

# Effects of Social Support Network Size on Mortality Risk: Considerations by Diabetes Status

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## ■ ABSTRACT

**Objective.** Previous work demonstrates that social support is inversely associated with mortality risk. Less research, however, has examined the effects of the size of the social support network on mortality risk among those with and without diabetes, which was the purpose of this study.

**Methods.** Data from the 1999–2008 National Health and Nutrition Examination Survey were used, with participants followed through 2011. This study included 1,412 older adults ( $\geq 60$  years of age) with diabetes and 5,872 older adults without diabetes. The size of the social support network was assessed via self-report and reported as the number of participants' close friends.

**Results.** Among those without diabetes, various levels of social support network size were inversely associated with mortality risk. However, among those with diabetes, only those with a high social support network size (i.e., at least six close friends) had a reduced risk of all-cause mortality. That is, compared to those with zero close friends, those with diabetes who had six or more close friends had a 49% reduced risk of all-cause mortality (hazard ratio 0.51, 95% CI 0.27–0.94).

**Conclusion.** To mitigate mortality risk, a greater social support network size may be needed for those with diabetes.

The Social Cognitive Theory posits that behavior is influenced by a multitude of personal and environmental factors (1). In the context of health behaviors, this model indicates that self-efficacy may influence health behaviors directly, as well as indirectly via alterations in outcome expectations (e.g., physical, social, and self-evaluative), socio-structural factors (e.g., facilitators and impediments), and goal development/achievement. In alignment with this model, research demonstrates that older adults who perceive that they have social support are more likely to engage in health-enhancing behaviors (2). Research also demonstrates that social support plays a crucial role in

mortality risk, with those perceiving social support having a 50% increased odds of survival (3).

However, an under-investigated area of research in this domain is the extent to which the size of a person's social support network influences mortality risk (4,5). Recent work demonstrates that, among those in the general population, individuals with a greater social support network size (i.e., greater number of close friends who provide support) have a reduced mortality risk (4,5). Berkman et al. (6) thoroughly discussed how social networks subserve health. They conceptualize a model involving both upstream (social-structural conditions and social networks) and

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downstream (psychosocial mechanisms and various health behavioral, psychological, and physiological pathways) factors. In brief, they propose a cascading causal process starting with macro-social to psychobiological processes that are dynamically linked to influence health, with social networks subserving health behaviors through four primary pathways: provision of social support, social influence, social engagement and attachment, and access to resources and material goods.

In this article, we extend this investigation by specifically focusing on older adults with and without diabetes. Given the myriad of physiological (e.g., obesity and cardiovascular disease) and psychological (e.g., depression) consequences linked with diabetes (7), it is conceivable that those with diabetes may need a greater social support network size than those without diabetes to attenuate the early mortality risk associated with diabetes. Thus, the purpose of this study was to evaluate the association between social support network size and mortality risk among those with and without diabetes. We hypothesize that social support network size will be inversely associated with mortality risk among both groups, but for those with diabetes, a greater network size will be needed to confer the mortality risk reduction associated with social support.

## Methods

### Study Design and Participants

The National Health and Nutrition Examination Survey (NHANES) is an ongoing survey conducted by the National Center for Health Statistics, a major section of the Centers for Disease Control and Prevention. NHANES evaluates a representative sample of noninstitutionalized U.S. civilians, selected by a complex, multistage probability design. All procedures for data collection were approved by the National Center for Health Statistics ethics review board, and all participants provided writ-

ten informed consent prior to data collection.

Data from the 1999–2008 NHANES were employed. Data from participants in these cycles were linked to death certificate data from the National Death Index (NDI) via a probabilistic algorithm (8). As described elsewhere (8), potential NDI matches were based on various combinations of matching identifiers, including, for example, social security number, first name, last name, and date of birth. Person-months of follow-up were calculated from the date of the interview until the date of death or censoring on 31 December 2011, whichever came first.

Participants were considered to have diabetes if they answered “yes” to the question, “Other than during pregnancy, have you ever been told by a doctor or health professional that you have diabetes or sugar diabetes?” The present study included 1,412 older adults ( $\geq 60$  years of age) with diabetes and 5,872 older adults without diabetes.

### Social Support Network Size

Participants  $\geq 60$  years of age were eligible for the social support assessment. Regarding size of social network, NHANES participants were asked, “In general, how many close friends do you have?” Participants were classified as having zero (referent), one to two, three to four, five, or 6 or more close friends.

### Statistical Analyses

All statistical analyses were performed with Stata version 12.0 (StataCorp, College Station, Tex.) and accounted for the complex survey design used in NHANES by using survey sample weights, clustering, and primary sampling units (data analyzed in 2016). Weighted multivariable Cox proportional hazard models were used to examine the association between social support network size (0 close friends as referent) and all-cause mortality. Schoenfeld’s residuals were used to verify the proportional hazards as-

sumption. Statistical significance was established as  $P < 0.05$ .

Two Cox proportional hazard models were computed, one among those with diabetes and the other among those without diabetes. In both models, and in alignment with other work (5), covariates included age, sex, race/ethnicity, measured BMI, total cholesterol, self-reported engagement in moderate-to-vigorous physical activity in the past month, self-reported smoking status, heart disease, stroke, cancer, and physician-diagnosed hypertension. We also considered other covariates, such as marital status, but results were unchanged with their inclusion.

## Results

Table 1 displays the weighted characteristics of the study variables, stratified by diabetes status. Participants with and without diabetes were similar regarding mean age, sex proportions, race/ethnicity proportions, cancer history, and smoking status. However, those with diabetes had a higher BMI, were less physically active, and had a higher prevalence of hypertension and heart disease.

Table 2 displays the weighted Cox proportional hazard model results. Among those without diabetes, various levels of social support network size were inversely associated with mortality risk. However, among those with diabetes, only those with a high social support network size (i.e., six or more close friends) had a reduced risk of all-cause mortality. That is, compared to those with zero close friends, those with diabetes who had six or more close friends had a 49% reduced risk of all-cause mortality (hazard ratio [HR] 0.51, 95% CI 0.27–0.94).

## Discussion

The principal findings of this study are believed to be the first to document the association between social support network size and mortality risk specifically among individuals with and without diabetes. The current findings show that, although individuals without diabetes have a reduction in

**TABLE 1. Characteristics of the Sample Stratified by Diabetes Status**

	With Diabetes (n = 1,412)	Without Diabetes (n = 5,872)
Age, mean (SD), years	70.2 (0.2)	70.2 (0.1)
Age range, years	60–85	60–85
BMI, mean (SD), kg/m <sup>2</sup>	31.1 (0.2)	28.0 (0.1)
Total cholesterol, mean (SD), mg/dL	185.0 (1.7)	207.0 (0.7)
Sex, % female	52.4	55.7
Race/ethnicity, % white	72.2	84.2
Physical activity, % active	48.5	57.7
Smoking, % current smoker	9.6	12.2
Congestive heart failure, % yes	14.1	4.9
Coronary artery disease, % yes	18.6	9.0
Myocardial infarction, % yes	12.8	6.4
Stroke, % yes	14.2	6.0
Cancer, % yes	21.9	20.1
Hypertension, % yes	73.2	52.5
Network size, %		
0	4.8	4.0
1–2	19.8	17.1
3–4	22.3	20.0
5	13.1	13.2
≥6	39.9	45.8

mortality risk as their social support network size increases, individuals with diabetes had a reduced risk of all-cause mortality only when their social support network size exceeded six individuals. Future work investigating the underlying reasons for this

association are warranted, but it is likely driven by the increased comorbidities associated with diabetes (e.g., depression-induced social isolation), which are influenced by a multitude of social determinants (e.g., social assistance and financial support) (9).

Current evidence also indicates that the quantity and/or quality of social relationship structures globally are decreasing even with increases in technology and globalization (10). McPherson and Smith-Lovin (10) suggest that, although technology should presumably foster social connections, research has shown that people are becoming increasingly more socially isolated. This is concerning because social isolation and loneliness are contributors to increased incidence of heart disease and stroke (11). Concurrently, health statistics show that, within the United States, diabetes rates have nearly doubled in the past two decades (12,13). Given these trends, understanding the nature and extent of the association between social relationships and mortality among people with diabetes is an important contribution to the literature.

In today's health care environment, preventive health programs are both policy and social welfare issues that are hotly debated in both the media and the legislature. This study, in conjunction with others (10), documents the importance of including social relationship factors with other health risk factors such as obesity, smoking, and hypertension when evaluating targeted strategies to address health disparities in the United States. Overall, the implications for including social factors in

**TABLE 2. Cox Proportional Hazard Model Results Examining the Effects of Social Support Network Size on Mortality Risk Among Those With and Without Diabetes**

Network Size	With Diabetes (n = 1,412)		Without Diabetes (n = 5,872)	
	HR	95% CI	HR	95% CI
0	Referent		Referent	
1–2	0.64	0.33–1.26	<b>0.70</b>	<b>0.51–0.95</b>
3–4	0.57	0.30–1.08	0.81	0.58–1.13
5	0.62	0.30–1.27	<b>0.73</b>	<b>0.54–0.99</b>
≥6	<b>0.51</b>	<b>0.27–0.94</b>	<b>0.66</b>	<b>0.48–0.91</b>

Two Cox proportional hazard models were computed, one among those with diabetes and the other among those without diabetes. In both models, covariates included age, sex, race/ethnicity, BMI, total cholesterol, moderate-to-vigorous physical activity, smoking status, heart disease, stroke, cancer, and hypertension. Bold indicates statistical significance (P < 0.05).

the management of mortality risk are important for health care policy initiatives.

This concept aligns with emerging work demonstrating favorable effects of integration of social support strategies in community-based interventions. For example, such efforts among those with diabetes have been shown to improve various clinical-based outcomes (e.g., stress, depression, A1C, blood pressure, and lipid profile) and increase diabetes self-management, medication adherence, and adoption of a healthful diet and active lifestyle. Thus, in addition to assessing standard clinical parameters (e.g., glycemia and blood pressure) in patients with diabetes, evaluating patients' perceived social support and network structure and size would be sensible. Furthermore, development of tailored interventions to promote social support among those with diabetes is warranted.

In conclusion, the current findings highlight the importance of mitigating mortality risk in vulnerable populations, such as those with diabetes, and the impact of social network size on risk mitigation and/or reduction in these populations. This study was limited in that we were not able to ascertain participants' type of diabetes. Future work should also continue to explore this topic

by employing a longer follow-up period, evaluating potential mediators and moderators (e.g., across diverse samples of individuals with type 2 diabetes) that may explain our observed findings, and providing a more comprehensive assessment of social support network size (e.g., different configurations and interactions of the network size, such as support from relatives versus nonrelatives).

### Duality of Interest

No potential conflicts of interest relevant to this article were reported.

### Author Contributions

Both authors contributed to the writing of the manuscript, and P.D.L. computed the analyses. P.D.L. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis

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