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Network Type and Mortality Risk in Later Life

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Purpose: The purpose of this study was to examine the association of baseline network type and 7-year mortality risk in later life. ***Design and Methods:*** We executed secondary analysis of all-cause mortality in Israel using data from a 1997 national survey of adults aged 60 and older ($N = 5{,}055$) that was linked to records from the National Death Registry up to 2004. We considered six network types—diverse, friend focused, neighbor focused, family focused, community–clan, and restricted—in the analysis, controlling for population group, sociodemographic background, and health factors. We carried out Cox proportional hazards regressions for the entire sample and separately by age group at baseline: 60–69, 70–79, and 80 and older. ***Results:*** Network types were associated with mortality in the 70–79 and 80 and older age groups. Respondents located in diverse and friend-focused network types, and to a lesser degree those located in community–clan network types, had a lower risk of mortality compared to individuals belonging to restricted networks. ***Implications:*** Gerontological practitioners should address older adults' social networks in their assessments of clients. The parameters used to derive network types in this study can serve toward the development of practical network type inventories. Moreover, practitioners should tailor the interventions they implement to the different network types in which their elderly clients are embedded.

Key Words: Social network, Survival, Israel, Friends, Risk

This article considers the association of social network type and survival in later life. The social networks of older people tend to vary in size and composition. Such variations, reflected in a range of network types, may be related to rates of mortality. Examination of this association is important for gerontological knowledge development insofar as most of the factors that correlate with late-life mortality are irreversible. Exceptional in this respect is the domain of social network, which can serve as a target of purposive social intervention.

The notion of network type constitutes a useful diagnostic and analytic construct. Despite the potential contribution of this emerging measure, researchers have not yet applied it to the analysis of mortality in later life. The current investigation addresses this goal by using network-related survey data to derive network types and linking these types with mortality statistics. As such, the study allows for the consideration of the association of baseline network type with all-cause mortality 7 years later. The inquiry addresses two major questions: (a) Do different network types have a differing risk of mortality? and (b) Is the association between network type and mortality similar for all age groups in older age?

Another important aspect addressed in the current analysis is the association of ethnic or cultural background, network type, and late-life mortality. Investigators have noted that different ethnic groups reflect characteristically different network types. Thus, it is necessary to consider whether there are indeed differing ethnic risks of mortality, and, if so, whether such differences are related to network type.

We based the current inquiry on a sample of older adults in Israel. This study setting allows for examination of the main factors of interest in this investigation, that is, network type, age group, ethnicity, and mortality. The ethnic groups addressed in the analysis reflect the major cultural groupings in contemporary Israeli society: the veteran Jewish Israeli population, Arab Israelis, and new immigrants since 1989 (mostly Jews) who came from the former Soviet Union.

Groundbreaking research in the late 1970s established the association between social network and survival (Berkman & Syme, 1979). Several studies have since confirmed the association in a range of settings (Cohen, Teresi, & Holmes, 1987; Giles, Glonek, Luszcz, & Andrews, 2005; Orthgomer & Johnson, 1987; Sugisawa, Liang, & Liu, 1994; Yasuda et al., 1997). However, some studies still

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challenge the notion that social networks reduce mortality risk (Shahtahmasebi, Davies, & Wenger, 1992; Walter-Ginzburg, Blumstein, Chetrit, & Modan, 2002), and others hold that the association is confounded by additional factors (de Leon et al., 1999; Rutledge, Matthews, Lui, Stone, & Cauley, 2003). One reason for this uncertainty stems from the recursive relationship that exists between social network and health, a major predictor of survival (Bisschop et al., 2003; Keller, Magnuson, Cernin, Stoner, & Potter, 2003). Social networks both influence health and are shaped by health status (Melchior, Berkman, Niedhammer, Chea, & Goldberg, 2003).

Studies indicate, for example, that structural aspects of social networks and the support they provide correlate with several aspects of health status. In Spain, having strong friend networks was related to respondent self-rated health (Zunzunegui et al., 2004). In Denmark, having a strong social network reduced the risk of developing disability (Avlund, Lund, Holstein, & Due, 2004). In New Haven, the friend and relative components of respondents' networks were more associated with disability and recovery risks than were children and confidantes (de Leon et al., 1999).

A prospective study of Danish twins aged 75 years and older examined the effect of social ties on mortality, controlling for self-reported health (Rasulo, Christensen, & Tomassini, 2005). The results indicated that the presence of a spouse extended survival among all. Frequency of interaction with friends, on the other hand, was associated with survival only among women. A similar prospective study examined the relationship of social ties and survival among octogenarians in Switzerland (Guilley et al., 2005). After adjusting for sociodemographic and health-related variables, the presence of a spouse was not related to survival, but the presence of siblings and close friends was. The study also clarified that the protective effect of social relationships was related more to the nature of the social tie (e.g., close friends) than it was to frequency of contact.

The literature also reports significant variations as to how cultural groups utilize social networks to advance health and longer life (Nemoto, 1998; Pang, Jordan-Marsh, Silverstein, & Cody, 2003). Thus, for example, marital status and participation in formal organizations predicted longevity for Americans. However, contact with children was the primary predictor found among Swedes (Eriksson, Hessler, Sundh, & Steen, 1999). Older migrants are a particularly vulnerable cultural group. Migrating in later life, they risk having diminished social networks at a time when they need social support (Pudaric, Sundquist, & Johansson, 2000; Reijneveld, 1998).

A unique focus of the current inquiry is its attention to the notion of network type. Researchers have shown that network type was a significant predictor of health status (Litwin, 1998), mental health (Fiori, Antonucci, & Cortina, 2006; Litwin, 2001), and utilization of health and social services (Litwin, 2004; Wenger, 1997). However, no investigators have yet reported a formal examination of the association of network type and mortality in the gerontological literature.

We should note that several background variables associate with mortality in later life. These include primarily age (Bath, 2003), gender (Shye, Mullooly, Freeborn, & Pope, 1995; Walter-Ginzburg, Shmotkin, Blumstein, & Shorek, 2005), socioeconomic status (Manor, Eisenbach, Peritz, & Friedlander, 1999), and health status (Walker, Maxwell, Hogan, & Ebly, 2004). In fact, Ahmad and Bath (2005) cited age as the most important predictor of mortality in community-dwelling older adults.

Researchers have also found disability and morbidity to independently increase mortality risk in later life (van den Brink et al., 2005). The illnesses most frequently addressed in this regard include cancer, diabetes, heart attack, and stroke (Feil, Marmon, & Unutzer, 2003; Schupf et al., 2005). Dementia is also a mortality risk factor of increasing interest (Tschanz et al., 2004). In a 5-year follow-up study of a community-based cohort aged 77 and older, for example, mortality risk ratios were 2.0 for Alzheimer's disease (Aguero-Torres, Fratiglioni, Guo, Viianen, & Winblad, 1999).

As noted earlier, the current analysis addresses the three main components of the older cohort of Israel: (a) veteran Jewish Israelis; that is, the majority Jewish Israeli population that was born in the region or immigrated through 1989; (b) Arab Israelis; and (c) new immigrants from the former Soviet Union who came to Israel after 1989. These groups are different in several aspects (Litwin, 2004). Veteran Jewish Israeli elders are guided by Western values and modern urban culture but also retain a relatively strong family orientation. Older Arab Israelis reside mostly within large family networks in culturally homogeneous towns and villages. Elderly new immigrants from the former Soviet Union are similar in origin to many veteran Israeli Jews but differ mainly in that they immigrated in later life. Moreover, this immigrant cohort in Israel has a high rate of chronic disease and low compliance with preventative health behaviors (Benisovich & King, 2003), as well as poorer self-rated health (Carmel, 2001).

The current study of the association of network type and mortality thus addresses these two primary variables of interest, taking into account the variable of cultural diversity as well. Other relevant variables controlled for in the current analysis include background characteristics and health status. The aim of the inquiry was to determine whether network type is, indeed, associated with survival in later life and, if so, to suggest how this awareness can be used to inform social gerontological practice.

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Table 1. Baseline Network Characteristics Among Older Israelis: Values of Criterion Variables by Derived Network Type

Network Type	Married (%)	Proximate Children (*M*)	Contact With Children (*M*)	Contact With Friends (*M*)	Contact With Neighbors (*M*)	Attendance at Place of Worship (*M*)	Attendance at a Club for Senior Citizens (*M*)
Diverse	62.8	1.1	2.3	4.1	4.5	1.5	0.6
Friend	64.7	1.0	2.3	3.8	0.2	1.5	0.6
Neighbor	57.1	1.2	2.3	0.6	4.4	1.3	0.3
Family	63.8	5.7	3.2	0.6	1.6	1.7	0.2
Community–clan	80.9	7.4	3.7	4.2	4.3	2.0	0.4
Restricted	56.2	1.1	2.1	0.3	0.1	1.0	0.2

Notes: Variable scale ranges were the following: proximate children = 0–10; contact with children = 0–4; contact with friends = 0–5; contact with neighbors = 0–5; attendance at place of worship = 0–4; attendance at a club for senior citizens = 0–4.

Methods

The study examined the contribution of social network type to mortality risk among older people in Israel. We performed secondary analysis of data from a national survey of adults aged 60 and older that the Israeli Central Bureau of Statistics (CBS) conducted in 1997. The CBS based its survey on a household sample stratified by such factors as age, gender, population, and household composition, in municipalities of 2,000 residents or more. The CBS drew the gross household sample, which encompassed 4,275 household units, from the 1995 National Census of Israel. The sample excluded individuals who permanently resided in institutional facilities.

All adults aged 60 or older in the sampled households were initially eligible respondents. Of a total of 6,072 potential respondents, the CBS successfully interviewed 5,055 (response rate = 83%). The CBS interviewed a small part of the sample (n = 134) by proxy due to cognitive impairment or other reasons that prevented full participation. The final survey sample consisted of 824 Arab Israelis, 1,294 new immigrants from the former Soviet Union, and 2,937 veteran Jewish residents of Israel. For the purpose of the present analysis, we requested linkage of the survey data by the Central Bureau of Statistics to records from the National Death Registry, updated to 2004.

Study Variables

We calculated the outcome variable, 7-year time to death from all causes, from the date recorded in the death registry from 1997–2004. At the time of the current inquiry, 1,440 individuals from the original sample of 5,055 were deceased.

We derived the main independent variable, network type, by using K-means cluster analysis applied to selected survey data. This procedure has been described in detail elsewhere (Litwin, 2001, 2004). Suffice it to note that we employed designated criterion variables in order to identify homogeneous groupings within the study population based on Euclidian distance. The criterion variables employed in this case, as previously, were seven principal social network indicators that included marital status; the number of geographically proximate adult children; the frequency of contact with children, friends, and neighbors; and the frequency of attendance at places of worship and senior clubs. Analysis of the entire sample of veteran Jewish Israelis, Arab Israelis, and former Soviet immigrants, based on these criterion variables, yielded six baseline network types. They are termed the *diverse, friend-focused, neighbor-focused, family-focused, community–clan*, and *restricted* networks, respectively. A description of the values obtained for each of the criterion variables in each of the resultant network types appears in Table 1. The survey measured contact with children, friends, and neighbors on frequency scales, as it did with attendance at a place of worship or senior club.

As may be seen, the diverse network type reflected a group endowed with many kinds of ties: spouse (63%), children (M = 2.3) and friends (M = 4.1), neighbors (M = 4.5), and one adult child living in close proximity. Friend-focused network members was also relatively well-endowed with ties with spouse (65%), children (M = 2.3), and friends (M = 3.8), but not neighbors (M = 0.2). Neighbor-focused network members, in turn, reported having ties with spouse (57%), children (M = 2.3), and neighbors (M = 4.4), but few contacts with friends (M = 0.6). Family-focused network members reported having more proximate children than did members in the other network types (6), but having few ties with friends (M = 0.6) or neighbors (M = 1.6). Community–clan network members, on the other hand, were the most relatively endowed, reporting the highest mean scores in almost all the network criterion variables. In contrast, restricted network members reflected the most limited social environment, having ties with only one proximate adult child, on average.

We addressed cultural ethnicity by means of a categorical variable reflecting the three population groups: veteran Jewish Israelis, Arab Israelis, and former Soviet immigrants. Examination of the association of population group and network type

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revealed several important ethnic differences (χ^2 = 1913.1, df = 10, n = 4999, $p < .000$). Arab Israelis had more community–clan and family-intensive type networks. Immigrants from the former Soviet Union had relatively more neighbor networks. Jewish Israelis and immigrants were part of friend and restricted networks more frequently than Arab Israelis. On the other hand, a relatively large proportion of all three population groups was embedded in diverse network types.

We addressed health by means of disability and morbidity at baseline. We based the disability measure on the Hebrew version of the Physical Activity Scale (Cornoni-Huntley et al., 1985) that is used by the Israeli Central Bureau of Statistics. Reported difficulty in executing five physical tasks (pushing a large object, stooping, lifting, reaching, and using a delicate instrument) yielded a scale score that was subsequently divided into three levels: low, moderate, and high disability. We defined morbidity as prior diagnosis of cancer, diabetes, heart attack, stroke, and Alzheimer's disease. We measured reported diagnoses of each disease as a dichotomous variable (0 = no, 1 = yes).

Baseline sociodemographic control variables included age, income, education, and gender. We divided income into three levels: (a) very low (up to $10,000 per year; in New Israeli Shekels), (b) low (up to $20,000), and (c) moderate to high (more than $20,000 per year). We also measured education at three levels: (a) none–low (from 0–4 years of primary school), (b) primary and greater (5–12 years of schooling), and (c) secondary and greater (more than 12 years). We recorded gender as a simple dichotomous variable.

Analysis

The analysis proceeded in two main stages. First was bivariate examination of mortality and the control variables, followed by analysis of the association of mortality and network type. Next was a multivariate examination of associations between study variables and mortality risk. We followed this with separate multivariate assessments of mortality risk by age group at baseline. In each of these multivariate procedures, we employed Cox hazards regressions. The statistics presented are the corrected risk ratios for each variable after controlling for the effects of each of the other variables in the analysis.

Results

Table 2 presents the bivariate association of the baseline background and health variables with the mortality outcome. More than half the respondents aged 80 and older in the sample had died, as had more than one quarter of the 70–79 age group. One third of those with very low income had died, but less than one fifth of those with moderate to high income had. One third of respondents with little education were deceased, compared to one quarter of respondents with post-secondary education. Moreover, men had a higher mortality rate than women. However, differences were not evident according to population group. That is, the minor disparities viewed in rate of mortality among the three respective groupings were not significant.

The table also shows that all of the health variables were related to mortality. Thus, almost one half of all individuals reporting high disability had died, as had one quarter of the moderate-disability group. In addition, all of the illnesses addressed were associated with mortality. Half of the stroke patients and almost half of the cancer patients were no longer

Table 2. Bivariate Associations of Background and Health at Baseline and 7-Year All-Cause Mortality Among Older Israelis: Cross-Tabulations

		Died		
Baseline Variable	Total *N*	*N*	%	χ^{2a}
Background				
Age				
60–69	1949	244	12.5	
70–79	2099	602	28.7	
80+	1007	594	59.0	703.8***
Income				
Very low	2405	804	33.4	
Low	1430	412	26.9	
Moderate–high	956	177	18.5	77.4***
Education				
None–low	1431	497	34.7	
Primary and greater	2397	638	26.6	
Secondary and greater	1210	299	24.7	40.0***
Gender				
Male	2572	844	32.8	
Female	2483	596	24.0	48.2***
Population group				
Arab Israelis	824	246	29.9	
Immigrants from the former Soviet Union	1294	389	30.1	
Veteran Jewish Israelis	2937	805	27.4	4.0
Health				
Disability				
Low	2056	326	15.9	
Moderate	1388	347	25.0	
High	1583	755	47.7	456.7***
Diagnosed illness				
Cancer	253	115	45.5	38.0***
Diabetes	999	387	38.7	65.9***
Heart attack	1027	407	39.6	80.2***
Stroke	273	135	49.5	63.0***
Alzheimer's disease	82	54	65.9	57.6***

[a]The chi-square statistic in this table tests the differences in the study variables presented between those who died and those who survived.

***$p < .001$.

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Table 3. Bivariate Associations of Network Type at Baseline and 7-Year All-Cause Mortality Among Older Israelis: Cross-Tabulations

	Diverse		Friend		Neighbor		Family		Community–Clan		Restricted		
Sample	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	χ^{2a}
Total sample[b]	1469	29.4	983	19.7	809	16.2	354	7.1	403	8.1	981	19.6	
Total died	316	21.5	216	22.0	245	30.3	115	32.5	105	26.1	421	42.9	161.4***
Died by age group													
60–69	65	11.1	50	12.0	36	12.0	18	13.6	33	16.7	41	13.7	4.9
70–79	151	23.0	94	22.0	103	30.7	54	34.6	51	34.5	139	39.7	46.4***
80+	100	44.4	72	51.4	106	60.9	43	65.2	21	36.8	241	72.8	61.8***

[a]The chi-square statistic in this table tests the differences in network type and in network type by age between those who died and those who survived.
[b]Percentages in the row "Total sample" indicate the frequency distribution of network type, whereas percentages in other rows describe proportions of the deceased.
***$p < .001$.

alive 7 years later. Almost 40% of those reporting diabetes or heart attack had died. Although a very small percentage reported having been diagnosed with Alzheimer's disease (less than 2%), two thirds of them had died within 7 years.

Table 3 presents the relative representation of each network type in the sample, the mortality rate for each network type, and the mortality rate by network type and by age group. Thus, for example, individuals in diverse networks accounted for almost 30% of the baseline sample, and 22% of their members were no longer alive. In comparison, restricted networks accounted for about 20% of the baseline sample, but 43% of their members had died. The table shows that individuals in restricted networks had the highest mortality rate, followed by those in family-focused and neighbor-focused network types. The lowest mortality rate was evident among individuals in diverse, friend-focused, and community–clan network types, respectively. Viewing these associations by age group revealed that among the young-old (age 60–69), mortality rate was not related to network type. However, we observed significant associations between network type and mortality in the two older age groups.

Table 4 presents the results of the first Cox proportional hazards regression analyses. The analysis included all of the variables addressed thus far. We entered ethnicity as a control factor, despite its lack of bivariate association with mortality, due to its observed association with network type. The restricted network served as the reference category among the network types.

The table shows that among the background variables, age and gender were still associated with mortality when the effects of the other variables were controlled. People aged 80 and older at baseline were 4 times as likely to have died as those aged 60–69, and those aged 70–79 were twice as likely to have died as those aged 60–69. Men were almost twice as likely to have died as women. The other background variables, ethnicity included, were not associated with mortality. The table also shows that all health control variables were associated with mortality. Respondents with high disability were more than twice as likely to have died as respondents with low disability, and those with moderate disability were somewhat more likely to have died than respondents with low disability. In addition, all respondents who had been diagnosed with major illness had a higher relative risk of dying than respondents not diagnosed with major illness.

Examination of the association of network type and mortality was the main focus of the current inquiry. When we controlled for the effects of all the other variables, four of the five network types nevertheless revealed a lower risk of mortality in relation to the restricted network. Respondents who had been embedded in diverse, community–clan, friend-focused, or family-focused networks at baseline had significantly lower risk of mortality during the 7 years that followed.

The final stage of the analysis carried out separate multivariate Cox regressions of mortality risk for each of three age groupings: 60–69, 70–79, and 80 years and older (Table 5). Among the background variables, male gender had a significantly higher mortality risk in every age group, although the relative risk decreased with increasing age. None of the other background variables were associated with mortality in any of the age-group analyses.

Disability level showed a greater relative mortality risk, particularly in the two younger age groups. The association of illness varied, however, by age. Cancer was a significant relative risk across all age groups, particularly among the young-old. Diabetes and heart attack were associated with mortality in the two younger age groups only. Stroke was associated with death most strongly in the youngest age group. In comparison, Alzheimer's disease had a significant mortality risk among respondents aged 80 and older only.

Multivariate examination of the association of network type and mortality risk by age group revealed no differential network-related risk among

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Table 4. Baseline Correlates of 7-Year All-Cause Mortality Among Older Israelis: Cox Proportional Hazards Regression Analysis

Variable	Hazards Regression (95% Confidence Interval)
Background[a]	
Age 70–79	2.02 (1.73–2.36)***
Age 80+	4.15 (3.52–4.90)***
Very low income	1.10 (0.91–1.33)
Low income	1.02 (0.84–1.22)
None–low education	1.12 (0.93–1.34)
Primary and greater education	0.92 (0.80–1.07)
Male	1.72 (1.53–1.93)***
Arab Israeli	0.94 (0.77–1.15)
Immigrant from the former Soviet Union	1.02 (0.88–1.17)
Health[b]	
Moderate disability	1.37 (1.16–1.61)***
High disability	2.25 (1.92–2.63)***
Cancer	1.86 (1.53–2.27)***
Diabetes	1.33 (1.18–1.51)***
Heart attack	1.27 (1.12–1.43)***
Stroke	1.47 (1.22–1.77)***
Alzheimer's disease	1.45 (1.08–1.95)**
Network[c]	
Diverse network	0.68 (0.58–0.80)***
Friend network	0.72 (0.61–0.86)***
Neighbor network	0.88 (0.75–1.04)
Family network	0.77 (0.61–0.97)*
Community–clan network	0.69 (0.53–0.91)**

[a]Background reference categories were the following: income (moderate to high), education (secondary and greater), male (female), population group (veteran Jewish Israelis).
[b]Health reference categories were the following: disability (low); cancer, diabetes, heart attack, stroke and Alzheimer's disease (absence of the disease).
[c]Network reference category was the following: network type (restricted).
*$p < .05$; **$p < .01$; ***$p < .001$.

respondents aged 60–69. However, we observed a significantly lower risk of mortality among individuals aged 70 and older who had been embedded in diverse and friend-focused network types at baseline. They were joined by respondents aged 80 and older who reported having had a community–clan type network. The association of family-focused networks with mortality, which Table 4 shows, was not maintained when viewed separately by age group.

Discussion

This analysis of the Israeli elderly cohort confirmed that the network type in which respondents were embedded in later life is indeed associated with mortality risk. Moreover, the association between network type and mortality is significant mainly in the older age groups (those aged 70 and older). People in diverse networks, friend-focused networks, and, to a more limited degree, community–clan networks, demonstrated lower risk of all-cause mortality 7 years later.

The unique contribution of the current inquiry is its introduction of the notion of network type to the discourse on social ties and survival. The analysis showed that the network type construct is quite predictive of survival. Respondents embedded in networks reflecting a diversity of relationship types, and particularly in networks that included ties with friends, had significantly lower risk of mortality than respondents in restricted network types. This was the case even after controlling for major sociodemographic and health characteristics. The positive association between friend-based networks and survival in later life has also been documented in studies from Australia (Giles et al., 2005) and from Denmark (Rasulo et al., 2005).

Another contribution of this analysis is the clarification that one's network type is important for survival mainly in advanced old age. Lower mortality risk was evident in selected network types among respondents aged 70 and older in this study, but not among those aged 60–69. This finding reinforces those of an earlier study of older women in Baltimore, in which researchers found that social networks reduced mortality risk among respondents aged 75 and older, but not among 65–74-year-olds (Yasuda et al., 1997).

Mortality among the young-old respondents in the present study was associated with gender and with health, but not with social network. Morbidity, particularly cancer and stroke, seemed to be the prevailing risk factor for death among individuals aged 60–69. However, network type did play an important role among the older-old respondents. Thus, the nature of one's interpersonal milieu in advanced old age is a significant factor to address in promoting survival.

The current analysis also considered the association of network type and mortality within the context of culture or ethnic group. Unexpectedly, the results showed no association between ethnic or cultural factors and mortality among Israeli elders when comparing veteran Jewish Israelis, Arab Israelis, and new immigrants from the former Soviet Union. Neither did such differences emerge when we controlled for the effects of other factors.

Nevertheless, a possible effect of population group is noticeable in the lower risk of mortality among respondents embedded in a community–clan network type. Recall that this particular network constellation comprised mainly, but not entirely, Arab Israelis. Thus, it could be that the effect of this network type stems from the cultural differences associated with its primary members, Arab Israelis, as well as from the social structural differences in its composition. This possible explanation is partly challenged, however, by the results from the final analysis presented in the current inquiry. As we saw, after controlling for age group, lower mortality risk of individuals in the community–clan network was evident only among respondents aged 80 and older at baseline.

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Table 5. Baseline Correlates of 7-Year All-Cause Mortality Among Older Israelis by Age Group: Cox Proportional Hazards Regression Analysis

Variable	Aged 60–69	Aged 70–79	Aged 80 and Older
Background[a]			
Very low income	1.04 (0.67–1.60)	1.19 (0.88–1.60)	0.90 (0.66–1.23)
Low income	0.95 (0.64–1.42)	1.18 (0.89–1.58)	0.82 (0.59–1.14)
None–low education	1.36 (0.86–2.14)	1.14 (0.87–1.51)	1.07 (0.80–1.42)
Primary and greater education	1.04 (0.73–1.49)	0.92 (0.73–1.15)	0.90 (0.70–1.15)
Male	2.19 (1.64–2.91)***	1.85 (1.55–2.22)***	1.45 (1.21–1.74)***
Arab Israeli	1.31 (0.82–2.10)	0.87 (0.64–1.19)	0.90 (0.65–1.24)
Immigrant from the former Soviet Union	1.23 (0.84–1.85)	1.08 (0.87–1.35)	0.93 (0.75–1.15)
Health[b]			
Moderate disability	1.47 (1.04–2.08)*	1.50 (1.19–1.90)**	1.03 (0.76–1.39)
High disability	2.50 (1.73–3.60)***	2.54 (2.01–3.20)***	1.64 (1.25–2.15)***
Cancer	2.95 (1.89–4.60)***	1.66 (1.21–2.27)**	1.74 (1.27–2.38)**
Diabetes	1.80 (1.36–2.39)***	1.32 (1.09–1.59)**	1.16 (0.94–1.43)
Heart attack	1.40 (1.03–1.90)*	1.26 (1.05–1.52)*	1.15 (0.95–1.40)
Stroke	2.80 (1.81–4.33)***	1.17 (0.86–1.59)	1.42 (1.07–1.88)*
Alzheimer's disease	1.48 (0.46–4.79)	1.38 (0.77–2.45)	1.58 (1.09–2.29)*
Network[c]			
Diverse network	1.04 (0.68–1.58)	0.67 (0.52–0.85)**	0.57 (0.44–0.74)***
Friend network	1.16 (0.75–1.78)	0.64 (0.49–0.84)**	0.68 (0.52–0.91)**
Neighbor network	1.05 (0.66–1.66)	0.88 (0.67–1.14)	0.84 (0.66–1.06)
Family network	0.69 (0.38–1.27)	0.75 (0.52–1.08)	0.86 (0.60–1.23)
Community–clan network	0.94 (0.53–1.70)	0.89 (0.59–1.35)	0.36 (0.21–0.63)***

Notes: All data are presented as hazards regressions (95% confidence interval).
[a]Background reference categories were the following: income (moderate to high), education (secondary and greater), male (female), population group (veteran Jewish Israelis).
[b]Health reference categories were the following: disability (low); cancer, diabetes, heart attack, stroke and Alzheimer's disease (absence of the disease).
[c]Network reference category was the following: network type (restricted).
*$p < .05$; **$p < .01$; ***$p < .001$.

One limitation of the current study that we should note was the small groupings that resulted when we considered network types, age, and disease variables in concert. For example, few respondents in the family-focused and community–clan networks in each age group had been diagnosed with cancer, and even fewer in the diverse, friend-focused, and neighbor-focused networks had been diagnosed with Alzheimer's disease. Thus, it was not possible to explore interactions among these factors beyond controlling for the effects of each in the multivariate analysis.

Another possible limitation of the study stems from the nature of the data employed, which allowed examination of baseline network type with subsequent all-cause mortality. We cannot confirm that the network type at the time of death was in all cases the same as that which respondents identified at baseline. However, in a longitudinal study of rural elderly adults in the United States, Cerhan and Wallace (1997) found that low levels of social network ties were related to mortality, but that reduction of network ties over time was not. On the basis of their findings, moreover, they proposed that social isolation is a more significant determinant of mortality risk than are recent changes in one's social ties. We cautiously interpret this finding to suggest that baseline measurement of the level of one's social ties, as reflected in network type, may indeed suffice.

Despite these limitations, the findings present evidence for the association of network type and mortality. The construct of network type thus presents an important direction for the development of relevant assessment tools and for the implementation of professional network interventions. If social networks are to serve as targets of professional practice, it is necessary to perfect methods for the efficient and accurate identification by practitioners of the major network types. Until recently, researchers have been the main users of network typologies. Exceptional in this regard is work reported in England and Wales that sought to introduce the identification of network types as an integral part of gerontological social work practice (Wenger & Tucker, 2002). The network types that Wenger (1997) and colleagues have identified reflect differing risk profiles for mental illness and differing implications for hospital discharge and admission to institutional care.

The findings from the present study suggest that identifying older adults at risk, particularly those embedded in neighbor-focused and restricted networks, should be an important practice goal. Moreover, the means employed for network derivation in

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this study can provide guidelines for the construction of a relevant network-assessment inventory. We suggest adding the following questions to standard intake interviews: (a) Are you currently married or living with a partner? (b) Do you have children living up to 15 min away? How many? (c) How often are you in touch with your children? With friends? With neighbors? (d) How often do you attend a place of worship? A senior club or center?

The responses to these questions provide sufficient data for network typing. Analysts can develop a simple form that applies the logarithm necessary for network typing for this purpose, as was successfully tried and reported in the United Kingdom (Wenger & Tucker, 2002). As we have noted, individuals identified as belonging to networks at risk should constitute a priority group for preventive intervention.

The interventions required differ by network type. We will focus here on the two network types that emerged in both of the regression analyses as being at risk: neighbor-focused networks and restricted networks. Thus, the goal for older adults rooted in neighbor-focused networks would be to diversify the network member structure, particularly by incorporating friends. Practitioners can reinforce such networks through therapeutic means (working directly with the elderly client to remove barriers that prevent friendship ties) or through enrichment (e.g., instituting friendly visitors who might eventually become friends; Eckenrode & Hamilton, 2000). The National Insurance Institute of Israel operates such a visitation program of seniors for seniors.

The goal for individuals embedded in restricted networks would need to recognize that these are relatively isolated older people with only one adult child available for help. Consequently, the prescribed intervention in this case would best be aimed at supporting the family caregiver to prevent possible stress that could undermine the quality of the supportive relationship (Cutrona & Cole, 2000). One possible means for achieving this goal is to encourage the attendance of the focal elderly client at a day center, an activity that could potentially add new ties to his or her social network as well as provide respite for the family caregiver.

One must also remember that practitioners, particularly those in the public sector, must frequently deal with more immediate tasks in the delivery of case management. As a result, they often lack the time needed to implement preventive strategies, such as the reconstruction and the enrichment of their clients' social networks. It could be that the practice of network assessment and intervention currently receives a lower priority than it deserves.

The association of network type and survival in later life that was demonstrated in this study underscores the need for professional practitioners to address the nature of older people's social networks. Moreover, the varied effect of network type on mortality suggests the need to encourage differential implementation of network interventions according to the type of network in which the client is embedded. Adding such a network focus to the care of elderly clients could significantly enrich the repertoire of helping skills that are at the disposal of the gerontological practitioner.

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