial protective factors (e.g., perceived control), these same groups also exhibit naturally occurring sources of psychosocial resilience (e.g., religious involvement) that allow them to achieve better late-life cognitive health than would be otherwise expected. With regard to social relations, converging evidence from disparate studies shows that fostering late-life friendships in particular may have high potential for building cognitive reserve and promoting healthy cognitive aging.

Conclusions: Positive psychosocial factors represent culturally relevant resources that, through careful research, could ultimately be harnessed to promote better cognitive aging for a growing and increasingly diverse population of older adults.

Keywords: Dementia; Elderly/Geriatrics/Aging; Alzheimer’s disease

Introduction

Dementia is a growing global public health concern (Prince et al., 2013). The lack of disease-modifying pharmacological agents highlights the critical importance of prevention, and a recent review concluded that one third of dementia cases may be preventable (Livingston et al., 2017). Modifiable factors identified as having the strongest evidence base include: education, physical health and health behaviors (i.e., hearing loss, hypertension, obesity, smoking, physical inactivity, and diabetes), depression, and social isolation (Livingston et al., 2017). However, many of these factors are notoriously difficult intervention targets, particularly for older individuals. In addition to having independent links to dementia risk, positive psychosocial factors are also deeply interconnected with these modifiable factors and, in many cases, correspond to upstream determinants. For example, social relations during childhood affect educational attainment and later life health (Sharifian, Kraal, Zaheed, Sol, & Zahodne, 2019; Sharifian & Zahodne, 2020; Zahodne, Ajrouch, Sharifian, & Antonucci, 2019). Therefore, positive psychosocial factors may act as levers that can help individuals avoid risk factors and accumulate protective factors as they age.

Additional rationale for a focus on positive psychosocial factors relates to the observation that some of the identified protective factors in dementia (e.g., education) appear to affect cognitive level but not rates of cognitive decline (Piccinin et al., 2013; Zahodne et al., 2011). In contrast, psychological (e.g., depression), and social (e.g., social interaction) factors appear to have robust effects on both levels and changes in brain and/or cognitive aging (Pruitt et al., 2020; Zahodne, Ajrouch, Sharifian, & Antonucci, 2019; Zahodne, Gongvatana, Cohen, Ott, & Tremont, 2013; Zahodne, Stern, & Manly, 2014), as well as functional ability (Zahodne, Devanand, & Stern, 2013). Thus, targeting an individual's psychosocial context may have broad implications for aging.

Finally, positive psychosocial factors are highly relevant to the major public health and health justice concern of dementia inequalities. Specifically, racially patterned structural disadvantages lead to differential access to psychosocial protective factors, and psychosocial risk and protective factors help to explain dementia inequalities that persist despite controlling for the “usual suspects” in disparities research (e.g., socioeconomic status and cardiometabolic health). In addition, some positive psychosocial factors (e.g., religious involvement) reflect naturally occurring protective resources for certain groups that have been historically disadvantaged (Kraal, Sharifian, Zaheed, Sol, & Zahodne, 2019). Therefore, interventions targeting these factors may be highly culturally relevant. In this targeted review, I summarize recent evidence that positive psychosocial factors, which have received relatively less attention in the literature on dementia prevention to date, have high potential to optimize cognitive aging.

Positive Psychosocial Factors and Cognitive Aging

The field of positive psychology investigates how positive subjective experiences, positive individual traits, and positive institutions can improve quality of life and prevent pathology (Seligman & Csikszentmihalyi, 2000). Positive psychosocial factors can include a diverse set of constructs at the individual, interpersonal, and community levels (Bronfenbrenner & Ceci, 1994). For example, the NIH Toolbox Emotion module measures eudaimonic (e.g., life satisfaction and purpose in life) and hedonic (e.g., positive affect) well-being, self-efficacy, friendship, and social support as positive psychosocial factors that may be relevant to health (Salsman et al., 2013). Importantly, factor analytic work indicates that positive psychosocial factors do not just reflect the absence of negative psychosocial factors such as depression (Zahodne, Nowinski, Gershon, & Manly, 2014). Although positive psychosocial factors are correlated with negative psychosocial factors, they also represent a distinct dimension such that an individual can score at the high or low end of both negative and positive dimensions (Diener, 2000; Watson & Tellegen, 1985).

The Broaden & Build theory describes how positive psychosocial factors can influence health above and beyond negative psychosocial factors (Fredrickson, 2001, 2013; Fredrickson & Branigan, 2005). Specifically, positive emotional states allow thoughts and behaviors to be guided not by automatic responses, which predominate during negative emotional states and periods of stress, but rather by more novel, creative, and flexible responses. Acting in these novel ways builds important cognitive, psychological, and social resources that can ultimately benefit health, including cognitive health in late life. Other mechanisms that may link positive psychosocial factors to better cognitive aging include reducing the physiological impact of stressors (Frankenhaeuser, 1983; Fredrickson & Levenson, 1998; Fredrickson, Mancuso, Branigan, & Tugade, 2000; Marmot, Bosma, Hemingway, Brunner, & Standsfeld, 1997); facilitating better sleep (Phelan, Love, Ryff, Brown, & Hedrich, 2010); improving immune function (Friedman, Hayney, Love, Singer, & Ryff, 2007); increasing motivation, confidence and/or interest in healthy behaviors such as physical exercise and cognitively stimulating activities (Bandura, 1989; Barnes, Mendes de Leon, Wilson, Bienias, & Evans, 2004; Lachman, Neupert, & Agrigoroaei, 2011); and developing a broader set of neural networks that can be brought online in the event that primary networks become compromised by age-related disease (Bennett, Schneider, Tang, Arnold, & Wilson, 2006; Sharifian, Sol, Zahodne, & Antonucci, 2022).

In the current paper, I focus on three positive psychosocial factors that appear to be particularly relevant to cognitive aging: perceived control, religious involvement, and social relations. These factors span the individual, interpersonal, and community levels and therefore represent multiple points of intervention to optimize cognitive aging and reduce cognitive disparities.

Perceived Control

Perceived control refers to the extent to which one feels like they are in control of important life outcomes (Lefcourt, 2014). Greater perceived control is prospectively linked to better cognitive aging (Seeman, McAvay, Albert, Merrill, & Rodin, 1996). Indeed, epidemiological studies of national samples comprising largely non-Hispanic Whites (Zahodne, Nowinski, et al., 2014a) and more racially/ethnically diverse regional samples (Zahodne, Watson, Seehra, & Martinez, 2018) confirm that stronger control beliefs are associated with better late-life cognition above and beyond other positive and negative psychosocial factors. Further, stronger control beliefs are uniquely associated with preserved episodic memory in the context of smaller hippocampal volumes, suggesting that having stronger control beliefs may help build cognitive reserve (Zahodne, Schupf, & Brickman, 2018). Stronger

control beliefs may also attenuate the negative cognitive impact of low educational attainment (Zahodne, Nowinski, Gershon, & Manly, 2015b), indicating that they may represent a potential intervention target to offset early-life disadvantage. Together, these studies point to a role for control beliefs in cognitive aging, both directly as well as through interactions with other known risk and protective factors.

Control beliefs also appear to play a role in racial inequalities in cognitive aging. For example, perceived constraints (i.e., external control) partially mediate Black-White disparities in cognition in the National Survey of Midlife in the United States (MIDUS; Zahodne, Manly, Smith, Seeman, & Lachman, 2017), as well as Black-White and Hispanic-White disparities in the Washington Heights-Inwood Columbia Aging Project (WHICAP; Zahodne et al., 2021). Further, perceived constraints partially mediate Black-White disparities in the efficacy of two cognitive interventions implemented in the advanced cognitive training for independent and vital elderly (ACTIVE) multisite clinical trial (Zahodne et al., 2015a).

Perceived control may influence cognitive aging through behavioral, motivational, and/or affective pathways (Lachman, 2006). Importantly, perceived control is modifiable in that it reflects a learned view that can change over time and in response to experience (Eizenman, Nesselroade, Featherman, & Rowe, 1997). Both internal (e.g., personal mastery and self-efficacy; Seeman et al., 1996; Zahodne, Nowinski, et al., 2014; Zahodne, Watson, et al., 2018) and external (e.g., perceived constraints; Zahodne et al., 2015a, 2017, 2021) control beliefs have been linked to cognitive aging outcomes. Given that internal control is more likely to be shaped by an individual's micro-environment (e.g., family and peers) and external control is more likely to be shaped by an individual's macro-environment (e.g., larger social structures; Hughes & Demo, 1989), these results support multiple potential levels of intervention. However, the observation that external control is most relevant to cognitive disparities clearly points to the need to prioritize societal-level interventions.

Religious Involvement

Although much work on racial/ethnic inequalities in cognitive aging has emphasized risk factors like socioeconomic disadvantage, associations between race/ethnicity and cognitive aging reflect the sum of both risk and resilience pathways (Fig. 1). Historically marginalized groups can display not only higher levels of certain risk factors, but also higher levels of certain protective factors that offset the negative effects of social disadvantage and lead to better cognitive outcomes than expected based on the presence of various risk factors. Therefore, the overall measured associations between race and cognitive aging outcomes may actually underestimate the negative impacts of racially patterned social disadvantage. Considering both risk and resilience pathways can not only improve the accuracy of risk estimates but also point to additional, culturally relevant intervention targets.

Religious involvement is one culturally relevant resilience factor with a rich history in the literature on minority health, particularly African American health (Taylor, Chatters, & Levin, 2003). Religious involvement is a multidimensional construct that includes not only strength of religious belief, but also various behaviors and relationships. A recent study parsed this multidimensional construct into three components (i.e., strength of religious belief, frequency of attending formal religious services outside the home, and frequency of praying privately) and showed that both non-Hispanic Black and Hispanic participants in the Health and Retirement Study (HRS) reported higher levels of each component of religious involvement than non-Hispanic Whites, consistent with previous research (Kraal et al., 2019). In turn, two of these components (i.e., attending services and praying privately) were positively associated with episodic memory. Importantly, even though these two racial/ethnic groups exhibited “lower” overall memory performance than non-Hispanic Whites, these disparities were offset by the two independent resilience pathways involving religious involvement.

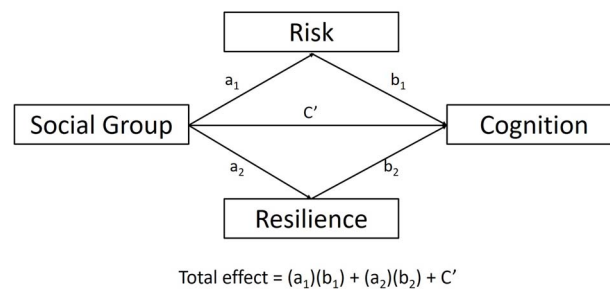


Fig. 1. Mediation framework showing that group differences in cognition reflect the sum of both risk and resilience pathways. The “total effect” of belonging to a particular social group on cognition is the sum of all “indirect effects” through both risk and resilience factors, as well as any residual “direct effects” that cannot be explained with available variables.

This evidence suggests that religious involvement may represent a naturally occurring resource within certain social groups and that its protective effects extend to cognitive aging. Of note, it is not religious belief per se that appears to be protective, but rather its associated active, stimulating, and/or social behaviors. This pattern of findings highlighting “behavior” fits well with the larger cognitive aging literature demonstrating the many cognitive benefits of active lifestyles (Sajeev et al., 2016). Future research should focus on building community partnerships (e.g., community-based participatory research) to identify and better understand additional, naturally occurring resources that could lead to culturally relevant interventions and recommendations for optimizing cognitive aging and eliminating racial/ethnic inequalities.

Social Relations

Because social development is cumulative, the comprehensive study of social relations involves a life course approach. Social relations experienced during earlier phases of development can influence social resources available later on, and social relations at any point in the life course can therefore have consequences for cognitive aging (Sroufe, Coffino, & Carlson, 2010). Indeed, social experiences during a relatively early phase of development (i.e., childhood) have been linked to later-life physical and cognitive health (Zhang, Xu, Li, Liu, & Choi, 2020). For example, in the reasons for geographic and racial differences in stroke (REGARDS) study, retrospective reports of important social resources (e.g., love, affection, trust, and encouragement) during childhood were positively associated with episodic memory performance decades later, above and beyond childhood socioeconomic status and household composition (Zahodne, Sharifian, Manly, et al., 2019). This cognitive advantage was maintained over at least 10 years and was mediated by higher educational attainment and better mid-life health. Similarly, data from the Wisconsin longitudinal study (WLS) indicate that positive mother–child interactions retrospectively reported around age 53 predicted better episodic memory performance 10 years later, as well as slower memory decline over the subsequent 7 years (Sharifian & Zahodne, 2020). These protective cognitive effects of positive mother–child interactions operated, in large part, through higher educational attainment, as well as through better social development in midlife.

Although intervening during childhood is likely to have broad and enduring effects, fostering later-life social relations may also represent an opportunity to optimize cognitive aging. For example, greater social support in late life is associated with better executive functioning and processing speed above and beyond a whole host of other positive and negative psychosocial factors, as well as physical health, in the national norming study for the NIH Toolbox (Zahodne, Nowinski, et al., 2014). However, much of the research on late-life social relations and cognition includes coarse indicators of social relations, which limits the translation of findings into actionable interventions. Social relations is a multidimensional construct that can include social network structure (e.g., size and composition), function (e.g., emotional, informational, and material support), and quality (i.e., perceived satisfaction with social relationships; Holt-Lunstad, 2018).

In order to translate research findings to interventions, more specific and comprehensive measurement is needed so that the “active ingredients” of social relations that are most likely to benefit cognitive health can be identified and operationalized. More detailed conceptualization and operationalization of social relations is also needed to clarify potential mechanisms underlying the protective effects of social network characteristics on cognitive aging. For example, it may be that social network structure (i.e., size and contact frequency), yields cognitive benefits via mental stimulation. In contrast, the quality of social relations may yield cognitive benefits by preventing and/or buffering against the neurotoxic effects of stress (Fig. 2). Finally, also important for the development of interventions is a recognition that these different dimensions of social relations are influenced by both individual and situational characteristics (Kahn & Antonucci, 1980). It is therefore necessary to consider contextual factors if the long term goal is to develop social network interventions that are not only efficacious, but also targeted and effective.

A recent paper used data from the HRS to deconstruct social relations into dimensions most relevant for cognitive aging (Zahodne, Ajrouch, Sharifian, & Antonucci, 2019). Results indicated that both social network structure and quality are uniquely associated with memory level, but only structure is additionally predictive of subsequent rates of memory decline. Specifically, having a spouse or partner predicted less future decline, which could reflect greater availability of material resources (e.g., wealth) and social support, as well as social monitoring of health behaviors (Carr & Springer, 2010). Follow-up work taking a life course approach and considering individual differences has additionally revealed that age at first marriage and time spent unmarried following one’s first marriage are particularly consequential for cognitive aging among previously married women (Zaheed et al., in press).

However, the single strongest predictor of better memory aging in the HRS study was not marital status, but rather more frequent interactions with non-family members (i.e., friends) (Zahodne, Ajrouch, Sharifian, & Antonucci, 2019). Having a large, friend-focused social network was also associated with better cognitive functioning in the more racially balanced WHICAP sample, particularly among non-Hispanic Black older adults (Sharifian, Manly, Schupf, Brickman, & Zahodne, 2019). Importantly, follow-up work on social network composition has clarified that having more family members in a network is not “bad” so long as it does not limit interactions with friends (Sharifian, Kraal, Zaheed, Sol, & Zahodne, 2020). Specifically, more

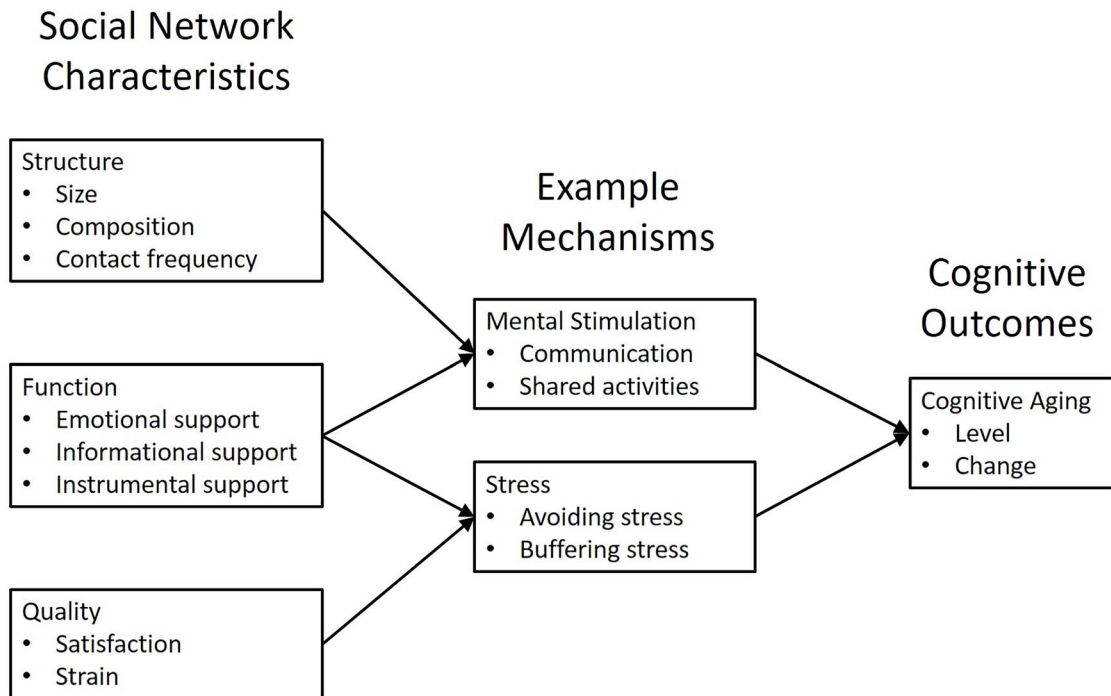


Fig. 2. Schematic of how different social network characteristics may operate through different mechanisms to influence cognitive aging outcomes.

frequent interactions with friends prospectively predicted less subsequent memory decline, but the frequency of interactions with family members was not uniquely associated with memory. These longitudinal analyses of observational data cannot confirm causation, but it is notable that experimental and interventional research supports a causal link between interacting with non-family members and better cognitive performance (Dodge et al., 2015; Ybarra, Winkelman, Yeh, Burnstein, & Kavanagh, 2011).

Multiple studies from disparate data sets and study designs converge on the unique benefits of friends for cognitive aging, which is consistent with theoretical work on the relative roles of family relationships versus friendships, as well as close versus weak ties (see Sharifian et al., 2022). With regard to mechanisms, the social psychology literature indicates that friendships, compared to family relationships, are rated as being a greater source of companionship (Crohan & Antonucci, 1989; Quan-Haase, Mo, & Wellman, 2017). Studies using experience sampling suggest that interactions with friends yield a greater sense of well-being than interactions with family (Larson, Mannell, & Zuzanek, 1986), which could reflect the obligatory and sometimes ambivalent nature of many family relationships (Crohan & Antonucci, 1989; Quan-Haase et al., 2017). In addition, friendships are much more effortful to maintain than more obligatory family relationships in that they require more communication, coordination, and activity engagement (Roberts & Dunbar, 2015). Daily diary studies reveal that individuals are more likely to be engaged in cognitively stimulating leisure activities when with a friend than with a family member, when they are more likely to be engaged in neutral household activities (Larson et al., 1986).

Potential mechanisms underlying the cognitive benefits of friendship were explored using data from MIDUS (Sharifian et al., 2020). These independent data replicated the previous finding that having a friend-focused network is potentially cognitively beneficial, but not because it protects individuals from negative effects of family. Rather, the positive association between interacting with friends and cognitive functioning was mediated by more frequent engagement in physical and cognitively stimulating leisure activities (Sharifian et al., 2020), which is consistent with previous literature (Ihle, Oris, Baeriswyl, & Kliegel, 2018), including daily diary studies (Larson et al., 1986).

This behavioral evidence supports the idea that the beneficial effects of social interaction, particularly with non-family members, operates through mental stimulation. However, neural mechanisms remain to be elucidated. Results from a clinicopathologic study suggest that greater social interaction may buffer against the negative cognitive effects of brain pathology (Bennett et al., 2006). Specifically, more Alzheimer's disease-related plaques and tangles measured at autopsy were only associated with worse cognitive functioning during life among older adults with small social networks. Among older adults with large social networks, cognitive performance was relatively high even at the highest levels of neuropathology. These results

- Dodge, H. H., Zhu, J., Mattek, N. C., Bowman, M., Ybarra, O., Wild, K. V., et al. (2015). Web-enabled conversational interactions as a means to improve cognitive functions: Results of a 6-week randomized controlled trial. *Alzheimer's & Dementia: Translational Research & Clinical Interventions*, *1*(1), 1–12.
- Eizenman, D. R., Nesselroade, J. R., Featherman, D. L., & Rowe, J. W. (1997). Intraindividual variability in perceived control in an older sample: The MacArthur successful aging studies. *Psychology and Aging*, *12*(3), 489.
- Frankenhaeuser, M. (1983). The sympathetic-adrenal and pituitary-adrenal response to challenge: comparison between the sexes. In Dembroski, T. M., Schmidt, T. H., & Blumchen, G. (Eds.), *Biobehavioral bases of coronary heart disease* (pp. 91–103). Basle: Karger.
- Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition and Emotion*, *19*(3), 313–332.
- Fredrickson, B. L., & Levenson, R. W. (1998). Positive emotions speed recovery from the cardiovascular sequelae of negative emotions. *Cognition and Emotion*, *12*(2), 191–220.
- Fredrickson, B. L., Mancuso, R. A., Branigan, C., & Tugade, M. M. (2000). The undoing effect of positive emotions. *Motivation and Emotion*, *24*(4), 237–258.
- Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, *56*(3), 218–226.
- Fredrickson, B. L. (2013). Chapter one—positive emotions broaden and build. *Advances in Experimental Social Psychology*, *47*, 1–53.
- Friedman, E. M., Hayney, M., Love, G. D., Singer, B. H., & Ryff, C. D. (2007). Plasma interleukin-6 and soluble IL-6 receptors are associated with psychological well-being in aging women. *Health Psychology*, *26*(3), 305–313.
- Holt-Lunstad, J. (2018). Why social relationships are important for physical health: A systems approach to understanding and modifying risk and protection. *Annual Review of Psychology*, *69*(1), 437–458.
- Hughes, M., & Demo, D. H. (1989). Self-perceptions of Black Americans: Self-esteem and personal efficacy. *The American Journal of Sociology*, *95*(1), 132–159.
- Ihle, A., Oris, M., Baeriswyl, M., & Kliegel, M. (2018). The relation of close friends to cognitive performance in old age: The mediating role of leisure activities. *International Psychogeriatrics*, *30*(12), 1753–1758.
- Kahn, R. L., & Antonucci, T. C. (1980). Convoys over the lifecourse: Attachment, roles, and social support. In Baltes, P. B., & Brim, O. (Eds.), *Lifespan development and behavior* (Vol. 3, pp. 253–286). New York: Academic Press.
- Kraal, A. Z., Sharifian, N., Zaheed, A., Sol, K., & Zahodne, L. B. (2019). Dimensions of religious involvement represent positive pathways in cognitive aging. *Research on Aging*, *41*(9), 868–890.
- Lachman, M. E. (2006). Perceived control over aging-related declines: Adaptive beliefs and behaviors. *Current Directions in Psychological Science*, *15*(6), 282–286.
- Lachman, M. E., Neupert, S. D., & Agrigoroaei, S. (2011). The relevance of control beliefs for health and aging. In Schaie, K. W., & Willis, S. L. (Eds.), *Handbook of the psychology of aging* (7th ed., pp. 175–190). San Diego, CA: Academic Press.
- Larson, R., Mannell, R., & Zuzanek, J. (1986). Daily well-being of older adults with friends and family. *Psychology and Aging*, *1*(2), 117–126.
- Lefcourt, H. M. (2014). *Locus of control: Current trends in theory and research*. Hove: Psychology Press [10.4324/9781315798813](https://doi.org/10.4324/9781315798813).
- Livingston, G., Sommerlad, A., Orgeta, V., Costafreda, S. G., Huntley, J., Ames, D., et al. (2017). Dementia prevention, intervention, and care. *Lancet*, *390*(10113), 2673–2734.
- Marmot, M., Bosma, H., Hemingway, H., Brunner, E., & Standsfeld, S. (1997). Contribution of job control and other risk factors to social variations in coronary heart disease incidence. *Lancet*, *350*(9073), 235–239.
- Mirowsky, J., & Ross, C. E. (1983). Paranoia and the structure of powerlessness. *American Sociological Review*, *48*(2), 228–239.
- Mirowsky, J., & Ross, C. E. (1990). The consolation-prize theory of alienation. *American Journal of Sociology*, *95*(6), 1505–1535.
- Phelan, C. H., Love, G. D., Ryff, C. D., Brown, R. L., & Hedrich, S. M. (2010). Psychosocial predictors of changing sleep patterns in aging women: A multiple pathway approach. *Psychology and Aging*, *25*(4), 858–866.
- Piccinin, A. M., Muniz, G., Clouston, S., Reynolds, C. A., Thorvaldsson, V., Deary, I. J., et al. (2013). Coordinated analysis of age, sex, and education effects on change in MMSE scores. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *68*(3), 374–390.
- Prince, M., Bryce, R., Albanese, E., Wimo, A., Ribeiro, W., & Ferri, C. P. (2013). The global prevalence of dementia: a systematic review and meta-analysis. *Alzheimer's & Dementia*, *9*, 63–75.
- Pruitt, P. J., Damoiseaux, J. S., Dodge, H. H., & Michigan Alzheimer's Disease Center (2020). Salience network functional connectivity associates with levels of social interactions in healthy and mild cognitively impaired older adults. *Alzheimer's & Dementia*, *16*(S5), e040519.
- Quan-Haase, A., Mo, G. Y., & Wellman, B. (2017). Connected seniors: How older adults in East York exchange social support online and offline. *Information, Communication & Society*, *20*(7), 967–983.
- Roberts, S. B. G., & Dunbar, R. I. M. (2015). Managing relationship decay: Network, gender, and contextual effects. *Human Nature*, *26*(4), 426–450.
- Sajeev, G., Weuve, J., Jackson, J. W., VanderWeele, T. J., Bennett, D. A., Grodstein, F., et al. (2016). Late-life cognitive activity and dementia: A systematic review and bias analysis. *Epidemiology*, *27*(5), 732–742.
- Salsman, J. M., Butt, Z., Pilkonis, P. A., Cyranowski, J. M., Zill, N., Hendrie, H. C., et al. (2013). Emotion assessment using the NIH toolbox. *Neurology*, *80*(Issue 11, Supplement 3), S76–S86.
- Seeman, T., McAvay, G., Albert, M., Merrill, S., & Rodin, J. (1996). Self-efficacy beliefs and change in cognitive performance: MacArthur studies of successful aging. *Psychology and Aging*, *11*(3), 538–551.
- Seligman, M. E., & Csikszentmihalyi, M. (2000). Positive psychology. An introduction. *American Psychologist*, *55*(1), 5–14.
- Sharifian, N., Kraal, A. Z., Zaheed, A. B., Sol, K., & Zahodne, L. B. (2019a). Longitudinal socioemotional pathways between retrospective early-life maternal relationship quality and episodic memory in older adulthood. *Developmental Psychology*, *55*(11), 2464–2473.
- Sharifian, N., Kraal, A. Z., Zaheed, A. B., Sol, K., & Zahodne, L. B. (2020). Longitudinal associations between contact frequency with friends and family, activity engagement, and cognitive functioning in later life. *Journal of the International Neuropsychological Society*, *26*(8), 815–824.
- Sharifian, N., Manly, J. J., Schupf, N., Brickman, A. M., & Zahodne, L. B. (2019b). Social network characteristics and cognitive functioning in ethnically diverse older adults: The role of network size and composition. *Neuropsychology*, *33*(7), 956–963.

- Sharifian, N., Sol, K., Zahodne, L. B., & Antonucci, T. (2022). Social relationships in later life. In *Comprehensive Clinical Psychology* (2nd ed.). Amsterdam, Netherlands: Elsevier.
- Sharifian, N., Zaheed, A. B., Morris, E. P., Sol, K., Manly, J. J., Schupf, N., et al. (2021). Social network characteristics moderate associations between cortical thickness and cognitive functioning in older adults. *Alzheimer's and Dementia*. Online ahead of print. doi: 10.1002/alz.12383.
- Sharifian, N., & Zahodne, L. B. (2020). The enduring effects of early life mother-child interactions on episodic memory later in adulthood. *Journal of Marriage and Family*, 81(4), 936–952.
- Sroufe, L. A., Coffino, B., & Carlson, E. A. (2010). Conceptualizing the role of early experience: Lessons from the Minnesota longitudinal study. *Developmental Review*, 30(1), 36–51.
- Taylor, R. J., Chatters, L. M., & Levin, J. (2003). *Religion in the lives of African Americans: Social, psychological, and health perspectives*. Thousand Oaks, CA: Sage Publications.
- Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin*, 98(2), 219–235.
- Ybarra, O., Winkelman, P., Yeh, I., Burnstein, E., & Kavanagh, L. (2011). Friends (and sometimes enemies) with cognitive benefits: What types of social interactions boost executive functioning? *Social Psychological and Personality Science*, 2(3), 253–261.
- Zaheed, A. B., Sharifian, N., Morris, E. P., Kraal, A. Z., Sol, K., & Zahodne, L. B. (2021). Life course marital biographies and late-life memory decline. *Psychology and Aging*. Online ahead of print. doi: 10.1037/pag0000617.
- Zahodne, L. B., Ajrouch, K., Sharifian, N., & Antonucci, T. (2019a). Social relations and age-related change in memory. *Psychology and Aging*, 34(6), 751–765.
- Zahodne, L. B., Devanand, D., & Stern, Y. (2013a). Coupled cognitive and functional change in Alzheimer's disease and the influence of depressive symptoms. *Journal of Alzheimer's Disease*, 34(4), 851–860.
- Zahodne, L. B., Glymour, M. M., Sparks, C., Bontempo, D., Dixon, R. A., MacDonald, S. W. S., et al. (2011). Education does not slow cognitive decline with aging: 12-year evidence from the Victoria longitudinal study. *Journal of the International Neuropsychological Society*, 17(6), 1039–1046.
- Zahodne, L. B., Gongvatana, A., Cohen, R. A., Ott, B. R., & Tremont, G. (2013b). Are apathy and depression independently associated with longitudinal trajectories of cortical atrophy in mild cognitive impairment? *American Journal of Geriatric Psychiatry*, 21(11), 1098–1106.
- Zahodne, L. B., Manly, J. J., Smith, J., Seeman, T., & Lachman, M. (2017). Socioeconomic, health, and psychosocial mediators of racial disparities in cognition in early, middle, and late adulthood. *Psychology and Aging*, 32(2), 118–130.
- Zahodne, L. B., Meyer, O. L., Choi, E., Thomas, M. L., Willis, S. L., Marsiske, M., et al. (2015a). External locus of control contributes to racial disparities in memory and reasoning training gains in ACTIVE. *Psychology and Aging*, 30(3), 561–572.
- Zahodne, L. B., Nowinski, C., Gershon, R., & Manly, J. J. (2014a). Which psychosocial factors best predict cognitive performance in older adults? *Journal of the International Neuropsychological Society*, 20(5), 487–495.
- Zahodne, L. B., Nowinski, C., Gershon, R., & Manly, J. J. (2015b). Self-efficacy buffers the relationship between educational disadvantage and executive functioning. *Journal of the International Neuropsychological Society*, 21(4), 297–304.
- Zahodne, L. B., Schupf, N., & Brickman, A. M. (2018a). Control beliefs are associated with preserved memory function in the face of low hippocampal volume among diverse older adults. *Brain Imaging and Behavior*, 12(4), 1112–1120.
- Zahodne, L. B., Sharifian, N., Kraal, A. Z., Zaheed, A. B., Sol, K., Morris, E. P., et al. (2021). Socioeconomic and psychosocial mechanisms underlying racial/ethnic disparities in cognition among older adults. *Neuropsychology*, 35, 264–275.
- Zahodne, L. B., Sharifian, N., Manly, J. J., Sumner, J., Crowe, M., Wadley, V., et al. (2019). Life course biopsychosocial effects of retrospective childhood social support on later-life cognitive development. *Psychology and Aging*, 34(7), 867–883.
- Zahodne, L. B., Stern, Y., & Manly, J. J. (2014b). Depressive symptoms precede memory decline, but not vice versa, in non-demented older adults. *Journal of the American Geriatrics Society*, 62(1), 130–134.
- Zahodne, L. B., Watson, C. W. M., Sehra, S., & Martinez, M. (2018b). Positive psychosocial factors and cognition in ethnically diverse older adults. *Journal of the International Neuropsychological Society*, 24(3), 294–304.
- Zhang, Z., Xu, H., Li, L. W., Liu, J., & Choi, S.-w. E. (2020). Social relationships in early life and episodic memory in mid- and late-life. *Journals of Gerontology: Social Sciences*, gbaa179. Online ahead of print. doi: 10.1093/geronb/gbaa179.