Title: Age and gender differences in social network composition and social support among older rural South Africans: findings from the HAALSI study

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ABSTRACT

Objectives: Drawing on data from the “Health and Aging in Africa: A Longitudinal Study of an INDEPTH community in South Africa” (HAALSI) baseline survey, we present data on older adults’ social networks and receipt of social support in rural South Africa. We examine how age and gender differences in social network characteristics matched with patterns predicted by theories of choice- and constraint-based network contraction in older adults.

Method: We used regression analysis on data for 5059 South African adults aged over 40.

Results: Older respondents reported fewer important social contacts and less frequent communication than their middle-aged peers, largely due to fewer non-kin connections. Network size difference between older and younger women was greater than that between older and younger men. This gender difference was explicable by much higher levels of widowhood amongst older women compared to younger women and older men.

Discussion: We found evidence for marriage-related structural constraint on older women’s social networks in rural South Africa, but not for choice-based network contraction. These findings suggest that many older women in rural Africa, a growing population, may have an unmet need for social support.

Keywords: constraint theory; functional selectivity theory; socioemotional selectivity theory; convoy model; kin; marital status
INTRODUCTION

Personal social networks promote well-being across the life course and are considered a key to “successful aging” (Rowe & Kahn, 1997). Social relationships often provide both emotional and instrumental support, protecting against and aiding recovery from health shocks through numerous mechanisms (Thoits, 2011). In the United States (US) and Europe, fewer numbers and poorer quality of social relationships in later life are associated with depression and loneliness (Stoeckel & Litwin, 2016), cognitive and functional impairment (Kuiper et al., 2015), risk of long-term care institutionalization (Pynnönen, Törmäkangas, Heikkinen, Rantanen, & Lyyra, 2012), and mortality (Shor & Roelfs, 2015).

Supportive networks in Sub-Saharan Africa (SSA) have been shown to improve access to medical care, HIV testing and adherence to antiretroviral therapy (Musheke et al., 2013; Ware et al., 2009). Given the paucity of formal social support on the continent, provision of informal support through personal networks may be more important for physical and mental health than elsewhere (Perkins, Subramanian, & Christakis, 2015). Yet despite recognition that social networks are associated with health (Berkman & Krishna, 2014; Perkins et al., 2015), research on older adults’ social networks in low- and middle-income countries, particularly SSA, is limited.

While several qualitative studies of personal networks have been conducted in SSA communities, including with older adults (De Klerk, 2011; van Eeuwijk, 2014), quantitative studies appear limited to a small study of older HIV-positive Togolese adults (Moore & Prybutok, 2014). In this article, we use personal network data from 5059 older adults living in rural Mpumalanga, South Africa to examine how patterns of social contact and support vary by age and gender, and on this basis, examine the extent to which theories developed in higher-income settings about network changes hold in rural South Africa.
Aging and Network Changes in High-Income Settings

US studies report that in contrast with younger and middle aged adults, older adults have smaller personal networks (Cornwell, Laumann, & Schumm, 2008) and lower rates of daily social contact and participation in social activities (Cornwell, 2011; Marcum, 2013). Two types of theory have been proposed to explain how social contact patterns change with age in higher-income settings: theories of choice and theories of constraint.

Theories of Choice

Contemporary scholars emphasize that older individuals’ small networks may not reflect social isolation (York Cornwell & Waite, 2009); rather, size may reflect socioemotional or functional selectivity (Cornwell, Schumm, Laumann, Kim, & Kim, 2014). Socioemotional selectivity theory (SST) argues that, as individuals age, they become more aware of their mortality and increasingly invest in a core group of emotionally-intimate network members (Carstensen, 1992). This investment leads to personal networks becoming smaller, denser and more kin-centric, and having greater multiplexity, i.e. each social contact provides a greater variety of support types (Smith et al., 2015). SST is also the basis of the convoy model of social support. The convoy model posits that more peripheral social contacts are shed as individuals age, leaving a stable core of emotionally-intimate family and friends – a convoy that “travels together” providing members with mutual support (Antonucci, Ajrouch, & Birditt, 2013). US evidence that emotional support remains stable with age, even as receipt of other support increases while contact with friends declines, seems to support SST (Shaw, Krause, Liang, & Bennett, 2007). Other US work, however, shows a decrease in tie multiplexity with age (Smith et al., 2015). This suggests that older adults maintain contacts fulfilling specific functions, i.e. functional selectivity, rather than a core of contacts providing multiple functions.
Theories of Constraint

Contraction in personal networks with age can also be explained by structural constraints inherent over the life course. Network structure and content change with each life course transition, e.g., marriage of adult children, birth of grandchildren, retirement, or change in marital status. The foci theory of social networks argues that relationships are drawn from foci of activity: the places in which we live, work, and socialize (Feld, 1981). As adults age and move between social roles, the number of foci and consequently network size may decrease.

Health or functional constraints may also affect personal networks. As adults age, they may lose their ability to reciprocate instrumental support, due to increased functional limitations, cognitive impairment or chronic conditions (Klein Ikkink & van Tilburg, 1999). According to exchange theory, norms of contemporaneous reciprocity dictate that relationships remain balanced; when balance is lost, relationships dissolve. However, normative role expectations may mean that individuals are willing to overlook an imbalance with older parents or other relatives (Shaw et al., 2007) if maintenance of currently imbalanced relationships reflects reciprocity from earlier points in time, when the relational imbalance was reversed. The convoy model can thus be regarded as a phenomenon of either choice or constraint.

Gender and Social Networks in Later Life

In higher-income settings, men and women experience different rates and forms of network change across the life course due to the gendered nature of family and work trajectories, and these gender differences increase with age (Fischer & Beresford, 2014). Women have larger networks with lower density and higher communication levels (McDonald & Mair, 2010), and greater variety in their networks, maintaining connections to family, friends, and neighbors. In contrast, men are more likely to maintain connections with coworkers (Shaw et al., 2007), and are more severely affected by network
loss following retirement (McDonald & Mair, 2010). Women are more likely to both provide and receive emotional, informational and financial support from both kin and spouses (Allen, 1994; McDonald & Mair, 2010), a difference that widens with age (Fischer & Beresford, 2014). These empirical findings suggest that men may be more functionally selective initially and more affected by structural constraints as they age, while women, as suggested by SST and the convoy model, maintain a more stable range of reciprocal relationships.

Aging and Social Dynamics in South Africa

In SSA, the number of people over 60 will rise rapidly in the near future. Between 2015 and 2030, the number is expected to rise by 64% across SSA and 49% in South Africa (United Nations, 2015). These changes reflect the shift in disease burdens, from acute, primarily communicable conditions (often affecting working-age individuals) towards chronic conditions resulting in early morbidity but less mortality (GBD 2013 Mortality and Causes of Death Collaborators, 2015). This increase will amount to only a small increase in the proportion of SSA individuals aged over 60 (from 4.8% to 5.3%). In South Africa, however, where the reduction in HIV-related mortality has driven demographic patterns in recent years (Pillay-van Wyk et al., 2013), there will be a 36% increase (from 7.7% to 10.5%) in the older population; by 2050 the proportion over 60 years will more than double to 15.4%. It is unclear how this increase in older individuals will affect social contact patterns. On the one hand, higher density of age-peers within communities may ensure greater social connectivity and mutual support into older age, generating greater opportunity for network choice. On the other hand, higher proportions of elderly individuals with greater morbidity may put strain on existing social ties and undermine exchange-based relationships within families and communities, generating greater network constraint.

Older adults in SSA typically have both dependent and productive household roles. Assumptions that norms of interdependence and reciprocity in “traditional” families prevail everywhere imply that
families will provide most later-life care (Manderson & Block, 2016; Schatz, Madhavan, Collinson, Gómez-Olivé, & Ralston, 2015). While these norms have changed, especially in urban areas, prime-aged adults are increasingly absent from rural homes due to migration for work or mortality, leaving older women to provide primary care to spouses, grandchildren, and dependent adult children (Schatz, 2007; Schatz & Seeley, 2015). Although this role can act as a network constraint, older women may enjoy these productive roles or even utilize these norms and socio-economic realities to their advantage. For instance, older women emphasize past sacrifices for children and older men use their earned wealth to induce social support and care (Cliggett, 2003).

These social and economic processes are particularly apparent in rural South Africa. Here, the substantial impact of HIV-related disease on household composition has been compounded by decades of labor migration, and a high and increasing level of female-headed households (Collinson, Tollman, Kahn, & Clark, 2006; Manderson & Block, 2016; Manderson, Block, & Mkhwanazi, 2016). High rural unemployment post-Apartheid has led men (and increasingly women) to leave their rural villages in pursuit of work. This migration increases the burden on older adults to support the family left behind, and provide the primary source of household income via a government-funded means-tested non-contributory pension to all those aged over 60 (Schatz, Gómez-Olivé, Ralston, Menken, & Tollman, 2012). As a result, even if the number of social connections may have risen for older South Africans, the net level of support they obtain may well have declined. Nevertheless, these familial obligations may act to cement ties within a core, intergenerational social network.

Gender remains central to older South African social relations. Economic roles such as mid-life labor migration and later-life pensions inform social roles in gendered ways such that rural South African women are tethered to the household (Camlin, Snow, & Hosegood, 2013; Oberhauser & Pratt, 2004). South African men are more likely to migrate for work, and typically migrate further, making them more likely to form social relations with other migrants and receiving community members. Men may then be
more heavily impacted by retirement – with the proviso that formal employment exists for a minority of rural South Africans. Female labor migrants are more likely to migrate to settlements closer to their home villages and maintain familial connections during their migrant years. Additionally, female pensioners are more likely to derive the majority of their income and wealth from government contributions. Aside from these economic factors, women are culturally expected to manage the household and maintain intergenerational relationships as they age, often contemporaneously caring for their children and grandchildren (Schatz & Seeley, 2015). These social forces may lead to gender-based patterns of social support similar to those in higher-income settings.

**Analytic Hypotheses**

We hypothesize that various age and gender-specific network patterns might be present in cross-sectional data of older adults in South Africa. Theory and evidence from higher-income settings predicts that networks are smaller in older age, that women have higher communication levels, and that this gender gap increases with age. We therefore expect network size and frequency of communication to be negatively associated with age for both men and women, but with a larger difference from a lower base for men. In addition, SST suggests that adults selectively maintain kin relationships either because they represent core connections, or because loss of ability to reciprocate is offset by normative role expectations for individuals to care for older relatives. Drawing from this choice-based theory of network contraction, we expect larger falls with age in contact and support from non-kin than from kin.

We also expect structural constraints to have more impact as individuals move from middle to older age. These constraints include the end of employment (for those previously employed) and the absence of a spouse (e.g. due to widowhood or migration) reducing social network size and communication frequency. We expect notably lower levels of social contact for people aged over 60, and for people who
have lost or never had a spouse compared to those currently living with one. Given the lower rates of employment in SSA, it is unclear whether any retirement effect will as strong as in the US.

Finally, SST suggests that while network size falls with age, receipt of emotional support may not decline if peripheral connections are dropped but a dense core of contacts remains; we test this possibility by comparing differences across age cohorts in the level of emotional support received with differences for other support types. A lesser decline in emotional support with age would support SST. We also test whether contacts are maintained into old age based on ability to provide support in multiple domains by seeing if the number of domains in which contacts provide support (i.e. tie multiplexity) is higher for older individuals.

METHODS

Sample

Health and Aging in Africa: a Longitudinal Study of an INDEPTH community in South Africa (HAALSI) is a population-based cohort study of the health, aging and wellbeing of middle-aged and older men and women. The baseline wave of HAALSI was conducted in 27 of the 31 villages that comprise the MRC/Wits Rural Public Health and Health Transitions Research Unit site in Mpumalanga Province, South Africa (hereafter, “Agincourt”) (Kahn et al., 2012) between November 2014 and November 2015. The study area is close to the Mozambique border and almost one-third of residents are Mozambican migrants, with or without formal residency. HAALSI participants were a random ~40% sample of all residents aged 40 and over in these 27 villages.

The baseline survey was modeled closely on the Health and Retirement Study and its several international sister studies, and was based on a three-hour household visit including structured
quantitative interviews, anthropometric and physiological measurements and blood draws. Experienced local interviewers trained specifically to collect social network data conducted all interviews in the local xiTsonga language. The response rate was 87%. HAALSI was granted ethics approved by the University of the Witwatersrand Human Research Ethics Committee, the Harvard T.H. Chan School of Public Health Office of Human Research Administration, and the Mpumalanga Provincial Research and Ethics Committee.

The HAALSI baseline survey included a social network module, based on the network data collection in the National Social Life, Health, and Aging Project. This module included one name generator question: “Please tell me the names of 6 adults with whom you have been in communication either in person or by phone or by internet in the past six months, starting with the person who is most important to you for any reason.” If the respondent was married and living with their spouse, but did not name them, the spouse’s name was added to the list. Respondents could provide fewer than six named persons (“alters”). Respondents were then asked questions about each alter’s socio-demographic information (age, sex, and residential location), relationship to the respondent, frequency of contact with the alter (in-person, by phone/text/email), how frequently the alter provided support (emotional, informational, physical, financial), and how frequently the ego and alter were in conflict. Finally, respondents were asked about the relationship and frequency of contact they believed each alter had with each other alter. These methods have been described as mapping an “ego-centered cognitive social structure”, highlighting that the data reflect respondents’ perceptions of others, which may or may not be accurate (Marcum et al., 2017).

Previous analysis of responses to this social network module has shown that both month of interview and interviewer identity predict the number of important others named by respondents, possibly due to interviewer learning effects (Harling et al., 2017). However, although 70% of interviews were conducted by women, neither interviewer gender nor interviewer-respondent gender homophily was associated
with reported network size. Fieldwork was facilitated by respondents’ and interviewers’ past experience of participating in various population-based research studies conducted at Agincourt.

**Measures**

Several domains of social connectedness were measured. First, network size was measured as the number of alters the respondent communicated with over the past six months on an at least monthly basis (“monthly alters”). Second, frequency of communication was measured as the approximate number of days per month, over the past six months, in which an alter had contact with a respondent: calculated by valuing “monthly” communication as one, “few times a month” as two, “weekly” as four, “few times a week” as ten, and “daily/almost daily” as 30. We used this approach to adjust for the unequal gaps between frequency categories as collected, so to generate an approximate total number of person-days of communication with important individuals per month, calculated as the sum of frequencies across all named alters (i.e. a maximum of 210). We calculated network size and contact frequency both for any social support, and for each of the four types of social support individually. Third, network density was measured as the proportion of alter-pairs who communicated at least monthly; we do not use more nuanced measures given the perceived nature of these data. Finally, mean tie multiplexity was measured as the number of support types provided by each alter, averaged across all alters for each respondent.

**Covariates**

We conducted our primary analyses using age in five categories (40-49, 50-59, 60-69, 70-79, 80+) to flexibly capture non-linear associations between age and social connectedness. We also considered various respondent socio-demographic characteristics expected to affect social support levels and differences across age: (i) educational attainment (none, primary, secondary, tertiary); (ii) country of origin (South Africa, Mozambique/other); (iii) marital status (civil or religious marriage, never married,
separated/divorced, widowed); (iv) household wealth quintile (including imputed values for 231 (4.6%) individuals with missing data); (v) household size (1, 2, 4-7, 8+); and (vi) employment status (not employed, employed, not working outside the home). Finally, we considered three characteristics of the respondent-alter relationship: kinship (kin versus non-kin); gender (homophilous versus non-homophilous); and alter location (same household, elsewhere in village, elsewhere in Agincourt, outside Agincourt).

Statistical Analyses

We began by describing the dataset, including univariate proportions and bivariate associations between respondent covariates and network size and frequency of communication. We then ran two-level hierarchical regression models (respondents nested within interviewers) for all HAALSI respondents with various measures of connectedness as outcomes. Our ‘unadjusted’ models contained indicators for age categories interacted by gender, month of interview indicators and random intercepts for interviewers. These models were therefore of the form:

$$\text{Connectedness}_{ij} = \beta_{k-1} \text{Age}_{ij} \times \text{Sex}_{ij} + \gamma_{m-1} \text{Month}_{ij} + \lambda_j + \epsilon_{ij}$$

Where respondents $i$ were nested within interviewers $j$, $k = 10$ and $m = 13$. We also ran ‘adjusted’ models that additionally contained respondent covariates. We used a Poisson link for count variables (except when values were over-dispersed, in which case we used a negative-binomial link), including a zero-inflation term where appropriate. We used the identity link for frequency and density variables. Unadjusted models included all HAALSI respondents; adjusted models used a complete-case approach, dropping 34 (0.7%) individuals with missing data on at least one covariate. From some models, we predicted mean outcome values for each of the ten age-gender categories, setting the month of interview to that with the highest response rate (December 2014). We did not include fully gender-interacted models (i.e. stratifying the model or also interacting the socio-demographic covariates with gender) to
maintain tractability in presenting our results, and because we did not have strong *a priori* reasons to believe that they would effect-modify our primary age-gender associations with social network characteristics.

To evaluate hypotheses relating to differences in social support by age and gender, we first evaluated unadjusted regression models of network size and communication frequency, testing for differences across ages within gender, and across gender within age groups, using $\chi^2_{m-1}$ tests on the $\beta$ coefficients. We measured how these differences were explained by other respondent characteristics, which may mediate associations between age-gender and social networks, in adjusted models. We then evaluated whether there was evidence for an employment-related structural constraint, in the form of a step-change in the level of social connectedness after age 60, or a marriage-related structural constraint, in the form of a lower level of social connectedness for unmarried individuals, and whether these patterns differed by gender.

**RESULTS**

The 5,059 HAALSI respondents reported communicating at least monthly with 15,058 alters, representing 96.8% of all 15,549 alters nominated (Table 1). Respondents named a median of three alters with whom they communicated at least monthly, with 267 (5.3%) individuals reporting zero alters and 669 (13.2%) reporting only one alter. One hundred and fifty (3.0%) currently married respondents reported six non-spousal alters and thus had a total of seven alters. Both monthly network size and frequency of communication were lower for individuals of older age, with no formal education, not of South African origin, not cohabiting with a partner, living in smaller households, not working and with lower household wealth. Under age 60, women reported larger networks and more frequency of contact than men; above age 60 this was reversed. Almost four-fifths (79.6%) of monthly alters were relatives,
28% lived in the same household as the respondent, 43.7% elsewhere in the same village and 12.0% elsewhere in Agincourt. Frequency of contact ranged from zero to 210 contacts per month (Supplementary Figure 1). The distribution was right-skewed with a median value of 60 and interquartile range 30-90, and had large masses at multiples of 30, reflecting the large proportion of respondents (43.7%) who only reported important alters with whom they communicated daily or almost daily. Respondents reported daily/almost daily in-person communication with 82.7% of same-household alters, 62% of same-village alters and 24.6% of those living further away.

**Social network differences by age and gender**

In unadjusted models, the number of monthly alters and frequency of monthly communication were lower for women over age 60 and men over age 70, for both in-person and phone/digital (“remote”) communication (Figure 1). Monthly alter differences by age were significant for both genders, although substantially greater in magnitude for women, such that over age 60 women had significantly lower levels of contact than their male counterparts (Table 2). This differential fall-off was explained by marital status, shown by the changes in effect size for age and gender when marital status was added in model 3. The social network difference reflected a shift from similar married/cohabiting levels at age 40 to very different levels at older ages (Figure 2). Results were similar when we stratified by communication type, i.e. in-person versus remote (Supplementary Table 1), and for frequency of communication (Supplementary Table 2).

To evaluate whether marriage and employment represented structural constraints, we ran two additional adjusted analyses, replacing marital or employment status as binary variables interacted with gender (Supplementary Table 3). We saw a substantial benefit to being married for men (IRR 1.39, 95%CI: 1.01-1.48) and a non-significant, lower benefit for women (IRR 1.31, 95%CI: 1.25-1.38). Employment status was not associated with social support level for men or women.
Selective maintenance of core networks

Network density was significantly higher among both older men and women compared to their younger same-sex peers in unadjusted models. This difference was somewhat lessened once respondent characteristics were included in the model: less than a 5% variation in density across all age-gender categories (Table 3). This result may reflect the high average level of density: 82% of all possible alter-alter ties were reported to exist based on at least monthly contact. Similarly, although multiplexity was high (respondents had mean of 3.1 types of support provided by each alter, and 36% of respondents with any alters reported all alters provided all four types of support at least monthly), it was not significantly higher in older age groups (Table 3).

In unadjusted models, men reported receiving each support type from a greater number of unique individuals than did women (Table 4). Levels of informational support was lower for both older men and women than for younger same-sex peers, as were levels of emotional support for women only. For all support types other than physical, differences across age and gender were explained in adjusted models by respondent characteristics, again largely by marital status (Supplementary Table 5). Patterns for frequency of support provision were very similar (Supplementary Table 6). In models stratified by whether the alter was kin or not, men had relatively stable numbers of kin relationships across age. Older women had fewer kin contacts than younger women, due largely to lower marriage rates (Table 5). Both older men and women had fewer non-kin alters than younger respondents, and these differences were not explained by differences in respondent characteristics. Women had consistently fewer non-kin alters than men.
DISCUSSION

SSA countries are set to age rapidly, increasing the importance of older African adults’ social situations. It is unclear whether the social networks of these adults look similar to those of age-peers in higher-income countries. In this article, we described the social networks of 5,059 older adults in rural South Africa, and the extent to which age and gender differences in these networks aligned with theories of choice and constraint developed for higher-income populations. When asked to report the important people in their lives, these older adults named a small number of others, in many cases kin from the same household or living geographically close to them, with whom they communicated daily. Communication was more frequently in-person than via phone or other means, although similar numbers of alters were contacted through each method, suggesting that in-person connections were more frequent than remote ones.

In line with evidence from higher-income settings (Antonucci et al., 2013; Cornwell et al., 2008), older adults named fewer important alters than middle-aged adults. Based on a measure of approximate communication frequency, in-person contact formed a larger proportion of all communication, possibly due to limited digital technology access or digital literacy among older rural South Africans, although mobile phone availability in South Africa is high. In contrast to higher-income settings, women had smaller networks and the gap between older and younger women was larger than that for men.

This gender difference was largely explained by far higher levels of marriage. Men over age 80 were over 60 percentage points more likely both to be married/cohabiting and to not be widowed (Figure 2). Both men and women who were currently married had consistently higher levels of support across age than people who were not. Adjusting for marital status greatly reduced differences in social network levels with age, and equalized levels and trends across gender. These results suggest a structural impact
of ended marriage in this setting. This result combined with much lower non-kin contact levels for older women means older women have significantly less support than others.

In contrast, we did not find support for retirement acting as a structural constraint: the only drop in contact levels for men and women around age 60 was of men’s kin rather than non-kin contacts. Similarly, being employed was not associated with substantially more social support in any analysis. These findings suggest that meaningful relationships for middle-aged and older rural South Africans arise largely from non-workplace settings. This interpretation seems plausible given the low levels of labor force participation and high labor mobility rates in South Africa. It may also reflect low salience for the idea of sudden and final retirement in these areas.

We found relatively little evidence of increasing perceived personal network density or multiplexity, although these measures may have been affected by ceiling effects: both density and multiplexity were high even among 40-49 year olds. Similarly, we did not see better maintenance of ties providing emotional support compared to other types of support, and for women emotional support levels fell more rapidly than for any other support type. However, we did see the number of kin relationships being maintained at all ages while non-kin ties fell rapidly for both men and women. This fall-off was the only variation in social support we could not explain via respondent socio-demographic characteristics, suggesting that these declines may be due to other respondent characteristics (e.g. decreased mobility or poorer health) or contextual factors. This question is an important area for future investigation.

In combination, our findings suggest that choice, including SST, does not play a strong role in how the social networks of rural South African women change with age. The association of social network characteristics with being married, and the selective maintenance of kin contacts, suggests that structural constraints play a substantial role in determining how much social support older women receive. In this context, the convoy model may act as a constraint on women who have lost key network members to
early mortality, and who are not able to reach out beyond their shrinking core network. Without longitudinal data, we have limited ability to determine whether this association is causal. Although close family contributed substantial social support in this setting for both men and women, the absence of a partner amongst oldest women led to significantly smaller social networks.

These findings suggest that, unlike in higher-income settings where social network contraction may represent an active choice by older adults, smaller social networks and lower levels of social support in rural South Africa may reflect external constraints. Many older women in particular may face an unmet need for social support, notably when they face numerous demands in the provision of care and support to younger family members (Schatz & Seeley, 2015). This shortfall may lead them to invest considerable efforts in strategizing to increase their social support (Cliggett, 2003).

**Strengths and Limitations**

Although the HAALSI sample consists of a very large random sample of older South Africans across a wide age range with a high response rate, our study has several potential limitations. First, this dataset covers a single study location, a poor and rural area in northeast South Africa. While the area is quite typical of other rural parts of South Africa, studies in other settings, particularly in urban areas, will help us to understand the generalizability of these findings. These findings will likely be replicable in many SSA settings, where social constraints on older women limit their ability to form new social ties, and where women often marry older men and female life expectancy exceeds that of males, meaning widowhood is common (United Nations, 2015).

Second, our data are cross-sectional, and cross-age comparisons conflate age and cohort effects. Although the whole study sample grew up under Apartheid, the impact of its end in the mid-1990s may have been felt differently across cohorts. Further, the heavy burden of HIV in this community, and rapid changes in family composition and gender relations, will have differentially affected cohorts. The
patterns we report may reflect selection effects arising from differential mortality by level of social support; for example, if older adults with smaller social networks die sooner, we may only see the most socially connected individuals at the older end of our age range. This situation, however, would result in an underestimate of the true longitudinal effects. Follow-up studies with the HAALSI cohort should allow us to disentangle such effects and to make within-individual comparisons.

Although we can show associations with our cross-sectional data, we are unable to examine causal pathways leading from other factors to high or low social connectedness. We therefore cannot yet fully evaluate theories of choice and constraint. Finally, survey name generators such as those in HAALSI do not capture the full range of network contacts, and may not be fully comparable cross-nationally.

Conclusion

In this study, we described the personal networks and support of middle-aged and older men and women living in rural South Africa to better understand the social and household dynamics of an aging population. We find support for structural constraints on their social networks, notably for women, arising from spousal loss. As individuals age, this constraint becomes less important if older men survive longer, or shifts to affect older ages if women continue to outlive their spouses by as long as they do now. If the latter is the case, population dynamics will mean a larger number of, often poor, women in need of additional support from beyond the kin network.
REFERENCES

Allen, S. M. (1994). Gender differences in spousal caregiving and unmet need for care. *Journal of Gerontology, 49*(4), S187-S195. doi:10.1093/geronj/49.4.S187

Antonucci, T. C., Ajrouch, K. J., & Birditt, K. S. (2013). The convoy model: Explaining social relations from a multidisciplinary perspective. *The gerontologist, gnt118*. doi:10.1093/geront/gnt118

Berkman, L. F., & Krishna, A. (2014). Social network epidemiology. In L. Berkman, I. Kawachi, & M. M. Glymour (Eds.), *Social epidemiology* (2nd ed., pp. 234-289). New York: Oxford University Press.

Camlin, C. S., Snow, R. C., & Hosegood, V. (2013). Gendered Patterns of Migration in Rural South Africa. *Population, Space and Place, 20*(6), 528-551. doi:10.1002/psp.1794

Carstensen, L. L. (1992). Social and emotional patterns in adulthood: support for socioemotional selectivity theory. *Psychology and Aging, 7*(3), 331. doi:10.1037/0882-7974.7.3.331

Cliggett, L. (2003). "Male Wealth" and "Claims to Motherhood": Gendered Resource Access and Intergenerational Relations in the Gwembe Valley, Zambia. In G. Clark (Ed.), *Gender at Work in Economic Life* (pp. 207-223): Altamira Press.

Collinson, M., Tollman, S. M., Kahn, K., & Clark, S. (2006). Highly prevalent circular migration: households, mobility and economic status in rural South Africa. In M. Tienda, S. E. Findley, S. Tollman, & E. Preston-Whyte (Eds.), *Africa on the move: African migration and urbanisation in comparative perspective* (pp. 194-216). Johannesburg: Witwatersrand University Press.

Cornwell, B. (2011). Age trends in daily social contact patterns. *Research on Aging, 33*(5), 598-631. doi:10.1177/0164027511409442

Cornwell, B., Laumann, E. O., & Schumm, L. P. (2008). The social connectedness of older adults: A national profile. *American Sociological Review, 73*(2), 185-203. doi:10.1177/000312240807300201
Cornwell, B., Schumm, L. P., Laumann, E. O., Kim, J., & Kim, Y.-J. (2014). Assessment of social network change in a national longitudinal survey. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences, 69*(Suppl 2), S75-S82. doi:10.1093/geronb/gbu037

De Klerk, J. (2011). *Being old in times of AIDS: aging, caring and relating in northwest Tanzania*. Leiden: African Studies Centre.

Feld, S. L. (1981). The focused organization of social ties. *American Journal of Sociology, 1015*-1035. doi:10.1086/227352

Fischer, C. S., & Beresford, L. (2014). Changes in support networks in late middle age: The extension of gender and educational differences. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences, 70*(1), 123-131. doi:10.1093/geronb/gbu057

GBD 2013 Mortality and Causes of Death Collaborators. (2015). Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet, 385*(9963), 117-171. doi:10.1016/S0140-6736(14)61682-2

Harling, G., Perkins, J. M., Gómez-Olivé, F. X., Morris, K. A., Wagner, R. G., Montana, L., . . . Berkman, L. F. (2017). Interviewer-driven variability in social network reporting: results from Health and Aging in Africa: a Longitudinal Study of an INDEPTH community (HAALSI) in South Africa. *Field methods, In press."

Kahn, K., Collinson, M. A., Gómez-Olivé, F. X., Mokoena, O., Twine, R., Mee, P., . . . Khosa, A. (2012). Profile: Agincourt health and socio-demographic surveillance system. *International Journal of Epidemiology, 41*(4), 988-1001. doi:10.1093/ije/dys115

Klein Ikkink, K., & van Tilburg, T. (1999). Broken ties: reciprocity and other factors affecting the termination of older adults' relationships. *Social Networks, 21*(2), 131-146. doi:10.1016/S0378-8733(99)00005-2
Kuiper, J. S., Zuidersma, M., Voshaar, R. C. O., Zuidema, S. U., van den Heuvel, E. R., Stolk, R. P., & Smidt, N. (2015). Social relationships and risk of dementia: a systematic review and meta-analysis of longitudinal cohort studies. *Ageing Research Reviews, 22*, 39-57. doi:10.1016/j.arr.2015.04.00

Manderson, L., & Block, E. (2016). Relatedness and care in Southern Africa and beyond. *Social Dynamics, 42*(2), 205-217. doi:10.1080/02533952.2016.1218139

Manderson, L., Block, E., & Mkhwanazi, N. (2016). Fragility, fluidity, and resilience: caregiving configurations three decades into AIDS. *AIDS Care, 28*(Suppl 4), 1-7. doi:10.1080/09540121.2016.1195487

Marcum, C. S. (2013). Age differences in daily social activities. *Research on Aging, 35*(5), 612-640. doi:10.1177/0164027512453468

Marcum, C. S., Lienert, J., Goldring, M., Lin, J., Miggins, A., Moss, M., . . . Koehly, L. (2017). *Ego-Centered Cognitive Social Structures of Close Personal Networks in the United States*. SocArXiv.

McDonald, S., & Mair, C. A. (2010). Social capital across the life course: age and gendered patterns of network resources. *Sociological Forum, 25*(2), 335-359. doi:10.1111/j.1573-7861.2010.01179.x

Moore, A. R., & Prybutok, V. (2014). Self-reported health and personal social networks of older people living with HIV/AIDS in Lomé, Togo. *Journal of cross-cultural gerontology, 29*(3), 329-338. doi:10.1007/s10823-014-9238-5

Musheke, M., Ntalasha, H., Gari, S., Mckenzie, O., Bond, V., Martin-Hilber, A., & Merten, S. (2013). A systematic review of qualitative findings on factors enabling and deterring uptake of HIV testing in Sub-Saharan Africa. *BMC Public Health, 13*(1), 220. doi:10.1186/1471-2458-13-220

Oberhauser, A. M., & Pratt, A. (2004). Women's collective economic strategies and political transformation in rural South Africa. *Gender, Place & Culture, 11*(2), 209-228. doi:10.1080/0966369042000218464
Perkins, J. M., Subramanian, S., & Christakis, N. A. (2015). Social networks and health: a systematic review of sociocentric network studies in low-and middle-income countries. *Social Science and Medicine, 125*, 60-78. doi:10.1016/j.socscimed.2014.08.019

Pillay-van Wyk, V., MsMburi, W., Laubscher, R., Dorrington, R. E., Groenewald, P., Matzopoulos, R., ... Gwebushe, N. (2013). Second national burden of disease study South Africa: national and subnational mortality trends, 1997–2009. *The Lancet, 381*, S113. doi:10.1016/S0140-6736(13)61367-7

Pynnönen, K., Törmäkangas, T., Heikkinen, R.-L., Rantanen, T., & Lyyra, T.-M. (2012). Does social activity decrease risk for institutionalization and mortality in older people? *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 67*(6), 765-774. doi:10.1093/geronb/gbs076

Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The Gerontologist, 37*(4), 433-440. doi:10.1093/geront/37.4.433

Schatz, E. (2007). "Taking care of my own blood": Older women's relationships to their households in rural South Africa. *Scandinavian Journal of Public Health, 35*, 147-154. doi:10.1080/14034950701355676

Schatz, E., Gómez-Olivé, X., Ralston, M., Menken, J., & Tollman, S. (2012). The impact of pensions on health and wellbeing in rural South Africa: Does gender matter? *Social Science & Medicine, 75*, 1864-1873. doi:10.1016/j.socscimed.2012.07.004

Schatz, E., Madhavan, S., Collinson, M., Gómez-Olivé, F. X., & Ralston, M. (2015). Dependent or Productive? A New Approach to Understanding the Social Positioning of Older South Africans Through Living Arrangements. *Research on Aging, 37*(6), 581-605.

Schatz, E., & Seeley, J. (2015). Gender, ageing and carework in East and Southern Africa: A review. *Global Public Health, 10*, 1185-1200. doi:10.1080/17441692.2015.1035664
Shaw, B. A., Krause, N., Liang, J., & Bennett, J. (2007). Tracking changes in social relations throughout late life. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences, 62*(2), S90-S99. doi:10.1093/geronb/62.2.S90

Shor, E., & Roelfs, D. J. (2015). Social contact frequency and all-cause mortality: A meta-analysis and meta-regression. *Social Science and Medicine, 128*, 76-86. doi:10.1016/j.socscimed.2015.01.010

Smith, E. J., Marcum, C. S., Boessen, A., Almquist, Z. W., Hipp, J. R., Nagle, N. N., & Butts, C. T. (2015). The relationship of age to personal network size, relational multiplexity, and proximity to alters in the Western United States. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences, 70*(1), 91-99. doi:10.1093/geronb/gbu142

Stoeckel, K. J., & Litwin, H. (2016). The impact of social networks on the relationship between functional impairment and depressive symptoms in older adults. *International Psychogeriatrics, 28*, 39–47. doi:10.1017/S1041610215000538

Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *Journal of Health and Social Behavior, 52*(2), 145-161. doi:10.1177/0022146510395592

United Nations. (2015). *World population ageing* (ST/ESA/SER.A/390). Retrieved from New York, NY:

van Eeuwijk, P. (2014). The elderly providing care for the elderly in Tanzania and Indonesia: making ‘elder to elder’ care visible. *Sociologus, 64*(1), 29-52. doi:10.3790/soc.64.1.29

Ware, N. C., Idoko, J., Kaaya, S., Biraro, I. A., Wyatt, M. A., Agbaji, O., . . . Bangsberg, D. R. (2009). Explaining adherence success in sub-Saharan Africa: an ethnographic study. *PLoS Medicine, 6*(1), e1000011. doi:10.1371/journal.pmed.1000011

York Cornwell, E., & Waite, L. J. (2009). Social disconnectedness, perceived isolation, and health among older adults. *Journal of Health and Social Behavior, 50*(1), 31-48. doi:10.1177/002214650905000103
FIGURES AND TABLES

Figure 1: Predicted number of unique contacts with important monthly alters per month and total number of contacts per month

Values from two-level Poisson regression models containing age/sex, month of interview and random effects for interviewer identity. Points represent predicted mean numbers of social contacts of the relevant type for individuals in the respective 10-year age groups at December 2014 response rates. Bars represent 95% confidence intervals around these point estimates.
Figure 2: Marital status of HAALSI sample by age & gender

Proportion of respondents each age by gender category with their respective current marital status.
Table 1: Descriptive statistics for HAALSI respondents

|                      | Respondents | Number of contacts | Frequency of communication |
|----------------------|-------------|--------------------|---------------------------|
|                      | N          | %                  | Mean 95% CI               | Mean 95% CI               |
| Age & gender         |             |                    |                           |                           |
| Male 40-49           | 418        | 8.3%               | 2.79 [2.63 - 2.95]        | 59.5 [55.8 - 63.2]        |
| Male 50-59           | 624        | 12.3%              | 2.97 [2.84 - 3.10]        | 59.9 [57.1 - 62.6]        |
| Male 60-69           | 643        | 12.7%              | 3.23 [3.10 - 3.36]        | 66.1 [63.0 - 69.1]        |
| Male 70-79           | 446        | 8.8%               | 2.99 [2.83 - 3.15]        | 62.9 [59.2 - 66.5]        |
| Male 80+             | 214        | 4.2%               | 2.93 [2.70 - 3.15]        | 57.0 [52.3 - 61.6]        |
| Female 40-49         | 500        | 9.9%               | 3.08 [2.94 - 3.21]        | 61.5 [58.2 - 64.7]        |
| Female 50-59         | 786        | 15.5%              | 3.09 [2.98 - 3.20]        | 63.8 [61.1 - 66.5]        |
| Female 60-69         | 661        | 13.1%              | 3.05 [2.92 - 3.18]        | 62.6 [59.5 - 65.7]        |
| Female 70-79         | 432        | 8.5%               | 2.76 [2.61 - 2.92]        | 53.7 [50.1 - 57.2]        |
| Female 80+           | 335        | 6.6%               | 2.45 [2.28 - 2.62]        | 47.7 [43.9 - 51.5]        |
| Education level      |             |                    |                           |                           |
| No formal education  | 2306       | 45.6%              | 2.81 [2.74 - 2.88]        | 56.4 [54.9 - 58.0]        |
| Some primary (1-7 years) | 1614  | 31.9%              | 3.12 [3.04 - 3.20]        | 64.7 [62.8 - 66.6]        |
| Some secondary (8-11 years) | 537  | 10.6%              | 3.09 [2.96 - 3.23]        | 62.5 [59.4 - 65.7]        |
| Secondary or more (12+ years) | 585  | 11.6%              | 3.12 [2.99 - 3.25]        | 63.5 [60.6 - 66.4]        |
| Country of origin    |             |                    |                           |                           |
| South Africa         | 3528       | 69.7%              | 3.02 [2.96 - 3.07]        | 61.3 [60.1 - 62.6]        |
| Mozambique/other     | 1526       | 30.2%              | 2.88 [2.79 - 2.96]        | 58.7 [56.8 - 60.6]        |
| Marital status       |             |                    |                           |                           |
| Currently married/cohabiting | 2575 | 50.9%              | 3.43 [3.37 - 3.49]        | 71.1 [69.7 - 72.5]        |
| Never married        | 290        | 5.7%               | 2.06 [1.88 - 2.23]        | 43.9 [39.8 - 48.1]        |
| Separated/divorced   | 650        | 12.8%              | 2.57 [2.45 - 2.69]        | 50.6 [47.9 - 53.4]        |
| Widowed              | 1540       | 30.4%              | 2.56 [2.48 - 2.64]        | 50.2 [48.3 - 52.1]        |
| Household composition|             |                    |                           |                           |
| Living alone         | 534        | 10.6%              | 2.31 [2.18 - 2.45]        | 43.7 [40.7 - 46.8]        |
| Living with 1 other person | 538  | 10.6%              | 2.88 [2.75 - 3.02]        | 58.2 [55.0 - 61.5]        |
| Living in 3-6 person household | 2438 | 48.2%              | 3.01 [2.94 - 3.07]        | 61.7 [60.2 - 63.1]        |
| Living in 7+ person household | 1549 | 30.6%              | 3.19 [3.10 - 3.27]        | 65.4 [63.5 - 67.3]        |
| Employment status    |             |                    |                           |                           |
| Not working          | 3719       | 73.5%              | 2.81 [2.76 - 2.86]        | 58.9 [57.7 - 60.2]        |
| Employed (part or full time) | 805  | 15.9%              | 3.06 [2.95 - 3.17]        | 63.6 [61.1 - 66.1]        |
| Not working outside the home | 521  | 10.3%              | 4.07 [3.92 - 4.21]        | 67.5 [64.3 - 70.7]        |
| Wealth index         |             |                    |                           |                           |
| Least wealthy quintile| 1046  | 20.7%              | 2.63 [2.53 - 2.73]        | 53.8 [51.5 - 56.2]        |
| Quintile 2           | 1001       | 19.8%              | 2.88 [2.78 - 2.98]        | 58.1 [55.8 - 60.5]        |
| Quintile 3           | 991        | 19.6%              | 3.10 [3.00 - 3.21]        | 61.9 [59.5 - 64.3]        |
| Quintile 4           | 1007       | 19.9%              | 3.06 [2.96 - 3.16]        | 62.2 [59.9 - 64.6]        |
| Most wealthy quintile| 1014      | 20.0%              | 3.22 [3.12 - 3.32]        | 66.9 [64.6 - 69.2]        |

Note. Number of contacts: at least monthly over the past six months; frequency of contacts: approximate number of contacts in a month on average over past six months. Based on Kruskall-Wallis tests, differences in the mean number of respondents reported were significant at p<0.01 for all variables.

Overall N=5059. 34 individuals missing at least one covariate: education level, n=17; country of origin, n=5; marital status, n=4; employment status, n=14.
Table 2: Respondent characteristics associated with number of unique at-least monthly alters

|                      | Model 1 | Model 2 | Model 3 |
|----------------------|---------|---------|---------|
| Male 40-49           | 1.00    | 1.00    | 1.00    |
| Male 50-59           | 1.01 [0.94 - 1.09] | 1.03 [0.95 - 1.11] | 0.97 [0.90 - 1.05] |
| Male 60-69           | 1.04 [0.96 - 1.12] | 1.07 [0.99 - 1.16] | 0.99 [0.92 - 1.07] |
| Male 70-79           | 0.94 [0.87 - 1.02] | 0.99 [0.91 - 1.08] | 0.92 [0.85 - 1.01] |
| Male 80+             | 0.89 [0.81 - 0.98] | 0.96 [0.86 - 1.06] | 0.89 [0.80 - 0.98] |
| Female 40-49         | 1.00 [0.93 - 1.08] | 0.98 [0.91 - 1.06] | 0.98 [0.90 - 1.06] |
| Female 50-59         | 1.00 [0.93 - 1.07] | 1.00 [0.93 - 1.08] | 1.01 [0.94 - 1.09] |
| Female 60-69         | 0.94 [0.88 - 1.02] | 0.97 [0.90 - 1.05] | 1.01 [0.93 - 1.10] |
| Female 70-79         | 0.84 [0.77 - 0.91] | 0.89 [0.82 - 0.98] | 0.96 [0.87 - 1.05] |
| Female 80+           | 0.74 [0.68 - 0.82] | 0.80 [0.73 - 0.89] | 0.90 [0.81 - 0.99] |
| No formal education  | 1.00    | 1.00    | 1.00    |
| Some primary (1-7 years) | 1.06 [1.02 - 1.10] | 1.05 [1.01 - 1.10] |
| Some secondary (8-11 years) | 1.10 [1.04 - 1.17] | 1.10 [1.03 - 1.17] |
| Secondary or more (12+ years) | 1.13 [1.05 - 1.22] | 1.11 [1.03 - 1.20] |
| South Africa         | 1.00 [1.00 - 1.00] | 1.00 [1.00 - 1.00] |
| Mozambique/other     | 1.02 [0.98 - 1.06] | 1.00 [0.96 - 1.05] |
| Not working          | 1.00    | 1.00    | 1.00    |
| Employed (part or full time) | 1.06 [1.01 - 1.12] | 1.05 [1.00 - 1.10] |
| Homemaker            | 1.16 [1.08 - 1.24] | 1.16 [1.08 - 1.24] |
| Living alone         | 1.00    | 1.00    | 1.00    |
| Living with one other person | 1.17 [1.08 - 1.26] | 1.05 [0.97 - 1.13] |
| Living in 3-6 person household | 1.20 [1.13 - 1.28] | 1.05 [0.98 - 1.12] |
| Living in 7+ person household | 1.26 [1.18 - 1.34] | 1.07 [1.00 - 1.15] |
| Least wealthy quintile | 1.00    | 1.00    | 1.00    |
| Quintile 2           | 1.04 [0.99 - 1.10] | 1.04 [0.98 - 1.09] |
| Quintile 3           | 1.07 [1.02 - 1.13] | 1.05 [1.00 - 1.11] |
| Quintile 4           | 1.05 [0.99 - 1.10] | 1.02 [0.96 - 1.08] |
| Most wealthy quintile | 1.10 [1.04 - 1.17] | 1.06 [1.00 - 1.12] |
| Currently married    | 1.00    | 1.00    | 1.00    |
| Never married        | 0.65 [0.60 - 0.71] |
| Separated / divorced | 0.77 [0.73 - 0.81] |
| Widowed              | 0.76 [0.72 - 0.79] |
| Gender differences ($\chi^2$) $^\dagger$ | | | |
| 40-49                | 0.0 0.99 | 0.3 0.57 | 0.4 0.54 |
| 50-59                | 0.2 0.63 | 0.6 0.42 | 1.4 0.24 |
| 60-69                | 9.2 0.002 | 9.7 0.002 | 0.4 0.52 |
| 70-79                | 8.4 0.004 | 7.1 0.008 | 0.9 0.35 |
| 80+                  | 11.0 0.001 | 10.6 0.001 | 0.0 0.85 |
| Age differences ($\chi^2$) $^{\dagger\dagger}$ | | | |
| Male                 | 15.8 0.003 | 9.2 0.055 | 9.3 0.054 |
| Female               | 72.3 <0.001 | 32.7 <0.001 | 10.5 0.033 |

Note. Results are from two-level Poisson regression models also containing indicator variables for month of interview. All coefficients are incidence rate ratios and 95% confidence intervals, except for $^\dagger$ and $^{\dagger\dagger}$, which are Z-scores and p-values. Tests of difference for age by gender interaction terms: $^\dagger$ across gender (e.g. Male 50-59 vs Female 50-59); and $^{\dagger\dagger}$ across age (i.e. are all five Male coefficients equal to one-another). N =5059 model 1; N=5025 for models 2 and 3.
Table 3: Alter and tie characteristics associated with number of unique at-least monthly alters

| Density | Unadjusted | Adjusted † | Multiplexity | Unadjusted | Adjusted † |
|---------|------------|------------|--------------|------------|------------|
| Male 40-49 | 1.00       | 1.00       | 1.00         | 1.00       | 1.00       |
| Male 50-59  | 0.98 [0.95 - 1.02] | 0.98 [0.94 - 1.02] | 1.00 [0.92 - 1.09] | 0.99 [0.90 - 1.08] |
| Male 60-69  | 0.99 [0.95 - 1.03] | 0.98 [0.94 - 1.02] | 0.92 [0.84 - 1.01] | 0.91 [0.83 - 1.00] |
| Male 70-79  | 1.03 [0.99 - 1.07] | 1.01 [0.96 - 1.05] | 1.02 [0.92 - 1.12] | 1.02 [0.92 - 1.13] |
| Male 80+    | 1.04 [0.99 - 1.10] | 1.02 [0.96 - 1.07] | 0.93 [0.82 - 1.05] | 0.95 [0.84 - 1.08] |
| Female 40-49| 0.95 [0.91 - 0.99] | 0.95 [0.91 - 0.99] | 1.00 [0.91 - 1.10] | 1.00 [0.91 - 1.09] |
| Female 50-59| 0.98 [0.95 - 1.02] | 0.97 [0.94 - 1.01] | 1.02 [0.94 - 1.11] | 1.04 [0.95 - 1.13] |
| Female 60-69| 1.01 [0.97 - 1.05] | 1.00 [0.96 - 1.04] | 0.95 [0.87 - 1.05] | 0.99 [0.90 - 1.09] |
| Female 70-79| 1.01 [0.97 - 1.06] | 1.00 [0.96 - 1.05] | 0.95 [0.86 - 1.05] | 1.02 [0.91 - 1.14] |
| Female 80+  | 1.01 [0.96 - 1.06] | 1.00 [0.95 - 1.05] | 1.02 [0.92 - 1.14] | 1.13 [1.00 - 1.28] |

N = 4098 4075 4792 4765

Note. Results are from two-level linear regression models also containing indicator variables for month of interview. * All density models also include indicator variables for network size and only include respondents reporting >1 alter. † Adjusted models also include respondent education, country of birth, employment status, household size and wealth quintile; full models provided as Supplementary Table 4.

Table 4: Association between age & gender and number of unique at-least monthly alters by support type

| Age Group | Informational | Emotional | Financial | Physical |
|-----------|---------------|-----------|-----------|----------|
| Male 40-49| 1.00          | 1.00      | 1.00      | 1.00     |
| Male 50-59| 0.90 [0.77 - 1.05] | 0.94 [0.80 - 1.12] | 1.04 [0.84 - 1.29] | 1.03 [0.88 - 1.21] |
| Male 60-69| 1.05 [0.90 - 1.21] | 1.05 [0.90 - 1.24] | 1.19 [0.97 - 1.46] | 1.11 [0.95 - 1.30] |
| Male 70-79| 0.86 [0.73 - 1.02] | 0.91 [0.76 - 1.09] | 0.99 [0.79 - 1.23] | 1.06 [0.89 - 1.25] |
| Male 80+  | 0.84 [0.69 - 1.03] | 0.93 [0.75 - 1.16] | 1.11 [0.85 - 1.45] | 0.98 [0.80 - 1.20] |
| Female 40-49| 0.90 [0.77 - 1.06] | 1.00 [0.84 - 1.20] | 0.80 [0.63 - 1.02] | 0.72 [0.60 - 0.86] |
| Female 50-59| 0.84 [0.73 - 0.98] | 0.95 [0.81 - 1.12] | 0.84 [0.68 - 1.04] | 0.77 [0.66 - 0.90] |
| Female 60-69| 0.84 [0.72 - 0.98] | 0.82 [0.69 - 0.98] | 0.68 [0.54 - 0.85] | 0.68 [0.58 - 0.81] |
| Female 70-79| 0.70 [0.59 - 0.84] | 0.74 [0.61 - 0.90] | 0.70 [0.54 - 0.90] | 0.64 [0.53 - 0.78] |
| Female 80+  | 0.65 [0.54 - 0.79] | 0.72 [0.59 - 0.88] | 0.76 [0.59 - 0.98] | 0.72 [0.59 - 0.88] |

Age differences ($\chi^2$) †

| Age Group | Male   | Female |
|-----------|--------|--------|
| Male      | 11.9   | 18.5   |
| Female    | 0.018  | 0.001  |

Note. Results are from two-level Poisson regression models also containing indicator variables for month of interview. All coefficients are incidence rate ratios and 95% confidence intervals, except for † which are Z-scores and p-values. Tests of difference for age by gender interaction terms: † across age (i.e. are all five Male coefficients equal to one-another). N=5059.
Table 5: Association between age & gender and number of unique at-least monthly alters by alter kinship status

| Kin alters     | Unadjusted | Adjusted † | Non-kin alters | Unadjusted | Adjusted † |
|----------------|------------|------------|----------------|------------|------------|
| Male 40-49     | 1.00       | 1.00       | 1.00           | 1.00       | 1.00       |
| Male 50-59     | 1.08 [0.99 - 1.18] | 1.02 [0.93 - 1.12] | 0.86 [0.72 - 1.03] | 0.88 [0.73 - 1.06] |
| Male 60-69     | 1.17 [1.07 - 1.27] | 1.07 [0.98 - 1.18] | 0.73 [0.61 - 0.88] | 0.78 [0.64 - 0.96] |
| Male 70-79     | 1.04 [0.95 - 1.14] | 0.98 [0.89 - 1.09] | 0.71 [0.58 - 0.86] | 0.77 [0.62 - 0.96] |
| Male 80+       | 1.03 [0.92 - 1.15] | 0.99 [0.88 - 1.11] | 0.53 [0.41 - 0.70] | 0.59 [0.45 - 0.79] |
| Female 40-49   | 1.09 [1.00 - 1.20] | 1.06 [0.97 - 1.16] | 0.77 [0.64 - 0.94] | 0.77 [0.64 - 0.94] |
| Female 50-59   | 1.10 [1.01 - 1.19] | 1.10 [1.01 - 1.20] | 0.76 [0.64 - 0.91] | 0.80 [0.66 - 0.96] |
| Female 60-69   | 1.08 [0.99 - 1.17] | 1.15 [1.04 - 1.26] | 0.61 [0.50 - 0.73] | 0.66 [0.54 - 0.82] |
| Female 70-79   | 0.99 [0.90 - 1.09] | 1.14 [1.02 - 1.26] | 0.44 [0.35 - 0.55] | 0.49 [0.38 - 0.62] |
| Female 80+     | 0.92 [0.83 - 1.01] | 1.12 [1.00 - 1.26] | 0.32 [0.24 - 0.41] | 0.35 [0.26 - 0.47] |

Currently married 1.00 1.00
Never married 0.57 [0.51 - 0.63] 0.95 [0.78 - 1.15]
Separated / divorced 0.71 [0.67 - 0.76] 1.01 [0.88 - 1.18]
Widowed 0.70 [0.67 - 0.74] 1.01 [0.90 - 1.14]

Gender differences (χ²) †

40-49 3.8 0.052 1.4 0.23 6.8 0.009 6.8 0.009
50-59 0.2 0.68 4.2 0.041 2.2 0.14 1.4 0.23
60-69 5.3 0.021 3.0 0.083 4.4 0.036 3.4 0.065
70-79 1.3 0.26 10.1 0.001 16.5 <0.001 15.0 <0.001
80+ 4.0 0.045 4.2 0.039 10.7 0.001 10.3 0.001

Age differences (χ²) ††

Male 17.2 0.002 6.5 0.16 27.6 <0.001 14.6 0.006
Female 23.3 <0.001 4.2 0.38 74.8 <0.001 49.8 <0.001

Note. Results are from two-level Poisson regression models also containing indicator variables for month of interview. All coefficients are incidence rate ratios and 95% confidence intervals, except for † and ††, which are Z-scores and p-values. Tests of difference for age by gender interaction terms: † across gender (e.g. Male 50-59 vs Female 50-59); and †† across age (i.e. are all five Male coefficients equal to one-another). N=5059 for unadjusted and N=5025 for adjusted models. † All Adjusted models also include respondent education, country of birth, employment status, household size and wealth quintile. Full adjusted models provided as Supplementary Table 7.
SUPPLEMENTARY MATERIAL

Title: Age and gender differences in social network composition and social support among older rural South Africans: Findings from the HAALSI study

Included in this appendix are supplementary tables and figure, which space did not allow us to include in the full paper. They are listed below for ease of reference; the full tables and figure follow. Please see the main text for context and their relation to our main findings.

- Supplementary Table 1: Association between age & gender and number of unique at-least monthly alters stratified by contact type
- Supplementary Table 2: Association between age & gender and approximate monthly frequency of communication
- Supplementary Table 3: Impact of marital and employment status by gender on number of unique at-least monthly alters
- Supplementary Table 4: Association between age & gender and network density and tie multiplexity of at-least monthly contacts between alters
- Supplementary Table 5: Association between age & gender and number of unique providers of at-least monthly social support, stratified by type of support
- Supplementary Table 6: Association between age & gender and frequency of provision of social support per month, stratified by type of support
- Supplementary Table 7: Association between age & gender and unique at-least monthly alters, stratified by alter kinship
- Supplementary Figure 1: Distribution of monthly communication contacts from important others
Supplementary Table 1: Association between age & gender and number of unique at-least monthly alters stratified by contact type

|                | In-person    |          |                      |                      |                      |                      |                      |
|----------------|--------------|----------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                | Male 40-49   | 1.00     | 1.00                 |                      |                      |                      |                      |
| Male 50-59     | 1.00         | [0.93 - 1.08] | 0.97 [0.89 - 1.05]  |                      |                      |                      |                      |
| Male 60-69     | 1.02         | [0.95 - 1.10] | 0.99 [0.91 - 1.07]  |                      |                      |                      |                      |
| Male 70-79     | 0.93         | [0.86 - 1.02] | 0.93 [0.85 - 1.01]  |                      |                      |                      |                      |
| Male 80+       | 0.88         | [0.79 - 0.97] | 0.89 [0.80 - 1.00]  |                      |                      |                      |                      |
| Female 40-49   | 0.94         | [0.87 - 1.02] | 0.93 [0.85 - 1.01]  |                      |                      |                      |                      |
| Female 50-59   | 0.96         | [0.89 - 1.03] | 0.99 [0.91 - 1.07]  |                      |                      |                      |                      |
| Female 60-69   | 0.88         | [0.82 - 0.95] | 0.97 [0.89 - 1.05]  |                      |                      |                      |                      |
| Female 70-79   | 0.79         | [0.73 - 0.87] | 0.93 [0.84 - 1.03]  |                      |                      |                      |                      |
| Female 80+     | 0.72         | [0.65 - 0.79] | 0.89 [0.80 - 1.00]  |                      |                      |                      |                      |
| No formal education | 1.00     |                      |                      |                      |                      |                      |                      |
| Some primary (1-7 years) | 1.06 | [1.01 - 1.11] |                      |                      |                      |                      |                      |
| Some secondary (8-11 years) | 1.09 | [1.02 - 1.17] |                      |                      |                      |                      |                      |
| Secondary or more (12+ years) | 1.13 | [1.05 - 1.23] |                      |                      |                      |                      |                      |
| South Africa   | 1.00         | [1.00 - 1.00] |                      |                      |                      |                      |                      |
| Mozambique/other | 0.97      | [0.93 - 1.02] |                      |                      |                      |                      |                      |
| Not working    | 1.00         |                      |                      |                      |                      |                      |                      |
| Employed (part or full time) | 1.05 | [1.00 - 1.11] |                      |                      |                      |                      |                      |
| Homemaker      | 1.09         | [1.01 - 1.18] |                      |                      |                      |                      |                      |
| Living alone   | 1.00         |                      |                      |                      |                      |                      |                      |
| Living with one other person | 1.05 | [0.97 - 1.14] |                      |                      |                      |                      |                      |
| Living in 3-6 person household | 1.07 | [0.99 - 1.14] |                      |                      |                      |                      |                      |
| Living in 7+ person household | 1.10 | [1.02 - 1.18] |                      |                      |                      |                      |                      |
| Wealth asset index=1 | 1.00 |                      |                      |                      |                      |                      |                      |
| Wealth asset index=2 | 1.05 | [0.99 - 1.11] |                      |                      |                      |                      |                      |
| Wealth asset index=3 | 1.05 | [0.99 - 1.11] |                      |                      |                      |                      |                      |
| Wealth asset index=4 | 1.02 | [0.96 - 1.08] |                      |                      |                      |                      |                      |
| Wealth asset index=5 | 1.04 | [0.98 - 1.11] |                      |                      |                      |                      |                      |
| Currently married | 1.00 |                      |                      |                      |                      |                      |                      |
| Never married  | 0.66         | [0.60 - 0.72] |                      |                      |                      |                      |                      |
| Separated / divorced | 0.79 | [0.74 - 0.84] |                      |                      |                      |                      |                      |
| Widowed        | 0.75         | [0.71 - 0.78] |                      |                      |                      |                      |                      |

Gender differences ($\chi^2_1$) †

|        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Age    |        |        |        |        |        |        |        |
|        | 40-49  | 50-59  | 60-69  | 70-79  | 80+    |        |        |
|        | 2.0    | 1.7    | 18.3   | 14.2   | 11.6   |        |        |
|        | 0.159  | 0.196  | 0.000  | 0.000  | 0.001  |        |        |
|        | 3.3    | 0.3    | 0.4    | 0.0    | 0.0    |        |        |
|        | 0.070  | 0.593  | 0.512  | 0.932  | 0.966  |        |        |
|        |        |        |        |        |        | 1.9    | 9.2    |
|        |        |        |        |        |        | 0.165  | 0.02   |
|        |        |        |        |        |        | 0.4    | 0.8    |
|        |        |        |        |        |        | 0.516  | 0.382  |
|        |        |        |        |        |        |        | 0.057  |

Age differences ($\chi^2_1$) ††

|        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Gender | Male   | Female |        |        |        |        |        |
|        | 13.8   | 59.6   | 6.8    | 6.7    |        |        |        |
|        | 0.008  | 0.000  | 0.146  | 0.151  |        |        |        |
|        |        |        | 35.8   | 137.9  |        |        |        |
|        |        |        | 0.000  | 0.000  |        |        |        |
|        |        |        | 19.2   | 26.8   |        |        |        |

These results are from two-level Poisson regression models also containing indicator variables for month of interview. N=5059 for unadjusted models; N=5025 for adjusted models.
Supplementary Table 2: Association between age & gender and approximate monthly frequency of communication

|                          | All               | In-person         | Remote             |
|--------------------------|-------------------|-------------------|--------------------|
|                          | (0.95 - 1.02)     | (0.81 - 1.02)     | (0.91 - 1.19)      |
| Male 40-49               | 1.00              | 1.00              | 1.00               |
| Male 50-59               | 0.96 [0.87 - 1.05]| 0.93 [0.85 - 1.02]| 0.99 [0.87 - 1.13]| 1.04 [0.91 - 1.19]|
| Male 60-69               | 0.99 [0.90 - 1.08]| 0.95 [0.87 - 1.05]| 1.06 [0.93 - 1.21]| 1.12 [0.97 - 1.28]|
| Male 70-79               | 0.92 [0.83 - 1.02]| 0.91 [0.82 - 1.01]| 0.91 [0.79 - 1.05]| 1.01 [0.87 - 1.17]|
| Male 80+                 | 0.82 [0.72 - 0.93]| 0.84 [0.74 - 0.95]| 0.77 [0.65 - 0.92]| 0.90 [0.75 - 1.07]|
| Female 40-49             | 0.96 [0.87 - 1.05]| 0.94 [0.86 - 1.04]| 1.13 [0.98 - 1.30]| 1.16 [1.01 - 1.33]|
| Female 50-59             | 0.96 [0.88 - 1.06]| 1.01 [0.92 - 1.10]| 1.08 [0.95 - 1.22]| 1.24 [1.09 - 1.42]|
| Female 60-69             | 0.90 [0.82 - 0.99]| 1.01 [0.92 - 1.12]| 0.96 [0.84 - 1.10]| 1.22 [1.06 - 1.41]|
| Female 70-79             | 0.75 [0.68 - 0.83]| 0.92 [0.82 - 1.03]| 0.73 [0.63 - 0.84]| 1.03 [0.88 - 1.21]|
| Female 80+               | 0.67 [0.60 - 0.75]| 0.87 [0.78 - 0.99]| 0.62 [0.53 - 0.72]| 0.96 [0.81 - 1.14]|

These results are from two-level negative binomial regression models also containing indicator variables for month of interview. N=5059 for unadjusted models; N=5025 for adjusted models. All coefficients are incidence rate ratios and 95% confidence intervals, except for † and ††, which are Z-scores and p-values. Tests of difference for age by gender interaction terms: † across gender (e.g. Male 50-59 vs Female 50-59); and †† across age (i.e. are all five Male coefficients equal to one-another).
Supplementary Table 3: Impact of marital and employment status by gender on number of unique at-least monthly alters

|                     | Model 1               | Model 2               |
|---------------------|-----------------------|-----------------------|
| Male 40-49          | 1.00                  | 1.00                  |
| Male 50-59          | 0.98 [0.91 - 1.06]    | 0.98 [0.91 - 1.06]    |
| Male 60-69          | 1.00 [0.95 - 1.08]    | 1.00 [0.92 - 1.08]    |
| Male 70-79          | 0.94 [0.86 - 1.02]    | 0.93 [0.85 - 1.02]    |
| Male 80+            | 0.90 [0.81 - 1.00]    | 0.90 [0.80 - 1.00]    |
| Female 40-49        | 1.02 [0.93 - 1.12]    | 1.00 [0.92 - 1.09]    |
| Female 50-59        | 1.07 [0.98 - 1.17]    | 1.04 [0.96 - 1.13]    |
| Female 60-69        | 1.07 [0.98 - 1.17]    | 1.03 [0.95 - 1.12]    |
| Female 70-79        | 1.01 [0.92 - 1.12]    | 0.97 [0.89 - 1.07]    |
| Female 80+          | 0.95 [0.85 - 1.05]    | 0.91 [0.82 - 1.01]    |
| No formal education | 1.00                  | 1.00                  |
| Some primary (1-7 years) | 1.06 [1.01 - 1.10] | 1.05 [1.01 - 1.10] |
| Some secondary (8-11 years) | 1.09 [1.03 - 1.16] | 1.09 [1.03 - 1.16] |
| Secondary or more (12+ years) | 1.11 [1.03 - 1.19] | 1.12 [1.04 - 1.20] |
| South Africa        | 1.00 [1.00 - 1.00]    | 1.00 [1.00 - 1.00]    |
| Mozambique/other    | 1.00 [0.96 - 1.05]    | 1.00 [0.96 - 1.04]    |
| Not working         | 1.00                  | 1.00                  |
| Employed (part or full time) | 1.05 [1.00 - 1.10] | 1.00 [0.96 - 1.04] |
| Homemaker           | 1.16 [1.08 - 1.24]    | 1.00 [0.96 - 1.04]    |
| Living alone        | 1.00                  | 1.00                  |
| Living with one other person | 1.03 [0.96 - 1.12] | 1.05 [0.97 - 1.14] |
| Living in 3-6 person household | 1.03 [0.97 - 1.11] | 1.05 [0.99 - 1.12] |
| Living in 7+ person household | 1.05 [0.98 - 1.13] | 1.07 [1.00 - 1.15] |
| Wealth asset index=1 | 1.00                  | 1.00                  |
| Wealth asset index=2 | 1.04 [0.98 - 1.09] | 1.04 [0.98 - 1.09] |
| Wealth asset index=3 | 1.05 [1.00 - 1.11] | 1.06 [1.00 - 1.11] |
| Wealth asset index=4 | 1.02 [0.96 - 1.07] | 1.02 [0.96 - 1.07] |
| Wealth asset index=5 | 1.06 [1.00 - 1.12] | 1.06 [1.00 - 1.12] |
| Currently married   | 1.00                  | 1.00                  |
| Never married       | 0.65 [0.60 - 0.71]    | 0.77 [0.73 - 0.82]    |
| Separated / divorced| 0.76 [0.73 - 0.79]    | 0.77 [0.73 - 0.82]    |
| Widowed             | 0.94 [0.85 - 1.03]    | 0.94 [0.85 - 1.03]    |

These results are from two-level Poisson regression models also containing indicator variables for month of interview. N=5025.
Supplementary Table 4: Association between age & gender and network density and tie multiplexity of at-least monthly contacts between alters

|                  | Network density (95% CI) | Tie multiplexity (95% CI) |
|------------------|--------------------------|---------------------------|
| Male 40-49       | 1.00                     | 1.00                      |
| Male 50-59       | 0.98 [0.95 - 1.02]        | 1.00 [0.92 - 1.09]        |
| Male 60-69       | 0.99 [0.95 - 1.03]        | 0.92 [0.84 - 1.01]        |
| Male 70-79       | 1.03 [0.99 - 1.07]        | 1.02 [0.92 - 1.12]        |
| Male 80+         | 1.04 [0.99 - 1.10]        | 0.93 [0.82 - 1.05]        |
| Female 40-49     | 0.95 [0.91 - 0.99]        | 1.00 [0.91 - 1.10]        |
| Female 50-59     | 0.98 [0.95 - 1.02]        | 1.02 [0.94 - 1.11]        |
| Female 60-69     | 1.01 [0.97 - 1.05]        | 0.95 [0.87 - 1.05]        |
| Female 70-79     | 1.01 [0.97 - 1.06]        | 0.95 [0.86 - 1.05]        |
| Female 80+       | 1.01 [0.96 - 1.06]        | 1.02 [0.92 - 1.14]        |

Unique contacts

|                  | Network density (95% CI) | Tie multiplexity (95% CI) |
|------------------|--------------------------|---------------------------|
| Two              | 1.00                     | 1.00                      |
| Three            | 0.98 [0.96 - 1.00]        | 0.97 [0.95 - 0.99]        |
| Four             | 0.97 [0.94 - 1.00]        | 0.96 [0.93 - 0.99]        |
| Five             | 0.96 [0.92 - 0.99]        | 0.95 [0.91 - 0.98]        |
| Six              | 0.92 [0.88 - 0.96]        | 0.92 [0.88 - 0.95]        |
| Seven            | 0.95 [0.90 - 1.00]        | 0.93 [0.89 - 0.98]        |

No formal education 1.00 1.00
Some primary (1-7 years) 0.99 [0.97 - 1.02] 1.05 [0.99 - 1.10]
Some secondary (8-11 years) 0.97 [0.94 - 1.00] 1.02 [0.95 - 1.10]
Secondary or more (12+ years) 0.97 [0.93 - 1.01] 0.99 [0.91 - 1.09]
South Africa 1.00
Mozambique/other 1.00 0.99 [0.94 - 1.04]
Not working 1.00
Employed (part or full time) 0.98 [0.95 - 1.00] 0.99 [0.93 - 1.06]
Homemaker 0.96 [0.92 - 1.00] 0.84 [0.76 - 0.92]
Living alone 1.00 1.00
Living with one other person 1.06 [1.02 - 1.10] 1.08 [0.99 - 1.18]
Living in 3-6 person household 1.05 [1.02 - 1.09] 1.13 [1.04 - 1.21]
Living in 7+ person household 1.06 [1.02 - 1.10] 1.13 [1.05 - 1.23]
Wealth asset index=1 1.00
Wealth asset index=2 1.00 [0.97 - 1.03] 0.98 [0.92 - 1.04]
Wealth asset index=3 1.00 [0.97 - 1.03] 0.97 [0.91 - 1.04]
Wealth asset index=4 1.00 [0.97 - 1.03] 0.96 [0.90 - 1.02]
Wealth asset index=5 0.98 [0.95 - 1.01] 1.01 [0.94 - 1.08]
Currently married 1.00
Never married 0.98 [0.94 - 1.03] 0.93 [0.85 - 1.02]
Separated / divorced 0.98 [0.95 - 1.01] 0.91 [0.85 - 0.97]
Widowed 0.98 [0.95 - 1.00] 0.89 [0.84 - 0.94]

N 4098 4075 4792 4765

These results are from two-level linear regression models also containing indicator variables for month of interview. * All density models only include respondents reporting >1 alter, since a minimum of two alters is required for calculation.

Supplementary Table 5: Association between age & gender and number of unique providers of at-least monthly social support, stratified by type of support
|                      | Informational | Emotional | Financial | Physical |
|----------------------|--------------|-----------|-----------|----------|
| Male 40-49           | 1.00         | 1.00      | 1.00      | 1.00     |
| Male 50-59           | 0.89 [0.76 - 1.04] | 0.95 [0.80 - 1.13] | 0.99 [0.79 - 1.23] | 1.00 [0.85 - 1.17] |
| Male 60-69           | 1.00 [0.85 - 1.18] | 1.06 [0.88 - 1.26] | 1.11 [0.89 - 1.38] | 1.04 [0.88 - 1.23] |
| Male 70-79           | 0.87 [0.72 - 1.04] | 0.94 [0.77 - 1.14] | 0.98 [0.77 - 1.25] | 1.04 [0.86 - 1.24] |
| Male 80+             | 0.87 [0.70 - 1.08] | 0.98 [0.77 - 1.23] | 1.08 [0.82 - 1.44] | 0.98 [0.79 - 1.22] |
| Female 40-49         | 0.88 [0.75 - 1.04] | 0.98 [0.81 - 1.17] | 0.77 [0.60 - 0.98] | 0.69 [0.58 - 0.83] |
| Female 50-59         | 0.90 [0.77 - 1.05] | 1.02 [0.86 - 1.22] | 0.88 [0.70 - 1.09] | 0.79 [0.67 - 0.93] |
| Female 60-69         | 0.99 [0.83 - 1.17] | 0.96 [0.79 - 1.16] | 0.83 [0.65 - 1.06] | 0.80 [0.67 - 0.97] |
| Female 70-79         | 0.92 [0.75 - 1.12] | 0.93 [0.74 - 1.15] | 0.94 [0.71 - 1.25] | 0.84 [0.68 - 1.05] |
| Female 80+           | 0.93 [0.75 - 1.16] | 0.97 [0.76 - 1.22] | 1.17 [0.87 - 1.58] | 1.05 [0.84 - 1.32] |

| No formal education  | 1.00 | 1.00 | 1.00 | 1.00 |
| Some primary (1-7 years) | 1.11 [1.01 - 1.21] | 1.06 [0.96 - 1.17] | 1.07 [0.94 - 1.20] | 1.00 [0.91 - 1.10] |
| Some secondary (8-11 years) | 1.15 [1.00 - 1.31] | 1.25 [1.09 - 1.43] | 1.02 [0.86 - 1.23] | 1.02 [0.89 - 1.17] |
| Secondary or more (12+ years) | 1.17 [1.00 - 1.38] | 1.21 [1.01 - 1.45] | 1.04 [0.83 - 1.31] | 1.10 [0.93 - 1.30] |
| South Africa         | 1.00 | 1.00 | 1.00 | 1.00 |
| Mozambique/other     | 1.13 [1.03 - 1.23] | 1.05 [0.95 - 1.15] | 1.10 [0.97 - 1.24] | 1.08 [0.98 - 1.18] |
| Not working          | 1.00 | 1.00 | 1.00 | 1.00 |
| Employed (part or full time) | 1.09 [0.98 - 1.21] | 1.00 [0.89 - 1.12] | 1.16 [1.00 - 1.35] | 1.11 [0.99 - 1.24] |
| Homemaker            | 1.06 [0.91 - 1.24] | 1.02 [0.87 - 1.19] | 0.76 [0.56 - 1.01] | 0.96 [0.80 - 1.14] |
| Living alone         | 1.00 | 1.00 | 1.00 | 1.00 |
| Living with one other person | 1.25 [1.05 - 1.49] | 1.49 [1.23 - 1.79] | 1.74 [1.34 - 2.26] | 1.45 [1.18 - 1.78] |
| Living in 3-6 person household | 1.19 [1.03 - 1.38] | 1.41 [1.20 - 1.66] | 1.66 [1.32 - 2.10] | 1.66 [1.39 - 1.98] |
| Living in 7+ person household | 1.28 [1.10 - 1.49] | 1.43 [1.21 - 1.69] | 1.76 [1.38 - 2.23] | 1.88 [1.57 - 2.26] |
| WEALth asset index=1 | 1.00 | 1.00 | 1.00 | 1.00 |
| WEALth asset index=2 | 0.96 [0.86 - 1.07] | 1.12 [1.00 - 1.26] | 0.96 [0.82 - 1.12] | 0.93 [0.82 - 1.04] |
| WEALth asset index=3 | 0.88 [0.79 - 0.99] | 0.98 [0.87 - 1.10] | 0.82 [0.70 - 0.96] | 0.91 [0.80 - 1.03] |
| WEALth asset index=4 | 0.96 [0.86 - 1.07] | 0.94 [0.83 - 1.06] | 0.87 [0.74 - 1.02] | 0.93 [0.82 - 1.05] |
| WEALth asset index=5 | 0.94 [0.84 - 1.06] | 0.96 [0.84 - 1.09] | 0.85 [0.72 - 1.00] | 0.93 [0.82 - 1.06] |
| Currently married    | 1.00 | 1.00 | 1.00 | 1.00 |
| Never married        | 0.63 [0.52 - 0.76] | 0.72 [0.59 - 0.86] | 0.63 [0.49 - 0.80] | 0.56 [0.46 - 0.69] |
| Separated / divorced | 0.63 [0.56 - 0.72] | 0.65 [0.57 - 0.74] | 0.50 [0.41 - 0.60] | 0.59 [0.52 - 0.68] |
| Widowed              | 0.62 [0.56 - 0.69] | 0.69 [0.63 - 0.77] | 0.52 [0.45 - 0.60] | 0.57 [0.51 - 0.63] |

Gender differences ($\chi^2$)$^\dagger$

|         | 0-49 | 50-59 | 60-69 | 70-79 | 80+ |
|---------|------|------|------|------|-----|
| Male    | 2.1  | 0.85 | 0.86 | 0.55 | 0.45 |
| Female  | 2.1  | 0.85 | 0.86 | 0.55 | 0.45 |

Age differences ($\chi^2$)$^{\dagger\dagger}$

|         | 0-49 | 50-59 | 60-69 | 70-79 | 80+ |
|---------|------|------|------|------|-----|
| Male    | 7.3  | 3.4  | 3.8  | 2.8  | 0.7 |
| Female  | 3.0  | 1.5  | 0.82 | 0.92 | 0.95 |

These results are from two-level Poisson regression models also containing indicator variables for month of interview. N=5025. All coefficients are incidence rate ratios and 95% confidence intervals, except for $^\dagger$ and $^{\dagger\dagger}$, which are Z-scores and p-values. Tests of difference for age by gender interaction terms: $^\dagger$ across gender (e.g. Male 50-59 vs Female 50-59); and $^{\dagger\dagger}$ across age (i.e. are all five Male coefficients equal to one-another).
### Supplementary Table 6: Association between age & gender and frequency of provision of social support per month, stratified by type of support

| Unadjusted models | Informational | Emotional | Financial | Physical |
|-------------------|---------------|-----------|-----------|----------|
| Male 40-49        | 1.00          | 1.00      | 1.00      | 1.00     |
| Male 50-59        | 0.98 [0.85 - 1.12] | 1.02 [0.88 - 1.18] | 0.98 [0.82 - 1.17] | 1.02 [0.88 - 1.18] |
| Male 60-69        | 1.09 [0.95 - 1.26] | 1.16 [1.00 - 1.34] | 1.08 [0.90 - 1.29] | 1.05 [0.90 - 1.21] |
| Male 70-79        | 0.91 [0.78 - 1.05] | 1.01 [0.86 - 1.18] | 1.01 [0.83 - 1.23] | 1.03 [0.88 - 1.21] |
| Male 80+          | 0.87 [0.72 - 1.05] | 0.87 [0.72 - 1.06] | 1.07 [0.84 - 1.36] | 0.93 [0.76 - 1.13] |
| Female 40-49      | 0.99 [0.85 - 1.14] | 1.11 [0.95 - 1.30] | 0.74 [0.61 - 0.89] | 0.81 [0.69 - 0.94] |
| Female 50-59      | 0.92 [0.81 - 1.06] | 1.02 [0.89 - 1.18] | 0.87 [0.73 - 1.03] | 0.81 [0.70 - 0.93] |
| Female 60-69      | 0.91 [0.79 - 1.05] | 0.91 [0.78 - 1.05] | 0.71 [0.59 - 0.85] | 0.71 [0.61 - 0.83] |
| Female 70-79      | 0.67 [0.58 - 0.79] | 0.72 [0.61 - 0.84] | 0.61 [0.49 - 0.74] | 0.58 [0.49 - 0.68] |
| Female 80+        | 0.65 [0.55 - 0.77] | 0.74 [0.62 - 0.88] | 0.72 [0.58 - 0.89] | 0.70 [0.59 - 0.83] |
| No formal education | 1.00          | 1.00      | 1.00      | 1.00     |
| Some primary (1-7 years) | 1.11 [1.01 - 1.21] | 1.09 [1.00 - 1.18] | 1.14 [1.03 - 1.26] | 1.17 [1.08 - 1.27] |
| Some secondary (8-11 years) | 1.15 [1.00 - 1.31] | 1.28 [1.12 - 1.45] | 1.10 [0.95 - 1.28] | 1.17 [1.04 - 1.32] |
| Secondary or more (12+ years) | 1.17 [1.00 - 1.38] | 1.07 [0.92 - 1.25] | 1.08 [0.90 - 1.30] | 1.22 [1.05 - 1.41] |
| South Africa      | 1.00          | 1.00      | 1.00      | 1.00     |
| Mozambique/other  | 1.11 [1.02 - 1.20] | 1.14 [1.04 - 1.24] | 0.99 [0.90 - 1.10] | 1.00 [0.92 - 1.08] |
| Not working       | 1.00          | 1.00      | 1.00      | 1.00     |
| Employed (part or full time) | 1.08 [0.98 - 1.18] | 1.05 [0.95 - 1.16] | 0.90 [0.80 - 1.02] | 1.02 [0.93 - 1.13] |
| Homemaker         | 1.24 [1.12 - 1.38] | 1.11 [0.99 - 1.25] | 0.40 [0.34 - 0.46] | 0.68 [0.62 - 0.76] |
| Living alone      | 1.00          | 1.00      | 1.00      | 1.00     |
| Living with one other person | 1.28 [1.11 - 1.47] | 1.34 [1.15 - 1.56] | 1.51 [1.26 - 1.81] | 1.26 [1.09 - 1.45] |
| Living in 3-6 person household | 1.19 [1.07 - 1.33] | 1.31 [1.16 - 1.48] | 1.56 [1.34 - 1.80] | 1.41 [1.25 - 1.59] |
| Living in 7+ person household | 1.22 [1.08 - 1.37] | 1.29 [1.13 - 1.47] | 1.58 [1.35 - 1.85] | 1.50 [1.32 - 1.70] |
| Wealth asset index=1 | 1.00          | 1.00      | 1.00      | 1.00     |
| Wealth asset index=2 | 0.93 [0.84 - 1.02] | 1.00 [0.90 - 1.11] | 1.03 [0.91 - 1.17] | 0.97 [0.88 - 1.07] |
| Wealth asset index=3 | 0.97 [0.88 - 1.07] | 1.00 [0.90 - 1.12] | 0.97 [0.85 - 1.10] | 0.99 [0.90 - 1.10] |
| Wealth asset index=4 | 0.96 [0.87 - 1.06] | 0.90 [0.80 - 1.00] | 0.97 [0.85 - 1.10] | 0.95 [0.85 - 1.05] |
| Wealth asset index=5 | 1.03 [0.92 - 1.14] | 0.99 [0.88 - 1.11] | 1.01 [0.88 - 1.16] | 1.04 [0.93 - 1.16] |
| Currently married | 1.00          | 1.00      | 1.00      | 1.00     |
| Never married     | 0.57 [0.49 - 0.66] | 0.66 [0.56 - 0.77] | 0.72 [0.60 - 0.87] | 0.52 [0.45 - 0.60] |
| Separated / divorced | 0.67 [0.61 - 0.75] | 0.69 [0.62 - 0.77] | 0.58 [0.51 - 0.66] | 0.62 [0.56 - 0.70] |
| Widowed           | 0.63 [0.58 - 0.69] | 0.67 [0.61 - 0.74] | 0.52 [0.47 - 0.58] | 0.57 [0.52 - 0.62] |

These results are from two-level Poisson regression models also containing indicator variables for month of interview. N=5059 for unadjusted and N=5025 for adjusted models.
**Supplementary Table 7: Association between age & gender and unique at-least monthly alters, stratified by alter kinship**

| Kin | Non-kin |
|-----|---------|
| **Age & gender** | | |
| Male 40-49 | 1.00 | 1.00 |
| Male 50-59 | 1.08 [0.99 - 1.18] | 1.02 [0.93 - 1.12] |
| Male 60-69 | 1.17 [1.07 - 1.27] | 1.07 [0.98 - 1.18] |
| Male 70-79 | 1.04 [0.95 - 1.14] | 0.98 [0.89 - 1.09] |
| Male 80+ | 1.03 [0.92 - 1.15] | 0.99 [0.88 - 1.11] |
| Female 40-49 | 1.09 [1.00 - 1.20] | 1.06 [0.97 - 1.16] |
| Female 50-59 | 1.10 [1.01 - 1.19] | 1.10 [1.01 - 1.20] |
| Female 60-69 | 1.08 [0.99 - 1.17] | 1.15 [1.04 - 1.26] |
| Female 70-79 | 0.99 [0.90 - 1.09] | 1.14 [1.02 - 1.26] |
| Female 80+ | 0.92 [0.83 - 1.01] | 1.12 [1.00 - 1.26] |
| **Education level** | | |
| No formal education | 1.00 | 1.00 |
| Some primary (1-7 years) | 1.05 [1.00 - 1.10] | 1.05 [0.94 - 1.18] |
| Some secondary (8-11 years) | 1.09 [1.02 - 1.17] | 1.12 [0.95 - 1.32] |
| Secondary or more (12+ years) | 1.10 [1.01 - 1.20] | 1.15 [0.95 - 1.40] |
| **Country of origin** | | |
| South Africa | 1.00 | 1.00 |
| Mozambique/other | 1.01 [0.97 - 1.06] | 0.97 [0.87 - 1.09] |
| **Marital status** | | |
| Currently married | 1.00 | 1.00 |
| Never married | 0.57 [0.51 - 0.63] | 0.95 [0.78 - 1.15] |
| Separated/divorced | 0.71 [0.67 - 0.76] | 1.01 [0.88 - 1.18] |
| Widowed | 0.70 [0.67 - 0.74] | 1.01 [0.90 - 1.14] |
| **Employment status** | | |
| Not working | 1.00 | 1.00 |
| Employed (part or full time) | 1.03 [0.97 - 1.10] | 1.10 [0.96 - 1.25] |
| Not working outside the home | 1.23 [1.13 - 1.32] | 0.85 [0.70 - 1.04] |
| **Household composition** | | |
| Living alone | 1.00 | 1.00 |
| Living with one other person | 1.08 [0.99 - 1.18] | 0.93 [0.76 - 1.14] |
| Living in 3-6 person household | 1.04 [0.97 - 1.13] | 1.09 [0.93 - 1.29] |
| Living in 7+ person household | 1.09 [1.00 - 1.17] | 1.01 [0.85 - 1.21] |
| **Wealth index** | | |
| Least wealthy quintile | 1.00 | 1.00 |
| Quintile 2 | 1.03 [0.97 - 1.09] | 1.08 [0.94 - 1.24] |
| Quintile 3 | 1.09 [1.02 - 1.15] | 0.94 [0.81 - 1.08] |
| Quintile 4 | 1.06 [1.00 - 1.13] | 0.86 [0.74 - 1.00] |
| Most wealthy quintile | 1.07 [1.00 - 1.14] | 1.05 [0.90 - 1.22] |

These results are from two-level Poisson regression models also containing indicator variables for month of interview. N=5059 for unadjusted and N=5025 for adjusted models.
Supplementary Figure 1: Distribution of monthly communication contacts from important others

Cumulative distribution (panel A) and point frequency (B) of number of average monthly communication contacts with important others. Pale red bars in panel B are at multiples of 30 contacts.