Losing and gaining in old age: Changes in personal network size and social support in a four-year longitudinal study

van Tilburg, T.G.

published in
The Journals of Gerontology. Series B : Psychological Sciences and Social Sciences
1998

DOI (link to publisher)
10.1093/geronb/53b.6.s313

document version
Publisher's PDF, also known as Version of record

Journal of Gerontology: SOCIAL SCIENCES
1998, Vol. 53B, No. 6, S313–S323

Losing and Gaining in Old Age: Changes in Personal Network Size and Social Support in a Four-Year Longitudinal Study

Theo van Tilburg

Vrije Universiteit, Amsterdam, The Netherlands.

Objectives. Previous studies have shown that most older people have a significant number of relationships. However, the question of whether the aging of old people produces losses in their personal networks remains open for discussion. This study models the individual variability of the changes affecting multiple personal network characteristics.

Methods. Personal interviews were conducted with 2,903 older Dutch adults (aged 55–85) in three waves of a four-year longitudinal study.

Results. A stable total network size was observed, with an increasing number of close relatives and a decreasing number of friends. Contact frequency decreased in relationships, and the instrumental support received and emotional support given increased. Age moderated the effect of time for some of the network characteristics, and for many of them, effects of regression towards the mean were detected. Furthermore, major variations in the direction and the speed of the changes were detected among individual respondents, and nonlinear trends were observed.

Discussion. The widely varying patterns of losses and gains among the respondents squares with the focus on the heterogeneity of developments among aging people. The instability of the network composition might reflect the natural circulation in the membership of networks.

THESE days, it is generally recognized that aging is not the same as becoming socially isolated. One of the social isolation indicators is a lack of personal network members. The personal network consists of the set of people (i.e., the spouse, children, relatives, neighbors, friends, fellow members of organizations, and acquaintances) with whom the focal person has a direct personal relationship. These relationships are selected from a broader social context of latent relationships; for example, relationships that are not maintained or relationships with new acquaintances that have not yet reached a personal level. There are undeniably older adults with very small personal networks, but nearly all of the studies have shown that most elderly people have a significant number of relationships. The modal network size of older adults has been assessed in several studies as ranging from about 5 to 10; higher averages were observed in some studies using deviating network delineation methods (see the overview by Broese van Groenou & van Tilburg, 1996). Furthermore, older people in general are not more vulnerable to losses in their network than young people (Berkman, Oxman, & Seeman, 1992).

However, the question of whether aging produces losses in a person's personal network remains open for discussion. Decline and loss associated with advanced age (known as the deficit model) have been the primary focus of gerontology (Baltes & Carstensen, 1996). Change in the networks of older adults has been described mainly in terms of life events. Widowhood (Morgan & March, 1992) affects the network composition (i.e., less contact with couples) or network functioning (i.e., more emotional support received). The death or incapacity of network members (Antonucci & Akiyama, 1987) result in losses, and the limitations of such personal resources as health (Morgan, 1988) may reduce possibilities for maintaining relationships. However, losses may coincide with gains. For example, poor health might limit a person's chances to maintain relationships, but it will likely increase the need for instrumental support (Brody, 1985). This increased need may mobilize helpers and increase the support received (Miller & McFall, 1991; Stoller & Pugliesi, 1988). The coincidence of losses and gains may result in stable network sizes over time. Personal networks may also expand at an advanced age. For example, retirement enables a person to make new commitments, and the frequency of contact with a person's children may increase after the birth of grandchildren.

The scope on developments in old age has not only expanded to positive outcomes, but also to the heterogeneity of developments among aging people (Baltes & Carstensen, 1996). In accordance with this view, data from two studies not focusing specifically on the impact of life events have shown a large variation among older adults with respect to the direction of the changes in their network size. In a four-year longitudinal study of 297 people older than the age of 75, Wenger (1986) observed that the number of people who assisted the respondent on a regular basis ranged on average from 5.9 to 6.5; 48% of the support networks increased in size, 30% remained the same, and 22% decreased. In a three-year longitudinal study of

256 people older than the age of 85, Bowling, Grundy and Farquhar (1995) observed a network size decrease in 42% of the networks, no change in 42%, and an increase in 16% of the older adults' networks. The sample was small in size, excluded younger older adults, and was based on only two observations. Despite these limitations, the sample contributed significantly to our knowledge and showed that individual growth trajectories cannot be represented by group-level growth curves in which contrasting individual developments are averaged (Collins, 1996). This is especially true for older adults, because it is generally recognized that life course differences not only produce differences in the networks of older adults, but also in the dynamics of these networks (Schulz & Rau, 1985; Stueve & Gerson, 1977). In this context, Kahn and Antonucci (1980) used the metaphor of a convoy: individuals enter and leave a variety of roles throughout their lifetimes, and each of these roles is accompanied by a specific set of personal relationships.

In this study, I describe the number and nature of personal network changes in a large sample of older Dutch adults, specifically focusing on the variation of developments in three observations. The type of change being studied is the change induced by the normal functional and developmental process (ontogenetic age-graded; Baltes, 1979), which must be distinguished from the unreliability of the data, inherent instability in systems, and change induced by life events external to the system (Leik & Chalkley, 1997). With regard to the changes in the network size, our first hypothesis is that, on average, there will a stable network size, but with many individual variations. To describe the variety of the developments I will examine whether patterns of changes are age-specific, for example whether the oldest of the older individuals experience losses whereas the youngest of the older individuals experience gains, and whether there are nonlinear changes.

Furthermore, this study focuses on developments in several dimensions of the network. In addition to the network size (i.e., the number of individuals), this article focuses on the network composition (i.e., the individuals in the network or the role types of the relationships), the interaction frequency with network members and the instrumental and emotional social support received and given within the relationships. Because it is assumed that frequent interaction and support enhance the feeling of social integration and strengthen coping behavior, they are referred to as functional characteristics. The focus on several dimensions is important (Berkman et al., 1992; Dean, Holst, Kreiner, Schoenborn, & Wilson, 1994), because developments in one domain are not independent from changes in another (Morgan, 1988). I will describe the changes in interaction frequency and in the support received, as well as a second and third hypothesis with respect to network composition and the intensity of support given.

Various segments of the network may change in different ways. As noted above, the study by Stoller and Pugliesi (1988) demonstrated that for older adults in poor health, the number of helpers and support increased, whereas other contacts decreased. Older people in good health may invest in specific relationships (Klein Ikkink, van Tilburg, & Broese van Groenou, 1995) to build up a support bank (Antonucci & Jackson, 1989) from which support can be obtained when needed. Within the personal network, a core consisting of close relatives and friends can be distinguished from a periphery consisting of network members contacted at infrequent intervals and distant relationships like casual acquaintances. Changes in the core of the network are less frequent than changes in the periphery (Carstensen, 1992; Kahn & Antonucci, 1980; Shulman, 1975; van Tilburg, 1992; Wenger, 1986). Therefore, investments in the core have the greatest chance of return in the form of future support receipts. My second hypothesis is that in time, there will be a stable or even increasing number of network members in the network core and a decreasing number in the periphery of the network.

Some older adults may receive increased instrumental support due to their worsening health or more emotional support after life events such as the loss of a spouse. However, because this study does not focus on external changes, there are no hypotheses for changes in support received. When support received increases, developments in giving support may follow the opposite trend. People strive for balance in their social interaction (Gouldner, 1960). Consequently, my third hypothesis is that as people receive more support, they try to increase the support they give. This may be true of a specific type of support, for example instrumental support both received and given may simultaneously increase. The same may be true among various types of support: an older adult who is provided a great deal of *instrumental* support may try to balance his or her relationships by providing other network members a great deal of *emotional* support.

Design of the Study

Respondents

Personal interviews were conducted in 1992 (T_1) with 3,805 respondents who participated in the "Living arrangements and social networks of older adults" research program (Knipscheer, de Jong Gierveld, van Tilburg, & Dykstra, 1995). This program used a stratified random sample of men and women born between 1908 and 1937. The oldest individuals, and in particular the oldest men, were overrepresented in the sample. The sample was taken from the population registers of eleven municipalities: the city of Amsterdam and two rural communities in the western part of the Netherlands, and two cities and six rural communities in the south and east. These three regions could be seen to represent differences in culture, religion, urbanization and aging in the Netherlands. Of the 6,107 eligible individuals in the sample, 2,302 (37.7%) were unwilling to participate due to a lack of interest or time; another 734 were ineligible because they had died or were too ill or cognitively impaired to be interviewed. The decision not to interview a person was made by the interviewer, based on information from a relative or a staff member of the institution where the person lived. The interviews mainly covered demographics, the personal network, loneliness and event history.

In 1992 and 1993 (T_2), a follow-up was carried out in the context of the Longitudinal Aging Study Amsterdam

(LASA; Deeg & Westendorp-de Serière, 1994). The LASA interviews covered a wide range of topics relating to physical and cognitive health, and social and psychological functioning. Of the T_1 respondents, 3,107 (81.7%) participated in the follow-up. Of the 698 T_1 respondents who did not participate in T_2, 126 (3.3% of 3,805) died and 134 (3.5%) could not participate in the study because of severe physical and/or mental health problems. Furthermore, 394 (10.4%) refused to be reinterviewed, and 44 (1.2%) could not be contacted. In 1995 and 1996, T_3 involved conducting personal interviews with 2,302 respondents (74.1% of the T_2 respondents). A telephone interview, which did not include the network delineation, was conducted with the respondent or a proxy (the partner, another member of the household, or a staff member of the institution where the respondent lived) (243 persons, 7.8%). Of the other T_2 respondents, 417 (13.4%) died, 38 (1.2%) were ineligible, 90 (2.9%) refused to cooperate and 17 (.5%) could not be contacted. In each wave, the interviews were carried out by interviewers who had received training for four days and who were intensively supervised, and the interviews were tape-recorded to monitor and enhance the quality of data. The interviews lasted between one-and-a-half and two hours.

The networks of 2,096 respondents were delineated in all the waves using the same method. The T_1 and T_2 networks were available from an additional 723 respondents (662 of whom were not interviewed in T_3); the T_1 and T_3 networks of an additional 44 respondents and the T_2 and T_3 networks of an additional 40 respondents were available. In total, longitudinal data were available for 2,903 respondents. There were various reasons not to delineate networks for all the interviews, including the premature termination of the interview, respondents' refusal for privacy reasons or lack of time for interviewing, and most frequently, an abridged version of the questionnaire was conducted with the respondents in a specific wave who were too physically or cognitively frail to be interviewed using the full questionnaire. The interval between T_1 and T_2 averaged .86 years (N = 2,819, SD = .18), between T_2 and T_3 3.06 years (N = 2,136, SD = .16), and between T_1 and T_3 3.92 years (N = 2,140, SD = .21, with a minimum of 3.16 and a maximum of 4.74 years).

The sample characteristics are shown in Table 1 (the characteristics of the 95 respondents who were interviewed three times, but for whom two or all three observations of the network were missing, are not shown). Using multivariate logistic regression, respondents who died, who refused and on whom longitudinal data were available were compared with regard to sex, age, ADL capacity (assessed on the basis of four items; a higher score indicates a better performance), educational level, income and household composition, all measured in T_1. Compared with the respondents whose longitudinal data were not available and who had died or were ineligible in T_2 or T_3, the respondents on whom longitudinal data were available were more often female, younger, less often institutionalized, and had better ADL capacity and education ($p < .01$). Compared with the respondents whose longitudinal data were not available and who refused to be interviewed in T_2 or T_3, the respondents whose longitudinal data were available had a higher income. Compared with the respondents with only two network observations, the ones with three observations were more often female and younger, and had a better ADL capacity and a

Table 1. Sample Characteristics[a]

	Longitudinal Data Not Available		Longitudinal Data Available (No. of observations)		
	Died or ineligible in T_2 or T_3 N = 396	Refused in T_2 or T_3 N = 411	2[b] N = 807	3 N = 2,096	2 or 3 N = 2,903
% Female	44.4	53.5	48.2	52.8	51.5
Age (mean[c], range 55–85)	75.6 (7.7)	70.1 (8.4)	72.7 (8.3)	68.2 (8.5)	69.5 (8.7)
ADL capacity (mean, range 4–20)	16.6 (4.1)	19.1 (2.0)	18.4 (2.9)	19.3 (1.7)	19.1 (2.1)
% With one or more chronic diseases[d]			79.7	72.8	74.5
Education (mean, range 5–18 years)	7.6 (3.0)	8.2 (3.0)	8.3 (3.2)	9.1 (3.4)	8.8 (3.3)
Income (median category, net Dutch guilders a month)	1,750–2,000	1,750–2,000	1,750–2,000	2,250–2,500	2,000–2,250
Household composition (%)					
– institutionalized	17.6	2.7	5.0	1.1	2.2
– alone	31.5	23.4	29.6	27.7	28.2
– with partner	45.5	67.8	61.5	67.1	65.6
– not with partner, with children	2.3	4.4	2.2	2.5	2.4
– other multiperson household	3.1	1.7	1.7	1.6	1.7
Network size[e]	10.9 (7.8)	12.7 (8.7)	13.0 (8.8)	15.1 (10.0)	14.5 (9.8)

[a]Having a chronic disease was assessed in T_2, all the other characteristics were assessed in T_1.
[b]Among these, in T_3 633 died or were ineligible and 73 refused to be interviewed.
[c]*SD* in parentheses.
[d]Too few cases with data for respondents without longitudinal network data.
[e]N = 257; 375; 767; 2,096 and 2,863, respectively.

better education. As a result, the study sample is a survivor sample. Furthermore, the sample is characterized by a relatively high socioeconomic status. However, the stratified sampling frame and the sample size guaranteed the inclusion of sufficient males, respondents in the highest age category, respondents with physical problems and chronic diseases, and respondents with a low socioeconomic status. The variations within the sample were retained by not restricting the study of change to respondents for whom three observations of network characteristics were available.

Measurements

In order to obtain adequate information on older adults' networks, I did not ask questions about aggregate characteristics (e.g., the number of friends without identifying these people, or the frequency of contacts with friends in general), but looked for detailed information on the older adults' relationships with network members identified by name. According to Starker, Morgan, and March (1993), these types of data are the minimum requirement for studying change in networks. The main objective was to identify a network that reflected the socially active relationships of the older adults in the core, as well as the periphery of the network. Several criteria were applied to the selection of a method for identifying the personal network, with regard to who was to be included in the network. First, the network composition had to be as diversified as possible, implying that all types of relationships deserved the same chance to be included in the network. This criterion led to a domain-specific approach in the network identification, using seven formal types of relationships: household members (including the spouse, if there was one), children (including stepchildren) and their partners, other relatives, neighbors, colleagues (including voluntary work or school), fellow members of organizations (e.g., athletic clubs, church, political parties), and others (e.g., friends and acquaintances). A second objective was to include all the network members with whom the respondent had regular contact, thus identifying the socially active relationships. To avoid picking out individuals who were contacted frequently by definition (such as all the members of a club), the importance of the relationship was added as a criterion.

This "domain-contact approach" combines the various roles an individual plays in society with the contact frequency and the importance of the relationships as criteria for the identification of network members, and differs from approaches in which *support* networks are delineated (e.g., Wenger, 1986). The identification method was derived from the method used in the study by Cochran, Larner, Riley, Gunnarson, and Henderson (1990). In each of the seven domains, the following question was posed: "Name the people (e.g., in your neighborhood) you have frequent contact with and who are also important to you." The interpretation of the criteria was left to the respondent. Only people older than the age of 18 could be nominated. The maximum number of names was set at 80, but no one reached this limit. The design of the measurements for the three observations was the same, giving network members identified in a previous observation and others the same chance to be identified in later observations.

Information was gathered on all the network members as to the type of the relationship with the respondent, gender and contact frequency (in eight categories ranging from less than once a year to daily, and converted to a number of days a year). A maximum of ten members were selected on the basis of the highest contact frequency with the respondent. Four questions were asked about the relationships with these ten (or fewer, if fewer had been identified). One question was asked pertaining to receiving instrumental support: "How often in the past year did X help you with daily chores in and around the house, such as preparing meals, cleaning the house, transportation, minor repairs, filling out forms?" One question was asked about receiving emotional support: "How often in the past year did you talk to X about your personal experiences and feelings?" For support given, the questions were reversed. The answer categories were never, seldom, sometimes and often, and were assigned values ranging from 0 to 3.

Procedure

I computed the total network size as the number of individuals identified. Partial networks were identified by the type of network member, i.e., child (including stepchildren), child-in-law, sibling, sibling-in-law, other relative (e.g., parent, grandchild, aunt, uncle, nephew, niece), friend, neighbor, or other non-relative (e.g., acquaintance, a colleague or fellow member of an organization) of the respondent. The sum of the partial network sizes equals the total network size. However, the spouse or partner was not included in the computation of the partial network sizes. The means across the relationships (partner relationships excluded) were aggregated for each respondent for presenting descriptions of contact frequency and support exchanges, and averaged again for the entire sample.

Commonly, change over time is analyzed using MANOVA for repeated measurements. However, this method assumes the availability of observations for all the respondents at each point in time and equal observation intervals among the respondents. These conditions were not met in this sample: only two observations were available for 807 respondents and there was a relatively large variation in the individual observation intervals. These conditions are not required in multilevel analysis (Snijders, 1996). Two or three observations were nestled in the respondents using this method for change over time in the total and partial network sizes. The model specifies three levels of change over time in relationship characteristics. Theoretically, a maximum of 240 (3×80) unique relationships were nestled in the respondents. Each of these relationships was nominated one to three times, and the observations of contact frequency and support across time were nestled in the relationships. The analyses will lead to regression equations with fixed effects that can be read as the product of an ordinary regression analysis. Fixed effects are the intercept, time (i.e., the interval between the first and other observations), age in T_1 and the interaction of time and age. The variables for the two main effects, time and age, were centered around the mean to avoid multicollinearity and the interaction term was computed as the product of these two variables. Differences of the time effect among individuals and the covariance between the intercept and the slopes were estimated by incorporating random effects into the model.

The models were analyzed using ML3, a program for multilevel analysis (Prosser, Rasbash, & Goldstein, 1991). There are two methods for evaluating the compatibility of models. The first focuses on the significance of the model change. Each model is characterized by the –2 log likelihood (deviance, i.e., the lack of correspondence between the model and the data). For each variable to be explained, I applied the forward modeling approach using an empty model (containing only a constant) at the start and added the parameters in the subsequent steps. The difference between the deviance of the steps is χ^2 distributed with the number of added parameters as degrees of freedom. The second method uses the reduction of the unexplained variance (Snijders & Bosker, 1994). In each step, the variability of the dependent variable is estimated at each level of analysis. The sum of these variance components in the empty model equals the variance of the variable. If explanatory variables are added to the model, the variance decreases for either one, two, or all of the levels. The degree of decrease provides insight into the explanatory power of the model. Unlike ordinary regression analysis, the added variances described may be negative. If they are strongly negative, the specification of the model should be questioned.

The variance of the slope and the covariance between the slope and the intercept were illustrated by computing the growth curves (Francis, Fletcher, Stuebing, Davidson, & Thompson, 1990; Rogosa, Brandt, & Zimowski, 1982) of individual respondents for whom three observations were available. The curves are the linear regression lines with time as an explanatory variable, and were used to estimate the regression intercept and slope of time for each individual. The intercept indicates the initial value and the slope indicates the direction and speed of linear change. The slope of time and the described variance in network size across time were used to categorize the respondents. The criterion of $R^2 \geq .4$ was chosen to distinguish upward or downward linear trends from other trends. If $R^2 < .4$, distinctive categories were *no change at all* if the network size was equal in the three observations, *about stable* if there were minor differences ($SD \leq 2$), and *no linear change* for the remaining respondents. Linear trends ($R^2 \geq .4$) were divided into *decrease* if the slope of time was negative and *increase* for positive estimates.

For detecting changes in the network composition, the names of all the network members identified in different observations were compared and, if possible, linked. The network stability, i.e., the overlap of individuals, was computed (Broese van Groenou, van Sonderen, & Ormel, 1990) as

$$\frac{Size\ T_1 \cap ... \cap Size\ T_j}{(Size\ T_1 + ... + Size\ T_j)\ /\ j}$$

where j = the number of observations. For example, for a respondent who identified ten network members during each observation, five of whom were identified during all observations, the overlap between the three observations was 5 / ((10+10+10)/3) = 50%.

Results

The average T_1 network size was 14.0 (SD = 9.6, N = 3,529; data on 276 respondents were missing). On average, respondents for whom three observations were available had the largest networks (Table 1), followed by respondents for whom two observations were available and respondents who refused in T_2 or T_3. The lowest average was observed for those who had died or were ineligible in T_2 or T_3. When checked with regard to age in T_1 (nonstandardized regression coefficient $b = -.183$, $F = 101$, $p < .001$, $R^2 = .028$), the differences between the four categories were smaller, but still significant ($F = 12$, $p < .001$, added $R^2 = .010$). Respondents for whom two observations were available could be specified into those who had died or were ineligible in T_3 (N = 633, M = 12.9, SD = 8.7), refused in T_3 (N = 73, M = 14.1, SD = 9.8), and 33 others. I conclude that in particular, respondents who had died or were ineligible had relatively small networks during an earlier observation. Further analyses were limited to the respondents for whom two or three network observations were available.

Descriptions of the longitudinal network characteristics are shown in Table 2. In the three waves, six, five, and one respondents, respectively, could not identify any network members. The maximum numbers identified were 77, 75 and 73, respectively.

Three models were analyzed for the multilevel regression of total network size with regard to time and age. The *empty model*, containing only the intercept, assumes there is no change over time and that there are no age-related differences. In the second model, the effect of time since T_1 has been added, indicating the *change over time*. Furthermore, individual variation in change over time and the effects of regression towards the mean have been modelled. By adding the interaction term of time since T_1 and age in T_1 in the third model, age-related variation in change over time (*age-specific change*) has been modelled in addition to the main effect of time. The second main effect, the cross-sectional effect of age in T_1, was also added.

Table 3 shows the results for the three models. The intercept in the empty model indicates that an average network size of 14.2 was found among all the respondents and in all the observations. The significance of the intercept variances indicates that the average network size differed among respondents (an estimate of 45.7) and differed among respondents across observations (an estimate of 34.2). The model of change over time was an improvement on the empty model as is indicated by the significant decrease of the deviance from the empty model to this model. A second indication of the improvement is the reduction observed in the unexplained variance. The reduction is considerable for the variance between the observations (from 34.2 to 28.3; a reduction of 17.2%). The unexplained variance between the respondents increased somewhat (from 45.7 to 47.5). The R^2 at the level of observations takes the reduction at both levels into account and is computed as 1 – (47.5 + 28.3) / (45.7 + 34.2) = .052. For the computation of R^2 at the level of respondents, the variance at the level of observations is divided by the average number of observations available for a respondent (2.63): 1 – (47.5 + 28.3/2.63) / (45.7 + 34.2/2.63) = .009. With respect to the first hypothesis, the results showed that the effect of time was minor and insignificant, indicating that there was no upward or down-

Table 2. Means (*SD* in Parentheses) of Total and Partial Network Sizes, Aggregated Contact Frequency and Instrumental and Emotional Support Received and Given

	T_1 and T_2 Data Available					Data of 3 Observations Available						
	N	T_1		T_2		*N*	T_1		T_2		T_3	
Total network size	2,819	14.6	(9.8)	13.9	(8.3)	2,096	15.1	(10.0)	14.3	(8.3)	14.5	(8.7)
Size partial networks												
Child	2,819	2.4	(1.8)	2.6	(1.9)	2,096	2.5	(1.8)	2.6	(1.9)	2.6	(1.8)
Child-in-law	2,819	1.5	(1.6)	1.6	(1.7)	2,096	1.5	(1.6)	1.6	(1.6)	1.7	(1.6)
Sibling	2,819	1.2	(1.7)	1.4	(1.6)	2,096	1.3	(1.7)	1.4	(1.6)	1.4	(1.6)
Sibling-in-law	2,819	1.5	(2.5)	1.4	(2.3)	2,096	1.6	(2.6)	1.5	(2.3)	1.6	(2.5)
Other relatives	2,819	1.4	(2.5)	1.2	(2.0)	2,096	1.4	(2.5)	1.1	(1.9)	1.4	(2.3)
Friends	2,819	1.5	(2.8)	1.5	(2.5)	2,096	1.7	(3.0)	1.6	(2.5)	1.3	(2.2)
Neighbor	2,819	1.8	(2.3)	1.6	(1.9)	2,096	1.8	(2.3)	1.6	(1.9)	1.7	(2.1)
Other non-relatives	2,819	2.5	(3.9)	1.9	(2.9)	2,096	2.7	(4.1)	2.0	(3.0)	2.3	(3.1)
Aggregated relationship characteristics												
Contact frequency (days per year)	2,819	114.5	(71.1)	110.6	(62.4)	2,094	112.9	(70.6)	109.4	(61.2)	105.7	(60.5)
Instrumental support received (0–3)	2,800	.70	(.71)	.80	(.73)	2,081	.69	(.70)	.79	(.71)	.86	(.72)
Instrumental support given (0–3)	2,805	.64	(.71)	.68	(.72)	2,080	.69	(.72)	.73	(.73)	.70	(.73)
Emotional support received (0–3)	2,793	1.58	(.86)	1.72	(.77)	2,077	1.61	(.84)	1.75	(.74)	1.61	(.79)
Emotional support given (0–3)	2,794	1.46	(.90)	1.59	(.83)	2,076	1.49	(.88)	1.62	(.80)	1.74	(.73)

Note: For all the variables, with the exception of the total network size, the partner relationship has been excluded.

Table 3. Multilevel Regression of Total Network Size on Time and Age in T_1 (*N* Respondents = 2,903; *N* Observations = 7,902)

	Empty Model			Model of Change			Model of Age-Specific Change		
	Estimate	SE[a]	*t*	Estimate	SE	*t*	Estimate	SE	*t*
Fixed part									
Intercept	14.2	.1	99.9*	14.2	.2	88.0*	14.2	.1	102.1*
Time (years)				–.007	.046	–.1	–.027	.046	–.6
Age in T_1 (years)							–.165	.016	–10.2*
Time × Age in T_1							.000	.005	.0
Random part, respondent level									
Variance intercept (between respondents)	45.7	1.6	29.2*	47.5	1.6	30.5*	45.4	1.5	30.2*
Slope variance				1.6	.2	9.0*	1.6	.2	9.0*
Intercept-slope covariance				–2.5	.3	–7.1*	–2.5	.3	–7.2*
Random part, observation level									
Variance intercept (among respondents, between observations)	34.2	.7	50.4*	28.3	.8	37.2*	28.3	.8	37.2*
Deviance		54,757			54,625			54,522	
Improvement model					$\chi^2_{(3)} = 132$ *			$\chi^2_{(2)} = 104$ *	
R^2 respondent level					.009			.044	
R^2 observation level					.052			.078	

*$p < .001$.
[a]Standard error of estimate.

ward linear trend in the total network size. However, individual curves for the development of network size varied around the general trend of stable total network size, as was indicated by the significant slope variance. Moreover, a significant negative covariance between the slope and the intercept was observed among the respondents, indicating an effect of regression towards the mean: the network size of respondents with a large T_1 network decreased, and the network size of respondents with small T_1 networks increased.

The model of age-specific change, where age and the interaction of time and age were added to the equation, was a significant improvement on the model of change over time. The age in T_1 had a significant effect on network size. The cross-sectional age differences ($b = -.165$) were somewhat less than among all the respondents whose T_1 data were available ($b = -.183$, as reported above). In all the observations, it was estimated on the basis of the parameters that the oldest respondent identified on average about five network members less than the youngest each time. Again, I did not observe an aging effect: The insignificance of the interaction term indicates that the general trend of stable network sizes was valid for the respondents at all ages.

The variation surrounding the general stable trend was illustrated by categorizing the respondents on the basis of the individual regression lines (Table 4). The extent of linear change was distinguished into strong, moderate and small on the basis of the slope of time. A linear increase was observed for approximately one third of the respondents, and the proportions of the categories of linear decrease and no linear change were about equal. From the average intercept for each of the categories one can derive that the effect of regression towards the mean was particularly strong for respondents with large T_1 networks. For example, the 144 respondents who lost 12 or more network members during the four-year interval between the first and third observations had an average intercept of 30. Another category with on average large T_1 networks was the one for which no linear upward or downward trend could be detected (the intercept was 16).

The stability of the total network at the network member level is shown in Table 5. For each observation, the number of unique network members is presented, categorized into those who were identified only once, in a different observation and during both the other observations. Approximately 47% of the network members identified during each observation were also identified in the two other observations. The percentages of network members identified during two or three observations are shown in Table 6. The amount of overlap has been computed for each respondent in this table, and then averaged for all the respondents. As could be expected, the overlap was negatively related to the length of the interval between the observations. The highest overlap was observed for the partial network of children, and less by children-in-law and siblings. The overlap was low for the other partial networks, friends included, and they could be designated as generally peripheral. On the basis of the data available, it was not possible to determine whether replacements came from meeting new people rather than the ongoing nomination of latent ties. Changes in partner relationships were as follows: Of the 2,096 respondents for whom data from the three observations were available, 598 had no partner and 1,302 had the same partner during all the observations. Between T_1 and T_2, a partner was lost by 29 respondents, three of whom started a new relationship in that period. Between T_2 and T_3, 145 respondents lost their partner, eight of whom started a new relationship in that period. Of the respondents without a partner relationship in T_1, 22 started a new relationship, 14 of whom did so between T_2 and T_3. Some of these new partner relationships had existed during an earlier observation, for example as friendships.

Multilevel regressions on time and age were performed for all the network and relationship characteristics. Table 7 summarizes the results (the results on total network size are taken from Table 3). With respect to the second hypothesis, the changes in the size of the partial networks were reviewed and some were found to be significant. The general trend is that the lack of change in the overall network size obscures the fact that increases in the number of relatives (belonging to the core of the network) are offset by decreases in the number of non-relatives (part of the periphery of the network). In the first step of the analyses when only time was entered as a fixed parameter into the equation, small but significant increases were observed for children, children-in-law and siblings, and decreases were observed for the number of friends (parameters not shown).

Table 4. Categorization on the Basis of Individual Regression Lines of Network Size on Time (Individual Growth Approach); Average Intercept for Each Category (N = 2,096)

			Intercept	
	N	%	*M*	*SD*
Strong linear decrease (≥ 3/year)	144	6.9	30.1	9.5
Moderate linear decrease	353	16.8	17.8	6.7
Minor linear decrease (< 1/year)	169	8.1	11.3	5.4
No change at all	21	1.0	8.0	5.6
Roughly stable ($R^2 < .4$, $SD \leq 2$)	155	7.4	10.4	5.7
No linear change ($R^2 < .4$, $SD > 2$)	583	27.8	16.4	8.2
Minor linear increase (< 1/year)	171	8.2	9.6	6.2
Moderate linear increase	350	16.7	10.7	6.2
Strong linear increase (≥ 3/year)	150	7.2	11.0	7.2
			$F = 140, p < .001$	

Table 5. Stability of Total Network Composition at the Level of Network Members

	T_1		T_2		T_3	
	abs.	%	abs.	%	abs.	%
Identified during:						
Only one measurement	8,782	27.8	5,806	19.4	9,446	31.0
Only T_1 and T_2	5,726	18.1	5,726	19.1		
Only T_1 and T_3	2,632	8.3			2,632	8.6
Only T_2 and T_3			3,956	13.2	3,956	13.0
All observations	14,416	45.7	14,416	48.2	14,416	47.3
Total	31,556	100.0	29,904	100.0	30,450	100.0

Note: N respondents = 2,095; one respondent with no network members at all has been excluded.

Table 6. Stability of Network Composition in Percentages of Overlap for Respondents With Three Observations of the Network (N = 2,095)

	T_1–T_2	T_2–T_3	T_1–T_3	T_1–T_2–T_3
Total network	65	60	54	46
Partial networks				
Children	90	91	88	84
Children-in-law	69	64	60	51
Siblings	60	59	52	42
Siblings-in-law	42	37	33	21
Other relatives	38	31	26	18
Friends	52	42	39	28
Neighbors	50	40	35	26
Other non-relatives	28	19	15	10

Notes: For one respondent with no network members at all, the observations have been excluded. Relationship type assigned hierarchically (e.g., a network member identified once as friend and once as neighbor is categorized as friend).

Table 7. Multilevel Regressions of Network Characteristics on Time (Years) and Age in T_1; Final Models (N Respondents = 2,903)

	Effect of Time		Effect of Age in T_1		Effect of Time × Age T_1		Random Part[a]			R^{2d}		
	b	*t*	*b*	*t*	*b*	*t*	Slope	Intercept-slope[b]	Change Deviance[c]	obs.	rel.	resp.
Total network size	–.027	–.6	–.165	–10.2***	.000	.0	***	***	236	.078		.044
Size partial networks												
Children	.034	5.7***	.001	.4	.001	1.4	***		49	.009		.001
Children-in-law	.034	4.2***	.005	1.6	–.003	–3.4***	***	*	121	.048		.010
Siblings	.024	2.9**	–.030	–10.1***	–.001	–1.3	***		141	.053		.038
Siblings-in-law	.008	.6	–.054	–13.4***	–.004	–2.7**	***	***	325	.117		.071
Other relatives	.036	2.5*	.033	8.8***	.008	4.9***	***	***	175	.082		.041
Friends	–.078	–5.8*	–.041	–9.2***	.001	.9	*	***	302	.035		.025
Neighbors	–.021	–1.8	–.009	–2.5*	–.002	–1.1	***	***	94	.054		.013
Other non-relatives	–.039	–2.1*	–.055	–9.6***	.001	.2	***	***	239	.058		.027
Relationship characteristics												
Contact frequency (days/year)	–1.276	–5.7***	–.476	–5.1***	.150	5.7***	***	***	1,470	.016	.002	.006
Instrumental support received (0–3)	.032	8.0***	.002	1.9	.001	3.1**	***		3,162	.056	–.020	–.011
Instrumental support given (0–3)	–.000	–.1	–.027	–24.7***	–.001	–2.2*	***		3,373	.096	.065	.126
Emotional support received (0–3)	.000	.1	–.010	–7.8***	.003	5.0***	***		5,689	.098	–.036	.000
Emotional support given (0–3)	.053	10.8***	–.010	–7.4***	.000	.7	***	***	5,902	.097	–.031	.005

*$p < .05$; **$p < .01$; ***$p < .001$.
[a]At the respondent level.
[b]All covariances negative.
[c]For all models $p < .001$.
[d]Explained variance at the observation level, at the relationship level (for the explanation of relationship characteristics), and at the respondent level.

Age in T_1 moderated the effect of time within three models. Taking the time as well as the interaction effect into account, and checking with regard to age, the changes were as follows. An increase was observed for the partial networks of children and siblings (the *b*s reported in the table are the changes per year, so the changes are estimated as +.14 and +.10 after four years, respectively). In T_1, only 77% of the surviving children and 39% of the surviving siblings were categorized as network members (van Tilburg, 1995). Therefore, it is likely that latent ties with children and siblings in an earlier observation more often square with the criteria for being included in the network in a later observation, although a small number of new relationships with stepchildren, who were categorized as children, may have entered the network as a result of a new partner relationship on the part of the older adult. The increase in children-in-law may be an indication that new relationships entered the network of the older adults as the result of new commitments on the part of their children. The significance of the negative interaction effect of time and age within this analysis indicates that the youngest respondents had a relatively large increase when compared with the oldest (estimated as +.46 and +.10, respectively, on the basis of the *b*s of the main and interaction effects). For siblings-in-law, gains were observed for the younger respondents (+.27) and losses for the older ones (–.21). A general change of +.14 was estimated for the other relatives, specified as –.34 for the youngest respondents and +.62 for the oldest. A significant decrease was observed in the number of friends (–.31) and of other non-relatives (–.16). The number of neighbors did not change. In short, a trend towards the core of the network was observed: for the youngest of the older individuals towards children, children-in-law, siblings and siblings-in-law, and for the oldest of the older individuals towards children, siblings and other relatives; the number of friends and other non-relatives decreased for all the respondents. For all the partial networks, with the exception of friends, there were significant individual variations among the general trends described. For all the partial networks, with the exception of children, children-in-law and siblings, there were significant negative covariances between the slope and the intercept, i.e., effects of regression towards the mean.

The multilevel analyses of the relationship characteristics (Table 7) were based on a large number of cases (112,390 for contact frequency, which were the observations on relationships with 64,796 unique network members, and about 68,000 cases for the support variables, which were the observations on relationships with about 40,000 network members). Therefore, it is not surprising that all the parameters for the slope variances within the random part and for model change were significant. In the bivariate analyses (parameters not shown) with time as the only explanatory variable, a decrease was observed in contact frequency and an increase in instrumental support received and emotional support given. Age moderated the effect of time in four of the extended models. The contact frequency in the relationships decreased for the youngest respondents (estimated as –14 days a year across the time span of four years) and increased for the oldest (+4 days a year). Because the negative main effect of age indicates that the oldest had less frequent contact, the combination with the positive interaction effect indicates that the difference between the youngest and oldest of the older respondents changed: the initial average difference between the youngest and the oldest respondents of 23 days a year, in favor of the youngest, had changed four years later into an average difference of 5 in favor of the oldest. The main effects for the instrumental support exchanges were that the receiving increased and the giving was stable over time. Interaction effects of time and age were observed for both. For receiving instrumental support, the increase was smaller for the youngest respondents than for the oldest (+.07 and +.19, respectively). For giving instrumental support, an increase was estimated for the youngest respondents (+.06) and a decrease for the oldest (–.06). The emotional support received did not change in general, but the youngest respondents received less (–.18) and the oldest received more (+.18). Finally, the general trend was that respondents of all ages reported giving more emotional support (+.21) to their network members. With regard to the third hypothesis, keeping the balance for the youngest of the older respondents was recognized by the increase of instrumental support given and received, and for the oldest of the respondents by the increase of instrumental support received and emotional support given. Considerable variations of the slope were observed among individual respondents for all the relationship characteristics. Effects of regression towards the mean were observed for contact frequency and emotional support given.

Discussion

In the study at hand, relatively large networks were identified as compared to other studies among older adults (Milardo, 1992; van Tilburg, 1995). It seems that the applied delineation method was especially successful at tapping into the latent pool of relationships. Cross-sectionally, there was a negative association between age and network size. Birth cohort differences rather than aging-related differences may be in effect because, in accordance with the first hypothesis, a stable total network size was observed in the four-year period. However, a closer look showed widely varying patterns of losses and gains among the respondents, which was in keeping with the results of studies by Wenger (1986) and Bowling and colleagues (1995), and fits with the focus on the heterogeneity of developments among aging people. I also observed that the network composition was unstable, i.e., many people entered and left the network, particularly in relationships not involving children. Unlike the two studies mentioned previously, which were based on only two observations, analyzing data from three observations revealed that there were many older adults for whom there was a large, nonlinear variation in total network size in time. Some of these respondents may occupy a stable position within their network with additional contact with a variety of other people, whereas others might have a network that is unstable as a whole. Whether this has consequences for support mobilization may be the topic of a future study.

The instability of the network composition as well as the large number of respondents with nonlinear variations in network size in time may be caused by the unreliability of the network delineation procedure (Bass & Stein, 1997). However, as argued by Starker, Morgan, and March (1993), the instability of the composition might also reflect the natural circulation in the membership of networks: losses were replaced by "old" relationships (already existing in the latent personal network) and by "new" ones. Several studies (e.g., Morgan, Neal, & Carder, 1997; Shulman, 1975; Wellman, Wong, Tidall, & Nazer, 1997; Wenger, 1986) have identified this circulation. Once a specific relationship has been replaced by another having approximately the same properties, for example neighbor A by neighbor B, the test-retest reliability of the network identification is damaged. However, one might doubt the significance of this type of replacement as an indicator of true change and lack of validity (Morgan et al., 1997). If replacements do not occur simultaneously with losses, nonlinear changes of network size can be expected.

In accordance with the second hypothesis, a general upward trend was observed for the number of children, children-in-law, siblings and other relatives, although the number of other non-relatives and friends decreased, contrary to the hypothesis. The greatest change was observed for friends, but all these changes were relatively minor. I conclude that there was a tendency of change towards the core of the network. With regard to close relatives, these results are in keeping with those of other studies, but differ for friends. The contact frequency within the relationships decreased for the younger respondents and increased for the older. Instrumental support received increased (relatively strongly for the oldest of the older respondents), the instrumental support given increased for the youngest of the older respondents and decreased for the oldest, the emotional support received decreased for the youngest of the older respondents and increased for the oldest, and the emotional support given increased. For the oldest, both of the trends in instrumental support might be related to decreasing physical capacities and worsening health, which affect the capacities to give support and produce an increasing need for instrumental support. In accordance with the third hypothesis, the increase in two types of supportive exchanges confirms the notion of keeping balance within relationships. If people need instrumental support, receiving it might be counterbalanced by giving instrumental support (by the youngest of the older respondents) or emotional support (by the oldest). Because reports on emotional support in particular are subjective (Antonucci & Israel, 1986), the question remains as to whether these changes took place only in the respondents' minds or were real.

With regard to the total network size, the size of peripheral partial networks, contact frequency and emotional support given, the effects of regression towards the mean have been observed. Regression towards the mean may be explained by the assumed nature of measurement errors (Nesselroade, Stigler, & Baltes, 1980). However, an intrinsic explanation is also possible. For people who initially had large networks, many frequent contacts, or emotionally supportive network members, there is no strong necessity to maintain the whole network. On the other hand, people who initially had small networks may try to enlarge the network in order to enhance the possibilities for support mobilization.

The general trend of stable total network sizes could not be specified according to age, although I was able to specify the trends for a number of other network characteristics. However, for nearly all the network characteristics, there were relatively large differences with respect to the direction and speed of changes among the respondents, which were not related to age differences. Further analyses should reveal whether these different patterns are related to the older adults' experience of specific life events, i.e., whether losses in network size and gains of support received occur more often among people who experienced stressful life events such as the loss of a partner, worsening physical or cognitive capacities, or a disease, and whether gains in network size or relationship exchanges are more common among people who experienced life events such as retirement. However, in keeping with Starker and colleagues (1993), it would be a serious mistake to focus exclusively on the impact of life events, because there are always changes. Therefore, I will also study whether different life courses, for example with respect to family formation and socioeconomic and health circumstances, have an impact on the development of older adults' networks.

The observed network changes supported, at least partially, the idea formulated by Baltes and Carstensen (1996) of selective optimization with compensation as a model of successful aging. The aim of this model is to account for the dynamics between gains and losses. The model describes the process of successful aging as anticipating and adapting. The model has three central elements, two of which are relevant to these findings. *Selection* was observed with respect to the composition of the network by type, with a greater emphasis on close relatives. *Optimization* was observed with respect to the contents of the relationships available, which were enriched by increasing contact frequency and instrumental support received, in particular for the oldest of the older respondents. The gains and losses jointly observed may have improved the network by creating a better response to the foreseen change in circumstances.

Acknowledgments

This study is based on data collected in the context of the "Living arrangements and social networks of older adults" and "Longitudinal Aging Study Amsterdam" research programs. These programs are conducted at the Vrije Universiteit in Amsterdam and the Netherlands Interdisciplinary Demographic Institute in The Hague, and are supported by the Netherlands Program for Research on Ageing (NESTOR) and the Ministry of Health, Welfare, and Sports.

Address correspondence to Dr. van Tilburg, Department of Social Research Methodology, Vrije Universiteit Amsterdam, De Boelelaan 1081c, 1081 HV Amsterdam, The Netherlands. E-mail: tilburgtgvan@scw.vu.nl

References

Antonucci, T. C., & Akiyama, H. (1987). Social networks in adult life and a preliminary examination of the convoy model. *Journal of Gerontology, 42,* 519–527.

Antonucci, T. C., & Israel, B. A. (1986). Veridicality of social support: A comparison of principal and network members' responses. *Journal of Consulting and Clinical Psychology, 54,* 432–437.

Antonucci, T. C., & Jackson, J. S. (1989). Successful aging and life course reciprocity. In A. Warnes (Ed.), *Human aging and later life: Multidisciplinary perspectives* (pp. 83–95). London, UK: Hodder & Soughton.

Baltes, P. B. (1979). Life span developmental psychology: Some converging observations on history and theory. In P. B. Baltes & O. G. Brim (Eds.), *Life span development and behavior* (pp. 255–279). New York: Academic Press.

Baltes, M. M., & Carstensen, L. L. (1996). The process of successful ageing. *Ageing and Society, 16,* 397–422.

Bass, L. A., & Stein, C. H. (1997). Comparing the structure and stability of network ties using the Social Support Questionnaire and the Social Network List. *Journal of Social and Personal Relationships, 14,* 123–132.

Berkman, L. F., Oxman, T. E., & Seeman, T. E. (1992). Social networks and social support among the elderly: Assessment issues. In R. B. Wallace & R. F. Woolson (Eds.), *The epidemiologic study of the elderly* (pp. 196–212). New York: Oxford University Press.

Bowling, A., Grundy, E., & Farquhar, M. (1995). Changes in network composition among the very old living in inner London. *Journal of Cross-Cultural Gerontology, 10,* 331–347.

Brody, E. M. (1985). Parent care as a normative stress. *The Gerontologist, 25,* 19–20.

Broese van Groenou, M. I., van Sonderen, E., & Ormel, J. (1990). Test-retest of personal network delineation. In C. P. M. Knipscheer & T. C. Antonucci (Eds.), *Social network research: Substantive issues and methodological questions* (pp. 121–136). Lisse: Swets & Zeitlinger.

Broese van Groenou, M. I., & van Tilburg, T. G. (1996). Network analysis. In J. E. Birren (Ed.), *Encyclopedia of gerontology: Age, aging and the aged* (Vol. 2, pp. 197–210). San Diego: Academic Press.

Carstensen, L. L. (1992). Social and emotional patterns in adulthood: Support for socioemotional selectivity theory. *Psychology and Aging, 7,* 331–338.

Cochran, M., Larner, M., Riley, D., Gunnarson, L., & Henderson, C. R. (1990). *Extending families: The social networks of parents and their children.* Cambridge: Cambridge University Press.

Collins, L. M. (1996). Measurement of change in research on aging: Old and new issues from an individual growth perspective. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (4th ed., pp. 38–56). San Diego: Academic Press.

Dean, K., Holst, E., Kreiner, S., Schoenborn, C., & Wilson, R. (1994). Measurement issues in research on social support and health. *Journal of Epidemiology and Community Health, 48,* 201–206.

Deeg, D. J. H., & Westendorp-de Serière, M. (Eds.). (1994). *Autonomy and well-being in the aging population: Report from the Longitudinal Aging Study Amsterdam 1992–1993.* Amsterdam: VU University Press.

Francis, D. J., Fletcher, J. M., Stuebing, K. K., Davidson, K. C., & Thompson, N. M. (1990). Analysis of change: Modelling individual growth. *Journal of Consulting and Clinical Psychology, 59,* 27–37.

Gouldner, A. W. (1960). The norm of reciprocity: A preliminary statement. *American Sociological Review, 25,* 161–179.

Kahn, R. L., & Antonucci, T. C. (1980). Convoys over the life course: Attachment, roles and social support. In P. B. Baltes & O. Brim (Eds.), *Life span development and behavior* (pp. 253–286). New York: Academic Press.

Klein Ikkink, C. E., van Tilburg, T. G., & Broese van Groenou, M. I. (1995). Strategieën bij wederkerigheid in onderlinge steun [Strategies of support reciprocity]. In B. C. M. Nitsche (Ed.), *Ouderen, wetenschap en beleid II* (pp. 79–96). Utrecht, The Netherlands: Netherlands Institute of Gerontology.

Knipscheer, C. P. M., de Jong Gierveld, J., van Tilburg, T. G., & Dykstra, P. A. (Eds.) (1995). *Living arrangements and social networks of older adults.* Amsterdam: VU University Press.

Leik, R. K., & Chalkley, M. A. (1997). On the stability of network relations under stress. *Social Networks, 19,* 63–74.

Milardo, R. M. (1992). Comparative methods for delineating social networks. *Journal of Social and Personal Relationships, 9,* 447–461.

Miller, B., & McFall, S. (1991). Stability and change in the informal task social support network of frail older persons. *The Gerontologist, 31,* 735–745.

Morgan, D. L. (1988). Age differences in social network participation. *Journals of Gerontology, 43,* S129–S137.

Morgan, D. L., & March, S. J. (1992). The impact of life events on networks of personal relationships: A comparison of widowhood and caring for a spouse with Alzheimer's disease. *Journal of Social and Personal Relationships, 9,* 563–584.
Morgan, D. L., Neal, M. B., & Carder, P. (1997). The stability of core and peripheral networks over time. *Social Networks, 19,* 9–25.
Nesselroade, J. R., Stigler, S. M., & Baltes, P. B. (1980). Regression toward the mean and the study of change. *Psychological Bulletin, 88,* 622–637.
Prosser, R., Rasbash, J., & Goldstein, H. (1991). *ML3 software for three-level analysis: Users' guide for version 2.* Institute of Education, University of London.
Rogosa, D., Brandt, D., & Zimowski, M. (1982). A growth curve approach to the measurement of change. *Psychological Bulletin, 92,* 726–748.
Schulz, R., & Rau, M. T. (1985). Social support through the life course. In S. Cohen & S. L. Syme (Eds.), *Social support and health* (pp. 129–149). Orlando: Academic Press.
Shulman, N. (1975). Life-cycle variations in patterns of close relationships. *Journal of Marriage and the Family, 37,* 813–821.
Snijders, T. A. B. (1996). Analysis of longitudinal data using the hierarchical linear model. *Quality & Quantity, 30,* 405–426.
Snijders, T. A. B., & Bosker, R. J. (1994). Modeled variance in two-level models. *Sociological Methods and Research, 22,* 342–363.
Starker, J. E., Morgan, D. L., & March, S. (1993). Analyzing change in networks of personal relationships. In D. Perlman & W. H. Jones (Eds.), *Advances in personal relationships* (vol. 4: A research annual, pp. 229–260). London: Jessica Kingsley.
Stoller, E. P., & Pugliesi, K. L. (1988). Informal networks of community-based elderly: Changes in composition over time. *Research on Aging, 10,* 499–516.
Stueve, C. A., & Gerson, K. (1977). Personal relations across the life-cycle. In C. S. Fischer, R. M. Jackson, C. A. Stueve, K. Gerson, L. McCallister Jones & M. Baldassare (Eds.), *Networks and places: Social relations in the urban setting* (pp. 79–98). New York: Free Press.
van Tilburg, T. G. (1992). Support networks before and after retirement. *Journal of Social and Personal Relationships, 9,* 433–445.
van Tilburg, T. G. (1995). Delineation of the social network and differences in network size. In C. P. M. Knipscheer, J. de Jong Gierveld, T. G. van Tilburg & P. A. Dykstra (Eds.), *Living arrangements and social networks of older adults* (pp. 83–96). Amsterdam: VU University Press.
Wellman, B., Wong, R. Y-l., Tidall, D., & Nazer, N. (1997). A decade of network change: Turnover, persistence and stability in personal communities. *Social Networks, 19,* 27–50.
Wenger, G. C. (1986). A longitudinal study of changes and adaption in the support networks of Welsh elderly over 75. *Journal of Cross-Cultural Gerontology, 1,* 277–304.

Received July 24, 1997
Accepted June 3, 1998