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The impact of social networks on mortality, disease incidence, and disease progression

Mary Bahner Maxwell
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<https://doi.org/10.15760/etd.451>

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THE IMPACT OF SOCIAL NETWORKS ON MORTALITY,
DISEASE INCIDENCE, AND DISEASE PROGRESSION

by

MARY BAHNER MAXWELL

A dissertation submitted in partial fulfillment of the
requirements for the degree of

DOCTOR OF PHILOSOPHY
in
URBAN STUDIES

Portland State University

1985

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ACKNOWLEDGEMENTS

The extent of support from my social network, both personal and professional, as I undertook the preparation of this dissertation has been overwhelming. Due to the generosity of key members of the staff at the Portland Veterans Administration Medical Center and the Kaiser-Permanente Center for Health Research, I have been provided resources for the accomplishment of this dissertation which I never dreamed possible one year ago. I also wish to thank those individuals who have so generously worked with me during the past year as I developed from clinician to researcher.

First, I express my deep gratitude to Dorothy Magedanz, R.N., M.S., Chief Nurse at the V.A. Medical Center, who was willing to allow me time from my clinical responsibilities to conduct this project. Her vision and perseverance helped secure an educational leave so that I could be at the Kaiser Center to learn research. Also on the V.A. staff, I thank David Hickam, M.D., coordinator of the Health Services Research and Development Program, for his advice and encouragement. He fortuitously put me in contact with Donald Freeborn, Ph.D., Senior Investigator at the Center for Health Research, who introduced me to the possibilities at the Center. Dr. Freeborn has provided a

consistent supportive link between the two institutions as the project went forward.

Next, I am grateful to my new colleagues at the Kaiser Center. Of primary importance is Clyde Pope, Ph.D., who is my preceptor at the Center and a member of my dissertation committee. Dr. Pope generously let me use the data from his household interview survey, and oriented me to the organization and interpretation of the complex data files. John Muloolley, Ph.D., has patiently provided statistical expertise. Tom Vogt, M.D., has given the epidemiological perspective, often mingled with the philosophical. Many others at the Center have assisted me in mastering the technical aspects of research. I particularly thank Marilyn Drichas, Lois Drew, Jan Blank, and Dan Azevedo.

To Nancy Chapman, Ph.D., Professor of Urban Studies at Portland State University, who chairs my dissertation committee, I owe a special debt. She has encouraged me from the beginning, and been most generous in giving of her time and advice. I thank also Berit Ingersoll-Dayton, Ph.D., and Sy Adler, Ph.D., who served on the committee.

Finally, my dear husband and children have faithfully endured these years of training, and rejoiced in my progress. My special thanks and love to Farley, Robin, Anne, and Paul.

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AN ABSTRACT OF THE DISSERTATION OF Mary Bahner Maxwell for
the Doctor of Philosophy in Urban Studies presented May 3,
1985.

Title: The Impact of Social Networks on Mortality, Disease
Incidence, and Disease Progression.

APPROVED BY MEMBERS OF THE DISSERTATION COMMITTEE:

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Seymour Adler

Cost-effective methods to maintain the health of urban
citizens are essential. Social factors have been shown in
prior research to be related to disease and its outcomes.
Several recent longitudinal studies of large community
populations have revealed that people with more extensive
network resources live longer. However, it is not known
whether this occurs because social ties prevent disease or
retard its progression once it occurs. Being able to

delineate when on the health/illness continuum social connections are important would make possible policy directed more specifically at either disease prevention or disease control.

The purpose of this research was to: (1) determine the relationship between social network indicators and mortality in an urban sample; (2) extend that knowledge by addressing the relationship between networks, disease incidence, and disease progression, and (3) delineate which specific network sectors were the strongest predictors of health outcomes. This was uniquely possible because measures of the three dependent variables were available within the same data set at the Kaiser Permanente Center for Health Research. The research design was longitudinal, based on survey data. The conceptual framework posited that social support delivered via social networks modifies disease states.

The setting was the Northwest Region, Kaiser Permanente Medical Care Program, an HMO serving the Portland-Vancouver SMSA. The sample includes 2603 adults who participated in a 1970 household interview survey. Their health service utilization data from 1967-73 has been computerized and linked with the survey information. As of 1982, 376 have died.

To measure the independent variables, four summary social network indexes (scope, size, frequency of contact,

and interaction) were prepared according to a network model based on the survey questions available, network theory, and prior research. Indexes representing relationship domains (spouse, children, family of origin, relatives, work, close friends, other friends, organizations, and social leisure) were constructed. Control variables included age, sex, socioeconomic status, health status indicators, and health behavior measures. Multiple logistic regression was used to assess the first hypothesis because mortality was a dichotomous variable. Since the other two outcomes were continuous, ordinary regression was used.

Each of the four summary network measures was a statistically significant predictor of 12 year mortality. Network scope was the strongest predictor. When broken down into relationship domains, marital, family, and kin relationships were not predictive of death, although almost all relationships were in the expected direction. Only the extended ties of close friends, other friends, work associates and social leisure activities were significant predictors. There was no relationship between network scope and either disease incidence or disease progression, so it is still unclear how social connections act to decrease mortality. To put the network contribution in perspective, only .01 of the total variance in the logistic regression

model of why people in the study population died was due to social factors.

This study of an urban community population in the Pacific Northwest confirmed evidence from other parts of the country that summary measures of the social network are associated with mortality and indicated that friends are the most health-protective part of the network.

CHAPTER I

INTRODUCTION

Since earliest times, humankind has speculated about disease. Why did some members of the group fall ill while others remained healthy? When more than one individual had the same symptoms at the same time, what caused the variations in the time some people took to recover from the illness, or, for those less fortunate, what caused the variation in the time till they died? With the dawn of the scientific era and the microscopic identification of disease-producing organisms, the sources of illness began to be identified. However, overwhelming microbial agents are unable to explain the occurrence of many diseases in modern technological society.

More than two-thirds of the people in the United States today dwell in cities. Historically, cities were unhealthy (Gluck & Meister, 1979). Even as late as the turn of this century, disease bred in overcrowded urban areas where large numbers of people had congregated because jobs were available as a result of industrial development (Berry, 1973). Sanitation was poor, and public health programs were just beginning.

Now the major infectious diseases have been controlled. Instead of tuberculosis, typhoid, and smallpox being the leading causes of mortality, illnesses such as heart disease, cancer, and stroke now claim most lives. These chronic illness etiologies are not well understood, and appear to be related in complex ways to lifestyle and the environment (Dubos, 1965). With current treatment methods, people with such diseases often live for long periods of time. There is a constant search for ways to eliminate, or at least modify, the chronic illness killers of our time.

In post-industrial society where technology has made the treatment of disease once it has occurred extremely expensive, finding cost-effective methods of disease prevention and the maintenance of the health of citizens is imperative. Two current trends in this direction are pertinent to urban community health. The first involves the movement to modify individual lifestyles by decreasing health destructive behaviors such as cigarette smoking, overeating, and lack of exercise. Maintaining social isolation is also considered a negative health behavior. The second movement involves the attempt to manipulate the social environment of people to provide more social support: self-help support groups, neighborhood centers, and programs for the elderly using volunteers are examples of this

approach. The attractiveness of these movements is that they do not need to be costly.

Both of the movements cited above involve the notion that disease can be prevented, or at least controlled, by social factors. However, exactly where social influences may be most pertinent on the health/illness continuum has not yet been determined (House, 1982). This is important to know, because if social support is more important in disease incidence, social and health policy in the area of prevention would be most appropriate. If, on the other hand, social ties function primarily to prolong survival, intervention after disease is apparent would be most in order. In this case, social support would be considered a form of therapy.

The two trends in community health described above can be traced in part to a seminal study first reported in 1979. In that year, Berkman and Syme published an exploratory study of a large community population from Alameda County, California, which reported that people with more extensive social networks lived longer. This study generated widespread interest because it implied that health of individuals and communities could be improved simply by increasing social interactions. Berkman and Syme speculated that the mortality differentials they obtained may have been due to social networks enhancing resistance to the occur-

rence of disease, or that, once ill, people with more social resources may have experienced slower progression of disease.

Within a short time, other investigators with longitudinal data sets from communities in others parts of the United States reanalyzed their data looking for similar network/mortality relationships. More rigorous controls and methodologies were used. Some found the same results as Berkman and Syme, others found them with less clarity, and a few did not find them at all. Thus, it is still unclear whether social networks do prolong life, to what degree, and exactly how they do this. The question of whether mortality risk is lower because social factors act to lessen disease incidence or act to retard disease progression has not yet been explored within the same data set where the network/mortality relationship is assessed. There are few places where the type of data needed for such an analysis is available.

The major purpose of this research is to determine the relationship between social networks and mortality in a basically healthy population of members of a large urban health maintenance organization which is located in Portland, Oregon. An attempt is then made to delineate whether social factors influence disease incidence or disease progression within this population. This research is important because it attempts to extend our knowledge of

the networks/mortality relationship by addressing the reasons behind the association of social factors with death. It is significant in that outcomes related to disease incidence, progression, and death are available within the same unique high quality longitudinal data set.

If social connections are significant predictors of mortality or the disease outcomes, it is important to know which specific aspects of the network are the most pertinent predictors. Thus, a secondary research aim involves exploring network components in relation to the outcome variables.

BACKGROUND

The notion of socially-induced stress as a precipitating factor in disease has gained wide acceptance. It has been found that a variety of social factors in the environment are associated with morbidity and mortality, including such factors as socioeconomic status, marital status, migration, social disorganization, occupational strain, and geographic mobility [Berkman, 1982; Cassel, 1974, 1976; McQueen & Siegrist, 1982]. Dubos (1965) recognized that even susceptibility to microbial infectious disease was probably a function of environmental conditions leading to physiological stress on the individual, rather than simple exposure to an external source of infection. For the past

twenty-five years, the role of stressful life events (i.e., divorce, job loss, bereavement) in the etiology of various disorders has been a productive field of research. In both retrospective and prospective investigations, modest but statistically significant relationships have been found between increased life changes and the onset of sudden cardiac death, myocardial infarction, accidents, diabetes, tuberculosis, and a variety of more minor disorders. For reviews of this literature, see Dean and Lin (1977), and Dohrenwend and Dohrenwend (1974; 1981), Rabkin and Struening (1976). Life events may also be related to the course of illness and recovery, whatever the etiology of the primary disease (Kagan & Levi, 1974).

Psychosocial stress may be moderated by supportive social relationships. Although still controversial, during the past 15 years research and theory have pointed to social support as protecting or buffering individuals against life stresses and their negative impact on health (Cassel, 1976; Cobb, 1976; Dean & Lin, 1977; Kaplan et al., 1977). This has been termed the "buffering Hypothesis" (Thoits, 1982). Social support also appears to have a direct effect on health (Gore, 1981; Thoits, 1982). The effect of social support does not appear to be limited to any one disease state or organ system and ranges from mental to physical (Antonovsky, 1979; Berkman & Syme, 1979; Broadhead et al., 1983; Cassel, 1974, 1976; House et al., 1982). Many

theorists consider the chronic diseases to be particularly influenced by stress and thus social support (Berkman & Syme, 1979; McQueen & Celentano, 1982; Rabkin & Struening, 1976). Although there have been a variety of cross-sectional and retrospective studies of small specialized groups which have addressed social support and its effects on health, few longitudinal studies have been conducted which used samples from general populations.

Recently, however, three major longitudinal studies involving community samples have been reported (Berkman & Syme, 1979; Blazer, 1982; House et al., 1982) that show a direct impact of social networks/support on mortality. Berkman and Syme (1979), in a nine-year mortality follow up of a representative sample of 6928 adults in Alameda County, California, first surveyed in 1965, found that individuals with few social and community ties were more likely to die in the ensuing years than those with more extensive relationships. Berkman and Syme's publication generated much attention from social epidemiologists and believers in wellness promotion. Its wide impact was probably due to the size and design of the research, the magnitude and clarity of the outcome, and the fact that apparently merely having a network in itself was protective (Schoenbach et al., 1983). The quality of the support provided by the network or the amount of stress it buffered against was not assessed in the

Berkman and Syme study. Subsequent studies have yielded conflicting support for the Berkman and Syme findings. House, Robbins, and Metzner (1982), in a similar study of a cohort of 2754 adults from a more rural community population in Tecumseh County, Michigan, found the same relationship between social connections and mortality after ten years. However, this only reached statistical significance for men. Blazer (1982) assessed social support along three parameters (these will be discussed in Chapter II) in a community sample of 331 persons 65 years of age and older in Durham County, North Carolina. These parameters significantly predicted mortality after 30 months. The Schoenbach et al. (1983) findings were more modest and Zuckerman et al. (1984) were unable to find relationships between social networks and mortality. Schoenbach states that because Berkman and Syme and House et al. did not employ a priori, specifically-defined social network variables, the results of their studies are open to suspicion.

The work of Berkman and Syme, House et al., and Blazer is unable to determine what produced the positive network mortality relationships they obtained because only death certificates were available to them as outcome measures. Although mortality is an important endpoint in epidemiological studies, it is not possible to be specific about where on the health/illness continuum social support is having its effect. As Berkman and Syme and House et al. have noted,

there are two possible ways in which social relationships may impact on mortality: by affecting the occurrence of disease (early on the continuum) or by affecting illness progression (late on the continuum).

Cassel (1976) believed that social processes affected disease incidence. He theorized that such processes, acting as "conditional" stressors, increased the susceptibility of the individual to disease causing agents in the environment by altering the endocrine balance in the body. He envisaged social processes as thus enhancing susceptibility to disease. However, in light of the aforementioned research involving community populations that delineated the networks/mortality relationships, social processes must have also affected people already stricken with disease. Not all people in a community population are in an optimum state of health. The mechanism postulated by Cassel could have been in operation, but in a different context. Social processes could have enhanced the susceptibility of diseased individuals to the physiological decline inherent in the particular disease process and hastened their demise. Thus, the next step in furthering our understanding of how social networks influence disease processes is to sort out where social connections are important.

CONCEPTUAL FRAMEWORK

The conceptual framework for this study, which is outlined in Figure 1, is based upon stress theory as it relates to the course of physical illness. In this model, support can buffer ubiquitous environmental stress and can directly affect disease. The elements of this conceptual framework are described next.

Stress

The original definitions of stress were developed by Cannon, Selye, and Wolff (Hinkle, 1973). The experience of a threatening or harmful stimulus (stressor) interacts with both physiological and psychological processes to evoke responses in organisms (stress) which influence physical and mental states. Stressors may be physical or psychosocial. A stressor may be life threatening, signal the loss of relationship or object, or represent an attack on one's belief system. Stress leads to a sustained state of arousal which is catabolic. The sustained physiological mobilization of the organism has biochemical outcomes which predispose the organism to morbidity and ultimately, mortality (Renner & Birren, 1977). For a recent detailed exposition of the neuroendocrinological mechanisms involved in the stress/illness relationship, see Henry (1982). Thus, psychosocial processes acting as stressors will, by altering

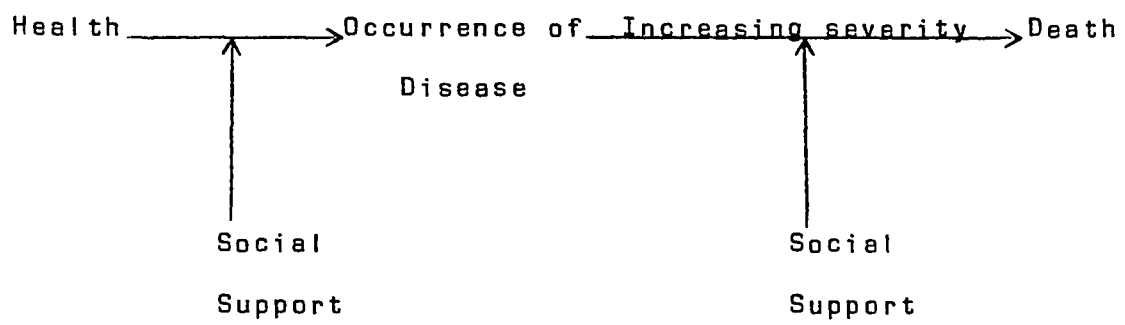


Figure 1. Conceptual framework.

the endocrine balance in the body, decrease the resistance of the organism to direct noxious stimuli. The psychosocial processes can be envisaged as enhancing susceptibility to disease. The clinical manifestations of this enhanced susceptibility will not be a function of the particular psychosocial stressor, but of the physiochemical or microbiological disease agents harbored by the organism or to which the organism is exposed. Disease manifestations will also be determined by constitutional factors, which in turn are a function of genetic endowment and previous experience (Cassel, 1974). These latter factors have been outlined in detail by Antonovsky (1979) in his salutogenic model of health. Kasl has recently critically reviewed the research linking stress to health (1984).

Social Support

Social support as a construct has been defined in a number of ways (Antonovsky, 1979; Caplan, 1974; Cobb, 1976; Kahn & Antonucci, 1980; Weiss, 1969;]. Most of the definitions contain some idea of dimensionality, reciprocity, and the implication of feedback from face-to-face interaction. For instance, the characteristics of social support described by Caplan (1974) include the notion that social support occurs through enduring relationships which provide help for the individual in mobilizing psychological resources and mastering emotional burdens, sharing tasks,

and providing material supplies, skills, and cognitive guidance. The social support system functions by offering information, guidance, and feedback to the individual and by acting as a refuge or sanctuary where the individual may experience stability and comfort. Barrera and Ainlay have recently reviewed the literature discussing the structure of social support (1983).

In terms of the stress model discussed above, it has been theorized that social support exerts a protective effect which buffers the individual from the physiological or psychological consequences of exposure to stressor situations (Cassel, 1975; Cobb, 1976; Rabkin & Struening, 1976). Social support can have direct effects on health as well (Gore, 1981; LaRocco, 1983; Thoits, 1982). For example, in instances of negative life events such as bereavement, network support can modify resultant stress which could lead to negative health outcomes (Walker et al., 1977). This is an example of a buffering effect of support. In terms of a main effect, ongoing network support may operate to promote health when no stressful events have occurred. Because there are no measures of stressful life events available for this research, it primarily assesses a direct effect model.

Social Networks

The way in which social support has been operationalized varies from study to study. Most measures fall into

either the category of quality or content of interpersonal relationships or quantity or structure of relationships. Some instruments measure both. For measuring the quantity of relationships, a social network model (Fischer, 1977; Mitchell, 1974) has often been used (Berkman, 1977; Liem & Liem, 1975; Tolsdorf, 1976; Walker et al, 1977). This has led to scoring network data which provide information about the network as a whole (size, density, functionality) and about the various types of support available to the individual through his or her ties to others. Mitchell and Trickett (1980) and Wellman (1981) have discussed applications of network analysis in social support research and the role of social networks in mediating the provision of support.

Disease

A disease is a well-defined model of a process of disruption in the normal homeostasis of psychological-physiological systems (Gonnella et al., 1984). Diseases can be broadly categorized as acute or chronic, and physical or emotional. Chronic diseases are physiological disorders of long duration which are noninfectious. They are syndromes which may have a long incubation phase and with which an individual may live for many years before death. They are often treatable and able to be stabilized by modern medical methods, but are not "cured" in the usual sense. Some

chronic diseases are serious and imply a shortened life span and/or physical impairment.

The incidence rate of a disease is the number of its new cases, in a defined population at risk, over a period of time. The preferred method for determining incidence is prospective surveillance of a cohort who are assessed for a variety of possible risk factors and are monitored for the development of new cases (Kasl, 1983). If the monitoring of the new cases of disease were to continue for additional medical outcomes, this process would become a study of the course or progression of the disease.

Health is a state of optimal biopsychosocial functioning.

Death is the absence of life.

HYPOTHESES

Given all of the foregoing and controlling for the major confounding factors (these will be discussed later) that would be expected to operate independently of stress in causing morbidity and its outcomes:

1. Adults with more social network resources will have less risk of death.
2. Adults with more social network resources will have lower incidence of disease.

3. Adults with more social network resources will have less disease progression.

Details of the operationalization and measurement of the social network, mortality, disease incidence, and disease progression variables are given in Chapter IV. Some discussion is appropriate now to explain hypotheses 2 and 3. When a person develops an illness, he or she comes to the health care system and uses its services for treatment. The first contact with the system usually indicates a new illness is occurring. If hypothesis 2 is correct, people with more social connections would have less of these contacts than those with fewer connections. After a person becomes ill, the amount of contact with the health care system is usually in proportion to the gravity of the physical problem. As the individual becomes sicker, more office visits are likely to occur and more resources are likely to be used over time to maintain as healthy a state as possible in the face of decline. Thus, if hypothesis 3 is correct, people with more social network ties should have slower illness progression and hence use relatively less health care and require fewer resources over time. Those individuals with minimal network connections would be expected to have a deterioration in their health status over time and concomitantly use relatively more resources and care.

OVERVIEW OF METHODS

To test the hypotheses that social network resources affected death, disease incidence, and disease progression, an existing longitudinal data set at the Kaiser Permanente Center for Health Research was utilized. A detailed explanation of this institution and this data set is offered in Chapter III. Briefly, a random sample of subscribers to the Northwest Region of Kaiser Permanente, selected in 1967 when the Center for Health Research began, has continuously had all details of its health care utilization computerized for research purposes. In 1970, a subsample of this group was selected to be the focus of an extensive household interview. The details of this survey are also explained in Chapter III. The survey elicited information of a demographic, economic, social, and attitudinal nature in terms of lifestyle and health from over two thousand adults. Social network information included 26 questions about numbers and interaction with family, friends, co-workers, and community organizations. The survey information on each individual has been linked to his or her health care utilization information, which comes from each person's medical record. This linkage of the two types of information is available from 1967 to 1973.

Thus, this dissertation uses a longitudinal design based on survey research which had been conducted in the

past for the purpose of describing Kaiser Permanente members. The dependent variables are mortality, disease incidence, and disease progression. The independent variable of major substantive interest is the social network. The research design includes nine control variables known also to affect the network/mortality relationship. The sample comprised the 2603 adult members of Kaiser Permanente surveyed in 1970, 376 of whom had died as of the end of 1982.

First a conceptual model of the social network construct was developed a priori based on the available questions from the household interview survey, network theory, and previous network/mortality research. The model is presented in Chapter IV. It features four structural network dimensions and several source and relationship domain dimensions. These dimensions were operationalized by combining 26 pertinent questions from the survey. Four overall network indexes were constructed: network scope, network size, frequency of contact with the network, and network interaction. Source indexes assessed family, friend, and community interactions. This model was tested for validity by subjecting its components to factor analysis. Reliability of the indexes was assessed by coefficient alpha.

Second, the control variables to be used in the study were selected from the many variables existing on the data files. These nine control variables included three demographic variables, three health behaviors, and three physical health status indicators. Age, sex, and socioeconomic status were the demographic variables. The three health behaviors related to smoking, drinking, and physical exercise. The three physical health status indicators were perceived health, length of hospital stay, and outpatient contacts with the health care system. These were selected for inclusion in the model by assessing the correlation of several available health status variables with each other and with mortality.

Next, the dependent variables were developed. Mortality within the 12 year period (1971-82) was the first dependent variable. The total incidence of new disease during a seven year period was the second independent variable. The assumption was made that there would be minimal network changes three and a half years before the survey, and three and a half years after because network changes usually occur slowly over time. Operationally, this variable was a simple count of all doctor's office visits made by respondents between the years 1967 and 1973 for a new illness or a new episode of disease or illness.

It was assumed that if social networks affected disease progression, this would be revealed by changes in

health service utilization over time. In other words, people getting sicker would use more resources and would need to make more contacts with the health care system over time. If networks were influential in hastening disease process, as hypothesized, people with more large networks would have a lower rate of use of health services than those with smaller networks.

Finally, to assess hypothesis 1, that more social network resources would result in reduced mortality, a logistic regression approach (Walker & Duncan, 1967) was used. This was preferable to multiple linear regression because mortality is a dichotomous variable and does not meet the assumptions for the more familiar regression method. Because a loglinear logistic approach was used, the continuous independent variables had to be collapsed. First, each control variable was evaluated independently against mortality, then with age entered as a control. This process was completed in order to eliminate variables not significantly predicting mortality so as to have the most parsimonious model. The final equation consisted of age, sex, and two of the health status measures, with the network measure entering last. Then, different parts of the network and various social relationship domains were tested to evaluate which aspect of the network was most important in predicting mortality.

For hypothesis 2, that social network resources would decrease disease incidence, a multiple linear regression approach was used. This was appropriate because disease incidence was measured on an interval scale. The demographic and health practices variables were used as controls.

Hypothesis 3 also involved using multiple linear regression to assess the relationship between networks and disease progression, which was also measured on an interval scale. In this model, only the demographic variables were used as controls.

In summary, this research uses regression techniques to explore relationships between social networks and mortality, disease incidence, and disease progression. The major aim is to probe reasons behind the networks/mortality association. A related aim is to assess which specific network components (i.e., spouse, relatives, friends, co-workers) are most predictive of health outcomes. An overview of the background, theoretical framework, and methods was given in this chapter.

Chapter II presents a review of the literature upon which the study was based. Chapter III discusses the data sources and sample to be used in the analysis. The focus is upon the structure of the existing information system as encountered at the Kaiser Permanente Center for Health Research before any manipulation to accomplish the aims of

this dissertation began. Chapter IV explains methodology. It highlights the social network index construction and preparation of the variables used in the research and the statistical procedures to which they were subjected. Chapter V gives the results obtained by the research, while Chapter VI features a discussion of these findings. Policy implications and suggestions for further work are given in Chapter VII.

CHAPTER II

REVIEW OF THE LITERATURE

Social epidemiology is a field of inquiry wherein the social factors leading to disease incidence, prevalence, progression, and death in large population groups are studied. As described in the previous chapter, the epidemiologist Cassel was one of the first to suggest that social support might be a causal factor in disease etiology (1976). This chapter reviews the literature on social support and social networks as variables in the biopsychosocial theory of disease.

The first section of the chapter addresses the construct of social support as well as the approach of social networks to its measurement. After tracing the origin of these ideas, the focus of the discussion is on describing the network concepts used in fashioning the network indexes for this dissertation. The second section of the chapter describes the mortality studies done since 1977, and, in particular, how the social networks were measured. Also featured are the recent studies shedding light on variables which confound the networks/mortality relationship. The third section of the chapter reviews empirical evidence for

the disease incidence hypothesis as opposed to the disease progression hypothesis.

PART I. SOCIAL NETWORKS

Social Support

The social support construct is rooted in classical sociology. As early as the turn of the century, Emil Durkheim (1950) had suggested that individuals who were not integrated into society were more likely to attempt suicide. Parsons (1951) suggested that the most important element of any aspect of social control was "support." He believed support served to provide reassurance to the individual, impeding the use of aggressive behavior to satisfy needs.

More recently, earlier terminologies have been subsumed under "social support" in reference to the processes by which interpersonal relationships protect people from the harmful effects of stress. Cassel (1976) was the first to suggest that social support buffered stress and reduced illness and its negative outcomes. Many studies have since appeared in the literature in an attempt to document this (Andrews et al., 1978; Barrera, 1981; Bloom, 1982; Davidson et al., 1981; Dimond, 1979; Eaton, 1978; Funch & Marshall, 1983; Gore, 1978; Henderson et al., 1978A, 1978B; Holahan and Moos, 1981; Langer et al., 1975; Liem & Liem, 1976; Lin et al., 1979; Lowenthal & Haven, 1968; MacElveen, 1972; Medalie & Goldbourt, 1976; Mermelstein et al., 1983; Norbeck

& Tilden, 1983; Nuckolls et al., 1972; Reed et al., 1983; Schaefer et al., 1981; Turner, 1981; Williams et al., 1981; Woods & Earp, 1978; Winnubst et al., 1982, are but a few), as well as numerous review articles (Berkman, 1984; Broadhead et al., 1983; DiMatteo & Hays, 1981; Ell, 1984; Heller, 1979; Jung, 1984; Thoits, 1982; Wallston et al., 1983; Wortman, 1984). Although there is yet no consensus on the nature, meaning, and measurement of social support (see Chapter I for definitions and types), many researchers claim that social support has positive effects not only on physical health but mental well-being (see Leavy, 1983; Mueller, 1980; and Henderson, 1984 for reviews). However, Wallston, Alaga, DeVellis, and DeVellis (1983), in a critical review of research linking social support and physical health, note that the evidence supporting this relationship is actually weaker than often claimed.

Social Networks

Meanwhile, in the course of ethnographic research, anthropologists had described many aspects of the social relations of the peoples they had studied. It remained to J. A. Barnes in 1954 to give the metaphoric concept of "network" concrete meaning in his classic study of a Norwegian fishing village (Whitten & Wolfe, 1973). Barnes used concepts from mathematical graph theory to describe an individual's social field in terms of the linkages sur-

rounding him or her. This type of network was termed a "personal" or "ego-centered" network. In contrast, the term "social network" was originally used to refer to the total set of linkages among all members of a particular population. More recently, however, the term social network has been used to refer to both microscopic and macroscopic types of networks [Mitchell & Trickett, 1980].

The network concept was quickly adopted by Elizabeth Bott (1955), whose studies of urban London families were widely read. Since then, network concepts have proved useful tools for analyzing groups as disparate as preliterate tribes, extended families, and complex bureaucratic organizations. Network analysis has especially helped to advance urban studies [Fischer, 1977, p. 20]:

The nature of urban life, opaque and confusing when viewed through the typical sociological perspectives, becomes much clearer and more amenable to investigation when looked at with network analysis.

A social network is a specific set of linkages among a defined set of persons. The overall structure of the network and the characteristics of the linkages may be used to interpret the social behavior of the persons involved. Information, goods, and services transmitted within networks are called social network support. A number of useful conceptual tools are available in applying a network analytic framework to health and social support [Craven & Wellman, 1973; Fischer, 1977; Mitchell, 1974].

Network Structure. To examine the overall structure or morphology of a network, patternings have been delineated which allow for classification. These include: size (number of actors in the network), clustering (extent to which distinct clusters of dense links exist within the network), density (extent to which members know each other independent of the focal person), and dispersion (range of sources of social contacts from which the links are established). Other structural properties are termed anchorage, reachability, range, and homogeneity. The structural form of the network is important because it influences the flow of resources through specific ties (Wellman, 1981).

Network Linkages. The links in a network can be studied quantitatively. Terminology describing linkages includes: sector (the social context from which the link emerged), frequency (the number of times contact is made), duration (how long the link has been in existence), symmetry (the balance of exchanges across a link), multiplexity (the number of different role relationships or distinct activities, exchanges, dependencies, or modes of interaction), intensity (degree of commitment in a link), and intimacy (degree of closeness). By constructing a profile of each link or an average for a set of links in terms of these dimensions, a sense of the range of functions performed by the social network for its members can be obtained.

Network Sources. People obtain support for different types of needs and crises from various patterns of immediate family, extended family, friendship circles, neighbors, and colleagues from school, church, or the work place. Role theory helps to distinguish the attributes of various sources of support that have the greatest consequences for health maintenance (Piilisuk & Froland, 1978).

Personal networks have often been diagrammed as a series of concentric circles radiating out from a focal individual (Berkman, 1977; Kahn & Antonucci, 1980; Maxwell, 1982). The center circle represents the individual being studied. The next circle, the personal cell, includes closest relatives, i.e., immediate family and perhaps most intimate friends. A farther zone includes very close relatives and friends with whom there are less intimate relations. Friends and relatives with whom one has more passive but still emotionally important relations comprise the next zone. The zone following contains people who are important in a pragmatic sense for the logistics of daily life. The most distant zones include people who are known by the individual but have no great importance in the individual's life. Separating network linkages into different sources is necessary because exchanges tend to occur differentially within each zone.

Exchanges. Social exchange theory promulgated by Blau (1964) views society as structured by its transactions.

Exchange refers to the content of the linkages between people. Exchange has been operationalized by McCallister and Fischer (1978) as an interdependence between two individuals whereby the behaviors of each impact directly on the outcomes of the other. Social support can be considered a type of exchange commodity. Although there have been many conceptualizations of social support (see Chapter I), the categories of social support offered by House (1981) can serve as an example.

House outlines four general categories of support that flow back and forth from the focal individual to his network members: (1) emotional support (esteem, affect, trust, concern, listening); (2) appraisal support (affirmation, feedback, social comparison); (3) informational support (advice, suggestion, directives, information); (4) instrumental support (aid in kind, money, labor, time). There appears to be a division of labor in providing support between different roles and zones in an individual's personal social network.

Litwak and Szelenyi (1969) examined the helping functions of kin, neighbors, and friends. They concluded that neighbors can best handle immediate nonrecurring emergencies, kin are most important for long-term commitments and material assistance, and friends can help in areas that require agreement, moral support, and positive affect. Each

sector of an individual's network may provide a unique part of his or her overall support. There is undoubtedly much overlap, and substitution occurs. The nuclear family provides intimacy, nurturance, and reassurance of worth (Berger & Wuescher, 1975). The presence of a confidante buffers against losses (Lowenthal & Haven, 1968). Linkages in the community sector serve for problem-solving, social integration, joint action, screening and referral, as well as transmittal of cultural values and norms. Whether there is a differential effect from these various kinds of exchanges in fortifying and strengthening the individual from adverse health consequences is unknown. Johnson (1983) found that among a population of older people, the most comprehensive and least stressful support was provided by a spouse. Many studies have shown positive health benefits from being married (Asher, 1984; Berkman & Syme, 1979; House et al., 1982; Chandra et al., 1983; Koskenvuo et al., 1981). The research of Simons (1984) points to the importance of diversity in the social network in order to compensate for the absence of a social category relevant for the satisfaction of a particular need.

Negative Aspects. It must be recognized that not all social relationships that make up networks are uniformly positive ones. Networks may or may not be supportive. They may contain both positive and negative aspects at the same

time, even within the same relationship (Argyl & Furnham, 1983; Rook, 1984).

Network Stability. Network changes as they occur over time are also an important issue. Schulz and Rau (1984), in a theoretical paper on social support through the life course, report that the consensus among most researchers is that network size and frequency of contact, especially with close kin, remain relatively stable across the life span. Others have found declines in network size with age, with decreasing frequency of certain types of social contacts with age.

PART II. SOCIAL NETWORKS AND MORTALITY

Lisa Berkman's (1977) classic exploratory study of network/mortality relationships began an era of research aimed at defining the health effects of social ties. This longitudinal study of a large general population showed that people lacking personal and community connections were more likely to die in the nine year follow up period than those with more extensive contacts. Networks were assessed using three single dichotomous survey questions (marriage, church membership, organization membership), an index prepared by ranking contacts with close relatives and friends, and a social network index based upon the ranking of the aforementioned sources of social contact weighted by mortality rates. The latter index was not strictly a measure of

quantity of social contacts: intimate contacts were weighted more heavily than extended ties. Modified chi square statistics were used to assess relationships between the network measures, mortality, and a variety of risk factors and potentially confounding variables. Each of the sources of social contact predicted mortality independently. The more intimate ties of marriage, and friends and relatives, were stronger predictors than church and group membership.

In 1982, House, Robbins, and Metzner reanalyzed data from the Tecumseh Community Health study to determine if social connections and activities also predicted mortality in their population. The social variables assessed during the survey which had been done approximately ten years earlier were grouped as intimate relationships (marital status, frequency of visiting friends and relatives, frequency of going on pleasure drives/picnics); organizational involvements (frequency of church attendance, frequency of attending meetings of voluntary associations), and active and passive social leisure activities (frequency of attending spectator events such as movies, plays, fairs, and sports events, time spent watching television, listening to the radio, or reading). The House et al. study contained more adequate measures to control for prior physical health status than did the Berkman and Syme study. Men reporting a

higher level of social relationships and activities were significantly less likely to die during the follow up period, after adjusting for age and a variety of risk factors. Trends for women were similar but generally non-significant with age and risk factors controlled in multiple logistic regression analysis. There was no association between mortality and satisfaction with the social relationships or activities. The results obtained by House et al. are generally similar to those of Berkman and Syme, who had used somewhat different measures. In the Tecumseh study, however, weaker associations were found between friend and relative contact and religious involvements and mortality, with much stronger associations for organizational involvements. Leisure activities were not assessed in the Berkman and Syme study, but proved consequential in Tecumseh.

Also in 1982, Blazer reported a study of an elderly population in which social support predicted mortality within a 30 month period. Three parameters of support were constructed from 11 items on the Older Americans Resources and Services (OARS) social support scale: (1) roles and attachments (marital status, number of living children, number of living siblings); (2) frequency of interaction (telephone calls during the past week, visits with friends or relatives during the past week); and (3) perception of social support, made up of six items. Each of these three parameters significantly predicted mortality after control-

ling for a variety of risk factors in binary linear regression analysis. Impaired perceived support was the strongest predictor. In contrast to Berkman and Syme, who found increased mortality rates as social ties decreased, no consistent pattern of increased mortality rates was associated with lower interaction or support. Rather, a threshold effect seemed to be in operation in Blazer's data, in contrast to Berkman and Syme's findings of a dose-response association.

In an attempt to replicate Berkman and Syme's work, Schoenbach and his colleagues studied the relationship between a social network index and survivorship in an Evans County, Georgia, cohort from 1967 to 1980. They constructed an index similar to Berkman and Syme's and tested it in race-sex-specified proportional hazards models (logistic regression without interaction terms) for 2059 subjects who were examined in 1967-69 during the Evans County Cardiovascular Disease Epidemiologic Study. The study emphasized a priori construction of the social network index and specification of the statistical test to be used prior to the analysis of the data.

Schoenbach et al. found only modest support for the network/mortality relationship. Among white males the age-adjusted hazard ratio comparing the lowest to highest value of their 6-point network index was 2.0, but controlling for

confounders (primarily cardiovascular disease risk factors) reduced this ratio to 1.5. The coefficient for the social network effect was not significant in the fully controlled model. The network effect among white females, black males, and black females was weaker and clearly nonsignificant. Marital status and church activities were predictive of survivorship in exploratory analyses. Diminished survivorship among older people with few social ties was found.

Zuckerman, Kasl, and Ostfeld (1984) studied psychosocial predictors of mortality among the elderly poor in an eastern city. Nine questions on a survey assessed contacts with friends and relatives. Four questions concerned friendships, and two questions asked about children. Strict controls for objective health status were used. It was found that when rigorous control for prior health was introduced, mortality among the elderly poor was not related to friendship networks or frequency of interaction among friends. Only the presence of living children reduced the risk of mortality.

Moderators of the Networks/Mortality Relationship

It is well known that other variables are related to both networks and mortality to various degrees. Some of these which have been used as control variables in the aforementioned studies have included age, sex, objective health measures, perceived health, socioeconomic status, and

various psychological states. Apart from age, health, and sex, the latter measures have had minor effects. Recent studies examining psychosocial/mortality relationships have been published and will now be described.

In a paper based on data from the Human Population Laboratory (the same Alameda County data used by Berkman and Syme), Kaplan (1983) demonstrates the effects on ischemic heart disease mortality of health behaviors, perceived health, social networks, socioeconomic status, depression, helplessness, and life satisfaction. In Kaplan's view, progress in psychosocial epidemiology depends on converting lists of variables into theory or models which show the impact of the variables on disease incidence, progression, and mortality. The purpose of model construction is to allow sight of the common threads, interrelationships between variables, and direct and indirect paths of influence, as the search for underlying pathophysiological mechanisms continues. In Kaplan's path analytic-like models, only social networks and socioeconomic status had exclusively direct effects on ischemic heart disease mortality. The effects of these two variables were also the largest of all those considered. Health practices had direct and indirect effects through social networks and perceived health. Perceived health had some direct effects, with indirect relationships via health practices, socioeconomic status, and helplessness. Depression directly

affected networks with indirect links to health practices, helplessness, perceived health, and socioeconomic status. Life satisfaction impacted on health practices, perceived health, helplessness, and social networks.

Health Practices. Certain aspects of daily lifestyle were predictive of future health status among survivors in the Human Population Laboratory's nine year longitudinal analysis. Cigarette smoking, alcohol consumption, physical exercise, hours of sleep per night, and weight in relation to height were significantly associated with overall health outcomes later. Socioeconomic level was also associated with the health practices index (Wiley & Camacho, 1980). Using information from the same data set, Wingard, Berkman, and Brand (1982) found that four health-related practices predicted mortality in her study: never smoking, physical activity, alcohol consumption, and sleeping seven to eight hours per night.

In a study investigating the relationship between individuals' perceived level of social support and their performance of beneficial health practices, a strong positive relationship was found (Hubbard et al., 1984). The two groups studied were not random samples, however. One group consisted of senior citizens, and the other adults attending a health fair. Langlie (1977), in a survey of 383 midwestern adults, found that appropriate indirect health risk

behaviors were associated with high socioeconomic status and a social network characterized by frequent interaction with nonkin. Pratt (1971) found that structural characteristics of the family influenced health practices. Coburn and Pope (1974) reported that socioeconomic status positively affected health practices among their sample of Canadian male workers, and that group membership and participation were also significant indicators of health practices.

Branch and Jette (1984) assessed personal health practices as they affected mortality among the elderly, using data from the Massachusetts Health Care Panel Study. They noted that research on young and middle aged adults has demonstrated a correlation between certain personal health practices and reduced mortality, and wanted to see whether these findings could be generalized to elders in their 70's and 80's. They examined the association of physical activity, cigarette smoking, hours of sleep, alcohol consumption, and number of meals with five year mortality rates. For elderly women, never having smoked was the only personal health practice that achieved a statistically significant multivariate relationship with lower mortality. None of the personal health practices were related significantly to mortality among elderly men.

Perceived Health. Although convenient, self-ratings of health have often been considered a rather questionable substitute for objective health status as a predictor of

such outcomes as morbidity, mortality, or general well-being. However, recent studies indicate that perceived health has predictive importance in its own right. Mossey and Shapiro (1982) analyzed data from the Manitoba longitudinal study on aging to test the hypothesis that self-rated health is a predictor of mortality independently of objective health status. Controlling for a variety of confounders, mortality risk for persons who believed their health was poor was significantly greater. In analysis of the mortality experience of a different cohort, perceived health made a strong and independent contribution to ischemic heart disease mortality, even with controls for family history, serum cholesterol, blood pressure, and smoking (Kaplan, 1983). In an analysis of data from the Human Population Laboratory, the perceived health/mortality relationship was strong and consistent across all levels of self-reported physical health status, with other variables including social network participation controlled (Kaplan & Camacho, 1983).

PART III. SOCIAL NETWORKS AND DISEASE INCIDENCE VS. DISEASE PROGRESSION

Studies of mortality alone do not inform us as to where in terms of the spectrum of disease, social networks and support have their greatest effect. It may be that

social factors affect mortality by reducing disease incidence or they may speed recovery or slow progression once disease has occurred.

Kasl [1983] has written about the difficulties of defining the boundaries between incidence of disease and its course or progression. He argues that the distinction between the two presupposes a discontinuity which it may not be possible to elucidate. Also, the methodology of many studies makes such a distinction impossible. Among the complexities pointed out by Kasl are: (1) an ambiguous initial point of assessment; (2) an often arbitrary distinction between overt, diagnosable disease and the underlying disease process; (3) mortality data, without previous medical history, do not allow distinguishing between incidence or course; (4) the distinction between incidence and course may or may not represent a corresponding social reality for the patient; and (5) whether the risk factors for incidence and for progression will be alike or different seems specific to the particular disease and variables being studied. All these points are expanded upon by Kasl [1983], whose chapter features an analysis of research related to psychosocial factors and disease progression. He does not deal further with social factors as they impact on disease incidence as he considers disease incidence almost impossible to measure precisely.

With the above caveats in mind, after review of the available evidence, it appears equiprobable that social ties may be influential in preventing disease or in slowing its course. The following section discusses a sample of studies presenting evidence pro and con each of these two possibilities. In none of the studies has it apparently been possible, within the same data set, to evaluate both outcomes at the same time.

Disease Incidence, Evidence Pro

Gore (1978) investigated the health consequences of unemployment due to a factory shutdown. Men who had the emotional support of their wives during unemployment experienced fewer symptoms of illness than those who lacked such support.

Nuckolls, Cassel, and Kaplan (1972) studied the interrelationship of stressful life events, psychosocial assets, and complications of pregnancy in 170 army wives. Measurement of psychosocial assets tapped certain elements of social support. Results indicated that in the presence of a high level of life change both before and during pregnancy, women with high psychosocial assets had only one-third the complication rate of women with low assets. Psychosocial assets and complications were not significantly related among women with low life change.

In a more recent study of pregnancy complications by Norbeck and Tilden (1982), many of the same variables used by Nuckolls et al. were examined more rigorously within the context of a large urban medical center. Emotional support as well as instrumental support were measured along with life stress and emotional disequilibrium. When tangible support and emotional support were combined, support variables were not independent predictors of total complication rates. However, the interaction of tangible support and life change during the time of pregnancy was significant for each of several types of complications. Subjects with many life changes and few supports had the highest complication rates.

Medalie and Goldbourt (1976) conducted a prospective five year study of the incidence of angina pectoris among a cohort of 10,000 male civil servants in Israel. They found that among those who had high levels of anxiety, the angina incidence rate was significantly reduced by having a loving and supportive wife.

In a study of 7499 Finnish men, the highest incidence of ischemic heart disease occurred among the widowed (Koskenvuo, 1981).

In a cohort of women, clerical workers with nonsupportive bosses were found to be at increased risk for the development of coronary heart disease over an eight year follow up period (Hayes & Feinleib, 1980). However, nonsup-

portive bosses was not a predictor for other groups of working women, nor for men.

Joseph, using a sample of 3809 Japanese-American men living in the San Francisco Bay area, showed that social affiliation defined as ties to spouse, a religious group, and organizations is a significant independent risk factor in coronary heart disease. This work is as yet unpublished (Berkman, 1984).

The above seven studies, although highly different, provide evidence that social support may be able to prevent disease from occurring.

Disease Incidence, Evidence Con

Reed and his co-workers in Hawaii published longitudinal analyses in 1983 and 1984 of a large cohort of Japanese-American men who had participated in a heart program. They assessed the social networks of these men as related to several types of morbidity. Their network measures were constructed a priori from nine survey questions (closeness of subject's parents, closeness of wife's parents, marital status, number of living children, number of persons in the household, frequency of social activities, frequency of attending church, frequency of attending social organizations, and frequency of discussing serious problems).

In their 1983 publication (Reed, McGee, Yano, & Feinleib) which concerned coronary heart disease, the net-

work indexes did not predict incidence, using logistic regression models with controls. Further, no individual question was associated with incidence rates. However, the index did predict coronary heart disease prevalence, although the social questions alone still did not.

In a publication one year later using the same cohort and network measures but investigating incidence of other chronic diseases as well as coronary heart disease, Reed, McGee, and Yano (1984) continued to find no association. Social networks measured eight years earlier were unable to predict the incidence of stroke, cancer, heart disease, and all diseases combined.

Disease Progression, Evidence Pro

In a study of steroid therapy in chronic asthma (DeAraujo, 1973), a measure of psychosocial assets was used that tapped some aspects of social support as well as other factors. Findings indicated that patients with high psychosocial assets required relatively low daily steroid doses regardless of the amount of life change, while patients with low assets and high life changes required high doses.

Cobb (1976) studied the effect of social support in preventing joint swelling precipitated by job loss in patients suffering from arthritis. He found that 4% of the men who received much support had two or more swollen joints, in contrast to 41% of the men with little support.

Finlayson (1976) studied 75 men one year after discharge from the hospital where they had been treated for myocardial infarction. She divided the patients into those with best, intermediate, and poorest outcome and investigated the degree of nonprofessional help and advice obtained from neighbors, friends, and relatives by the wife of each man during the year. The wives of patients with the best outcomes had more sources of support than those with poor outcomes.

Good social relationships were also associated with surviving longer than expected based on prognosis among terminal cancer patients (Weisman & Worden, 1975).

Dimond (1979) found that less deterioration in social functioning led to better adjustment to hemodialysis.

Chandra, Szklo, Goldberg, and Tonascia (1983) studied a group of 1401 patients in Baltimore who had experienced an acute myocardial infarction. They were classified as "married" or "unmarried." A 10 year follow up of 888 of the subjects who were discharged alive showed a significantly better survival rate for the married compared to the unmarried. This held true for both men and women.

Kaplan and DeLongis (1983), using data from the Human Population Laboratory, assessed the role of prior distress, social networks, and marital strain on the course of arthritis. They studied 693 arthritics who developed the disease

during a 9 year period. They assessed four different types of resulting disability. Belonging to groups made no difference for any of these disabilities, but for three out of four of the disabilities assessed, large risk factors were obtained for both marital status and close relationships. These findings suggest an important role for interpersonal relations in determining the progression of arthritis.

Disease Progression, Evidence Con

Cassileth, Lusk, Miller, and Brown (1984) have studied social ties, marital history, and other psychosocial variables to see if they could predict survival in cancer patients. Analysis of data on 326 patients indicates that none of these factors, either individually or in combination, influenced length of survival or time until relapse. These investigators state that, although it is still possible that psychosocial factors may contribute to the initiation of cancer, they do not seem to play a role once the disease is established. The biology of cancer appears to predominate and override the potential beneficial influence of lifestyle and psychosocial assets. This is interesting in light of Asher's work on social support and adult health. Asher (1984) believes that social support networks have no impact on explaining health outcomes for illnesses over which the individual has little control. Although some might disagree, cancer would appear to be a good example of

such an illness. However, when a wider range of illnesses is considered, Asher believes social networks probably do play a role in affording improved health.

Berkman (1984) has reviewed the findings on social networks as related to morbidity. She finds the state of the art to be that: (1) social networks appear to influence illness states in a nonspecific way; (2) results are not as robust in the morbidity studies as in those measuring mortality, and may be contradictory; (3) measures used to indicate social support or networks have usually been developed post hoc from items included in surveys for other reasons; (4) many studies which claim to measure networks and support use measures too limited to actually do so; (5) more sophisticated measures need to be used which permit the assessment of more specific network characteristics.

In conclusion, with the exception of the work of Reed et al. (1983, 1984), the morbidity studies just reviewed have not been designed to specifically answer the question of whether networks are more influential in disease incidence or disease progression as this is reflected in lowered mortality risks in community populations. It is unusual to have a longitudinal data set which contains information appropriate to this task. However, such a data system is available at the Kaiser Permanente Center for Health Research. It is to this system and setting that we now turn.

CHAPTER III

BACKGROUND OF THE STUDY

In a dissertation involving an analysis of an existing data set, one is fortunate in not having to collect the data to be used. However, the trade off is that it is usually necessary to master a large and complicated set of files. This chapter discusses the data sources to be used in this analysis, their origin, data organization schemes, coding, and the samples involved. The focus is on the structure of the existing information system as encountered at the Kaiser Permanente Center for Health Research before any manipulation to accomplish the aims of this dissertation began.

First, the setting for the study is described. Next, four data sources pertinent to the study are explained. These are the outpatient information system, the inpatient information system, the household interview survey, and the calendar file. Following this, two special coding schemes developed by the Center are discussed. These are the clinical-behavioral disease classification system and the relative value system (for assessing costs). Finally, the samples are described. First, the larger 5% random sample continually maintained by the Center is explained. Then, a subset of that sample, those participating in the household

interview survey in 1970, is highlighted. It is this subset which is the specific focus of this research.

THE SETTING

The setting for this study is the Northwest Region of Kaiser Permanente, a prepaid health maintenance organization serving the Portland-Vancouver SMSA. A prototype health maintenance organization, the Program was established in 1943 to provide comprehensive medical care to workers in the Kaiser shipyards during World War II. The plan currently enrolls more than 265,000 subscribers, approximately 20% of the people living in the Portland area.

The members of Kaiser Permanente are a broadly based population group with demographic and social characteristics which correspond closely to the population of the metropolitan area as a whole (Pope, 1982). The health status of this population and the tendency to use medical care is similar to that of populations enrolled in Blue Cross/Blue Shield and commercial insurance plans (Freeborn & Pope, 1982). Because medical services are readily accessible due to the prepayment scheme, barriers to health care utilization are eliminated. This population is ideal for the study of issues related to health in the urban setting.

In the Kaiser Permanente system, medical and health care personnel, practicing full time in an integrated hospital-ambulatory care system, provide comprehensive

health services within the context of group practice. Most patient care is provided in the physician or nurse practitioner's office, where patients are usually seen by appointment. Walk-in care is also available, as are emergency services at all hours. A basic principle of this method of care delivery is the inclusion of preventive services (Pope, 1976).

The Kaiser Permanente system maintains a single centralized medical record for each member. Every medical care contact made by the member is recorded in his or her chart. These records provide highly reliable indicators of all aspects of health care utilization. Pope (1982) reports that members receive virtually all their health care within or through the Kaiser system.

In 1964, the Center for Health Research was established as an affiliate of the Kaiser Foundation Hospitals. The founding objective of the Center was to develop a comprehensive research program that would make the best use of the prepaid group practice setting and of the data available within its system. It was clear that the nature of the medical care system provided unique opportunities for research into the relationship between characteristics of individuals and families and their behavior in terms of health care utilization. Because of these possibilities, a multifaceted research effort to identify the social and

behavioral determinants of health care utilization was begun [Greenlick, et al., 1968].

For this research endeavor, the medical records available for the health maintenance organization (HMO) population could provide information about disease and medical care utilization, and administrative files were available to provide information on some of the sociodemographic characteristics of the subscribers. Detailed demographic, social, economic, situational, and attitudinal data were obtained when a household survey was conducted in the early 1970's.

DATA SOURCES

Several different data systems at the Center for Health Research make this dissertation possible. These computerized systems allow the linkage of social network and demographic data to medical care utilization information over a seven year period (1967 to 1973) for the outpatient system, and over a nine year period (1967 to 1975) for the inpatient system. Both data systems are now described.

Outpatient Information System

The outpatient information system, initiated in late 1966, was designed and developed to record the outpatient utilization experience of a 5% random sample of all Kaiser Permanente subscriber units, i.e., subscribers and their

enrolled dependents (spouses and/or children). As already noted, the Plan uses a single, centralized medical record for each member. The outpatient chart contains information for all medical care contacts an individual has with the program, including office visits, emergency care, laboratory and x-ray services, phone calls, correspondence, and a summary of each inpatient admission.

Whenever the medical record is removed from the centralized file or any information is filed into it, the record is checked (using an identification system known by medical record personnel) to determine its inclusion in the study project. These charts are immediately routed to the Research Medical Records Department, where a specially trained staff of medical record technicians and clerical personnel peruse the record to collect information for research purposes. Data coded for each contact include time, place, type of service, type of provider, presenting and associated morbidity, symptoms, episodes, and procedures including laboratory and radiology services.

Morbidity episodes are coded in the following manner: each time a patient presents for the first time with a new morbidity (or a new episode of a morbidity or illness), this morbidity is coded as an "initial" visit. Subsequent visits for the same illness are considered "continuing" visits. The initial plus return visits are deemed an "episode" for that particular problem. For example, if an individual

presents only once with a specific morbidity such as influenza and recovers uneventfully, there would be only one visit recorded, and the visit would be coded as initial. However, if the same individual was diagnosed as having diabetes ten years ago, his first visit for diabetes would have been termed initial, with further visits over the years for that chronic illness considered continuing. The ten years of contacts, and those required indefinitely into the future for diabetes care, would all be seen as a single episode.

Figure 2 displays pertinent structural aspects of the outpatient information system. [The disease classification system is explained later in this chapter.] "Doctor's office visits" refer to number of office visits made. "Contacts" is more inclusive, referring to all interactions with the outpatient system: office visits, phone calls, letters, and emergency room visits.

Detailed recording and coding instructions have been developed by Center staff. The International Classification of Diseases, Adapted (ICDA, 8th Edition) has been expanded and modified, especially with relation to ambulatory care morbidity patterns. This classification and how it is used to record diagnoses and symptoms will be explained later. Services provided and procedures rendered are coded in terms of an adaptation of the California Relative Value System

		Disease Classification																			
		1		2		3		4		5		6		7		8		9		10	
		Require Hospitalization		Emotional		Chronic, Nontreatable		Chronic, Treatable		Acute Micro-organism		Acute Non-micro-organism		Symptoms		Pregnancy		Trauma		No Disease	
		I*	C**	I	C	I	C	I	C	I	C	I	C	I	C	I	C	I	C	I	C
Y E A R																					
1 9 6 7																					Contacts
																					Dr.'s office visit
1 9 6 8																					Contacts
																					Dr.'s office visit
1 9 6 9																					Contacts
																					Dr.'s office visit
1 9 7 0																					Contacts
																					Dr.'s office visit
1 9 7 1																					Contacts
																					Dr.'s office visit
1 9 7 2																					Contacts
																					Dr.'s office visit
1 9 7 3																					Contacts
																					Dr.'s office visit
		total		total		total		total		total		total		total		total		total		total	

*I = initial
 **C = continuing

Figure 2. A schema of structural aspects of the Center for Health Research Outpatient Information System.

(CRVS, 4th Edition). This system will also be explained in more detail later.

Quality control is built into the data collection system at each step. To assist the technicians with questions that arise and clarifications that are needed during the data collection processes, physicians practicing within the system are routinely available. Assuring the reliability and validity of the data collected is an ongoing concern. Monthly validity checks are conducted to test the standardization of the recording process. At the same time, new or revised recording procedures may be introduced, and questions identified and resolved about the recording processes.

A number of forms are used in the data collection and maintenance processes. The basic encounter form, called Form A, is used to record each patient contact with the system. Laboratory and radiology services are, in turn, recorded on a Form B. [Copies of these forms are included in Appendix A.] Detailed recording instructions and procedures, entitled, "Recording and Coding Instructions for Medical Care Utilization Study," are used by the technical personnel. Completed forms are entered into the data base at the Center by a minicomputer system, with data being cleaned and edited at each step.

Overall, the outpatient information system is designed to provide a general data base which can be used for a

variety of research purposes. It can illustrate the health services utilization of a specific patient population, examine the incidence, prevalence, and services provided for specific diseases, examine the use of resources by providers, or describe an episode of illness and its concomitant resource use and outcome. These are only a few examples of the system's capabilities.

Inpatient Information System

The inpatient information system was begun in March, 1965, and continues as an ongoing data system within the HMO. All patients admitted to the two Kaiser hospitals in Oregon are included in this data system. Thus, it is a 100% sample, as opposed to the outpatient system which is based upon a 5% sample.

Each inpatient record provides information from three separate data forms. The first is a personal history questionnaire filled out by the patient or family sometime during the hospital stay. The second is a discharge summary completed by a research medical record technician using medical information taken directly from the patient's official hospital record. This includes admission and discharge dates, diagnoses, and surgical and laboratory procedures, as well as consultations. The third form is the nurse's evaluation form. It is completed by the charge nurse of the

inpatient floor from which the patient was discharged. The inpatient data collection forms are included in Appendix A.

The Household Interview Survey

A lengthy household interview survey of a sample of members from the Plan was begun in 1970 and completed in 1971 to provide a data base for the study of the relationship between personal and family characteristics and health care utilization and other health-related issues.

The survey was designed to obtain three difference types of information:

1. objective data, such as demographic and social characteristics of the families and individuals enrolled in the Plan;
2. information about behaviors of the family as a unit and of individual family members, including actions directed toward health problems as well as interaction within the family, at work, and within the community;
3. perceptual or attitudinal data, involving a wide variety of beliefs, opinions, and perceptions about medicine, sickness, the self, and one's personal situation.

The questions asked on the survey included the following: demographic characteristics, socioeconomic characteristics, biographical data, family and friendship, religion, voluntary associations, leisure, work and the job

situation, health status, health beliefs, health practices, reports on utilization, insurance and the Kaiser Foundation Health Plan, membership perspectives on the Health Plan, attitudes toward medicine and medical care, and general feelings and outlook on life.

Interviews were conducted in the homes of the respondents and averaged over two hours in length. Data were obtained about all members of the subscriber unit or family. For husband/wife pairs, separate but simultaneous interviews were conducted using different forms. This approach was taken because it was believed that some of the data sought would be more reliable and valid if obtained from the husband/father and others if obtained from the wife/mother. It was believed (this was in 1970) that men could give more accurate information on family economic matters and that women could be more accurate about family social affairs. The perceptual and attitudinal data were reported by each individual for herself or himself on their respective forms. For single individuals, a third form of the survey was used which included all the questions. Details of all aspects of the household interview survey are contained in a monograph by Pope (1976).

There were many provisions for quality control throughout the survey. A pilot study of over 100 subscriber units was carried out in early 1969 to test the interview tool and train the interviewers. The survey itself was

carried out by a private survey organization that specializes in serving researchers in nonprofit organizations, universities, and public agencies. Thus, the respondents in the study could be assured that the person to whom they were talking during the survey was neutral, and not a Kaiser Permanente employee. Interviewers were continually evaluated. For instance, persons not in the sample were "planted" from time to time and completed interviews with these "plants" were tape recorded for review by the evaluation staff. (Interviewers had been forewarned that this could occur.) Other quality control measures taken along these lines as the interviews went forward, were coded, and were organized for computerization are described by Pope (1976).

There were 1659 eligible subscriber units (families). Completed interviews were obtained from 1529 of these units for a completion rate of 92%. All together, 2603 adults participated in the survey. This total number included 988 married couples.

The survey was conducted approximately in the middle of the period during which medical record data was collected for most of the respondents in the study. It will be recalled that health services utilization data from 1967 to 1973 has been computerized and linked with the survey data. The survey data were obtained in 1970. Thus, some utiliza-

tion information predates and some postdates the household interview survey. The assumption is made, for purposes of this research, that the cross-sectional survey data would not be significantly different had it been collected in a two to four year period either preceding or following the actual survey. This is because most the information gathered concerned stable characteristics that would not be expected to change markedly in a short period of time.

Membership Information and the Calendar File

The sample of subscribers for which longitudinal data is gathered changes over time. As would be expected, over the years subscribers become deceased or leave the Medical Care Plan when they move out of the area, change employers, remarry, and the like. A method was needed to keep track of people in research studies.

Kaiser Permanente maintains a membership information system of currently eligible health plan members for administrative and financial purposes . However, this information system does not retain a history of eligibility status of members. To overcome this limitation so as to provide a continuous historic record of the eligibility of every individual in a research study, a calendar file was originated by the Center. The calendar file interfaces with the membership file so that changes in the eligibility status of any individual included in a study are continu-

ously recorded to maintain a permanent record of health plan eligibility.

THE CODING SCHEMES

Kaiser Clinical-Behavioral Classification System

The most common disease classification system in use today is the International Classification of Disease, Adapted (ICDA). In this classification system, each disease entity is given a unique code number, and code numbers are grouped together under either etiology or organ system. However, these codes were developed to classify diseases for statistical purposes for generating morbidity and mortality information, not for the analysis of medical care utilization. The staff of the Center developed its own classification system, retaining the use of ICDA codes, so as to reflect disease from a clinical perspective while at the same time grouping together those diseases which are likely to produce similar behavioral responses in persons with similar sociodemographic and psychosocial characteristics (Hurtado & Greenlick, 1971). The clinical subgroupings and algorithms within the classification system can be seen in Appendix B.

The Kaiser clinical-behavioral classification system features ten classes of disease, each of which includes conditions believed to produce a similar medical care utilization response. These mutually exclusive classes are:

1. Diseases generally requiring hospitalization
2. Diseases with a high emotional component
3. Chronic disease with no symptoms or nontreatable symptoms
4. Chronic disease with treatable symptoms
5. Acute microorganism disease
6. Acute nonmicroorganism disease
7. Symptoms of undiagnosed disease
8. Pregnancy and complications of pregnancy
9. Trauma and adverse effects of external causes
10. Nondisease, refractive error, preventive care, and miscellaneous

Each code in an expanded ICDA system is convertible to a code in the Kaiser classification system. A complete listing of all the diseases and their ICDA code numbers included in the Center for Health Research system is available (Hurtado and Greenlick, no date). For the purpose of this research which focuses on disease, wherever possible the last three classes will not be considered.

The Relative Value System

The purpose of the relative value system is to provide a means of assessing costs of health care.

For research purposes, services provided and procedures rendered within Kaiser Permanente are coded according to an adaptation of the California Relative Value Studies

(CRVS), 4th Edition. This coding system has been modified and expanded to include all additional medical, surgical, laboratory, or radiology procedures introduced since 1964. Drug orders are coded using a coding system developed by the Center.

Every medical, surgical, laboratory, and radiology procedure has a relative value assigned to it. In addition, the Center has created a relative value system for drug orders abstracted from the outpatient medical record.

Comprehensive outpatient system cost data are available from Kaiser Permanente which allow the derivation of a dollar cost per relative value unit for all medical office visits, surgical procedures, laboratory procedures, radiology procedures, and drug orders. Each type of RVS unit has a different dollar equivalent. Conversion of relative value units into dollars allows relative value units of different types to be added to produce an estimate of the total medical care utilization costs per person.

THE SAMPLES

The 5% Sample

This section describes the random sample routinely maintained since 1967 by the Center for research purposes. Its purpose is to provide a description of Kaiser Permanente members.

The membership records of the Kaiser Plan are stored on magnetic tape to allow routine computer processing. Both individual members and their family units (subscriber plus spouse and dependents when enrolled) are identified by unique numbers. Thus, a reliable sampling frame was available. The basic membership record also contained information such as age, sex, place of residence, size of family unit, and enrollment group.

The original 5% sample for the medical care utilization project was a 2-stage probability sample. Using a simple random sampling technique, a 5% sample of subscriber units (the primary sampling unit) was selected by computer. The units approximate primary families (subscriber plus spouse and dependents when enrolled) and provide natural clusters of individual elements. All the people (elements) in the cluster were included in the sample because the phenomena of research interest, health care, was considered basically family-oriented. This method provided an equal probability cluster sample of the health plan population. The original sample was drawn from the list of families eligible for service on September 1, 1966. Each month thereafter, a 5% sample of all new families is added to the overall sample. This continuously updated 5% sample is designed to represent the overall health plan members at any point in time.

The Household Interview Survey Sample

The study population for this dissertation is the Household Interview Survey sample.

Because of the effort and expense involved in conducting the household interview survey, it was decided not to include the entire 5% sample of subscriber units active at the time of the survey but to focus upon a subset of this sample. The subset was defined as all sampled subscriber units enrolled in the Medical Care Plan for the two full calendar years 1969 and 1970. This provided a minimum of two years utilization data for the subscriber units surveyed. Fifty-five percent of the household interview sample was enrolled as of 1967 when the outpatient information system began. The remaining 45% of the survey sample enrolled some time between 1967 and the beginning of 1969.

Although it was necessary that the subscriber unit be continuously enrolled in the Kaiser Plan throughout 1969 and 1970 to be included in the sample, not all the individuals in the unit were necessarily covered for the two year period of time. Through birth or marriage, persons could have been added to the units. Through death, leaving the family, or becoming over age, individuals could have left the unit during that time period. For practical purposes, those persons in the family at the time of the interview and covered by the health plan were subjects of the questions asked.

Interviewing began in early 1970. This meant that some of the units from which interviews were obtained subsequently left the Plan during 1970. These units were dropped from the sample since they failed to meet the criteria of membership for the two full years of 1969-70. The 101 respondents from those units have been included in this analysis, however, since the objective here is analytic and not to generalize to the Kaiser population. In this project the focus is on testing theory and relationships between variables.

A total of 2603 individuals from 1529 subscribers units were interviewed. Frequency distributions for selected demographic characteristics of this study population are shown in Table I.

TABLE I
FREQUENCY DISTRIBUTIONS FOR SELECTED DEMOGRAPHIC
CHARACTERISTICS OF HOUSEHOLD INTERVIEW
SURVEY RESPONDENTS (IN 1970)

A. AGE OF RESPONDENT			E. EMPLOYMENT STATUS OF RESPONDENT		
18-29	405	{15.6}	Working . . .	1559	{59.9}
30-39	556	{21.4}	Housewife . .	785	{30.2}
40-49	493	{18.9}	Retired . . .	216	{ 8.3}
50-59	486	{18.7}	Temp off or		
60-69	398	{15.3}	disabled . .	21	{ 0.8}
70-79	219	{ 8.4}	Unemployed. .	16	{ 0.6}
80-90	46	{ 1.8}	Never had job	2	{ 0.1}
Total	2603	100%	Missing . . .	4	{ 0.2}
			Total	2603	100%
B. SEX OF RESPONDENT			F. OCCUPATION OF HEAD OF HOUSEHOLD		
Male.	1202	{46.2}	Professionals	426	{16.4}
Female. . . .	1401	{53.8}	Managers. . .	302	{11.6}
Total	2603	100%	Clerical. . .	325	{12.5}
			Crafts. . . .	529	{20.3}
C. MARITAL STATUS OF RESPONDENT			Operatives. .	407	{15.6}
Married . . .	2167	{83.3}	Service . . .	280	{10.8}
Never married	94	{ 3.6}	Laborers. . .	152	{ 5.8}
Widowed . . .	178	{ 6.8}	Not employed.	142	{ 5.5}
Divorced. . .	164	{ 6.3}	Missing . . .	40	{ 1.5}
Total	2603	100%	Total	2603	100%
D. EDUCATION OF RESPONDENT			G. FAMILY INCOME		
0-7 years . .	135	{ 5.2}	Under \$5000 .	365	{14.0}
8th grade . .	248	{ 9.5}	\$5000-7499. .	306	{11.8}
9-11 years. .	431	{16.6}	\$7500-9999. .	465	{17.9}
High school			\$10,000-14,000	857	{32.9}
graduate . .	987	{37.9}	Over \$15,000.	559	{21.5}
Some college.	427	{16.4}	Missing . . .	51	{ 2.0}
College			Total	2603	100%
graduate . .	144	{ 5.5}			
Graduate work	225	{ 8.6}	H. RACE OF FAMILY UNIT		
Missing . . .	6	{ 0.2}	White	1459	{95.4}
Total	2603	100%	Black	51	{ 3.3}
			Other	17	{ 1.1}
			Unknown . . .	2	{ 0.2}
			Total	1529	100%

CHAPTER IV

METHODOLOGY

The data systems, setting, and subjects of this research have been described. This chapter explains in detail the conceptual and technical work accomplished to prepare the variables for analysis.

Construction and preparation of the independent variables to be used took place first. Network measures were created from questions included in the household interview survey. Summary network measures were tested for reliability and validity. The most appropriate demographic, risk factor, and health status measures to use as control variables were selected from the extensive data set. The mortality status of the subjects was determined. Dependent measures to assess incidence and change in health status were created. Table II gives an overview of the variable list, data sources, and measurement instruments for the study. The last section of the chapter features a discussion of loglinear logistic regression, an uncommon statistical method, which it was necessary to utilize because mortality is a dichotomous outcome. The analytic approaches taken to explore the data and then test the hypotheses are explained.

THE SOCIAL NETWORK INDEXES

Twenty-one questions representing various aspects of social connections were selected from those administered during the household interview survey (Table III). (See Appendix C for a complete listing of questions and age and sex-specific responses.) Three of these questions concerned social participation in the community. They assessed frequency of attendance at church and voluntary organizations, and the number and type of leisure activities engaged in. The remaining were questions about the numbers of family, kin, and friends available to the individual and the frequency with which they were seen. These questions were selected with the intent of combining them into indexes to view the network from a number of different perspectives.

Limitations of the Questions

As often occurs with secondary analysis of data gathered years before for other purposes, the available questions were less sensitive than if they had been developed solely for purposes of social network research. For instance, the question asking for the number of siblings does not include whether or not they were alive at the time of the survey. Also, when asked about the number of rela-

TABLE II
VARIABLE LIST, DATA SOURCE, AND MEASUREMENT INSTRUMENT
FOR SOCIAL NETWORK AND MORTALITY/MORBIDITY STUDY

<u>VARIABLE</u>	<u>DATA SOURCE AND/OR MEASURE</u>
INDEPENDENT VARIABLES	
1. Network Scope	Indexes developed from Household Interview Survey ↓
Immediate Family Scope	
Immediate/Extended Family Scope	
Friends Scope	
Community Scope	
2. Network Size	
3. Network Frequency of Contact	
4. Network Interaction	
Marriage	
Children	
Family of Origin	
Relatives	
Close friends	
Other friends	
Work	
Organizations, incl. church	
Social Leisure	
CONTROL VARIABLES	
1. Demographic	Household Interview Survey
Age	
Sex	
Socioeconomic status	Duncan Index
2. Health Practices	
Smoking	Household Interview Survey
Drinking	
Physical Exercise	
3. Health Status	
Perceived Health	Household Interview Survey
Length hospital stay, 1967-70	Inpatient Information System
Rate outpatient contacts for 7 disease classes, 1967-70	Outpatient Information System
DEPENDENT VARIABLES	
1. Mortality	KPMCP membership files
2. Disease Incidence	Outpatient Information System
3. Disease Progression	Outpatient Information System

TABLE III
QUESTIONS FROM THE HOUSEHOLD INTERVIEW SURVEY
ASSESSING RELATIONSHIP DOMAINS

SECTOR	SOURCE	RELATIONSHIP DOMAIN	
FAMILY	IMMEDIATE FAMILY	SPOUSE	Yes or no
		CHILDREN	Number ¹
	FAMILY OF ORIGIN	FATHER LIVING	Alive or deceased
		MOTHER LIVING	Alive or deceased
		SIBLINGS	Number ²
	KIN	RELATIVES NEAR *	Number ² How many see often ³
		RELATIVES DAY AWAY *	Number ² How many see often ³
		RELATIVES FAR *	How often in touch
FRIENDS	FRIENDS	CLOSE FRIENDS	Number ² How often keep in touch
		OTHER FRIENDS *	How many get together with/year ³ How often get together with
		NEIGHBORS *	Number ¹
		WORK ASSOCIATES	Number ³ How often seen outside work place
COMMUNITY	COMMUNITY	ORGANIZATIONS	How often attend meetings of organizations belong to (to 6)
		CHURCH	How often attend
		SOCIAL LEISURE	Number activities engaged in

* Answered by wife for family

1 Discrete data

2 Discrete data primarily, but grouped for largest numbers

3 Grouped data

tives nearby or a day's drive away, it is possible that the respondents named siblings or parents who had already been counted in earlier questions. There is no way of knowing whether people named as "close friends" might also have been included in the numbers given earlier for neighbors and relatives. Thus, there is the potential for overlapping categories. How one labels the people in one's network is uncertain if the criteria for inclusion are not clearly defined. Further, questions asking for numbers of individuals in the various categories called for responses that did not always supply entirely discrete data. Some included groupings as well as discrete information, as when the respondent was asked if he or she had one, two, three, or four or more friends. Other questions involved answers with groupings only such as "a few," "some," or "a great many" rather than specific numbers of people. This becomes a problem when the goal is constructing an individual's network quantitatively. (For details about how such problems were managed in the index construction, see the overview boxes in Appendix D. Also, the possible responses to each question can be seen in Appendix C.) Finally, in the case of married couples (approximately two-thirds of the sample), the questions concerning relatives, neighbors, and more distant friends were asked only of wives, who answered for the entire family. The wife's response was subsequently coded to the husband. It is likely that if the husbands had

provided their own responses to these questions, their personal networks would have appeared different.

The Network Model

Because there is as yet no standard method for aggregating groups of questions about networks and no fixed standard by which to judge their validity (Reed et al., 1983), a conceptual network model was constructed a priori based on the available questions, the way networks had been conceptualized in other mortality studies, and network theory (Figure 3). The model featured three major network sectors: a family sector, a friends sector, and a community sector. These were further subdivided into five sources and fifteen role relationship domains. The most intimate relationship domain, the marital, was placed at the top of the hierarchy. Prior epidemiological studies had revealed the importance of the marital tie in terms of health outcomes. This was followed in descending order of intimacy by children, family of origin, friends, neighbors, work associates, and community involvements.

Based on the kinds of questions available, it seemed possible to combine them such that four different perspectives of the network could be envisaged by summing vertically down the relationship domains. The four structural network perspectives were: overall network scope,

STRUCTURAL PERSPECTIVE

SECTOR	SOURCE	RELATIONSHIP DOMAIN	SCOPE	SIZE	FREQUENCY OF CONTACT	INTER- ACTION
FAMILY	IMMEDIATE FAMILY	SPOUSE	X	X		X
		CHILDREN	X	X		X
	FAMILY OF ORIGIN	FATHER LIVING	X	X		X
		MOTHER LIVING	X	X		X
		SIBLINGS	X	X		X
	KIN	RELATIVES NEAR	X	X	X	X
		RELATIVES DAY AWAY	X	X	X	X
		RELATIVES FAR			X	
FRIENDS	FRIENDS	CLOSE FRIENDS	X	X	X	X
		OTHER FRIENDS		X	X	X
		NEIGHBORS	X	X		
		WORK ASSOCIATES	X	X	X	X
COMMUNITY	COMMUNITY	ORGANIZATIONS	X		X	X
		CHURCH	X		X	X
		SOCIAL LEISURE	X			X

Figure 3. Social network model. (X = questions available to assess the relationship)

overall network size, overall frequency of contact with network members, and overall network interaction (Figures 4 through 7). Although the network scope and interaction indexes were inclusive of most of the relationship domains, frequency of contact was limited to contacts outside of the more immediate family, and size did not include any individuals from the community sector.

The four overall measures, although using information generated by the same questions, were designed to be conceptually unique. Network scope assessed whether or not at least one person in a relationship domain was present. Network size was a simple unweighted count of people mentioned by the respondent in response to questions about numbers of family members, friends, work associates, and neighbors. Network frequency of contact summed all the items which asked how often the respondent saw people in the various sectors. Network interaction was a more complicated overall structural measure. It represented the sum of nine separate interaction indexes created for the relationship domains.

To create the overall interaction measure, first, the number of individuals identified by the respondent in each relationship domain was multiplied by the variable corresponding to how frequently the respondent indicated he saw the individuals. Then, each of these separate indexes was collapsed to a metric of six (the range of scores for the

STRUCTURAL PERSPECTIVE

SECTOR	SOURCE	RELATIONSHIP DOMAIN	SCOPE
FAMILY	IMMEDIATE FAMILY	SPOUSE R013	SCOPE OF IMMEDIATE FAMILY
		CHILDREN F033 F045 F071	
	FAMILY OF ORIGIN	FATHER LIVING R015	SCOPE OF EXTENDED FAMILY
		MOTHER LIVING R021	
		SIBLINGS R056	
	KIN	RELATIVES NEAR F109	NETSCOPE Scope of Overall Network
		RELATIVES DAY AWAY F112	
		RELATIVES FAR	
FRIENDS	FRIENDS	CLOSE FRIENDS R116	SCOPE OF FRIENDS
		OTHER FRIENDS	
		NEIGHBORS F108	
		WORK ASSOCIATES R257	
COMMUNITY	COMMUNITY	ORGANIZATIONS R173,178 183,188 193,198	SCOPE OF COMMUNITY ACTIVITIES
		CHURCH R318	
		SOCIAL LEISURE R121, etc. R150	

Figure 4. Components of network scope indexes.

STRUCTURAL PERSPECTIVE

SECTOR	SOURCE	RELATIONSHIP DOMAIN	SIZE
FAMILY	IMMEDIATE FAMILY	SPOUSE	R013
		CHILDREN	F033 F045 F071
	FAMILY OF ORIGIN	FATHER LIVING	R015
		MOTHER LIVING	R021
		SIBLINGS	R056
	KIN	RELATIVES NEAR	F109
		RELATIVES DAY AWAY	F112
		RELATIVES FAR	
FRIENDS	FRIENDS	CLOSE FRIENDS	R116
		OTHER FRIENDS	RF117
		NEIGHBORS	F108
		WORK ASSOCIATES	R257
COMMUNITY	COMMUNITY	ORGANIZATIONS	
		CHURCH	
		SOCIAL LEISURE	

NETSIZE
 Size of Overall
 Network

Figure 5. Components of network size index.

STRUCTURAL PERSPECTIVE


SECTOR	SOURCE	RELATIONSHIP DOMAIN	FREQUENCY OF CONTACT
FAMILY	IMMEDIATE FAMILY	SPOUSE	 NETFREQ Frequency of contact with network members
		CHILDREN	
	FAMILY OF ORIGIN	FATHER LIVING	
		MOTHER LIVING	
		SIBLINGS	
	KIN	RELATIVES NEAR	RFAM
		RELATIVES DAY AWAY	RFAMDAY
		RELATIVES FAR	F115
FRIENDS	FRIENDS	CLOSE FRIENDS	R117
		OTHER FRIENDS	RF116
		NEIGHBORS	
		WORK ASSOCIATES	R277
COMMUNITY	COMMUNITY	ORGANIZATIONS	FREQMEET
		CHURCH	R318
		SOCIAL LEISURE	

Figure 6. Components of frequency of contact index

STRUCTURAL PERSPECTIVE			
SECTOR	SOURCE	RELATIONSHIP DOMAIN	INTERACTION
FAMILY	IMMEDIATE FAMILY	SPOUSE R013	<u>Marriage</u>
		CHILDREN F033 F045 F071 }	<u>Children</u>
	FAMILY OF ORIGIN	FATHER LIVING R015	Faminter Interaction with family of origin
		MOTHER LIVING R021	
		SIBLINGS R056	
	KIN	RELATIVES NEAR RFAM x F109	Relinter Interaction with relatives
		RELATIVES DAY AWAY RFAMDAY x F112	
		RELATIVES FAR	
FRIENDS	FRIENDS	CLOSE FRIENDS R116 x R117 }	Erninter Interaction with close friends
		OTHER FRIENDS RF116 x RF117 }	<u>Friends</u> Interaction with other friends
		NEIGHBORS	
		WORK ASSOCIATES R257 x R277 }	Workint Interaction with co-workers
COMMUNITY	COMMUNITY	ORGANIZATIONS R173, R178, R183, R188, R193, R198	Fregmeet Interaction with organizations and church
		CHURCH R318	
		SOCIAL LEISURE R121 R150	<u>Leisure</u> Leisure activities interaction

NETINTER

Interaction with overall network

Figure 7. Components of interaction indexes.

social leisure index precluded using a larger metric). There were four relationship domains lacking a specific question about frequency of contact by which to multiply the number of network members: marriage, children, family of origin, and social leisure. For marriage and children, it was assumed that maximum frequency of contact would occur; therefore, there was no need for multiplication. Due to the importance of the marital tie in network/health relationships, a value of 8 was given for having a spouse. This value was an average of the numbers used by other investigators to weight the marital tie (Blazer, 1980; House et al., 1982; Reed et al., 1983). To obtain a proxy measure of frequency of contact with family of origin, a question assessing perceived strength of family ties [to brothers, sisters, and parents] was used. It was assumed that if family relationships were felt to be close and strong, greater frequency of contact would be occurring. Finally, there was no way of knowing how frequently people engaged in their social leisure activities. However, the question asking for number and type of social leisure activities was different from the other questions. In response to an open-ended question, up to fourteen different types of social leisure activities were mentioned. Some of these activities presumably would be engaged in more frequently than others. Thus, there was no way of assessing frequency specifically

for each one, and it seemed most reasonable to use the total number engaged in. Except for marriage, then, the indexes from each domain were given equal weight in summing for the overall network interaction measure.

The four different perspectives from which to view the network were computed to evaluate which structural aspect of the social network was most important in relation to health. In addition to the overall measures, interaction indexes had been constructed which could give a more focused view of the specific sectors of the network. Indexes were formed and documented regarding: conceptual meaning, construction procedures, range and frequency distribution of scores, normative data, coefficient alpha, intercorrelations of index components, and percent of respondents with missing scores. Index documentation can be seen in the overview boxes in Appendix D. All the indexes were constructed so that higher scores reflected a larger network.

Validating the Network Model

Factor analysis procedures were used to validate the conceptual network model as the basis for grouping questions into indexes representing relationship domains and then into overall indexes. First, a principal components analysis was completed using the raw score variables concerning family and friends. The purpose of this procedure was to determine whether the dimensions underlying the responses to the ques-

tions corresponded to the way the questions had been combined in the model.

Next, a principal components analysis was done with the nine interaction indexes representing aspects of the relationship domains that were components of the overall interaction measure. This was done to determine if they combined in terms of the sources and sectors delineated in the model.

Finally, a third principal components analysis was completed to assess whether the four overall network measures were measuring more than one underlying construct.

For the most part, the construct validity of the model was substantiated by factor analysis. As demonstrated in Table IV, a principal components analysis using the raw score variables concerning family and friends yielded six significant factors accounting for 51% of the variance. The eigenvalues of the six factors ranged from 2.10 to 1.04, indicating that the relative importance of each factor was approximately the same.

The negative loading of siblings on the second factor was due to the influence of age. A crosstabulations analysis of age and number of siblings revealed that larger families prevailed in the past. The two questions about the status of parents were coded dichotomously (0 = dead and 1 = alive). Thus, older people, whose parents would more

TABLE IV
PRINCIPAL FACTOR ANALYSIS OF FAMILY AND FRIEND VARIABLES FROM HOUSEHOLD INTERVIEW SURVEY*

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
	Friends	Family of Origin	Frequency See Relatives	Immediate Family and Kin	Work	Close Friends, Neighbors
How often see friends/families	.80	.04	.03	-.07	.03	-.06
How many friends/families see	.76	.13	.09	.04	.08	.03
Mother alive	.13	.75	-.08	.15	.02	-.07
Father alive	.09	.75	-.07	.08	.00	-.09
Number of siblings	.04	-.55	.01	.31	-.18	-.17
Frequency of contact fam/rel far	-.08	.06	.64	-.01	.12	.08
Frequency see relatives near	.12	-.07	.63	-.02	-.18	-.04
Frequency see relatives day away	.16	-.13	.62	.06	.05	-.10
Number children	-.18	-.03	.14	.66	.03	-.02
Number relatives near	.27	.03	-.43	.55	.02	-.14
Marriage	-.08	.32	.18	.44	.01	.44
Number relatives day away	.23	.13	-.12	.39	-.02	.24
Number talk to at work	-.06	-.02	-.04	.17	.79	-.03
Frequency see co-workers outside	.22	.12	.05	-.17	.63	-.03
Frequency see close friends	.27	.03	.19	.08	.23	-.62
Number close friends	.28	-.35	-.05	-.06	.24	.46
Number neighbors	.36	-.08	.21	.18	.04	.44
Eigenvalues	2.10	1.81	1.39	1.35	1.10	1.04
% Variance	12.33	10.65	8.17	7.93	6.46	6.13
Cum & Variance	12.33	22.97	31.14	39.07	45.54	51.66

*N=1038 minimum, pairwise; varimax rotation

often be deceased, had a greater number of siblings. Frequency of contact with close friends loaded negatively on Factor 6 (close friends, neighbors) with numbers of close friends and numbers of neighbors. It may be that people with larger numbers of close friends have had the opportunity to reside in several geographical areas. They may have a dispersed friendship network which they are able to see only infrequently but which nevertheless are considered close. Individuals with fewer close friends may have resided only in one area and been able to come in contact with fewer people to be close friends. Because they live within the same area, they may see these people frequently.

However, the results of this factor analysis are open to question because, due to an inordinate number of missing values on several of the questions, the minimum number of subjects entered for this pairwise evaluation was only 1038 (out of a potential 2603). For instance, there were more than 500 missing answers to the questions about frequency of contact with close friends (because over 500 respondents declared they had no close friends) and over 1000 missing answers to questions about work because of the women who were homemakers and the older people who were retired.

When the nine indexes representing aspects of the relationship domains which had been summed for the overall network interaction index were factor analyzed (missing values were not a problem here), three factors were

extracted with eigenvalues ranging from 1 to 2 (Table V). These factors accounted for 46% of the variance. Upon varimax rotation, the three factors defined the network sectors somewhat differently than the conceptual model. The first factor combined the indexes comprising both the community and friends sectors. In the model, these were separated as two distinct areas. The second factor defined by the analysis was equivalent to the immediate family source. The third factor combined the family of origin and relative sources. In the model, all the elements of the family had comprised a single sector. Ultimately, this information applied only to the network scope indexes. These had been prepared by summing elements in the sectors that had been delineated conceptually. Since these indexes had already been prepared using a rationale based on reports in the literature, it was decided not to change them but to compare them at a later time with the combinations suggested by this analysis.

A third principal components analysis, which had been done to assess whether the four overall network measures were measuring more than one underlying construct, revealed only one factor. No rotation was done because its interpretation was clear due to the high correlations among the measures. This factor accounted for 71% of the variance (Table VI). The intercorrelations were substantial: they

TABLE V
PRINCIPAL FACTOR ANALYSIS OF INTERACTION INDEXES FROM RELATIONSHIP DOMAINS*

	FACTOR 1 Community, Friends	FACTOR 2 Immediate Family	FACTOR 3 Kin
Interaction with other friends	.70	-.01	.13
Social leisure interaction	.60	-.04	.02
Interaction with close friends	.59	-.20	.10
Interaction at meetings, church	.55	.31	-.05
Work interaction	.40	.10	-.38
Marriage	-.06	.73	-.04
Children	.00	.69	.10
Interaction with family of origin	.06	-.07	.78
Interaction with relatives	.19	.31	.60
Eigenvalues	1.76	1.28	1.09
% Variance	19.60	14.18	12.07
Cum % variance	19.60	33.78	45.85

*N=2379 minimum, pairwise; varimax rotation

TABLE VI
PRINCIPAL COMPONENTS ANALYSIS OF FOUR OVERALL
NETWORK MEASURES*

	FACTOR 1
Network Interaction	.93
Network Scope	.87
Network Size	.79
Network Frequency	.77

*N = 2321, listwise; no rotation

ranged from .76 to .38 (Table VII). High intercorrelations among the four indexes occurred because, although they measured different network dimensions, the information used in constructing them derived from the same set of questions.

Reliability of the Network Indexes

The summative indexes constructed to measure the social networks of the household interview survey sample were a simple aggregation of the relationship domains. The components of these indexes were selected and combined, as explained earlier, based on the survey questions that were available, knowledge of past research results, and network theory.

Most satisfactory indices or scales are homogeneous, have a high average correlation among components, and are dominated by a single factor. However, the size of an individual's family may be conceptualized as a combination of the number of family members from several sources (spouse, parents, siblings, children). One would not expect the size of all the various sectors to be highly correlated and yet the combination of these sources is a meaningful way to think about the size of a respondent's family as a construct. The low correlations often found among the variables making up the indexes, although disappointing, were not unexpected. Whether one's parents were alive or dead, how many relatives one had, and whether one saw co-

TABLE VII
INTERCORRELATIONS OF OVERALL NETWORK INDEXES

	Network Scope	Network Size	Network Frequency	Network Inter- Action
Network scope	1.00			
Network size	.62	1.00		
Network frequency	.57	.38	1.00	
Network interaction	.76	.70	.67	1.00

workers outside the work place are factors not generally related to each other although the presence of each has the possibility of providing some measure of social support. The internal consistency reliability for the network indexes were low due to the low item correlations. Cronbach's alpha which was computed for each overall index ranged from .30 for network size to approximately .43 for network scope. Each component of the index was then assessed so as to be sure it was making a positive contribution to the total scale. Reliability results can be viewed as part of the overview boxes in Appendix D.

DEPENDENT MEASURES

Mortality

Known deaths that occurred among the 2603 respondents between 1970 and 1982 serve as the measure of mortality. The specific causes of death are not available for analysis.

Of the 2603 individuals interviewed in 1970, approximately 1475 were still eligible members at the close of 1982. Each year approximately 100 had left the program (see Figure 8). Deaths that occurred among respondents while they were subscribers are known either from hospital records or from the membership information files. It is expected that some of the respondents who left the Plan subsequent to the survey have since died. Without that data, however, the

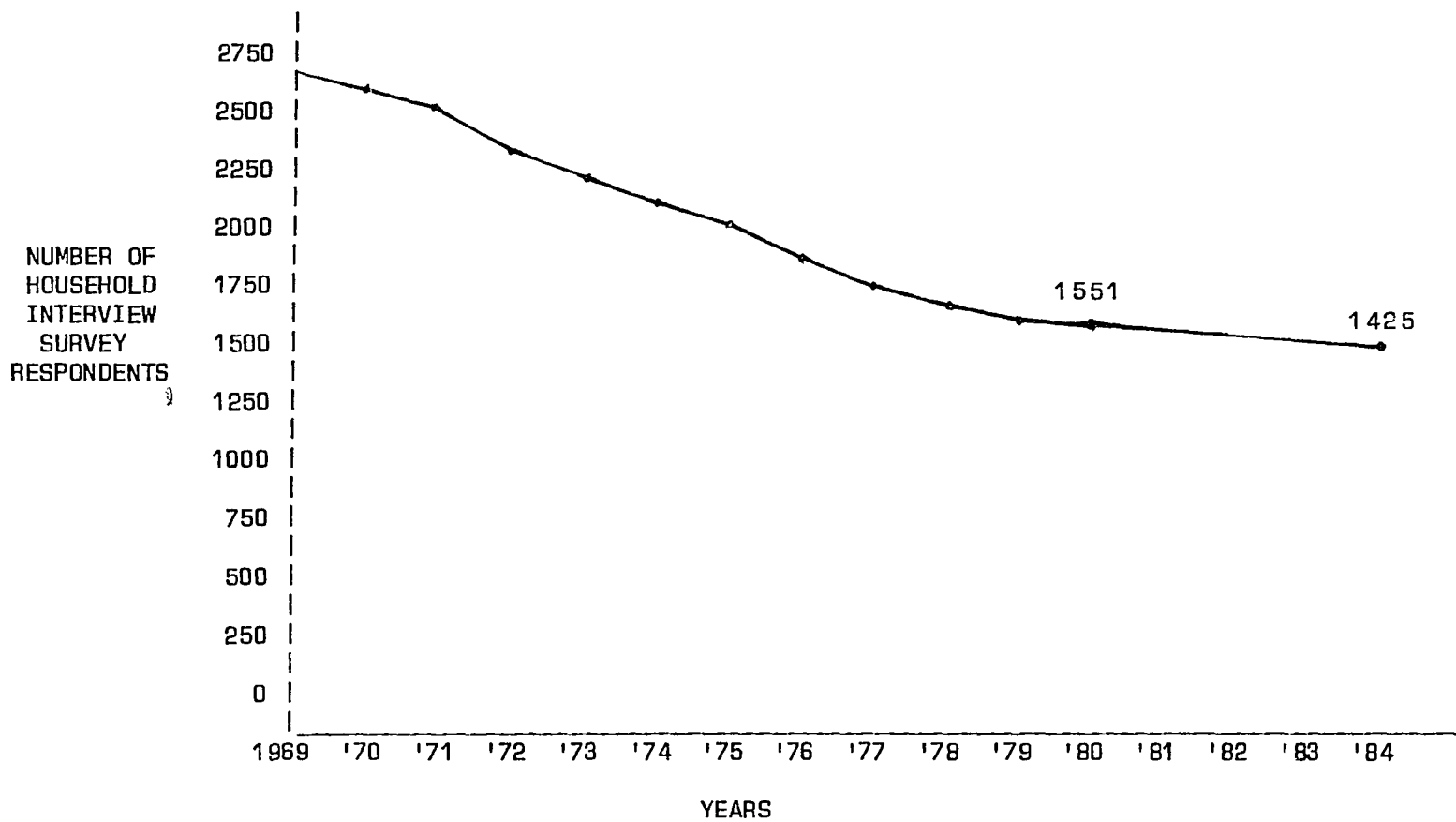


Figure 8. Number of respondents remaining eligible for the Kaiser Medical Care Plan in years subsequent to Household Interview Survey, 1969-1984.

best estimate of the mortality rate of the respondents to the household interview derives from known deaths.

How do the mortality rates calculated from the known deaths within the study group compare with mortality rates from other community populations? If there were many unknown deaths among the study population, their death rates would be unusually low. The 12 year mortality rates for persons aged 30-69 within the Kaiser Permanente cohort were compared to those obtained by Berkman and Syme (1979) over 9 years using the Human Population Laboratory data. The results in Table VIII indicate that the Kaiser mortality rates for men are higher (14.2 compared to 9.5) while those for women are more similar (7.8 as opposed to 6.4). It would be expected that the Kaiser rates would be at least somewhat higher because the observation period for this Portland sample was three years longer than that of the Alameda County group. This comparison supports the assumption that the number of known deaths among the study population is a reasonably accurate measure of all the deaths that may have occurred during the 12 year period.

Disease Incidence

Incidence of disease is measured using health services utilization data. The disease incidence variables encompassed seven years, in the middle of which the household interview survey occurred. Two different ways were prepared

TABLE VIII
COMPARISON OF AGE-SPECIFIC MORTALITY RATES PER 100
FOR MEN AND WOMEN AGED 30-69 IN THE KAISER
MEDICAL CARE PLAN (Portland, 1970-82)
AND THE HUMAN POPULATION LABORATORY
(Alameda County, 1965-1974)

Age	No. of Respondents	No. of Deaths	% Died
<u>HUMAN POPULATION LABORATORY</u>			
<u>MEN</u>			
30-39	673	16	2.4
40-49	729	36	4.9
50-59	501	68	13.6
60-69	<u>326</u>	<u>91</u>	27.9
Total	2229	Total 211	(Crude rate) 9.5
<u>WOMEN</u>			
30-39	728	16	2.2
40-49	807	32	4.0
50-59	574	45	7.8
60-69	<u>387</u>	<u>67</u>	17.3
Total	2496	Total 160	(Crude rate) 6.4
<u>KAISER-PERMANENTE MEDICAL CARE PLAN</u>			
<u>MEN</u>			
18-29	168	2	1.2
30-39	278	8	2.9
40-49	231	15	6.5
50-59	226	36	15.9
60-69	178	71	39.9
70-79	90	67	74.4
80-90	<u>31</u>	<u>23</u>	74.2
Total	1202	Total 222	(Crude rate) 18.5
<u>WOMEN</u>			
18-29	237	1	0.4
30-39	278	5	1.8
40-49	262	6	2.3
50-59	260	24	9.2
60-69	220	45	20.5
70-79	129	60	46.5
80-90	<u>15</u>	<u>13</u>	86.7
Total	1401	Total 154	(Crude rate) 11.0

initially to measure disease incidence, but only the first (Version A), was ultimately utilized.

Disease Incidence, Version A. The number of total initial doctor office visits over all ten disease classes has been summarized for 1967 through 1973 for each person in the study population. These summaries have been converted to mean annual rates per 10 person years to take into account differing lengths of membership in the Kaiser Plan. The formula used by the Center for rate calculation is displayed in Figure 9. An "initial" visit indicates the first outpatient visit for a new morbidity. Subsequent visits for the same morbidity, should they occur, are coded as "continuing." Initial plus continuing visits for a single morbidity are known as an "episode." The first approach to measuring disease incidence consisted of total initial visits over the study time period.

Disease Incidence, Version B. Because the available initial visits measure (Version A) is not broken down into its component disease categories, it also contains non-disease visits such as those for preventive care, obstetrics and trauma. In order to overcome this deficiency, but not without limitations of their own, a series of new nominal variables was created for each of the first seven (true disease) categories in the classification system.

$$\begin{array}{ccccccc}
 \text{Rate per} & & \text{Number} & & & & \\
 10, 100, \text{ or} & = & \text{of} & / & \text{Months} & \times & 12 \\
 1000 \text{ person} & & \text{visits} & & \text{Eligible} & \times & (\text{months} & \times & 10, 100, \\
 \text{years} & & & & & & \text{per year}) & & \text{or } 1000
 \end{array}$$

Figure 9. Formula used by Center for Health Research to convert utilization summary measures to rates per person year.

The new variables measured whether or not at least one initial doctor's office visit (with the health care system) had occurred within a disease class for the individual, based on visits during the seven year period. Variables were created for classes 1 through 7. Classes 8 through 10 were disregarded. First, it was assumed that anyone who had an ongoing chronic disease condition would have been seen at least once in 1967 or 1968, which were considered the base-line years. The purpose here was to eliminate all people making continuing visits. People with one or more visits in 1967 - 1968 were coded 0, and were meant to be excluded from the analysis because it would be impossible to ascertain whether their visits were continuing or initial. Next, respondents who had no visits at all during the entire seven year period were coded 1. Those remaining, the largest group, had one or more visits during the latter 5 years (1969-73). It was assumed that this would represent at least one initial contact, or new disease, for an individual and this group was coded 2. Thus, if the second hypothesis was correct, people with more network resources would fall more frequently into category 1, which meant no visits to the health care system.

For each of the seven disease classes, then, a dichotomous measure was computed indicating whether or not at least one initial visit had occurred within that disease class during a five year period. Because of their nominal

nature, these measures could not be converted to rates. Therefore, for statistical testing, only subscribers eligible for the entire seven year time period (1406 individuals) were to be included in the analysis. As noted earlier, these measures are also conservative, but were meant to serve as an alternate approach to assessing disease incidence. However, their use would have entailed using additional computer resources. Therefore, it was decided to keep them in reserve to be used for further exploration should version A have been statistically significant.

Disease Progression

To reiterate, the objective of this research is to assess whether social networks impact on mortality by affecting disease incidence or by affecting survival once illness occurs. When a person develops an illness, he or she comes to the health care system and uses its services for treatment. The amount of this contact is usually in proportion to the gravity of the physical problem. If the individual becomes sicker, more office visits are likely to occur and more resources are likely to be used over time to maintain as healthy a state as possible in the face of decline. Thus, if hypothesis 3 is correct, people with more social network ties should have slower illness progression and hence use relatively less health care and require fewer resources over time. Those individuals with minimal network

connections would be expected to have a deterioration in their health status over time and concomitantly use relatively more resources and care.

Change in health status was operationalized as the change in the rate of outpatient contacts and change in the rate of total resource use, as measured by the RVS system. A seven year period of time, 1967-1973, was utilized. In order to control for health/illness level at the time of the survey, the years prior to the survey served as a baseline.

Disease Progression, Variable A. First, all outpatient contacts for the first seven disease classes (true disease, not trauma, obstetrics, or preventive care) were summed for each year separately. Measures were created for 1967, 1968, 1969, 1970, 1971, 1972, and 1973. Of these, the baseline years, 1967 through 1970, were combined by summing for a new variable. The subsequent years, 1971 through 1973, were also aggregated for a second new variable. Rates of contact per 10 person years were then computed for each of these two time periods, using the formula in Figure 9. The rate of contact for 1967-70 was then subtracted from the rate of contact for 1971-73. This rate of change variable yielded a measure more specific to actual disease.

Disease Progression, Variable B. In a similar manner, two resource use variables were created for the same time periods before and after the survey using RVS codes. Sub-

traction of the one from the other gave a new variable which could be used similarly to measure rate of change in disease progression. This resource variable, however, counted all resource use across the 10 disease classification categories. Thus, it was a less sensitive measure of actual disease than variable A. For this reason it was decided to hold variable B in reserve to be used if variable A proved significant, requiring further exploration of the networks/progression data.

CONTROL VARIABLES

Demographic Variables

Age. Age was available as a continuous variable (18-90). It was also collapsed into four categories for certain analyses. The categories were: under 35, 35-49, 50-65, and over 65. A variable reflecting these categories was used which had been created for prior Center studies. Age was further collapsed by combining the two younger categories for some analyses: 18-49, 50-64, and 65 and over.

Socioeconomic Status. The Duncan Index was used to stratify the household interview sample in terms of socioeconomic status. This index had been created by the Center for all families using the methodology explicated by Duncan (1961). A widely used measure, the Duncan Index is based upon occupational prestige and education. Its reliability and validity have been reported elsewhere (Duncan, 1961).

This variable was collapsed to a metric of five for some analyses.

Health-Related Behaviors

Three indexes assessing health behaviors were used that had been created for prior Center studies (Pope, 1982). Each is described below.

Smoking. Smoking behavior is measured by the number of cigarettes smoked by current smokers and by smoking history. Scores on this index range from 1 to 9. Light smokers are those who smoke half a pack or less per day, medium smokers smoke one half to one pack per day, and heavy smokers are defined as using more than a pack per day. The total index is:

1. Never smoked
2. Formerly smoked but stopped more than ten years ago
3. Formerly smoked but ceased within the past ten years
4. Currently light smoker, having smoked for ten years or less
5. Currently light smoker, having smoked for more than ten years
6. Currently a medium smoker, having smoked for ten years or less
7. Currently a medium smoker, having smoked for more than ten years

8. Currently a heavy smoker, having smoked for ten years or less
9. Currently a heavy smoker, having smoked for more than ten years

Drinking. An index of drinking was constructed by grouping together those drinking patterns assumed to be similar in their health impact. Drinking patterns are defined by the quantity of alcohol imbibed per occasion in combination with how frequently the occasions of drinking occur. The scores on the ordinal drinking scale range from 1 to 4 and combine drinking types in the following manner:

1. Abstainers and both regular and occasional light drinkers
2. Occasional heavy drinkers and regular drinkers, occasionally heavy
3. Regular drinkers, frequently heavy
4. Regular drinkers, heavy

Because it includes nothing on the history of drinking, this measure is a conservative indication of drinking behavior. It must be assumed that current drinking status is similar to past practices. However, heavy drinkers in the past may have been converted to sobriety.

Physical Activity. An index of physical activity based on responses to the open-ended questions about the kinds of leisure engaged in resulted in a measure which had a range of scores from 0 to 12. Six types of activities

which ordinarily use physical exertion were selected from the responses and weighted arbitrarily in terms of the amount of physical exertion required. Unknown was the amount of time spent doing the activity for any specific time period, how frequently the respondent engaged in the activity, and for how long he had been doing it. Types of activities that were seasonal or did not necessitate a great deal of physical exertion were given weights of 1, while types of activities that occurred year round or required much exertion were weighted 4. For example, activities given weights of 1 were: camping, fishing, gardening, and hunting. Weights of 4 were assigned to "participating in sports" and "other physical activities."

Health Status Indicators

An important variable in the networks/mortality relationship is state of physical health. People in poor health may have smaller networks because illness limitations preclude being in contact with other people in social situations. Three different health status indicators are used to control for each individual's health status prior to the survey. These variables were selected by correlating all available health status measures with mortality status (alive or deceased) as of 1982 and with each other, assessing for redundancy (see Table IX for correlations). Each

TABLE IX
ZERO-ORDER CORRELATIONS OF INDICATORS OF HEALTH STATUS AT TIME
OF HOUSEHOLD INTERVIEW SURVEY AND MORTALITY

	Mortality	Resources Use, 1967-70	Outpatient Contacts, 1967-70	Length Hospital stay, 1967-70	Hospital Discharges 1967-70	Physical Symptoms	Perceived Health
Mortality	1.00						
Resource Use, 1967-70	.16	1.00					
Outpatient Contacts, 1967-70	.18	.83	1.00				
Length Hospital Stay, 1967-70	.26	.41	.49	1.00			
Hospital Discharges, 1967-70	.22	.43	.51	.86	1.00		
Physical Symptoms	.07	.14	.11	.06	.06	1.00	
Perceived Health	.24	.30	.32	.25	.25	.23	1.00

measure selected seemed to capture a different dimension of health. One measure is subjective (perceived health), one is from the outpatient file (outpatient contacts), and one is from the inpatient file (length of hospital stay). The other items in Table IX were eliminated.

Perceived Health. As part of the survey, respondents were asked to evaluate their own health as excellent, good, fair, or poor. Subjective assessment of health has been found to be a predictor of mortality in longitudinal assessments of general populations (Mossey & Shapiro, 1982; Kaplan & Camacho, 1983).

Length of Hospital Stay. The inpatient information system provides data on the number of days spent in the hospital during the years 1967-70. The days have been summed to create a variable which has been converted to rates. People spending more time in the hospital would be expected to be in poorer health.

Outpatient Contacts For Seven-Disease Classes. Rates for chronic and acute disease outpatient contacts have been combined for disease classes 1 through 7, for the time period from 1967-1970.

STATISTICAL TESTS

This section will be directed toward those statistical tests which were used to determine the relationship between social networks and the disease outcomes. Those statistical

tests which established the reliability and validity of the network indexes have already been described.

Crosstabulations and one-way analysis of variance procedures were used to assess bivariate relationships between dependent and independent variables. Crosstabulations were used for categorical and ANOVA was used for continuous dependent measures. The network structural variables were collapsed and mortality rates calculated for people with small, medium, and large networks. These rates were computed by dividing the frequency distributions into three parts as evenly as possible based on cumulative percentages.

Independent, dependent, and control variables were correlated with each other in order to evaluate the extent of multicollinearity that might need to be considered in the interpretation of the results. The correlations are displayed in Appendix E. All control variables had correlations with mortality significant at the $p < .05$ level.

Since there were potentially a large number of regressions possible given the different types of network variables and the different types of outcomes, it was decided to begin the analysis with the network scope measure as the trial independent variable. Network scope was chosen because it was the most highly correlated with mortality. If a significant relationship was found, the other network

variables would then be used. If network scope had no impact on the particular outcome, it would be assumed that the other network measures would likewise be nonsignificant. The full regression model is outlined in Figure 10.

Mortality

Because mortality was a dichotomous variable, it did not meet the assumptions required for multiple linear regression. Thus, a loglinear logistic regression model was used, as available in the SPSS^X computer package. This model provides a means for assessing the relationship between a dichotomous dependent variable and categorical predictor variables, and it can be extended to deal with variables whose categories have an underlying order. The loglinear model predicts the logarithm of the expected cell frequencies in a multifactorial contingency table using a linear combination of predictor variables. Some information and power is lost as the continuous independent variables must be broken into categories to reduce the number of empty cells. (However, House [1982] states that he found that contingency table, ordinary least squares correlation and regression, and multiple logistic function analysis using maximum likelihood estimation procedures [BMD] yielded very similar substantive conclusions in his networks/mortality study.)

INDEPENDENT VARIABLES

NETWORK STRUCTURE

Scope
Size
Frequency of Contact
Interaction

NETWORK SOURCE

Marriage
Children
Family of Origin
Kin
Close Friends
Other Friends
Work
Organizations
Social Leisure

CONTROL VARIABLES

DEMOGRAPHIC

Age
Sex
Socioeconomic Status

RISK FACTORS

Smoking
Drinking
Physical Activity

HEALTH STATUS

Perceived Health
Length Hospital Stay
Outpatient Visits

DEPENDENT VARIABLES

MORTALITY

DISEASE INCIDENCE

DISEASE PROGRESSION

Figure 10. Model for the study of the ability of social networks to predict morbidity and mortality.

In the general loglinear model, all variables are treated equally, as response variables whose relationships are to be determined by a multiplicative or additive function of an entire set of variables. There is a special case of this general version, called the logit model. Logit models are categorical variable analogs to ordinary linear regression for continuous dependent variables. In logit analysis, as in regression, one variable is taken conceptually as dependent upon variation induced by the others. The criterion variable is the natural log of the odds of being in the first, rather than the second, category of the dependent variable (Knoke & Burke, 1980; Payne, 1977).

For each model considered, the technique estimates a residual chi square statistic for assessing the overall fit. The strategy employed was to determine the most parsimonious model providing acceptable fit. The residual chi square may be interpreted as the error in prediction for the specified model. If it is statistically significant, the model must be rejected and other models considered. A measure of association between the dependent and independent variable(s), called entropy, can be interpreted as multiple R in ordinary regression.

The parameters of the logit model can be interpreted similarly to the coefficients of ordinary regression (Goodman, 1972). Positive coefficients (coefficients are also known as betas) indicate that the independent variable

raises the odds on the dependent measure while negative betas show that the odds are decreased. In the logit model, computer output includes a coefficient for each category of the independent variable.

In instances where levels of the independent variable form an ordinal measure, a model similar to ordinary regression is used. For this version, a contrast is used to convert the scale to a metric measure. Instead of coefficients for each category of the independent variable, only one coefficient is computed for the variable. It represents the change in the dependent variable per unit change in the independent. As with the logit model, each coefficient is then multiplied by 2 for the logistic coefficient. To obtain the odds ratio (relative risk), the antilog of the coefficient is taken (SPSS^X User's Guide). Statistical significance tests are based on z ratios for the logistic function coefficients. Two-tailed tests of significance were applied.

When dichotomous independent variables are used (no contrast needed) in the logistic regression version, they are interpreted in the opposite direction as when three or more levels of the variables are used. This occurs because in the logit model, low levels of the independent variable are compared to high levels. Dichotomous variables are interpreted in a similar manner because a contrast has not

been used with them. In regression, high levels are compared to low. Thus, the signs on dichotomous independent variables that appear in the Tables in Chapter V have been reversed from those appearing on the computer printout. Positive values indicate that increases in the independent variable raise the odds on dying; negative values indicate that the odds are decreased. The coding for the variables and the versions to which they were collapsed for the logistic analyses can be seen in Appendix F.

The logistic regression analyses proceeded in five phases, with the initial intent of eliminating control variables which did not make a significant contribution to mortality. This approach minimized the decrease in sample size that resulted from missing data, and created the most parsimonious model.

In the first series of logistic analyses, the three demographic, three health status, and three risk factor variables as well as the network scope measure were assessed for their zero-order relationship with mortality. Each was collapsed to a variable involving from 3 to 5 ordered categories. If the resulting model did not fit due to a non-linear relationship, a quadratic term was added to the linear multiplicative constant required for the approach being utilized.

In the second series of analyses, each control variable which was significant in phase one was again related to

mortality after being adjusted for age, which had been collapsed to 4 categories. Each control variable was dichotomized due to constraints posed by potentially empty cells. However, in most of the analyses using the full model, to be described next, all the variables were in three ordered categories as this most consistently provided the best model fit.

In the third series of analyses, the dichotomized control variables still significantly related to mortality were entered one at a time, with those most significant entering first. The network scope variable always entered last, as this was the variable of primary substantive interest. In other words, the strongest predictor, age, was added first, and predictors were added until none of those remaining could significantly [$p < .05$] increase the prediction of mortality. The final model included only age, sex, perceived health, and hospitalization, followed by network scope. Smoking had become non-significant when entered following hospitalization.

In the fourth series of analyses, scope of immediate family, scope of extended family, scope of friends, and scope of community involvement were entered in lieu of the overall network scope variable for the purpose of determining which network scope sectors were most pertinent to mortality risk. Logistic regression procedures were also

done to ascertain whether networks predicted death more in older people than in younger people, and whether a sex difference existed. Then, also using the final model, the summary measures of network size, frequency of contact, and interaction were each entered last, in place of scope, in four additional regression analyses.

Finally, in order to ascertain the relative importance of the various relationship domains contained within the network model (in Figure 3), ten additional analyses regressed the interaction indexes on mortality.

Morbidity

The multiple linear regression program contained within the SCSS, a conversational statistical package, was used to estimate the relative contribution of network scope to predicting disease incidence and disease progression. All of the variables were used in their continuous versions. A hierarchical, forced entry strategy was utilized. Age was added as the first control, as age is the intervening variable known to be most strongly related to health outcomes. In subsequent equations, additional control variables were added with network scope always entering last. This same approach was utilized with the disease progression outcome.

In summary, this chapter has highlighted the preparation of the network, control, and outcome measures used in this research. The testing of three hypotheses exploring

the relationships between social networks and mortality, disease incidence, and disease progression was carried out by the logistic and multiple linear regression methods described. The results of these analyses will be the focus of the next chapter.

CHAPTER V

RESULTS

The purpose of this research is to assess whether social networks impact on disease and its outcomes. The major focus of this chapter is to report on the findings of the hypothesis testing activities outlined in Chapter IV. Related statistics will be presented. However, social networks in and of themselves are interesting. Therefore, some data describing the networks of the study population will be presented first.

DESCRIBING THE NETWORKS OF THE STUDY POPULATION

It can be seen in the overview boxes that there is variability in people's networks. What are the networks of a basically healthy group of individuals representative of the Portland urban area like? How do they differ by sex and across the life cycle? What can be said about the structure of their networks? In comparing the social networks of men and women by age, it must be kept in mind that for married pairs, both husband and wife had the same scores on some of the variables (near relatives and relatives living farther away, friends, neighbors: see Table III). This scoring from wife to husband occurred because by the design of the

survey instrument, wives answered some questions about social life for the family. Mean scores for males and females in different age categories on the summary network indexes can be seen in Table X.

Not surprisingly, older people had smaller networks in terms of all the structural perspectives. This is undoubtedly because those over 65 years of age usually no longer have work networks, and their spouses and parents may be deceased. Social networks were greatest in age group 35-49. Men in the first two age categories had slightly more network resources, probably reflecting the fact that many women in the sample were homemakers and did not have work networks. Within the age category inclusive of those 50-65, men's and women's networks approached equality. After age 65, when most men would be expected to be retired, the networks of women became somewhat greater. The networks of men decreased most with age. Table XI displays the percent distribution of the study population in small, medium, and large network categories by age. It can be seen that more young people fall into large network categories, and more older people fall in the small network categories. This trend is most pronounced for network scope and least pronounced for network size.

TABLE X

MEAN SCORES ON SUMMARY NETWORK INDEXES BY AGE AND SEX

	<u>Under 35</u>	<u>35-49</u>	<u>50-65</u>	<u>Over 65</u>
NETWORK SCOPE (Range 1-13)				
Male	10.47	10.38	9.58	7.66
(<u>N</u> = 1101)	(<u>N</u> = 276)	(<u>N</u> = 346)	(<u>N</u> = 297)	(<u>N</u> = 182)
Female	10.06	10.09	9.29	8.07
(<u>N</u> = 1324)	(<u>N</u> = 375)	(<u>N</u> = 368)	(<u>N</u> = 355)	(<u>N</u> = 226)
NETWORK SIZE (Range 2-40)				
Male	23.25	24.01	22.27	19.11
(<u>N</u> = 1159)	(<u>N</u> = 289)	(<u>N</u> = 361)	(<u>N</u> = 310)	(<u>N</u> = 199)
Female	22.56	22.76	21.30	20.15
(<u>N</u> = 1370)	(<u>N</u> = 385)	(<u>N</u> = 377)	(<u>N</u> = 369)	(<u>N</u> = 239)
NETWORK FREQUENCY (Range 2-24)				
Male	13.59	13.68	13.12	11.22
(<u>N</u> = 1113)	(<u>N</u> = 283)	(<u>N</u> = 353)	(<u>N</u> = 297)	(<u>N</u> = 180)
Female	12.96	13.36	13.27	13.20
(<u>N</u> = 1316)	(<u>N</u> = 382)	(<u>N</u> = 359)	(<u>N</u> = 355)	(<u>N</u> = 220)
NETWORK INTERACTION (Range 3-42)				
Male	28.09	29.26	26.65	22.03
(<u>N</u> = 1073)	(<u>N</u> = 273)	(<u>N</u> = 336)	(<u>N</u> = 292)	(<u>N</u> = 172)
Female	27.40	28.29	26.00	22.30
(<u>N</u> = 1313)	(<u>N</u> = 375)	(<u>N</u> = 366)	(<u>N</u> = 351)	(<u>N</u> = 221)

TABLE XI
PERCENT OF STUDY POPULATION IN SMALL, MEDIUM,
AND LARGE NETWORK CATEGORIES BY AGE

		<u>SMALL</u> (<u>N</u> = 632)	<u>MEDIUM</u> (<u>N</u> = 898)	<u>LARGE</u> (<u>N</u> = 895)		
NETWORK SCOPE						
Age under 35	(<u>N</u> = 651)	15%	36%	49%	Total:	100%
35 - 49	(<u>N</u> = 714)	14%	37%	49%	"	
50 - 65	(<u>N</u> = 652)	29%	41%	30%	"	
over 65	(<u>N</u> = 408)	61%	33%	6%	"	
Total		2425				
		<u>SMALL</u> (<u>N</u> = 833)	<u>MEDIUM</u> (<u>N</u> = 792)	<u>LARGE</u> (<u>N</u> = 904)		
NETWORK SIZE						
Age under 35	(<u>N</u> = 674)	26%	35%	39%	Total:	100%
35 - 49	(<u>N</u> = 738)	25%	34%	41%	"	
50 - 65	(<u>N</u> = 679)	38%	28%	34%	"	
over 65	(<u>N</u> = 438)	50%	25%	25%	"	
Total		2529				
		<u>SMALL</u> (<u>N</u> = 781)	<u>MEDIUM</u> (<u>N</u> = 725)	<u>LARGE</u> (<u>N</u> = 923)		
NETWORK FREQUENCY						
Age under 35	(<u>N</u> = 665)	29%	35%	36%	Total:	100%
35 - 49	(<u>N</u> = 712)	29%	31%	40%	"	
50 - 65	(<u>N</u> = 652)	34%	27%	39%	"	
over 65	(<u>N</u> = 400)	41%	25%	34%	"	
Total		2429				
		<u>SMALL</u> (<u>N</u> = 710)	<u>MEDIUM</u> (<u>N</u> = 816)	<u>LARGE</u> (<u>N</u> = 860)		
NETWORK INTERACTION						
Age under 35	(<u>N</u> = 648)	22%	39%	39%	Total:	100%
35 - 49	(<u>N</u> = 702)	17%	35%	48%	"	
50 - 65	(<u>N</u> = 643)	34%	33%	33%	"	
over 65	(<u>N</u> = 393)	58%	27%	15%	"	
Total		2386				

NETWORKS AND MORTALITY

A total of 222 men (18.4% of the 1202 male study population) and 154 women (11% of the 1401 female study population) died during the 12 year follow up period. Figures 11 and 12 display mean overall network scores during the 12 year follow up period according to mortality, age, and sex. Interestingly, for the youngest age group, those who later died usually had larger networks than those surviving. This was particularly true for females. However, there were too few deaths in this young age category for this information to be meaningful. From age 35 on, those who succumbed had lower mean network scores than the survivors.

In order to assess whether there is a dose-response relationship between networks and mortality or a threshold effect, mortality rates were plotted for levels of the network scope measure. There is a rather consistent pattern of decreased mortality rates for each increase in social resources until the high levels are reached whereupon the network effect becomes smaller (Figure 13).

Table XII shows mortality rates by age and sex. In order to see whether people in the study population with small networks have higher mortality rates as theorized, age and sex-specific mortality rates were calculated by categories of the structural network indexes (Table XIII).

MALES

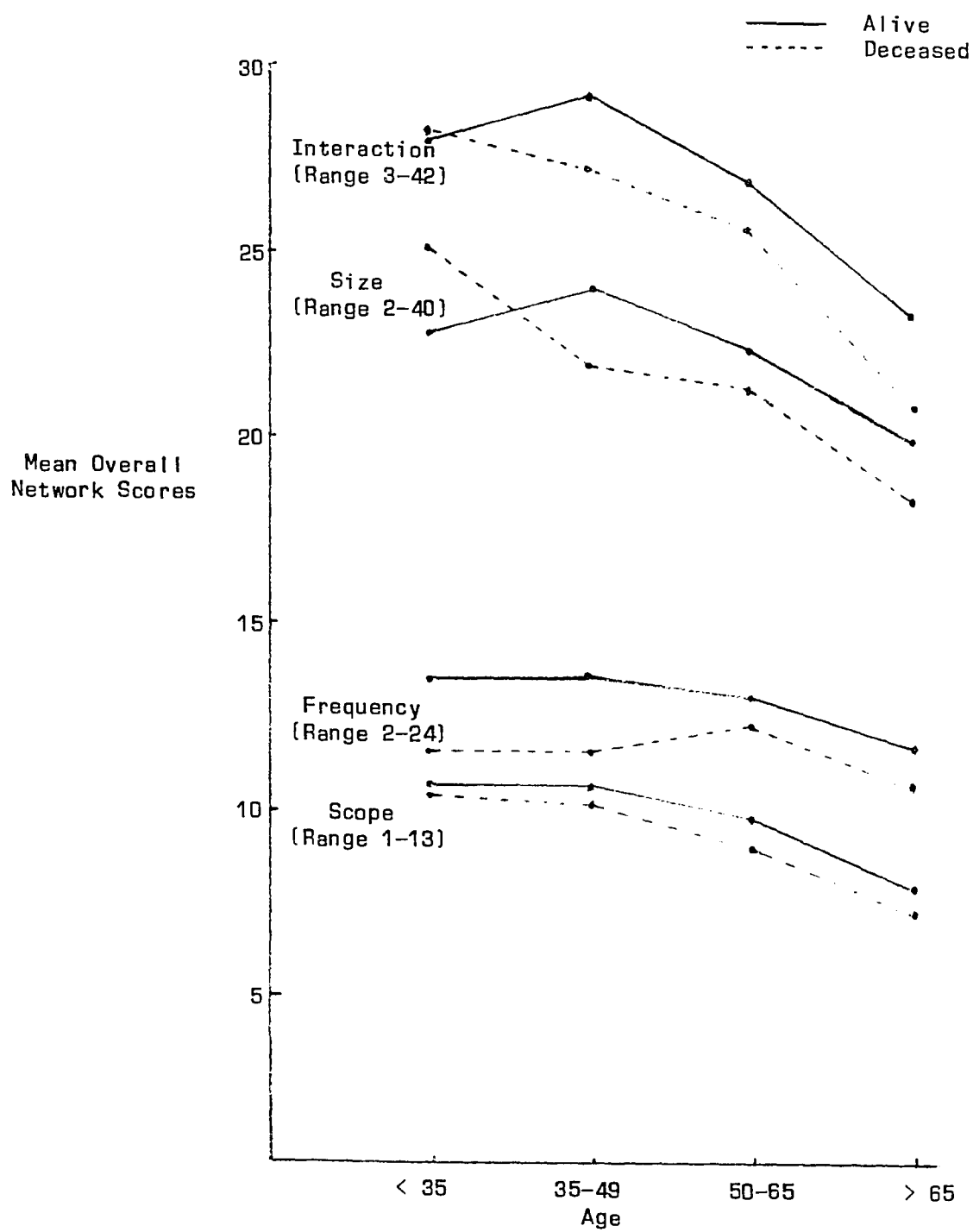


Figure 11. Mean overall network scores of deceased and surviving males, by age.

FEMALES

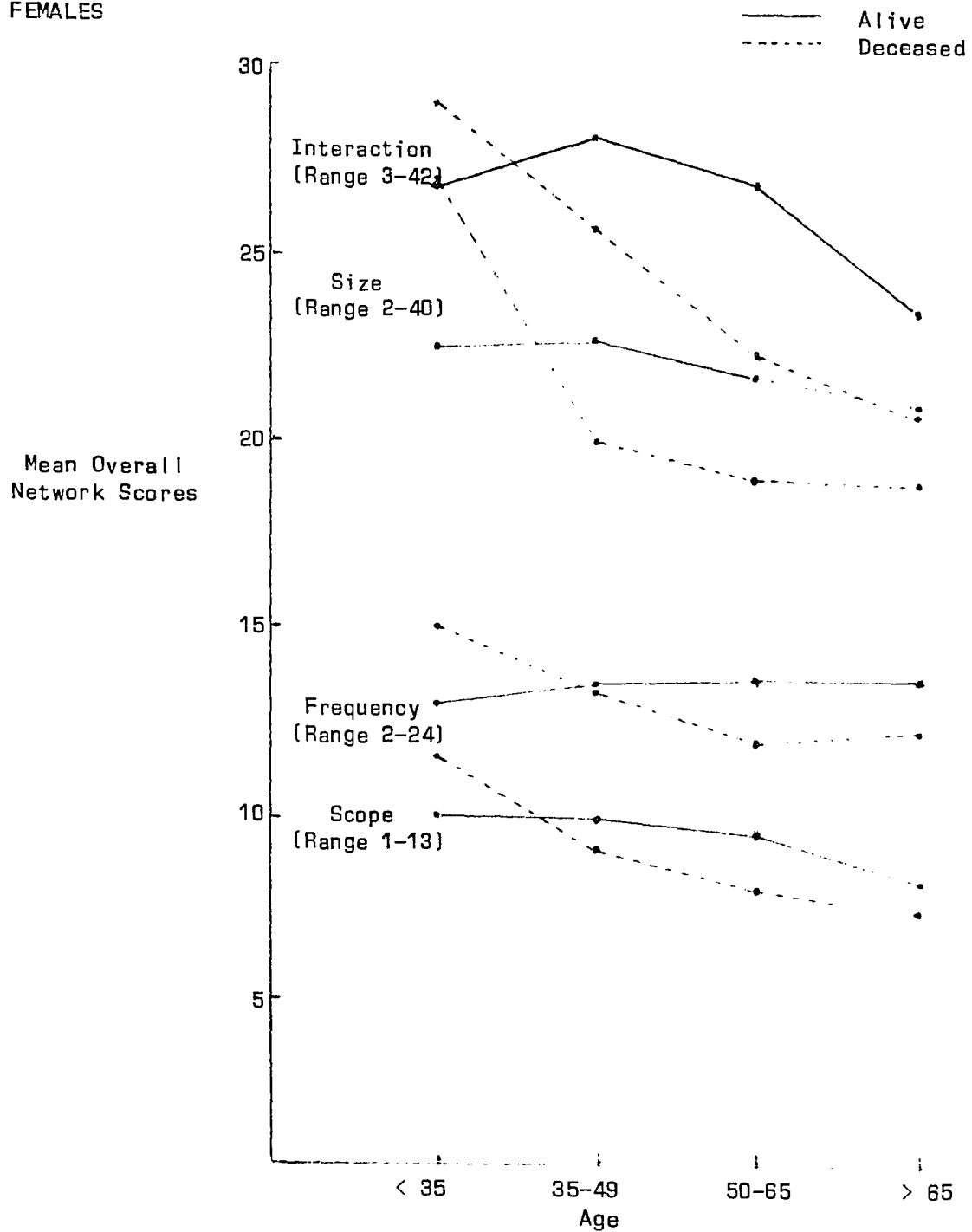


Figure 12. Mean overall network scores of deceased and surviving females, by age.

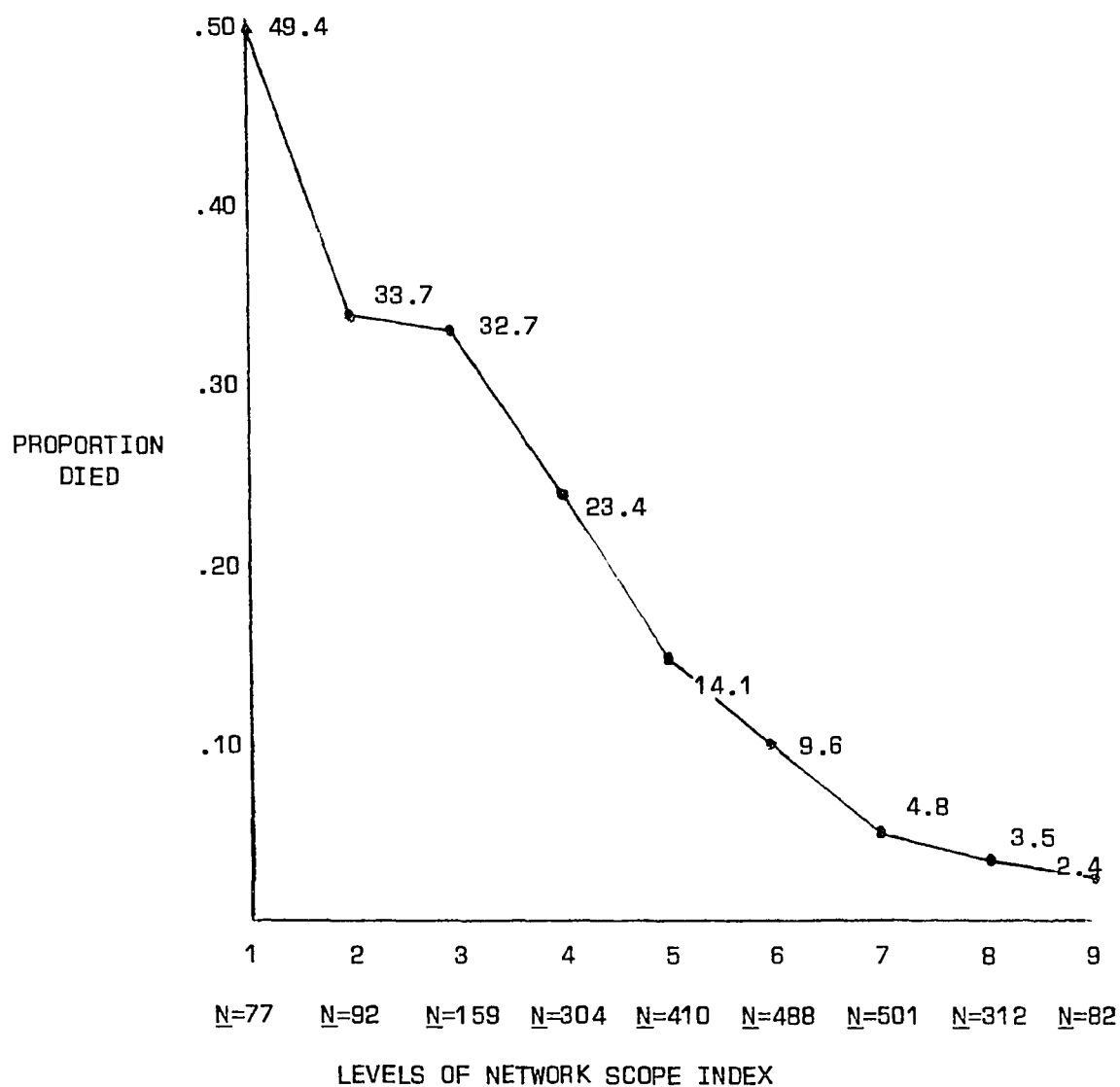


Figure 13. Graph of mortality rates by levels of network scope index.

TABLE XII
AGE-SPECIFIC 12 YEAR MORTALITY RATES PER 100
FOR MEN AND WOMEN, AGES 18 AND ABOVE

	No. of Respondents	No. of Deaths	% Died
<u>Men</u>			
Under 49	677	25	3.7
50 - 65	316	65	20.6
Over 65	<u>209</u>	<u>132</u>	63.2
Total	1202	222	18.5 (crude rate)
<u>Women</u>			
Under 49	777	12	1.5
50 - 65	378	45	11.9
Over 65	<u>246</u>	<u>97</u>	39.4
Total	1401	154	11.0 (crude rate)

TABLE XIII

AGE AND SEX-SPECIFIC MORTALITY RATES PER 100 BY CATEGORIES OF STRUCTURAL NETWORK INDEXES

	18 - 49				50 - 64				65 - 90			
	No.	No. of Deaths	% Died	X ² Signif.	No.	No. of Deaths	% Died	X ² Signif.	No.	No. of Deaths	% Died	X ² Signif.
MEN												
NETWORK SCOPE												
Small	72	3	4.2		72	23	31.9		119	81	68.0	
Medium	212	7	3.3		128	23	17.9		51	28	54.9	
Large	338	10	2.9	.86 (NS)	97	14	14.4	.014*	12	3	25.0	.007**
NETWORK SIZE												
Small	148	7	4.7		105	23	29.9		103	71	68.9	
Medium	213	6	2.6		98	20	22.5		47	24	51.1	
Large	289	11	3.8	.63 (NS)	116	22	19.0	.79 (NS)	49	32	65.3	.10 (NS)
NETWORK FREQUENCY												
Small	171	12	7.0		106	29	27.4		95	64	67.4	
Medium	207	4	1.9		75	12	16.0		40	25	62.5	
Large	258	6	2.3	.012*	116	19	16.4	.07 (NS)	45	24	53.3	.27 (NS)
NETWORK INTERACTION												
Small	105	5	4.8		92	22	23.9		96	66	68.8	
Medium	214	7	3.3		84	17	18.1		49	27	55.1	
Large	290	8	2.8	.61 (NS)	108	21	19.8	.60 (NS)	27	13	48.1	.08 (NS)
WOMEN												
NETWORK SCOPE												
Small	127	2	1.6		113	23	20.4		129	60	46.5	
Medium	284	4	1.4		141	18	12.8		82	25	30.5	
Large	332	5	1.5	.99 (NS)	101	3	3.0	.001***	15	2	13.3	.008**
NETWORK SIZE												
Small	210	6	2.9		153	25	16.3		114	55	48.2	
Medium	279	1	0.4		101	13	12.9		63	16	25.4	
Large	273	5	1.8	.08 (NS)	115	7	6.1	.04*	62	23	37.1	.01**
NETWORK FREQUENCY												
Small	224	1	0.4		117	20	17.1		68	32	47.1	
Medium	245	3	1.2		97	9	9.3		61	27	44.3	
Large	272	7	2.6	.14 (NS)	141	13	9.2	.09 (NS)	91	28	30.8	.07 (NS)
NETWORK INTERACTION												
Small	161	2	1.2		124	26	21.0		132	63	47.7	
Medium	284	4	1.4		120	13	10.8		55	18	32.7	
Large	286	5	1.7	.92 (NS)	107	4	3.7	.000***	34	7	20.6	.007**

NS = nonsignificant

* $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$

These calculations were done by using cell percentages in contingency tables. Chi square tests were used to evaluate whether the frequencies obtained in the cells differed significantly from each other. There was a consistent trend in the expected direction; however, of the 24 crosstabulations, only nine were statistically significant at the $p \leq .05$ level. Six analyses for women reached statistical significance, those involving the older age categories of scope, size, and interaction. For men, three analyses reached statistical significance, two for older people in the scope index and one for the youngest group in the frequency of contact index.

Because marriage had been an important predictor of mortality in other studies, mortality rates were calculated for marital status (Table XIV). Surprisingly, when adjusted for age and sex, whether a person in this sample was married or not did not significantly affect his or her mortality outcome. Trends were in the expected direction, however.

MORTALITY AND ITS PREDICTORS

Prior to the hypothesis testing analyses, an attempt was made to eliminate the nonsignificant control variables. Each independent variable (the nine potential confounding variables and the network scope measure) was regressed separately on mortality. Network scope was used as the

TABLE XIV
AGE AND SEX-SPECIFIC MORTALITY RATES FOR MARITAL STATUS

	No. Married	% Died	No. Not Married	% Died	χ^2	p
<u>Men</u>						
18 - 49						
Alive (N = 652)	583		69			
Deceased (N = 25)	<u>23</u>	3.8	<u>2</u>	2.8	.17	.67(NS)
Total	606		Total	71		
50 - 65						
Alive (N = 251)	231		20			
Deceased (N = 65)	<u>58</u>	20.1	<u>7</u>	25.9	.52	.47(NS)
Total	289		Total	27		
Over 65						
Alive (N = 77)	65		12			
Deceased (N = 132)	<u>104</u>	61.5	<u>28</u>	70.0	.99	.32(NS)
Total	169		Total	40		
<u>Women</u>						
18 - 49						
Alive (N = 765)	672		93			
Deceased (N = 12)	<u>10</u>	1.4	<u>2</u>	2.1	.22	.64(NS)
Total	682		Total	95		
50 - 65						
Alive (N = 333)	265		68			
Deceased (N = 45)	<u>34</u>	11.3	<u>11</u>	13.9	.39	.53(NS)
Total	299		Total	79		
Over 65						
Alive (N = 149)	77		72			
Deceased (N = 97)	<u>45</u>	36.9	<u>52</u>	41.9	.66	.42(NS)
Total	122		Total	124		

NS = Nonsignificant

measure of the social network because it was most correlated with mortality. These analyses are displayed in Table XV. (In order to provide background, the mortality rates for the levels of the variables seen in this table can be viewed in Appendix G. From reviewing these mortality rates calculated from the raw data, non-linearity, when it occurs, is readily apparent.) In each of these analyses and those to come, due to missing values on some of the variables, sample size numbers ranged from 2400 to 2603.

Table XV presents more data in terms of each model fit and parameter estimates than are given in later tables. The overall fit is given by a chi square comparison of the observed and expected values in each cell. Chi square must be non-significant: a p value as close to .99 as possible is considered optimal. Entropy, a measure of association between the dependent and independent variables in the model, is interpreted as is multiple R in ordinary regression.

For some control variables, such as drinking and physical activity, model fit could only be achieved by the introduction of a quadratic term. If the independent variable had a curvilinear relationship with mortality, a metric contrast fitted the line in one direction (either positive or negative) and a quadratic contrast the other. This gave two betas and their corresponding z values for

TABLE XV
RESULTS OF A SERIES OF LOGISTIC ANALYSES OF EFFECTS OF NINE
CONTROL VARIABLES AND NETWORK SCOPE ON MORTALITY

	Model Fit				Parameter Estimates			
	Likelihood ratio chi square	Degrees freedom	<u>p</u> value	Entropy (mult. <u>R</u>)	Logistic coefficient {beta} [linear]	<u>Z</u> of beta	Logistic Coefficient {beta} [quadratic]	<u>Z</u> of beta
Age	.71	2	.70	.27	1.59	19.01***		
Sex	.00	0	1.0	.01	.30	5.35***		
Socioeconomic Status	2.71	3	.43	.01	-.22	-5.12***		
Perceived health	.86	1	.35	.06			.22	11.33***
Length hospital stay	.49	1	.48	.05	.76	10.74***		
Rate outpatient contacts	2.70	1	.10	.02			.12	7.89***
Smoke	3.19	3	.36	.0	-.04	-.74(NS)		
Drink	2.26	13	1.0	.03	-3.12	-7.11***	.60	6.72***
Physical activity	3.46	13	.99	.02	.84	2.79**	-.22	-3.73***
Network scope	4.01	3	.26	.11	-.68	-12.92***		

NS = nonsignificant
 * $p \leq 0.05$
 ** $p \leq 0.01$
 *** $p \leq 0.001$

some of the variables in Table XV. On subsequent analyses with more independent variables in the equation, quadratic terms were not required to achieve acceptable fit of the model.

Regression-like logistic coefficients, betas, give a measure of the association between an independent variable and mortality. From these coefficients are calculated predicted relative risk, or odds ratios. It must be remembered that an "odds" is the basic form of the variation to be explained when the outcome has only two possibilities. An odds ratio is the ratio between the frequency of being in one category of the dependent variable and the frequency of not being in that category. Its interpretation in this research is the chance that an individual selected at random will be observed to fall into the category of mortality as opposed to the category of survival. Odds ratios (relative risk) take only positive values, have no upper limit, and are 1.00 when no relationship exists (Knoke & Burke, [1977]). Using the data on age from Table XV for example, the odds ratio for age, calculated from the logistic coefficient (see Chapter IV for formula), is 4.9. This means that people in the highest age category (oldest) are predicted to be almost 5 times as likely to die in the 12 year observational period as those in the lowest category (youngest). The logistic coefficient for network scope is $-.68$. This gives an odds ratio, or relative risk, of .50. In this case, the lowest

network category is the one most associated with mortality, and a beta with a negative sign is produced. Thus, the predicted relative risk of death for a person in the highest category is half that of a person in the lowest. Stated another way, the relative risk of people in the highest category surviving is 2 to 1. In all subsequent tables, predicted relative risk is calculated and displayed along with the logistic coefficients (betas).

From Table XV it can be seen that age is the most highly related to death, followed by network scope. The strength of association (entropy) between mortality and age is .27; that between mortality and network scope is .11 before any of the control variables are added to the equation.

All of the potential confounding variables are significantly related to mortality at the $p < .001$ level, except for smoking. However, because it appeared from prior correlations that smoking may interact with age, smoking was not abandoned yet as a potential confounding variable. Except for the health measures, the control variables are not highly associated with mortality, as measured by entropy. Perceived health and length of hospital stay are 0.06 and 0.05, respectively. All the other control variables are less than 0.03. Smoking and drinking have curvilinear relationships with mortality, as can be seen by the mortality rates for the different categories of these

variables as they are displayed in Appendix G. None of the control variables, then, was able to be eliminated at this stage of the analysis.

Continuing with the strategy of attempting to eliminate variables, a second series of logistic analyses is summarized in Table XVI. In this series, the relationship between mortality and each confounding variable is adjusted for age. At this stage, drink and physical activity become nonsignificant, and socioeconomic status and rate of contacts were eliminated because they were no longer significant at the $p < .001$ level. The individual contribution of each of the control variables is not of particular substantive interest in this research. Of import is the impact of social networks on mortality after removing the variation due to these potentially confounding factors.

HYPOTHESIS 1: SOCIAL NETWORKS AS PREDICTORS OF MORTALITY

The final logistic model, as seen in Table XVII, was decided upon by the strategy of adding the most significant remaining variables one at a time, ending with the network scope measure each time, until none of the remaining confounders could increase the prediction of mortality. Entropy was raised from .28 with age and scope alone to .32 with age, sex, perceived health, hospital stay, and network scope. Smoking was eliminated at this stage. Network scope

TABLE XVI
RESULTS OF A SERIES OF LOGISTIC ANALYSES OF EFFECTS
OF DICHOTOMIZED CONTROL VARIABLES ON
MORTALITY, ADJUSTING FOR AGE

<u>VARIABLE</u>	<u>LOGISTIC COEFFICIENT {BETA}</u>	<u>RELATIVE RISK</u>	<u>Z OF BETA</u>	<u>ENTROPY (MULTIPLE R)</u>
Sex	-.40	.67	6.19***	.29 (<u>N</u> = 2603)
Socioeconomic Status	-.19	.83	-2.76**	.27 (<u>N</u> = 2419)
Perceived Health	-.45	.64	-6.49***	.28 (<u>N</u> = 2556)
Hospitalization	.36	1.43	5.27***	.29 (<u>N</u> = 2603)
Outpatient Contacts	.16	1.17	2.50**	.27 (<u>N</u> = 2603)
Smoke	.24	1.27	3.55***	.28 (<u>N</u> = 2588)
Drink	.00	1.00	.09 (NS)	.27 (<u>N</u> = 2465)
Physical Activity	-.04	.96	-.73 (NS)	.27 (<u>N</u> = 2540)

NS = Nonsignificant

* $p \leq 0.05$

** $p \leq 0.01$

*** $p \leq 0.001$

TABLE XVII
CHANGES IN RELATIVE MORTALITY RISK FOR THE INDEX OF
TOTAL NETWORK SCOPE, WITH ADJUSTMENT FOR
SIGNIFICANT CONTROL VARIABLES

All Independent Variables Dichotomized
(except age in 4 levels)
(Five Multiple Logistic Analyses)

Adjustment Variables	Logistic Coeff. (Beta)	Relative Risk	Z of Beta	Entropy (Multiple R)	Model Fit, p
No adjustment (network scope alone)	-.79	.45	-11.84***	.083	
Age (and network scope)	-.34	.71	- 4.42***	.278	.66
Age, Sex (and network scope)	-.37	.69	- 4.76***	.296	.65
Age, Sex, perceived health (and network scope)	-.32	.72	- 4.09***	.312	.54
Age, Sex, perceived health, hospital stay (and network scope)	-.32	.72	- 4.06***	.318	.41

All Independent Variables in Three Levels
(Five Multiple Logistic Analyses)

No adjustment (network scope alone)	-1.17	.31	-13.30***	.108	.80
Age (and network scope)	-.57	.56	- 5.74***	.285	.53
Age, Sex (and network scope)	-.60	.55	- 5.86***	.296	.46
Age, Sex, perceived health (and network scope)	-.52	.59	- 5.01***	.313	.60
Age, Sex, perceived health, hospital stay (and network scope)	-.52	.59	- 4.97***	.321	.82

*** $p \leq 0.001$

made a statistically significant independent contribution even after adding all the control variables. Although its z value fell from 4.42 with age alone to 4.06 in the full model, network scope continued to be significant at the $p < .001$ level. Thus, all things being equal in this sample, people with larger network scope have a reduced risk [.72] of dying when compared to people with smaller network scope.

In order to understand what differences might occur when the independent variables were in three ordinal levels rather than dichotomized (two levels), five additional analyses were conducted. It was thought that such an analysis would allow network scope to predict mortality more accurately. It can be seen that there is a slight decrease in predicted relative risk corresponding to a slight increase in z values, but the strength of association remains relatively unchanged. These analyses appear at the bottom of Table XVII. For the majority of the remaining analyses, the variables were used in three ordinal levels wherever possible, because using three levels achieved optimal model fit. For a few of the analyses, age divided into four levels gave superior fit.

As seen in the lower portion of Table XVII, when mortality is regressed on network scope alone, people with extensive network scope have an impressively lower risk of death [.31] as compared to those with networks of small

scope. It may be easier to interpret this relationship by reversing it: people with minimal networks have more than three times (3.22) the risk of dying as opposed to those with maximum networks. These calculations can be computed for all the network variables by taking the antilog of the logistic coefficient without its negative sign. When age is controlled for, the relationship between networks is decreased by approximately one-half. In other words, people with minimal networks then have 1.77 times the risk of death as compared to those with maximum networks. As the sex and health status control variables are added to the equation, relative risk of mortality decreases to 1.68.

The next question is, if the summary network scope index predicts mortality, which part of an individual's social network is most important in this relationship? Each sector of network scope was used separately to predict mortality, with controls for the significant confounding variables. According to Table XVIII, it can be seen that the scope of friends index has the lowest relative risk, .72, followed by the scope of community index. This means that people with more friends and more community ties have a lower risk of death. The scope of immediate family was nonsignificant, and the scope of extended family index just barely reached minimal significance.

TABLE XVIII
 RELATIVE MORTALITY RISK FOR SECTORS OF NETWORK SCOPE,
 ADJUSTED WITH SIGNIFICANT CONTROLS (FULL MODEL)
 (FOUR MULTIPLE LOGISTIC ANALYSES)

Scope Sector	Model Fit, p level	Logistic Coeff. (Beta)	Relative Risk	Z of Beta	Entropy (Multiple R)
Scope of Family					
Immediate	.45	-.13	.88	-1.38(NS)	.307
Extended (Immediate + relatives)	.55	-.14	.87	-2.03*	.308
Scope of Friends	.70	-.41	.72	-3.87***	.318
Scope of Community	.45	-.28	.75	-3.96***	.319

NS = Nonsignificant

*p ≤ 0.05

**p ≤ 0.01

***p ≤ 0.001

Since the summary network scope measure significantly predicted mortality, three additional analyses were conducted utilizing the other three summary structural network indexes. The results of these analyses appear in Table XIX. All were statistically significant. People with large networks and frequent contact both had decreased relative risks for death of .81 while those with much network interaction had risks of .68, slightly more than that of network scope (.59).

A series of ten analyses were computed to assess the relative mortality risk for network interaction within the relationship domains, using the full model (Table XX). Having a spouse, children, interaction with family of origin and with relatives did not predict mortality. However, the logistic coefficients for these relationship domain measures were in the predicted direction, except for family of origin. The two indexes concerning friends (close friends and other friends) were significant predictors of mortality at the $p < .05$ level. Work interaction predicted mortality at the $p < .01$ level, but church attendance and interactions meetings did not. Those who did not engage in social leisure activities were at the highest relative risk. People with no such activities had 1.5 times the risk of death compared to those with much social leisure interaction.

TABLE XIX
RELATIVE MORTALITY RISK FOR THE FOUR NETWORK STRUCTURAL
INDEXES, ADJUSTED WITH SIGNIFICANT CONTROLS, FULL
MODEL (FOUR MULTIPLE LOGISTICS ANALYSES)

	Model Fit, <u>p</u> level	Logistic Coeff. (Beta)	Relative Risk	<u>Z</u> of Beta	Entropy (Multiple <u>R</u>)
Network Scope	.88	-.52	.59	-4.97***	.321
Network Size	.34	-.21	.81	-2.51*	.308
Network Frequency of Contact	.84	-.21	.81	-2.41*	.308
Network Interaction	.55	-.39	.68	-3.99***	.317

*p ≤ 0.05

**p ≤ 0.01

***p ≤ 0.001

TABLE XX
RELATIVE MORTALITY RISK FOR INTERACTION WITHIN
RELATIONSHIP DOMAINS, USING FULL MODEL (TEN
MULTIPLE LOGISTIC REGRESSION ANALYSES)

Relationship Domain	Model Fit, p level	Logistic Coeff. (Beta)	Relative Risk	Z of Beta	Entropy (Multiple R)
Marriage	.44	-.09	.91	-1.06(NS)	.306
Children	.70	-.08	.92	-0.84(NS)	.306
Family of Origin	.45	.02	1.02	0.33(NS)	.301
Relatives	.75	-.06	.94	-0.73(NS)	.308
Close Friends	.90	-.19	.83	-2.19*	.314
Other Friends	.33	-.19	.83	-2.39*	.313
Work	.46	-.28	.76	-2.64**	.308
Church (Frequency of attendance only)	.50	-.15	.85	-1.82(NS)	.310
Meetings	.37	-.16	.85	-1.95(NS)	.306
Social Leisure	.52	-.39	.67	-3.91***	.315

NS = Nonsignificant

*p ≤ 0.05

**p ≤ 0.01

***p ≤ 0.001

Did networks predict mortality more strongly for men or for women? As can be seen in Table XXI, after adjustment, the difference in relative risk between people who score high and low on overall network scope is greater for women than for men (predicted relative risk .50 for women vs. .76 for men). Did networks influence death risk more in young people or older people? It was found that networks were slightly more predictive for people in their older years than in middle age (relative risk for age 50-65 was .55 vs. .49 for over 65 years of age). Network scope was not predictive of mortality for the people aged 35-49 [Table XXII].

In summary, many logistic regression analyses were conducted to explore various network aspects and their relationship to mortality. Some of the network measures were independently predictive of demise. However, these analyses do not indicate the importance of the network variables in relation to the other factors that influenced why the people in the study population died. To answer this question it is necessary to look more closely at the association between the independent and dependent variables in the model. Table XXIII shows the full logistic regression model with and without the network scope variable entering last. Entropy, or multiple R , is .3213 if network scope is included. If network scope is omitted, entropy

TABLE XXI
RELATIVE MORTALITY RISK FOR NETWORK SCOPE FOR MEN AND WOMEN
USING FULL MODEL (SIX MULTIPLE LOGISTIC ANALYSES)

	Model Fit, p level	Logistic Coeff. (Beta)	Relative Risk	Z of Beta	Entropy (Multiple R)
<u>MEN</u>					
No adjustment (network scope alone)	.31	-1.22	.30	-10.50***	.127
Age (and network scope)	.86	- .53	.60	- 3.86***	.314
Age, perceived health, hospital stay (and network scope)	.81	- .27	.76	- 2.56*	.333
<u>WOMEN</u>					
No adjustment (network scope alone)	.35	-1.20	.30	- 8.76***	.104
Age (and network scope)	.38	- .68	.50	- 4.51***	.273
Age, perceived health, hospital stay (and network scope)	.97	- .68	.50	- 4.28***	.297

* $p \leq 0.05$
*** $p \leq 0.001$

TABLE XXII
 RELATIVE MORTALITY RISK FOR NETWORK SCOPE BY AGE CATEGORIES,
 ADJUSTED FOR SIGNIFICANT CONTROL VARIABLES, FULL MODEL
 (THREE MULTIPLE LOGISTIC ANALYSES)

	Model Fit, <u>p</u> level	Logistic Coeff. (Beta)	Relative Risk	<u>Z</u> of Beta	Entropy (Multiple <u>R</u>)
Age 35 - 49	.51	.04	1.04	.14(NS)	.106
Age 50 - 65	.88	-.59	.55	-3.74***	.086
Age over 65	.91	-.71	.49	-3.89***	.101

NS = Nonsignificant

*** $p \leq 0.001$

TABLE XXIII

RELATIVE MORTALITY RISK FOR VARIABLES IN FULL LOGISTIC REGRESSION
MODEL, WITH AND WITHOUT NETWORK VARIABLES ENTERING
LAST (TWO LOGISTIC REGRESSION ANALYSES)

	Logistic Coefficient (Beta)	Relative Risk	Z of Beta
<u>Full Model</u>			
Intercept	-5.45		-12.84
Age	1.54	4.66	14.91***
Sex	.43	1.53	6.00***
Perceived Health	.49	1.63	5.01***
Length Hospital Stay	.36	1.43	3.95***
Network Scope	-.52	.59	-4.97***
Model Fit, p level = .88 Entropy = .3213 N = 2418			
<u>Full Model Without Network Variable</u>			
Intercept	-6.90		-22.12
Age	1.71	5.52	18.04***
Sex	.44	1.55	6.29***
Perceived Health	.56	1.75	5.89***
Length Hospital Stay	.38	1.46	4.26***
Model Fit, p level = .29 Entropy = .3108 N = 2556			

is .3108. Network scope thus contributes only .01 of the variance to the model; the other network variables contribute even less, as seen in entropy in other models displayed in the tables.

HYPOTHESIS 2: SOCIAL NETWORKS AS PREDICTORS OF DISEASE INCIDENCE

The series of logistic analyses just described confirms an independent prospective relationship between some social network indicators and mortality.

Other such studies of community populations have ended here. Fortuitously, the opportunity affords itself in this study to continue with an exploration of where social networks are most effective on the health/illness continuum. Do the health benefits of social resources occur early, preventing disease from beginning by, for instance, strengthening host resistance? Or do the health benefits come later, slowing disease progression once it has occurred? It is to these questions that we now turn.

Hypothesis 2 stated that adults with more visual network resources would have lower incidence of disease. Multiple linear regression was used to test this hypothesis, using the continuous versions of each of the variables. Before testing the hypotheses, however, bivariate relationships between age, sex, and network scope were assessed. This was done because it appeared from preliminary

regression analyses that sex contributed much variance to the model. It thus seemed important to assess men and women separately. Table XXIV, showing network scope, age, and sex relationships with disease incidence as operationalized by initial doctor's office visits, reveals network scope (in 3 categories) to be a statistically nonsignificant predictor for women but significant ($p = .04$) for men, using one-way ANOVA. Men with small networks made more initial doctor office visits, as hypothesized, except for the over 65 group. For men, age did not play a part in the number of initial visits made during the seven year time period. For women, however, age was highly significant ($F_{26.4}$). Young women made many more initial visits than older women. (This finding was not unexpected. Previous analysis of this data set had shown that young women avail themselves of outpatient health care frequently [Hibbard & Pope, 1983]). This does not mean that older women make fewer visits overall, however. Older women, with more chronic illnesses, probably simply make visits of a continuing nature.

Ordinary multiple regression analyses predicting disease incidence were completed for men and women separately in terms of the disease incidence outcome. A hierarchical, forced entry strategy was utilized with age added as the first control. In subsequent equations, additional control variables were added with network scope

TABLE XXIV
MEAN RATES PER 10 PERSON YEARS OF INITIAL
DOCTOR OFFICE VISITS* BY AGE,
SEX, AND NETWORK SCOPE

	Small Scope	Medium Scope	Large Scope
<u>Men</u>			
Under 35	13.0	10.8	11.0
35 - 49	12.5	11.0	9.9
50 - 65	11.6	10.1	8.2
Over 65	10.8	11.9	11.6
<u>Women</u>			
Under 35	18.9	17.2	16.3
35 - 49	14.2	12.3	12.7
50 - 65	12.8	10.9	10.7
Over 65	10.3	11.9	11.3

*Range: 0 - 94.3; mean: 12.0

One-way analysis of variance:

Men	Age independent, $F = 1.63$, $p = .18$ (NS)
	Scope independent $F = 3.12$, $p = .04$
Women	Age independent, $F = 26.36$, $p = .0000$
	Scope independent, $F = .15$, $p = .85$ (NS)

NS = Nonsignificant

always entering last. These analyses are displayed in Table XXV. For women, but not for men, age was an important predictor of disease incidence. However, in terms of the second hypothesis of this research, the scope of the network made no impact on disease incidence.

HYPOTHESIS 3: SOCIAL NETWORKS AS PREDICTORS OF DISEASE PROGRESSION

Disease progression, as operationalized by changes in rates of outpatient contacts for the seven disease classes, was also first described in terms of relationships between network scope, age, and sex (see Table XXVI). For men, neither age nor network were significantly related to rate changes, using one-way analysis of variance. (It will be recalled that if patients were getting sicker, it would be expected that the rate changes would be in a positive direction.) For women, again network scope did not make a difference. However, age was significant in that older people had a more positive rate of change. This meant, according to the interpretation of the dependent variables for disease progression in this research, that older women had more disease progression than those younger ($F = 5.7$, $p < .007$).

To test hypothesis 3, which stated that adults with more network resources would have less disease progression,

TABLE XXV
HIERARCHICAL MULTIPLE LINEAR REGRESSION ANALYSES
FOR MEN AND WOMEN PREDICTING DISEASE
INCIDENCE[†] FROM NETWORK SCOPE

	Parameter		Model		
	Standardized Beta	F (Beta)	Multiple R	R ²	F (of model)
<u>Men</u> (N = 1090)					
Age	-.051	2.12(NS)	.018	.000	.35(NS)
Socioeconomic Status	-.055	3.16(NS)	.065	.004	2.28(NS)
Smoke	.000	.00(NS)	.065	.004	1.52(NS)
Drink	-.014	.21(NS)	.066	.004	1.17(NS)
Physical Activity	-.041	1.66(NS)	.081	.007	1.43(NS)
Network Scope	-.031	.79(NS)	.085	.007	1.33(NS)
<u>Women</u> (N = 1170)					
Age	-.251	63.13***	.231	.053	66.45***
Socioeconomic Status	-.018	.43(NS)	.232	.054	33.43***
Smoke	.000	.00(NS)	.232	.054	22.27***
Drink	-.018	.39(NS)	.232	.054	16.77***
Physical Activity	-.015	.27(NS)	.232	.054	13.41***
Network Scope	-.051	2.68(NS)	.237	.056	11.64***

[†]Based on total initial doctor office visits per 10 person years

Note: All Variables Continuous

NS = Nonsignificant

***p ≤ 0.001

TABLE XXVI
CHANGE IN MEAN RATE OF OUTPATIENT CONTACTS*
BY AGE, SEX, AND NETWORK SCOPE

	Small Scope	Medium Scope	Large Scope
<u>Men</u>			
Under 35	.69	.10	.23
35 - 49	.91	.61	.18
50 - 65	-1.39	.85	.42
Over 65	1.72	.97	.32
<u>Women</u>			
Under 35	-.74	-.62	-.12
35 - 49	-.20	-.50	-.17
50 - 65	-.49	1.01	.10
Over 65	2.21	.87	.77

*Range: -67.7 TO +84.9

Mean: .27

One-way analysis of variance:

Men Age independent, $F = 1.88$, $p = .13$ (NS)
 Scope independent, $F = .48$, $p = .62$ (NS)

Women Age independent, $F = 5.70$, $p = .007$
 Scope independent, $F = .67$, $p = .51$ (NS)

NS = Nonsignificant

ordinary multiple regression procedures were utilized. Again a hierarchical, forced entry strategy was utilized whereby age was entered as the first control. In subsequent equations additional control variables were added with network scope always entering last. As can be viewed in Table XXVII, network scope was not predictive of disease progression.

SUMMARY

In summary, the major findings of the study are:

1. Social networks predict mortality. Each of the summary indexes of four different network perspectives (scope, size, frequency of contact, and interaction) independently predict mortality. Network scope is the strongest predictor.
 - A. In terms of the four sectors which comprise the scope index, scope of community activities, scope of friends, and scope of extended family each predict death. An indicator of the scope of the immediate family does not.
 - B. In terms of specific social relationships, the more intimate family connections with spouse, children, family of origin, and relatives do not affect risk of death. Relationships with friends do, as do relationships with co-

TABLE XXVII
HIERARCHICAL MULTIPLE LINEAR REGRESSION ANALYSES
FOR MEN AND WOMEN PREDICTING DISEASE^T
PROGRESSION FROM NETWORK SCOPE

	Parameter		Model		
	Standardized Beta	<u>F</u> (Beta)	Multiple <u>R</u>	<u>R</u> ²	<u>F</u> (of model)
<u>Men</u> (<u>N</u> = 1090)					
Age	.039	1.30(NS)	.040	.001	1.77(NS)
Socioeconomic Status	.043	1.94(NS)	.058	.003	1.80(NS)
Network Scope	-.016	.21(NS)	.059	.003	1.27(NS)
<u>Women</u> (<u>N</u> = 1170)					
Age	.080	6.53**	.083	.007	8.08**
Socioeconomic Status	-.039	1.71(NS)	.091	.008	4.89**
Network Scope	.000	.04(NS)	.091	.008	3.27*

^TDisease Progression based on change in rate outpatient contacts

NS = Nonsignificant

*p ≤ 0.05

**p ≤ 0.01

workers. Whether one attends church or is involved with voluntary associations is not predictive of mortality. The number of social leisure activities engaged in is the strongest individual predictor of death.

C. Network scope is more influential in mortality outcomes for women than for men.

D. Network scope predicts death risk most strongly for people in the oldest age group. It does not predict death for those under 50 years.

E. Social factors account for only a small amount of the total variance in the logistic regression model.

2. Social networks do not predict disease incidence or disease progression.

CHAPTER VI

DISCUSSION

The importance to an individual of a group of supportive people has long been recognized. This concept, now known as a social network, has been defined, elaborated, quantified, and in the past few years investigated in terms of health. It has been shown to predict mortality in community populations. The purpose of this research has been to determine the relationship between social networks and mortality in a cohort living in an urban area of the Pacific Northwest, and to extend that knowledge by delineating whether networks influence disease incidence or disease progression.

The findings of this study have been presented in the previous chapter. In this chapter, these findings will be discussed and placed in a broader perspective. This chapter features three sections. In the first section, the findings will be discussed in terms of the research hypotheses. The reasons why hypotheses 2 and 3 were not upheld will be explored. The results of the hypothesis testing will then be related to the theoretical framework of the study.

The second section of the chapter features a discussion of the network relationship sectors which were

significant predictors of mortality in this study. The findings from these sectors are compared with those found in other similar studies. Reasons why contradictions across studies may have occurred are explored. Since the nature of the samples, analytic approaches, and social network measurements cannot be detached from the results themselves, methodological factors will be discussed in the third section.

HYPOTHESES

Hypothesis #1

The first hypothesis stated that, controlling for confounding factors, adults with more social network resources would have less risk of death. This hypothesis was confirmed. Summary measures of size, frequency, interaction, and network scope were shown to independently predict mortality in the study population. This parallels the findings of Berkman and Syme (1979), House et al. (1982), and Blazer (1982), who obtained similar results in community populations in San Francisco, Michigan, and North Carolina. All these studies point to social factors influencing mortality risk in a positive direction, which is important for community health.

Of the four structural measures of the network, network scope was the most important predictor, followed by network interaction. Network size and the frequency with

which the respondents had contact with their networks were of lesser importance. This indicates that it is not so much the quantity within the particular network sections but the diversity or breadth of the network as a whole that is important. Each role relationship domain probably affords a particular kind of support, each of which is important for maximum health protection. When some are missing, one becomes more susceptible to environmental stress.

Hypothesis #2 and #3

Mortality is but a crude measure of what is actually happening to people in terms of disease states which lead to death. A major purpose of this research, as reflected in the second and third hypotheses, was to extend the networks/mortality knowledge by assessing whether networks were more important in reducing disease incidence or retarding disease progression. It was hypothesized that adults with more social network resources would have lower disease incidence (hypothesis #2), and that adults with more social network resources would have less disease progression (hypothesis #3). Neither of these two hypotheses could be confirmed. There was no relationship between network scope, the network independent variable used, and disease incidence or disease progression. Why did this occur?

It has often been said that research results are only as good as the operationalization and measurement of the

variables used. The operationalization and measurement of mortality in this study was definite and specific. However, the operationalization and measurement of the other two dependent variables, disease incidence and disease progression, were more problematic. Specific problems encountered in relation to these two dependent variables will now be discussed.

Hypothesis #2: Disease Incidence. 1) Disease incidence could only be counted if the individual sought assistance from the health care system when ill. Many people choose to treat more minor illnesses by themselves. Also people with large networks may not seek assistance when symptoms develop, relying instead on network members to help them. This issue relates to the adequacy of health care utilization data to provide a measure of disease incidence, which, as pointed out by Kasl (1983), is difficult to measure in any sense.

2) The disease incidence variable used initial visits from each of the ten classes of the Kaiser Disease Classification System. This meant that visits for preventive care, trauma, and obstetrics were included, resulting in a measure with a great deal of "noise." Rather than counting only initial visits that occurred because the individual was actually sick, visits concerning pregnancy (only the first visit of the entire pregnancy, however), accidents, or

routine physical exams were also included in the number of initial visits.

It should be noted that the theoretically preferred method for determining incidence of disease is a prospective surveillance of a cohort, free of disease initially, who are assessed for a variety of possible risk factors and then are monitored for the development of cases of the disease (Kasl, 1983).

However, it is possible that disease incidence was not associated with social networks because networks are not protective against episodes of new morbidity but only against such episodes being fatal. This relates to the need for theoretical refinement, which is discussed more fully in the succeeding chapter.

Hypothesis #3: Disease Progression. 1) Disease progression was operationalized to be change in the rate of health care contacts. The baseline period for the time covered in this variable was the four years prior to the survey, as compared to the three years subsequent to it. Three years was probably insufficient time to detect rate changes in disease progression due to networks. A more adequate measure of disease progression would be a comparison of, for instance, ten or more years of contacts following the baseline period. A longer time frame may be necessary because many chronic diseases progress slowly. This more extensive measurement of the disease progression

variable will be possible when the planned linkage of the survey data and utilization data to 1980 is accomplished by the Center.

2) The use of quantitative health care utilization data to measure disease progression can be problematic. For instance, the "worried well" (people who fear they may be sick but are not) may make an inordinate number of out-patient contacts in proportion to the severity of their disease problems, giving an inaccurate picture of disease status. Had it been possible to peruse patient records, a measure more pertinent to actual change in disease states could have been developed in addition to, or combined with, health service utilization data.

Ideally, disease progression would be assessed over time by the monitoring of new cases of specific diseases for additional medical outcomes. The outcomes of interest would include: (1) case fatality: frequency with which individuals with the disease die of the disease during a stated period; (2) repeat episodes: new medical events, such as myocardial infarction, among people who have already experienced the initial event; (3) exacerbations; (4) length of recovery; and (5) amount of residual morbidity; i.e., among those recovering from a stroke, the range of motion remaining in the affected limb (Kasl, 1983).

THE THEORETICAL FRAMEWORK

The model in Figure 1 provided the basis for the conceptual framework for this research. The results lend support to the theory that social support, delivered via social networks, either buffers the ubiquitous stress in the environment of individuals or acts directly to promote health. Because no measure of stress or stressful life events was available on the survey, there is no way to distinguish between the buffering effects of social support and its main effects.

Because network scope was not significant in relation to both disease incidence and disease progression, it is not possible to advance this theory so as to be able to determine where on the health/illness continuum social support is most efficacious. It may be that social networks do not impact disease status at the junctions postulated in this theory. It may be that social support affects symptom-reporting subsequent to disease initiation. People with more supportive ties may receive encouragement to seek medical care earlier, thus effecting early cure. This would be important in a disease such as cancer. The true mechanisms may be numerous and varied and specific for different social environmental conditions and different health outcomes. Or, the attempt to distinguish between disease incidence and disease progression may be untenable.

Social support in both etiology and recovery may be similarly mediated.

NETWORK RELATIONSHIPS AND MORTALITY

A secondary aim of this dissertation was to assess which of the network relationships were most important in predicting health outcomes. Indexes of network sectors (family, friends, community) and role relationship domains (spouse, children, family, organizations) were used separately to predict mortality. (The outcomes of these analyses were presented in Tables XVIII and XX in Chapter V.) Previously published research of this type had provided conflicting evidence for the pertinence of specific aspects of the network. It should be kept in mind, however, that the variety of indexes developed across studies has been too great to expect more than very general consistency of results.

The relationship domains assessed in Table XX are now discussed and compared to findings in other similar studies. Then, the possible reasons behind conflicting results are presented.

Marriage

In the study population, marriage did not predict mortality. This was true also in the studies by Blazer (1982) and Zuckerman et al. (1984). However, Berkman and

Syme [1979], House et al. [1982], and Schoenbach [1983] had found the presence of a spouse was important in prolonging life, particularly for men. This contradiction is hard to understand, as it is known that marriage usually positively affects a variety of health outcomes. One possible explanation relates to the fact that Blaizer and Zuckerman and her colleagues both studied elderly samples and tracked them for shorter time periods (30 months and 24 months, respectively). According to Zuckerman, marital status may have had a strong direct influence on the health status of the subjects for ten or more years before the start of the study and therefore an indirect influence on mortality during the two years of follow up. Because health status variables at the time of the survey are used as control variables in the regression analysis, an indirect influence would not be apparent. If marriage is more important in retarding mortality in people studied for at least a decade, however, the Kaiser study population should have also indicated that marriage was a significant predictor of mortality.

Family

The family of origin (mother, father, siblings) index failed to predict death among the study population. Neither did having or not having children. However, for the aged cohort studied by Zuckerman et al. [1984], the absence of children predicted mortality. It makes sense that children

might not be important predictors among younger people. However, children may be the most significant social contacts for the elderly in terms of maintaining health.

Relatives

Relatives were also nonsignificant in predicting mortality for the study population. It is not possible to assess separately the effects of relatives on mortality in other studies because they were combined with friends into a single measure. Berkman and Syme (1979) found an index of contacts with friends and relatives to significantly affect risk. House et al. did not find as strong an association between mortality and friend/relative contact. Schoenbach et al. (1983) found no such relationship. In the household interview survey, only information about relatives living nearby or a day's drive away was obtained. Thus, the index assessing interaction with relatives may be a weak indicator of the extent of this aspect of the social network.

Friends and Work Associates.

A measure of close friends and a measure of other friends both prospectively predicted mortality. As noted above, most studies combined friends and relatives for a single measure, so a comparison of friends effects is not possible across studies. However, in Zuckerman's study (1984) which did include a measure of friends, mortality among the elderly poor was not related to friendship net-

works or frequency of interaction among friends. In this study, having interaction with coworkers affected risk of death significantly. Most other studies did not include measures of this aspect of the social network. Friends and work associates will be discussed together, because, from the nature of the questions regarding interaction with coworkers outside of the work place (see Appendix C), it seems clear that these coworkers would be regarded by the respondent as friends.

Three types of friends, then, are assessed in this study--close friends, friends of a less intimate nature, and friends from the work place--and each is a prospective risk factor for mortality. Three reasons can be advanced which may account for this. (1) The content of exchanges that characterize friendship interactions may be the "commodity" that most influences health outcomes. According to Litwak and Szelenyi (1969), important exchanges distinguishing friends from interactions with other network members are emotional or moral support, positive affect, and mutual agreement. However, these are too non-specific to be of much value clinically. Further research would be needed to define more completely what it is that is differentially supportive about transactions between friends. (2) Choosing to have friends and be in contact with them is under the control of the individual more than are other network rela-

tionships such as relatives, children, parents, or siblings. Making and keeping friends involves trusting and being willing to take social risks. Thus, a person who has a more positive trusting attitude toward life and feels more in control (what has been termed a sense of "coherence" by Antonovsky [1979]), may choose more interaction with friends. It has been postulated that people with more "coherence" have enhanced health status (Kobasa, 1982). The concept "sense of coherence" has not yet entered empirical investigations of mortality. (3) Intervening processes involving healthy life styles or specific health protective behaviors which have implications for lessening disease remain a possibility for accounting for some of the friends/mortality association. Langlie (1977) found that health promotion behaviors were associated with a social network characterized by frequent interaction with nonkin. However, in the present study, smoking, drinking, and physical activity were ruled out as explanations. The association between health maintenance activities and network characteristics warrants further exploration.

Organizations

With the study population in this research, belonging to organizations and attending meetings were not significant predictors of mortality. Berkman and Syme found that people who belonged to formal and informal groups had lower mor-

tality rates. However, the difference between those who did and those who did not participate in meetings was not as large as that observed for other kinds of contacts (marriage, friends, and relatives). House et al., however, found the opposite. In their cohort, there were weaker associations of mortality with friend and relative contact and stronger associations with organizational involvements. The measure of organizational involvements used in this research was different from the dichotomous variable used by the other investigators.

Church

In this study, people who attended church did not have lower risk of death. In House et al.'s study, church attendance was a weaker predictor than organizational involvement, but still significantly influenced survival for women. Zuckerman found an index of religiousness (which included church attendance) a significant predictor of mortality among the elderly poor, particularly among those in poor health. Exploratory but not hypothesis-testing analysis of Schoenbach's data suggested that church activities were predictive of survivorship.

Social Leisure

Social leisure activities were the strongest predictor of survival for the Kaiser study group. This was also true

of the House et al. (1982) data. None of the other longitudinal studies provided measures of this variable.

The social leisure question from the household interview survey upon which the index was based, was open-ended as opposed to that of House. Respondents were asked to name their leisure activities rather than being presented with a list of activities to which they were to indicate recent participation. This investigator made the decision as to which activities were social by judging whether other people were usually involved in the activity or whether it occurred outside the home where presumably other people would be encountered. (See the Overview Box describing the social leisure variable in Appendix D.) It may be that preferring social rather than solitary leisure time activities and then engaging in more of them depends upon personality factors not assessed in this study, such as happiness (Zuckerman et al., 1984), self-esteem, or "coherence" (Kobasa et al., 1982), constructs also related to health outcomes. Or, the measure could have favored younger, healthy people (activities included camping, sports, going to the movies) in ways not controlled by the two measures of health status or by the age variable collapsed to four categories instead of continuous.

A third possibility exists which relates to the fact that social leisure activities are correlated with close friends ($r = .16$) and other friends ($r = .21$) to a larger

extent than within any of the other relationship variables (see Appendix E). It makes sense that people engaging in a wider variety of leisure time activities of a social nature would have more friends with whom to do them. It may be that it is actually the presence of friends that is critical to health with social leisure representing a dimension of the process of how these friend contacts occur.

UNDERSTANDING THE CONFLICTING FINDINGS ACROSS STUDIES

When considering the contradictions about the importance of different network ties in the findings of this and other research, three salient aspects of comparison become apparent: the nature of the sample, the analytic methods used, and social network measurement. Differences in these three aspects may have resulted in some of the variations found.

Nature of the Sample

Four factors concerning the basic nature of the samples studied may have accounted for the differences obtained. These four factors are: old vs. young, urban vs. rural, healthy vs. unhealthy, and men vs. women.

Old vs. Young. Blaizer (1982) and Zuckerman et al. (1984) both used elderly samples of smaller size, followed for shorter periods of time. In addition, Zuckerman's subjects were a low-income group. There is a clear difference

in these two samples and the other community population groups. The House et al. (1982), Schoenbach (1983), and Berkman and Syme (1979) samples included middle-aged subjects from ages 30-69. The study population for this research had a wider range of ages: the youngest was 19 and the oldest was 90. Because different network sectors may be in ascendancy at different stages of the life cycle (i.e., in youth, friends sectors may be paramount; in old age children may be most important) having a greater age span may have made a difference in outcomes across studies.

Urban vs. Rural. House speculated that the reason his Tecumseh County study found extended ties more predictive of mortality in contrast to the findings of Berkman and Syme was that his study involved a rural/small town population while theirs was urban. House believed that differing processes of social integration and activity might be in operation in the two locales. For instance, in a more rural area social relations and activities involving friends and relatives may be more a part of the normal pattern of daily life and not be especially noted, whereas in a metropolitan area such interactions may be seen as special events. As a result, some relationship measures may be less differentiating among people residing in a small town than among those in urban areas. This interpretation, however, would not apply to the present data.

Healthy vs. Unhealthy. How equal was the health status of the different samples studied at the time of the survey? Each social network/mortality study has attempted to control for health status, but a variety of measures have been used. It is not known which controls for health status are optimal. Those measures that have been used are physical measures (blood pressure and pulmonary function tests, for example), health services utilization data, perceived health assessments, and ordinal measures of disability. In this study, health service utilization data were used. If the people with chronic illnesses at the time of the survey were not accounted for in the study design, it might appear that people with small networks died sooner. The extent to which the confounding influences of health have been successfully removed in all these reports is not clear.

Men vs. Women. There were approximately equal numbers of men and women in each of the community samples studied for network/mortality associations, as was the case with the population used for the present study. This population was composed of family units, so more than 2000 of the sample were husband-wife pairs. This was probably not true of the other community populations.

Many of the social questions on the survey were answered by the wife for herself and her spouse when a couple was involved. In turn, the husband answered questions of an economic nature for himself and his wife. In

general, this would have made the network indexes less discriminating between males and females.

It is interesting to note that House and his colleagues (1982) speculated that the survey questions which they used may have more accurately assessed the social integration of men than women. Their study and a number of others (Berkman, 1977; Schoenbach, 1983) had found that networks predicted death more strongly for men than women. In the present study, by the design of the survey, the social networks of women were measured more accurately than men.

Women had more close friends than did men, who were twice as likely to declare they had no close friends. There is thus a better distribution on the close friends measure for women than men. Because restriction of range makes it more difficult to find relationships, the difference in frequency distribution may have accounted for the fact that networks were more predictive of death for women than men.

Analytic Methods

The analytic methods used by the investigators in the different studies were primarily logistic regression. Blazer (1982) used binary linear regression, and Berkman and Syme (1979) used a variation of chi square in which additional controls could be included. Most of the logistic regression studies appeared to have used the BMD computer

package where it is possible to use continuous variables. (However, it will be recalled that House et al. (1982) stated there was minimal difference in outcome between the three methods of doing regression with a binary dependent variable.) For the loglinear approach used in the present research, continuous variables had to be collapsed. It is possible that if "age" had been utilized in its continuous form rather than three or four categories, the network variables may not have been statistically significant. Both networks and mortality are highly related to age. Also, tighter controls for other confounding factors, such as health status, may have eliminated any remaining variance in mortality due to social ties. People with small networks who will die earlier may have fewer ties simply because illness precludes their being in social situations.

House and his colleagues used one-tailed tests of statistical significance in their study, which have given more power to detect statistical differences. Whether this decision was made a priori is unknown. In the present study, two-tailed tests were used. It should also be kept in mind that when working with large samples, it is relatively easier to achieve statistical significance in outcomes.

Social Network Measurement

Weaknesses. Many researchers and critical reviewers [Berkman, 1984; Wallston et al., 1983; Eli, 1984; Jung, 1984] have lamented the wide variety of approaches used to measure networks, and the lack of consensus as to how to establish their reliability and validity. The summary network indexes used in this study certainly had low reliability. Most of the other network/mortality studies of this nature did not report reliability for their measures.

Network sectors are usually measured by responses to one or two questions, either singly or combined in some fashion. It is when different network relationships are assessed individually against mortality that differences across studies occur. When network relationships are aggregated into indexes by whatever means, indexes usually predict mortality. It may be that indexes that assess only one part of a network are weak or unreliable: when combined together they become more discriminating. Berkman and Syme (1979) had found that the friends and relatives questions alone did not predict mortality, but when combined into a ranked index they did. Reed et al. (1983; 1984) found statistical significance only for their network index: individual questions alone were nonsignificant. In this study, when the relationship domain indexes were combined, the summary measures which resulted were statistically significant. Only a few of the relationship indexes were

significant alone, but almost all showed a trend in the hypothesized direction.

House and his colleagues (1982) had suggested that people might have different interpretations of the survey questions depending upon whether they were urban or rural dwellers, or whether they were male or female. The same could possibly be true of young as opposed to older people. What is more likely is that questions on these surveys have been stretched to serve as social network measures, not having been specifically designed to gather the type of information needed to make network assessments. In this study, for example, the number of siblings identified by respondents was included in the family of origin index, although it was unknown whether they were still alive at the time of the survey. There was potential for overlapping categories because the difference between neighbors, friends, and relatives was not clearly specified. Other examples of this type of problem are detailed in Chapter IV. Undoubtedly the other investigators of network/mortality relationships in community populations encountered similar problems.

Strengths. The network indexes developed for this study, although not perfect, do provide an acceptable measure of social connection. In particular, the network scope index, the index most frequently used as the network

measure, would be hard to improve upon. This index provided a score of 1 for one or more relationships in each role domain. Measures of social support utilized in prior studies have often been limited, such as one or two global questionnaire items. For this study, more sophisticated network measures were prepared than had been possible in prior studies.

In a theoretical model concerning social support measurement (House & Kahn, 1985), three salient domains of social support are identified. The first domain concerns social relationships, the second domain concerns the social network (structural aspects), and the third domain concerns social support. The network indexes in this study were able to assess the first two domains. It was not possible to directly measure social support. In terms of social relationships, their existence, quantity, and type were assessed. For the social network, structural aspects of size, scope, frequency, and interaction were assessed. Other network aspects such as density and reciprocity were not able to be measured. This research is important because not only were four structural properties of the network measured, but also nine relationship categories, providing more detail on the networks of the study population than has been possible in prior research.

CONCLUSION

Overall, the results indicate that social networks predict mortality and that interacting with friends and engaging in social leisure activities are the strongest predictors. What mechanisms are involved in the link to mortality cannot be inferred from the data or from recent other studies using a comparable approach and conceptually similar variables.

CHAPTER VII

IMPLICATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

It has been shown that in a sample representative of a large city in the Pacific Northwest, elevated mortality risk is associated with having few social ties, particularly extended ones. Other studies in rural and urban areas of the United States have found similar results. The reasons why social networks have predicted mortality have been unclear. This research attempted to explore underlying mechanisms by discerning whether social networks impacted differentially on disease incidence or disease progression. Although the effort was unsuccessful, it may not have been an adequate test of the research questions because of the methodological problems outlined in the previous chapter. We still do not know how social connections act to decrease mortality. It now remains to state how these research findings can be applied and extended. The first section of this chapter discusses social network interventions which have implications for community health and the quality of urban life. The second section provides suggestions for continued exploration of this area of research in terms of measurement, design, and theory.

SOCIAL INTERVENTIONS

The social network/social support concept has appeal due to its potential implications for treatment and prevention. As noted by Cassel in 1975, "It seems more feasible to improve or strengthen the social supports rather than to reduce the exposure to stressors" (p. 121). This approach, focused on naturally occurring social systems, is fiscally appealing and in keeping with the basic philosophy of community health. The purpose of this dissertation was to attempt to highlight whether support was most beneficial as a general measure of primary disease prevention or as a more focused therapy with those already stricken with disease. It was hoped also that by observing the positive and negative influences associated with various network relationships it could be learned what it is that benefits people in terms of health.

Fortunately, network relationships involving friends were found predictive of mortality. This is fortunate because making and keeping friends is more under individual control and choice than are relationships with family and relatives. Thus, friendship relations appear more amenable to interventions aimed at strengthening of quality and quantity of social support, strategies often a part of current community health programs. Unfortunately, the

pathway of the social network/disorder association was not uncovered in this research. Only the outcome of mortality was predicted by the social network measures. The study confirms the knowledge that social connections affect mortality in community populations.

Because this relationship has been shown to occur in a variety of communities in the United States and has been well publicized, many health professionals and workers in community programs already have integrated network concepts into their practice and programs. The general positive value of social ties, not only for physical health but for mental health and general well-being, is understood, and social integration is fostered in a variety of urban settings with a variety of groups and clients. Gottlieb (1978) has outlined the manner in which attachments can be structured as systems of support: (1) self-help groups; (2) community caregivers where work roles involve them in handling the health problems of citizens; (3) neighborhood-based helping networks; (4) the primary social network, composed of family members and social intimates.

Many self-help groups have been and are being organized for people with chronic illnesses and their families. These feature prominently the provision of support to lessen the stresses accompanying chronic illness. For instance, the "I Can Cope" program for individuals with cancer has proven effective (Johnson, 1982). "I Can Cope,"

originating in Minneapolis, was adopted by the American Cancer Society, and has subsequently spread to many urban areas in the country.

Network therapy has become popular with social workers, nurses, and mental health professions in solving individual and family health-related problems (MacElveen, 1978; Halevy-Martini et al., 1984). The broad purpose of such therapy is to heal rifts in society by reconstructing cooperatively functioning social groups which will then have a healing effect on the family and the client. The social network is defined as the group of people consisting of an identified client, the immediate family, the extended family, and all their relevant supporting social relations, such as neighbors, coworkers, and friends. Service providers and professional people are included in the network. Systems theory provides the theoretical base for social network intervention. Based upon this research, it would seem expedient to focus on enhancing relationships with friends when using network therapy to influence health outcomes.

Also apparently effective has been an innovative public education campaign in California which attempted to teach the public to strengthen natural support networks. The campaign appeared particularly effective with people who had experienced the death of someone close to them during

the past year, and within that group, increases in support were largest among subjects below average in prior levels of support (Hersey et al., 1984).

It is suggested that continued encouragement and facilitation of the aforementioned systems of support in urban settings is indicated until future research is able to document more precisely how social resources facilitate health.

SUGGESTIONS FOR FUTURE RESEARCH

Measurement

There is a clear need for better definition of the social network/support constructs and for development of better measures of support and the disease outcomes (incidence and progression). Although there has been much progress in the area of social support conceptualization and measurement in recent years, all of the studies of social networks and mortality similar to this one have employed network data collected before recent developments. The use of a prospective longitudinal research design, needed to answer questions of mortality a decade or more in the future, presents problems of cost and feasibility.

Design

Even with improved measurement methods, the ability to carry this research area forward using epidemiological methods may be limited. Such population based methods can

only assess broad outcomes in the aggregate. Research is needed where individuals can be tracked over time in terms of their network changes as these relate to health status changes. For individual people, social support may make the difference between life and death in illness situations. Qualitative research is also needed to assess types, meanings, and perceptions of support or non-support in health and illness states.

Cassel (1976) suggested that there was enough available evidence for the benefit of support on health to warrant clinical interventions with careful evaluation of outcomes. It may be that such field experiments are the most fruitful way now to advance our understanding in a practical manner. Laboratory studies using animal models are another possibility, and it is true that animal studies of stress and social interaction have been informative. But problems inherent in cross-species generalization, particularly in behavioral research, limit the possibilities of this type of research.

Prospective, longitudinal, clinical studies are needed to answer the questions posed by this research. Network measures must provide more than the rudimentary information gleaned from a few items on prior surveys. The comprehensive and sophisticated network and social support assessment and measurement methods that have been developed

in recent years must be utilized. An adequate assessment of health status at the initial point of study is mandatory, as well as an analytical schema which controls for the effect of initial status on later outcome. Where patients are to be followed over a number of years, social network changes must also be accounted for.

Subjects

Attempting to prospectively assess disease incidence in healthy community populations is a formidable task (Kasl, 1983). Intervention trials focused on high-risk individuals may be more fruitful. Social network and support variables could be the experimental interventions in terms of health outcomes. People with few network resources could have their social ties supplemented. The study of people with no close friends as opposed to those with many would be interesting. To study disease incidence, people at risk, such as those having undergone specific life crises such as bereavement, could be studied. Or, to study disease progression, individuals already affected by specific chronic diseases could have their support augmented. In both these models, experimental subjects would then be compared to similar control subjects. Or, a case-control design could be used which compared subjects with low support to those with adequate support in terms of disease outcomes.

Theory

It is still unknown how social networks fit into a model of disease causation. It may be that networks do not prevent disease or episodes of disease exacerbation but simply prevent death from occurring. There may be some critical point in serious illness where social support makes the difference in the continuation of a trajectory towards death.

The direction of causality in the network/mortality relationship may actually be reversed i.e., health may predict social networks. However, since health status is controlled in the network/mortality studies, it is difficult to see how this theoretical approach is actually different from the conceptual framework utilized. An alternate causal model in which isolation causes ill health rather than support promoting better health is also a possibility. A more complex theoretical model is needed which is capable of explaining both buffering effects and main effects of social support, as well as providing new leads for research in terms of disease states.

Another basis for theoretical refinement would be to explore new intervening personality variables or variables of a psychological nature. It may be that such constructs as trust, locus of control, self-confidence, or will to live cause some people to have more social connections. For

instance, a scale to measure "will to live" could be developed to determine if high levels of this variable predict more social resources. Instruments to measure "coherence" have been developed, but findings from studies utilizing this variable in relationship to mortality have not yet been published. Path analytic models similar to those reported by Kaplan (1983) can be useful in sorting out interrelationships.

It is now generally accepted that social networks are associated with health. This research has further strengthened this knowledge in terms of mortality. The focus in the future should be upon the process of how support and health are linked. Are the effects of social support on health mediated by behavioral change, physiological change, perceptual change, or by some combination thereof? Further knowledge in this area has the potential to make clinical social network interventions more specific and health-enhancing for urban citizens.

CONCLUSION

In this study, social networks were found to predict mortality, particularly extended ties. The scope or breadth of the network was its most important aspect. Friends offered more protection than spouses or other family members. Leisure time spent in activities involving other people also was found protective against death. However,

social factors were only weak influences on mortality compared, undoubtedly, to factors related to the physiological processes of the disease. We do not yet know when or how social factors affect disease states. Until such knowledge is forthcoming, non-specific strengthening of network ties, particularly those of friends, is advocated as a broad public health measure. More sophisticated research is needed based on more complex theories.

LIST OF REFERENCES

- Andrews, G., Tennant, C., Henson, D. M., & Vaillant, G. E. (1978). Stress, social support, coping style, and risk of psychological impairment. Journal of Nervous and Mental Disease, 116(5), 307-316.
- Antonovsky, A. (1979). Health, stress, and coping. San Francisco: Jossey-Bass.
- Argyl, M. & Furnham, A. (1983). Sources of satisfaction and conflict in longstanding relationships. Journal of Marriage and the Family, 8, 481-493.
- Asher, C. C. (1984). The impact of social support networks on adult health. Medical Care, 22, 349-359.
- Barrera, M. (1981). Social support in the adjustment of pregnant adolescents. In B. H. Gottlieb (Ed.), Social networks and social support (pp. 69-96). Beverly Hills: Sage Publications.
- Barrera, M., & Ainlay, S. (1983). The structure of social support: A conceptual and empirical analysis. Journal of Community Psychology, 11, 133-143.
- Berger, M., & Wuescher, L. (1975). The family in the substantive environment. Journal of Community Psychology, 3(3), 246-253.
- Berkman, L. F. (1977). Social networks, host resistance, and mortality: A follow up study of Alameda County residents. Dissertation Abstracts International. (University Microfilms No. 78-12, 490).
- Berkman, L. F. (1982). Social network analysis and coronary heart disease. Advances in Cardiology, 29, 37-49.
- Berkman, L. F. (1984). Assessing the physical health effects of social networks and social support. Annual Review Public Health, 5, 413-432.
- Berkman, L. F. , and Syme, L. (1979). Social networks, host resistance, and mortality: A nine-year follow up study of Alameda County residents. American Journal of Epidemiology, 109(2), 186-204.

- Berry, B. J. (1973). The human consequences of urbanization. New York: St. Martin's Press.
- Blau, P. (1964). Exchange and power in social life. London: Wiley.
- Blazer, D. G. (1980). Social support and mortality in an elderly community population. Dissertation Abstracts International. (University Microfilms No. 8114790).
- Blazer, D. G. (1982). Social support and mortality in an elderly community population. American Journal of Epidemiology, 115(5), 684-694.
- Bloom, J. R. (1982). Social support, accommodation to stress, and adjustment to breast cancer. Social Science and Medicine, 16, 1329-1338.
- Bott, E. (1955). Urban families: Conjugal roles and social networks. Human Relations, 8, 345-384.
- Branch, L. G. & Jette, A. M. (1984). Personal health practices and mortality among the elderly. American Journal of Public Health, 74, 1126-1129.
- Broadhead, W. E., Kaplan, B. H., James, S. A., Wagner, E. H., Schoenbach, V. J., Grimson, R., Heyden, S., Tibblin, G., & Gehlbach, S. H. (1983). The epidemiologic evidence for a relationship between social support and health. American Journal of Epidemiology, 117, 521-537.
- California Medical Association Introduction (1956) to California Relative Value Study. Cited in Relative Value Studies. San Francisco, CA: California Medical Association, 1964.
- Caplan, G. (1974). Support systems. In G. Caplan (Ed.), Support systems and community mental health (pp. 1-40). New York: Behavioral Publications.
- Cassel, J. (1974). Psychosocial processes and "stress" theoretical formulation. International Journal of Health Sciences, 4(3), 471-482.
- Cassel, J. (1976). The contribution of the social environment to host resistance. American Journal of Epidemiology, 104, 107-123.

- Cassileth, B., Lusk, E., Miller, D., Brown, L. (1984). Psychosocial correlates in malignant disease. American Society of Clinical Oncology Abstracts, May 1984, Abstract No. C-271.
- Chandra, V., Szklo, M., Goldberg, R., & Tonascia, J. (1983). The impact of marital status on survival after an acute myocardial infarction: A population-based study. American Journal of Epidemiology, 117, 320-325.
- Cobb, S. (1976). Social support as a moderator of life stress. Psychosomatic Medicine, 38, 300-314.
- Coburn, D., & Pope, C. R. (1974). Socioeconomic status and preventive health behavior. Journal of Health and Social Behavior, 15, 67-77.
- Craven, P., & Wellman, B. (1973). The network city. Sociological Inquiry, 43, 57-88.
- Davidson, T. N., Dowden, M. L., Tholen, M. S., James, M. H., & Feller, I. (1981). Social support and post-burn adjustment. Archives of Physical Medicine and Rehabilitation, 62, 274-278.
- Dean, A., & Lin, N. (1977). The stress-buffering role of social support. Journal of Nervous and Mental Disease, 165, 403-417.
- DeAraujo, G., Van Ardsdel, P. P., Holmes, T. H., & Dudley, D. L. (1973). Life change, coping ability, and chronic intrinsic asthma. Journal of Psychosomatic Research, 17, 359-363.
- DiMatteo, M. R., & Hays, R. (1981). Social support and serious illness. In B. H. Gottlieb (Ed.), Social networks and social support (pp. 117-148). Beverly Hills: Sage Publications.
- Dimond, M. (1979). Social support and adaptation to chronic illness: The case of maintenance hemodialysis. Research in Nursing and Health, 2, 101-108.
- Dohrenwend, B. S., & Dohrenwend, B. P. (Eds.). (1974). Stressful life events: Their nature and effects. New York: John Wiley & Sons.
- Dohrenwend, B. S., & Dohrenwend, B. P. (Eds.). (1981). Stressful life events and their contexts. New York: Prodist.

- Dubos, R. (1965). Man adapting. New Haven: Yale University Press.
- Duncan, O. D. (1961). A socioeconomic index for all occupations. In A. J. Reiss, Jr., (Ed.), Occupations and social status (pp. 109-138). New York: Free Press.
- Durkheim, E. (1951). Suicide. New York: The Free Press.
- Eaton, W. T. (1978). Life events, social supports, and psychiatric symptoms. A Reanalysis of the New Haven Data. Journal of Health and Social Behavior, 19, 230-234.
- Ell, K. (1984). Social networks, social support, and health status: A review. Social Service Review, (3), 133-149.
- Finlayson, A. (1976). Social networks as coping resources. Social Science and Medicine, 10, 97-103.
- Fischer, C. S. (1977). Networks and places. New York: The Free Press.
- Freeborn, D., & Pope, C. (1982). Health status, utilization, and satisfaction among enrollees in three private types of private health insurance plans. Group Health Journal, 3, 4-11.
- Funch, D. P. & Marshall, J. (1983). The role of stress, social support, and age in survival from breast cancer. Journal of Psychosomatic Research, 27, 77-83.
- Gluck, P. R., & Meister, R. J. (1979). Cities in transition. New York: New Viewpoints.
- Gonnella, J. S., Hornbrook, M. C., Louis, D. Z. (1984). Staging of Disease. Journal of the American Medical Association, 251, 635-644.
- Goodman, L. A. (1972). A modified regression approach to the analysis of dichotomous variables. American Sociological Review, 37, 28-46.
- Gore, S. (1978). The effect of social support in moderating the health consequences of unemployment. Journal of Health and Social Behavior, 19, 157-165.

- Gore, S. (1981). Stress-buffering function of social supports: An appraisal and clarification of research methods. In B. S. Dohrenwend & B. P. Dohrenwend (Eds.), Stressful life events and their contexts (pp. 202-222). New York: Prodist.
- Gottlieb, B. H. (1978). The development and application of a classification scheme of informal helping behaviors. Canadian Journal of Behavioral Science, 10, 105-115.
- Greenlick, M. R., Hurtado, A. V., Pope, C. R., Saward, E. W., & Yoshioka, S. S. (1968, November). Determinants of Medical Care Utilization. Paper presented to the Medical Care Section, American Public Health Association 96th Annual Meeting, Detroit, Michigan.
- Halevy-Martini, J., Hamley-Van der Velten, E. M., Ruhf, L., & Schoenfeld, P. (1984). Process and strategy in network therapy. Family Process, 23, 521-533.
- Hayes, S., Feinleib, M., & Kannel, W. (1980). The relationship of psychosocial factors in coronary heart disease in the Framingham Study, III: Eight year incidence of coronary heart disease. American Journal of Epidemiology, 111, 37-58.
- Heller, K. (1979). The effects of social support: Prevention and treatment implications. In A. P. Goldstein & F. H. Kanfer (Eds.), Maximizing treatment gains (pp. 353-382). New York: Academic Press.
- Henderson, A. S. (1984). Interpreting the evidence on social support. Social Psychiatry, 19, 49-52.
- Henderson, A., Duncan-Jones, P., McAuley, H., & Ritchie, K. (1978). The patient's primary group. British Journal of Psychiatry, 132, 74-86.
- Henderson, S., Byrne, D. G., Duncan-Jones, P., Adcock, S., Scott, R., & Steele, G. P. (1978). Social bonds in the epidemiology of neurosis. Journal of Psychiatry, 132, 463-466.
- Henry, J. P. (1982). The relation of social to biological processes in disease. Social Science in Medicine, 16, 369-380.
- Hersey, J. C., Klibanoff, L. S., Lam, D. J., & Taylor, R. L. (1984). Promoting social support: The impact of California's "Friends can be good medicine" campaign. Health Education Quarterly, 11, 293-311.

- Hibbard, J. H., & Pope, C. R. (1983). Gender roles, illness orientation, and use of medical services. Social Science and Medicine, 17, 129-137.
- Hinkle, L. E. (1973). The concept of "stress" in the biological and social sciences. Science, Medicine, and Man, 21, 31-48.
- Holahan, C. J., & Moos, R. H. (1981). Social support and psychological distress: A longitudinal analysis. Journal of Abnormal Psychology, 90, 365-370.
- House, J. A. (1981). Work, stress, and social support. Reading, Massachusetts: Addison-Wesley.
- House, J. S., & Kan, R. L. (1985). Measures and concepts of social support. In S. Cohen & S. L. Syme (Eds.), Social support and health (pp. 83-108). New York: Academic Press.
- House, J. S., Robbins, C., & Metzner, H. L. (1982). The association of social relationships and activities with mortality: Prospective evidence from the Tecumseh community health study. American Journal of Epidemiology, 116, 23-140.
- Hubbard, P., Muhlenkamp, A. F., & Brown, N. (1984). The relationship between social support and self-care practices. Nursing Research, 33, 266-269.
- Hurtado, A. V., & Greenlick, M. R. (1971). A disease classification system for analysis of medical care utilization, with a note on symptom classification. Health Services Research, 16, 235-250.
- Hurtado, A. V., & Greenlick, M. R. The clinical-behavioral disease classification system. Paper available from Kaiser Center for Health Research, 4610 S. E. Belmont, Portland, Oregon 97205.
- Johnson, C. L. (1983). Dyadic family relations and social support. Gerontologist, 23, 377-383.
- Johnson, J. (1982). The effects of a patient education course on persons with a chronic illness. Cancer Nursing, 5, 117-123.
- Jung, J. (1984). Social support and its relation to health: A critical evaluation. Basic and Applied Psychology, 5, 143-169.

- Kagan, A. R., & Levi, L. (1974). Health and environment - psychosocial stimuli: A review. Basic and Applied Psychology, 5, 143-169.
- Kahn, R. L., & Antonucci, T. C. (1980). Convoys over the life course: Attachment, roles, and social support. In P. B. Bates & O. Brim (Eds.), Life-span development and behavior (pp. 253-286). Boston: Lexington Press.
- Kaplan, B. H., Cassel, J. C., & Gore, S. (1977). Social support and health. Medical Care, 15(Suppl.), 47-57.
- Kaplan, G. A. (1983). Psychosocial aspects of chronic illness: Direct and indirect associations with ischemic heart disease mortality. Paper presented at the NATO Advanced Study Institute-Behavioral Epidemiology and Disease Prevention Conference in Bellagio, Italy.
- Kaplan, G. A., & Camacho, T. (1983). Perceived health and mortality: A nine-year follow up of the Human Population Laboratory cohort. American Journal of Epidemiology, 117, 292-304.
- Kaplan, G. A., & DeLongis, A. (1983). Psychosocial factors influencing course of arthritis: A prospective study. Paper presented at the 91st annual meeting of the American Psychological Association Conference, Anaheim, California.
- Kasl, S. V. (1983). Social and psychological factors affecting the course of disease. In D. Mechanic (Ed.), Handbook of health, health care, and the health professions (pp. 683-708). New York: The Free Press.
- Kasl, S. V. (1984). Stress and Health. Annual Review of Public Health, 5, 319-341.
- Knoke, D., & Burke, P. J. (1980). Log linear models. Beverly Hills: Sage Publications.
- Kobasa, S. C., Maddi, S. R., and Kahn, S. (1982). Hardiness and health: A prospective study. Journal of Personality and Social Psychology, 42, 168-177.
- Koskenvuo, M., Kaprio, J., Romo, M., & Langinvainio, H. (1981). Incidence and prognosis of ischemic heart disease with respect to marital status and social class. Journal of Epidemiology and Community Health, 35, 192-196.

- Langer, E. J., Janis, I. L., & Wolfer, J. A. (1975). Reduction of psychological stress in surgical patients. Journal of Experimental Social Psychology, 11, 155-165.
- Langlie, J. K. (1977). Social networks, health beliefs, and preventive health behavior. Journal of Health and Social Behavior, 18, 244-260.
- LaRocco, J. M. (1983). Theoretical distinctions between causal and interaction effects of social support. Journal of Health and Social Behavior, 24, 91-92.
- Leavy, R. L. (1983). Social support and psychological disorder: A review. Journal of Community Psychology, 11, 3-18.
- Liem, J. H., & Liem, R. (1976). Life events, social supports, and physical and psychological well-being. Paper presented at the annual meeting of the American Psychological Association.
- Lin, N., Ensel, W. M., Simeone, R. S., & Kuo, W. (1979). Social support, stressful life events, and illness: A model and an empirical test. Journal of Health and Social Behavior, 20, 198-219.
- Litwak, E., & Szelenyi, I. (1969). Primary group structures and their functions: Kin, neighbors, and friends. American Sociological Review, 34, 465-481.
- Lowenthal, M. F., & Haven, C. (1968). Interaction and adaptation: Intimacy as a critical variable. American Sociological Review, 33, 20-30.
- MacElveen, P. M. (1978). Social networks. In D. C. Longo & R. A. Williams (Eds.). Clinical practice in psycho-social nursing: Assessment and Intervention (pp. 318-338). New York: Appleton-Century-Crofts.
- MacElveen, P. M. (1972). Cooperative Triad in Home Dialysis Care and Patient Outcomes. Communicating Nursing Research, 5, 134-147.
- Maxwell, M. B. (1982). The use of social networks to help cancer patients maximize support. Cancer Nursing, 5, 275-282.
- McCallister, L., & Fischer, C. S. (1978). A procedure for surveying personal networks. Sociological Methods and

Research, 7, 131-148.

- McQueen, D. V., & Celentano, D. D. (1982). Social factors in the etiology of multiple outcomes: The case of blood pressure and alcohol consumption patterns. Social Science and Medicine, 16, 397-418.
- McQueen, D. V., & Siegrist, J. (1982). Social factors in the etiology of disease: An overview. Social Science and Medicine, 16, 353-367.
- Medalie, J. H. & Goldbourt, M. A. (1976). Angina pectoris among 10,000 men. American Journal of Medicine, 60, 910-921.
- Mermelstein, R., Lichtenstein, E., & McIntyre, K. (1983). Partner support and relapse in smoking-cessation programs. Journal of Consulting and Clinical Psychology, 51, 465-466.
- Mitchell, J. C. (1974). Social networks. Annual Review of Anthropology, 3, 279-299.
- Mitchell, R. E., & Trickett, E. J. (1980). Task force report: Social networks as mediators of social support. Community Mental Health Journal, 16, 27-44.
- Mossey, J. M., & Shapiro, E. (1982). Self-rated health: A predictor of mortality among the elderly. American Journal of Public Health, 72, 800-808.
- Mueller, D. P. (1980). Social networks: A promising direction for research on the relationship of the social environment to psychiatric disorder. Social Science and Medicine, 14A, 147-161.
- Norbeck, J. S., & Tilden, V. P. (1983). Life stress, social support, and emotional disequilibrium in complications of pregnancy. Health and Social Behavior, 24, 30-46.
- Nuckolls, K. B., Cassel, J., & Kaplan, B. H. (1972). Psychosocial assets, life crisis, and the prognosis of pregnancy. American Journal of Epidemiology, 95, 431-441.
- Parsons, T. (1951). The Social System. New York: The Free Press.

- Payne, C. (1977). The log-linear model for contingency tables. In C. O'Muircheartaigh & C. Payne (Eds.), The analysis of survey data: Model fitting, Vol. 2. New York: John Wiley & Sons.
- Pilisuk, M., & Froland, C. (1978). Kinship, social networks, social support, and health. Social Science and Medicine, 12B, 273-280.
- Pope, C. R. (1976). Data from the 1970-71 household interview survey: Report series #1, Portland, Oregon. Kaiser Foundation Hospitals Health Services Research Center.
- Pope, C. R. (1982). Life-styles, health status, and medical care utilization. Medical Care, 20, 402-413.
- Pratt, L. (1971). The relationship of socioeconomic status to health. American Journal of Public Health, 61, 281-291.
- Rabkin, J. G., & Struening, E. L. (1976). Life events, stress, and illness. Science, 184, 1013-1020.
- Reed, D., McGee, D., & Yano, K. (1984). Psychosocial processes and general susceptibility to chronic disease. American Journal of Epidemiology, 119, 356-370.
- Reed, D., McGee, D., Yano, K., & Feinleib, M. (1983). Social networks and coronary heart disease among Japanese men in Hawaii. American Journal of Epidemiology, 117, 384-396.
- Renner, V. J., & Birren, J. E. (1977). Stress: Physiological and psychological mechanisms. In R. B. Slone (Ed.), Handbook of mental health and aging (pp. 310-336). Englewood Cliffs, NJ: Prentice-Hall.
- Rook, K. S. (1984). The negative side of social interaction. Journal of Personality and Social Psychology, 46, 1097-1108.
- Schaefer, C., Coyne, J. D., & Lazarus, R. S. (1981). The health-related functions of social support. Journal of Behavioral Medicine, 4, 381-406.
- Schoenbach, V. J., Kaplan, B. H., Kleinbaum, D. G., & Fredman, L. (1983). Social ties and mortality. Presented at the annual meeting of the American Public Health Association, Dallas, Texas.

- Schulz, R., & Rau, M. T. (1984). Social support through the life course. In S. Cohen & L. Syme (Eds.), Social support and health (in press). New York: Academic Press.
- Simons, R. L. (1984). Specificity and substitution in the social networks of the elderly. International Journal of Aging and Human Development, 18, 121-139.
- SPSS^X User's Guide. (1983). Chicago: McGraw-Hill.
- Thoits, P. (1982). Life stress, social support, and psychological vulnerability: Epidemiological considerations. Journal of Community Psychology, 10, 341-362.
- Tolsdorf, C. C. (1976). Social networks, support, and coping: An exploratory study. Family Process, 15, 407-417.
- Turner, R. J. (1981). Social support as a contingency in psychological well-being. Journal of Health and Social Behavior, 22, 357-367.
- U.S. Dept. Health, Education, Welfare, Public Health Service, International Classification of Disease, Adapted, Vol. 1, Tabular list. Publication 719, Washington, D. C., Government Printing Office.
- Walker, K. N., MacBride, A., & Vachon, M. L. (1977). Social support networks and the crisis of bereavement. Social Science and Medicine, 14, 35-41.
- Walker, S. H., & Duncan, D. B. (1967). Estimation of the probability of an event as a function of several independent variables. Biometrika, 54, 167-179.
- Waliston, B. S., Alaga, S. W., DeVellis, B. M., & DeVellis, R. F. (1983). Social support and physical health. Health Psychology, 2, 367-391.
- Weisman, A. D., & Worden, J. W. (1975). Psychosocial analysis of cancer deaths. Omega, Journal of Death and Dying, 6, 61-75.
- Weiss, R. S. (1969). The fund of sociability. Transaction, 6, 36-40.
- Wellman, B. (1981). Applying network analysis to the study of support. In B. H. Gottlieb (Ed.), Social networks and social support, (pp. 171-200). Beverly Hills: Sage Publications.

- Whitten, N. E., & Wolfe, A. W. (1973). Network Analysis. In J. Hongmann (Ed.), Handbook of Social and Cultural Anthropology (pp. 717-745). New York: Rand McNally.
- Wiley, J. A., & Camacho, T. C. (1980). Life style and future health: Evidence from the Alameda County study. Preventive Medicine, 9, 1-21.
- Williams, A. W., Ware, J. E., Donald, C. A. (1981). A model of mental health, life events, and social supports applicable to general populations. Journal of Health and Social Behavior, 22, 324-336.
- Wingard, D. L., Berkman, L. F., & Brand, R. J. (1982). A multivariate analysis of health-related practices. American Journal of Epidemiology, 116, 765-775.
- Winnubst, J. A., Marcelissen, F. H., & Kleber, R. J. (1982). Effects of support in the stressor-strain relationship: A Dutch example. Social Science and Medicine, 16, 475-482.
- Woods, N. F., & Earp, J. L. (1978). Women with cured breast cancer. Nursing Research, 27, 279-285.
- Wortman, C. (1984). Social support and the cancer patient. Cancer, 53(Suppl.), 2339-2362.
- Zuckerman, D. M., Kasl, S. V., & Ostfeld, A. M. (1984). Psychosocial predictors of mortality among the elderly poor. American Journal of Epidemiology, 119, 410-423.

APPENDIX A

FORMS USED BY CENTER FOR HEALTH RESEARCH
TO RECORD UTILIZATION DATA
FROM MEDICAL RECORDS

Study # _____		MEDICAL CARE UTILIZATION STUDY—FORM A MEDICAL SERVICE RECORD FORM		Stamp # (74-78)																																												
<p>PATIENT'S NAME _____</p> <p>(1-3) 101 (4-9) _____</p> <p>Card Code _____ CHART NO. _____</p> <p>(10-19) _____</p> <p>H.P.I.D. _____</p> <p>1. (20-25) DATE OF SERVICE</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Month</td> <td>Day</td> <td>Year</td> </tr> <tr> <td>2. (26) DAY'S SERVICE NO.</td> <td colspan="2">(27) MORB. NO.</td> </tr> <tr> <td>1 2 3 4 5 0</td> <td colspan="2">1 <input checked="" type="checkbox"/></td> </tr> </table> <p>3. (28) DAY OF SERVICE</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>S</td> <td>M</td> <td>T</td> <td>W</td> <td>Th</td> <td>F</td> <td>S</td> </tr> <tr> <td>7</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> </table> <p>4. (29) PLACE OF SERVICE</p> <p>1 <input type="checkbox"/> clinic 6 <input type="checkbox"/> Kaiser inpatient</p> <p>2 <input type="checkbox"/> home 8 <input type="checkbox"/> other hospital (specify) _____</p> <p>3 <input type="checkbox"/> nursing home</p> <p>4 <input type="checkbox"/> emerg. room</p> <p>5 <input type="checkbox"/> phone/letter 9 <input type="checkbox"/> outside H.O.</p> <p>0 <input type="checkbox"/> other (specify) _____</p> <p>5. (30) TYPE OF SERVICE</p> <p>1 <input type="checkbox"/> physician 6 <input type="checkbox"/> optometry</p> <p>2 <input type="checkbox"/> physical therapy 7 <input type="checkbox"/> audiology</p> <p>3 <input type="checkbox"/> nurse 8 <input type="checkbox"/> other (specify) _____</p> <p>4 <input type="checkbox"/> mental health</p> <p>5 <input type="checkbox"/> social worker 9 <input type="checkbox"/> inapplicable</p> <p>6. (31) TIME OF SERVICE</p> <p>1 <input type="checkbox"/> during clinic hours 9 <input type="checkbox"/> inapplicable</p> <p>0 <input type="checkbox"/> not ascert.</p> <p>2 <input type="checkbox"/> not during clinic hours _____ (time)</p> <p>7. (32) TYPE OF APPOINTMENT</p> <p>1 <input type="checkbox"/> regular scheduled 4 <input type="checkbox"/> phone/letter</p> <p>2 <input type="checkbox"/> walk-in 5 <input type="checkbox"/> other (specify) _____</p> <p>3 <input type="checkbox"/> emergency room</p> <p>7 <input type="checkbox"/> walk-in/after clinic hours</p> <p>8. (33-35) PHYSICIAN OR OTHER PROFESSIONAL RENDERING OR ORDERING SERVICE</p> <p>_____ 999 <input type="checkbox"/> inapplicable</p> <p>9. (36) STATUS OF PHYSICIAN</p> <p>1 <input type="checkbox"/> regular attending 5 <input type="checkbox"/> other (specify) _____</p> <p>2 <input type="checkbox"/> temporary 9 <input type="checkbox"/> inapplicable</p> <p>3 <input type="checkbox"/> consultant--referred by: _____</p> <p>Clerk: _____</p> <p>9 11700 Revised 6/75</p>		Month	Day	Year	2. (26) DAY'S SERVICE NO.	(27) MORB. NO.		1 2 3 4 5 0	1 <input checked="" type="checkbox"/>		S	M	T	W	Th	F	S	7	1	2	3	4	5	6	<p>A. MORBIDITY NAME</p> <p>ICDA NO. _____ (Card 01/37-40) <input type="checkbox"/> 9999 inapp.</p> <p>B. STATUS OF DIAGNOSIS</p> <p>(41) 1 <input type="checkbox"/> unknown 3 <input type="checkbox"/> established</p> <p>2 <input type="checkbox"/> tentative 9 <input type="checkbox"/> inapplicable</p> <p>C. EPISODE</p> <p>(46) 1 <input type="checkbox"/> initial visit 3 <input type="checkbox"/> preventive</p> <p>2 <input type="checkbox"/> continuing 9 <input type="checkbox"/> inapplicable</p> <p>Punch 9's if blank (47-54) _____ Serv-Morb No. _____</p> <p>Stamp Series (55-56) 06 07 08 09 (57) Cht. _____</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Clinic or Hosp (53)</td> <td>BK</td> <td>Dv</td> <td>Vc</td> <td>O/I</td> <td>Dv</td> <td>FS</td> <td>SS</td> <td>Is</td> <td>HA</td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td></td> </tr> </table> <p>D. MAJOR PRESENTING SYMPTOMS</p> <p>(59-62) _____ (63-66) _____</p> <p>(no 2nd sym. <input type="checkbox"/> 0000)</p> <p>8's <input type="checkbox"/> not ascertained</p> <p>9's <input type="checkbox"/> inapplicable 0's <input type="checkbox"/> no symptoms</p> <p>E. DURATION OF MAJOR PRESENTING SYMPTOMS</p> <p>_____ days (67-69) 666 <input type="checkbox"/> vague, less than a year</p> <p>000 <input type="checkbox"/> less than 1 day 777 <input type="checkbox"/> greater than a year</p> <p>998 <input type="checkbox"/> not ascertained 888 <input type="checkbox"/> since birth</p> <p>999 <input type="checkbox"/> inapplicable</p> <p>(70) Assoc. Morb. for Hosp. Adms. _____</p> <p>Referred by: _____ (71-73) stamp# (74-78)</p> <p>Card Code (1-3) 102 Duplicate Cols 4-28</p> <p>F. PROCEDURES RENDERED</p> <p>Punch 9's in blank fields</p> <p>1. _____ 2. _____ 3. _____</p> <p>(Cd. 02/29-32) (33-36) (37-40)</p> <p>4. _____ 5. _____ 6. _____</p> <p>(41-44) (45-48) (49-52)</p> <p>G. TYPE OF SCHEDULED RETURN VISIT</p> <p>(53) RETURN VISIT:</p> <p>1 <input type="checkbox"/> Scheduled..... 54-76 SEE BELOW</p> <p>8 <input type="checkbox"/> Not scheduled... 54-76 punch 8's</p> <p>9 <input type="checkbox"/> Inapplicable... 54-76 punch 9's</p> <p>(54) <input type="checkbox"/> this physician _____ days (55-57)</p> <p>000 <input type="checkbox"/> NA 777 <input type="checkbox"/> today</p> <p>(58) <input type="checkbox"/> attending physician _____ days (59-61)</p> <p>000 <input type="checkbox"/> NA 777 <input type="checkbox"/> today</p> <p>(62) <input type="checkbox"/> consultant (70) <input type="checkbox"/> other</p> <p>(63) <input type="checkbox"/> laboratory (71) <input type="checkbox"/> soc. worker</p> <p>(64) <input type="checkbox"/> radiology (72) <input type="checkbox"/> telephone</p> <p>(65) <input type="checkbox"/> pathology (73) <input type="checkbox"/> hospital</p> <p>(66) <input type="checkbox"/> mental health (74-76) _____</p> <p>(67) <input type="checkbox"/> physical therapy _____ days</p> <p>(68) <input type="checkbox"/> nurse 000 <input type="checkbox"/> NA</p> <p>(69) <input type="checkbox"/> optometry 777 <input type="checkbox"/> today</p> <p>Tech: _____ (77) No. of Associated Morbidities</p> <p>(73) Loc. of Pt. when Referred to II. _____</p> <p><input type="checkbox"/> SEE REVERSE SIDE FOR ASSOC. MORBS. & DRUGS</p>				Clinic or Hosp (53)	BK	Dv	Vc	O/I	Dv	FS	SS	Is	HA	1	2	3	4	5	6	7	8	9	
Month	Day	Year																																														
2. (26) DAY'S SERVICE NO.	(27) MORB. NO.																																															
1 2 3 4 5 0	1 <input checked="" type="checkbox"/>																																															
S	M	T	W	Th	F	S																																										
7	1	2	3	4	5	6																																										
Clinic or Hosp (53)	BK	Dv	Vc	O/I	Dv	FS	SS	Is	HA																																							
1	2	3	4	5	6	7	8	9																																								

MEDICAL CARE UTILIZATION STUDY—FORM C
SUPPLEMENTARY MORBIDITY RECORD FORM

CHART NO. _____ DATE _____ DSN _____

	14. Assoc. Morbidity	15. Assoc. Morbidity	16. Assoc. Morbidity
	131 Card Code (1-3) 4 Morb. No. (27)	141 Card Code (1-3) 5 Morb. No. (27)	151 Card Code (1-3) 6 Morb. No. (27)
A. MORB. NAME			
ICDA NO.	(Card 31/37-40) <input type="checkbox"/> 9999 inapp.	(Card 41/37-40) <input type="checkbox"/> 9999 inapp.	(Card 51/37-40) <input type="checkbox"/> 9999 inapp.
B. STATUS OF DIAGNOSIS	(41) <input type="checkbox"/> unknown <input type="checkbox"/> established <input type="checkbox"/> tentative <input type="checkbox"/> inapplicable	(41) <input type="checkbox"/> unknown <input type="checkbox"/> established <input type="checkbox"/> tentative <input type="checkbox"/> inapplicable	(41) <input type="checkbox"/> unknown <input type="checkbox"/> established <input type="checkbox"/> tentative <input type="checkbox"/> inapplicable
C. EPISODE	(46) <input type="checkbox"/> initial visit <input type="checkbox"/> prevent. <input type="checkbox"/> continuing <input type="checkbox"/> inapp.	(46) <input type="checkbox"/> initial visit <input type="checkbox"/> prevent. <input type="checkbox"/> continuing <input type="checkbox"/> inapp.	(46) <input type="checkbox"/> initial visit <input type="checkbox"/> prevent. <input type="checkbox"/> continuing <input type="checkbox"/> inapp.
Punch 9's if blank	(47-54) Service-Morb. No.	(47-54) Service-Morb. No.	(47-54) Service-Morb. No.
D. MAJOR PRESENTING SYMPTOMS	(59-62) (63-66) (no 2nd sym <input type="checkbox"/> 0000) 8's <input type="checkbox"/> not ascertained 9's <input type="checkbox"/> inapplicable 0's <input type="checkbox"/> no symptoms	(59-62) (63-66) (no 2nd sym <input type="checkbox"/> 0000) 8's <input type="checkbox"/> not ascertained 9's <input type="checkbox"/> inapplicable 0's <input type="checkbox"/> no symptoms	(59-62) (63-66) (no 2nd sym <input type="checkbox"/> 0000) 8's <input type="checkbox"/> not ascertained 9's <input type="checkbox"/> inapplicable 0's <input type="checkbox"/> no symptoms
E. DURATION OF MAJOR PRESENTING SYMPTOMS	_____ days (67-69) 666 vague, less than a year 000 less than 1 day; 777 greater 998 not ascert. 777 than a year 999 inapplicable 888 since birth	_____ days (67-69) 666 vague, less than a year 000 less than 1 day; 777 greater 998 not ascert. 777 than a year 999 inapplicable 888 since birth	_____ days (67-69) 666 vague, less than a year 000 less than 1 day; 777 greater 998 not ascert. 777 than a year 999 inapplicable 888 since birth
F. PROCEDURES RENDERED	132 (1-3) 1. _____ 2. _____ (Cd. 32/29-32) (33-36) Others (37-52)	142 (1-3) 1. _____ 2. _____ (Cd. 42/29-32) (33-36) Others (37-52)	152 (1-3) 1. _____ 2. _____ (Cd. 52/29-32) (33-36) Others (37-52)
G. TYPE OF SCHEDULED RETURN VISIT	(53) RETURN VISIT: 1 <input type="checkbox"/> Scheduled..... 54-76 SEE BELOW 8 <input type="checkbox"/> Not scheduled... 54-76 punch 8's 9 <input type="checkbox"/> Inapplicable... 54-76 punch 9's	(53) RETURN VISIT: 1 <input type="checkbox"/> Scheduled..... 54-76 SEE BELOW 8 <input type="checkbox"/> Not scheduled... 54-76 punch 8's 9 <input type="checkbox"/> Inapplicable... 54-76 punch 9's	(53) RETURN VISIT: 1 <input type="checkbox"/> Scheduled..... 54-76 SEE BELOW 8 <input type="checkbox"/> Not scheduled... 54-76 punch 8's 9 <input type="checkbox"/> Inapplicable... 54-76 punch 9's
Punch 1 for each checked box unless otherwise specified	(54) <input type="checkbox"/> this physician _____ days (55-57) 000 NA 777 today (58) <input type="checkbox"/> attending physician _____ days (59-61) 000 NA 777 today (62) <input type="checkbox"/> consultant (70) <input type="checkbox"/> other (63) <input type="checkbox"/> laboratory (71) <input type="checkbox"/> social worker (64) <input type="checkbox"/> radiology (72) <input type="checkbox"/> telephone (65) <input type="checkbox"/> pathology (73) <input type="checkbox"/> hospital (66) <input type="checkbox"/> mental health (74-76) (67) <input type="checkbox"/> physical therapy days (68) <input type="checkbox"/> nurse 000 NA (69) <input type="checkbox"/> optometry 777 today	(54) <input type="checkbox"/> this physician _____ days (55-57) 000 NA 777 today (58) <input type="checkbox"/> attending physician _____ days (59-61) 000 NA 777 today (62) <input type="checkbox"/> consultant (70) <input type="checkbox"/> other (63) <input type="checkbox"/> laboratory (71) <input type="checkbox"/> social worker (64) <input type="checkbox"/> radiology (72) <input type="checkbox"/> telephone (65) <input type="checkbox"/> pathology (73) <input type="checkbox"/> hospital (66) <input type="checkbox"/> mental health (74-76) (67) <input type="checkbox"/> physical therapy days (68) <input type="checkbox"/> nurse 000 NA (69) <input type="checkbox"/> optometry 777 today	(54) <input type="checkbox"/> this physician _____ days (55-57) 000 NA 777 today (58) <input type="checkbox"/> attending physician _____ days (59-61) 000 NA 777 today (62) <input type="checkbox"/> consultant (70) <input type="checkbox"/> other (63) <input type="checkbox"/> laboratory (71) <input type="checkbox"/> social worker (64) <input type="checkbox"/> radiology (72) <input type="checkbox"/> telephone (65) <input type="checkbox"/> pathology (73) <input type="checkbox"/> hospital (66) <input type="checkbox"/> mental health (74-76) (67) <input type="checkbox"/> physical therapy days (68) <input type="checkbox"/> nurse 000 NA (69) <input type="checkbox"/> optometry 777 today
Punch 8's for each blank field or box			

MEDICAL CARE UTILIZATION STUDY — FORM B

Laboratory, Radiology & Other Services

STUDY #		(1-3)		103		(4-9)		(10-19)			
CARD CODE		CHART NUMBER		M P I D							
RELATED SERVICE (20-37)		MORBIDITY NUMBER		MONTH		DAY		YEAR			
		OSN MORB		DATE OF SERVICE		MONTH		DAY			
HEMATOLOGY		URINALYSIS		SERUM CHEMISTRY		COAGULATION		BACTERIOLOGY-MISC.			
8628	CBC	8955	SPECIFIC GRAVITY	8723	GLUCOSE	8712	PRO TIME	8455	BLOOD CULTURE		
8624	WBC	CHEMICAL	PH	8760	GLUCOSE COLA	CHECKED	PRO CONTROL	8739	BLOOD TYPING		
8620	RBC		PROTEIN	8722	GLUCOSE		8751	PTT	9330	EEG	
8622	HGB		GLUCOSE	8745	BUN			PTT CONTROL	9101	EKG	
8681	HCT		KETONES	8664	CREATININE		8674	FIBRINOGEN SCREEN	8961	GRAVINDEX	
	MCV		BILE	8747	URIC ACID			FIBRINOGEN CONTROL	8685	HETEROPHIL (includes Many Tests)	
	MCH		OCULT BLOOD	8605	AMYLASE		8658	LEE-WHITE COAG	8911	PAP SMEAR	
	MCHC			8752	BILIRUBIN TOTAL		8656	CLOT RETRACTION	8923	PATHOLOGY (includes Microscopy)	
	RDW			8753	BILIRUBIN DIRECT		8612	BLEEDING TIME	8741	ZNITODDY SCREEN	
8708	PLATELET COUNT		8956	WBC	8734		TOTAL PROTEIN			8692	RA TEST
				RBC	8735		ALBUMIN		PULMONARY FUNCTION LABORATORY	8756	PUBELLA SEROLOGY
DIFFERENTIAL			HYALINE	8657	CHOLESTEROL			8600	TOXOPLASMOSIS		
8626	PMN		FINE GRAN	8755	TRIGLYCERIDE	9200	LUNG VOLUMES	8457	CULTURE (except A/R Blood & Urine)		
	BANDS		COARSE GRAN	8650	CPK	9202	VENTILATION	8459	SENSITIVITY (except TB)		
	LYMPHS		WBC (CASH)	8691	LDH	9224	TEST RE MIXING TIME	8675	SEROLOGY (except TB)		
	MONOS		RBC (CASH)	8736	SGOT	9277	DIFFUSION	8477	SMEAR (non)		
	EOS		OTHER	8763	GAMMA GT	9170	BLOOD GASES	8475	SMEAR (stained)		
	BASO		BACTERIA	8705	ALK PHOS	9171	EXPIRED GASES	8757	T-3		
8718	SED RATE		MUCOUS	8704	ACID PHOS	9172	INDUCED SPUTUM	8758	T-4		
8715	RETIC COUNT		CRYSTALS	8641	CALCIUM			8483	THROAT CULTURE		
			AMORPHOUS	8707	PHOSPHORUS			8484	URINE CULTURE		
			EPITH CELLS	8721	SODIUM			READINGS			
			TRICHOMONAS	8709	POTASSIUM			9391	MPD		
			YEAST	8650	CHLORIDE			0010	TIME		
			OTHER	9153	pH			OTHERS			
				8643	pCO ₂						
					BASE EXCESS						
					CO ₂ CONTENT						
				9168	pO ₂						
					O ₂ SATUR (gm Cent)						

RADIOLOGY SERVICES					
HEAD		UPPER EXTREMITIES (Continued)		SPECIAL PROCEDURES	
7014	CEPITAL BONES (complete study) (non-contrast)	7260	FINGER(S) (single film) (contrast)	7360	BARIUM ENEMA (RE) (contrast) (non-contrast)
7010	MANDIBLE (single film) (contrast) (non-contrast)	7255	FOREARM (single film) (contrast) (non-contrast)	7363	CHOLECYSTOGRAM (GB) (contrast) (non-contrast)
7012	PARANASAL SINUSES (complete study) (contrast) (non-contrast)	7233	HAND (contrast)	7375	CYSTOGRAM (single film) (contrast) (non-contrast)
7026	SKULL (complete study) (contrast) (non-contrast)	7259	HAND (complete study) (contrast) (non-contrast)	7377	INTRAVENOUS PYELOGRAM (IVP)
TRUNK		7250	HUMERUS (single film) (contrast) (non-contrast)	7370	KIDNEY (DIETER) BLADDER (KUB) (contrast) (non-contrast)
7056	ABDOMEN (single AP) (contrast) (non-contrast)	7246	SCAPULA (single film) (contrast) (non-contrast)	7466	MAMMOGRAM (diagnostic)
7351	ABDOMEN (complete study) (contrast) (non-contrast)	7261	SHOULDER (contrast) (non-contrast)	7465	MAMMOGRAM (diagnostic)
7100	CHEST (single film) (contrast) (non-contrast)	7257	WRIST (single film) (contrast) (non-contrast)	7468	XEROGRAPH (contrast) (non-contrast)
7101	CHEST (single film) (contrast) (non-contrast)	LOWER EXTREMITIES		7366	UPPER GASTROINTESTINAL TRACT (UGIT)
7111	PELVIS (contrast) (non-contrast)	7307	ANKLE (contrast) (non-contrast)	OTHER	
SPINAL COLUMN		7309	FOOT (contrast) (non-contrast)		
7201	CERVICAL SPINE (contrast) (non-contrast)	7308	HIP (contrast) (non-contrast)		
7202	LUMBO-SACRAL SPINE (contrast) (non-contrast)	7304	KNEE (contrast) (non-contrast)		
7207	THORACIC SPINE (contrast) (non-contrast)	7217	PELVIS (contrast) (non-contrast)		
UPPER EXTREMITIES		7306	THUMB & FINGER (single film) (contrast) (non-contrast)		
7245	CLAVICLE (CLAVICLE BONE) (contrast) (non-contrast)	7320	TOES (contrast) (non-contrast)		
7252	ELBOW (single film) (contrast) (non-contrast)	7303	THUMB (single film) (contrast) (non-contrast)		

PATIENT PERSONAL HISTORY QUESTIONNAIRE

DISCHARGE SUMMARY

(KEY PUNCH: SKIP ALL COLUMNS THAT ARE BLANK
EXCEPT STAMP NUMBERS)

CARD CODE 02 STAMP NO. CL.
(1-2) (3-8) (9-14)

RACE: (15) -1-White -3-Oriental -5-Other(specify)
-2-Negro -4-Indian

RELIGIOUS PREFERENCE: (16)
 -1-Protestant -0-None
 -2-Catholic ____ Other(specify)____
 -3-Jewish -Blank-No answer

ADMISSION DATE: (17-22) _____
(Month) (Day) (Year)

DAY OF WEEK: (23) S M T W Th F S
7 1 2 3 4 5 6

TIME OF ADMISSION: (24)
 -1- 9:00am - 4:59pm, Mon. through Sat.
 -2- 5:00pm - 11:59pm, Mon. through Sat.
 -3- Midnight - 8:59am, Mon. through Sat.
 -4- 9:00am - 11:59pm, Sun. & Holidays
 -5- Midnight - 8:59am, Sun. & Holidays

DISCHARGE DATE: (25-30) _____
(Month) (Day) (Year)

DAY OF WEEK: (31) S M T W Th F S
 7 1 2 3 4 5 6

TIME OF DISCHARGE: (32)

- 1- 9:00am - 4:59pm, Mon. through Sat.
- 2- 5:00pm - 11:59pm, Mon. through Sat.
- 3- Midnight - 8:59am, Mon. through Sat.
- 4- 9:00am - 11:59pm, Sun. & Holidays
- 5- Midnight - 8:59am, Sun. & Holidays

TOTAL LENGTH OF STAY: (33-35)

SERVICE (DISCHARGE). (36-37)		
00 Newborn	06 Peds	13 Dermatology
01 Int Med	07 Surg	14 Mental Health
02 OB	08 Urology	15 Neurosurgery
03 Gyn	09 E N T	16 Psychiatry
04 Ophthal	10 Fam Pract	17 Oral Surg - Dental
05 Ortho	12 Allergy	

PHYSICIAN'S NUMBER (DISCHARGE): (38-40)

CONSULTATIONS:

(41) <u> </u> Family Practice	
(42) <u> </u> Medicine	(48) <u> </u> Urology
(43) <u> </u> Ob-Gyn	(49) <u> </u> E N T
(44) <u> </u> Ophthalmology	(50) <u> </u> Mental Health Personnel
(45) <u> </u> Orthopedics	(M.D.'s & Others)
(46) <u> </u> Pediatrics	(51) <u> </u> Neurology/Neurosurgery
(47) <u> </u> Surgery	(52) <u> </u> Other (M.D.'s only)

ADMITTING DIAGNOSES: PRIMARY(53-56)

SECONDARY (57-60)

DISCHARGE DIAGNOSES: PRIMARY _____
(6)-64)

(65-68) (69-72) (73-76) (77-80)

CARD CODE 03(1-2) STAMP NO.(3-8)

(9-12) (13-16) (17-20)

(21-24) (25-28)

SURGICAL PROCEDURES: PRIMARY (29-31)

(32-34) (35-37) (38-40)

(41-43) (44-46) (47-49)

LAB TESTS:

(50-52)___Urine Tests

(53-55)___Hematology

(56-58)___Chemistry and Serology

(59-60)___Transfusions

(61-62)___Bacteriology

(63-64)___Cross Match and Typing

(65-66)___Coagulation

(67)___Cervical/Vaginal Pap Smear

(68-69)___Miscellaneous

(70-71)___Pathology

X-RAYS: CHEST(72) OTHER(73-74)

EKG'S: (75-76)

DISCHARGE STATUS:(77) -1-Alive -2-Expired
 Alive: -3-CCU -5-ICU -7-CCU & ICU
 Expired: -4-CCU -6-ICU -8-CCU & ICU

AUTOPSY: (78) -1- Alive when discharged
-2- Expired--NO autopsy
-3- Expired--AUTOPSY

HOSPITAL INFECTION:(79) -0-No -1-Yes

STATUS OF PERSONAL HISTORY QUEST:(80)

- 1- Completed
- 2- Patient expired before completion
- 3- Patient unable to complete
- 4- Refused
- 5- Previous admission (P.A.)
- 6- Not completed--misc. reasons
- 7- Newborn
- 8- Partially completed (P.C.)

PATIENT PERSONAL HISTORY QUESTIONNAIRE

SUNNYSIDE MEDICAL CENTER

TODAY'S DATE _____

1-7

Your cooperation in answering the following questions will aid your physician and will provide information to help the Health Plan improve service. Please read the questions carefully and fill in the blanks or check the appropriate boxes. Your answers will be strictly confidential. Thank you.

1. WHAT IS YOUR ADDRESS? _____
2. WHAT IS YOUR DATE OF BIRTH? (Month, day and year) _____ 8
3. WHAT IS YOUR ETHNIC ORIGIN? (This question is optional and used for statistical purposes only) 9

4 <input type="checkbox"/> Native American (Indian)	3 <input type="checkbox"/> Asian
5 <input type="checkbox"/> Hispanic	2 <input type="checkbox"/> Negro (Black)
6 <input type="checkbox"/> Other (specify) _____	1 <input type="checkbox"/> Caucasian (White)
4. WHAT IS YOUR PRESENT MARITAL STATUS? 10

0 <input type="checkbox"/> Never married	2 <input type="checkbox"/> Remarried	4 <input type="checkbox"/> Widowed
1 <input type="checkbox"/> Married	3 <input type="checkbox"/> Divorced	5 <input type="checkbox"/> Separated
5. WHAT SERIOUS ILLNESSES HAVE YOU HAD? (Like Pneumonia, Typhoid, etc.) 11

Disease	Year	Disease	Year
6. HOW MANY CHILDREN DO YOU HAVE? (Include newborns) _____ 12
7. HOW MANY PEOPLE LIVE IN YOUR RESIDENCE? (Include yourself) _____ 13
8. HOW MANY ROOMS ARE IN YOUR RESIDENCE? (Exclude bathrooms) _____ 14
9. DO YOU PRESENTLY SMOKE CIGARETTES? 1 ☐ Yes 0 ☐ No 15

IF YES: APPROXIMATELY HOW MANY CIGARETTES PER DAY DO YOU SMOKE? _____ 16

HOW MANY YEARS HAVE YOU SMOKED? _____ 17
10. IF YOU DON'T SMOKE NOW, DID YOU EVER REGULARLY SMOKE CIGARETTES? 18

1 ☐ Yes 0 ☐ No

IF YES: APPROXIMATELY HOW MANY CIGARETTES PER DAY DID YOU SMOKE? _____ 19

WHEN DID YOU QUIT? _____ 20

HOW MANY YEARS DID YOU SMOKE? _____ 21
11. YOU REGULARLY SMOKE CIGARS OR A PIPE? 1 ☐ Yes 0 ☐ No 22
12. DO YOU DRINK ALCOHOLIC BEVERAGES? 0 ☐ Never 2 ☐ Occasionally 23

1 ☐ Seldom 3 ☐ Frequently

4 ☐ Daily
13. WHEN YOU DRINK, HOW MANY OF THE FOLLOWING DO YOU USUALLY DRINK DURING A DAY? 24

____ Glasses of wine, and/or ____ Bottles(glasses) of beer, and/or ____ Drinks 25

of liquor 26
14. COMPARED TO LAST YEAR ARE YOU NOW DRINKING: 1 ☐ More 3 ☐ About the same 27

2 ☐ Less
15. DURING THE PAST YEAR HAVE YOU EVER BEEN WORRIED OR CONCERNED ABOUT YOUR DRINKING? 28

1 ☐ Yes 0 ☐ No

PLEASE COMPLETE THE QUESTIONS ON THE OTHER SIDE OF THIS FORM

APPENDIX B

KAISER CLINICAL-BEHAVIORAL CLASSIFICATION SYSTEM

DISEASES

Disease generally requiring hospitalization (except psychiatric hospitalization)

- Requiring surgery
 - Usually emergency surgery (11)
 - Malignancy (14)
 - Usually nonemergency surgery (12)
- Other (13)

Diseases not generally requiring hospitalization

- Diseases with high emotional component
 - Emotionally produced or aggravated diseases (21)
 - Diseases secondary to social or psychological disorganization (22)
 - Emotional disease (23)
- Diseases without high emotional component
 - Chronic disease
 - With symptoms
 - Symptoms completely controlled under treatment (31)
 - Symptoms treatable, nonmalignant
 - Systemic or general (41)
 - Internal (CNS, intrathoracic, intraabdominal) (42)
 - Other (43)
 - Obesity (44)
 - Symptoms treatable, malignant
 - Systemic or general (46)
 - Internal (CNS, intrathoracic, intraabdominal) (47)
 - Other (48)
 - Symptoms nontreatable (32)
 - Without symptoms (33)
 - Birth injuries and congenital malformations (34)
 - Complications of other illnesses (45)

Acute disease

- Microorganism-produced
 - Viral
 - Systemic or general (51)
 - Internal (CNS, intrathoracic, intraabdominal) (52)
 - Other (53)
 - Bacterial
 - Systemic or general (54)
 - Internal (CNS, intrathoracic, intraabdominal) (55)
 - Other (56)
 - Other
 - Systemic or general (57)
 - Internal (CNS, intrathoracic, intraabdominal) (58)
 - Other (59)
- Non-microorganism-produced
 - Systemic or general (61)
 - Internal (CNS, intrathoracic, intraabdominal) (62)
 - Other (63)
- Complications of other illnesses (64)
- Complications of surgical and medical procedures (65)
- Symptoms of undiagnosed disease (71)

PREGNANCY

Prenatal and postnatal services (81)
Complications (82)

TRAUMA AND ADVERSE EFFECTS OF EXTERNAL CAUSE

Burns and traumatic injuries and adverse effects of chemicals and other external causes

- Hospitalization usually required (91)
- Hospitalization not usually required (92)
- Late effect of trauma (94)
- Hospitalization and surgery usually required (95)

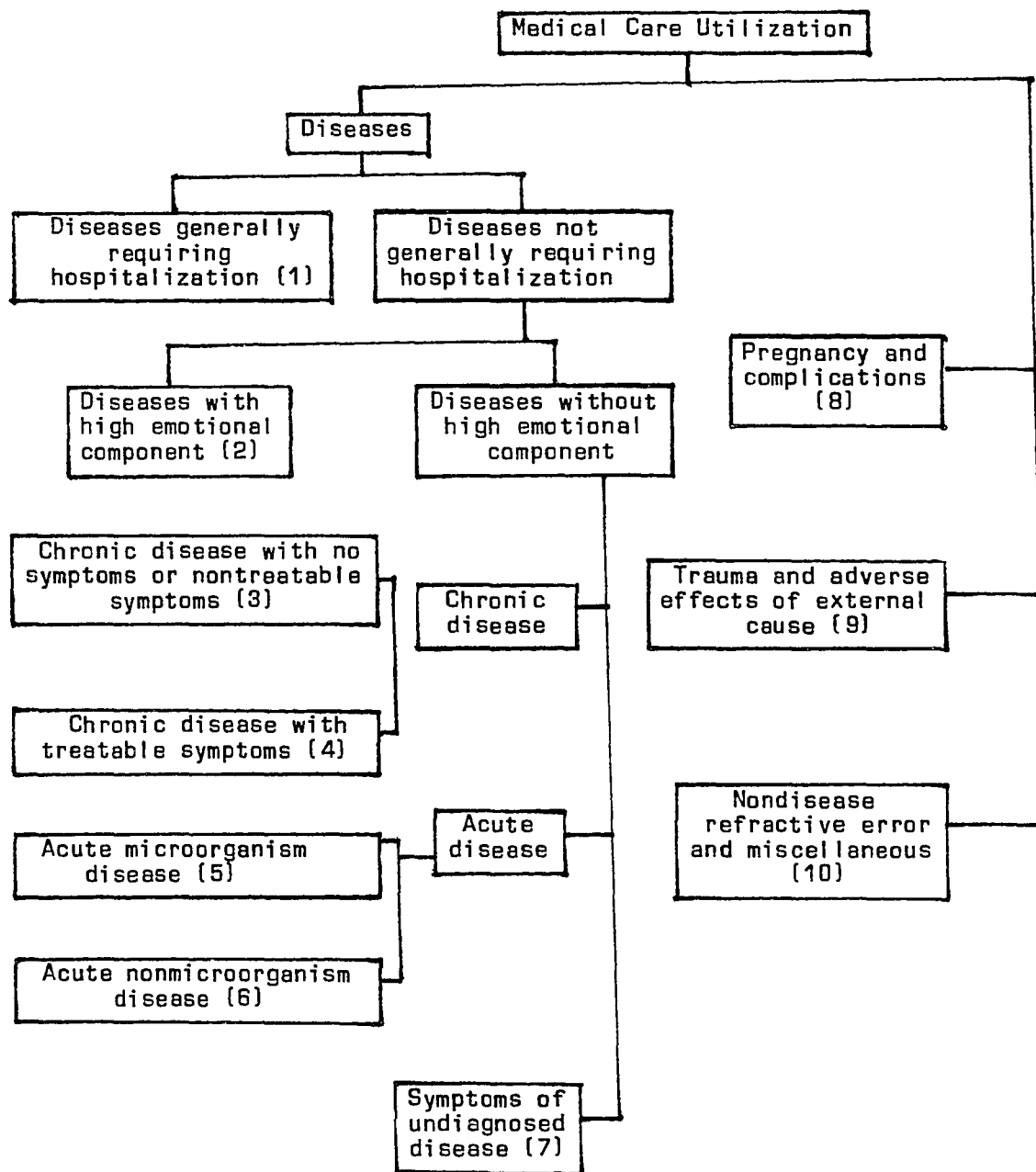
Adverse effects of drugs (93)

NONDISEASE, REFRACTIVE ERROR, AND MISCELLANEOUS

Preventive services (01)
No disease present (ICDA diagnosis) (02)
Other (03)
Refractions (04)
Refractive error (04)
No refractive error (05)

Clinical subgroups in the Kaiser Clinical-Behavioral Classification System

Source: Hurtado, A. V., & Greenlick, M. R. (1971). A disease classification system for analysis of medical care utilization, with a note on symptom classification. *Health Services Research*, 16, 240.



Basic structure of the Kaiser Clinical-Behavioral Classification System

Source: Hurtado, A.V. & Greenlick, M.R. (1971). A disease classification system for analysis of medical care utilization, with a note on symptom classification. *Health Services Research*, 16, 239.

APPENDIX C

AGE AND SEX-SPECIFIC RESPONSES TO SOCIAL NETWORK QUESTIONS ON THE HOUSEHOLD INTERVIEW SURVEY

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
"What is your marital status?"

Marital Status	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
1 Married	87.0	91.5	91.5	80.9	87.1	88.5	79.1	49.6
2 Never Married	7.3	3.2	4.1	5.3	3.0	2.1	2.4	2.8
3 Widowed	.3	1.1	1.3	8.6	.3	2.4	10.6	41.1
4 Divorced	5.3	4.3	3.2	5.3	9.6	7.9	7.9	6.5
TOTAL (N)	100 (301)	100 (376)	100 (316)	100 (209)	100 (396)	100 (321)	100 (378)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
"How many children do you have?"

Number of Children	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 None	20.3	4.5	14.6	23.4	14.1	3.9	13.8	24.4
1	24.6	9.3	17.1	24.4	20.7	8.4	22.2	22.0
2	24.9	25.0	28.2	18.2	27.5	22.6	30.4	20.7
3	16.9	24.7	15.5	20.1	20.2	24.9	13.5	17.1
4	7.6	18.1	11.7	7.2	11.1	21.3	8.2	6.9
5 or more	5.6	18.4	13.0	6.7	6.3	18.9	11.9	8.9
TOTAL (N)	100 (301)	100 (376)	100 (316)	100 (209)	100 (396)	100 (381)	100 (378)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
"Is your father living?"

Father Living	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
1 Deceased	23.9	56.2	87.5	100.0	20.4	54.8	88.2	100.0
2 Alive	76.1	43.8	12.5	0	79.6	45.2	11.8	0
TOTAL (N)	100 (297)	100 (370)	100 (313)	100 (205)	100 (387)	100 (378)	100 (373)	100 (245)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
"Is your mother living?"

Mother Living	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
1 Deceased	6.0	32.6	66.3	96.1	7.6	31.9	75.1	97.2
2 Alive	94.0	67.4	33.7	3.9	92.4	68.1	24.9	2.8
TOTAL (N)	100 (299)	100 (374)	100 (315)	100 (206)	100 (395)	100 (379)	100 (377)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "Including yourself, how many children were
 in your family (of origin)?"

Number Siblings	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 None	12.3	16.8	17.4	15.3	13.6	15.0	12.2	11.8
1	21.6	16.5	14.6	8.6	21.7	19.2	10.8	3.3
2	21.9	16.0	10.4	8.6	24.5	17.8	15.3	10.6
3	16.6	15.7	13.3	12.0	6.6	12.6	13.5	12.2
4	9.0	8.8	6.3	12.0	6.6	10.0	11.6	15.4
5 or more	18.6	26.3	38.0	43.5	16.6	25.5	36.5	46.7
TOTAL (N)	100 (301)	100 (376)	100 (316)	100 (209)	100 (396)	100 (381)	100 (378)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How many families who are relatives of yours live
 in or around Portland or Vancouver?"*

Number of Relatives Near	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 None	9.0	15.4	14.6	15.8	9.8	15.7	11.9	15.0
1	11.6	13.6	14.3	19.6	11.4	11.8	16.7	17.9
2	5.6	9.6	13.0	18.2	8.1	10.5	13.8	16.7
3	7.0	9.8	7.3	10.5	8.1	8.4	10.1	13.0
4	9.3	10.9	7.0	9.1	9.3	10.0	9.5	7.7
5	8.3	6.9	5.7	2.4	9.3	7.3	5.6	4.1
6 or more Missing=2	49.2	33.8	38.1	24.4	43.9	36.2	32.4	25.6
TOTAL (N)	100 (301)	100 (376)	100 (315)	100 (209)	100 (396)	100 (381)	100 (377)	100 (246)

*Asked of wife only who provided answers for both herself and husband.

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How many of these families do you see often?"*

Near Relatives Families See Often	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 Have none	11.6	21.0	20.6	24.2	14.1	21.0	18.4	21.1
1 < half	19.3	17.0	12.7	8.2	19.2	14.7	9.6	8.1
2 About half	29.2	21.5	23.2	16.9	27.5	21.8	22.4	16.7
3 All	39.9	40.4	43.5	50.7	39.1	42.5	49.6	54.1
TOTAL (N)	100 (301)	100 (376)	100 (315)	100 (207)	100 (396)	100 (381)	100 (375)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How many other families who are relatives of yours
 do you have who live within a day's drive
 of Portland or Vancouver?"*

Number of Relatives Day Away	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 None	22.3	26.6	27.3	26.4	22.5	29.9	25.7	28.6
1	13.0	16.2	21.0	24.0	13.1	18.4	19.4	20.8
2	9.0	11.7	10.5	10.1	11.6	8.9	14.3	13.1
3	8.0	8.2	9.2	9.1	7.1	7.6	10.9	8.6
4	8.0	6.9	5.7	5.3	7.3	6.3	5.8	5.7
5	8.3	4.0	4.4	4.8	7.6	3.4	4.2	4.1
6 or more Missing = 3	31.6	26.3	21.9	20.0	30.8	25.5	19.6	19.2
TOTAL (N)	100 (301)	100 (376)	100 (315)	100 (208)	100 (396)	100 (381)	100 (377)	100 (245)

*Asked of wife only who provided answers for both herself and husband.

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How many of these [families] do you
 see fairly often?"*

Relatives Families See One Day Away	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 None	44.2	42.3	46.3	46.6	40.9	48.8	44.3	44.7
1 < half	20.6	16.5	14.3	11.5	19.7	14.4	13.8	9.4
2 About half	18.6	18.4	13.3	13.0	19.4	14.7	16.4	14.8
3 All	16.6	22.9	26.0	28.8	19.9	22.0	25.5	31.1
TOTAL (N)	100 (301)	100 (376)	100 (315)	100 (208)	100 (396)	100 (381)	100 (377)	100 (244)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "Do you have any especially close friends—that is,
 people you feel free to talk with about personal
 things? How many do you have?"

Number of Close Friends	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 None	23.9	27.7	30.7	46.6	12.7	13.6	15.6	20.0
1	9.0	6.9	4.7	5.8	12.2	16.0	12.2	10.6
2	29.2	18.4	14.6	7.7	28.9	26.5	19.6	18.4
3	12.6	13.3	12.3	9.1	24.8	19.2	20.4	17.6
4	11.0	9.8	7.9	9.6	12.4	10.0	10.8	11.0
5	11.3	18.9	17.4	12.5	8.6	12.9	17.5	16.3
6	3.0	5.1	12.3	8.7	0.5	1.8	4.0	6.1
Missing = 45								
TOTAL (N)	100 (301)	100 (376)	100 (316)	100 (208)	100 (395)	100 (381)	100 (378)	100 (245)

*Asked of wife only who provided answers for both herself and husband.

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How often do you keep in touch with these
 especially close friends?"

Frequency See Close Friends	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
Never— 0 [no close friends]	23.9	27.7	31.0	46.6	12.7	12.7	15.6	20.0
1 Seldom, occasionally	9.6	14.1	14.9	14.9	6.3	6.8	7.9	7.3
2 Quite often	27.9	25.3	26.3	17.8	22.5	26.3	27.8	21.2
3 Very often	38.5	32.8	27.8	20.7	58.5	53.2	48.7	51.4
TOTAL (N)	100 (301)	100 (375)	100 (316)	100 (208)	100 (395)	100 (380)	100 (378)	100 (245)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How many different friends or families do you
 get together with throughout the year?"*

Friends, Families See During Year	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
1 A few	25.6	32.2	41.6	52.4	25.5	34.6	44.3	42.6
2 Some	47.5	44.1	38.7	31.6	48.0	43.0	36.1	32.8
3 Great many	26.9	23.7	19.7	16.0	26.5	22.3	19.6	24.6
Missing = 5								
TOTAL (N)	100 (301)	100 (376)	100 (315)	100 (206)	100 (396)	100 (381)	100 (377)	100 (244)

*Asked of wife only who provided answers for both herself and husband.

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How often do you get together with friends?"*

How Often Get With Friends	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
1 Rarely	7.7	14.7	20.6	27.1	8.4	18.4	20.2	21.3
2 Occasionally	40.1	41.1	30.2	34.8	41.3	37.0	34.6	29.9
3 Frequently	51.3	44.3	49.2	38.2	50.4	44.6	45.2	48.8
Missing = 8								
TOTAL (N)	100 (300)	100 (375)	100 (315)	100 (207)	100 (395)	100 (381)	100 (376)	100 (244)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "About how many other employees do you see and
 talk to at work during a typical day?"

Coworkers Interact With	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
Not working								
0 or don't interact	8.5	7.9	24.9	93.2	60.4	49.3	53.5	92.7
1 1-2	4.1	6.0	3.2	1.5	2.3	2.9	4.0	0
2 3-10	31.5	30.4	27.2	1.5	15.4	20.7	16.2	4.1
3 11-25	36.3	33.9	25.6	2.9	14.4	18.4	17.0	2.0
4 Over 25	19.7	22.0	19.2	1.0	7.6	8.7	9.3	1.2
TOTAL (N)	100 (295)	100 (369)	100 (313)	100 (206)	100 (396)	100 (381)	100 (376)	100 (246)

*Asked of wife only who provided answers for both herself and husband.

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How often do you spend time away from the job
 with your coworkers?"

Frequency See Co- Workers Outside Work	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
Not working								
0 or don't see	5.1	4.1	19.4	90.2	58.8	47.0	51.2	91.9
1 Rarely	34.4	39.7	48.9	5.4	21.5	29.9	26.9	3.7
2 Occasionally	51.7	48.9	28.2	4.4	17.4	19.9	20.5	4.4
3 Very often	8.8	7.3	3.6	0	2.3	3.1	1.3	0
Missing = 32								
TOTAL (N)	100 (294)	100 (368)	100 (309)	100 (205)	100 (396)	100 (381)	100 (375)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "Here is a list of various kinds of organizations.
 Do you belong to any of these organizations,
 clubs or groups? How many? How often do
 you attend meetings of this
 organization?"

Frequency Attend Meet- ings Organ- ization #1	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
Inapprop.								
0 or never	38.5	26.1	29.6	44.5	48.1	36.5	44.4	42.7
1 Seldom	24.4	24.3	24.2	15.3	12.5	13.5	12.2	12.2
2 Occasionally	13.4	24.8	24.8	20.6	12.7	20.5	17.0	15.4
3 Regularly	23.7	24.8	21.3	19.6	26.8	29.7	26.3	29.7
TOTAL (N)	100 (299)	100 (375)	100 (318)	100 (209)	100 (395)	100 (381)	100 (376)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How often do you attend meetings of a
 second organization?"

Frequency Attend Meetings Organ. #2	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
Never, 0 inapprop.	62.5	48.8	60.8	71.8	70.6	55.3	67.9	66.7
1 Seldom	10.0	16.8	9.5	8.6	5.8	8.7	7.7	4.5
2 Occasionally	9.0	12.3	12.7	6.2	4.3	12.6	6.9	8.5
3 Regularly	18.4	22.1	17.1	13.4	19.2	23.4	17.5	20.3
TOTAL (N)	100 (299)	100 (370)	100 (316)	100 (209)	100 (395)	100 (380)	100 (377)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How often do you attend meetings of a
 third organization?"

Frequency Attend of Meetings Organ. #3	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
Never, 0 inapprop.	80.3	70.5	76.2	87.1	86.4	79.3	83.6	75.6
1 Seldom	3.3	4.8	5.1	3.8	2.3	3.7	3.4	4.5
2 Occasionally	5.3	9.8	8.9	3.8	4.8	5.0	5.6	5.3
3 Regularly	11.0	14.9	9.8	5.8	6.6	12.1	7.4	14.6
TOTAL (N)	100 (300)	100 (376)	100 (315)	100 (209)	100 (396)	100 (380)	100 (377)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How often do you attend meetings of a
 fourth organization?"

Frequency Attend Meetings Organ. #4	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
Never, 0 inapprop.	92.0	85.4	89.2	93.3	94.7	91.1	92.9	87.0
1 Seldom	1.3	2.9	2.5	1.9	1.5	2.1	0.5	0.8
2 Occasionally	1.7	2.9	3.8	1.9	0.8	1.0	2.4	2.4
3 Regularly	5.0	8.8	4.4	2.9	3.0	5.8	4.2	9.8
TOTAL (N)	100 (301)	100 (376)	100 (316)	100 (209)	100 (396)	100 (381)	100 (378)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How often do you attend meetings of a
 fifth organization?"

Frequency Attend Meetings Organ. #5	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
Never, 0 inapprop.	96.3	92.3	94.3	97.1	96.7	96.1	95.5	93.1
1 Seldom	0.3	0.8	2.2	0	0.8	1.0	0.8	0.8
2 Occasionally	0.7	2.1	1.3	0	1.0	1.0	1.6	2.4
3 Regularly	2.7	4.8	2.2	2.9	1.5	1.8	1.7	3.7
TOTAL (N)	100 (300)	100 (376)	100 (316)	100 (209)	100 (396)	100 (381)	100 (378)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How often do you attend meetings of a
 sixth organization?"

Frequency Attend Meetings Organ. #6	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
Never, 0 inapprop.	98.0	95.2	97.5	98.6	98.5	97.9	99.2	94.7
1 Seldom	0.3	2.7	1.3	1.0	0.5	0.5	0	0.4
2 Occasionally	1.3	0.8	0.9	0	0	0.3	0.3	0.8
3 Regularly	0.3	1.3	0.3	0.5	1.0	1.3	0.5	4.1
TOTAL (N)	100 (301)	100 (376)	100 (316)	100 (209)	100 (396)	100 (381)	100 (378)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "If you attend church (or synagogue), how often
 do you usually attend?"

Frequency Attend Church	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 Never	31.7	30.8	26.6	38.1	24.5	23.0	21.1	22.8
1 Few times a year	39.9	32.1	39.3	23.9	34.0	29.7	28.5	22.0
2 Monthly	5.5	6.6	6.6	5.6	7.7	9.6	8.4	7.9
3 Several times a mo.	5.1	8.8	4.3	3.0	9.0	8.6	9.1	8.3
4 About weekly	13.0	15.4	16.7	24.4	18.8	20.3	22.5	27.8
5 More than once weekly	4.8	6.3	6.6	5.1	5.9	8.8	10.3	11.2
TOTAL (N)	100 (293)	100 (364)	100 (305)	100 (197)	100 (388)	100 (374)	100 (364)	100 (246)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "What are some of the things you do in your leisure
 or spare time, when you are not working?"

Social Leisure Score (Collapsed)	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 No social, leisure	11.1	16.7	25.3	37.3	13.2	13.0	20.4	21.3
1	33.6	27.9	32.1	28.0	19.7	20.4	25.5	29.8
2	22.8	24.1	17.3	23.8	26.1	24.6	21.4	20.9
3	18.3	16.7	16.7	7.3	20.3	19.8	18.8	16.6
4	8.3	10.4	7.4	1.6	11.9	11.6	8.6	8.5
5 Maximum	5.9	4.1	1.3	2.1	8.9	10.6	5.4	3.0
Missing = 63								
TOTAL (N)	100 (289)	100 (365)	100 (312)	100 (193)	100 (395)	100 (378)	100 (373)	100 (235)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "How frequently do you keep in touch through
 telephone calls or letters with relatives
 who live away from the Portland area?"*

Frequency Contact f Relatives Far Away	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
1 Not very frequently	35.5	36.9	28.6	28.2	34.4	31.6	28.1	27.6
2 Somewhat regularly	36.8	35.8	36.7	36.9	35.9	37.3	37.3	30.3
3 Very frequently	27.7	27.4	34.7	34.9	29.8	31.1	34.6	42.1
Missing = 74								
TOTAL (N)	100 (296)	100 (369)	100 (311)	100 (195)	100 (393)	100 (367)	100 (370)	100 (228)

*Asked of wife only who provided answers for both herself and husband.

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "Some adults have a strong sense of family ties
 to parents and brothers and sisters; others
 don't. Would you say you have a strong
 sense of family ties?"

Strength of Family ties	MEN				WOMEN			
	under		over		under		over	
	35	35-49			35	35-49		
1 Not very strong	20.5	29.8	25.8	26.2	10.7	14.4	11.7	10.8
2 Fairly strong	42.7	42.1	38.1	32.6	40.6	34.0	34.9	26.5
3 Very strong	36.9	28.1	36.1	41.3	48.7	51.6	53.4	62.8
Missing = 74								
TOTAL (N)	100 (293)	100 (359)	100 (291)	100 (172)	100 (394)	100 (376)	100 (367)	100 (223)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "While you were growing up, how close knit would
 you say your family was?"

Family Origin Close Knit	MEN				WOMEN			
	under		over		under		over	
	35	35-49			35	35-49		
1 Not very	16.0	12.8	10.6	8.3	14.4	12.1	7.2	8.1
2 Somewhat	41.0	48.2	41.9	44.3	42.0	37.2	35.3	29.7
3 Extremely	43.0	39.0	47.4	47.3	43.5	50.7	57.5	62.3
Missing = 55								
TOTAL (N)	100 (293)	100 (376)	100 (310)	100 (192)	100 (395)	100 (379)	100 (374)	100 (236)

DISTRIBUTION OF RESPONSES BY AGE AND SEX TO QUESTION,
 "About how many families in this neighborhood do
 you know well enough to drop in on
 unexpectedly for a visit?"*

Neighbors	MEN				WOMEN			
	under 35	35-49	50-65	over 65	under 35	35-49	50-65	over 65
0 None	14.7	11.7	15.2	13.0	14.6	14.2	15.7	10.3
1	18.0	6.1	9.8	8.7	13.6	8.4	9.3	8.3
2	14.7	14.4	10.2	14.0	15.7	14.2	12.8	15.3
3	12.0	12.5	14.9	12.6	12.4	12.9	14.6	9.5
4	10.7	11.7	11.7	6.3	11.1	11.0	10.1	9.1
5	5.7	8.5	7.6	7.2	7.6	6.6	7.7	7.4
6 or more	24.3	35.1	30.5	38.2	25.0	32.8	29.8	40.1
Missing = 10								
TOTAL (N)	100 (300)	100 (376)	100 (315)	100 (207)	100 (396)	100 (381)	100 (376)	100 (242)

*Asked of wife only who provided answers for both herself and husband.

APPENDIX D

OVERVIEW BOXES FOR SOCIAL NETWORK INDEXES

INDEX OF SCOPE OF IMMEDIATE FAMILY

FAMSCOP1

0 No family linkages available

1

2

3

4 Four family linkages available

Missing: persons who gave no answer to one or more items

Conceptual meaning:

Scope or breadth of immediate family reflects how many of four potential immediate family linkages (spouse, parents, children, siblings) are available to the respondent. Those receiving the highest score reported the presence of a spouse in the household and at least one living parent, one child, and one sibling. Moderate scores reflect the presence of two or three potential immediate family linkages.

Index construction procedures:

The new variable was set at zero and constructed such that being married added 1, having either a father or a mother alive added 1, having at least one sibling added 1, and having at least one child added 1.

FAMSCOP1 (continued)

ITEM	RESPONSE	SCORE
Marital status of respondent	Married	+ 1
R013	Never married Widowed Divorced	
Respondent's father living	Alive	+ 1
R015	Dead	
Respondent's mother living	Alive	
R021	Dead	
Total children family of origin R056 (siblings)	One (only child)	
	Two	
	Three	
	Four	+ 1
	Five	
	Six	
	Seven or more	
Total number of respondent's children F033 + F045 + F071 Children Children Children home left past left home year	None	
	One	
	Two	+ 1
	Three	
	.	
	Twelve	

Disposition of "no answer" responses:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 1.6%

Frequency distribution

0 = 9	Mean = 3.14
1 = 117	Variance = .77
2 = 433	Std. dev. = .88
3 = 943	% missing = 1.6%
4 = 1063	
Missing = 41	N = 2603 Valid N = 2562

INDEX OF SCOPE OF TOTAL FAMILY

FAMSCOP2

0 No family linkages

.

.

.

6

Missing: persons who gave no answer to one or more items

Conceptual meaning:

Scope of total family reflects how many of 6 potential total linkages (spouse, children, parents, sibling, relatives living nearby, and relatives living one day away) are available to the respondents. Those receiving the highest score on this index reported the presence of a spouse in the household, and at least: one living parent, one child, one sibling, one relative nearby, and one relative a day away. Respondents receiving the lowest score reported that none of these 6 family linkages exist for them. Moderate scores reflect the presence of two, three, or four of the potential total family scores.

Index construction procedures:

The new variable was set to equal FAMSCOP1 and constructed such that having at least one relative nearby added 1 and having at least one relative a day away added 1.

FAMSCOP2 (continued)

ITEM	RESPONSE	SCORE
Index of scope immediate family FAMSCOP1	0 No family linkages	0
	1	.
	2	+ .
	3	.
	4 All immediate family linkage's present	4
How many relatives live nearby F109	None	
	One	
	Two	
	Three	+ 1
	Four	
	Five	
How many relatives live day away F112	Six	
	None	
	One	
	Two	
	Three	+ 1
	Four	
	Five	
	Six	

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 1.7%

Frequency distribution

0 =	3	Mean	= 4.75
1 =	24	Variance	= 1.23
2 =	72	Std. dev.	= 1.11
3 =	232	% missing	= 1.7%
4 =	559		
5 =	953		
6 =	716		
Missing =	44	N = 2603	Valid N = 2559

INDEX OF SCOPE OF FRIENDS

FRNSCOPE

0 No linkages with any friends

1

2

3 Friends in each category

Missing: persons who gave no answer to one or more items

Conceptual meaning:

Scope of friends index reflects how many of 3 potential linkages within the friends sector (close friends, neighbors, coworkers) is available to the respondent. Those receiving the highest score reported the presence of at least one close friend, at least one neighbor that was visited in the home, and the potential to have work associates because they were employed.

Index construction procedures:

Three items were used to construct this score. FRNSCOPE was first set at zero. If one or more close friends were available, 1 was added. If one or more neighbors were available, 1 was added. If the person was working or would soon be working again, 1 was added.

FRNSCOPE (continued)

ITEM	RESPONSE	SCORE
How many close friends	None	
R116	One	
	Two	
	Three	+ 1
	Four	
	Five	
	Six	
Families know to drop in	None	
F108 (neighbors)	One	
	Two	
	Three	+ 1
	Four	
	Five	
	Six	
Employment status	Working	
R201	Temporarily off	+ 1
	Retired but working 20 hrs week	
	Temporarily disabled	
	Unemployed	
	Retired	
	Never had a job	
	Housewife	

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 0.6%

Frequency distribution

0 = 29	Mean = 2.25
1 = 343	Variance = .52
2 = 1155	Std. dev. = .72
3 = 1060	% missing = 0.6%
Missing = 16	Valid N = 2587
N = 2603	

INDEX OF SCOPE OF COMMUNITY INVOLVEMENT

COMMSCOP

- 0 No community involvement
 - 1
 - 2
 - 3
 - 4 Maximum breadth of involvement
- Missing: persons who gave no answer to one or more items

Conceptual meaning:

This index indicates breadth of participation in the social life of the community. If the respondent attends meetings of one or more groups or organizations, if he attends church at all, and if he participates in leisure social activities at two levels he scores high. Those who score low do not attend meetings or churches or engage in social leisure.

Index construction procedures:

First, LEISURE was collapsed so that those who engaged in one or two social leisure activities = 1 and those who engaged in 3 or more social activities = 2.

Second, R318 was revised so that if the respondent never attended church he received a score of 0. The values were also reversed so that the low numbers meant little attendance and higher numbers indicated greater frequency of attendance.

The new variable was set at zero. If the respondent attended church at all he received 1. If he attended meetings at all he received 1. If he engaged in one or two social activities he received a score of 1; if three or more social activities, he received 2 points.

COMMSCOP (continued)

ITEM	RESPONSE	SCORE
Frequency of attendance at church	Never	
R318 (reversed order)	Few times year	
	About monthly	
	Several times a month	+ 1
	About weekly	
	More than once a week	
Index of frequency of attendance at meetings of organizations	0 Never	
FREQMEET	.	
	.	
	.	+ 1
	.	
	18 Maximum attendance	
Index of social leisure	0 None	
R201	One - two activities	+ 1
	Three or more activities	+ 2

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 5.1%

Frequency distribution

0 = 75	Mean = 2.56
1 = 335	Variance = 1.11
2 = 700	Std. dev. = 1.05
3 = 860	
4 = 500	% missing = 5.1%
Missing = 133	Valid N = 2470
N = 2603	

INDEX OF OVERALL NETWORK SCOPE

NETSCOP1

- 0 No breadth of linkages available
 .
 .
 .
 13 Maximum linkages
 Missing: persons who gave no answer to one or more items

Conceptual meaning:

This index reflects how many of 13 potential linkages from family, friends, and community sectors are available to respondents. High scorers would have persons available in all the possible role relationships and community involvements. Low scorers would have very limited social resource categories.

Index construction procedures:

This index is the sum of three scope indexes already created.

ITEM	RESPONSE	SCORE
Index scope total family FAMSCOP2	0 No family at all	0
	1	1
	2	2
	3	+ 3
	4	4
	5	5
	6 Maximum family linkages	6
Index scope of friends FRNSCOPE	0 No friends	0
	1	1
	2	+ 2
	3 Maximum friend linkages	3
Index scope community involvement COMMSCOP	0 No community participation	0
	1	1
	2	+ 2
	3	3
	4 Maximum commun. particip.	4

NETSCOP1 (continued)

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 6.8%

Frequency distribution

1 =	2	Mean	= 9.62
2 =	2	Variance	= 3.76
3 =	6	Std. dev.	= 1.93
4 =	17		
5 =	50	% missing	= 6.8%
6 =	92		
7 =	159		
8 =	304		
9 =	410		
10 =	488		
11 =	501		
12 =	312		
13 =	82		
Missing =	178	N = 2603	Valid N = 2425

Reliability

Coefficient Alpha .43

ITEM	ITEM- TOTAL CORRELATION	ALPHA IF ITEM DELETED
Marriage	.14159	.42395
Children	.16295	.40633
Mother living	.08401	.42663
Father living	.13688	.42205
Siblings	-.01914	.46109
Relatives near	.15884	.40997
Relatives far	.17771	.40278
Close friends	.15943	.40688
Other friends	.30781	.39579
Neighbors	.17920	.40090
Work associates	.07488	.42954
Organizations	.27967	.36500
Church	.19143	.39718
Leisure activities	.20925	.39511

CORRELATION MATRIX FOR SCALE NETSCOP1

	MARRIAGE	CHILDREN	MOTHER LIVING	FATHER LIVING	SIBLINGS	RELATIVES NEAR	RELATIVES FAR	CLOSE FRIENDS	OTHER FRIENDS	NEIGHBORS
MARRIAGE	1.00000									
CHILDREN	.16345	1.00000								
MOTHER LIVING	.10602	.00767	1.00000							
FATHER LIVING	.14559	.05365	.47053	1.00000						
SIBLINGS	-.08273	.06009	-.19271	-.21265	1.00000					
RELATIVES NEAR	.10180	.11424	.10194	.13119	.01359	1.00000				
RELATIVES FAR	.11552	.05643	.08940	.11124	.02075	.14597	1.00000			
CLOSE FRIENDS	-.04526	-.00649	-.03231	-.02866	.01428	.02855	.03535	1.00000		
OTHER FRIENDS	.02962	.01163	.10095	.13071	-.06378	.12599	.10398	.18043	1.00000	
NEIGHBORS	.12829	.06457	-.04142	-.03416	.00089	.02053	.11988	.09222	.18660	1.00000
WORK ASSOCIATES	.02150	.02749	.15968	.21491	-.08555	.08442	.03865	.03320	.05944	-.06275
ORGANIZATIONS	.07082	.09315	.00657	.04925	-.03056	-.00127	.04515	.13497	.19875	.19207
CHURCH	.00460	.12336	-.03526	-.04824	.06514	.02596	.02155	.12417	.14416	.10797
LEISURE ACTIVITIES	-.02441	.03269	.09931	.13978	.00624	.04742	.04197	.13175	.20984	.04631
	WORK ASSOCIATES	ORGANI- ZATIONS	CHURCH	LEISURE ACTIVITIES						
WORK ASSOCIATES	1.00000									
ORGANIZATIONS	.12498	1.00000								
CHURCH	-.07267	.23701	1.00000							
LEISURE ACTIVITIES	.07956	.21852	.07333	1.00000						

INDEX OF CHILDREN

ALLKIDS

- 0 No children
 .
 .
 .
 12 Maximum number of children

Conceptual meaning:

This measure is a sum of all the children of the respondent, and includes those currently living at home, those who left home during the past year, and those who have been living away from home for one or more years. Younger people would have children living at home, while older would be expected to have more in the latter category.

Index construction procedures:

Number of children from the 3 raw score variables are summed.

ITEM	RESPONSE	SCORE
Number of children at home F033	None	+ 1
	.	+ 2
	.	.
	.	.
	.	.
Number of children left home past year F045	None	+ 1
	.	+ 2
	.	.
	.	.
	.	.
Number of children left home one or more years F071	None	+ 1
	.	+ 2
	.	.
	.	.
	.	.

ALLKIDS (continued)

Frequency distribution

0 =	365	Mean	= 2.43
1 =	466	Variance	= 3.16
2 =	657	Std. dev.	= 1.78
3 =	503		
4 =	316	% missing	= 0.0%
5 =	177		
6 =	55		
7 =	42		
8 =	16		
9 =	9		
10 =	1		
11 =	2		
12 =	3		
Missing =	0	N = 2603	Valid N = 2603

INDEX OF FAMILY OF ORIGIN INTERACTION

FAMINTER

0 Minimum interaction
.
.
.
21 Maximum interaction

Conceptual meaning:

This index indicates the interaction with family of origin in terms of numbers of these family members and how often they are seen. Because there is no direct measure of frequency of contact, a proxy measure was created (FAMTIES) which indicates strength of family ties and thus indirectly how often they might be seen. Thus, someone with weak ties would see these family members less than someone with strong ties. A respondent with a mother living, a father living, and up to 7 siblings who has a strong sense of family ties would receive the highest score. Someone without a living parent who was an only child and had a weak sense of family would be a low scorer.

Index construction procedures:

The index FAMTIES was collapsed to a metric of 0-3 so as to have the same metric of the other frequency variables used in index constructions. A small number (51) of the respondents had been coded "0" (missing) in addition to those coded as "9" (missing), non-applicable. Presumably these 51 had no family members. Thus these zeros were permitted to enter the computations as 0. Number of living parents and siblings were summed and then multiplied by the FAMTIES index.

FAMINTER (continued)

ITEM	RESPONSE	SCORE		ITEM	RESPONSE	SCORE
Father living	No			Sense of	(no family)	0
R015	Yes	+ 1		Family ties		
Mother living	No			FAMTIES	Weak	1
R021	Yes	+ 1		(Proxy measure		
Siblings	0		X	for frequency)	Moderate	2
R056	1	+ 1		R074	Strong	3
	2	+ 2				
	3	+ 3				
	4	+ 4				
	5	+ 5				
	7 or more	+ 6				

Frequency distribution

0 =	149	Mean	=	7.78	
1 =	53	Variance	=	24.61	
2 =	148	Std. dev.	=	5.0	
3 =	155				
4 =	248	% missing	=	4.5%	
5 =	132				
6 =	370				
7 =	26				
8 =	186				
9 =	128				
10 =	260				
12 =	229				
14 =	56				
15 =	221				
18 =	78				
21 =	46				
Missing =	118	N =	2603	Valid N =	2485

INDEX OF FAMILY TIES

FAMTIES

Pearson's r : .42

0 Minimum sense of family

.

.

.

9 Maximum sense of family

Percent missing scores: 3.2%

Conceptual meaning:

This index combines two variables which indicate how strong the respondent's ties to his family were and are. Since there is no variable concerned with frequency of contact with family of origin, it was created to give a proxy measure of how often the respondent might see these family members based on his feelings of closeness to them. A low score is given if a sense of family ties is not very strong and his/her family was not very close knit. A high score indicates a very strong sense of family ties and an extremely close knit family of origin.

Index construction procedures:

Both variables were recoded to reverse direction to from low to high. They were then multiplied together.

ITEM	RESPONSE	SCORE		ITEM	RESPONSE	SCORE
Was family (of	Not very	1	X	Sense of	Not strong	1
origin) close	Somewhat	2		family ties	Fairly strong	2
knit	Extremely	3		R074	Very strong	3
R073				(recoded)		
(recoded)						

INDEX OF INTERACTION WITH RELATIVES

RELINTER

0 No interaction with relatives
.
.
.
12 Maximum interaction
Missing: persons who gave no answer to one or more items

Conceptual meaning:

This index combines the number of relatives living nearby and a day away with the frequency with which they are seen by the respondent. It includes a measure of the frequency with which the respondent keeps in touch with relatives far away. Low scorers have no or few relatives with whom they interact seldom. High scorers have many relatives and see them often.

Index construction procedures:

First, three variables concerning frequency of contact were summed to create a new index, FREQREL1. Each was in a metric of 0-3. Each was recoded so the order went from low to high. People who did not have relatives living nearby or day away with whom they could have contact had been coded 100 (missing). These people were recoded to a value of 0 so they could be entered in the computations. Otherwise there would have been almost half the sample excluded from the index FREQREL1.

Next, the two variables concerned with the number of relatives nearby and a day away were summed for a new index SIZEREL.

Finally, the new variable, INTERREL, was set at zero, and FREQREL1 and SIZEREL were multiplied.

RELINTER (continued)

This is how FREQREL1 was constructed:

Range: 1-9

ITEM	RESPONSE	SCORE
Keep in touch with away relatives F115	All nearby	0
	Not very frequently	+ 1
	Somewhat frequently	+ 2
	Very frequently	+ 3
Near relatives family see often RFAM	None or inappropriate (have no near relatives)	0
	Less than half	+ 1
	About half	+ 2
	All	+ 3
Relatives families one day away See often RFAMDAY	None or inappropriate (have no day away relatives)	0
	Less than half	+ 1
	About half	+ 2
	All	+ 3

Percent with "missing" scores: 0.8%

This is how SIZEREL was constructed:

Range: 1-12

ITEM	RESPONSE	SCORE
How many relatives live nearby F109	None	0
	One	+ 1
	Two	+ 2
	Three	+ 3
	Four	+ 4
	Five	+ 5
	Six or more	+ 6
How many relatives live day away F112	None	0
	One	+ 1
	Two	+ 2
	Three	+ 3
	Four	+ 4
	Five	+ 5
	Six or more	+ 6

Percent with "missing" scores: 0.2%

RELINTER (continued)

 Finally, this is how RELINTER was constructed:

ITEM	RESPONSE	SCORE		ITEM	RESPONSE	SCORE
Index of	None	0		Index of	None	0
frequency of	.	.		number of	.	.
contact with	.	.		relatives	.	.
relatives near,	.	+	X	nearby and	.	+
day away, and	.	.		day away	.	.
far away	9 (much	.		SIZEREL	.	.
FREQREL1	contact) 9	9		12 or more	12	12

Percent_with_"missing"_scores: 0.6%

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Frequency distribution

0 = 266	25 = 23	Mean = 21.31
2 = 2	27 = 46	Variance = 297.46
3 = 115	28 = 44	Std. dev. = 17.25
4 = 62	30 = 109	
5 = 24	32 = 41	% missing = 0.6%
6 = 215	33 = 12	
7 = 38	35 = 47	
8 = 46	36 = 147	
9 = 76	40 = 76	
10 = 42	42 = 64	
11 = 6	44 = 24	
12 = 231	45 = 34	
14 = 31	48 = 110	
15 = 71	50 = 24	
16 = 21	54 = 22	
18 = 146	55 = 10	
20 = 34	60 = 65	
21 = 45	66 = 8	
22 = 22	72 = 32	
24 = 157	Missing = 15	

N = 2603 Valid N = 2588

INDEX OF CLOSE FRIENDS INTERACTION

FRNINTER (close friends interaction measure)

0 No close friends, so no interaction
 .
 .
 .
 18 Maximum interaction
 Missing: persons who gave no answer to one or more items

Conceptual meaning:

This index measures the extent of the respondent's interaction with close friends. If he has over 10 close friends and sees them frequently, he receives a high score. If he has few friends and sees them seldom, he receives a low score.

Index construction procedures:

First, R117 was recoded to reverse the order to low to high frequency. At the same time, the pilot response of "often" was included in "very often" so as not to have to count those 85 responses as missing. It was a choice between including the 85 with "very often" or "fairly often," and it seemed more reasonable that what was meant by those respondents fit better with "very often."

The new variable was set at 0. R116 was multiplied by R117. Those with no friends with 0 (missing) were entered into the computations.

ITEM	RESPONSE	SCORE		ITEM	RESPONSE	SCORE
How many close friends R116	One	1	X	How often in touch with close friends	Seldom, occasional	1
	Two	2			Fairly often	2
	Three	3			Very often	3
	Four	4		R117 (recoded)	incl. pilot	
	Five - ten	5			Inapprop. (no	0
	Over ten	6			close friends)	
	Inappropriate 0 (no close friends)					

FRNINTER (continued)

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 0.2%

Frequency distribution

0 =	581	Mean	=	5.90
1 =	33	Variance	=	23.97
2 =	138	Std. dev.	=	4.90
3 =	220			
4 =	185	% missing	=	0.2%
5 =	42			
6 =	495			
8 =	90			
9 =	229			
10 =	146			
12 =	191			
15 =	187			
18 =	61			
Missing =	5	N =	2603	Valid N = 2598

INDEX OF OTHER FRIENDS INTERACTION

FRIENDS

1 Little interaction

.
.
.

9 Maximum interaction

Missing: persons who gave no answer to one or more items

Conceptual meaning:

This index measures categorically whether one sees few or many families of friends and how often these people are seen. In contrast to the measure of close friends which is primarily a measure of persons with whom one interacts on a more intimate basis, this index assesses a broader sweep of friend's families. These relationships would be considered more distant ones. Low scorers would have only a few such relationships and see them rarely. High scorers would have a great many of these friend relationships and see them often.

Index construction procedures:

The recoded variables from the Masterfile were used as they both measured low to high. These two variables were then multiplied.

ITEM	RESPONSE	SCORE		ITEM	RESPONSE	SCORE
	A few	1			Rarely	1
How many				How often get		
friends	Some	2		together with	Occasionally	2
families get			X	these friends		
with during	A great many	3		RF116	Frequently	3
year						
RF117	Inappropriate	0			Inappropriate	0

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

FRIENDS (continued)

Frequency distribution

0 =	12	Mean	=	4.54
1 =	134	Variance	=	7.30
2 =	456	Std. dev.	=	2.70
3 =	226			
4 =	471	% missing	=	0.6%
6 =	616			
9 =	479			
Missing =	0	N =	2603	Valid N = 2603

INDEX OF WORK INTERACTION

WORKINT

- 1 Unemployed, or does not interact at work
 - .
 - .
 - .
 - 12 Maximum interaction with friends and associates from work
- Missing: persons who gave no answer to one or more items

Conceptual meaning:

This index indicates interaction within the respondent's work network. It is a measure of the number of people he talks to at work multiplied by how often he sees work friends apart from the work situation. Many of the respondents are housewives, and quite a few are retired, so they do not have a work network. Low scorers would not be working, or have jobs where they do not work with others. If they were working they would seldom see their work associates outside their place of employment.

Index construction procedures:

First, R257 was collapsed to combine categories one and two due to small numbers in each. Thus, one and two = 1, three = 2, four = 3, and five = 4.

Second, R277 was recoded so that "works alone" (four) was included in "zero, inappropriate."

The new variable was set at zero and R257 and R277 multiplied.

ITEM	RESPONSE	SCORE		ITEM	RESPONSE	SCORE
	1 - 2	1			Rarely	1
People talk	3 - 10	2		Spend time	Occasionally	2
to at work	11 - 25	3		off job with	Very often	3
R257	Over 25	4	X	coworkers		
	Inappropriate	0		R277	Inappropriate	0
	(retired,				(retired,	
	housewives)				housewives)	

WORKINT (continued)

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 1.2%

Frequency distribution

0 = 1178	Mean = 2.40
1 = 43	Variance = 8.03
2 = 323	Std. dev. = 2.83
3 = 228	
4 = 304	% missing = 1.2%
6 = 283	
8 = 151	
9 = 26	
12 = 36	
Missing = 31	N = 2603 Valid N = 2572

INDEX OF INVOLVEMENT IN ORGANIZATIONS OR CLUBS

FREQMEET (Frequency of attendance at meetings of 6 organizations)

1 No involvement with organizations, clubs, or groups

.

.

.

18 Much involvement

Missing: persons who gave no answer to one or more items

Conceptual meaning:

Organizational involvement reflects how many clubs, groups, or organizations the respondent belongs to as well as how much he attends meetings of the organizations. This would indicate integration into the community, and being in relationship to other people who could be supportive. People who scored highest on this index would belong to 6 organizations and go to meetings of each organization regularly. People who scored lowest would not belong to organizations or clubs.

Index construction procedures:

First, R173, R178, R183, R188, R193, R198 were each recoded to reverse the order so that 1 = seldom, 2 = occasionally, and 3 = regularly. 4 was recoded to 0 = never. Also set at 0 were the missing variables that were inappropriate. These represented respondents who did not belong to organizations. The zeros could be entered in the calculations. Missing values 9 were set at 99.

Then the six variables were summed. Scores ranged from 0-18.

FREQ.MEET (continued)

ITEM	RESPONSE	SCORE	ITEM	RESPONSE	SCORE
Organization 1 attend meetings R173	Never,	0	Organization 4 attend meetings R188	Never,	0
	inappropriate			inappropriate	
	Seldom	+ 1		Seldom	+ 1
	Occasionally	+ 2		Occasionally	+ 2
	Regularly	+ 3		Regularly	+ 3
Organization 2 attend meetings R178	Never,	0	Organization 5 attend meetings R193	Never,	0
	inappropriate			inappropriate	
	Seldom	+ 1		Seldom	+ 1
	Occasionally	+ 2		Occasionally	+ 2
	Regularly	+ 3		Regularly	+ 3
Organization 3 attend meetings R183	Never,	0	Organization 6 attend meetings R198	Never,	0
	inappropriate			inappropriate	
	Seldom	+ 1		Seldom	+ 1
	Occasionally	+ 2		Occasionally	+ 2
	Regularly	+ 3		Regularly	+ 3

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 0.6%

Frequency distribution

0 = 881	7 = 89	13 = 16	% missing = 0.6%
1 = 208	8 = 77	14 = 12	
2 = 277	9 = 72	15 = 11	
3 = 371	10 = 35	16 = 3	
4 = 166	11 = 26	17 = 6	
5 = 132	12 = 25	18 = 1	
6 = 180		Missing = 15	

N = 2603 Valid N = 2588

INDEX OF ORGANIZATION AND CHURCH INTERACTION

FREQMECH

- 0 No church or organization interaction
 - .
 - .
 - .
 - 10 Maximum interaction
- Missing: persons who gave no answer to one or more items

Conceptual meaning:

This index measures church and organizational involvement such that church attendance is given the same weight as the measure of attendance at meetings of organizations, FREQMEET. Thus, church is considered very important as a source of social linkages and support. High scorers attend church frequently and belong to many organizations and attend their meetings.

Index construction procedures:

First, R318 was revised to reverse order from low to high, and six = 0 (none).

Then, FREQMEET was collapsed to a metric of five to be the same as R318.

The new variable was set at zero and FREQMEET and R318 added together.

FREQMECH (continued)

ITEM	RESPONSE	SCORE
Index of Organizational Involvement FREQMEET	0 No interaction . . . 5 Much interaction	0 . + . . 5
Frequency of attendance at church R318 (reversed order)	Never Few times year About monthly More than monthly Weekly More than weekly	0 + 1 + 2 + 3 + 4 + 5

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 3.3%

Frequency distribution

0 =	306		
1 =	336		
2 =	227		
3 =	239		
4 =	360		
5 =	277		
6 =	213		
7 =	175		
8 =	185		
9 =	161		
10 =	39		
Missing =	85	N = 2603	Valid N = 2518

INDEX OF SOCIAL LEISURE

LEISUR2

0 No social leisure activities

.

.

.

14 Maximum social leisure

Missing: persons who gave no answer to one or more items

Conceptual meaning:

The social leisure index is an indication of how many leisure activities the respondent engages in that involve doing things with other people or involve getting him or her out of the house in situations that would involve others. From a potential list of about 30 leisure activities that the respondents reported they did in their spare time, 14 were selected by the investigator as being social (as opposed to solitary activities). Each one of these social activities that the respondent mentioned added one point to his score.

Index construction procedures:

The new variable was set at zero. If a social leisure activity was noted by the respondent, 1 was added to the score. These were summed for the total score.

LEISUR2 (continued)

ITEM	RESPONSE	SCORE	ITEM	RESPONSE	SCORE
R121 Camping	Yes No	+ 1	R135 Attend Plays	Yes No	+ 1
R122 Attend meetings	Yes No	+ 1	R140 Shopping	Yes No	+ 1
R124 Attend concerts	Yes No	+ 1	R141 Spectator sports	Yes No	+ 1
R125 Entertaining	Yes No	+ 1	R142 Sports participant	Yes No	+ 1
R128 Going out	Yes No	+ 1	R144 Visiting	Yes No	+ 1
R131 Movie attendance	Yes No	+ 1	R145 Volunteer work	Yes No	+ 1
R134 Play cards	Yes No	+ 1	R150 Other social	Yes No	+ 1

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 2.4%

Frequency distribution

0 =	471		
1 =	673		
2 =	579		
3 =	444		
4 =	231		
5 =	85		
6 =	38		
7 =	13		
8 =	3		
9 =	2		
10 =	1		
Missing =	63	N = 2603	Valid N = 2540

INDEX OF NETWORK SIZE

NETSIZE (Total network size)

0 Nobody in network

.

.

.

10 Maximum number people in network

Missing: persons who gave no answer to one or more items

Conceptual meaning:

Network size is a simple count of the total number of individuals enumerated by the respondent, adding down all available categories of social relationships (family, kin, friends, neighbors, coworkers). It is an overall measure of the size of the group of people from whom support could be drawn. Respondents receiving the highest score would have large nuclear and extended families and many friends, neighbors, and work associates. The lowest score would be received by never married subjects with few friends and kin who were unemployed.

Index construction procedures:

Two previously constructed indexes, SIZEFAM2 (size total family) and SIZEFRND (size friends network) were summed for this index.

ITEM	RESPONSE	SCORE
Index of total family size SIZEFAM2	0 No family members	0
	.	.
	.	+ .
	.	.
	27 Largest possible family	33
Index of friends network SIZEFRND	0 Nobody in network	0
	.	.
	.	+ .
	.	.
	18 Largest possible network	18

NETSIZE (continued)

Disposition of "no answer" response:

If any item in this index was unanswered, respondent was coded "missing" on this score.

Percent with "missing" scores: 2.8%

Frequency distribution

2 = 2	16 = 110	29 = 88	Mean = 22.16
4 = 3	17 = 86	30 = 96	Variance = 39.82
5 = 4	18 = 121	31 = 72	Std. dev. = 6.31
6 = 4	19 = 128	32 = 40	
7 = 14	20 = 147	33 = 36	% missing = 2.8%
8 = 11	21 = 159	34 = 32	
9 = 22	22 = 154	35 = 20	
10 = 28	23 = 162	36 = 12	
11 = 37	24 = 170	37 = 11	
12 = 54	25 = 153	48 = 4	
13 = 53	26 = 119	39 = 3	
14 = 70	27 = 117	40 = 4	
15 = 87	28 = 97	Missing = 74	

N = 2603 Valid N = 2529

Reliability

Coefficient Alpha .30

ITEM	ITEM- TOTAL CORRELATION	ALPHA IF ITEM DELETED
Marriage	.16327	.29282
Children	.10931	.28227
Mother living	.09956	.29678
Father living	.14925	.29005
Siblings	-.01999	.34417
Relatives near	.19937	.22700
Relatives far	.20076	.22501
Close friends	.08732	.29346
Other friends	.22964	.26636
Neighbors	.11661	.28078
Work associates	.05289	.30513

INDEX OF IMMEDIATE FAMILY SIZE

FAMSIZE1 (size of immediate family)

0 No immediate family members

.

21 Maximum number immediate family members

Missing: persons who gave no answer to one or more items

Conceptual meaning:

This index is a simple count which reflects how many persons are available in the respondent's immediate family. Potential family members are: one spouse, two living parents, up to twelve children, and up to six (or more) siblings.

Index construction procedures:

Five items were used to construct this index. The presence of each possible family member added 1 and the score for that person is the total sum.

FAMSIZE1 (continued)

ITEM	RESPONSE	SCORE
Marital status of respondent	Married	+ 1
R013	Never married Widowed Divorced	
Respondent's father living	Alive	+ 1
R015	Dead	
Respondent's mother living	Alive	+ 1
R021	Dead	
Total children family of origin R056 (siblings)	One (only child)	0
	Two	+ 1
	Three	+ 2
	Four	+ 3
	Five	+ 4
	Six	+ 5
	Seven or more	+ 6
Total number of respondent's children F033 + F045 + F071 Children Children Children home left past left home year	None	0
	One	+ 1
	Two	+ 2
	Three	+ 3
	Four	+ 4
	Five	+ 5
	Six	+ 6
	.	.
	.	.
	Twelve	+ 12

Disposition of "no answer" responses:

If any item in this index was unanswered, respondent was coded "missing" on this score.

INDEX OF TOTAL FAMILY SIZE

SIZEFAM2 (Size of total family)

0 No family members

.

.

.

33 Maximum number family members

Missing: persons who gave no answer to one or more items

Conceptual meaning:

This index is a simple count of all the immediate and extended family members available to the respondent. It includes all the immediate family members (spouse, parents, siblings, children) from the FAMSIZE1 and adds kin. A score of up to 6 is added if the respondent has 6 or more relatives living nearby. A score of up to six is also added if the respondent has 6 or more relatives a day away. This index considers family size as inclusive of not only the immediate family but also kin.

Index construction procedures:

This index starts at zero and adds the Index of Immediate Family Size (FAMSIZE1), the number of relatives who live nearby, and the number of relatives who live at a day's distance.

SIZEFAM2 (continued)

ITEM	RESPONSE	SCORE
Index of immediate family size FAMSIZE1	0 No immediate family members	0
	.	.
	.	+ .
	.	.
	21 Maximum number immediate family members	. 21
How many relatives live near F109	None	0
	One	+ 1
	Two	+ 2
	Three	+ 3
	Four	+ 4
	Five	+ 5
	Six or more	+ 6
How many relatives live day away F112	None	0
	One	+ 1
	Two	+ 2
	Three	+ 3
	Four	+ 4
	Five	+ 5
	Six or more	+ 6

Disposition of "no answer" responses:

If any item in this index was unanswered, respondent was coded "missing" on this score.

INDEX OF FRIENDS NETWORK SIZE

SIZEFRND (Size of friends network)

0 No friends

.

18 Maximum number of friends

Missing: persons who gave no answer to one or more items

Conceptual meaning:

Size of friends network counts those people outside the family circle that the respondent knows well and with whom he socializes. Included in this index are up to six values for close friends, up to six values for neighbors he knows well enough to drop in on, up to three values for associates he talks to at work, and up to 3 values for families of less close friends he sees. The latter two categories of friends are ranges which have been weighted so that they count less than close friends and neighbors because they are assumed to be less intimate to the respondent in terms of providing social support. Of course, if the respondent is not employed, he would not have anyone in his work network.

Index construction procedures:

Four items were used to construct this score. R257 was first collapsed from 5 to 3 values. Thus, 1, 2, and 3, were merged to 1 (0-10) because there were very few cases in both 1 and 2.

The new index was set at zero and the four items were summed.

SIZEFRND (continued)

ITEM	RESPONSE	SCORE
How many close friends F116	None	0
	One	+ 1
	Two	+ 2
	Three	+ 3
	Four	+ 4
	Five to ten	+ 5
	Over ten	+ 6
Families know to drop in F108	None	0
	One	+ 1
	Two	+ 2
	Three	+ 3
	Four	+ 4
	Five	+ 5
	Six or more	+ 6
How many others talk to at work (collapsed) R257	Don't work	0
	One to ten	+ 1
	Eleven to twenty-five	+ 2
	Over twenty-five	+ 3
How many friends get together with during year R277	A few	+ 1
	Some	+ 2
	A great many	+ 3

Disposition of "no answer" responses:

If any item in this index was unanswered, respondent was coded "missing" on this score.

INDEX OF FREQUENCY OF CONTACT WITH NETWORK MEMBERS

NETFREQ

0 Infrequent contact
.
.
.
24 Maximum frequency of contact

Conceptual meaning:

This index indicates categorically the amount of contact the respondent has with network members other than immediate family and family of origin. High scorers see their kin, friends, and work associates very frequently, and attend meetings and church very frequently. Low scorers see these network members seldom.

Index construction procedures:

Many of the 8 row score variables were already in a metric of 3. Those that were not were collapsed to a metric of 3. Recodes were done so all the variables went from low to high. Then the 8 raw score variables were summed.

NETFREQ (continued)

ITEM	RESPONSE	SCORE
Keep in touch with away relatives F115	All nearby Not very frequently Somewhat frequently Very frequently	0 + 1 + 2 + 3
Nearby relatives families see often RFAM	None or inappropriate Less than half About half All	0 + 1 + 2 + 3
Relatives families one day away see often RFAMDAY	None or inappropriate Less than half About half All	0 + 1 + 2 + 3
How often in touch with close friends R117	No close friends Seldom, occasionally Fairly often Very often	0 + 1 + 2 + 3
How often get with friends RF116	Rarely Occasionally Frequently	+ 1 + 2 + 3
Spent time off with coworkers R277	not applicable or never Rarely Occasionally Very often	0 + 1 + 2 + 3
Frequency of attending meetings of 6 organizations FREQMEET	Never Low Medium High	0 + 1 + 2 + 3
Frequency of attending church R318	Never Few times a year Monthly, several times month about weekly or more	0 + 1 + 2 + 3

NETFREQ (continued)

Frequency distribution

2 =	4	Mean	=	13.15
3 =	5	Variance	=	13.68
4 =	18	Std. dev.	=	3.70
5 =	31			
6 =	41	% missing	=	6.7%
7 =	66			
8 =	105			
9 =	132			
10 =	179			
11 =	200			
12 =	252			
13 =	249			
14 =	224			
15 =	259			
16 =	199			
17 =	174			
18 =	128			
19 =	75			
20 =	47			
21 =	26			
22 =	9			
23 =	4			
24 =	2			
Missing =	174	N = 2603	Valid N	= 2429

Reliability

Coefficient Alpha .38

ITEM	ITEM- TOTAL CORRELATION	ALPHA IF ITEM DELETED
F115	.09624	.37340
RFAM	.11738	.36718
RFAMDAY	.10115	.37580
RRR117	.19180	.33351
RF116	.29247	.31842
RR277	.06108	.38527
FREQ MEET	.25867	.28353
R318	.19631	.32928

INDEX OF OVERALL NETWORK INTERACTION

NETINTER

- 0 No network interactions
- .
- .
- .
- 48 Maximum network ineteraction

Conceptual meaning:

This index is an overall measure of the respondent's total interaction with family, friends, and work associates as well as involvement in the community by attending meetings, church, and engaging in social leisure.

Index construction procedures:

This index was constructed by summing all the interaction indexes after they were all collapsed to a metric of 6. Being married was considered a very important tie, so it was weighted 8 in this variable to take into consideration that all married people see their spouses very frequently. (Recall that the frequency of contact variables had a metric of 3, with 3 indicating very frequent contact.) Each number variable was multiplied by the frequency of contact variable to form an interaction index for that relationship domain.

Since children represent the family with whom the respondent is living (or they are at least very close) they are considered to also have the maximum frequency of contact. Since multiplying the number of children by 3 would not change the frequency distribution, this variable was simply collapsed to the same metric as the other variables entering the overall index.

NETINTER (continued)

INDEX LABEL	COMPUTER NAME	RESPONSE (collapsed)	SCORE
Index of marital status	R013	Yes No	+ 8
Index of total children	ALLKIDS	0 None . 5 Maximum	0 . 5
Index of interaction with family of origin	FAMINTER	0 None . 5 Maximum	0 . 5
Index of relatives interaction	CRELINTE	0 None . 5 Maximum	0 . 5
Index of close friends interaction	FRNINTER	0 None . 5 Maximum	0 . 5
Index of other friends interaction	FRIENDS2	0 Minimum interaction . 5 Maximum interaction	0 . 5
Index of work interaction	WORKINT	0 . 5	0 . 5
Index of meeting interaction (including church)	FREQMECH	0 . 5	0 . 5
Index of social leisure	LEISUR2	0 . 5	0 . 5

NETINTER (continued)

Frequency distribution

3 =	1	24 =	101	Mean	=	26.72
4 =	2	25 =	108	Variance	=	43.16
5 =	3	26 =	154	Std. dev.	=	6.58
6 =	2	27 =	176	% missing = 8.3%		
7 =	3	28 =	130			
8 =	9	29 =	147			
9 =	6	30 =	154			
10 =	9	31 =	127			
11 =	10	32 =	114			
12 =	18	33 =	103			
13 =	18	34 =	96			
14 =	26	35 =	74			
15 =	27	36 =	65			
16 =	35	37 =	51			
17 =	56	38 =	31			
18 =	52	39 =	23			
19 =	58	40 =	10			
20 =	69	41 =	7			
21 =	70	42 =	5			
22 =	118	Missing =	217			
23 =	118					

N = 2603 Valid N = 2386

Reliability

Coefficient Alpha .44

ITEM	ITEM- TOTAL CORRELATION	ALPHA IF ITEM DELETED
MARRIAGE	.06115	.44150
ALLKIDS	.08925	.44573
FAMINTER	.10327	.43842
CRELINTE	.19328	.40432
FRNINTER	.21705	.39373
FRIENDS2	.34198	.35109
WORKINT	.10722	.44456
FREQMECH	.27283	.36769
LEISUR2	.25517	.38089

CORRELATION MATRIX FOR SCALE NETINTER

	MARRIAGE	ALLKIDS	FAMINTER	CRELINTE	FRNINTER	FRIENDS2	WORKINT	FREQMECH	LEISURE2
MARRIAGE	1.00000								
ALLKIDS	.15672	1.00000							
FAMINTER	-.03113	.34171	1.00000						
CRELINTE	.12122	.10506	.15432	1.00000					
FRNINTER	-.07320	-.02086	.04609	.07453	1.00000				
FRIENDS2	.01475	-.03160	.03930	.19351	.25829	1.00000			
WORKINT	.00944	-.00207	-.03547	.02480	.07570	.12227	1.00000		
FREQMECH	.06084	.13736	.05037	.04958	.15809	.23132	.07713	1.00000	
LEISUR2	-.03326	.03306	.07072	.04084	.16078	.25659	.10324	.18343	1.00000

APPENDIX E

CORRELATIONS OF INDEPENDENT, DEPENDENT, AND CONTROL VARIABLES

ZERO-ORDER PAIRWISE CORRELATIONS OF INDEPENDENT, DEPENDENT, AND
CONTROL VARIABLES, USING CONTINUOUS VERSIONS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Network variables															
1. Scope															
2. Size	.60														
3. Frequency	.57	.38													
4. Interaction	.78	.70	.67												
Demographic variables															
5. Age	-.41	-.19	-.09	-.29											
6. Sex (1=male, 2=female)	-.05	-.05		-.05											
7. Socioeconomic status	.12		.12	.11	.14										
Health practices															
8. Smoke			-.09		-.14	-.19	-.10								
9. Drink	.11	.05		.08	-.25	-.26	-.05	.37							
10. Physical activity	.30	.12	.09	.24	-.20	-.21	.12	.04	.12						
Health status															
11. Perceived health (1=excellent, 4=poor)	-.25	-.14	-.16	-.20	.26		-.15	.07	-.03	-.17					
12. Hospital stay	-.15	-.07	-.04	-.10	.22				-.08	-.10	.25				
13. Outpatient contacts	-.15	-.10	-.06	-.11	.17	.13		-.05	-.13	-.10	.32	.49			
Dependent variables															
14. Initial visits					-.15	.14					.17	.15	.47		
15. Change in contacts					-.06							.10	.31	.08	
16. Mortality (0=dead 1=alive)	.31	.17	.15	.25	-.47	.11	.11		.08	.12	-.24	-.26	-.18		.13

Note: Those shown $p \geq 0.05$

All coded low-high except where indicated

ZERO-ORDER PAIRWISE CORRELATIONS OF INDEPENDENT, DEPENDENT, AND
CONTROL VARIABLES, USING DICHOTOMOUS VERSIONS

	1	2	3	4	5	6	7	8	9	10	11	12	13
Network variables													
1. Scope													
2. Size	.41												
3. Frequency	.39	.21											
4. Interaction	.58	.46	.49										
Demographic variables													
5. Age (1-3)	-.35	-.14	-.04	-.20									
6. Sex	-.07	-.06		-.06									
7. Socioeconomic status	.08		.10	.06	.12								
Health practices													
8. Smoke			-.07		-.13	-.27	-.08						
9. Drink	.14	.08		.07	-.31	-.23	-.06	.32					
10. Physical activity	.23	.07	.07	.17	-.21	-.16	.09	.07	.12				
Health status													
11. Perceived health (1=excellent, 4=poor)	.23	.11	.11	.13	-.24		.09		.07	.12			
12. Hospital stay	-.10			-.05	.19		-.03		-.04	-.07	-.20		
13. Outpatient contacts	-.11	-.04		-.07	.18	.16		-.05	-.12	-.09	.22	.36	
Dependent variables													
14. Mortality	.26	.12	.10	.18	-.48	.11	.10		.14	.11	.23	-.19	-.13

Note: Those shown $p \geq 0.05$

ZERO-ORDER PAIRWISE CORRELATIONS OF RELATIONSHIP DOMAIN INDEXES,
CONTROL VARIABLES, AND MORTALITY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Relationship index (interaction)															
1. Marriage (1=yes, 2=no)															
2. Children (1=none or few, 2=many)	-.11														
3. Family of origin (1=some, 2=much)															
4. Relatives (1=some, 2=much)	-.10	.05	.11												
5. Close friends (0=none, 1=some, 2=much)	-.05		.06	.05											
6. Other friends (1=some, 2=much)	-.05		.05		.20										
7. Work (0=none, 1=some, 2=much)				.04	.05	.11									
8. Meetings (0=none, 1=some, 2=much)	-.08	.07			.14	.21	.16								
9. Church attendance (0=never, 1=occas., 2=often)		.09	.09	.06	.13	.12	-.05	.21							
10. Social leisure (0=none)			.08	.04	.16	.21	.10	.21	.07						
Control variables															
11. Age (1-3)	.22	-.14	-.06	-.06	-.05	-.17	-.38		.03	-.17					
12. Age (1-4)	.19	-.05	-.09	-.08	-.06	-.19	-.32	-.07	.05	-.17	.93				
13. Sex (1=male, 2=female)															
14. Perceived health (1=poor, 2=good)	-.07	.04		.04	.08	.14	.14	.11	.04	.12	-.24	-.24			
15. Hospital stay	.05						-.12	-.04		-.03	.19	.19	-.20		
Dependent variable															
16. Mortality (0=dead, 1=alive)	-.11	.08	.06	.04	.11	.15	.23	.09	.05	.17	-.48	-.45		.23	-.19
Partials, controlled by Age (1-4)	(-.03)	(.06)			(.09)	(.07)	(.11)	(.08)	(.08)	(.11)					

Note: Those shown $p \geq 0.05$

APPENDIX F

CODING OF COLLAPSED VARIABLES FOR LOGISTIC REGRESSION ANALYSES

CODING OF COLLAPSED CONTROL VARIABLES FOR LOGISTIC
ANALYSES IN TABLES XII THROUGH XX
(ALL TOTAL 2603)

AGE			PHYSICAL ACTIVITY		
Version A	1 = 18-49 yrs	N = 1454	1 = low	N = 1198	
	2 = 50-64	694	2 = high	1342	
	3 = over 65	455	Missing	63	
Version B			NETWORK SCOPE		
	1 = 18-34 yrs	N = 697	Version A	1 = small	N = 1186
	2 = 35-49	757		2 = large	1239
	3 = 50-64	694		Missing	178
	4 = over 65	455	Version B	1 = small	N = 632
SEX				2 = medium	898
	1 = male	N = 1202		3 = large	895
	2 = female	1401		Missing	178
SOCIOECONOMIC STATUS			MORTALITY		
	1 = low	N = 1268	0 = dead	N = 376	
	2 = high	1151	1 = alive	2227	
	Missing	184			
PERCEIVED HEALTH					
Version A					
	1 = poor	N = 471			
	2 = good	2085			
	Missing	47			
Version B					
	1 = excellent	N = 893			
	2 = good	1192			
	3 = fair or poor	471			
	Missing	47			
LENGTH HOSPITAL STAY					
Version A					
	1 = none	N = 2075			
	2 = one or more	528			
Version B					
	1 = none	N = 2075			
	2 = some	261			
	3 = much	267			
OUTPATIENT VISITS					
	1 = none/low	N = 1310			
	2 = many	1293			
SMOKE					
	1 = never	N = 1054			
	2 = current smoke	1534			
	Missing	15			
DRINK					
	1 = never, or light	N = 1549			
	2 = moderate, or heavy	916			
	Missing	138			

CODING OF COLLAPSED NETWORK VARIABLES FOR LOGISTIC
ANALYSES IN TABLES XVI AND XVII
(ALL TOTAL 2603)

NETWORK SCOPE	1 = small	N = 632
	2 = medium	898
	3 = large	895
	Missing	178
NETWORK SIZE	1 = small	N = 833
	2 = medium	792
	3 = large	904
	Missing	74
NETWORK FREQUENCY	1 = small	N = 781
	2 = medium	725
	3 = large	923
	Missing	174
NETWORK INTERACTION	1 = small	N = 710
	2 = medium	816
	3 = large	860
	Missing	217
SCOPE IMMEDIATE FAMILY	1 = small	N = 559
	2 = medium	943
	3 = large	1060
	Missing	41
SCOPE EXTENDED FAMILY	1 = small	N = 890
	2 = medium	953
	3 = large	716
	Missing	44
SCOPE FRIENDS	1 = small	N = 372
	2 = medium	1155
	3 = large	1060
	Missing	16
SCOPE OF COMMUNITY ACTIVITIES	1 = small	N = 1110
	2 = medium	860
	3 = large	500
	Missing	133

CODING OF COLLAPSED RELATIONSHIP DOMAIN
INDEXES (INTERACTION) FOR LOGISTIC
ANALYSIS IN TABLE XVIII
(ALL TOTAL 2603)

MARRIAGE	1 = married	N = 2167
	2 = not married	436
CHILDREN	1 = none	356
	2 = one or two	1123
	3 = three or more	1124
FAMILY OF ORIGIN	1 = low	753
	2 = moderate	842
	3 = high	890
	Missing	118
RELATIVES	1 = low	844
	2 = moderate	875
	3 = high	869
	Missing	15
CLOSE FRIENDS	1 = none	581
	2 = low	1113
	3 = high	904
	Missing	5
OTHER FRIENDS	1 = low	811
	2 = moderate	697
	3 = high	1095
WORK	1 = don't work or low	1178
	2 = moderate	594
	3 = high	800
	Missing	31
CHURCH	1 = never attend	675
	2 = occasionally attend	802
	3 = often attend	1054
	Missing	72
MEETINGS	1 = none	881
	2 = low	856
	3 = high	851
	Missing	15
SOCIAL LEISURE	1 = none	471
	2 = some	1252
	3 = many	817
	Missing	53

APPENDIX G

MORTALITY RATES FOR CONTROL VARIABLES AND SCOPE
VARIABLE USED IN TABLE XIII

MORTALITY RATES FOR COLLAPSED CONTROL
VARIABLES AND NETWORK SCOPE
USED IN TABLE XIII

Variable	Dead	Alive	Mortality Rate
AGE			
1. Under 35	7	690	1.0
2. 35 - 49	30	727	3.9
3. 50 - 65	110	584	15.8
4. Over 65	<u>229</u>	<u>226</u>	50.0
Total	376	Total 2227	
SEX			
1. Male	322	980	18.4
2. Female	<u>154</u>	<u>1247</u>	11.0
	376	2227	
SOCIOECONOMIC STATUS			
1. Low	79	361	17.9
2. Low/medium	80	442	15.3
3. Medium	74	506	12.7
4. Medium/high	54	412	11.6
5. High	<u>27</u>	<u>382</u>	6.6
	314	2103	
PERCEIVED HEALTH			
1. Excellent	66	827	7.4
2. Good	142	1050	11.9
3. Fair/poor	<u>145</u>	<u>326</u>	30.8
	353	2203	
LENGTH HOSPITAL STAY			
0. None	228	1847	10.9
1. Short	50	211	19.2
2. Long	<u>98</u>	<u>169</u>	36.7
	376	2227	
RATE CONTACTS/DISEASE			
0. None/low	87	812	9.7
1. Medium	92	736	11.1
2. High	<u>197</u>	<u>679</u>	22.5
	376	2227	
SMOKE			
1. Never	156	898	14.80
2. Light	101	548	15.56
3. Moderate	77	557	12.15
4. Moderate/heavy	32	183	14.88
5. Heavy	<u>6</u>	<u>30</u>	16.67
	372	2216	
DRINK			
1. Never	283	1266	18.30
2. Light	26	494	5.00
3. Moderate	15	180	7.70
4. Heavy	<u>31</u>	<u>170</u>	15.40
	355	2110	
PHYSICAL ACTIVITY			
0. None	88	482	15.40
1. Little	125	503	19.90
2. Moderate	99	711	12.20
3. Much	<u>39</u>	<u>493</u>	7.30
	351	2189	
NETWORK SCOPE			
1. Small	192	440	30.38
2. Small/medium	58	352	14.15
3. Medium	47	441	9.63
4. Medium/large	24	477	4.79
5. Large	<u>13</u>	<u>381</u>	3.30
	334	2091	