Journal of Gerontology: PSYCHOLOGICAL SCIENCES
1997, Vol. 52B, No. 5, P197–P205

The Relationship of Social Environment, Social Networks, and Health Outcomes in The Seattle Longitudinal Study: Two Analytical Approaches

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This study examined the relation of social networks and perceived social environment to health outcomes and cost utilization over a 1-year period in a community sample of 387 (173 males, 214 females). Two analytical strategies, a variable-oriented approach and a subject-oriented approach, were used to complement each other: structural equation modeling assessed the direct relationship between social relationships and health, while cluster analysis examined how social relationship patterns were related to health outcomes. Lower levels of perceived social environment were associated with an increased number of hospital visits. For unmarried individuals, increased age was associated with greater medical usage and estimated total health care cost, while low perceived social environment was related to a greater number of doctor visits. Among married individuals, women had more frequent doctor visits, medication usage, estimated outpatient costs, and primary care visits. Married individuals with low levels of social networks had increased total health care costs, outpatient costs, and primary care visits. Cluster analysis was used to group individuals by characteristics of perceived social environment and social networks. Members of the cluster groups with greater health problems were more likely to be isolated, had the least social contact, and had lower levels of education and income. Including subject-oriented approaches is useful in complementing more popular regression methods for data analysis.

SOCIAL relationships have been found to reduce morbidity (Wallston, Alagna, DeVellis, & DeVellis, 1983) and mortality (House, Landis, & Umberson, 1988; House, Robbins, & Metzner, 1982; Orth-Gomer & Johnson, 1987; Sugisawa, Liang, & Liu, 1994). Because of the increased rates of disease and disability, individuals' social relationships attain even more importance in advanced age. Environmental support, social ties, and assistance by others become critical factors in the maintenance of individuals' independence. Social relationships also play an important role in older adults' maintenance of mental health and physical well-being by acting as buffers for stressful life experiences. Hence, the association between social relationships and health outcomes is important in explaining the maintenance of one's independence in old age.

Two forms of social relationships have been examined in prior studies. Measures of structural social networks are similar to what sociologists refer to as social networks. A social network has been defined as a set of linkages whose characteristics in an identified group of people may explain the social behavior of the people involved (Berkman, 1984). Perceived social environment measures, in contrast, assess the interactive process by which emotional, instrumental, or financial aid is obtained from one's social network (Bowling & Farquhar, 1991); these measures generally seek information about a person's perception of the availability or adequacy of resources provided by other persons (Cohen & Syme, 1985).

Research on social relationships and adults may be seen as reflecting two broad theoretical frameworks. The first of these frameworks represents a social problems approach that focuses on problems arising from disruption in the traditional sources of social support, such as widowhood, retirement, relocation, or death of friends or relatives. The second theoretical framework emphasizes continuity. Within this theoretical framework, phenomena such as immersion in supportive ties, tendencies toward participation or nonparticipation in groups and organizations, network sizes, and frequency of contact (especially with close kin) are seen as relatively stable over the life span (Field & Minkler, 1988). Support for the latter orientation comes from the Duke Longitudinal Studies of Aging (Cutler, 1977) and from the Berkeley Older Generation Study (Field, Minkler, Falk, & Leino, 1993). These studies demonstrate that most elders maintain their social networks even though family and friendship support systems may have differential salience at different stages of the life course. Within these networks, older adults tend to continue a level of social involvement consistent with their earlier lives.

Health status has been operationalized and measured in diverse ways. This diversity has contributed to the difficulty in comparing findings from different studies of health and social relationships. Both objective and subjective indicators of physical health have been used as outcome measures in investigations of the relationship between social relationships and health. Past research has shown correlations be-

tween self-reported subjective health and mental well-being as well as physical health. More objective health status measures (i.e., physicians' ratings of health or symptom checklists) seem to be related only to physical health (Hooker & Siegler, 1992).

Physical health measures that overlap with measures of psychological functioning may exaggerate the magnitude of the correlation between social relationships and physical health (Schaefer, Coyne, & Lazarus, 1981). Thus, measures of social relationships may share more variance with subjective health measures than with objective measures, since the former (i.e., well-being, life satisfaction, morale, happiness) may not be empirically distinct from other measures of psychological health.

Social environment, social network, and health are all multidimensional constructs. Hence, one must ask not only the question of how perceived social environment and social networks are related to health and well-being, but also whether there are distinct patterns of subjects' perceived environment and social networks that result in different health outcomes.

The relationship between social relationships and health outcomes in this study was examined by two distinct analytical techniques: structural equation modeling (SEM) and cluster analysis. SEM yields estimates of latent constructs that underlie the observed variables (Bollen, 1989). By contrast, cluster analysis, unlike analytical techniques based on covariance matrices, is not a variable-oriented approach, but rather is concerned with identifying typologies of subjects sharing common characteristics.

The two analytical techniques were chosen to complement each other. SEM examines a covariance matrix based on rank ordering. This statistical method estimates the magnitude of association between variables in the population; however, it is typically assumed that constructs being observed are linear and additive. Univariate analyses of single factors such as sociodemographic variables, social environment, or social networks are of importance as predictors of morbidity but may not necessarily depict the combinations of factors that underlie the determination of health and well-being. Cluster analysis can be used to display the different patterns in which key variables such as social networks, social environment, and health may occur. Thus, general linear models such as SEM provide an opportunity to examine the direct linear relationship of several variables or constructs, while cluster analysis captures the sometimes complex profiles of social relationships and health as they are expressed in different population subtypes.

SEM was used to estimate two models: a full model and a multilevel model split by whether individuals were married or not. Previous studies that have focused on healthy adults of all ages have found that married persons have higher levels of well-being and mental health and fewer physical health problems than do unmarried persons (Ross & Mirowsky, 1989). Married persons have lower mortality rates (Berkman & Syme, 1979), use fewer health services (Evashwick, Rowe, Diehr, & Branch, 1984), and have significantly better survival rates after suffering an acute myocardial infarction than those who are not married (Wingard, 1984). Because of the difference in health between married and unmarried adults, we were interested in examining the relationship of social associations separately for married and unmarried adults.

The present study had three goals. First, we examined the extent to which both social networks and perceived social environment relate to health outcomes and service utilization in the middle to later years. Clarification of this relationship is important because the elderly are at highest risk for almost all morbidity and mortality events (Seeman, Kaplan, Knudsen, Cohen, & Guralnik, 1987). In addition, relatively few studies of social relationships and health have previously addressed dependent health measures other than mortality. Second, the relationship of marital status and health was examined. Many epidemiologic studies have found a relationship between being married and lower rates of mortality (Berkman & Syme, 1979; House, Robbins, & Metzner, 1982). Third, this study examined how two different analytical techniques (variable-oriented and subject-oriented approaches) contribute alternative information to the broader question of the relationship between social environment and health.

Methods

Subjects

A subsample was selected from the Seattle Longitudinal Study, in which data have been collected from more than 5,000 participants between the ages of 22 and 95. Subjects entering this study were selected randomly within gender and age/cohort groups of the membership of a large health maintenance organization (HMO) in the Seattle, Washington, area. The sampling frame was a community-dwelling population representing a wide range of occupational, educational, and economic backgrounds (for a detailed discussion of the Seattle Longitudinal Study see Schaie, 1996).

At the time of testing, there were 387 subjects (173 males and 214 females) with a mean age of 58.28 years (range 36–82 years) who had medical data abstracted. The sample had a wide range of educational (M = 14.50 years, SD = 2.81) and income levels (M = $28,600, SD = 7,580) (see Table 1).

Measures

The Life Complexity Inventory (LCI). — Various demographic and personal information items were extracted from

Table 1. Summary of Sociodemographic Indicators and Health Outcome and Medical Utilization, 1991

	Mean	*SD*	Range
Age	58.28	11.28	36 – 82
Income	$28,600	$7580	$2,000 – >$50,000
Education	14.50	2.81	7–20
Total health care costs	$3203.43	$2270.06	$465–$11,835
Outpatient care costs	$1450	$858.90	$383–$6,076
Primary care visits	3.61	1.59	2–10
Hospital visits	1.7	5.3	0–50
Disease episodes	4.31	3.52	0–23
Medication usage	1.86	2.01	0–11
No. of diagnoses	9.52	11.76	0–134

Note: N = 387.

the LCI survey of individual background characteristics (see Schaie, 1996, for greater detail). Information from the LCI included subjects' age, family income, education, and social network measures.

Structural social network measures. — Structural measures were also obtained from the LCI. Participants were asked to report, on a 4-point Likert scale (1 = none; 2 = 1–2; 3 = 3–4, and 4 = 5 or more) the number of friends they had and rank the number of confidants and neighbors they could contact if the need arose. Participants also listed the amount of time they spent at church/synagogue, meetings attended, number of visits received, number of neighbors, and the number of social activities engaged in per week.

Perceived social environment measures. — Moos and Moos (1986) constructed a 90-item true-and-false Family Environment Scale that measured 10 different dimensions of one's social environment. Each dimension consists of nine items (Moos, 1987). Schaie and Willis (1995) modified eight of the Moos scales by selecting five items per scale and changing the response format to a Likert scale. Individuals were asked to rate their current social environment, which could include friends, family, and others. These ratings were taken as an indication of perceived social environment. Only six of the eight dimensions were included in this study. The other two dimensions were not appropriate for this study. The six dimensions used in this study were (1) cohesion — the degree of commitment, help, and support family members and friends provide for one another; (2) expressiveness — the extent to which family members and friends are encouraged to act openly and to express their feelings directly; (3) conflict — the amount of openly expressed anger, aggression, and conflict between family members and friends; (4) achievement orientation — the extent to which activities are cast into an achievement-oriented or competitive framework; (5) intellectual-cultural orientation — the degree of interest in political, social, intellectual, and cultural activities; and (6) active-recreational orientation — the extent of participation in social and recreational activities (Moos & Moos, 1986).

A confirmatory factor analysis was conducted on a random half of a larger sample to determine whether the retained items clustered on factors described by Moos (Schaie, 1996). The obtained fit, $\chi^2(702) = 1254.48$, $p < .001$, goodness-of-fit index (GFI) = .839, root mean-square residual (RMR) = .089, was then confirmed on the second random half, $\chi^2(702) = 1357.07$, $p < .001$, GFI = .829, RMR = .089. The internal consistency for each dimension is as follows: cohesion .79, expressiveness .67, conflict .72, achievement-orientation .55, intellectual-cultural orientation .71, active-recreational orientation .63.

Health outcome measures. — Complete medical histories were available because of our participants' membership in an HMO. Medical data were abstracted for each individual and coded using the International Classification of Diseases (USPHS, 1968). Inter-rater reliabilities for coded medical histories in earlier studies on this sample have ranged from .93 to .99 (Hertzog, Schaie, & Gribbin, 1978).

Health outcome variables included number of diagnoses, number of disease episodes, and number of hospital visits recorded over a 1-year period (1991). Disease episodes are the unique manifestations of a particular diagnosis. Participants also brought all prescription medications taken regularly for at least 1 month prior to the testing session. The type and the number of medications individuals used were recorded.

Estimated total health care costs, outpatient costs, and number of primary care visits for 1991 were estimated based on a chronic disease score. The chronic disease score involves a set of empirically derived weights based on age, gender, and pharmacy utilization of the HMO's pharmacies. These weights were then used to calculate a predicted score for each subject for the total health care costs, outpatient costs, and for frequency of primary care visits (Clark, Von Korff, Saunders, Baluch, & Simon, 1994).

Analyses

Structural equation modeling. — Before testing the structural model, the underlying measurement model was evaluated by means of confirmatory factor analysis (CFA) using LISREL VIII (Jöreskog & Sörbom, 1993) (see Figure 1). The measures of perceived social environment were allowed to load on one factor and the social network variables on another. Several criteria were used to assess the model. Chi-square alone is not an adequate measure of model fit when a relatively large number of subjects is used. It is overly sensitive in detecting small discrepancies between the model and the data when the distribution of the observed variables is non-normal or the sample size is large (Bollen, 1989). The Nonnormed Fit Index (NNFI) and the Normed Fit Index (NFI), formerly the Bentler-Bonett Index (Bentler & Bonett, 1980) are useful in CFA studies to compare a fit of a proposed model with the fit of a null model where all the variables are assumed to be uncorrelated. Values less than 0.9 for these indices indicate that the model may be substan-

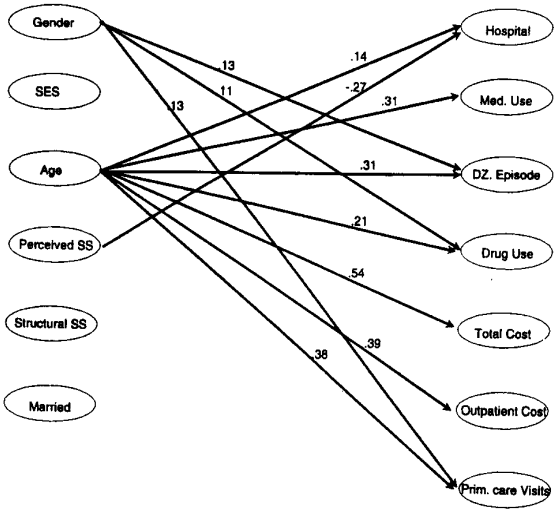

Figure 1: Structural path model — social relationship predicting health outcome — total model.

tially improved. The Comparative Fit Index (CFI; Bentler, 1990) is a robust measure of comparative fit that corrects some of the shortcomings of the NFI. CFI values range from 0 to 1.0, with values closer to 1.0 suggesting a better fitting model. The CFI is based on the noncentrality parameter of the chi-square statistic and the goodness-of-fit statistic. The root mean-square residual (RMR) is a summary statistic for the residuals and ideally all residuals should be near zero (Jöreskog & Sörbom, 1993). The root mean-square error of the approximation (RMSEA; Steiger, 1990) provides a measure of discrepancy per degree of freedom of the model. Values less than or equal to .05 are considered a good fit of the model relative to the degrees of freedom (Browne & Cudek, 1993). The GFI and the adjusted-goodness-of-fit (AGFI) measure the relative amount of variances and covariances accounted for by the model (Jöreskog & Sörbom, 1993).

Cluster analysis. — The group average agglomerative method with cosine similarity measures was used to cluster individuals on two separate sets of constructs (perceived social environment and social networks). Group average is an agglomerative method that begins with N clusters (i.e., each observation constitutes its own cluster). In successive steps, this agglomerative method combines the two closest clusters, thus reducing the number of clusters by one in each step. Group average is defined as a group of entities in which each member has a greater mean similarity with all members of the same cluster than it does with all members of any other cluster (Blashfield, 1976).

Similarity indices used in cluster analysis guide cluster formation. Objects are represented as points in multidimensional space such that observed dissimilarities between objects correspond to the metric distance between the respective points. The cosine coefficient was chosen for this analysis because this similarity index accounts for the shape, scatter, and elevation of the individual profiles (Cronbach & Gleser, 1953).

Results

The means and standard deviations for health outcome and utilization variables for 1991 are shown in Table 1. The measurement model will first be discussed, followed by the results of the structural path and cluster analyses.

Measurement model for total model. — To examine the relationship between social relationship and health outcome and utilization, we chose all the variables available in our data set that have in prior research been found to be related to either health and/or social relationships. Gender, marital status (married or not), age, and the health variables were treated as manifest variables; they were unique factors in and of themselves. The observable dependent variables were treated as latent variables to assess whether they were directly impacted by social relationships and sociodemographic variables.

The overall goodness-of-fit indexes for this CFA were quite satisfactory, $\chi^2[199; n = 387] = 359.25$, $p < .001$; GFI = .936, AGFI = .894, and the RMR = .051. The NFI was .91, and the NNFI was .93. The RMSEA was .046 and the CFI = .96. The correlation matrix among the latent variables (the PSI matrix) is shown in Table 2. Increased social networks was negatively correlated with hospital visits, and being unmarried was negatively correlated with higher estimated total health care costs, outpatient costs, and number of primary care visits. Increased perceived social environment was negatively correlated with lower estimated primary care. Increased age was positively correlated with all the health variables, while lower socioeconomic status was negatively correlated with increased number of disease episodes, medications used, and estimated utilization. Higher factor loadings indicate a closer relationship between the manifest variable and the underlying latent factor. The estimated factor loadings were of substantial magnitude and differed significantly ($p < .05$) from zero (Table 3).

Structural path analyses for the total model. — The maximum likelihood procedure was chosen as the preferred method of parameter estimation (Jöreskog & Sörbom, 1988). Each model contained direct paths of the independent latent variables to the dependent latent variables. Correlations among the exogenous variables were permitted to be freely estimated. Figure 1 presents the significant path coefficients, which indicate the magnitude of the effects for

Table 2. Correlation Among Factors

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender (1 = male)	—												
2. Socioeconomic status	−.17*	—											
3. Age	−.09	−.38*	—										
4. Perceived social environment	.01	.09	−.01	—									
5. Structural social support	.03	−.01	.05*	.04*	—								
6. Marital status	.22*	−.34*	.21*	−.14*	.01	—							
7. Hospital visits	−.07	.01	.16*	.01	−.06*	−.03	—						
8. Diagnoses	−.03	−.08	.27*	.04	.01	.02	.54*	—					
9. Disease episodes	.09	−.13*	.28*	−.03	.01	.06	.27*	.71*	—				
10. Drug use	.08	−.14*	.21*	.02	−.01	.04	.17*	.29*	.36*	—			
11. Total health care costs	−.09	−.21*	.55*	−.02	.02	−.15*	.26*	.41*	.42*	.47*	—		
12. Oupatient costs	.04	−.15*	.35*	−.03	.01	−.12*	.23*	.38*	.42*	.50*	.93*	—	
13. Number of care visits	.09	−.18*	.34*	−.09*	−.01	−.15*	.20*	.38*	.44*	.50*	.86*	.94*	—

*$p < .05$.

Table 3. Standardized Factor Loadings for Latent Variables

	SES	Perceived Social Environment	Social Network
Education	.74		
Income	.34		
Cohesion		.91	
Expressiveness		.70	
Conflict		.53	
Achievement		.19	
Culture		.42	
Recreation		.27	
Neighbor			.39
Confidant			.20
Friend			.22
Meetings			.48
Visits			.18
Social level			.22
Church			.24

Note: Marital status, gender, age, and all health outcome measures were treated as observable variables, and hence, factor loadings were not estimated. All loadings are significant at or beyond the .05 level.

each path. Females had more physician visits, used more medications, and had higher estimates of number of primary care visits, while the magnitude of perceived social relationship was related negatively to the number of hospital visits and estimated primary care visits. Advanced age predicted greater health problems. The amounts of variance accounted for by the structural equations were as follows: hospital visits 10%, medical utilization 8%, total disease episodes 10%, medication use 8%, estimated total health care costs 30%, estimated outpatient costs 14%, and estimated primary care visits 16%.

Measurement model for marital status. — Differences between married and unmarried adults were examined using a multigroup SEM. The model was the same as the total model except that marital status was excluded. The marriage model contributed 55% ($\chi^2 = 313.65$) to the chi-square for the overall model. The overall goodness-of-fit indexes for this CFA exhibited an acceptable model fit ($\chi^2[378; n = 387] = 570.27, p < .001$; GFI = .83), and the RMR = .08. The NFI was .86, and the NNFI was .92. The RMSEA was .036 and the CFI = .95. (Descriptive information on marital status can be found in Table 4.)

Structural path analyses for marital status. — We tested the same model as the total model with the exclusion of marital status as an independent variable. Married women had more disease episodes, increased medication usage, increased estimated outpatient costs, and more primary care visits than married men. In addition, for married individuals age was negatively related to all health variables, while structural social networks were negatively related to total health care costs, outpatient costs, and primary care visits (see Figure 2). For unmarried individuals, age was positively related to increased medical usage and total health care costs, and perceived social environment was negatively related to disease episodes (see Figure 3).

Table 4. Summary of Sociodemographic Indicators, Health Outcome, and Medical Utilization by Marital Status

	Married	Unmarried
Age		
M	56.93	62.48
SD	10.39	12.86
range	36–81	36–82
Income		
M	$29,700	$23,560
SD	6,180	9,480
range	$4,000–>$50,000	$1,000–>$50,000
Education		
M	14.67	13.97
SD	2.82	2.74
range	5–20	7–20
Total health care		
M	$3,015.47	$3,789.29
SD	2,139	2561
range	$465–$9,149	$613–$11,835
Outpatient care costs		
M	$1,391.81	$1,631.38
SD	820	951
range	$383–$4,634	$444–$6,076
Primary care visits		
M	3.47	4.05
SD	1.51	1.77
range	2–9	2–10
Hospital visits		
M	1.83	1.28
SD	5.66	3.94
range	0–50	0–20
Disease episodes		
M	4.20	4.66
SD	3.38	3.92
range	0–20	0–23
Medication usage		
M	1.82	1.99
SD	1.97	2.13
range	0–9	0–11
No. of diagnoses		
M	9.49	9.95
SD	4.86	9.79
range	0–134	0–48

Cluster Analysis

The results will be presented in the following order: a discussion of the determination of the number of clusters followed by a description of the cluster groups and a report of the relationship between cluster patterns and health outcomes.

Determination of the number of clusters. — Data were standardized by subtracting the mean and dividing by the standard deviation for each variable. Two separate cluster analyses were conducted, and four clusters were retained from each analysis using three retention criteria. The first criterion was the use of analyses of variance to test the difference between cluster groups for each set of observable measures; there were significant differences for all variables tested. Post hoc tests were then performed to determine

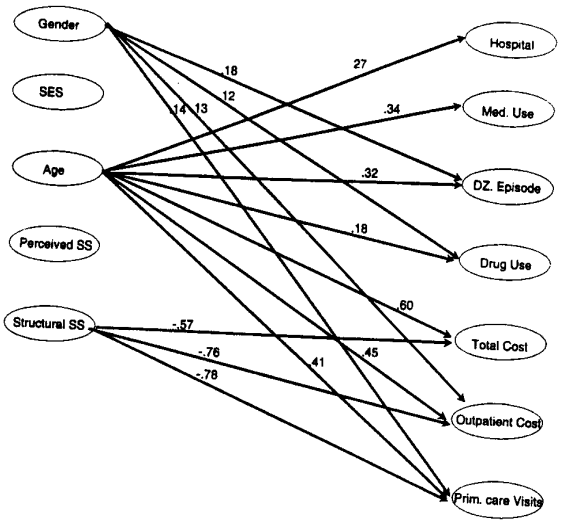

Figure 2. Structural path model — social relationship predicting health outcome — married model.

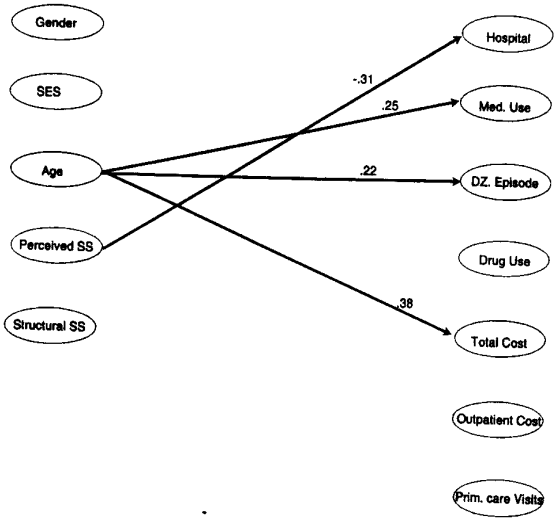

Figure 3. Structural path model — social relationship predicting health outcome — unmarried model.

which cluster groups differed significantly from each other on each of the clustered variables. For each set of cluster analyses, each cluster group was differentiated from every other one, except for intellectual-cultural orientation, which did not distinguish two of the four groups in the perceived social environment analysis.

The second method used to determine the number of clusters is called the agglomeration schedule. The agglomeration schedule displays the order and the distances at which items and clusters combine to form new clusters. A large distance between the merging of two cases implies that two relatively dissimilar clusters have been merged, and thus the number of clusters prior to this "jump" is the most reasonable estimate of the number of clusters (Blashfield & Aldenderfer, 1988). Using the agglomeration schedule, four cluster groups for perceived social environment and structural social network were able to differentiate participants in a unique, but parsimonious way.

The final method used to validate a clustering solution was performing significant tests that compared clusters on variables not used to generate the cluster solution. As Aldenderfer and Blashfield (1984) suggest, the power of external validation is that it directly tests the generality of the cluster solution against relevant criteria.

Perceived social environment. — Cluster 3 was the oldest cluster (M = 60 years), followed by cluster 2 (M = 59 years), cluster 1 (M = 58 years), and cluster 4 (M = 57 years). Cluster differences in education and income were assessed by 2 (gender) by 3 (cluster membership) analyses of covariance (ANCOVAs) with age covaried for both models. Clusters differed on the amount of education attained [$F(3, 378) = 3.01$, $p < .03$]. Cluster 4 had M = 14.94 years of education, followed by cluster 1 (M = 14.74), cluster 2 (M = 14.00), and cluster 3 (M = 13.73). In addition, subjects in cluster 4 had the highest income level (M = \$29,620), followed by cluster 1 (M = \$29,450), cluster 2 (M = \$28,120), and cluster 3 (M = \$22,900).

Cluster 1 (n = 142) was the only group with ratings above the sample mean for all six domains. This group had the highest level of intellectual-cultural and active-recreational orientation and the second highest for cohesion and expressiveness. Cluster 2 (n = 101) scored below the sample mean on all dimensions and was lowest on three of the six dimensions. Cluster 3 (n = 22) represents a unique group because it had consistently low scores on all measures except for conflict and achievement orientation. Cluster 4 (n = 101) was above the sample mean for four of the six domains. This group had the highest levels of cohesion and expressiveness, and lowest amount of conflict. However, this group was below the sample average for active-recreational orientation and for achievement.

Structural social network. — The cluster groups differed by age; cluster 2 was the oldest (M = 60.09 years), followed by cluster 4 (M = 59.57 years), and cluster 3 (M = 59.08 years). Cluster 1 was the youngest (M = 56.73 years). Groups also differed across income levels [$F(3,378) = 2.56$, $p < .06$]. Cluster 3 had the lowest income (M = \$26,200), followed by cluster 1 (M = \$28,240), cluster 4 (M = \$28,700), and cluster 2 (M = \$28,960).

Individuals in cluster 1 were below the sample mean for five of the seven measures, and they formed the largest (n = 181) cluster. This group had the most neighbors and participated in more meetings relative to other groups; however, they apparently had the fewest confidants and/or friends. Cluster 2 (n = 77) was below the sample mean for six of the seven measures. This group, however, had more church visits than any other group, and it is likely that religion had a significant role in these individuals' lives. Cluster 3 (n = 52) was above the sample mean for five of the seven measures, two of which (number of visits received and number of hours spent participating in social activities) were more than one standard deviation above the rest of the sample. Cluster 4 (n = 77) reported overall higher levels of structural social

networks; they had more confidants and friends than any other group.

Relationship between cluster membership, health outcome, and health service utilization. — To investigate the role of gender and cluster membership on social relationship, a series of 2 (gender) by 4 (cluster membership) ANCOVAs were performed with age covaried for each dependent variable. Age was controlled for because it is significantly related to health outcomes; chronic illness and disability become more prevalent with increased age (Revenson, 1986).

Gender differences among the dependent variables. — There were gender differences for number of medications used; women used significantly more medications (M = 2.00) than males (M = 1.69). In addition, women were more likely to experience more disease episodes (M = 4.58) and more primary care visits (M = 3.71) compared with men, M = 3.97 and M = 3.49, respectively.

Perceived social environment cluster membership differences among the dependent variables. — There was a significant difference among clusters for disease episodes. Cluster 3 had the most (M = 6.13), followed by cluster 2 (M = 4.46), cluster 4 (M = 4.28), and cluster 1 (M = 3.92). There was also a significant trend for outpatient costs. Again, we saw a similar pattern for outpatient costs as for disease episodes.

Gender and cluster membership interaction for perceived social environment. — An interaction was found for number of medications used [$F(3,378) = 3.56$, $p < .01$]; women in clusters 1 and 2 used more medications relative to men of the same clusters, while men in cluster 4 used more medications than women in the same cluster. Men and women in cluster 3 used the same amount of medications; however, the amount surpassed any other group.

Gender and cluster membership interaction for structural social network. — An interaction was also found for number of hospital visits [$F(3,378) = 2.76$, $p < .04$]; women in clusters 2 and 4 had more hospital visits relative to men of the same clusters, while men in clusters 1 and 3 had more visits.

Discussion

Substantive Contributions

The results of this study support the hypothesis of a positive association between social relationships and health outcome and service utilization. The structural path analyses indicated that perceived social environment and social networks had different patterns of relationship with health outcome and service utilization. Support for the distinction between perceived social environment and social networks was confirmed by means of CFA. For the total model, low levels of perceived social environment were related to a larger number of hospital visits. Among married individuals, a greater social network was associated with lower total care costs, outpatient costs, and fewer primary care visits, while for unmarried individuals, lower perceived social environment was related to increased physician visits.

Distinct subgroup patterns of social relationships were identified by means of cluster analyses. In the perceived social environment cluster analysis, members of cluster 3 had the lowest levels of social environment, specifically, intellectual-cultural and active-recreational orientation. These individuals also had the lowest levels of education and income, were older, and had the most health problems. It is possible that the intellectual-cultural and active-recreational orientation scales represent indirect assessments of activity and involvement. This group may therefore be more isolated than the rest of the sample and/or their disorders are preventing them from interacting with others. This inference is in agreement with the findings of Coulton and Frost (1982), who reported that more socially isolated elders use fewer services (including physician and mental health professionals). Our sample was composed of relatively healthy individuals who are still mobile, but once their health deteriorates and they become less self-sufficient, these individuals are likely to have less support and access to medical attention. Thus, those individuals identified as being isolated might be at a greater mortality risk. In addition, clusters 1 and 4 showed the highest levels of cohesion and expressiveness and had the fewest health problems. Perceived cohesiveness in one's family and freedom to express oneself may ensure a supportive social network, which moderates stress and decreases health risks.

The examination of structural social network using cluster analysis revealed that members of cluster 2 had significantly lower levels of social interaction except for high church attendance; members of this cluster also had the highest estimated health care costs. Despite an involvement with church, individuals who lacked a social network were more likely to have more severe health problems. Cluster 1 and cluster 3 were characterized by greater social interactions. Members of these two clusters also tended to be younger and have the lowest estimated health costs. This relationship is not surprising considering that increased age is generally associated with greater disability and less social interaction, which is related to greater health problems.

Explanation of Findings

The thought that a supportive social environment and extensive social networks are beneficial to the maintenance of health is intuitively appealing. However, it is important to consider what specific factors of social relationship are related to health outcomes. While community studies find general support for the hypothesis that supportive social relationships are related to lower mortality risk, the strength of the association varies among subpopulations or cohorts studied. In addition, the reported strength of the associations also differs because different measures of social relationships and different operationalizations of health status are used. Smith, Fernengel, Holcroft, and Marien (1994) conducted a meta-analysis of the effects of different types of social relationship on physical, psychological, and stress-related health outcomes across 67 studies. Similar to the findings reported here, these researchers reported that social relationship explained only a relatively small amount of health outcome variance.

One explanation for our failure to find consistent and high associations between measures of social relationships and indicators of health outcomes is that, in general, participants of our study tended to be quite healthy. All participants were members of an HMO and therefore had adequate access to health care as long as they were members. Second, this sample represents primarily the upper 75% range of the socioeconomic spectrum (Schaie, 1996). Socioeconomic status (SES) is known to be highly related to better health.

Our findings that high SES was related to fewer health problems are similar to those observed in past studies (House, 1987; Slater, Lorimar, & Lairson, 1985). Higher SES has repeatedly been shown to be associated with better health status (Slater et al., 1985). The gender differences in this study were also similar to results of previous studies. Women were more likely to seek medical attention than men and were more likely to use more medications than men.

Similar to previous studies (Ross & Mirowsky, 1989), we found evidence that married persons tend to have fewer physical health problems than unmarried persons. Specifically, married individuals had fewer estimated total health care costs, outpatient costs, and primary care visits than did unmarried individuals. Various medical studies have shown reduced morbidity, faster recovery, and lower mortality following medical problems for married patients (Evashwick, Rowe, Diehr, & Branch, 1984; Ross & Mirowsky, 1989; Wingard, 1984). A variety of mechanisms have been suggested for the protective effects of marriage in reducing the risk of mortality and morbidity, including the association of caregiving in times of illness or poor health and the fact that marriage encourages healthy behaviors and discourages risky or nonhealthy ones. Umberson (1987) found that marriage and parenthood reduce the occurrence of a number of health-threatening behaviors such as problem drinking, drinking and driving, substance abuse, and other risk taking.

We assumed that a more extensive social network had a cumulative positive and beneficial influence. A greater number of friends, confidants, visits, and hours spent in church or synagogue was therefore thought to be related to fewer health problems. However, investigators have begun to consider that not all social relationships are supportive; every relationship involves costs and benefits. Rook (1984) speculated that when people answer questions pertaining to the amount of social support they receive they give summary assessments that include positive as well as negative, stressful perceptions. It was also assumed that a negative association between supportive social relationships and subsequent morbidity implied the protective influence of social relationships. However, Berkman (1986) points out that a decrease in social ties may be a consequence rather than a cause of illness. Hence, a negative correlation between social relationship and health can reflect the inability of the sick to maintain social roles and relationships (Forster & Stoller, 1992).

Methodological Contribution

The third goal of this study was to investigate how two distinct analytical techniques could be used to complement one another in the study of social relationship and health. SEM is one way to examine the observed relationships between a set of variables. However, these relationships may express the fact that across a large and heterogenous sample, a relatively small association occurs between health and social relations, as in this study. Cluster analysis, by contrast, provided a means to identify those subgroups of individuals that displayed a strong association between health and social relationship. This analysis also permitted us to identify those few persons who were at an increased risk of morbidity because of a lack of social relationships. For instance, there were 22 individuals who had low levels of activity and involvement and subsequently had more diseases and health care costs than the rest of the sample.

In addition to examining the direct linear relationship between two variables, cluster analysis provides one way to capture the more complex interactions that exist between social relationships and health. For example, there was evidence to suggest that those individuals who had the lowest levels of perceived social environment (low levels on the intellectual-cultural and active-recreational orientation) also had low levels of education and income, as well as greater health problems.

Variable-oriented techniques are useful in testing theories and specific hypotheses. Person-oriented approaches also can be used to test hypotheses such as nonlinear relationships and generate hypotheses through data exploration. In addition, cluster analysis provides a way of identifying the dominant characteristics within the linear model and isolating those cases that do not match the assumed linearity of the model. However, cluster analysis has certain limitations that reduce its popularity for applications by social scientists, one of which is that, by definition, multiple clusters will always be found. Concerns have also been expressed regarding generalization when using cluster analysis; cluster groups may be a unique artifact of the particular data set analyzed. As with any analytical technique, results should be replicated and validated.

Models and methods that use individuals as the conceptual unit of analysis to investigate subjects in terms of patterns are needed to complement the more popular regression methods for data analysis. Typologies of support patterns may be particularly useful for gerontological research because of the increased differentiation among older adults, and because nonlinear analytical approaches allow researchers to examine heterogeneity of their samples.

ACKNOWLEDGMENTS:

This research was supported by grant R37 AG08055 from the National Institute on Aging to the second author. The first author was supported by a predoctoral fellowship training grant from the National Institute of Mental Health (T32 MH18904-07) and a postdoctoral fellowship training grant from the National Institute of Mental Health (5 T32 MH191909-08).

The study was conducted as part of the first author's master's thesis under the direction of the second author. The authors gratefully acknowledge the members and staff of the Group Health Cooperative of Puget Sound for their enthusiastic collaboration. The authors acknowledge earlier comments by Rebecca A. Essinger, Robert C. Intrieri, Ilene C. Siegler and Steven H. Zarit. We also thank Anna Shuey for her help in preparing the manuscript.

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Received October 29, 1995
Accepted April 28, 1997