Whose Education Counts? The Added Impact of Adult-Child Education on Physical Functioning of Older Taiwanese

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Objectives. Research has implicated education as an important predictor of physical functioning in old age. Older adults in Taiwan tend to experience tight familial integration and high rates of adult-child coresidency—much more so than is typical in Western cultures—which might imply additional influences stemming from the education of children. This could arise in a number of ways; for instance, through the sharing of health-related information between child and parent, the quality of caregiving efforts, monetary assistance for medical and other services, or other psychosocial avenues. Despite this probable association, such hypotheses have rarely been tested. In this study, a nationally representative survey of older Taiwanese was used to examine these concurrent effects.

Methods. Outcome variables include the existence of any functional limitations (dichotomously measured) and the severity of functional disorders (ordinally measured). Dichotomous and ordinal logistic models were used.

Results. Results suggest that, after adjusting for age, sex, and other factors, both child and respondent education associate with the existence of limitations, but the child’s education is more important than the parent’s when predicting severity of limitations.

Discussion. This implies that models ignoring social network characteristics in determining health outcomes of older adults may be misspecified, at least in some non-Western societies, and calls for further testing in other societies as well.

“A family is an economic unit bound by emotional ties. . . . It is in the household that the larger social and economic order impinges on individuals, exposing them to varying degrees of hardship, frustration and struggle” (Ross, Mirowsky, & Goldsteen, 1990, pp. 1059–1071). This quote illustrates the principle that families interact and influence one another in a multitude of ways, and these interactions serve to shape the life experiences of family members. There is some debate over the nature of family in American society (Luescher & Pillemer, 1998; Silverstein & Bengston, 1997), but there are also societies in which the existence of high degrees of family cohesion, interaction, coresidence, and reciprocity are less debatable. Subsequently, the potential for interactions between families and individuals within families is substantial across much of the world.

The quote above notes that among the life experiences shared and shaped by families are health outcomes. Overlooking the influences of the family can result in limited insights into the factors that determine health. The current research took place in Taiwan and is born out of an extensive history of research documenting an association between socioeconomic status and health. Although there are some recent exceptions (Robert & Li, 2001), research contemplating the socioeconomic determinants of health among older adults usually involves what can be called an individualistic perspective, ignoring the attributes of a wider social network. In the current study, we sought to answer the question of whether the education of an adult child associates with the physical functioning of their aged parents in addition to, or over and above, the effects of the older adult’s own level of education. If so, what aspects of physical functioning associate with child’s education? To answer these questions, we examined the influence of parent and child education, separately and combined, on the probability that an aged parent has functional limitations and on the severity of those limitations.

There is a lengthy social tradition that examines how stratification affects health, although most of this has concerned populations in the United States and Britain. By reviewing decades of empirical evidence that shows a robust association between class and mortality, Antonovsky (1967) helped initiate the modern discourse on the topic. His review was followed by extensive studies of individual socioeconomic characteristics on health and mortality in the United States and England (Kitagawa & Hauser, 1973; Marmot, Rose, Shipley, & Hamilton, 1978). More recently, attention in Western industrialized countries has turned to investigating the changing trends in socioeconomic status and health over time (Pappas, Queen, Hadden, & Fisher, 1993; Preston & Elo, 1995; Townsend & Davidson, 1982) and examining causal mechanisms and intervening factors that serve to disadvantage those of lower socioeconomic status (House, Lepkowski, Kinney, Mero, Kessler, & Herzog.
With respect to those at older ages, there is some evidence of convergence in rates of mortality and chronic disorders by levels of education (Elo & Preston, 1995; House et al., 1990). Yet there is also convincing evidence that significant differentials in a variety of physical functioning abilities are maintained into old age (Camacho, Strawbridge, Cohen, & Kaplan, 1993; Duffy & MacDonald, 1990; Guralnik, Land, Blazer, Fillenbaum, & Branch, 1993; Kaplan, Strawbridge, Camacho, & Cohen, 1993; Rogers, Rogers, & Belanger, 1992). Such differences may reflect the cumulative impact of education throughout life (Lynch, Kaplan, & Shema, 1997; Ross & Wu, 1996).

Most of the studies noted above focused on the socioeconomic characteristics of the indexed individual, and differentials in health were explained as a function of personal characteristics including one’s access to medical care, personal behaviors, knowledge of disease prevention, and psychological dimensions such as stress and feelings of self-efficacy. But health crises and ongoing conditions tend to involve family networks in many ways. Adult children may assume not only caretaking roles, but they also bring considerable financial, knowledge, and management resources into decisions about the timing and quality of health care and subsequent actions. To the extent that this is so, studies of the influence of socioeconomic status on health that focus solely on the individual respondent’s attributes may misspecify the determinants of health of older adults.

The Taiwan Setting

Because of its Confucian culture, and what this means for intergenerational support, Taiwan represents an ideal setting for studying the impacts of an adult child’s education on older adult health. The Chinese who originally settled in Taiwan, beginning in the seventeenth century, brought with them a family system based on extended households and the notion of family as a corporate unit (Hermalin, Ofstedal, & Lee, 1992). As a corporate unit, the Chinese family is organized around a collective economy whereby earnings are pooled and used to provide support for all family members (Lang, 1946). This notion extends beyond economics to providing assistance with household maintenance and caregiving. There are good reasons to presume that the influence of the child on parental health would be substantial in this data source. The occupation of Taiwan by the Japanese from 1895 to 1945 did little to change the basic organization of the family (Hermalin et al., 1996). Since that time, Taiwan has undergone demographic and socioeconomic changes that have transformed it from a rural-based to an urban-based society and from having a less developed economic infrastructure to a more developed one. Rapid reductions in fertility and increases in life expectancy over the last two decades have created a rapidly aging society. Yet the cohesiveness of the family appears to remain intact. Household sizes, although decreasing slightly over time, remain large (Asis, Domingo, Knode, & Kalyani, 1995), and intergenerational support remains strong across a number of economic and caregiving domains (Hermalin, Ofstedal, & Lee, 1992).

An additional change, noteworthy for the current study, is the rapid rise in educational attainment and the diminution of the gender gap in education that have occurred over the last several decades. College attendance for men 18 to 21 rose from about 2% to about 29% between 1952 and 1988, whereas for women the increase was from almost 0% to about 33% during the same time period (Hermalin et al., 1996, Table 1). This has created a situation in which the current generation of older adults has educational levels well below those of their children. Children are now exposed to a new set of beliefs and an expanding knowledge base that may alter and expand the resources available in the care of their aging parents (Cormman, Hermalin, Roan, & Chang, 1996).

METHODS

Data

The data come from The 1989 Survey of Health and Living Status of the Elderly in Taiwan. This survey involved a large sample of older Taiwanese, selected randomly to be nationally representative. Adults aged 60 and older at the end of 1988 were considered to be the sample universe. One of every 370 older adults living in Taiwan was selected for study, 4,049 individuals were interviewed, and the response rate was 92%. Of the respondents, 3,795 had at least one living child. The analysis was restricted to these individuals. The main aim of this project was to collect information useful in analyzing the influence of rapid social and economic change on elderly adults in Taiwan. As such, the survey itself is extremely extensive and includes information on the physical health and sociodemographics of the respondent, but also includes sociodemographic information on all coresident and noncoresident children. These qualities make this data source ideal for comprehensive testing of the relationship between education and functional status and the possible added influences of social network members. More information on this survey is found in the first research report published as part of the project (Taiwan Provincial Institute of Family Planning, 1989).

Measuring Physical Functioning

Functional health can be defined as the ability to conduct tasks such as activities of daily living (ADLs; Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963), instrumental activities of daily living (IADLs; Lawton & Brody, 1969) or tasks in-
volving general upper and lower body movements (Crimmins & Saito, 1993; Nagi, 1976). Some of these types of tasks, particularly IADLs, can be confounded by role expectations and living environments (Freedman & Martin, 1998; Simonsick et al., 2001; Verbrugge & Jette, 1994). For instance, the answer to a question such as "Do you have any problem shopping for things?" may depend, to some degree, on the distance one needs to travel to buy things or on who tends to be responsible for doing the shopping. The distinction between these types of activities has been made by Nagi (1976, 1991), who identified functional limitation, the loss of ability to perform tasks, as a specific state mediating impairment, or physiological abnormality, and disability, or behavior patterns that evolve from impairment (Kelly-Hayes, Jette, Wolf, D’Agostino, & Odell, 1992). In the current study, we sought to limit our functional measures to those that indicate limitations and therefore involve upper or lower body movements. By focusing on limitations, we sought to avoid the social biases that can relate to disability. Specifically, we used ability crouching, climbing stairs, walking, grasping, and reaching for things. A number of other items in the data, such as doing housework, were omitted because responses may reflect role expectations and living environments as noted above. Other items, such as lifting things and standing for a period of time, were omitted because of a high number of missing responses. Specifically, many individuals responded that they never did these tasks and therefore could not assess their ability.

Our conceptualization of functional limitations assumes two distinct measures. All ailments, whether they are chronic conditions or temporary illnesses, can be measured dichotomously, indicating the existence of the ailment, or using an ordinal level scale, indicating the severity of the ailment. For instance, with respect to functional capacity we can first measure the existence of any functional limitations. Second, for those who have limitations, we can measure the severity. Many individuals, even at older ages, are not troubled with functional limitations at all. For those who are troubled with limitations, the severity will vary. In terms of education, this assumes two questions. First, how does education influence the probability of having a functional limitation? Second, how does education influence the severity for those who have functional limitations? If determinants act distinctly on the existence versus the severity of functional limitations, then combining both effects into a single equation may distort the effect of this variable. For this reason, we constructed two functional outcome measures, the first indicating existence and the second indicating severity among those who have functional limitations.

Table 1 provides the distribution of functional limitation items including the possible response categories. This table is organized from the most difficult task to the easiest according to the proportion reporting no difficulty. The most frequently reported difficulties were crouching, with about 27% reporting at least a little difficulty, and climbing stairs, with about 26% reporting at least a little difficulty. On the other hand, over 90% reported no difficulty grasping or reaching. A factor analysis of these items (not shown in tabular form) showed that they load highly onto a single factor (eigenvalue of 3.5), and the Cronbach’s alpha coefficient for this group of items was .89. This suggests that they represent a single construct.

Respondents who reported at least a little difficulty with at least one of five functional tasks were considered as having a functional limitation and were given a code of 1 with respect to the existence of functional limitation variable. Others were given a code of 0. To construct a severity variable, we examined specific responses to the five items and determined whether the limitations reported were mild, moderate, or severe. Those reporting only a little difficulty with only one or two tasks were considered to have mild limitations. Those individuals reporting “a lot of difficulty” with, or that they “cannot do,” one or two functional tasks, or those individuals reporting “a little difficulty” with more than two (that is three to five) functional tasks, were coded as having moderate limitations. Finally, those individuals reporting “a lot of difficulty” with, or that they “cannot do,” three or more functional tasks were coded as having severe limitations. Of those who reported at least one limitation, 43% were coded as mild, 38% as moderate, and 19% as severe.

Other measures that have been used in the past to indicate degree of severity include number of limitations reported and a composite scale on which points are awarded for no difficulty, some difficulty, a lot of difficulty, or being unable to do the task and the points are summed across available items. Although these types of measures are referred to frequently in the literature, there has been no agreement on one best way to measure severity, and each measure has limitations. For instance, an individual may have a high number of functional limitations, but if they report only a little difficulty with each task, the total number of limitations may not be reflective of severity. Similarly, points arbitrarily awarded to response categories, say a score of 1 for “a little difficulty” and a score of 2 for “a lot of difficulty,” may not reflect a true difference in severity. It is uncertain, in this example, that having a lot of difficulty is exactly twice as severe as having a little difficulty. Yet, all of these scales are highly correlated and represent a similar construct. In the current data there was a .94 Pearson’s r between the number of limitations and the ordinal severity scale, and there was a .89 correlation between a summative score and the ordinal severity scale. Furthermore, sensitivity tests suggest that our conclusions do not differ when using these other scales. The choice of severity measure is then somewhat based on preference and relation to the particular research task. We used the ordered measure because we were interested in capturing a qualitative degree of differ-

<table>
<thead>
<tr>
<th>Task</th>
<th>No difficulty</th>
<th>A little difficulty</th>
<th>A lot of difficulty</th>
<th>Cannot do the task</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crouching</td>
<td>73.3</td>
<td>12.9</td>
<td>6.8</td>
<td>6.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Climbing stairs</td>
<td>73.9</td>
<td>15.3</td>
<td>5.4</td>
<td>5.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Walking</td>
<td>80.0</td>
<td>10.4</td>
<td>5.0</td>
<td>4.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Grasping</td>
<td>91.7</td>
<td>4.5</td>
<td>1.7</td>
<td>2.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Reaching</td>
<td>92.6</td>
<td>3.7</td>
<td>1.4</td>
<td>2.2</td>
<td>100.0</td>
</tr>
</tbody>
</table>
energy in severity while using categories that best parallel the response categories of the original items.

Covariates

Education has been shown to relate to knowledge and understanding of disease processes, prevention, and practice, self-esteem, and sense of control. It is a consistent measure of socioeconomic status, remaining constant throughout adulthood for most individuals. It is also a relatively accessible and reliable measure. Individuals not only know their own level of education, but most also can accurately report their children’s. This is in contrast to, say, income, which may be accrued in a variety of ways, changes throughout life, and has high levels of reporting error, particularly on reports of the income of family members other than the respondent. These considerations have led a number of authors to consider education the aspect of socioeconomic status most important to health (Ross & Wu, 1995; Winkleby, Jatulis, Frank, & Fortmann, 1992).

Education was measured as categorical variables that reflect low, middle, and high levels of education for the respondent and for his or her most highly educated child. Because educational attainment increased substantially over the course of a generation in Taiwan, the actual years of education reflecting low, middle, and high differ between the parents and children. For the parents, low education was considered to be those with no formal schooling, those with primary education were coded as having middle education, and those with more than primary had high education. For children, low education was considered to be those who had no more than primary. Those with junior or senior high were coded as having middle education. Those with at least some college had high education.

Family sizes in Taiwan tend to be large, and each child has the potential to influence their parent. Ideally, one would try to bring in the characteristics of each child to the model, but aside from considering some composite of all children’s education, this type of modeling is complex and difficult to interpret. To capture family resources available through children, we considered the educational attainment of the most highly educated child. This strategy has at least two advantages. First, there tends to be a fair amount of homogeneity in the educational attainment of all children within a household, so that the most highly educated child is a good proxy for the education of all children. Second, the health of an older adult is likely to be most influenced by the child who has the greatest resources to bring to bear, and this is well represented by the child with the most education. We note that rather than indicating the education of a selected child, our measure can be considered a general indicator of resources that may be available to parents through their offspring.

Because more than one child within a family can have the same level of education (for instance, more than one child can have a college education), we could not select a particular child who has the highest level of education. However, by determining the children who tie with the highest level of education, we could construct other variables of relevance. First, we measured the gender of the most highly educated child or the gender composition when there were ties. Gender of children is important because men are thought to have greater earning power than women, and parents may disproportionately rely on their male offspring for financial support and the wife of male offspring for ADL and IADL support (Hermalin et al., 1996). In cases in which there was just one child with the highest level of education, or more than one child, but all with the same gender, we coded the gender as male or female. In cases in which there was at least one male and at least one female child with the same high level of education, we coded the gender as both male and female. We constructed dummy variables to test for the influence of the gender of the child, with female being the comparison category. In a similar vein, we measured the residential proximity of child to parent. It is reasonable to expect that the education of a child who is a coresident will be more influential than that of a child living farther away. If two or more children had equally high levels of education, we considered the proximity as the child living closest to their parent. Residence status for the most highly educated child or children was coded into three categories: coresiding, living nearby (in the same community, village, or town), or living farther away, with the last being the comparison.

We also considered a set of covariates that related to the demographic characteristics of the parent and were expected to influence physical functioning outcomes. Age is an important correlate of health, and those who were older were expected to have a higher probability of reporting limitations. We adjusted for gender of respondent because women have been shown, in the past, to be more likely to suffer from functional disorders at older ages (Verbrugge, 1989). Access to medical facilities may differ between rural and urban areas, and we included rural or urban residence in our models. Marital status has been shown to influence health in a number of ways, such as through support (Goldman, Korenman, & Weinstein, 1995; Ortmeyer, 1974). We considered marital status as a dichotomous variable—married versus other. Taiwan is fairly homogenous ethnically, but there is an important distinction between “Mainlanders” and others. Mainlanders are those who migrated to Taiwan from China after the Second World War. They are predominantly male soldiers and officials and have distinct social and behavioral characteristics that warrant particular attention (Hermalin et al., 1996). For instance, Mainlanders are more likely to be employed in the government, to be unmarried, and to have higher incomes than are other Taiwanese. Because they were soldiers, Mainlanders may have higher fitness levels than do others, and they may consequently have fewer functional limitations. Our ethnicity variable therefore contrasted Mainlanders with others. We also included a measure of total number of children in our model to account for the overall availability of support from children.

Finally, to adjust results for economic well-being and to assure that influences of education were not due strictly to wealth, we included a measure of household income. This comes from the question “At present, how much is the total monetary income you (and your spouse) receive in a month?” The survey recorded responses categorically, and we created an income variable with five categories. Those
in the lowest income category earned less than 5,000 NT (New Taiwan Dollars, the equivalent of about $150 U.S.) per month. The next categories are those reporting 5,000 to 9,999 NT, those reporting 10,000 to 19,999 NT, and those reporting 20,000 NT and higher. Even though responses were categorical, about 13% of individuals did not report their income. Rather than imputing a value for these individuals, we considered those with missing income as a fifth category, and we examined whether those with missing income had different functioning outcomes than others. Distributions and coding schemes for all the variables involved in the analysis are provided in Table 2.

Statistical Analysis

The two outcome measures suggest a two-part analytical approach. According to Manning, Duan, and Rogers (1987) a two-part strategy is also appropriate when zero values are considered to be true zeros rather than censored cases. This is the case in the present problem, as an individual without a limitation can be calculated as:

\[
\Pr(y_j = 1 | X_j) = \frac{\exp (\beta_1 x_{1j} + \beta_2 x_{2j} + \ldots + \beta_k x_{kj})}{1 + \exp (\beta_1 x_{1j} + \beta_2 x_{2j} + \ldots + \beta_k x_{kj})}.
\]

...
In the second part, we used a cumulative ordered logistic regression approach (Agresti, 1996), which has the following form for predicting the probability of membership in any group:

$$\Pr(\text{outcome}_j = i) = \Pr(k_j - 1 < \beta_1 x_{ij} + \beta_2 x_{ij} + \ldots + \beta_k x_{ij} + \mu_j \leq k_j)$$

where $k$ is the cut point between any two groups and $x_{1j}, x_{2j}, \ldots, x_{kj}$ are the variables listed on the left-hand side of Figure 1. The ordinal logistic model is a proportional model in that it assesses the log odds ratio changes to be the same when dividing the ordered variable into any two parts. For instance, in a three-category ordered variable, coefficients represent the change that a one-unit increase in an independent variable has on the log odds of membership in Group 1 versus 2 or 3, or Group 1 or 2 versus 3. Probabilities were predicted on the basis of one set of coefficients and a number of constants, usually referred to as cut points, for which the number of constants is the number of categories in the ordered variable minus one.

A disadvantage of the two-part strategy for modeling having any limitations and severity of limitations is that the variation in older adult education, already lessor in Taiwan than is the case in most Western-based samples, narrows when eliminating those who have no limitations from the second stage of the analysis. But, some variation remained. About 140 respondents who had high education had a functional limitation, as did about 340 with midlevel education. One of the aims of the second stage, outlined above, was to determine whether these 480 respondents displayed different patterns of limitation severity than did those with limitations and no education. In addition, to comment on the robustness of these findings, we conducted several sensitivity tests, by first coding functional limitation severity as ordered and, as tends to be more traditional, continuous level variables that include all respondents, and then running appropriate models. These tests are reported in the Results section below.

**RESULTS**

We begin by examining education’s association with the existence of any functional limitations. Model 1 of Table 3 shows that, in addition to age, gender, and income, the level of education of the aged parent, entered separately, is a significant determinant of any limitations. This is the standard finding when considering an individualistic approach to modeling the functional health of an older adult. For example, odds ratios show that older adults who have high-level education (that is, more than primary), are 53% less likely to report a functional limitation in comparison to those with low-level education.

Model 2 shows that both parent and child effects are substantial and significant predictors of having a functional limitation, adjusting for other sociodemographic covariates. Comparing Model 1 with Model 2, we found the effect of parent’s education is reduced somewhat. The odds ratios change from .72 to .77 when the older adult has midlevel education in comparison with low level, and from .47 to .54 when the older adult has high-level education in comparison with low level. Net of parent’s education, however, the child’s education appears to have an additional effect. For example, the odds ratio for having a limitation for those with high versus low child education is .69, meaning that the those who have a child with high education are 31% less likely to report a limitation in comparison with those whose most highly educated child has primary education or less. Log-likelihood results indicate that each education measure, that of child and their aged parent, are significant factors in determining the probability of reporting a functional limitation net of each other.

Model 3, examining whether residence proximity or gender of child makes a difference with respect to functional limitations of the aged parent, shows little improvement in log-likelihood, and the added coefficients are not significant. This indicates that a child living farther away versus coresiding or living nearby, and the most highly educated child being a woman versus a man versus being either male or female, does not matter with respect to having a functional limitation. Adding these variables does make the contrast between midlevel child schooling and no schooling significant.

Table 4 presents odds ratios from ordinal logistic regression models that predict the functional limitation severity for older adults who reported at least one functional task difficulty. Looking first at Model 1, we found the education of the older adult has some negative association with limitation severity, but the coefficients are not significant. This is
a result that is somewhat surprising and different than when considering the existence of any limitation. Model 2 indicates that the education of the most highly educated adult child does indeed have a significant impact on severity of limitations over and above the effect of parent’s education. The odds ratios for midlevel and high education are less than 1.00, indicating that in cases in which the education of the child is higher, the probability that limitations are more severe decreases, although only the coefficient for high education is statistically significant. This odds ratio suggests that when the highest level of education among children is high, the probability that the parent will have a higher level of limitation severity decreases by about 31% in comparison with a situation in which the highest level of education among children is low. This result means that only the addition of the education of the child significantly enhances the predictive power of the model and that child’s education adds something not of the older adult’s education, but parent’s education does not add to the model net of their other sociodemographic characteristics.

The addition of residency status of the child and gender of the child show similar results in predicting limitation severity as they did in predicting any limitations. That is, these effects are not significant themselves but enhance the effect of children’s education. It does not seem to matter then where the child lives or whether the most highly educated child is male, female, or either. Child’s education influences functional status consistently across these other covariates.

When testing for a series of interaction effects between child’s education and other characteristics, we found there was virtually no change to our conclusions and the interactions themselves were generally insignificant. For this reason, we do not report these results in tabular form (they are available from the authors on request). There is no interaction between child and parent education, suggesting that the impact of child’s education is consistent regardless of the education of the parent. One interaction worth noting is the impact of the interaction of child’s low education with living farther away from parents on severity of limitations. Severity is significantly greater in cases in which the child has low education and lives far away from their parents versus any other combination of education and proximity.

To determine the robustness of our findings with respect to severity, we conducted several sensitivity analyses involving modeling severity of limitations without eliminating the group reporting no limitations. In one test we coded severity as an interval variable, summing scores of 0 for having no problem, 1 for a little difficulty, 2 for a lot of difficulty, and 3 for being unable to do the task across the five functional tasks. This is a more traditional way of coding limitation severity. We then ran least squares multiple regression to predict this score, which ranged from 0 to a maximum of 15. This procedure confirmed the robustness of our findings and therefore adds confidence to the results presented above. In the multiple regression, child’s education was both a stronger determinant and more significant than respondent’s education. (For instance, the unstandardized beta comparing respondents with low to high education is .297, p = .064, whereas the coefficient comparing children with low to high education is .858, p = .000). In further tests we ran an ordered regression coding having no limitations as an additional category and a multinomial regression, treating limitation severity as a discretely measured variable, including a category for no limitations. Although all of these tests do not disentangle the effects we are modeling—the presence of a limitation versus the severity of limitations—they are all in agreement that the child’s education is strongly associated with the limitation measures used, and that at times it is a statistically significant predictor, whereas the education of the older adult is not. These tests are not reported here in tabular form, but are available from the authors on request.

**DISCUSSION**

The current study examined the impact of education on functional status outcomes of older adults in Taiwan. Its contribution comes in the attempt to ascertain whether the level of education of an adult child has added effects over and above an older adult’s own education and in the dual conceptualization of functional limitations as existence and severity. We chose Taiwan as an ideal environment to test this phenomenon because it is characterized by high degrees of family integration despite rapid changes in socioeconomic structure. It is also characterized by wide discrepan-

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### Table 4. Ordered Logistic Regression Adjusted Odds Ratios for Functional Limitation Severity for Those Reporting at Least One Functional Limitation (N = 1,369)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent’s education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Mid</td>
<td>.77</td>
<td>.80</td>
<td>.82</td>
</tr>
<tr>
<td>High</td>
<td>.99</td>
<td>1.07</td>
<td>1.13</td>
</tr>
<tr>
<td>Child’s education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Mid</td>
<td>.78</td>
<td>.68**</td>
<td>.59**</td>
</tr>
<tr>
<td>High</td>
<td>.69*</td>
<td>.59**</td>
<td>.59**</td>
</tr>
<tr>
<td>Child’s sex</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Female</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male and female</td>
<td>.87</td>
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<td></td>
</tr>
<tr>
<td>Child’s residence status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lives farther away</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coresides</td>
<td>.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lives near by</td>
<td>1.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1.05**</td>
<td>1.05**</td>
<td>1.05**</td>
<td></td>
</tr>
<tr>
<td>Sex (1 = female)</td>
<td>1.04</td>
<td>1.05</td>
<td>1.05</td>
</tr>
<tr>
<td>Marital status (1 = married)</td>
<td>1.14</td>
<td>1.16</td>
<td>1.17</td>
</tr>
<tr>
<td>Residence (1 = rural)</td>
<td>1.15</td>
<td>1.13</td>
<td>1.12</td>
</tr>
<tr>
<td>Ethnicity (1 = mainland)</td>
<td>1.08</td>
<td>1.15</td>
<td>1.18</td>
</tr>
<tr>
<td>Number of living children</td>
<td>1.05*</td>
<td>1.06*</td>
<td>1.08**</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Second</td>
<td>.91</td>
<td>.70</td>
<td>.96</td>
</tr>
<tr>
<td>Third</td>
<td>.59**</td>
<td>.62**</td>
<td>.62**</td>
</tr>
<tr>
<td>Highest</td>
<td>.78</td>
<td>.83</td>
<td>.90</td>
</tr>
<tr>
<td>Missing</td>
<td>1.40*</td>
<td>1.43*</td>
<td>1.42*</td>
</tr>
<tr>
<td>−2 Log-Likelihood</td>
<td>2,741.8</td>
<td>2,709.4</td>
<td>2,704.6</td>
</tr>
</tbody>
</table>

*p < .05; **p < .01.
cies in parent–child education levels, suggesting that an adult child may have the ability to mobilize additional resources that can be brought to bear on the parent’s behalf. The evidence overwhelmingly supports the hypothesis that the educational level of children can be an added influence on their parent’s functional status. Child’s education proved to be important in two ways. First, it had an important additive influence on the existence of a functional limitation. Second, when examining severity, child’s education was shown to be the crucial determinant. Conversely, the education of an older adult was a significant determinant in predicting the existence of functional limitations—a finding that has been found consistently in the literature—but not the severity of the limitations. This distinction has gone unobserved in previous research, likely because existence and severity have not generally been isolated in predictive models. Because a majority of older adults have no limitations, results from any conceptualization of functional status that does not separate existence and severity would be heavily weighted toward no limitations versus any limitations, whereas the specific determinants of the level of severity, among those with any limitations, may go unnoticed.

As noted, the significance of an older adult’s education on the existence of a functional limitation confirms much previous research, this time in Taiwan. The results for the severity of limitations shed some further light on the determinants of functional status among this sample of older adults and allow us to speculate further on the dynamics involved. The function of own level of education on late life functional status in Taiwan may be mainly one of prevention. Education is determined early on in life, and for older adults, the influence of education is a life-long phenomenon. Lifestyle factors could influence individuals from an early age. These include health behaviors, such as eating a healthy diet or partaking in activities and exercise. Next, there is a broad range of psychosocial phenomena, including stress, an important determinant of health (Pearlin, 1989); locus of control, or a sense of control over the course of one’s life; environmental factors, some of which may be related to occupation; and social support (House et al., 1994). There also are resources that become available and can be used throughout life that allow for access and use of health services. Those with higher education can better afford quality and more constant medical care throughout life. These influences can serve to ward off potential health problems that relate to physical functioning in later life.

The associations with severity substantiate the role of family in the progression of limitations once they arise. In Chinese societies, in which filial piety is a moral obligation, the health care of an older adult is the responsibility of the family. Once a functional limitation occurs, the resources, knowledge, and assistance that can be provided by adult children come into play, and it appears from our results that the type of resources that become mobilized are captured well by the education of the most highly educated child. Those with more highly educated children gain similarly with respect to the level of severity regardless of their own education, and the gain is related to the level of the children’s education. This suggests that, when a parent is ailing, the quality of the child’s assistance in caregiving and ar-

ranging care, the financial resources that they can mobilize, and their advice on how to deal with a given ailment can determine the course of the disorder. A possible specific mechanism associated with children’s resources is that more highly educated children are more likely to be employed in situations in which they have health insurance, and it was not uncommon in Taiwan (prior to the 1995 enactment of the Universal Health Plan) to allow parents as well as children to be listed as dependents, making them eligible for coverage.

Several competing hypotheses to that proposed here must be considered. One is that the lack of significance in parent’s education on severity is a statistical artifact due to the reduction in the variation in education that occurs when eliminating a good proportion of the more highly educated people who have no limitations in the second part of the analysis. In response we note that although there is a strong association between the educational level of the respondents and the existence of a limitation, there was a sufficient number of cases of more highly educated parents with a limitation to support the two-stage strategy. In addition, the sensitivity tests we conducted that did not use the two-step strategy reaffirm the importance of children’s education vis a vis the parents’. Indeed, our findings can be interpreted as establishing the importance of tracing the health implications of the strong education generation gap and the rapid widening of educational opportunities currently in place in Taiwan. Although the educational level of children is correlated with the educational level of their parents in Taiwan as elsewhere, the changing opportunity structure means that more than 20% of older adults with no education have children who are college educated. It is reasonable to expect that the resources and knowledge possessed by these children would benefit the health outcomes of their parents as well as other aspects of their parents’ lives.

Another competing possibility is the existence of an endogenous association between the goals of educating a child and the resources, attitudes, and practices of a parent that also promote his or her good health. It may be that parents who have been attentive to maintaining their own health through use of available health care facilities and knowledge would also be those most likely to be attentive to the rapidly widening educational opportunities in Taiwan and to be most successful in furthering their children’s educational attainment. It is also possible that the mechanism hypothesized above—of the mustering of resources at the time of limitation—is misplaced in time. In a society like Taiwan, with frequent contacts between parents and children, the high level of education among children may redound to the advantage of parents’ health throughout their later life. If so, it does not negate the benefits of the child’s education but suggests additional mechanisms at work. The fact that proximity of the children with higher education was not itself significant in the analysis runs counter to this possibility, but more testing along these lines is in order.

Despite these cautions, the hypothesis advanced here is that the quality of children’s resources, as reflected in their education, that can be mobilized at the time of parental functional limitation is influential in the progression of that limitation. Our findings that children’s education is more strongly
associated with the severity of the limitation than is its presence and that parental education ceases to be significantly related to severity point strongly in this direction. Nevertheless, much more testing remains to be done in terms of replication as well as in terms of more detailed data collection. There are opportunities for replication in several directions. A number of developing and newly industrialized countries are similar to Taiwan in the rapid broadening of educational opportunities in recent decades, making for substantial differences between the education of the current older population and their children, as well as minimizing the level of educational correlation between parents and children. Many of these societies also have strong norms for support of parents by children and high levels of coresidence, though there is also a fair degree of variation on these dimensions. It would be of considerable interest to replicate the type of analysis presented here across a set of these countries to observe how consistently and strongly the role of children’s education emerges and whether this association varies with indicators of family norms and structures. Another replication of interest would be for the United States and other Western industrial societies where educational differences between generations will be less, on average, and where there is some debate about the nature and changes in family solidarity (Luescher & Pillemer, 1998). It may be that despite a narrower educational generation gap, parents in the United States benefit from children’s greater sophistication in health matters as well as the children’s knowledge of the health system. Observing the degree to which children’s education matters with regard to parental health across different cultural environments can be helpful for understanding the effects of stratification on older adult health as well as for understanding the nature and function of family interactions and solidarity. Including diverse ethnic groups within the United States that are marked both by cultural heterogeneity and differential intergenerational educational patterns might be particularly revealing.

In addition to appropriate replications using similar data, there is the need for more nuanced data collection that focuses on measuring the degree and form of family mobilization that takes place on the onset of a limitation and the relation of those resources to the health outcomes. This would most likely require a combination of qualitative and quantitative longitudinal measurements involving both older adults and key family members. Such research, although challenging, would greatly elucidate the family caregiving and decision processes associated with the onset of disorders among older adults, but it would also allow a more detailed examination of how the characteristics and resources of family members interact with those of the older individual to affect health outcomes. The research presented here suggests that this aspect of family dynamics merits much more attention.

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