

Social Ties and Perceived Support:

*Two Dimensions of Social Relationships
and Health Among the Elderly in Taiwan*

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Objectives: Assess the effects of social relationships on physical and mental health among the elderly in Taiwan. **Methods:** Using 4 waves of a survey of the elderly, we examine the relationship between social ties and perceived support and four health outcomes—mortality, functional status, self-assessed health, and depression. **Results:** Perceived support and social ties are related to health, but many of the apparent effects are attenuated in the presence of controls for prior health. However, positive perceptions about support are protective of mental (but not physical) health. **Discussion:** If baseline health is ignored, estimates of the effects of social relationships on health at a given stage of life are likely to be inflated by reverse causality or by effects occurring prior to baseline. Inclusion of controls for initial health reveals that, in general, the relationship between social support and health at the older ages in Taiwan is relatively modest.

Keywords: *social support; perceived support; health; elderly; Taiwan*

Numerous studies that have examined the relationship between social support and health have generally concluded that social support has a positive effect on both mental and physical well-being. People with

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more extensive social support tend to be in better health and are less likely to die in a given period (see House, Umberson, & Landis, 1988; Seeman & Crimmins, 2001 for reviews of the evidence). The measures of social support used to test this relationship, however, vary from one study to the next, with different types of support having varying effects on different health outcomes. Under the rubric of social support, researchers have considered (a) measures of social networks or social ties that reflect the degree to which a person is socially integrated, (b) measures of received support that indicate what a person has actually received or reported to have received, and (c) measures of perceived support that capture an individual's beliefs about the availability of and/or satisfaction with support (Sarason, Sarason, & Pierce, 1990). House, Umberson, and Landis (1988) argued that although all of these measures are indications of different dimensions of social relationships, only the latter two sets of measures constitute social support. Social ties and social support, therefore, can be seen as two dimensions of social relationships, both of which have been shown—although not consistently—to be related to mental and physical health (Berkman, 1985; Doeglas et al., 1996; House & Kahn, 1985; Kessler & McLeod, 1985; Wethington & Kessler, 1986).

Because most prior research has focused on Western populations, less is known about these relationships in non-Western settings. As populations outside the West have been aging, some of them at faster rates than in the West, maintaining and improving the health and well-being among the elderly has become an important issue for these societies, particularly for those in East Asia that have been experiencing rapid socioeconomic development. Such development, coupled with rapid population aging, is placing strains on traditional family support systems, which have provided most social support to the elderly (e.g., see Lin, 1994; Ogawa & Rutherford, 1997). Unlike Western societies,

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many of these newly industrial societies have few social welfare programs to which the elderly can turn for support. A thorough understanding of the relationships linking social ties and social support to health can help to inform effective and efficient social policies regarding the well-being of the elderly.

This study builds and expands on previous research in several ways. First, we use longitudinal survey data on the elderly in Taiwan that comprise four interviews over a 10-year period to examine the associations between social relationships and health. Specifically, we test the effects of social relationships on mortality and on health (functional status, self-assessed health, and depression) across three intervals (1989-1993, 1993-1996, and 1996-1999), controlling for health status at the beginning of each interval. Second, unlike most previous studies, we control extensively for health status at the start of each interval in an effort to reduce the likelihood (although not completely eliminating the possibility) that the effects of social support are due to reverse causality, that is, that respondents in poor health are more likely than their healthier counterparts to have inadequate support and negative assessments of the support they receive (Beckett, Goldman, Weinstein, Lin, & Chuang, 2002; Heller & Swindle, 1983; Vinokur & Schul, 1987). The incorporation of baseline controls for health also adjusts for effects that social support may have had on health prior to the start of the survey, thereby focusing the analysis on the impact of social relationships in later life.

Finally, we examine two very different dimensions of social relationships—social ties and perceived support—across multiple health outcomes. Because of data limitations, many previous studies have focused either on only one health outcome or on a single dimension of social support. Examining different dimensions of health allows for a better understanding of the health consequences of social isolation and inadequate support (Sherbourne, Merdith, Rogers, & Ware, 1992). Comparing results across health measures within the same population also permits us to make stronger inferences about the differential impact of social relationships on various health outcomes than can be made by comparing the results of distinct studies that use different samples and different explanatory variables. Likewise, measuring these two aspects of relationships allows for the evaluation of the

impact of the availability of various support resources on health (Cohen & Syme, 1985).

In the following section, we provide details about Taiwanese society that are likely to influence findings regarding the associations between social relationships and health. Next, we discuss the theoretical linkages between social ties, perceived support, and health, and review findings from previous studies. Subsequently, we provide a description of the data, outline the analytic strategy, and report the results. Finally, we discuss the findings and their implications for future research.

Taiwanese Context

Several social, demographic, and cultural aspects of Taiwanese society are likely to influence the results of this study. One such dimension is the primacy of the family. When the Chinese annexed and began to settle Taiwan in 1683, they brought with them the patriarchal/patrilineal kinship system that had prevailed on the Mainland (Lamley, 1981; Meskill, 1979). Thus, historically Taiwanese society has been organized around the Chinese family system in which the individual existed completely in the familial environment (Baker, 1979; Fricke, Liu, Thornton, Freedman, & Yang, 1994).

Within the context of the family, age and generation are particularly important to the study of social support in Taiwan. Intergenerational relationships within the family are governed by strong norms of filial piety, which stress the primacy of a child's relationship with his or her parents. Children are expected to be obedient and subservient to their parents and to respect them throughout their lives (Cowgill, 1972; Davis-Freedman, 1983; Fricke, Chang, & Yang, 1994; Ikels, 1993). Norms of filial piety also dictate that children care for their parents in later life (Sung, 1990). The provision of support to one's parents, therefore, is viewed as a moral obligation. In addition, most Taiwanese regard coresidence with at least one married son as the ideal living arrangement (Davis-Freedman, 1983).

Recent demographic, economic, and social changes, however, are likely to have affected the availability of traditional family-based support. Between 1952 and 1995, total fertility declined from 6.6 to 1.8,

and life expectancy increased from 56 to 72 years for men and from 56 to 78 years for women. As a result, the percentage of the population aged 65 and older rose from 3% to 8% during this period, and by 2025 is projected to reach 14% (Cornman, 1999). At the same time, Taiwan has transformed itself from an uneducated, agricultural society to one that is highly industrialized and well educated. The percentage of the labor force employed in the agricultural sector fell from 56% in 1952 to only 8% in 2000. School enrollment rates also rose dramatically: Enrollment rates for senior high school (15- to 17-year-olds) increased from only 8% in 1952 to 87% in 2000, and college enrollment rates (18- to 21-year-olds) increased from 2% to 39% (Hermalin, Liu, & Freedman, 1994; Ministry of Education, 2001). Furthermore, women's labor force participation rose from 19% in 1956 to 45% in 1995 (Cornman, 1999).

By providing adult children with social and economic opportunities outside the family as well as the means for greater geographic mobility, these social, economic, and demographic changes may place strains on traditional forms of family support for the elderly. Hermalin, Ofstedal, and Chang (1996), for example, reported that coresidence with children declined from 67% to 57% among the elderly between 1976 and 1989, whereas the percentage of elderly living alone or solely with a spouse increased from 9% to 23%. In light of such changes, examining the impact of social relationships on health is an important and timely undertaking.

Social Ties and Health

Here we outline the causal mechanisms through which social ties and perceived support are hypothesized to affect health, and we review evidence from previous research regarding the effects of social ties and perceived support on physical and mental well-being. We focus on studies involving the elderly, particularly those within East Asia.

Maintaining social ties and involvement is hypothesized to provide one with feelings that others are available to provide help and to increase feelings of self-identity and personal control (Cohen, 1988; Cohen & Syme, 1985; Mendes de Leon, Gold, Glass, Kaplan, & Gold, 2001). Embeddedness in a social network also may give meaning and

purpose to one's life through the fulfillment of various social roles (Mendes de Leon et al., 2001), thus leading to lower levels of psychological distress.

A sense of embeddedness, self-identity, and personal control may also affect physical health through its effects on health behaviors and physiological responses (Cohen, 1988; Cohen & Syme, 1985; House, Umberson, et al., 1988; Seeman & Crimmins, 2001). People who are more socially embedded may engage in more positive health behaviors (e.g., exercise and a healthy diet) and have fewer negative health habits (e.g., smoking and excessive consumption of alcohol) because members of their support networks encourage or discourage such behaviors. Involvement in a social network also may encourage positive health habits out of a sense of responsibility to others (Cohen, 1988; Cohen & Syme, 1985; House, Umberson, et al., 1988). The maintenance of social ties is also thought to affect physiological responses that impact illness and survival (Cohen, 1988; Cohen & Syme, 1985; House, Umberson, et al., 1988; Seeman, Berkman, Blazer, & Rowe, 1994; Seeman & Crimmins, 2001). For example, greater social involvement and maintenance of social ties are associated with lower levels of cardiovascular and neuroendocrine activation in response to stressful life events and concomitant reductions in the risks of health problems such as heart disease and hypertension (Seeman & Crimmins, 2001). Positive social relationships can also bolster immune competence, thereby reducing the susceptibility to physical illness.

Previous research, conducted largely in Western populations, has examined a broad range of measures of social ties: network size, composition of network (e.g., proportion of kin vs. non-kin and number of confidants or close ties), accessibility of network members, availability of specific kin (e.g., children or spouse), and frequency of contact with network members. These structural aspects of networks are hypothesized to affect the flow of resources and are often viewed as an index of the quantity and diversity of potential support sources (Cutrona, 1986).

Marital status is one of the most widely investigated network characteristics. Most studies have shown that married people tend to have better health and lower probabilities of dying in a given period than their unmarried counterparts (Blazer, 1982; Goldman, Korenman, & Weinstein, 1995). Research also has demonstrated that widowhood

has a negative effect on mental and physical health, although the effect may diminish as time since the loss of a spouse increases (Goldman, Korenman, & Weinstein, 1995; Umberson, Wortman, & Kessler, 1992). Several studies using data from Asian populations, however, have failed to find a significant relationship between marriage and self-assessed health (Zimmer, Natividad, Lin, & Chayovan, 2000) and mortality (Sugisawa, Liang, & Liu, 1994).

Number of social contacts and involvement in social activities are typically positively associated with health and survival among elderly Americans. Persons who are socially involved have lower probabilities of dying and better health within a follow-up period than their more isolated counterparts (Blazer, 1982; Krause, 1987). Sugisawa et al. (1994) also found a strong positive impact of participation in social organizations on mortality, functional status, and self-rated health among Japanese elderly. Beckett et al. (2002) demonstrated that poor health status is associated with limited networks of friends for Taiwanese elderly. Zimmer, Liu, Hermalin, and Chuang (1998), however, reported that membership in an organization and the frequency of socializing have little effect on transitions in functional status among the elderly in Taiwan.

Given the strong cultural norm and expectation that adult children will care for their parents in old age, the number of and coresidence with children are two additional aspects of social relationships that are likely to be important in the Taiwanese setting. Several studies have examined the effects of having children on the health of the elderly in Taiwan. Beckett and colleagues (2002), who examined the effect of contact with children on a measure of health that combines functional status, self-assessed health, and mortality, found that having little contact with children is deleterious to the elderly's health (Beckett et al., 2002). In contrast, Zimmer et al. (2000) failed to find a significant relationship between the number of children and older persons' self-assessed health.

Perceived Support and Health

Perceived support is defined as the degree to which a person feels like his or her needs are being met (Procidano & Heller, 1983). It has

been measured in terms of both satisfaction with support provided and the perception that support will be provided if needed (Doeglas et al., 1996; Sarason et al., 1990; Wethington & Kessler, 1986). Research on Western populations has demonstrated that positive perceptions about one's support networks may not only promote health and health care utilization (Cassel, 1976; Cobb, 1976; Doeglas et al., 1996; Schmidt, Russell, & Cutrona, 1997), but also may act as a buffer for the effects of stress on psychological outcomes (Kessler & McLeod, 1985; Wethington & Kessler, 1986). Early work on social support hypothesized that the positive effects of social support emanate more from the individual's perception of support than from the actual supportive behaviors of the relationship (Cassel, 1976; Cobb, 1976).

Perceived support has been examined most closely in relation to mental health. In general, previous research has shown that better perceptions about social support are negatively associated with psychological distress. Krause (1987), for example, found that older respondents who are unsatisfied with the support that they receive are more likely to experience psychological distress. Using vignettes that describe hypothetical situations in which a respondent might receive support, Turner and Noh (1988) found that respondents who felt more supported had lower levels of depression. In a longitudinal analysis of cardiac patients, Helgeson (1993) reported that the perceived availability of support predicts reduced levels of distress. To the best of our knowledge, no studies have examined the relationship between perceived support and mental health in the Asian setting.

The evidence regarding the relationship between perceived support and physical health is mixed. In a study of the elderly, Blazer (1982) found that poor perceptions about social support at baseline are significantly associated with a higher probability of dying 30 months later. Doeglas et al. (1996) determined that satisfaction with emotional support is significantly and positively related to self-assessed health. Sherbourne and Hays (1990), however, reported that perceived availability of support is not related to physical health. House, Robbins, and Metzner (1982) found that satisfaction with support at baseline is not related to the probability of dying 9 to 12 years later, although they speculate that the lack of an association may be due to poor measurement of satisfaction. One study of Japanese elderly found that although better perceptions about emotional support are related to

having fewer functional limitations and better self-assessed health, perceptions are not directly related to mortality (Sugisawa et al., 1994).

Several studies have examined the effects of social ties and perceived support on both mental and physical health. Krause (1987), for instance, showed that frequency of support received and satisfaction with support have a greater effect on depression than on self-assessed health. In contrast, Ren, Skinner, Lee, and Kazis (1999) found that perceived support has a strong effect on both mental health and physical functioning.

Thus, previous research findings suggest that the effects of social relationships on health are likely to vary according to the specific social relationship and health measures examined. It is important to note that many of these studies that report significant associations between social relationships and health do not control for prior health status, increasing the possibility that these associations result, at least in part, from reverse causality or from effects that occurred prior to the initial survey date. Given the disparate findings and shortcomings of previous research and the dearth of analyses for non-Western settings, we seek to answer three questions. First, are social ties and perceptions about social support significantly related to the health of the elderly in Taiwan? Second, are these relationships significant in the presence of extensive controls for prior health status? Finally, do the effects of perceptions and social ties differ across health outcomes?

Methods

DATA

Data for this study come from the Survey of Health and Living Status of the Elderly in Taiwan. The initial survey, conducted in 1989, is based on a nationally representative probability sample, including the institutionalized population, of men and women who were age 60 and over in 1989. Face-to-face interviews were completed with 4,049 of the 4,412 respondents selected into the sample, resulting in a response rate of 92%. Respondents were reinterviewed in 1993, 1996, and 1999. All four waves are used in this analysis. Deaths up to the time of

each follow-up were recorded, and the surviving individuals represent the sampling frame for subsequent interviews. Although response rates for follow-up interviews range from 89% to 91%, the sample suffers from progressive panel attrition. Overall, 37% of respondents died between 1989 and 1999 (more details on mortality are given below), and 15% were lost to follow-up (LFU) at one or more waves. In addition, at each survey wave, between 4% and 10% of interviews were conducted with proxies. Because proxies were not asked any of the subjective questions about health and social support, proxy interviews are excluded from our analyses.

The exclusion of proxy interviews and cases LFU at one or more waves may bias our results. Logistic regression analyses that predict whether a respondent is a proxy or was LFU at one or more waves indicate that these individuals are more likely than respondents who were interviewed at all waves to be in poor health, to be older, have less education, and have fewer social ties and worse perceptions about the availability of social support at baseline (results not shown). Analyses by Beckett et al. (2002) that used the 1989, 1993, and 1996 waves of the Survey of Health and Living Status of the Elderly to examine transitions in health between 1993 and 1996 revealed that respondents LFU are selected for poor health and for many of the same explanatory variables (including social support) associated with poor health. The exclusion of proxy interviews and cases LFU, therefore, most likely results in conservative estimates of the relationship between the explanatory variables and the health outcomes used in the analyses. (see Beckett et al., 2002, for more details).

HEALTH MEASURES

We examine the effects of social relationships on four health outcomes in 1993, 1996, and 1999—mortality, functional status, self-assessed health, and depression—after controlling for health status at the previous survey wave (i.e., in 1989, 1993, and 1996, respectively). For each of the four outcomes, the health controls include self-assessed health, functional status, and depression. By employing such a strategy, we are implicitly examining changes in health status between successive surveys.

Our choice of health outcomes is based on several motivations. We consider mortality because previous research on Western populations has shown a strong relationship between social integration and mortality (House, Landis, & Umberson, 1988). Between 11% and 13% of nonproxy respondents died between each survey wave (Table 1).

Functional status, which represents a person's ability to perform socially defined and expected roles, has been used extensively in previous research on the health of the elderly, in part, because it captures social as well as medical components of health (Reynolds, Rushing, & Miles, 1974). There is also evidence that the elderly provide reliable reports of their physical functioning, rendering this measure more suitable for analysis than other types of self-reports, such as reports of chronic disease (Chappell, 1981).

Questions regarding difficulties with various functioning activities were not consistent across waves of the survey. All waves asked questions about mobility functioning, but the 1989 survey contained fewer questions about activities of daily living (ADLs) than the subsequent waves. As a result of this inconsistency, we exclude the first time interval (1989-1993) for analyses of functional status and use a modified version of the functional status variable as a control in analyses of the three remaining health outcomes.

The outcome measure of functional status is a summary measure of mobility limitations and difficulties with ADLs. In 1993, 1996, and 1999, respondents were asked to report their ability to perform seven mobility activities (standing, squatting, climbing stairs, lifting 11 to 12 kilograms, running 20 to 30 meters, performing physical work around the house, and walking 200 to 300 meters) and six ADLs (bathing, dressing, eating, getting out of bed or a chair, moving about the house, and going to the toilet). Because all respondents who have any ADL difficulty also have problems with mobility, and because the development of mobility limitations generally precedes the development of problems performing ADLs (Verbrugge & Jette, 1994), we measure functional status as an ordered three-category variable: (a) no mobility or ADL limitations, (b) only mobility limitations, and (c) both mobility and ADL limitations, where a limitation is defined as having any difficulty with an activity. In the analyses of functional status, the baseline control for physical functioning is represented by a set of dummy variables denoting the same three categories. Between

50% to 60% of the nonproxy respondents in our sample report only mobility limitations at each wave; less than 10% report having both ADL and mobility limitations (Table 1).

The second measure of functioning, used as a control variable in analyses of mortality, self-assessed health, and depression, is a count of the number of activities with which a respondent had any difficulty. The items included in this functioning scale are based on the contents of the 1989 survey. Six items—five mobility activities and one ADL—are included: squatting, climbing stairs, lifting 11 to 12 kilograms, performing physical work around the house, walking 200 to 300 meters, and bathing. The mean number of functional limitations ranges from 1.3 in 1989 to 1.8 in 1996 (Table 1).

Self-assessed health, a broad evaluation of a respondent's overall health, is an important predictor of future health outcomes—especially mortality—even after controlling for other health-related risk factors (Burstrom & Freedlund, 2001; Idler & Benyamini, 1997; Mossey & Shapiro, 1982). Poor self-assessments of health are associated with the presence of chronic disease, functional limitations, pain, injuries, hospital utilization, and unhealthy behaviors. Moreover, self-assessed health appears to capture social and psychological as well as physiological aspects of health, which may be particularly important for assessing the overall well-being of the elderly.

In the questionnaire, self-assessed health is classified into five categories: poor, not so good (hereafter called fair), average, good, and excellent health. In line with previous studies, which typically dichotomize this categorical outcome, we differentiate between those in poor or fair health and those in average, good, or excellent health. In 1989 and 1993, approximately 22% of nonproxy respondents reported their health as either fair or poor. By 1996, 34% reported fair or poor health and in 1999, 40% felt they were in fair or poor health (Table 1).

Mental health is examined for two reasons. First, previous research has shown that social support is significantly associated with mental well-being; for example, people with more extensive social support are less likely to experience psychological distress (Helgeson, 1993; Kessler & McLeod, 1985; Wethington & Kessler, 1986). Second, research has shown that psychological distress and poor physical health are interrelated, with one leading to or prolonging the other

Table 1
Means and Percentage Distributions of Health and Survival Measures

| Measure | 1989 | 1993 | 1996 | 1999 |
|---|-------|-------|-------|-------|
| Survival | | | | |
| Alive at each survey wave | — | 87.0 | 88.3 | 86.8 |
| Died since last interview | | 12.9 | 11.3 | 12.0 |
| Survival status unknown | | 0.2 | 0.4 | 1.2 |
| <i>N</i> | | 3,868 | 3,264 | 2,729 |
| Functional status (outcome) | | | | |
| No mobility or ADL limitations | — | 40.0 | 42.8 | 29.1 |
| Mobility limitations only | | 54.1 | 50.7 | 60.3 |
| Mobility and ADL limitations | | 4.9 | 6.6 | 9.9 |
| Missing | | 1.1 | 0.0 | 0.7 |
| <i>N</i> | | 2,960 | 2,408 | 2,069 |
| Functional status 2 (control variable) | | | | |
| Mean number of functional limitations | 1.3 | 1.6 | 1.8 | — |
| Standard deviation | 1.8 | 1.9 | 2.0 | — |
| Self-assessed health | | | | |
| Excellent/good/average | 77.7 | 77.0 | 66.0 | 59.5 |
| Fair/poor | 22.3 | 23.0 | 34.0 | 40.1 |
| Missing | 0.1 | 0.1 | 0.0 | 0.0 |
| <i>N</i> | 3,868 | 2,960 | 2,408 | 2,069 |
| Depression (range 0-27) | | | | |
| <i>M</i> | 6.3 | 6.4 | 6.2 | 6.0 |
| <i>SD</i> | 4.8 | 5.4 | 6.0 | 6.0 |
| Missing | 0.7 | 0.7 | 1.3 | 0.8 |
| <i>N</i> | 3,868 | 2,960 | 2,408 | 2,069 |

(Gurland, Wilder, & Berkman, 1988, in Wallsten, Tweed, Blazer, & George, 1999).

We use a composite measure of depressive symptoms based on the Center for Epidemiologic Studies–Depression Scale (CES-D; Radloff, 1977). This scale has been used in studies of depression among elderly respondents (Wallace & Herzog, 1995). Although the original scale has 20 items, the surveys used in this study contained a shortened version. Respondents reported whether they had experienced a number of different situations or feelings in the past week (0 [*no*]) and how often they experienced these feelings from (1 [*rarely or one day*], 2 [*sometimes or 2 to 3 days*], and 3 [*often/chronically or 4 or more days*]). Nine items were asked in all four waves. Seven items are negative (poor appetite, exhaustion, poor sleep, feeling depressed, loneliness, unfriendliness of others, and unable to get oneself going) and 2

are positive (joyful feelings and feelings that life is going well). The depression scale is the sum of the individual depression items, with the scores for the positive items reversed. Cronbach's alpha for these 9 items ranges from 0.75 in 1989 to 0.85 in 1999 (data not shown). The depression scale ranges from 0 to 27, with higher scores indicating more severe depression. The mean level of depression ranges between 6.0 and 6.4 (Table 1).

SOCIAL RELATIONSHIP MEASURES

We examine two dimensions of social relationships: social ties and perceived support. We focus on perceived as opposed to received support for two reasons. First, previous research has shown that perceived support has a greater impact than received support on health and well-being (Doeglas et al., 1996; Wallsten et al., 1999; Wethington & Kessler, 1986). Second, received support is often confounded with need for assistance and, therefore, may not accurately measure the actual availability of support (Sherbourne & Hays, 1990). In our data in particular, questions regarding the receipt of assistance with ADLs and instrumental activities of daily living (IADLs) are asked only of respondents who indicated that they have difficulty with these tasks. The receipt of support, therefore, may be largely another indicator of health, as those who are in worse health tend to need and receive more help. Furthermore, individual differences in support needs may mean that the same level of support can be translated into different perceptions about the availability of or satisfaction with support (Helgeson, 1993).

Perceived social support has been measured in two ways: the perceived availability of social support and satisfaction with support received. We examine both of these dimensions as they may be capturing different aspects of perceptions (Sarason et al., 1990). For instance, respondents may report that they do not have reliable social support, but may be satisfied with this situation if their expectations for support are low.

In each survey year, respondents were asked to rate the availability of three types of social support: willingness of others to listen when the respondent needs to talk, level of caring or love given to the respondent, and the reliability of others to provide sick care.

Respondents also were asked to evaluate their satisfaction with the emotional care and with the sick care and financial assistance that they receive (both sick care and financial assistance are in the same question). However, although the wording of the questions was very similar across waves, the response categories and the form of the questions were not. In 1989, the perceived support questions were asked separately about spouses, children, and friends. To make these support measures more comparable to the measures in other years, we created an overall support measure for each type of support by averaging the responses regarding spouses, children, and friends. In the 1993 survey, for questions regarding the perceived availability of support, there was a filter question asking if there is anyone available to provide each type of support followed by a question with three response categories asking the respondent to evaluate the level of support available. The 1996 survey asks the respondent to evaluate the availability of support in general (i.e., without specific reference to any one network member).

Table 2 shows examples of how response categories changed across surveys. To make responses comparable, we carried out the following procedure. First, we recoded all responses into three categories reflecting whether the respondent feels that the availability of or satisfaction with social support is 0 (*poor*), 1 (*adequate*), or 2 (*good*). For example, for questions regarding the willingness of others to listen, the responses of "extremely willing" and "very willing" are recoded as good; "willing" and "neither willing nor unwilling" are considered adequate; and "somewhat unwilling," "very unwilling," "extremely unwilling," and "no one available" are regarded as poor. This strategy is followed for all three questions about perceived availability of support. For the two satisfaction questions, "very satisfied" is recoded as good, whereas "satisfied" and "average" are considered adequate and "unsatisfied" and "very unsatisfied" are classified as poor.

We then created two indices in each survey year: one reflecting perceived availability of, and the other, satisfaction with support. The index of perceived availability is the sum of the three scores for the perception about each type of support. The theoretical range of the perceived availability index is zero to six, with higher scores reflecting more positive perceptions about the availability of support. The mean of the perceived availability index ranges from 3.7 to 4.6 across

Table 2
Examples of Year by Year Comparisons of Response Categories for Measures of Perceived Support

| Response Category | 1989 | 1993 | 1996 |
|--|-------|-------|-------|
| Willingness of network members to listen | | | |
| Extremely willing (good) ^a | 17.8 | 59.1 | |
| Very willing (good) | 38.6 | | 26.0 |
| Willing (adequate) ^b | 36.8 | | 37.4 |
| Neither willing nor unwilling (adequate) | | 16.7 | 14.2 |
| Somewhat unwilling (poor) ^c | 5.6 | 0.1 | 16.0 |
| Very unwilling (poor) | | | 3.4 |
| Extremely unwilling (poor) | 0.9 | | |
| No one available to listen (poor) | | 22.3 | |
| Missing | 0.4 | 1.8 | 3.1 |
| Total | 100.0 | 100.0 | 100.0 |
| N | 3,868 | 2,960 | 2,408 |
| Satisfaction with emotional care provided by network members | | | |
| Very satisfied (good) | 41.0 | 37.5 | 31.3 |
| Satisfied (adequate) | 55.4 | 43.3 | 42.8 |
| Average (adequate) | | 14.5 | 20.4 |
| Unsatisfied (poor) | | 3.0 | 3.9 |
| Very unsatisfied (poor) | 3.4 | 1.3 | 1.3 |
| Missing | 0.2 | 0.4 | 0.3 |
| Total | 100.0 | 100.0 | 100.0 |
| N | 3,868 | 2,960 | 2,408 |

a. Respondent's perception of availability of or satisfaction with support is classified as "good."

b. Respondent's perception of availability of or satisfaction with support is classified as "adequate."

c. Respondent's perception of availability of or satisfaction with support is classified as "poor."

waves, indicating that the Taiwanese elderly generally hold positive perceptions about the availability of support (Table 3). Less than 8% of respondents score below two on the index, a range in which availability could be rated as poor (data not shown). Cronbach's alpha for this index ranges from 0.69 to 0.83 across survey waves.

The satisfaction with support index is the sum of the two scores for satisfaction with each type of support. The theoretical range of the satisfaction index is zero to four. The mean varies between 2.4 to 2.7 (Table 3). Less than 9% of respondents reveal a high level of dissatisfaction with support received (i.e., scores below 2—data not shown). Alpha ranges from 0.78 to 0.87.

Social ties are represented by a set of variables that have been shown to predict future health: marital status, number of and coresidence with children, number of friends, and social involvement. In

Table 3
Descriptive Statistics for Perceived Support Indices and Social Tie Measures

| Perceived Support Index | 1989 | 1993 | 1996 |
|--|-------|-------|-------|
| Perceived support | | | |
| Perceived availability of support (range 0-6) | | | |
| <i>M</i> | 4.50 | 4.60 | 3.70 |
| <i>SD</i> | 1.70 | 1.70 | 1.60 |
| α | 0.83 | 0.69 | 0.77 |
| Satisfaction with social support (range 0-4) | | | |
| <i>M</i> | 2.70 | 2.60 | 2.40 |
| <i>SD</i> | 1.02 | 1.02 | 0.97 |
| α | 0.78 | 0.87 | 0.78 |
| Social ties | | | |
| Percentage currently married | 65.20 | 63.00 | 60.00 |
| Number of children (percentage; range 0-13) | | | |
| 0 children | 5.60 | 5.400 | 4.70 |
| 1 to 2 children | 14.40 | 15.00 | 14.30 |
| 3 or more children | 80.00 | 79.60 | 79.00 |
| Percentage of elderly living with one or more children | 70.50 | 66.20 | 64.50 |
| Percentage of elderly reporting seeing two or more friends regularly | 67.20 | 60.40 | 74.3 |
| Social activities (percentage; range 0-7) | | | |
| 0 activities | 21.90 | 25.00 | 20.50 |
| 1 to 2 activities | 63.10 | 59.40 | 61.70 |
| 3 or more activities | 14.50 | 15.50 | 16.60 |
| Missing | 0.50 | 0.10 | 1.20 |
| <i>N</i> | 3,868 | 2,960 | 2,408 |

view of the importance of the presence of a spouse for health, we examine the effects of being married vs. not being married. Unfortunately, incomplete information on the timing of widowhood and divorce prohibits us from also examining the effects of losing a spouse. The percentage married at each wave declines from 65% in 1989 to 60% in 1996.

We use two variables measured at the time of each survey to capture the effects of having children: one measures the number of living children and the other indicates whether a respondent lives with one or more children. To identify respondents with the fewest social ties, number of children is a three-category variable—zero, one or two, and three or more children. Most elderly (80%) in our sample have three or more children and fewer than 6% at each wave have no children

(Table 3). The percentage of elderly living with children declines from 71% in 1989 to 65% in 1996.

Social ties with friends is measured by the number of friends that the respondent sees or speaks to regularly and is dichotomized into respondents with zero or one friend and those with two or more friends. In each wave, at least 60% of the respondents report seeing two or more friends on a regular basis (Table 3). The increase between 1993 and 1996 in the percentage reporting two or more friends is likely due to a change in the wording of the question regarding frequency of contact with friends: in 1989 and 1993, the question referred to friends contacted in the last week, whereas the 1996 question referred to friends contacted in the last month.

Social involvement is a count of the number of social activities in which a respondent participated, including exercise, socializing with friends/neighbors, and/or memberships in a religious group, business association, political group, clan association, and/or an elderly organization. The total number of activities ranges from zero to seven. We examine the differences between those with zero activities, those with one or two activities, and those with three or more activities. Approximately one-fifth to one-quarter of respondents are not involved in any activity and between 14% and 17% are involved in three or more activities at a given wave (Table 3).

In preliminary analyses not presented here, we examined the number of relatives other than children that respondents see at least once a week, but found no association with any of the health outcomes. We, therefore, did not include this measure in our final models.

ADDITIONAL CONTROLS

In addition to prior health status, our models include other control measures that we expect to be related to health: demographic characteristics, socioeconomic status (SES), and survey year. Demographic characteristics include age, sex, and ethnicity. SES is evaluated by a variable denoting difficulty meeting monthly expenses, which is a time-varying covariate, and by the educational attainment of male respondents or of the husbands of female respondents. We use the level of education of husbands to assess the status of the female respondents because about three-quarters of women in this cohort

have no formal education. These women, however, most likely gain social and economic benefits from the educational attainment of their husbands. We also considered measures of monthly income and occupational prestige of the respondent's (or husband's) primary lifetime occupation. However, because these variables were not significantly related to any of our health outcomes in preliminary multivariate analyses (results not shown), they were not included in the final models.

ANALYSIS

We model the effects of social ties and perceived support measured at the beginning of each survey interval (i.e., 1989-1993, 1993-1996, and 1996-1999) on mortality and health measured at the end of the interval. All the measures of social ties and perceived support are time varying; that is, they are updated at each interview. As described earlier, in each model we control for three measures of health status at the start of the interval, as well as socioeconomic and demographic characteristics. We estimate three models for each health outcome. Model 1 includes all socioeconomic and demographic control variables, the social tie measures and the perceived availability of support index. This model allows us to test whether there is an association between social relationships and subsequent health outcomes in the absence of controls for health status at the start of the interval. Model 2 incorporates prior health status in an effort to determine whether any effects apparent in Model 1 are diminished or eliminated in the presence of these controls. Model 3 substitutes the satisfaction with support index for the perceived support index in Model 2. Because the two indices are highly correlated (Pearson correlation coefficients range from 0.46 to 0.72 across waves), we examine their effects on health in separate models. Models 2 and 3 permit us to assess whether these two dimensions of perceived support have an effect on health and mortality at the older ages net of other factors that may be associated with health, including measures of social ties.

For analyses of mortality, we use a discrete time hazard model (logistic regression) to model the log-odds that a respondent dies between survey dates conditional on being alive at the previous wave. For analyses of self-assessed health, functional status and depression, we estimate random effects models, based on maximum likelihood, to

account for the intraindividual correlation in repeated measures of the outcome variables across survey waves. These models also permit us to retain cases with fewer than four interviews, thereby reducing the bias introduced by nonresponse. For self-assessed health, a random-effects logit model represents the log odds of reporting fair or poor health. Depression, which is treated as a continuous variable, is analyzed with a random effects linear regression model. Finally, functional status, a variable with three categories that are ordered with respect to successively poorer functional status, is analyzed with a random-effects ordered logit model. All models are estimated using version 7 of the Stata statistical software (StataCorp, 2001); the random effects ordered logit model is estimated with the GLLAMM routine available as an add-in to Stata (Rabe-Hesketh, Pickles, & Skrondal, 2001).

Results from all four sets of multivariate models are presented in terms of estimated coefficients and standard errors. Because a higher value for each of these outcomes denotes poorer health status, a positive coefficient for a given covariate indicates that having the characteristic (in the case of a dummy variable) or having higher values (in the case of a continuous variable) at the start of an interval is associated with poorer health or death at the end of the interval.

Results

Multivariate results for the four health outcomes appear in Table 4. We restrict our discussion to the measures that are significantly related ($p < .05$) to the four health outcomes. Due to space limitations, we present only the estimates for the effects of the social relationship measures. Full statistical tables are available from the authors.

SOCIAL TIES

The effects of social ties vary by health outcome and by whether controls for prior health are included in the model. Marital status is significantly related to only the probability of dying. Respondents who are married are less likely than respondents who are not married to die within a specified interval, even after controlling for prior health status (Table 4).

Although number of children is not significantly related to any of the four outcomes, living arrangements is related to self-assessed health. Respondents who coreside with children are significantly less likely to report fair or poor health at follow-up (Model 1), but this relationship is no longer significant after controlling for prior health (Models 2 and 3). This finding suggests that the elderly may be more likely to live with children because of poor health.

Number of friends is associated with both the probability of dying and with functional limitations. Respondents reporting regular contact with two or more friends are significantly less likely to die within the interval and to have more severe functional limitations at follow-up (Model 1). Neither effect, however, remains significant after controlling for prior health (Models 2 and 3).

Finally, in the absence of controls for baseline health, number of social activities is significantly associated with all four outcomes: Respondents who are involved in more social activities have better physical and mental health at follow-up than their counterparts. However, in the presence of controls for prior health status, this effect remains significant only for depression and functional status.

PERCEIVED SUPPORT

The estimates reveal that greater perceived availability of social support is significantly associated with lower mortality, better subjective health status, and lower levels of depression (Model 1), although, in the presence of controls for prior health, the coefficient is significant only for depression (Model 2). Similarly, satisfaction with support is significantly related to only depression (Model 3). Thus, the estimates indicate that even in the presence of controls for baseline health, respondents with higher perceived availability of support or those who are more satisfied with their support have significantly lower levels of depression at follow-up than their respective counterparts.

Analyses not presented here indicate that these findings are robust to alternative specifications of the perceived support indices. For example, we explored these associations using separate measures for each of the three components of the perceived availability index and the two components of satisfaction with support. We also considered

Table 4
Estimated Coefficients (and Standard Errors) for the Effects of Social Ties and Perceived Support on Four Health Outcomes^a

| Variable | Probability of Dying | | | Functional Limitations | | |
|------------------------------------|----------------------|---------------------|---------------------|------------------------|---------------------|---------------------|
| | (1) ^b | (2) ^c | (3) ^c | (1) ^b | (2) ^c | (3) ^c |
| Social ties | | | | | | |
| Currently married | -0.211** (0.081) | -0.225** (0.084) | -0.226** (0.083) | -0.100 (0.121) | -0.050 (0.083) | -0.051 (0.083) |
| <i>Not married^d</i> | | | | | | |
| Number of children | | | | | | |
| 1 to 2 children | -0.091 (0.187) | -0.070 (0.192) | -0.073 (0.191) | 0.232 (0.300) | 0.121 (0.209) | 0.128 (0.208) |
| 3 or more children | -0.247 (0.182) | -0.214 (0.187) | -0.217 (0.187) | -0.087 (0.289) | -0.039 (0.200) | -0.034 (0.199) |
| <i>0 children</i> | | | | | | |
| Lives with 1 or more children | 0.153 (0.082) | 0.147 (0.085) | 0.147 (0.085) | 0.095 (0.113) | 0.109 (0.079) | 0.108 (0.079) |
| <i>Not living with children</i> | | | | | | |
| Number of friends | | | | | | |
| 2 or more friends | -0.223** (0.077) | -0.152 (0.080) | -0.153 (0.080) | -0.236* (0.108) | -0.104 (0.081) | -0.103 (0.081) |
| <i>0 to 1 friend</i> | | | | | | |
| Number of social activities | | | | | | |
| 1 to 2 social activities | -0.285** (0.084) | -0.110 (0.088) | -0.110 (0.088) | -0.440** (0.123) | -0.274** (0.093) | -0.278** (0.093) |
| 3 or more social activities | -0.339** (0.123) | -0.034 (0.129) | -0.034 (0.129) | -0.787** (0.167) | -0.438** (0.123) | -0.443** (0.122) |
| <i>0 social activities</i> | | | | | | |
| Perceived support | | | | | | |
| Perceived availability index | -0.044* (0.022) | -0.008 (0.024) | | -0.040 (0.031) | 0.015 (0.024) | |
| Satisfaction with support | | | -0.014 (0.038) | | | 0.049 (0.038) |
| Observations ^e | 8,027 | 8,027 | 8,027 | 3,783 | 3,783 | 3,783 |
| Number of respondents ^e | | | | 2,269 | 2,269 | 2,269 |

(continued)

indices of perceived support that captured respondents' experiences over a 7-year period (1989-1996), and together with an extensive set of controls for health in 1996, we used these longitudinal measures of perceptions to predict health and survival status in 1999. Statistical

Table 4 (continued)

| Variables | Probability of Reporting Fair or Poor Health | | | Depression | | |
|------------------------------------|---|-------------------|-------------------|---------------------|---------------------|---------------------|
| | (1) ^b | (2) ^c | (3) ^c | (1) ^b | (2) ^c | (3) ^c |
| Social ties | | | | | | |
| Currently married | -0.071 (0.098) | -0.058 (0.070) | -0.047 (0.070) | -0.283 (0.179) | -0.236 (0.152) | -0.249 (0.151) |
| <i>Not married</i> | | | | | | |
| Number of children | | | | | | |
| 1 to 2 children | 0.120 (0.243) | 0.108 (0.177) | 0.128 (0.177) | 0.056 (0.437) | 0.220 (0.374) | 0.155 (0.372) |
| 3 or more children | -0.158 (0.235) | -0.032 (0.170) | -0.011 (0.170) | -0.416 (0.424) | -0.100 (0.360) | -0.161 (0.359) |
| <i>0 children</i> | | | | | | |
| Lives with 1 or more children | -0.196* (0.092) | -0.125 (0.069) | -0.124 (0.069) | -0.153 (0.164) | -0.070 (0.145) | -0.077 (0.145) |
| <i>Not living with children</i> | | | | | | |
| Number of friends | 0.007 (0.085) | 0.005 (0.069) | 0.012 (0.069) | -0.157 (0.151) | -0.086 (0.146) | -0.117 (0.145) |
| <i>2 or more friends</i> | | | | | | |
| <i>0 to 1 friend</i> | | | | | | |
| Number of social activities | | | | | | |
| 1 to 2 social activities | -0.054 (0.095) | 0.050 (0.077) | 0.056 (0.077) | -0.501** (0.172) | -0.339* (0.166) | -0.335* (0.165) |
| 3 or more social activities | -0.425** (0.137) | -0.158 (0.110) | -0.148 (0.110) | -1.089** (0.236) | -0.728** (0.222) | -0.729** (0.222) |
| <i>0 social activities</i> | | | | | | |
| Perceived support | | | | | | |
| Perceived availability index | -0.051* (0.025) | 0.008 (0.020) | | -0.269** (0.045) | -0.193** (0.043) | |
| Satisfaction with support | | | -0.040 (0.033) | | | -0.341** (0.068) |
| Observations ^e | 6,493 | 6,493 | 6,493 | 6,435 | 6,435 | 6,435 |
| Number of respondents ^e | 2,904 | 2,904 | 2,904 | 2,891 | 2,891 | 2,891 |

a. Coefficients are estimated using the following models: discrete time hazard models for the probability of dying, random effects logit models for the probability of reporting fair or poor health, random effects ordered logit models for functional limitations, and linear random effects models for depression.

b. Model controls for survey year, age, sex, ethnicity, husband's education, and economic difficulties.

c. Model controls for health status at the beginning of the interval, survey year, age, sex, ethnicity, husband's education, and economic difficulties.

d. Omitted categories shown in italics.

e. Number of respondents refers to the number of the original 4,049 respondents interviewed in 1989 that were included in the analysis. Number of observations is the total number of times these respondents were observed.

* $p < .05$. ** $p < .01$.

models that incorporate these alternative specifications of perceived support yield the same findings as the models presented in Table 4: In the presence of controls for prior health status, perceptions about support are consistently related to depression, but not to the other health outcomes (results not shown).

Discussion

The purpose of the article has been to determine (a) if two dimensions of social relationships—social ties and perceived support—are significantly related to the health of the elderly in Taiwan, (b) if these relationships are significant in the presence of extensive controls for prior health status, and (c) if the two dimensions generally have the same effect across selected physical and mental health outcomes. We find that perceived support and social ties are related to health, but that many of the apparent effects of social relationships on health are attenuated and no longer significant once controls for prior health status are introduced. These findings suggest that, if health status at baseline is not taken into account, estimates of the effects of social relationships on health at a given stage of life are likely to be inflated by reverse causality or by corresponding effects occurring prior to the period of interest. They also reveal that the relationship between social support and health at the older ages in Taiwan is likely to be weak or, at best, modest.

The results also indicate that the effects of perceived support and social ties depend on whether the outcome entails mental or physical health. Based on models that include controls for health, results show that perceptions about social support are significantly related to and protective of mental health: Better perceptions about the availability of support and greater satisfaction with received support are associated with lower levels of depression at follow-up. In contrast, these perceptions are not significantly associated with the other health outcomes.

These findings are more convincing than those in many earlier studies for four reasons. First, they are based on analyses that use multiple observations of social relationship variables and health status over a 10-year period. Second, extensive controls were introduced

into the statistical models to reduce the effects of reverse causality. Third, these findings are robust to alternative specifications of the perception variables. And fourth, the lack of impact on physical health is consistent across three well-measured outcomes, namely, mortality, functional status, and self-assessed health (the last of which is largely but not entirely based on physical health). These results are also consistent with work by Krause, Liang, and Yatomi (1989) that suggested that perceptions about support affect mental health but not the reverse.

Although there are some significant associations between social ties and health, many of the effects are weak, nonsystematic, or insignificant. For example, marital status is significantly related only to mortality. Similarly, contact with friends is not significantly associated with any of the outcomes when prior health is controlled. More surprisingly, number of children and living arrangements reveal few strong or systematic associations with health, despite the strong cultural norms for children to support elderly parents and the essential role of family in Taiwanese society. Social activities, however, seem to be a critical factor for promoting health, even in the presence of controls for prior health. These results suggest that the level of social involvement may be more important than the types of persons involved in social relationships. These results also indicate that the protective effects of specific network members on health may be weaker in Taiwan, and perhaps more generally in East Asian populations, than in Western societies. These hypotheses are supported by a study in Japan that finds no relation between marital status and health (Sugisawa et al., 1994) and studies in Taiwan that find no relation between marital status or the number of children and health, but find that the amount of contact with children is positively associated with health at follow-up (Beckett et al., 2002; Zimmer et al., 2000).

Our finding regarding the importance of social support for mental well-being is not surprising given that such perceptions are likely to increase feelings of self-identity, personal control, and social integration (Cohen, 1988; Cohen & Syme, 1985; Mendes de Leon et al., 2001). Perhaps more unexpected is the lack of effect on other health outcomes considered in this analysis. There are several plausible explanations for these findings, as well as the results pertaining to social ties, some or all of which may be operating here. One is that the period of follow-up (3 to 4 years between surveys) may be too short to

observe a sufficiently large number of changes in survival and physical health. A second explanation is that elderly persons' responses regarding their perceptions, as well as their social ties, may not be accurate; in particular, the low proportions of Taiwanese respondents providing negative perceptions suggest that they may be reluctant to report critical assessments of or inadequate contact with their relatives, friends, and neighbors. A third possibility, also related to the accuracy of responses, is that variations in the wording or structure of the perceived support measures across waves weakened the measures of support perceptions. A fourth explanation is that the exclusion of proxies and nonrespondents, who are typically in poorer health and have weaker social support than other survey participants, has led to an underestimate of the effects of social relationships on health. Finally, social interactions and support may be more pervasive and more likely to be a part of everyday life in Taiwan than in the West, in ways not measured here. Ongoing data collection for this survey, together with a growing number of studies of social support and health in developing and newly industrialized countries, are likely to provide new insights into some of these issues. Information that emerges from these new data collection efforts will be useful for shaping effective and efficient policies regarding the future well-being of the elderly in these societies.

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APOE ε4 as a Predictor of Subjective Quality of Life in a Biracial Older Person Community Sample

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Objectives: The ε4 allele of apolipoprotein E (APOE) has been associated with health-related outcomes that may adversely affect quality of life (QOL) in older adults. In the absence of published information, we sought to determine whether the ε4 allele was associated with subjective QOL across 5 parameters in a community sample of older adults. **Design:** Prospective cohort study. **Setting:** Community-based sample of older adults in North Carolina (Duke site of the Established Populations for Epidemiologic Studies of the Elderly [Duke EPSE]). **Participants:** Self-responding genotyped sample members ($n = 1,880$) of whom 1,254 provided longitudinal data. **Measurements:** APOE genotype and five newly constructed, reliable, and valid measures of subjective QOL derived from the Duke EPSE questionnaire. The 5 parameters measured were social, economic, mental and physical health, and functional

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