THE EARLY LIFE ORIGINS OF LATER LIFE NETWORKS*

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ABSTRACT

Personal social networks profoundly influence a wide range of outcomes throughout the life course. But little research has considered how some of the most consequential features of individuals' social networks may be shaped by the enduring influence of exposures and experience in early life – the most vulnerable developmental period in the life course. This study uses nationally representative data from three waves of the National Social Life, Health, and Aging Project (NSHAP) to examine how childhood circumstances may shape the structure of older adults' personal social networks. Analyses show that higher socioeconomic status and higher levels of family happiness in childhood are associated with what are often considered to be more advantageous features of older adults' personal social networks, including larger network size, more expansive network structures, and greater network intimacy. Results also suggest that studying the relative advantages of social network connectivity may benefit from contextualizing individuals' social networks in terms of their social origins. I close by discussing the need for additional research on the life-course bases of the link between childhood circumstances and later-life network properties, and what role this connection plays in shaping later life well-being.

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INTRODUCTION

The interconnectedness of human lives touches nearly every facet of social life. The relevance of social networks has been established at multiple points across the life course, including adolescence and young adulthood (Bearman and Moody 2004; Moreno et al. 2011), midlife (Liebler and Sandefur 2002), and later life (Cornwell, Laumann, and Schumm 2008). An abundance of research shows that social networks shape numerous individual outcomes within each of these life stages, including educational attainment, access to social support, engagement in criminal activity, and overall health and well-being, among others (House, Umberson, and Landis 1988; Umberson, Crosnoe, and Reczek 2010; Youm, Laumann, and Lee 2018).

At the same time, the past twenty years have witnessed a monumental expansion in our understanding of how early life experiences shape these same types of opportunities and conditions across the life course. Specifically, exposure to childhood (dis)advantage – e.g., family socioeconomic status (SES), exposure to adversity, family structure – appears to structure social advantage and well-being across multiple domains in adulthood, including educational attainment and earnings, marriage and family structure, criminal behavior, health and mortality, social functioning, and other lifestyle measures (Goodman, Joyce, and Smith 2011; Hayward and Gorman 2004; Repetti, Taylor, and Seeman 2002; Sampson and Laub 2003).

Despite the robustness of these findings, little work has linked these two lines of research by considering how the structure and dynamics of personal social networks are life course phenomena shaped by individuals' personal histories. There are good reasons to adopt a life-course perspective when studying social networks. For one, the life course perspective emphasizes the inherently interconnected nature of human lives (Alwin 2012; Elder 1994). Life course events and stages are not experienced in isolation. Rather, individual trajectories are

inherently social, as individuals are "linked" through their relationships with others who influence one another within and across life stages (Carr 2018; Elder 1994). Furthermore, other research shows that social networks are shaped by a wide range of life course factors, including education, marriage, parenthood, retirement, and widowhood (e.g., Carbonaro 1998; Kalmijn 2003; Wrzus et al. 2013), many of which are also shaped by early life circumstances.

But while we know that social connectedness characterizes individuals' progression through the life course, little research has considered how early life-course factors shape individuals' social networks. This study aims to bridge the interconnectedness of life stages with the interconnectedness of human lives, considering how early life experiences may structure some of the most consequential features of older adults' social connections. Accordingly, this paper considers how circumstances early in life – the key developmental period of the life course – influences the relational structure in which the end of life is embedded – a life stage characterized by numerous personal and social changes (Crosnoe and Elder 2002).

I propose that childhood circumstances may have enduring effects on how individuals maintain their personal social networks as they age. Using three waves of data from the National Social Life, Health, and Aging Project (NSHAP), I examine how aspects of early life may shape personal social networks in later life. Results suggest that early life circumstances may set in motion distinct trajectories of social resource cultivation across the life span that persist to affect features of one's closest social ties in later years. I conclude by considering the implications of these findings for future studies on the intersection of social networks and the life course.

THEORETICAL BACKGROUND

Personal Social Network Structure and the Life Course Perspective

Personal social networks represent individuals' immediate social context – that is, those strong ties with whom individuals often engage in support exchange, who influence individual perspectives, and who provide information and other resources that shape decision-making, behavior, and dispositions (Fischer 2011; Marsden 1987). Rather than exclusively focus on individual attributes and outcomes, the social network perspective emphasizes patterns in the structural linkages that provide access to resources, opportunities, and behavioral constraints that shape many individual outcomes that are of primary interest to social scientists (Wellman 1983).

Various characteristics of personal social networks have been the focus of prior studies, including network size, composition, and multiplexity. Studies of social network structure specifically recognize that individuals' lives are defined in important ways by their connections to others, but also emphasize the connections *among* social network members. The presence or absence of connections among one's network members are fundamental aspects of social structure that define how individuals access social and other benefits.

The concept of social network capital, for instance, asserts that key social resources are embedded in the ties among one's network members (Coleman 1988). Dense social networks, marked by strong ties among network members, can provide a sense of trust, facilitate the availability of social supports and companionship, and coordinate around meeting network members' needs (Ashida and Heaney 2008; Domínguez and Watkins 2003; Hurlbert et al. 2000).

At the same time, more expansive network structures marked by weak or absent ties among network members (i.e., bridging positions) can offer certain advantages. Opportunities to access novel information, for example, are more likely when one's personal network members are less likely to socialize with one another, thereby reducing redundancy in information and advice (Burt 2005; Granovetter 1973). Access to diverse social domains by way of disconnected

network ties may also reduce normative pressures around an individual's opinions, belief systems, behavior, and decision making (Feld 1981).

Lower levels of network density also have implications for one's sense of self. More openly structured networks can foster greater self-efficacy, mastery, and independence, which can benefit overall well-being and have important implications for how one responds to life course transitions (Thoits 2011). Likewise, more diverse personal networks, which often imply connections to distinct social domains, are also associated with higher morale and greater subjective well-being in later life. This may reflect the less restrictive nature of such networks, meaning that older adults' well-being is less vulnerable or dependent on a single cluster of densely connected individuals (Fiori et al. 2007; Litwin 2001).

The Origins of Social Network Structure. Whereas the correlates of network structure have been studied in the context of numerous sociological outcomes, scholars use a range of theoretical orientations to explain the development of social network structure – that is, how patterns in the connections among one's network members comes to exist. One orientation draws on foundational network theory, proposing that cognitive pressures that lead individuals to prefer triadic closure among their close social ties, leading to tightly connected social contacts (Davis 1963). Other work suggests that social ties organize around the structure of social contexts (foci) in the broader environment. Varying degrees of density (or bridging) reflect structural opportunity or constraint in the time, space, and activity shared by one's network members (Feld 1981; Wellman 1983). Yet another perspective draws on more agentic processes, whereby individuals seek out networks structures that best align with their personal goals, including individual interests, motivations, and social roles, and the interpersonal transactions and exchanges necessary to fulfill those pursuits (Burt 1992; Gould and Fernandez 1989). Other

research proposes that aspects of the broader social environment that reflect dimensions of social inequality act as macro-level constraints on network structure (Desmond 2012; Small 2007).

Another dominant perspective – and one most relevant to the current study -- views social network structure as a product of life course experiences (Alwin et al. 2018). Marriage and parenthood, for example, are two key markers of adulthood shown to increase the overlap between one's own and one's spouse's network ties (e.g., Kalmijn 2003). With regard to later life, retirement may lead to a decrease in network size (Settels et al. 2018), while aging and declining health are also life course experiences with implications for one's abilities to maintain a less dense, more expansive network structure (Cornwell 2009).

Studies within this perspective recognize the social interdependencies, or "linked lives," that shape the life course (Antonucci et al. 2010; Elder 1994). Indeed, the social network perspective emphasizes the timing, contingency, and interconnectedness of the social structure (Emirbayer 1997), much in the same way that the life course perspective emphasizes these same qualities in the context of experiences and events within individuals' lives (Alwin 2012; Elder 1994). Nevertheless, far less work has linked these perspectives in the context of childhood, despite the fact that the relational qualities and outcomes associated with social network structure are closely related to many of the same outcomes linked with early life conditions, including attainment in adulthood (Burt 2005; Lin 2001) and health and well-being (Berkman et al. 2000). Indeed, life course theory recognizes how individuals' lives are defined by their own agentic choices and behaviors carried out within the constraints of the social structure (Elder 1994). At the broader level, this social structure refers to macro-level processes such as economic resources. At the micro-level, I argue, one's personal social network structure has important implications for the constraints and opportunities that shape individual actions and outcomes.

The Imprints of Early Life Factors

A key contribution of this study is expanding the focus on the life course and social networks to beyond just the individual or a particular dyadic relationship (e.g., spouse, child) (Carr and Springer 2010), recognizing that individuals' lives are influenced by the structure of an arguably wider array of close others. Our understanding of how the reach of early life reverberates throughout the life course may benefit from examining how exposures during this vulnerable period enhance or compromise features of those social ties that shape numerous other outcomes.

The enduring influence of early life has long been of interest to social scientists, as (dis)advantage during these formative years predicts well-being and achievement along several social dimensions in adulthood. For example, lower SES and adversity during childhood are associated with lower educational attainment and earnings (e.g., Case, Fertig, and Paxson 2005), marital instability and lower marital quality (Conger, Conger, and Martin 2010), less social support (e.g., Ferraro et al. 2016), and worse health (Hayward and Gorman 2004) later on in life.

Life course theories suggest both direct and indirect pathways through which early life imprints on mid and later life outcomes, all of which hinge on the notion that childhood and adolescence are especially vulnerable developmental periods. Events and exposures during this time are more likely to have a lasting impact on life trajectories than are experiences that take place in other periods of the life course (Ben-Shlomo and Kuh 2002). With regard to health, for instance, early exposure to adverse, toxic, or otherwise stressful environments can directly and permanently modify the body's biological capacity to respond to future insults and stressors (Ben-Shlomo and Kuh 2002).

Other models propose more indirect pathways. The accumulation of adverse behavioral, environmental, and social exposures across the life course can damage biological and other

personal resources over time (Willson et al. 2007). Much of this literature recognizes the tendency for risk exposures and markers of disadvantage to cluster along various dimensions. Indeed, the notion of "correlated environments," or the "social patterning" of opportunity, suggests that individuals who face social disadvantage early in life are more likely to face social disadvantage later in life (Ben-Shlomo and Kuh 2002; Preston, Hill, and Drevenstedt 1998), such that early disadvantage sets off "cascading" socioeconomic and lifestyle events (Hayward and Gorman 2004, p. 88) that impede good health and upward mobility in adulthood. In some cases, this correlation supports findings that early life effects on outcomes such as health are explained by SES in adulthood (Elo 2009; Preston et al. 1998). Still, other work finds that the influence of early life may be modified by circumstances in adulthood (Luo and Waite 2005).

Early Life (Dis)advantage and Social Relationships

Whereas extensive empirical work documents the link between early life disadvantage and adult achievement and well-being, a large literature also emphasizes the psychosocial imprints of childhood circumstances. Disadvantaged social origins are tied to greater anger, anxiety, hostility, and hypervigilance against threats in adulthood, in addition to lower self-regulatory abilities, lower levels of resiliency, and a diminished sense of control and self-efficacy over one's life circumstances (Bridgett et al. 2015; Elo 2009; Latham-Mintus and Aman 2017; Repetti et al. 2002). Ambivalent or otherwise adverse early life relationships are also associated with difficulties in the formation and maintenance of adult social relationships. These include withdrawal from social interactions, antisocial behavior, interpersonal avoidance, social distancing, and hostility (Cicchetti and Toth 2015; Doyle and Cicchetti 2017).

To date, much of the research linking early life disadvantage and social relationships has done so in the context of examining potential mediators of how childhood circumstances

indirectly shape well-being later in life (Latham-Mintus and Aman 2017; Repetti et al. 2002; Surachman et al. 2018; Umberson et al. 2014). Fewer studies focus on social relationships in adulthood as outcomes in and of themselves, even though close social ties impact nearly every facet of individual livelihood and well-being across the life course (Umberson et al. 2010). Those studies that have begun to examine this topic tend to find that early life stress and disadvantage is associated with greater relationship strain and loss later in life (Donnelly et al. 2018; Ferraro et al. 2016; Umberson et al. 2014). Scholars generally suggest that early life circumstances lead to certain behavioral processes such as social withdrawal and risky health behaviors (e.g., addiction) that have direct implications for relationship qualities in adulthood (Umberson et al. 2016). To this end, the enduring traces of early life (dis)advantage appear to be biological, socioeconomic, as well as social-psychological.

Early Life Circumstances and Social Networks

Despite these findings, more explicit attention to how early life influences social relationships later in life is sorely needed. Social relationships are among the key social determinants of health and well-being (Berkman et al. 2000; House et al. 1988). Although prior focus on psychosocial tendencies imply the existence of relationships with others (or lack thereof), this work remains largely focused on individual-level consequences of early life, with less attention to the broader social structure. Put differently, there has been less overt consideration of potential consequences from a relational perspective, including one's relationships with others (dyadic level) and, to an even lesser extent, the relationships *among* an individual's close ties (triadic level).

There are several reasons to expect early life disadvantage to be associated with social network structure later in life. For one, a large literature shows that social networks are themselves dimensions of social stratification. Higher education, for example, is associated with

larger and more diverse personal social networks (Marsden 1987). Greater access to social capital, defined as the investment in and use of resources embedded in social network ties, is also associated with greater socioeconomic attainment (Lin 1999, 2000). At the same time, denser personal networks require fewer resources to maintain, as members are frequently in touch and therefore exhibit greater potential for support coordination and informational redundancy (Hurlbert et al. 2000). To this end, denser personal networks among socially disadvantaged individuals may reflect a greater reliance on network ties to fulfill immediate practical and instrumental needs (e.g., housing, income) (Domínguez and Watkins 2003).

The life course perspective is also relevant to explaining the link between social network structure and social position. Prior research also emphasizes childhood as a "pivotal life stage that leads to social inequality" throughout the life course (Ferraro et al. 2016:109). Older adults with more disadvantaged childhoods may exhibit features of their personal social networks that are associated with lower socioeconomic position, or that preclude upward mobility in adulthood, including larger network size and lower levels of network density, which could yield access to new and distinct opportunities. Indeed, a key aspect of social resource theory proposes that social capital access at a given point in time is dependent on "initial positions," namely parental resources or resources from a prior time (Lin 1999). In this sense, the life course perspective is implicit in the study of how network resources are used in status attainment processes, acknowledging the indelible mark that early life social position has on the structural constraints and opportunities that define later life social position.

Even apart from one's adult social position, lifelong patterns of relationship development may be shaped through early socialization and family SES. Children adopt skills in social tie development from early exposure to parents and peers, whose own social networks reflect

opportunities and constraints in the broader environment (Singh-Manoux and Marmot 2005). The notion of parents as socialization agents has been widely applied to the study of intergenerational influence in health behaviors, education, and occupation, and other opportunities (Jonsson et al. 2009). This concept may also apply to norms around maintaining social connections that foster such opportunities and, in particular, social network structure and its association with parental (or familial) social position (Singh-Manoux and Marmot 2005).

Second, psychosocial tendencies that originate in childhood disadvantage and endure over the life course may predispose individuals to maintain certain structural features of their social networks. Mistrust and hypervigilance against threat, for instance, may make one more likely to maintain a tighter-knit, densely connected personal network of close and trusted others. More advantageous early life circumstances that foster a lasting sense of self-efficacy, mastery, and self-regulation (e.g., Bridgett et al. 2015; Elo 2009), may make one more likely to engage and develop close ties in diverse social domains across the life course, and in turn maintain a less dense, more open social network structure (Burt 2005; Feld 1981).

Importantly, the family unit likely maintains a key role in explaining this potential linkage. Generally speaking, exposure to chronic stressors, conflict, or general unhappiness in the home during childhood contributes to heightened emotional reactivity and generally poor coping strategies in response to stressful situations later in life, including greater conflict, aggression, and social withdrawal (Repetti et al. 2002). Disruption of family structure, low family income, and exposure to physical abuse and parental conflict are among the most significant risk factors of antisocial behavior (Farrington 2005). Akin to the notion of "chains of disadvantage," exposure to abuse or family distress during childhood may lead to the

proliferation of additional stress exposures later in life, which inevitably affects the content and quality of social ties in adulthood (Pearlin 2010; Umberson et al. 2010).

This perspective may be extended to consider implications for personal social network structure. Individual tendencies toward conflict, aggression, and withdrawal may contribute to a more fragmented personal network structure. Likewise, responses to social stress that are aggressive, hostile, or otherwise antisocial may preclude the development of supportive relationships, such as those characterized by a high degree of contact and greater network density, which could facilitate coordination and connection with other social network members.

Finally, it is worth considering that homophily, or similarity, is a fundamental principle of how social network connections are formed. Individuals tend to form ties with others who are similar to them on a variety of dimensions, including education, social class, race/ethnicity, age, and gender, as well as values and belief systems (McPherson et al. 2001). As childhood conditions predict social position in adulthood, individuals' social networks are likely to include others of similar sociodemographic background and life history. A preponderance of disadvantaged circumstances among one's core confidants may lead to a stressful, high-need network, ultimately straining ties, lessening available support (Offer and Fischer 2018), and potentially leading to smaller and more fragmented (less dense) network structure.

The Present Study

Prior literature has established the broad and enduring nature of both personal social networks and early life characteristics, but has yet to consider how the circumstances that characterize the beginning of life may shape personal social networks at the end of life. Given the persistence in social position across the life course, and the link between network properties and status attainment, childhood disadvantage may be associated with more densely structured networks

that offer fewer opportunistic advantages elicited through access to diverse social contexts, and that require fewer resources to maintain. At the same time, exposure to disadvantaged familial circumstances or other markers of childhood adversity may foster certain individual dispositions that could preclude the development of a larger social network, or denser network structures that are most conducive to accessing social support. In light of these possibilities, I examine how various dimensions of early life are associated with personal social network size and density in later life, and whether any association may be explained by other dimensions of social position and life course transitions known to shape older adults' social networks.

DATA AND METHODS

To address this research question requires a dataset that collects information about respondents' personal social network structure, as well as measures of early life circumstances. To my knowledge, there exists no nationally representative dataset that systematically tracks individuals' social networks from early through later life, and that allows for a comprehensive assessment of the various experiences and life course factors that take place between early and later life that could account for any associations between childhood and later life networks. To date, however, the National Social Life, Health, and Aging Project (NSHAP) offers a unique opportunity to begin to shed light on this research question. The NSHAP is the only nationally representative study that collects both retrospective measures of older adults' childhood circumstances as well as longitudinal data on their personal social networks.

As a population-based panel study of non-institutionalized older adults in the United States (Suzman 2009), the overall goal of the NSHAP is to better understand how health and social context intersect to influence older adults' well-being as they age. The original cohort (Wave 1) includes 3,005 older adults ages 57-85 at baseline (2005-2006), with a weighted

response rate of 75.5%. Wave 2 (2010-2011) includes 3,377 returning respondents and their co-resident partners, if applicable, yielding a conditional response rate of 89%. Wave 3 (2015-2016) includes returning respondents and their partners, if applicable (N = 2409), as well as new cohort of respondents born between 1948 and 1965 and their co-resident partners (N = 2368). At each wave, data collection consisted of in-home interviews conducted by the National Opinion Research Center (NORC), which included the collection of personal social network information (described below). Following the in-home interview, respondents were also asked to complete a leave-behind questionnaire (LBQ) to be returned to NORC by mail.

Measures of Social Network Structure

My primary argument is that later life network structure is partly a function of early life circumstances. At each wave of the NSHAP, respondents were asked to name up to five individuals (i.e., alters) with whom they discussed "important matters" in the prior year. This name generator is commonly used to elicit individuals' core social confidants, including their strongest and most intimate social ties, with whom they are most likely to exchange resources and support (Marsden 1987). Respondents were asked how often they spoke with each alter (1 = less than once a year, 8 = every day), their relationship to each alter (e.g., spouse, friend), and how often each alter spoke with every other alter in the prior year (0 = have never spoken, 8 = every day).

Measures of network structure reflect social network size as well as the connectivity among individuals' social network members. Social network size is measured as the total number of alters named. Social network density is measured as a count of the number of ties that exist in the respondent's network (a tie "exists" if alters speak with one another at least annually) (e.g., Cornwell et al. 2008). This count depends on network size, which dictates the number of possible

ties in the network. I account for this in the negative binomial regression modeling strategy, explained below. Alternate measures of network connectivity, including measures of bridging potential (Appendix Table 1), produce results that are consistent with those presented here.

Measures of Early Life Circumstances

At waves 2 and 3, the NSHAP respondents were asked several questions about their childhood as part of the LBQ. Respondents were asked to indicate the highest grade completed by their father and mother, separately, as "no formal education," "1-11 grades," "12 high school graduate," "13-15 some college," "16 college graduate," "17 or more post college," "other," or "don't know," which I use as a measure of childhood SES. I categorize responses as either "less than high school," "high school completed," or "more than high school." I also create a "missing" category (e.g., Hayward and Gorman 2004), which includes respondents who reported that they "don't know" their parents' education, or who did not answer this question on the LBQ. By creating this "missing" category, I aim to avoid excluding respondents from the analyses who were unfamiliar with parental education, perhaps because they grew up in unstable or otherwise complex household arrangements, but who were able to report on other dimensions of their early life (described below). Results are consistent when these respondents are excluded from the analyses. The final measure uses the highest reported level of parental education.

Respondents were also asked five questions referring to the time when they were 6 to 16 years old: 1) childhood health status (1 = poor, 5 = excellent), 2) how financially well off their family was (1 = not so well off at all, 5 = very well off), 3) whether or not they lived with both parents, 4) to rate their agreement with the statement: "When I was growing up, my family life was always happy" (1 = disagree very much, 6 = agree very much), and 5) whether or not they ever experienced or witnessed any violent events (assault, beating, shooting, murder, or rape).

These six measures represent the full breadth of childhood measures collected as part of the NSHAP. Although retrospective in nature, and therefore prone to recall bias, these questions are representative of the types of questions asked on other nationally representative surveys of adults in mid to later life, and which have been used to make key inferences about the enduring nature of childhood SES, health, adversity, and overall well-being on outcomes in adulthood (e.g., Ferraro et al. 2016; Haas 2007; Hayward and Gorman 2004). Additionally, prior research finds retrospective reports to be a reliable data source for studying the later life influence of childhood at the population level (Haas 2007). As no other population-based survey collects information about both childhood circumstances and personal social networks, the retrospective reports included in the NSHAP represent the best available data to study this topic.

I include each childhood measure individually in my analysis, given each represent different dimensions of childhood adversity and disadvantage. In supplementary models, I considered alternative combinations of the early life questions, including a single index that standardizes and sums each measure. The results are substantively similar to those presented here (available upon request), but ultimately yield less information about which dimensions of early life may be most relevant to social network structure across the life course.

Covariates

The structure of older adults' social networks is influenced by numerous social, health, and other lifestyle determinants that evolve across the life course, and that are also shaped by early life circumstances. The NSHAP measures of a number of these factors, which I account for in the models. Race/ethnicity is coded as white, black, Hispanic/non-black, and other. Educational attainment is categorized as less than high school, high school or equivalent, some college/vocational school, and bachelor's degree or more. I also account for respondent age

(divided by 10 to make the coefficient more meaningful), gender, marital status (married/partnered, divorced or separated, widowed, or never married), and employment (whether the respondent reports that they are currently working).

Later life well-being is associated with the maintenance of more openly structured social networks (Cornwell 2009), and is also shaped by early life conditions (e.g., Hayward and Gorman 2004). I therefore control for self-rated health, as well as depressive symptoms and functional health to capture more specific dimensions of mental and physical well-being. Depression is measured as a scale of 11 standardized items from the Centers for Epidemiologic Studies Depression Scale, asking respondents how often they experience things like "felt sad" or "could not get going." Functional health is measured as a scale of respondents' standardized responses to 9 items from the Activities of Daily Living (ADL) Scale, assessing individuals' difficulty in completing routine tasks such as driving and getting dressed.

In models predicting social network density, I also account for social network size, proportion of network alters that live with the respondent, and how often the respondent reports talking to their network members, on average (where 1 = "less than once a year" and 8 = "everyday"). A larger number of network members may make it more difficult to maintain a densely connected network. At the same time, more household-based networks are likely to include more familiar network members, and thereby exhibit a denser structure. More frequent interaction with one's social network alters may also foster greater connectivity within one's personal social network. Table 1 includes descriptive statistics for all covariates.

Analytic Strategy

I use a series of multivariate regression models to evaluate how early life may be associated with social network size and density. First, I use Poisson models to predict social network size, as the

outcome is a count of network members. Next, negative binomial regression is used to model network density, given that the outcome is a count of the number of ties that exist among alters in the network. Network size is used to calculate the number of possible ties that could exist ((n*[n-1]/2)), and this measure is used as the exposure variable in these models. Negative binomial regression is used instead of Poisson given evidence of overdispersion.

For each outcome, I begin by considering how sociodemographic (gender and race/ethnicity) and childhood measures predict social network structure. I then add measures of attainment, health, and other aspects of social life. This stepwise process allows me to consider whether any association between childhood measures and later life networks may be direct or indirect, to the extent that they are explained by these adulthood covariates. Additionally, as some prior research finds that the later life effects of early life interact with other dimensions of social stratification (Umberson et al. 2014), I use an additional set of models to consider whether any observed associations are conditional on gender, race/ethnicity, or educational attainment.

The analytic sample includes those respondents that provided information on early childhood measures at wave 2 or 3. All covariates are measured at the survey wave when early childhood measures were first collected, so that these models essentially rely on a pooled cross-sectional sample of older adults surveyed at waves 2 and 3. All models also include a fixed effect for which survey wave (2 or 3) the respondent's measures are collected.

Of the age-eligible respondents that reported on their social network and returned the LBQ, missing data on sociodemographic and health covariates accounts for less than one percent of those excluded from the analytic sample. The greatest source of exclusion was non-response to the questions about childhood circumstances, with 9.5% percent of respondents not reporting on at least one dimension of early life. Supplementary analyses indicate that respondents

excluded due to missing data on childhood measures have somewhat smaller social networks compared to those included in the analytic sample ($M = 3.58$ versus $M = 3.81$, $p < .01$ by unweighted t-test), but that these two groups do not differ on the basis of social network density. Models predicting social network density also exclude respondents with zero or one network members, who were not able to report on the presence or absence of ties *among* network alters. These restrictions result in final analytic samples of 4,261 for models predicting social network size, and 3,932 for models predicting social network density.

To help reduce bias that may result from excluding respondents with smaller social networks, and to more systematically account for exclusion from the models due to missing data, I create a propensity score for each respondent that reflects their probability of being included in the models. This process uses logistic regression to predict whether the respondent is included in the final analytic samples using a number of covariates that may predict exclusion on the basis of sociodemographic, life course, and health measures. I then multiply the inverse of these probabilities by the person-level weights provided by the NSHAP that adjust for selection and non-response and apply the final weights to all models. This weighting adjustment helps to generate estimates that better resemble those that would have been generated had all respondents been included in the final models (Cornwell et al. 2008; Morgan and Todd 2008). Standard errors are adjusted for clustering and stratification in the NSHAP sampling design.

RESULTS

Table 1 includes descriptive statistics for the main variables included in the models. On average, respondents name between three and four network members. With regard to density, respondents tend to report that between four and five ties exist among the alters in their social network. As this count depends on network size, it can also be useful to consider alternate measures of

network density to characterize the analytic sample. On average, respondents' networks are relatively dense, with 75% of possible pairs of ties reported as "existing" (i.e., 75% of possible network pairs are in contact with one another at least once a year).

Turning to early life measures, just over 30% of the sample reports that at least one parent earned more than a high school degree, and just over 25% report less than a high school degree as the highest level of parental education. The majority of respondents (just over 80%) report that they lived with both parents, while just under 20% report that they experienced or witnessed a violent event between ages 6 and 16. On average, respondents report their family to have been between "not so well off" and "average" financially, and childhood health as between "very good" and "excellent." Respondents tended agree moderately (between "a little" and "pretty much") with the statement: "When I was growing up, my family life was always happy."

[Table 1 about here]

There is also considerable variation across dimensions of early life, suggesting that respondents' childhood circumstances are not entirely clustered around relatively negative or positive experiences. Within each category of parental education, for example, between 17% and 21% of respondents witnessed or experienced a violent event. Whereas 83% of those whose parents earned less than a high school degree reported having lived with both parents during childhood, a comparable 86% of those with a parent earning more than a high school degree report the same living arrangement. Likewise, reports of family happiness are comparable within categories of parent education. Just under 25% of respondents with either the highest or lowest levels of parental education also report levels of family life happiness in the highest tertile of the distribution. Approximately one third of those with the highest levels of parental education rate their childhood family happiness in the lowest tertile, compared to 39% of those with the lowest

levels of parental education. In general, early life measures are weakly correlated, with the strongest correlation between family happiness and lack of exposure to violent events ($r = .33$)

Early Life Circumstances and Social Network Structure

Results from the first set of regression models suggest that properties of social network structure are patterned by certain aspects of early life. In Model 1 of Table 2, higher levels of parental education are associated with larger social networks in later life, before accounting for adulthood measures. Those with a parent that earned a high school degree or more name a significantly higher number of network members relative to those whose parents earned less than a high school degree ($p < .001$), while missing data on parental education is associated with significantly smaller network size ($p < .05$). Other early life measures exhibit no statistically significant association with network size. Being female is associated with significantly larger social networks ($p < .001$), while black respondents and those of other races/ethnicities have significantly smaller networks compared to whites ($p < .01$ and $p < .05$, respectively).

Model 2 of Table 2 reveals that most of these associations remain significant even when accounting for adult attainment, marital status, and later life health. Those whose parents earned a high school degree named network members at a 4.2% higher rate than respondents whose parents earned less than a high school degree (incident rate ratio [IRR] = 1.042, $p < .01$). Respondents whose parents earned more than a high school degree named network members at a 5% higher rate than those whose parents earned less than a high school degree (IRR = 1.050, $p < .01$). The association between "missing" data on parental education and network size is not statistically significant, while being female and white remain associated with significantly larger social networks. With regard to attainment in adulthood, respondents with some college or a bachelor's or more name network members at 13.1% and 16.3% higher rates, respectively (IRR

= 1.131, $p < .001$ and IRR = 1.163, $p < .001$), compared to those respondents with less than a high school degree. Whereas employment and health are not significant predictors of network size, older adults who are never married name network members at a 7% lower rate than those respondents who are married or partnered (IRR = .930, $p < .05$).

[Table 2 about here]

Models 3 and 4 indicate that early life measures are also significantly associated with the connectivity among older adults' network members, and that different childhood measures demonstrate different directionality in predicting network density.[1] Before accounting for later life measures (Model 3), those whose parents earned more than a high school degree have significantly lower levels of network density (IRR = .917, $p < .001$) relative to those with the lowest levels of parental education. At the same time, older adults that report higher levels of family happiness and better health during childhood have denser social networks in later life (IRR = 1.028, $p < .001$ and IRR = 1.017, $p < .05$, respectively). Exposure to a violent event, however, is associated with less connectivity among network members (IRR = .963, $p < .05$). With regard to sociodemographic predictors, black respondents and those of other races/ethnicities have higher levels of network density compared to whites ($p < .05$), while women have significantly lower levels of density compared to men ($p < .001$).

Even when accounting for the later life covariates (Model 4), respondents with the highest levels of parental education report ties among network members at a 5.1% lower rate than respondents with the lowest levels of parental education (IRR = .949, $p < .01$). At the same times, each increase in reported levels of family happiness during childhood is associated with a

[1] These associations emerge with the same directionality and levels of significance in simpler bivariate models that use just family SES and just family happiness to predict network outcomes.

1.9% higher rate of connectivity among network members (IRR = 1.019, $p < .001$). Childhood health and exposure to violent events, however, are not statistically significant predictors of network density when accounting for attainment, health, and life course measures. Racial/ethnic differences in network density are also not statistically significant in this model, although respondent's own educational attainment is inversely associated with network density. Those with some college or a bachelor's degree or more have 4.6% and 7.8% lower rates of ties among alters compared to older adults who earned less than a high school degree (IRR = .954, $p < .05$ and IRR = .922, $p < .001$, respectively). In addition, being in contact with network members on a more frequent basis and having a higher proportion of co-residing network members are each associated with higher levels of network connectivity ($p < .001$). Appendix Table 1 shows that results are similar when predicting social network bridging (i.e., whether there is at least one pair of poorly connected alters in respondents' networks), yet coefficients exhibit opposite directionality, as bridging represents the *absence* rather than the *presence* of ties among alters.

Given that higher levels of family SES (i.e., parental education) and higher levels of family happiness exhibit opposite directionality in their associations with network density, it can be useful to consider the implications of childhood circumstances in terms of predicted social network structure, accounting for multiple early life measures simultaneously. Figure 1 displays the predicted network density for older adults that report the highest and lowest levels of parental education, and by the highest and lowest levels of family happiness.

[Figure 1 about here]

Within each category of parental education, the predicted difference in network density between those with the lowest and highest levels of childhood family happiness is between .06 and .07, and these differences are statistically significant ($p < .05$). Across categories of parental

education, however, the differences in predicted density are non-significant. Respondents with the highest predicted density are those with the lowest levels of parental SES but the highest levels of family happiness (.78), while those with the lowest predicted density are older adults with the highest levels of parental SES and the lowest levels of family happiness (.69). The link between early life conditions and later life network structure is not moderated by other dimensions of stratification (full results available upon request).

In supplementary models, I consider whether the influence of early life on social network structure may be cumulative, to the extent that *changes* in social network size and density between waves 1 and 2 are also predicted by early life measures. This time frame captures the largest sample of respondents whose network information was collected at least twice. These models also account for changes in life course measures (marital and employment status) between waves. Although there is no association between childhood measures and changes in network size, higher levels of family happiness and childhood health are associated with increasingly denser networks ($p < .05$). Older adults whose families were more well off during childhood are more likely to experience a decline in density between waves ($p < .05$). Parental education is not a significant predictor of changes in network measures (Appendix Table 2).

DISCUSSION AND CONCLUSIONS

How does social structure shape the lives of older adults? The enduring influence of childhood on mid- and later-life outcomes is well-established. This study contributes to a growing body of research bridging the life course perspective with social network studies (Alwin et al. 2018), broadening the scope of outcomes affected by early life to include those at the structural, relational level. The findings suggest that childhood circumstances shape the connectivity of those social bonds that are arguably most consequential for older adults' well-being, and that are

key social resources used to navigate numerous life course transitions that take place in later life (Umberson et al. 2010). Higher parental education is associated with larger social networks and lower social network density. At the same time, other dimensions of childhood – in particular, higher levels of family life happiness – are associated greater social network density.

The opposing directionality of associations between certain dimensions of childhood (i.e., parental education and family happiness) and later life network density may seem counterintuitive; however, these findings are not at odds with prior literature. Applications of social network theory tends to emphasize the utility and benefits of social network structure using two perspectives. One perspective conceptualizes tie intimacy, social support, and resource exchange with close others as facilitated by the *presence* of network connections (Ashida and Heaney 2008; Hurlbert et al. 2000). Another perspective emphasizes access to diverse sources of information and resources, and independence from social constraint and normative pressures which are facilitated by lower levels of density via the *absence* of ties among network members (i.e., bridging positions) (e.g., Burt 2005; Granovetter 1973).

Empirical research on the intersection of social networks and inequality rarely considers these lines of thinking simultaneously, often focusing on either the presence or absence of ties among network members, and the various resources that these distinct network features yield. The results of this study, however, emphasize the co-existence of these structural dimensions, given that different childhood circumstances predict higher and lower levels of network connectivity in later life. These results further underscore that social network (dis)advantages may not necessarily be inferred from structural elements alone. Those individuals who may be considered the most and least advantaged in childhood conditions appear similar with regard to

predicted network structure in later life, despite the possibility that similar network structures may reflect disparate social origins and distinct contexts of later life social network relationships.

Indeed, as childhood SES may impact learned norms around maintaining social resources (e.g., Singh-Manoux and Marmot 2005), children from more advantaged families may be socialized to a lifestyle of developing and maintaining less dense social network ties that yield access to distinct social domains. Greater resources during early life, represented by higher parental education, may also equip individuals to maintain more advantageously structured social ties throughout the life course, including those opportunities and informational resources afforded by lower levels of network density (or social network bridging) (e.g., Burt 2005; Granovetter 1973). At the same time, exposure to positive family experiences (e.g., higher levels of family happiness) early in life may set in motion one's proclivity and capacity to maintain a close-knit, supportive network throughout the life course.

Although a rigorous test of potential mechanisms requires extensive data on individuals' life histories, these linkages between childhood and later life networks can be used to propose how structurally similar networks may be functionally distinct in terms of the social resources that they yield. For older adults with more advantaged backgrounds, lower levels of network density may represent access to distinct pools of resources and information, fewer normative pressures, and greater independence (e.g., Lin 1999). Likewise, ties among network members may reflect a capacity for trust, social support, and resource exchange (Hurlbert et al. 2000). For older adults reporting lower levels of family happiness, however, lower levels of density may signal the absence of a coordinated network. Certain psychosocial dispositions or tendencies that may emanate from childhood family circumstances could lead to difficulties in maintaining intimate social ties later in life, ultimately leaving individuals to be more isolated from key social

supports. At the same time, a high level of network connectivity among older adults with lower childhood SES may signal structural constraint, including the lack of opportunity to access distinct social domains (e.g., Domínguez and Watkins 2003).

These potential distinctions also highlight a theoretical contribution of this work in terms of how social networks and the life course are studied – that is, the need to contextualize social networks in terms of their origination (i.e., early life) and the social resources that they yield to fully understand how they benefit or harm individual well-being, and thereby contribute to inequality in later life. This theoretical component dovetails well with key tenants of the life course perspective, namely the historical contingencies and interdependences of social relationships in the context of human lives (Elder 1994). Situating individuals' social relationships in the context of their personal trajectories adds insight in terms of how we interpret the meaning of social network relationships – not only in terms of the resources and outcomes that they generate, but also the early circumstances that predict their development.

The NSHAP provides one of the first opportunities to examine how early life circumstances may be associated with the individuals' closest social ties in later life using a nationally representative sample of older Americans. Despite this study's contributions, some limitations should be recognized. First, although the NSHAP collects extensive information on older adults' social lives and well-being, events or circumstances in early adulthood or midlife (e.g., spells of unemployment, health problems, problems in the lives of children, the death of a parent) could help to explain the associations observed in this study. To fully address this issue would require far more extensive data collection on individuals' life histories as they transpire.

It is also worth noting although this study relies on retrospective reports of childhood condition, recall bias is likely to be in the positive direction, with individuals tending to

remember childhood circumstances more favorably with the passage of time (Ferraro et al. 2016), suggesting that these findings may be downwardly biased. Additionally, while homophily may be a mechanism whereby individuals develop and maintain network ties with individuals of similar (dis)advantaged backgrounds, the NSHAP does not collect information on respondents' network members. I am therefore unable to examine the role of those characteristics of older adults' network members which may shed further light on these findings. Finally, given the robust link between early life circumstances and later life health, future research should consider how this association may be mediated or moderated by social networks.

In conclusion, this study adds to emerging research suggesting that individuals' social resources throughout the life course may be shaped by childhood (e.g., Ferraro et al. 2016; Umberson et al. 2014). These findings draw particular attention to early life as a potentially important, yet relatively overlooked determinant of personal social network structure, which could function as a mechanism for many of the disparate outcomes faced by older adults (health and otherwise), including those already studied in the context of early life determinants. Much has been made in sociological theory of childhood socialization regarding status attainment, including occupation and education, but less work has considered how early socialization could manifest at the relational level. Future research may consider that social network structure be studied from a perspective of intergenerational transmission or socialization, further contributing to how we understand the intersection of life course principles and social networks.

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Table 1. Descriptions of Key Variables (N = 4261)

Variable	Proportion or Weighted Mean (SD)
Social Network Outcomes	
Social network size	3.486 (1.475)
Social network density [a]	
Number of ties among network alters; Range: 0 – 10	4.452 (3.077)
Proportion of ties that exist among network members	.745 (.312)
Early Life Measures	
Parental education (highest level)	
Less than HS	.255
HS or equivalent	.323
More than HS	.301
Missing	.121
Family happiness from age 6 - 16 (Range: 1 – 6)	4.352 (1.491)
Lived with both parents from age 6 - 16	.829
Witnessed or experienced violent event from age 6 - 16	.188
Childhood health from age 6 - 16 (Range: 1 – 5)	4.094 (.966)
Family well off from age 6 - 16 (Range: 1 – 5)	2.588 (.968)
Sociodemographic and Life Course Covariates	
Age (divided by 10)	6.531 (.925)
Female (1 = yes)	.536
Race/ethnicity	
White	.723
Black	.136
Hispanic, non-black	.106
Other	.035
Educational attainment	
Less than HS	.148
HS or equivalent	.239
Some college	.344
Bachelor's or more	.270
Marital status	
Married/partnered	.717
Separated/divorced	.113
Widowed	.130
Never married	.040
Employed (1 = yes)	.359
Social Network Covariates	
Proportion of alters living in respondent's household [a]	.207 (.203)
Average contact between respondent and their alters (1- 8) [a]	6.777 (.826)
Health Status	
Self-rated physical health	
Poor	.042
Fair	.198
Good	.335
Very Good	.311
Excellent	.114
Standardized depression score (Range: -.621 – 3.021)	.032 (.606)
Standardized ADL score (Range: -.366 – 6.895)	-.046 (.674)

[a] Covariates only included in models predicting network density. Means are therefore calculated from respondents in the analytic sample who name at least two network members (n = 3,932).

Table 2. Incident Rate Ratios (IRR) from Poisson and Negative Binomial Regression Models Predicting Older Adults' Social Network Size and Density.

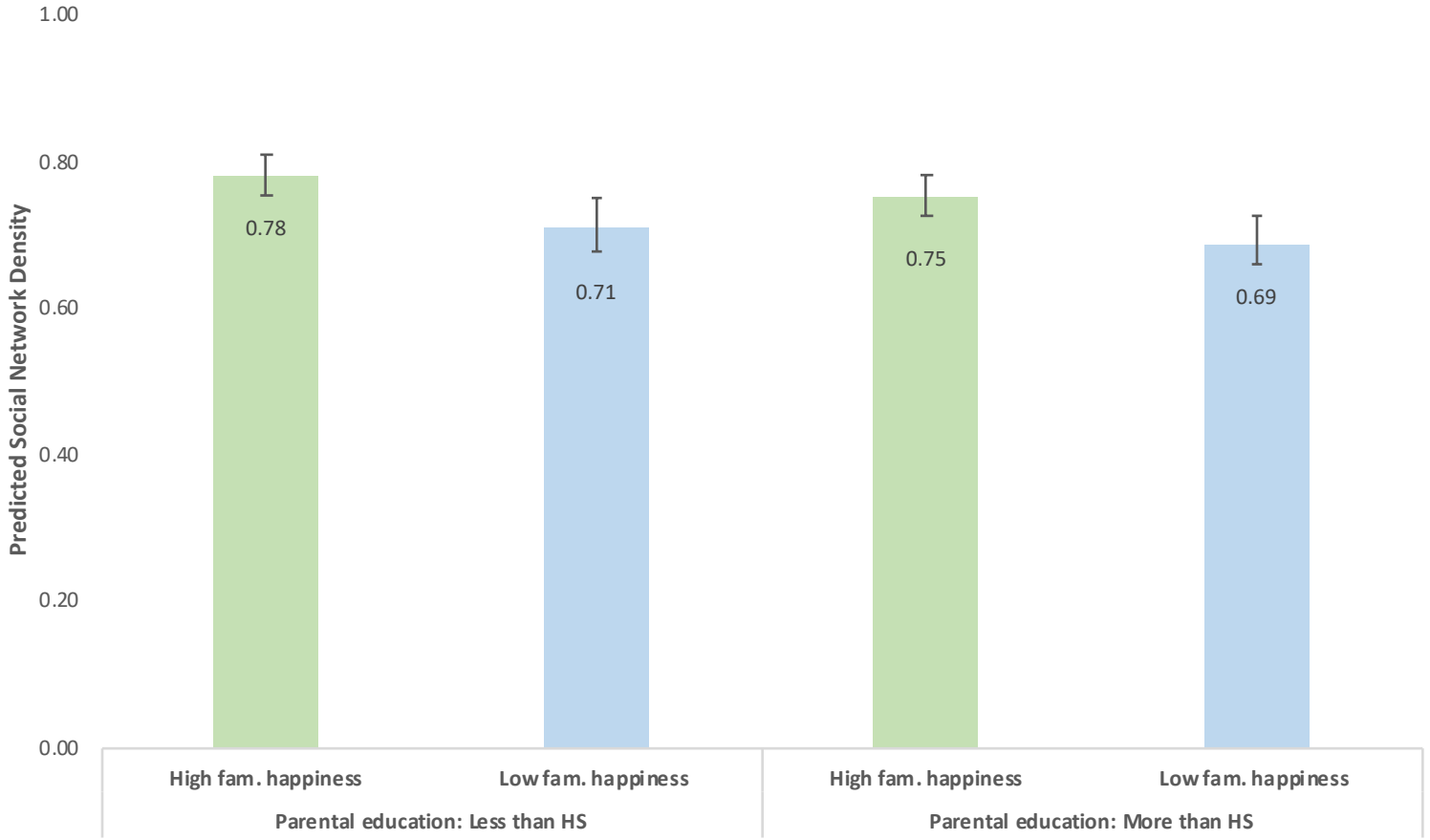
	Network Size (Poisson)		Network Density (Negative Binomial)	
Predictor	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Parental education *(Ref = Less HS)*				
HS or equivalent	1.071***	1.042**	.974	.981
	(1.038 - 1.107)	(1.010 - 1.075)	(.939 - 1.012)	(.950 - 1.012)
More than HS	1.119***	1.050**	.917***	.949**
	(1.087 - 1.151)	(1.018 - 1.082)	(.881 - .955)	(.914 - .986)
Missing	.941*	.968	.992	.957
	(.891 - .994)	(.917 - 1.022)	(.945 - 1.041)	(.914 - 1.001)
Family happiness	1.007	1.007	1.028***	1.019***
	(.998 - 1.016)	(.998 - 1.016)	(1.017 - 1.039)	(1.010 - 1.028)
Lived with both parents	1.016	1.007	1.025	1.028
	(.986 - 1.047)	(.979 - 1.036)	(.983 - 1.070)	(.990 - 1.068)
Witnessed or experienced a violent event	.984	.989	.963*	.975
	(.949 - 1.021)	(.954 - 1.025)	(.929 - .999)	(.942 - 1.009)
Childhood health	1.007	.998	1.017*	1.012
	(.993 - 1.020)	(.985 - 1.010)	(1.002 - 1.032)	(.998 - 1.025)
Family well off	.991	.991	.989	.991
	(.978 - 1.005)	(.977 - 1.004)	(.975 - 1.003)	(.978 - 1.004)
Female	1.121***	1.126***	.951***	.945***
	(1.094 - 1.149)	(1.098 - 1.154)	(.925 - .978)	(.920 - .970)
Race/ethnicity *(Ref = White)*				
Black	.945**	.959*	1.069*	1.040
	(.908 - .983)	(.922 - .998)	(1.013 - 1.129)	(.996 - 1.086)
Hispanic, non-black	.963	.987	1.045	.950
	(.915 - 1.014)	(.937 - 1.039)	(.978 - 1.116)	(.896 - 1.008)
Other	.917*	.906**	1.085*	1.096**
	(.856 - .981)	(.850 - .966)	(1.013 - 1.162)	(1.031 - 1.166)
Age		.990		.992
		(.972 - 1.009)		(.971 - 1.013)
Educational attainment *(Ref = Less than HS)*				

HS or equivalent		1.060*		.985
		(1.005 - 1.118)		(.935 - 1.037)
Some college		1.131***		.954*
		(1.078 - 1.187)		(.916 - .994)
Bachelor's or more		1.163***		.922***
		(1.101 - 1.229)		(.880 - .966)
Marital status *(Ref = Married/partnered)*				
Separated/divorced		.977		.906***
		(.943 - 1.013)		(.871 - .943)
Widowed		.963		.988
		(.925 - 1.003)		(.937 - 1.040)
Never married		.930*		.875***
		(.868 - .996)		(.811 - .944)
Employed (1 = yes)		.993		.965**
		(.960 - 1.027)		(.940 - .991)
Network size		--		.999
				(.983 - 1.015)
Average contact with alters		--		1.165***
				(1.137 - 1.193)
Proportion of alters living in R's household		--		1.629***
				(1.502 - 1.766)
Wave of variable measurement	.996	.989	.959*	.929**
	(.965 - 1.028)	(.955 - 1.025)	(.927 - .992)	(.888 - .972)
Constant	2.929***	2.824***	.680***	.280***
	(2.666 - 3.219)	(2.347 - 3.398)	(.623 - .742)	(.208 - .379)
F (df)	15.98*** (13, 83)	12.96*** (27, 69)	7.41*** (13, 83)	26.06*** (30, 66)
N	4261		3932	

Note: Models predicting social network density (measured as number of ties that exist in a respondent's network) are limited to respondents that include at least two network members, and therefore allow for measures of network density. Number of possible ties among network members is used as the exposure variable in the density models. Models 2 and 4 include controls for self-rated health, depression, and functional health which are not significant, and are not shown due to space constraints.

* $p < .05$; ** $p < .01$; *** $p < .001$ (Two-tailed tests). 95% confidence intervals appear in parentheses.

Figure 1. Predicted Social Network Density Among Respondents with Higher and Lower Levels of Parental Education and Family Happiness During Childhood.



Note: For ease of graphical interpretation and comparison across respondents with different network sizes, predicted values represent average marginal effects from an ordinary least squares regression that models social network density as the proportion of ties that exist in a respondent's network, using the same set of covariates shown in Model 4 of Table 2.

Appendix Table 1. Log Odds from Logistic Regression Models Predicting Social Network Bridging Potential (N = 3932).

Predictor	
Parental education *(Ref = Less HS)*	
HS or equivalent	.113
	(-.082 - .308)
More than HS	.372**
	(.098 - .646)
Missing	.276
	(-.104 - .656)
Family happiness	-.120***
	(-.181 - -.059)
Lived with both parents	-.024
	(-.267 - .219)
Witnessed or experienced a violent event	.191
	(-.087 - .468)
Childhood health	-.046
	(-.149 - .056)
Family well off	.064
	(-.038 - .165)
Female	.364***
	(.160 - .568)
Race/ethnicity *(Ref = White)*	
Black	-.205
	(-.522 - .113)
Hispanic, non-black	-.078
	(-.539 - .383)
Other	-.620*
	(-1.131 - -.108)
Age	-.170*
	(-.311 - -.029)
Educational attainment *(Ref = Less than HS)*	
HS or equivalent	.008
	(-.398 - .415)
Some college	.247
	(-.127 - .620)
Bachelor's or more	.416
	(-.002 - .835)
Marital status *(Ref = Married/partnered)*	
Separated/divorced	.084
	(-.191 - .358)
Widowed	-.225
	(-.504 - .054)
Never married	.176
	(-.373 - .724)
Employed (1 = yes)	.340**
	(.140 - .541)
Network size	.668***
	(.584 - .751)
Average contact with alters	-.685***
	(-.796 - -.573)

Proportion of alters living in R's household	-2.649***
	(-3.281 - -2.016)
Wave of variable measurement	.153
	(-.121 - .426)
Constant	3.072***
	(1.284 - 4.861)
F (df)	23.00*** (30, 66)

Note: Analytic sample is limited to respondents that include at least two network members, and therefore allow for measures of social network bridging potential.

* $p < .05$; ** $p < .01$; *** $p < .001$ (Two-tailed tests). 95% confidence intervals appear in parentheses.

Appendix Table 2. Coefficients from Lagged Poisson and OLS Models Predicting Older Adults' Social Network Size (Incident Rate Ratios) and Density at Wave 2.

	Model 1	Model 2
Predictor	**Network Size W2 (Poisson)**	**Network Density W2 (OLS)**
Network size W1	1.091***	.009
	(1.072 - 1.109)	(-.007 - .026)
Network density W1		.192***
		(.117 - .266)
Parental education *(Ref = Less HS)*		
HS or equivalent	1.004	.001
	(.966 - 1.044)	(-.035 - .038)
More than HS	1.025	-.025
	(.976 - 1.076)	(-.071 - .022)
Missing	.950	-.016
	(.887 - 1.019)	(-.061 - .029)
Family happiness	1.001	.011*
	(.989 - 1.014)	(.001 - .022)
Lived with both parents	1.003	.011
	(.955 - 1.054)	(-.042 – .064)
Witnessed or experienced a violent event	1.025	-.025
	(.975 - 1.078)	(-.067 - .017)
Childhood health	1.000	.018*
	(.984 - 1.017)	(.002 - .035)
Family well off	1.004	-.015*
	(.983 - 1.025)	(-.028 - -.001)
Constant	2.178***	.394**
	(1.774 - 2.674)	(.165 - .623)
R^2		.17
F(df)	14,75*** (29, 22)	11.86*** (32, 19)
N	1758	1483

Note: All models include controls for age, gender, educational attainment, race/ethnicity, marital status, employment status, self-rated health, depression, functional health, all measured at wave 1, as well as changes in marital status and employment status between waves. Models predicting social network density include controls for network size, average contact with alters, and proportion of alters living in R's household measured at wave 1 and are limited to respondents who named at least two network members at both waves. Density is modeled as the proportion of ties that exist in a respondent's network, given the inability to use two exposure variables to model density as the number of ties that exist at both waves. Models are weighted using wave 1 respondent level weights that adjust for selection and attrition across waves, and account for the NSHAP survey design.

* $p < .05$; ** $p < .01$; *** $p < .001$ (Two-tailed tests). 95% confidence intervals appear in parentheses.