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ORIGINAL ARTICLE

Social network and life satisfaction among older adults in rural Uttar Pradesh, India: an application of structural equation modelling

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Abstract

Aim The effect of social networks on health has been widely investigated; however, no study in India has looked into the effects of specific social networks with children, relatives, friends and confidants on life satisfaction among the elderly. This article examines the association between social network and life satisfaction among the rural elderly.

Subjects and methods A sample of 630 older persons living in 12 villages in rural Uttar Pradesh, India, was selected. This study used Berkman's theoretical model of social relations linking to life satisfaction.

Results Results of the Confirmatory Factor Analysis demonstrated that the four specific social network types—children, relatives, friends and confidants—were tenable. The result of structural equation modelling shows that the higher network with 'relatives/siblings' is significant in promoting life satisfaction.

Conclusion The study suggests that there is a need for sensitisation of families and the community at large to the needs and problems of the elderly.

Keywords Social network · Life satisfaction · Older adults · Structural equation modelling · India

Introduction

Life satisfaction (LS) is an important universal objective and measurement of the quality of life, when a person gives conscious evaluative judgements about his or her satisfaction with their life as a whole or evaluative judgements about specific aspects of their life. Studies have defined life satisfaction as "a cognitive judgmental global evaluation of one's life. It may be influenced by affect but is not itself a direct measure of emotion" (Diener et al. 1999). Since the 1980s, there has been a considerable increase in research on life satisfaction, which is a cognitive-evaluative factor according to most researchers. Specifically, studies on life satisfaction are particularly dependent on social comparisons with other important reference groups, for example, with different age groups or a cross-cultural comparison. Although life satisfaction has been measured and studied in a systematic way only in recent years, self-report questions about life satisfaction are commonly included in surveys and used as indicators in large cross-cultural surveys.

Life satisfaction continues to be an important construct in the psycho-social study of ageing. It is one of the commonly accepted subjective conditions of the quality of life and seems to be one of the facets of successful ageing, both of which are key concepts in ageing (Iyer 2003). Some persons achieve a sense of fulfilment and satisfaction in their old age, while others turn bitter and lament the decline of their physical abilities and social significance. For instance, studies assert that elderly people review their past life, and if they feel that most goals of their life have been fulfilled, they feel satisfied (Erikson et al. 1986). Conversely, a feeling that not much has been achieved brings a sense of despair among the aged, because it may be too late to make amends.

Some researchers focus on cross-cultural or cross-national differences in life satisfaction. Economic and cultural factors

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are important variables; different economic and cultural living conditions would be conducive to the diversity of life satisfaction (Murtagh and Hubert 2004; Mroczek and Spiro III 2005). The studies of countries in transition discovered relations among economic prosperity, culture and life satisfaction. This means macroeconomic movements have strong effects on the life satisfaction of nations in total (Hofer and Sliwinski 2001).

Population-based studies including mixed samples of older people have demonstrated that several aspects contribute to life satisfaction. Besides macroeconomic movements, microeconomic factors, such as socioeconomic status, employment and income, are clearly associated with life satisfaction. Studies have examined a large set of personal characteristics, for instance, gender, income, age, religion and educational levels, as well as the level of inequality in society and their effect on life satisfaction. For instance, studies have presented results between age and its relationship with life satisfaction, ranging from finding no relationship at all (Diener et al. 1999; Hamarat et al. 2002; Hsieh 2003) to a positive relationship (Mercier et al. 1998; Prenda and Lachman 2001) and even negative relationships (Freund and Baltes 1998; Chen 2001). One of the few studies that apply a longitudinal design found a decrease in life satisfaction in very old age (Mroczek and Spiro III 2005). Furthermore, empirical studies of the influence of socioeconomic status on life satisfaction in later life found that the association was relatively moderate (Pinquart and Sörensen 2000). Their interpretation was that the quality of life in elderly people is not endangered by reduced income because of the actual ability to adjust needs and desires to the financial situation. Evidence suggests that the marital status of older persons has been related to life satisfaction across all ages, including old age (Diener et al. 2000). In a cross-sectional study, the positive association between marriage and life satisfaction was found to reflect certain personality traits of people living in long-lasting relationships, traits that per se are strongly related to satisfaction (Mastekaasa 1992).

Apart from these determinants, studies documented a significant association between social relationship and network with life satisfaction among older persons. Ageing takes place within a social context, with the individual belonging to a variety of kinship and social groups at each phase of the human cycle. The extent to which the older adult is enmeshed within this social network of family, friends and neighbours greatly affects his/her experience of ageing (Rikhe and Chadha 2004). Social network analysis is one of the many ways in which the social life of the elderly can be examined. Ideally social networks can be defined as all the people with whom the individual interacts, typically including persons whom they live with as well those in categories of social identities such as neighbours, friends and colleagues at work (Chadha and Van Willigen 1995). Several studies have examined the relationship between social support and life satisfaction among the elderly. Most of this literature has indicated a positive relationship between social support and life satisfaction. For instance, a study found that social support was significantly related to life satisfaction of the elderly (Aquino et al. 1996). In another study of 212 persons aged ≥ 80 years, including variables such as social support (contact with children, contact with siblings, contact with friends, number of close friends and satisfaction with friends), satisfaction with friends correlated significantly with life satisfaction and health (need of assistance and self-rated health) and health was found to be strongly related to life satisfaction (McCamish-Svensson et al. 1999).

There is reason to believe that social networks play an essential role in life satisfaction amongst the oldest-old. Social networks are usually described either in terms of structural measures such as frequency of social contacts or as functional indicators such as quality of the social network and social support (Cohen et al. 2001). Paradoxically, although frequency of social contacts has been found to decrease with age (Lang and Carstensen 1994; Due et al. 1999), satisfaction with the social network tends to increase (Lansford et al. 1998). The quality of the social network has repeatedly been found to be important to life satisfaction (Pinquart and Sörensen 2000). On the other hand, there is also evidence that frequency of social contacts is more important than quality (Bowling 1990). The conflicting results may be an expression of individual differences in what is gained through network involvement. For example, among people with low health status in need of assistance, low frequency of contacts may have more negative consequences compared with effects of low quality of contacts. Findings of a negative impact of low social support on the level of life satisfaction in elderly people (Newsom and Schulz 1996) probably reflect increased dependency with ageing and support the assumption that networks differ in functions according to different needs. The conclusion is that life satisfaction and different measures of social networks seem to form a complex pattern of associations in late life.

A number of studies analysing life satisfaction have been focusing on the determinants or correlates of developed countries or comparative research within developed countries till the late 1990s. It is only in recent years that life satisfaction in developing countries has been studied. In this article, an attempt has been made to explore the association between social network and life satisfaction among the older population in a rural Indian setting. We explored the bivariate relationships between socioeconomic and demographic characteristics of older persons with elderly life satisfaction. We presented the results of multivariate analysis to examine the net effect of social networks on elderly life satisfaction after adjusting other independent variables in the model.

Data and methodology

Conceptual framework

The study has used the conceptual framework proposed by Berkman et al. in 2000 to examine the effect of social network on life satisfaction in the Indian context (Berkman et al. 2000). The Berkman model proposes multiple pathways through which the social network has potential influence on well-being. Berkman's model begins with the 'upstream forces', that is, the macro-social context in which the social network operates. These larger social and cultural factors may condition the extent, shape, nature and structure of the social network and may include socioeconomic status, culture and processes of societal change. The structure of the social network and interaction between the members of the social network are described as the 'mezzo' level in Berkman's model. The structural component, such as the size (the number of network members), proximity of network members along with aspects of the network that relate to interaction, such as frequency of contact, shape the definition of the social network. This study focuses on the effects of the mezzo level of the social network on life satisfaction among the older population in rural areas. The 'micro' level in the model includes the ways in which the social network may function, through the provision of social support, social influence, social engagement and access to material goods and resources.

This 'micro' level of social network function is then hypothesised to influence life satisfaction through a number of more proximate pathways. These may include psychological stress responses, health-damaging behaviour such as tobacco consumption, health-promoting behaviour such as appropriate health service utilisation, medical adherence and exercise, and, finally, exposure to infectious and non-communicable diseases.

Study area and sampling

The data for the present study were collected from a cross-sectional survey conducted in 2011 in the rural areas of the Varanasi district of Uttar Pradesh, a state in north India. The old age dependency ratio in Uttar Pradesh (136) is almost equal to the national average (Jeyalakshmi et al. 2011). The sample was selected by multi-stage sampling and the inclusion criteria were: aged ≥ 60 years, living in the village for> 1 year, no evidence of severe mental disease or cognitive disorders and no hearing or speech impairment. Mental disorder was assessed based on evidence of clinically diagnosed criteria and, in case of absence of clinical evidence, an adult member was asked to confirm whether the elderly person was mentally ill at the time of the survey. On average, one elderly person in each village had one of these conditions and was therefore not included in the study. Both male and female subjects aged ≥ 60 years in rural areas were included in the survey.

Pindra tehsil (or sub-district) of the Varanasi district was purposely selected for this study. According to the 2011 Census, > 90% of the population in *Pindra tehsil* lives in rural areas (ORG & CC 2001). Of four administrative blocks in *Pindra tehsil*, *Harhua block* was selected as it was convenient for the researcher in terms of distance, time and costs. Twelve villages from *Harhua block* were picked by the probability proportional to size (PPS) sampling procedure. From a total of 2046 older persons in the 12 selected villages, the number of subjects was calculated regarding the proportion according to the size of each village. The proportion of this study was 0.31 (= 631/2046). Selecting households in each village was conducted by systematic random sampling using household lists. One elderly person per household, who met the inclusion criteria, was interviewed. The non-response rate was around 5%.

Measuring social network and social support

Glass et al. proposed multidimensional models of the social network that reflected the social network with children, relatives, friends and confidants as well as the total social network for each study participant using confirmatory analysis (CFA). They highlighted the need to consider the strength of each specific network separately because of the different social roles. In this model, both the number and frequency of contact with people in each type of network were used to construct summary scores for each specific type of network. A total social network measure was calculated as the sum of the four-component network variables. To measure each of these constructs, the elderly respondents were asked:

(1) How many network members do you have?
(2) How often do you have visual contact with them?
(3) How often do you have non-visual contact with them?

These questions were asked for each network component, that is, children, siblings or relatives, friends or neighbours, and confidants. For measuring contact with the network component, each item was scored to a range of:

(1) Daily
(2) Three or more times a week
(3) Once or twice a week
(4) Once or twice a month
(5) Every few months
(6) Once or twice a year
(7) Less than once a year
(8) Never
(9) Not applicable

The composite reliabilities of the latent variables in the present study were 0.83 for the children social network, 0.78 for the relative social network, 0.69 for the friend social network and 0.68 for the confidant social network.

The Perceived Support Scale (PSS) was developed by Krause and Markidesin to measure the receipt of support from children, relatives, friends and confidants (Krause and Markides 1990). The original scale consisted of 41 items measuring four support dimensions, both support received (informational support, tangible help and emotional support) and support given (integration). Of these 41 items, Krause and colleagues used 10 to measure three kinds of support received from significant others: informational support, tangible help and emotional support (Krause 1999; Krause and Shaw 2002). To be consistent with the Indian context, these ten items were modified in this study to measure perceived support from network members in three dimensions: informational, emotional and instrumental. This modification was based on interviews with older persons about the support they received. The social support scale (Krause and Markides 1990) of this study was performed by deleting one item of information: "how often has someone told you what they did in a stressful situation that was similar to the one you were experiencing?" This item was deleted because the older persons in the village stated that they rarely suffered from stressful situations and that they seldom discussed them with others.

The tangible support dimension was modified by changing the items, "how often has someone helped you with shopping?" into "how often has someone provided you clothes or groceries?" and "how often has someone pitched in to help you do something that needed to get done like household chores or yard work?" into three items of tangible support:

(1) How often has someone helped you do something that needed to get done inside the house like household chores?
(2) How often has someone helped you with bathing, eating, dressing, toileting, etc.?
(3) How often has someone helped you do something outside the house, like yard work, harvesting or any income generating activity?

As financial support is important for the elderly, an item was added to the tangible support dimension: "how often has someone lent or given you money?" The details of each item were considered appropriate and consistent with the situation in the Indian context.

Thus, the social support scale of this study consisted of 12 items: informational support, 2 items; emotional support, 4 items; instrumental support, 6 items. The participants in the study were asked to indicate the support they received on a four-point scale rated from 1 (never) to 4 (routinely), for example,

(1) Information support: "how often have relatives suggested some action that you should take in order to deal with the problem you were having?"
(2) Emotional support: "how often have relatives taken care and been right there with you in a stressful situation or when you were sick?"
(3) Instrumental support: "how often have relatives taken you to a health service, provided transport to get to the doctor urgently or taken you to some place?"

A score of social support for each network domain was created by calculating a mean of sub-domain support received. A high score indicates that support was received from network members more frequently. The social support scale resulted in acceptable reliability (Cronbach's alpha 0.83 for children support, 0.81 for relative support, 0.80 for friend support and 0.82 for confidant support).

Pretesting was done on a small sample of respondents from the target population. Both the interviewer(s) and the respondents were asked a series of questions regarding the survey and the process of data collection during the debriefing session. Such debriefing sessions helped in detecting any problem with the design of the questionnaire and the process of administering the survey, which often led to ambiguity of words, misinterpretation of questions, inability to answer a question and sensitive questions.

Defining life satisfaction

A valid picture of life satisfaction in a given population requires instruments that are adjusted to the characteristics of the population in question. One of the few scales developed for the purpose of capturing life satisfaction in old age is the Life Satisfaction Rating (Neugarten et al. 1961), and modified versions are frequently used in studies of older populations. Nearly 177 individuals aged 50 to 90 years were interviewed with the aim of portraying older people's own evaluations of their lives. The result of the analysis of the interviews was the derivation of five dimensions of life satisfaction:

(1) zest versus apathy: referring to the degree of enthusiasm and ego involvement in various activities
(2) resolution and fortitude: referring to feeling one's own influence and responsibility for one's life
(3) congruence between desired and achieved goals: referring to perception of accomplishing desired goals
(4) self-concept: referring to perception of one's own physical, psychological and social attributes
(5) mood tone: high ratings referring to optimistic attitudes and mood in relation to one's life.

These dimensions provided a base for the construction of the Life Satisfaction Rating, which in turn resulted in the

shorter indexes LSI (Life Satisfaction Index) A and B. The LSI-Z is a further modification of these scales and consists of a three-factor solution with 13 items (Wood et al. 1969).

(1) Zest: representing positively worded satisfaction with present life and zest—"As I grow older, things seem better than I thought they would", "I'm just as happy as when I was younger", "These are the best years of my life", "The things I do are as interesting to me as they ever were" and "I have made plans for things I'll be doing a month or a year from now".
(2) Mood: represented by negatively worded present life satisfaction and mood tone—"This is the dreariest time of my life", "Most of the things I do are boring or monotonous", "Compared with other people I get down in the dumps too often" and "In spite of what people say, the lot of the average person is getting worse, not better".
(3) Congruence: representing past life satisfaction and congruence—"I have gotten more breaks in life than most of the people I know"; "As I look back on my life, I am fairly well satisfied". "When I think back over my life, I didn't get most of the important things I wanted" and "I've got pretty much what I expected out of life". The three-factor structure of Zest, Mood tone and Congruence has been previously confirmed in the LSI-A version (Adams 1969; Hoyt and Creech 1983). Even though the scale consists of separate dimensions, the LSI-Z is typically analysed at the level of the total sum of scores (Kritz-Silverstein et al. 2002). Negative items were reversed; thus, higher scores reflect greater life satisfaction. Cronbach's alpha was 0.74.

Analytical strategies

Social network construct was performed by using confirmatory factor analysis (CFA) with the weighted least square (WLS) method to confirm whether the four dimensions were valid and reliable. To illustrate, CFA tests a proposed measurement model that describes the relationships between the observed and latent variables. In the present case, the latent variables are the social networks. To understand the effects of the social network on life satisfaction, bivariate and multivariate analyses were performed. Multiple linear regression analysis was used to examine the net effect of the social network on life satisfaction. All the variables identified as significant in the bivariate analyses using the chi-squared test were included in the linear regression model. Four multivariate models were applied to examine the effect of four networks, namely children, relatives, friends and confidants, while adjusting for the potential background, socioeconomic and demographic characteristics such as, age, sex, education, current work status, caste, wealth index, living arrangement and chronic health conditions. Chronic diseases were assessed based on self-reported or diagnosed arthritis, stroke, angina, lung disease, asthma, cataract, diabetes, hypertension, injuries, any cancer and tuberculosis (TB) and any others as per the WHO-SAGE guidelines https://www.who.int/healthinfo/sage/en/. The analyses were conducted using Stata version 12 (StataCorp 2011).

To examine a structural model, the structural equation modelling (SEM) with a maximum likelihood (ML) method was performed by using the Amos. SEM was used to establish the relationship between the social network and life satisfaction, mediated by social support. In building the SEM, the exogenous latent variables included the children, relatives, friends and confidant networks. The endogenous latent variables were children, relatives, friends, and confidant support and well-being.

Results

Sample characteristics

Table S1 shows that the majority of the households had a family size of seven (SD = 3.9) and about 75% of the households in the study had a family size of five and above; 14% had a family size of six persons. In the study sample, on average, an older woman had 5.7 (SD = 2.4) children ever born. However, there was not much difference between the average number of sons (3.0) and daughters born to older women. About 10% of the older adults reported that they did not have a daughter compared with 4% in the case of a son. Sample distribution suggests that the average number of children who survived was nearly 4.3 (SD = 1.9). The average number of children currently living with older adults was estimated at 1.4 (SD = 1.2).

The median age of the respondents was 65 years (Table S2). Since mean and median ages of the respondents were fairly close, one could conclude that data on the age of the respondents was quite close to a normal distribution and that there were few chances of recall bias. The sample distribution of older adults by broad age groups showed that a higher proportion (58%) belonged to the 60–69 age group. The majority of surveyed older adults were female (53%) and about two out of five were widowed. However, the study also found that the majority of the women were widowed (52%) compared with the men (19%) in the sample (not shown in Table). The sample distribution shows that the majority of the elderly (67%) had never attended any formal school. Among the elderly who were working, more than two-thirds (71%) were unskilled workers followed by one-fourth (23%) whose livelihoods were based on agriculture. The findings show that 50% of the elderly were residing with their spouse and at least with one of their children. Only 5% of the older adults were living alone and nearly 15% were residing with their spouse at the time of the

survey. Nearly 43% of the older adults were living with a spouse, son (either married or unmarried) and grandchildren at the time of the survey (not shown in table). Over 95% of the older adults belonged to the Hindu religion and nearly 50% were from Other Backward Castes (OBCs)—a collective term used by the Government of India to classify castes who are socially and educationally disadvantaged.

Measurement of social networks: confirmatory factor analyses (CFA)

Results suggest that while the overall fit of our model is good, a more exact fit to the data could have been achieved by allowing single indicators to load on multiple factors. In particular, an examination of modification indices indicated that a single improvement of fit could have been achieved by allowing the indicator for number of children to load on the factor for other relatives and friends. While fitting these paths may have made substantive sense, our goal was to permit items to load on one factor only in order to combine indicators into a meaningful subscale in the most parsimonious manner.

The factor loadings (both standardised and standardised) for the measurement model are presented in Table S3. The results suggest that the coefficients of determination of the individual observed variables were moderate. The λ^{s}_{ij} values for the children, relatives, friends and confidant latent variables were, however, comparable in size to those reported by Glass et al., where the λ^{s}_{ij} ranged from 0.31 to 0.99. The composite reliabilities of the latent variables in the present study were 0.83 for the children social network, 0.78 for the relative social network, 0.69 for the friend social network and 0.68 for the confidant social network. The analogous figures reported by Glass et al. were 0.88 for the children social network, 0.67 for the relative social network, 0.80 for the friend social network and 0.97 for the confidant social network. Glass et al. calculated their specific network variables by summing the observed variables that made up each latent variable, arguing that their social network variables were identical whether the λ_{ij} was used as a weight or not. When a composite variable is created from variables with similar variances and factor loading, then the difference in terms of reliability that arises from equal weighting versus differential weighting by λ_{ij} is very small (Liang et al. 1990, 2005). However, summing of the observed variables by Glass et al. resulted in specific social network variables with different ranges, and these specific social network variables could not be compared easily with each other.

In this study, the average of the standardised observed variables was used to calculate the four specific network variables. Averaging was carried out in preference to summing because there were four observed variables for the children's social network and three observed variables for the relative, friend and confidant social networks. A total social network variable was also calculated as the sum of the four specific social network variables. Each of the social network variables was also categorised according to its tertiles, resulting in variables with the categories of lower, middle and higher for each social network type and the total social network variable.

Bivariate differentials

Table 1 reveals that the difference in mean score of life satisfaction becomes more pronounced at the extremes of the socioeconomic spectrum. Educational attainment, household

Table 1 Mean and [standard deviation] for the Life Satisfaction Index (LSI) among older persons by selected socioeconomic and demographic characteristics, rural Varanasi, Uttar Pradesh, India ($n = 600$)

Variable	LSI
Age[a]	F = 0.233; $p = 0.792$
Youngest-old (60–69 year)	5.183 [2.724]
Old-old (70–79 years)	5.301 [2.806]
Oldest-old (≥ 80 years)	5.385 [2.258]
Sex[b]	$t = 0.149$; $p = 0.882$
Male	5.261 [2.695]
Female	5.228 [2.689]
Current marital status[b]	$t = 1.303$; $p = 0.193$
Currently married	5.352 [2.704]
Currently not married	5.055 [2.659]
Educational level[a]	F = 2.181; $p = 0.089$
No schooling	5.095 [2.607]
1–5 years of schooling	5.175 [2.859]
6–9 years of schooling	5.600 [2.857]
≥ 10 years of schooling	5.914 [2.765]
Occupational status[b]	$t = -1.051$; $p = 0.293$
Not working	5.166 [2.756]
Working	5.416 [2.531]
Caste[a]	F = 1.872; $p = 0.155$
SCs/ST	4.847 [2.641]
OBC	5.383 [2.639]
Others	5.301 [2.801]
Wealth quintile[a]	F = 8.210; $p = 0.000$
Poorest	4.642 [2.351]
Poorer	4.742 [2.785]
Middle	4.933 [2.452]
Richer	5.650 [2.630]
Richest	6.250 [2.879]
Living arrangement[a]	F = 2.849; $p = 0.037$
Living alone	4.448 [2.627]
Living with spouse only	4.586 [2.797]
Living with spouse and at least one child	5.472 [2.682]
Living without spouse but at least one child	5.175 [2.639]
Any chronic illness[a]	F = 8.497; $p = 0.000$
None	5.9
One	5.1
Two or more	4.8
ADL disability[a]	F = 3.489; $p = 0.031$
None	5.5
One	5.4
Two or more	4.9
IADL disability[a]	F = 3.131; $p = 0.044$
None	5.4
One	5.2
Two or more	4.7
Total	5.243 [2.689]

[a] p value based on one-way analysis of variance

[b] p value based on independent sample t-test

Table 2 Mean and [standard deviation] for the Life Satisfaction Index among older persons by the specific and total social network, rural Varanasi, Uttar Pradesh, India ($n = 600$)

Variable	LSI
Children's network	F = 1.900; $p = 0.150$
Lower	5.045 [2.744]
Middle	5.540 [2.646]
Higher	5.145 [2.664]
Relatives network	F = 12.990; $p = 0.000$
Lower	4.726 [2.665]
Middle	5.759 [2.607]
Higher	5.850 [2.604]
Friends network	F = 10.735; $p = 0.000$
Lower	4.804 [2.669]
Middle	5.657 [2.213]
Higher	5.860 [2.749]
Confidant network	F = 9.262; $p = 0.000$
Lower	4.523 [2.997]
Middle	5.484 [2.556]
Higher	5.678 [2.346]
Total network	F = 12.015; $p = 0.000$
Lower	4.592 [2.652]
Middle	5.256 [2.659]
Higher	5.885 [2.613]
Total	5.243 [2.689]

Note: p value based on one-way analysis of variance

wealth index and living arrangement of the respondent were significantly associated with life satisfaction among the rural elderly. However, the mean score of life satisfaction did not significantly differ by the age, gender, current marital status, current work status and caste of the respondent.

For instance, mean score of life satisfaction (5.914) was higher among those elderly who had competed 10 years of schooling and above, whereas the same was lowest among the illiterate (5.095). As the wealth index of the respondent increases, the mean score of satisfaction with life reveals an apparent increase (F = 8.210; $p = 0.000$). As far as the living arrangement is concerned, the elderly living with a spouse and at least one child (5.472) recorded the highest mean score of life satisfaction and the lowest mean score of life satisfaction was recorded among the elderly who were living alone at the time of the survey (4.448) (F = 2.849; $p = 0.037$).

Not surprisingly, there were marked differentials in the mean score of life satisfaction by health status among the elderly. For instance, the elderly who were not suffering from any chronic illness at the time of the survey were more satisfied (5.919). Mean score of life satisfaction was lower among those elderly who were suffering from ADL disability or IADL disability than those who did not suffer from the same.

The bivariate analysis of the effect of social network that we hypothesise to be associated with life satisfaction among the elderly produced an association in the expected directions (Table 2). For instance, the finding shows that the total network was significantly associated with life satisfaction among the elderly ($p = 0.000$). Results also indicate that networks with relatives, friends and confidants were significantly associated with life satisfaction among the elderly ($p = 0.000$), whereas the network with children does not show a significant effect on life satisfaction among the elderly.

The findings suggest that the mean score of life satisfaction was much better (5.850) for those elderly whose relative network was higher than those elderly who had a lower network of relatives (4.726) (F = 12.990; $p = 0.000$). Furthermore, the mean life satisfaction score was the lowest among the elderly with a smaller network of friends (4.804), followed by those elderly who had a middle-sized friend network (5.657). The highest mean life satisfaction score was evident among the elderly who had a larger friend network at the time of the interview (5.860) (F = 10.735; $p = 0.000$). As observed in the case of the relative and friend networks, the same pattern is evident in the case of the confidant network. For example, the mean score of life satisfaction was highest among those elderly who had a larger confidant network (5.678), whereas it was lowest among the elderly with a smaller confidant network (4.523) (F = 9.262; $p = 0.000$). Concerning the total network,

Table 3 Mean and [standard deviation] for the Life Satisfaction Index among older persons by specific and total social support, rural Varanasi, Uttar Pradesh, India ($n = 600$)

Variable	LSI
Children support	F = 34.036; $p = 0.000$
Lower	4.060 [2.815]
Middle	5.574 [2.495]
Higher	6.090 [2.323]
Relative support	F = 17.653; $p = 0.000$
Lower	4.321 [2.885]
Middle	5.682 [2.561]
Higher	5.680 [2.400]
Friend support	F = 20.788; $p = 0.000$
Lower	4.332 [2.751]
Middle	5.500 [2.602]
Higher	5.924 [2.454]
Confidant support	F = 13.550; $p = 0.000$
Lower	4.452 [2.909]
Middle	5.527 [2.588]
Higher	5.735 [2.386]
Total support	F = 33.940; $p = 0.000$
Lower	4.030 [2.844]
Middle	5.891 [2.535]
Higher	5.809 [2.241]
Total	5.243 [2.689]

Note: p value based on one-way analysis of variance

the findings reveal that the highest mean score of life satisfaction was among those elderly subjects who had a larger total network (5.885). However, for those elderly who had a smaller total network, the mean score of life satisfaction was lowest (4.592), followed by those older persons with a middle-sized total network (5.256).

The results suggest that the mean score of life satisfaction is significantly associated with all types of specific social support including children, relatives, friends and confidants along with total support ($p = 0.000$) (Table 3**).** For instance, the mean life satisfaction score was the highest among those elderly who had more support from children (6.090), whereas it was the lowest among the elderly who had less support from their children (4.060) (F = 34.036; $p = 0.000$). Concerning support from relatives, the findings show that the highest mean life satisfaction score was for those elderly who had more relative support (5.680). However, the lowest mean life satisfaction score was evident among the elderly with less relative support (4.321), followed by the elderly who had mid-level relative support (5.682) (F = 17.653; $p = 0.000$).

For friend support, the results show the highest mean score of life satisfaction was among those elderly who had a higher level of friend support (5.924), while the lowest score was observed among those older persons who had less support from friends (4.332) (F = 20.788; $p = 0.000$). For the elderly whose confidant support level was higher, the mean life satisfaction score was highest (5.733). However, the mean life satisfaction score was lowest among those elderly subjects who had less confidant support (4.452), followed by those elderly with middle-level confidant support (5.527) (F = 13.550; p value = 0.000).

The results also suggest that mean life satisfaction increases with an increase in the total social support from the lower to middle category of total social support, but moving to the higher category of social support, the mean social support declined (F = 33.940; $p = 0.000$). For instance, the mean life satisfaction score among those elderly who had lower total support was lowest (4.030). However, the mean life satisfaction was highest among those elderly who had middle-level total support (5.891), followed by elderly subjects who had higher total support levels (5.809).

Multivariate results

To understand the association between the social network and life satisfaction, a multiple regression model was used

Table 4 Multiple regression model estimates of the beta coefficients and confidence intervals for the effect of specific social networks on life satisfaction for older persons, rural Varanasi, Uttar Pradesh, India ($n = 600$)

Variable	Model I β [95% CI]	Model II β [95% CI]	Model III β [95% CI]	Model IV β [95% CI]
Children network	F = 2.24; $p = 0.108$	F = 0.82; $p = 0.442$	F = 0.44; $p = 0.647$	F = 0.38; $p = 0.683$
Lower (ref.)				
Middle	0.545 [0.032–1.058]	0.266 [−0.25–0.781]	0.229 [−0.294–0.752]	0.205 [−0.318–0.727]
Higher	0.197 [−0.318–0.711]	−0.032[−0.549–0.484]	0.040 [−0.497–0.578]	0.016 [−0.522–0.554]
Relatives network	F = 6.13; $p = 0.002$	F = 3.84; $p = 0.022$	F = 2.43; $p = 0.039$	F = 2.55; $p = 0.027$
Lower (ref.)				
Middle	0.841 [0.203–1.48]	0.761 [0.092–1.43]	0.704 [0.037–1.371]	0.741 [0.075–1.406]
Higher	0.765 [0.271–1.26]	0.714 [0.143–1.286]	0.469 [−0.114–1.053]	0.435 [−0.149–1.019]
Friends network	F = 3.45; $p = 0.033$	F = 0.51; $p = 0.602$	F = 0.77; $p = 0.465$	F = 1.18; $p = 0.309$
Lower (ref.)				
Middle	0.563 [−0.128–1.253]	0.155 [−0.579–0.889]	0.219 [−0.514–0.951]	0.297 [−0.439–1.032]
Higher	0.625 [0.129–1.121]	0.299 [−0.285–0.884]	0.371 [−0.218–0.96]	0.462 [−0.131–1.055]
Confidant network	F = 4.33; $p = 0.014$	F = 1.23; $p = 0.292$	F = 1.50; $p = 0.225$	F = 1.34; $p = 0.262$
Lower (ref.)				
Middle	0.622 [0.118–1.125]	−0.738[−1.729–0.252]	−0.686[−1.709–0.337]	−0.713 [−1.737–0.311]
Higher	0.864 [0.236–1.492]	−0.544[−1.632–0.543]	−0.325[−1.496–0.846]	−0.422 [−1.599–0.755]
R-squared	0.7781	0.8321	0.8764	0.8870
Adj R-squared	0.7656	0.8144	0.8361	0.8411

Model I: Unadjusted results for each network

Model II: Controls for children support, relatives support, friends support and confidant support

Model III: Controls for age, sex, educational attainment, current work status, caste, wealth status, living arrangement and in addition all variables mentioned in Model II

Model IV: Controls for suffering from any chronic illness, ADL, IADL and in addition to all variables mentioned in Model III

Figures in parentheses are 95% confidence intervals for the beta coefficients; p refers to the adjusted Wald test

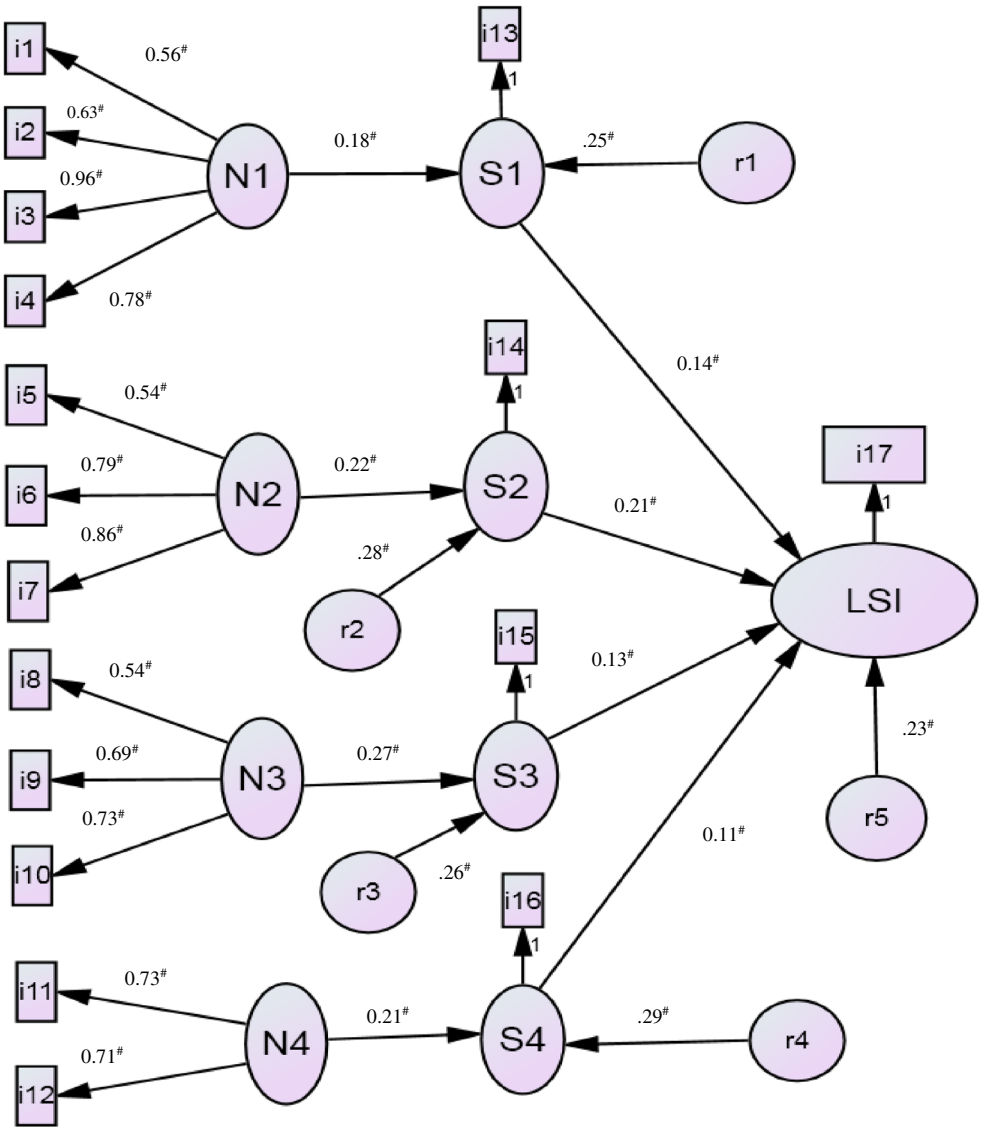

Fig. 1 Pathway of the Life Satisfaction Index model obtained from the Structural Equation Model (SEM)

considering that the dependent variable is continuous in nature (Table 4). Apart from support from children, relatives, friends and confidants, the models were adjusted by other individual, socioeconomic and demographic predictors such as age, sex, educational attainment, current work status, caste, wealth status, living arrangement, ADL and IADL disability.

The study has fitted four versions of the multiple linear regression models to understand the changing nature of the association between life satisfaction and social network, described in the following section. In Model I only specific social network variables were included with no other covariates; however, in Model II, the estimates were adjusted by specific social network variables along with specific social support. In Model III, socioeconomic and demographic variables were introduced along with social support to the adjusted effect of social network variables on life satisfaction. Concerning the last model (Model IV), health-related

Table 5 Direct and indirect association of variables on the Life Satisfaction Index, Rural Varanasi, Uttar Pradesh

Variable	Direct effect	Indirect effect
Children network		−0.04
Relatives network		0.47#
Friends network		0.14
Confidant network		−0.20
Children support	0.14#	
Relatives support	0.21#	
Friends support	0.13#	
Confidant support	0.11#	

Note: #$p < 0.01$, \$$p < 0.05$ *$p < 0.10$

$\chi^2 = 173.25$, df = 111, χ^2/df = 1.56, GFI = 0.969, AGFI = 0.924, $p < 0.05$

variables were added to the social support and socioeconomic and demographic variables to examine the net effect of the social network on life satisfaction among the elderly. The total social network was not considered in the regression model as the total social network variable was derived by summing up the four specific social network variables. Addition of the total social network to the model could create multicollinearity in the regression model. Along with the total social network, some other variables were not considered in the multivariate analysis, such as marital status and presence of any chronic illness, because of multicollinearity. For instance, marital status and living arrangement are correlated, and presences of any chronic illness and disability are correlated so that, on the basis of the literature review, living arrangement and disability were considered in the regression model rather than marital status and presence of any chronic illness. In Model IV, the network with relatives remains a significant factor explaining life satisfaction among the elderly even after controlling for important socioeconomic, demographic and health-related variables. The elderly with higher- and middle-level relative networks were highly satisfied with their life compared with those elderly having lower-level relative networks. For instance, in Model IV, the mean score of life satisfaction among the elderly who had a middle-level relative network was higher (β = 0.741; 95%CI = 0.075–1.406) compared with the elderly who had lower-level relative networks.

Direct and indirect association

The mechanisms by which social relationships were associated with life satisfaction among the elderly are presented in Fig. 1. The SEM findings suggest a direct positive association of support from children, relatives, friends and confidants on life satisfaction. For instance, relative support was directly associated with life satisfaction (β = 0.21, $p < 0.01$), followed by that of children (β = 0.14, $p < 0.01$) and friends (β = 0.13,

Table 6 Path coefficients of the Life Satisfaction Index (LSI) model among older persons, Rural Varanasi, Uttar Pradesh

Variable	Path coefficient
LAMBDA-Y	
Children support: information/emotion/instrument support	1.00
Relative support: information/emotion/instrument support	1.00
Friend support: information/emotion/instrument support	1.00
Confidant support: information/emotion/instrument support	1.00
LSI-13 Items	1.00
Lambda-X	
Children network: number of living children	0.56#
Children network: proximity children	0.63#
Children network: contact children	0.96#
Children network: phone children	0.78#
Relative network: number of close relatives	0.54#
Relative network: contact relatives	0.79#
Relative network: phone relatives	0.86#
Friend network: number of close friends	0.54#
Friend network: contact friends	0.69#
Friend network: phone friends	0.73#
Confidant network: existence of confidant	0.73#
Confidant network: spouse is a confidant	0.71#
BETA	
Children support: LSI	0.14#
Relative support: LSI	0.21#
Friend support: LSI	0.13#
Confidant support: LSI	0.11#
GAMMA	
Children network: children support	0.18#
Relative network: relatives support	0.22#
Friend network: friends support	0.27#
Confidant network: confidant support	0.21#

# $p < 0.01$; $ $p < 0.05$; * $p < 0.10$

$p < 0.01$). Furthermore, the findings show that the positive relationship between the relative network and life satisfaction was mediated by relative support ($\beta = 0.47$, $p < 0.01$). This implies that a network with relatives can indirectly influence life satisfaction among the elderly through the provision of support from relatives. The results show that the support from children, relatives, friends and confidants increases as the network increases (Tables 5 and 6).

Discussion

This article assesses the relationship between specific social networks and life satisfaction among the older population in rural areas. The effects of specific and total social networks upon life satisfaction were examined, using multiple linear regressions to adjust for a broad range of covariates. The analyses showed that a better relative network was associated with higher satisfaction with life among older persons. However, the analyses further suggested that there was no significant effect of children on life satisfaction among the elderly. There is evidence of a significant effect of a friend network and confidant network on life satisfaction, but these appeared to be weaker once controlled for a range of covariates in the regression model.

The results raise important questions about how a social network with relatives affects life satisfaction in later life. The model proposed by Berkman et al. suggests that the effects of a relative network on life satisfaction arises because of micro-level and subsequent pathway effects of the social network. The micro-level effects of a relative social network may operate through the provision of social support, social influence, social engagement or access to goods and resources.

The micro-level of the social network function may influence well-being through a number of pathways, including health behaviour and psychosocial routes. For instance, cognitive and emotional states such as self-esteem, coping, depression and sense of well-being may be affected by the psychosocial mechanisms (Burg and Seeman 1994; Seeman and McEwen 1996; Uchino et al. 1996; Seeman 2000; Uchino 2006), and a review of some of the negative effects of family members on health suggested that the spouse in particular may promote poor health habits. Older persons may have been more influenced by advice offered by relatives than by advice offered by a child, spouse or friend. The sibling may be particularly important in this regard. An alternative explanation is that relatives, in particular siblings, also possibly share early life environments and health behaviours. Thus, the network of relatives may be a proxy measure of genetic factors, including the predisposition to survival and good or poor health. Another possible pathway through which the relative network may affect life satisfaction is the direct link between physiological mechanisms and the social network, with subsequent beneficial effects upon life satisfaction. Any physiological advantage that stems from the network with relatives probably reflects a mixture of genetic factors and health behaviours that are shaped by early life environments. A further refinement of the social network with specific relatives aside from those with children and spouses is warranted according to these results. Disentangling the effects of the network with different relatives, such as siblings, nephews or nieces, may provide further insights into how the relative networks act to promote life satisfaction in later life.

To conclude, the results suggest that specific social relationships may have an effect on life satisfaction in later life. Having a strong social network, particularly with relatives, is significant in promoting life satisfaction among older persons. However, the present study was unable to include characteristics reflecting the early life and childhood (e.g., poverty, food deprivation, etc.). Furthermore, the study did not include older adults with mental disorders, which might result in a biased sample. Previous studies have shown that physical health is hardly relevant for older people's life satisfaction, whereas differences in mental health could distinguish between those with low and those with high life satisfaction (Berg et al. 2006; Puvill et al. 2016).

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical statement The study was reviewed and approved by the institutional review board (ethics committee) of the International Institute for Population Sciences (IIPS), Mumbai, India, before the study began. The purpose of the study and procedure of data collection were described to the *Gram Pradhans* (elected head of each village) and the district social welfare officer to attain their permission and cooperation. The detailed purpose, protocol of the study and time required to complete questionnaires were explained to each respondent. Confidentiality was also explained to participants so that they could refuse to answer any question and withdraw from the study at any point of time. The study did not offer any incentives in either cash or kind for participation. The entire interview, including the questionnaire and scales used in this study, was conducted in the local language, which is Hindi.

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