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Children's Education and Parents' Trajectories of Depressive Symptoms

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Abstract

Using five waves of the Taiwanese Longitudinal Study of Aging (1996–2011), we investigate (a) the association between family members' education and the age trajectories of individuals' depressive symptoms and (b) gender differences in those relationships. Our examination is guided by several theoretical frameworks, including social capital, social control, age-as-leveler, and resource substitution. Nested models show that having a more educated father is associated with lower depressive symptoms, but the relationship disappears after controlling for respondent's education. Including spouse's education attenuates the coefficient for respondent's education. A similar pattern appears when children's education is added to the model. Among all the family members, children's education has the strongest association with depressive symptoms, with a similar magnitude for both genders, although its strength gradually weakens as respondents age. Our findings suggest the importance of the transfer of resources from children to parents and how it may affect mental health at older ages.

Keywords

Family; Offspring; Gender; Education; Mental Health

The benefit of education for individuals' mental health is well documented. With increasing educational attainment, individuals experience less psychiatric morbidity (Kessler et al. 2005) and lower levels of psychological distress (Ross and Mirowsky 2006). The education of family members can also be beneficial because having close social ties with people of higher socioeconomic status (SES) may protect mental health by strengthening subjective social status, providing social support, and facilitating health-promoting lifestyles (Christakis and Fowler 2008; Goldman et al. 2006; Lewis and Rook 1999; Song 2011). Prior

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work, however, has focused mainly on individuals' own education. The small number of health studies related to family members' education has focused mainly on the association between parents' or a spouse's education and physical health, with a few focusing on mental health (e.g., Brown et al. 2014; Luo and Waite 2005). Recent empirical studies have pointed out that an investment in an offspring's schooling may potentially improve parental longevity (Friedman and Mare 2014; Torssander 2013; Zimmer et al. 2007), yet the effect of an offspring's education on the mental health of parents has received little attention.

We incorporate several theoretical approaches to investigate the association between family members' education and mental health at old ages. Guided by the theory of social capital as well as by previous health research (Song and Lin 2009), we hypothesize that having well educated family members is beneficial for the mental health of older adults. Integrating social control theory with a life course perspective (Umberson et al. 2010), we predict that the most influential resource in the family changes throughout the life course from parents, to spouse, to adult children. Thus, we predict children's education should have the strongest association with mental health of older adults. Based on the age-as-leveler hypothesis (e.g., Dupre 2007), we expect that the observed association may diminish as individuals age. The theory of resource substitution (Ross et al. 2012) suggests that individuals with fewer resources (e.g., power, authority, and earnings) are more likely to benefit from resources alternative to their own. Given the lesser status of women in many cultures, we hypothesize that the association between children's education and the mental health of parents is a stronger relationship for women than men.

Data come from five waves (1996 – 2011) of the Taiwanese Longitudinal Study of Aging (TLSA), which consists of older adults who were born before 1947. TLSA provides a unique opportunity to test our hypotheses because in Chinese society (a) both education and family integration are highly valued, (b) the cultural norm of filial piety places responsibility for the care of elderly parents with adult children, and (c) women born in the first half of the twentieth century had fewer opportunities for education and employment than men, which might make support from well-educated children particularly important for their mental health. The present study is among the first to assess the mental health of older adults in relation to the education of family members, particularly adult children. Our findings provide insight into the potential psychological benefits of the upward transfer of family-level resources across generations.

BACKGROUND

Family Resources and Health

Since Durkheim's work on social integration and suicide ([1897] 1951), a large body of research has documented the strong influence of social relationships on the physical and mental health of individuals (Thoits 2011). The family is among the most significant institutions that affect individuals' health, as its strong social ties can provide socioeconomic and psychological resources (Carr et al. 2014). Although most support from family members is beneficial, the quality or efficacy of the resources that individuals receive from family members likely varies by the resources that their family members possess. Work on social capital and health, which highlights the importance of network members' resources to health

outcomes (Song and Chang 2012; Song and Lin 2009), suggests that educational levels and occupational prestige of network members, including family members, are positively associated with mental health. For example, a study of individuals living in a midsized southern city in the United States documented that the average education of network members was inversely associated with depressive symptoms (Haines et al. 2011). Similarly, using nationally representative data from the United States, studies have reported that the average level of education of network members is associated with greater life satisfaction and less anomie (Acock and Hurlbert 1993), and that the average level of occupational prestige of network members is negatively associated with depressive symptoms (Song 2011). Findings from these studies remain significant even after adjusting for an individual's own SES, indicating that the mental health benefits of the socioeconomic resources arising from close social ties are distinct from those from personal resources.

Social support and social control may be the most common means whereby family members affect an individual's health. For instance, emotional support may encourage healthy behaviors and increase an individual's capacity to cope with stressors; instrumental support (e.g., financial aid) and informational support (e.g., dietary advice) may also improve an individual's overall health (House et al. 1985; Thoits 1995). Family members may control and attempt to improve one another's health by nudging each other toward better health behaviors or by questioning unhealthy life styles (Lewis and Rook 1999; Umberson 1992). However, frequent criticism or excessive demands from family can also be a source of conflict, increasing psychological distress and leading to poor health outcomes (Newsom et al. 2005). Well-educated individuals tend to have healthier lifestyles, greater health knowledge, and better proficiency at negotiating health care services (Mirowsky and Ross 2003; Ross and Wu 1995). In addition, well-educated individuals are likely to experience fewer stressful life events, have higher levels of social support, and mobilize social support more effectively (Eckenrode 1983; Gecas and Seff 1989). Therefore, individuals who have well-educated family members may have better mental health than those with less educated family members.

> ***Hypothesis 1***: The education of family members is positively associated with the mental health of individuals even after accounting for a respondent's own education.

Changes in Family Influence on Health over the Life Course

The primary family members who shape an individual's health may change over the life course—from parents, to partners, to adult children. From childhood to young adulthood, parents have a strong effect on their children's wellbeing by providing them with socioeconomic resources and by monitoring their health-related behaviors (Steinberg and Morris 2001). Some studies found that the effect of childhood SES may persist well into adulthood (Gilman et al. 2002), although the effect may diminish at the oldest ages (Moody-Ayers et al. 2007). Marriage may result in a decline of parents' influence on health because marital partners tend to assume the leading role in monitoring one another's health (Umberson 1992). Married couples tend to have strong social, financial, legal, and emotional bonds and often exchange socioeconomic resources to maximize not only their own wellbeing but also that of their spouse (Brown et al. 2014). Having a more educated spouse

is associated with a lower risk of mortality (Jaffe et al. 2006) and better self-rated health (Brown et al., 2014). Studies have shown that mental health status is correlated between spouses (Siegel et al. 2004). Such an association may be partially attributable to assortative mating (i.e., men and women are more likely to choose partners of similar SES), yet recent studies have indicated a spillover effect of mental health from one spouse to the other (Fletcher 2009).

The intergenerational influences from parents to children may flow in the opposite direction as children mature (Silverstein et al. 2002). Using data from Taiwan, Zimmer et al. (2002) were the first to report a significant association between children's education and their parents' functional limitations, particularly for older adults who have severe limitations. Zimmer et al. (2007) found that for Taiwan—where older parents tend to rely on their children's support in later life—higher educational levels of both older adults and adult children reduce the risk of older adults' mortality, but children's education appears to be more important, mainly for parents who have serious health conditions. Findings from the United States are consistent: Friedman and Mare (2014) reported that children's education has an effect on parents' mortality that is independent of parents' own education, although the effect weakens over the life course. Torssander (2013) found similar results in Sweden, where older adults who have children with tertiary education have a lower risk of mortality than those who have children with only compulsory schooling, even after controlling for education and other SES characteristics of parents. In short, studies from both Eastern and Western societies have highlighted the importance of children's education for determining health of older adults.

Well-Educated Children and Psychological Rewards to Elderly Parents

Though mental health disorders represent four of the ten leading causes of disability worldwide (WHO 2001), few studies have investigated the association between children's education and the mental health of older adults. There are at least three reasons for examining this association. First, having well-educated children may be psychologically rewarding by strengthening perceived SES for older parents. The socioeconomic resources that drive from strong social ties affect people's perception of their place in the social hierarchy: the more network resources individuals have, the higher their perceived social class identity (Hodge and Treiman 1968). This pattern may be more pervasive in societies like Taiwan, where family integration and educational achievement are strongly emphasized (Hsu and Wu 2015), and where adult children transfer extensive resources to their elderly parents (Lee et al. 1994). For example, Goldman et al. (2006) reported that the educational attainment of the most educated child has positive effects on the subjective social status of older adults in Taiwan even after accounting for other SES measures, including income and occupational prestige. Subjective social status, in turn, is a powerful predictor of mental health. Some studies have indicated that it predicts both current and future depressive symptoms, with a stronger association than material indicators of SES (Adler et al. 2000; Collins and Goldman 2008). Other studies have found that subjective social status partially mediates the association between network resources and psychological distress (Song 2011).

Second, having well-educated children may promote the mental health of older parents by reducing their exposure to stressors. According to the stress process model (Pearlin 1989), differential exposure and vulnerability to stressors play key roles in socioeconomic disparities in health. Stressful life events are likely to disproportionately affect individuals with lower SES who have fewer stress-dampening resources, less effective coping strategies, and weaker psychological fortitude (Thoits 2010). The stress spillover hypothesis suggests that strain encountered by one member of a dyad can affect the stress level of the other (Pearlin 1989; Thoits 1995). As well-educated children have stable jobs and earnings, they may be less likely to be a source of anxiety for their parents (Ryff et al. 1994). A recent study found that when adult children experience illness and unemployment, the depressive symptoms of their elderly parents increase, indicating that adult children and their elderly parents have “linked lives” (Milkie et al. 2008).

Finally, well-educated children may promote the mental health of older parents by providing various forms of social support. Such support may be particularly important for psychological wellbeing in old age, when individuals experience dramatic life transitions, such as involuntary retirement or the loss of a spouse. Higher levels of children’s educational attainment may expose parents new health-promoting knowledge and facilitate the adoption of a healthy lifestyle and the avoidance of unhealthy behaviors. Specifically, compared with children with less education, those with more education may be more likely to encourage their parents to quit smoking, exercise regularly, consume fresh vegetables, and obtain physical check-ups. They may use their resources to find timely and superior health care services for their ill parents. A prior study has shown that parents who have well-educated children are less likely to engage in unhealthy behaviors, such as smoking and inactivity (Friedman and Mare 2014). In addition, well-educated children may provide financial assistance, which may shield their parents from experiencing economic difficulties (Xie and Zhu 2009) or at least buffer the negative impact of any financial hardships they may experience. This line of research leads us to expect the following:

> ***Hypothesis 2***: Children’s education has a stronger positive association with the mental health of older adults than other family members’ education.

Children’s Education and Parental Mental Health across the Life Course

The Friedman et al. (2004) study is one of only a few that has investigated whether the association between children’s education and older parents’ heath changes across life course stages. There are two competing theories of how and why the association varies over the life course. Based on cumulative advantage/disadvantage theory (for reviews, see DiPrete and Eirich 2006), studies have indicated that health disparities by education increase with age (Miech and Shanahan 2000; Ross and Wu 1996). Thus, children’s education may be more salient in old age, possibly because parents with poorly-educated children have greater cumulative exposure to stressors over the life course, coupled with fewer resources for coping and poorer health practices. In contrast, the age-as-leveler perspective suggests that health and mortality differentials at earlier ages will decrease with increasing age due to selective mortality and attrition among poorly-educated individuals (Beckett 2000; Dowd and Bengtson 1978; House et al. 2005). Using data from Taiwan, Zimmer et al. (2007) found that parents with poorly educated children have a higher mortality rate than those with well-

educated children. Differential attrition may therefore lead to a reduced gap in mental health between these two groups over time. In addition, age-related biomedical frailty may overshadow the effect of educational differences on psychological wellbeing (Crimmins et al. 2009). Zajacova et al. (2009) used simulation models to show that even if individuals experienced a cumulative advantage of education with increasing age, selective mortality could result in a progressive weakening of the education differential in health at the older age. Accordingly, we expect that:

> ***Hypothesis 3:*** The association between children's education and the mental health of older parents becomes weaker in old age.

Gender Differences

Whether men and women receive the same benefits from the educational attainment of family members remains an open question. Findings from prior studies, which are based primarily in Western societies, have shown that parents' socioeconomic resources have protective effects on health for both genders (Galobardes et al. 2004). Still, results regarding the role of spouses' education have been mixed. Studies conducted in Europe, Israel, and China have shown that wives' education is beneficial for men's health (Jaffe et al. 2006; Li et al. 2013; Monden et al. 2003). Other studies in the United States have suggested that wives' education is negatively associated with men's health (Suarez and Barrett-Connor 1984). A possible explanation may be that well-educated wives are likely to be breadwinners, which may harm the stereotypical masculinity ideal of the 'male provider' and result in adverse health for their husbands (Springer 2010). Nonetheless, research on husbands' education and wives' health is unambiguous: it has consistently shown protective effects on women's health across countries (Li et al. 2013; Wilson 2002). Regarding children's education, Torssander (2013) found that the inverse association between children's education and parental mortality risk was stronger for women than men in Sweden, although it was not statistically significant.

The theory of resource substitution (Ross et al. 2012) suggests that the health benefits from family-level resources may be conditional upon an individual's own resources. Using data from Taiwan, Song and Lin (2009) have found that the association between network members' occupational prestige and individuals' mental health is stronger for individuals with less education. In other words, individuals who are poorly educated may benefit more than those who are well-educated from having ties with high SES individuals. In Taiwan, many women who were born before 1950 are illiterate and have never worked outside the home or the family farm (Goldman et al., 2006). Therefore, the mental health of these women may be more sensitive than men to the resources of other family members. In addition, studies based on network stress theory have indicated that older women in Taiwan are more vulnerable than older men to network events that happen to family members, such as illness and death (Lee et al. 2014a; Lee et al. 2014b). Therefore, for women born in the first half of the twentieth century, having well-educated children may mitigate exposure to stressors and sustain good mental health in later life. Accordingly, we propose that:

> ***Hypothesis 4***: Women are more likely than men to benefit psychologically from family members' education—particularly their children's education.

METHODS

Data

The current study included participants in the Taiwanese Longitudinal Study of Aging (TLSA), a nationally representative survey designed to assess the health of older people in Taiwan. TLSA began in 1989 with a cohort aged 60 and older (n = 4,049). In 1996, a younger refresher cohort aged 50 – 66 (n = 2,462) was added. Follow-up interviews were completed every 3 to 4 years. We used both cohorts, including all five waves from 1996 through 2011 (response rates: 88 – 92%). A total of 5,131 respondents aged 50 and older were interviewed at baseline (1996). Detailed information about the survey is provided elsewhere (Chang et al. 2012).

Measures

Education—We used the baseline wave of TLSA to determine educational attainment of the respondent and family members. Respondents reported years of education, ranging from 0 to 17, for each of their family members—father (mean = 1.80, SD = 3.52), spouse (mean = 4.61, SD = 4.34) and children (mean =10.69, SD = 3.22), as well as their own education (mean = 4.69, SD = 4.55). Correlations between each family member's education range from .31 (father and respondent's child) to .53 (respondent and child). As Taiwanese education systems were not uniform across the three generations, a year of schooling may not be strictly comparable across generations. To facilitate meaningful comparisons, we standardized the measure of education for each family member in the pooled sample (mean = 0 and standard deviation [SD] = 1). Since most respondents had multiple children (mean = 4.35, SD = 1.82), there were many possible ways to measure the education of children. We used the average educational attainment of all living children. In preliminary analyses, we considered two alternatives: maximum and minimum educational level of all living children. Our findings were generally consistent across measures, although the association between children's education and parental depressive symptoms was strongest using the average and weakest using the minimum.

Depressive symptoms was measured by a 10-item subset of the 20-item Center for Epidemiological Studies Depression scale (CES-D) (Radloff 1977). Respondents were asked how often in the past week they experienced negative situations or feelings that fall into four domains: 1) somatic symptoms (poor appetite, everything is an effort, poor sleep, and no energy), 2) depressive affect (bad mood, lonely, and sad), 3) interpersonal relations (people are unfriendly), and 4) positive affect (feel happy, and life is going well). Possible responses for each item range from 0 ("rarely or none of the time [less than 1 day]") to 3 ("most or all of the time [5–7 days]"). The composite CES-D score was obtained as a sum of the 10 items. Cronbach's alpha for these ten items for the five survey waves was .83. In both Western and Eastern populations, shortened forms of the CES-D scale demonstrate similar internal consistency, factor structure, and accuracy in detecting depressive symptoms versus the full 20-item CES-D scale (Andresen et al. 1994; Cheng and Chan 2005). The distribution of CES-D scores was positively skewed. To reduce the skewness, we applied the natural log transformation to CES-D scores. Since the log of zero cannot be calculated, we first rescaled

the CES-D scores by adding one. To compare effect size across models, we standardized log (CES-D).

Covariates—We included seven controls in all models: 1) age (the underlying time-scale), 2) gender, 3) marital status (married/cohabitating vs non-married), 4) residential area (rural vs non-rural), 5) co-residence with children, 6) number of living children, and 7) whether the respondent's youngest child is under age 25. Some respondents had children who were still young at baseline and had not completed their schooling. Thus, we set the age cutoff for the respondent's youngest child at 25, because most Taiwanese complete their higher education/certification (e.g., college) by that age. Although some of these control variables (e.g., marital status and co-residence with children) may change over time, we cannot determine the temporal order of changes in these variables relative to depressive symptoms. For example, an increase in depressive symptoms for a respondent may have led to changes in his or her living arrangements. Consequently, we used baseline values for all covariates to avoid potential biase stemming from reverse-causality.

Analytic strategy

We limited our sample to respondents who had a child at baseline (n= 4,937; 96% of the baseline sample). Among them, 2,416 (49%) died prior to the 2011 survey and another 502 (10%) were lost to follow up (LFU) for at least one wave between 1996 and 2011. Nonetheless, we included all respondents who were interviewed in any wave (1996, 2003, 2006, 2008, or 2011), even if they ultimately died or were otherwise LFU. Among those who survived and participated at any given wave, about 20% of respondents had missing data for at least one variable. The range of missing information for individual variables varies, for example father's education (8%), spouse's education (≤ 2%), children's education (≤ 1%), and CES-D (7 – 11%). Most individuals with missing data were interviewed by proxy and, thus, were not administered the CES-D.

Using the *ice* command in Stata (StataCorp 2013), we performed multiple imputation (five imputations) at the individual level to predict missing values for all variables in the analysis. We used "multiple imputation, then deletion" (MID), i.e., we generated imputed values, including dependent variables (MI), and then deleted observations with imputed dependent variables. Von Hippel (2007) has argued that, compared with conventional MI, MID gives more accurate estimates of standard error and is more robust to problems in the imputation model. After deleting observations for which the CES-D was imputed, the analysis sample included 16,188 observations across five survey waves, representing 4,716 respondents with an average of 3.4 observations per respondent. Respondents (n = 221) with no valid CES-D score in any of the five waves were omitted from the final models. After performing multiple imputation, we reconstructed indexes using the imputed data for individual components. We then used the *mim* prefix command to estimate the model for each imputed dataset and combine the five sets of estimates using Rubin's rules (Royston 2005; Royston et al. 2009).

We used multilevel growth curve models to estimate the age trajectory of depressive symptoms (Raudenbush and Bryk 2001; Singer and Willett 2003). Given the importance of aging effects on depressive symptoms, age was used for the underlying time-scale. Thus, we

used repeated measures of the CES-D score across five survey wave (15 years) to model individual- level age trajectories of depressive symptoms and determine whether covariates measured at baseline influenced subsequent age trajectories of depressive symptoms. To facilitate parameter interpretation, we centered age at 65 (i.e., setting 65 to 0) and the number of living children at the sample mean; therefore, the intercept can be interpreted as the mean of log CES-D (standardized) at age 65 for an individual who is in the reference group for each of the categorical variables with mean values for all continuous variables. In a preliminary model, we found no evidence that the age trajectory followed a non-linear pattern. Thus, we modeled the age trajectory as linear within the age range of the sample for all analyses (50 to 106). Gender was allowed to affect both the intercept and the slope components. All models were estimated in Stata 13.1 using the *xtmixed* procedure with the maximum likelihood estimator (StataCorp 2013).

Our analyses followed a two-step procedure to investigate the extent to which the educational attainments of family members were associated with the intercept and age slope of CES-D scores, while controlling for time-invariant covariates measured at baseline. First, we assessed whether the education of *each* family member (Table 2, Models 1 through 4) was significantly associated with (1) the intercept and (2) the age slope by including the age interaction term. We then tested whether there were gender differences in the associations by adding the gender interaction term. Second, we estimated a series of nested models by adding father's education first, then respondent's, then spouse's, and finally children's education to test Hypotheses 1 and 2 (Table 3, Models 1 through 4). Significant age interaction terms were added to Model 5 to ascertain whether the age slope for depressive symptoms varied by family members' education (Hypothesis 3). Finally, we included any significant gender interaction terms to determine whether the effects of family members' education varied by gender (Hypothesis 4; Table 3, Models 1 through 3).

Before estimating the models presented here, we conducted several preliminary analyses (supplementary Tables S1 and S2). First, we tested whether associations between family members' education and depressive symptoms depended on the respondent's own education (e.g., Ross and Mirowsky 2011). Because none of the interaction terms between a respondent's and family members' education was significant, they were not included in the models. Second, to reduce the possibility that unmeasured SES characteristics determine both children's education and parent's depressive symptoms, we added three potential confounders—the occupational prestige of the father, respondent, and spouse—to the models. None of these variables was significant, thus they were not included in any of the models shown here. Third, because prior studies have indicated that physical health problems are correlated with depressive symptoms (e.g., Lin et al. 2011), we explored models that controlled for the number of chronic diseases reported at baseline. Even after including controls for physical health, our key findings remained the same. Fourth, we tested whether our substantive conclusions changed when we allow the other covariates (e.g., marital status and co-residence with children) to affect the slope component. This auxiliary analysis demonstrated that our key findings are robust: children's education has a stronger positive effect than other family members' education on the mental health of older adults. Finally, since education became more widespread over time, we tested whether the effect of children's education differed between respondents from the older cohort (b. 1898 – 1928)

and the younger refresher cohort (b.1929 – 1946). The effect of children's education did not differ significantly by cohort.

RESULTS

Table 1 presents descriptive statistics for men and women who had at least one child in 1996. Women had higher scores on depressive symptoms than men. There were substantial gender gaps with regard to educational attainment. While the average woman completed only 2.81 years of schooling, the average man completed 6.40 years. Similarly, average years of education were 5.32 for respondents' husbands and 3.97 for respondents' wives.

Table 2 displays growth curve estimates of depressive symptoms (standardized log CES-D scores) by each family member's education. All of the models included the following covariates: gender, marital status, residential area, co-residence with children, number of living children, and whether the respondent has a child under age 25. In Model 1a, father's education was inversely associated with depressive symptoms: a one SD increase in father's education was associated with .073 of a SD decrease in log (CES-D). The observed association did not vary by age or gender (Models 1b and 1c). Similarly, there was a negative coefficient of respondent's education in Model 2a ($\beta = -.179$; $p < .001$). The age interaction term was not significant (Model 2b), yet the negative gender interaction term ($\beta = -.062$; $p < .05$) indicated that the inverse association between respondent's education and depressive symptoms was larger for women than men (Model 2c). In Model 3a (spouse's education), a one SD increase in spouse's education was associated with .158 of a SD decrease in log (CES-D). Neither interaction term with spouse's education was significant. Finally, Model 4a suggests some potential benefits of children's education ($\beta = -.209$; $p < .001$). The interaction term between age and children's education was positive and significant ($\beta = .005$; $p < .001$), indicating that the education differential in CES-D scores diminished with age (Model 4b), yet there was no significant gender difference (Model 4c). The positive associations between the education of family members and the mental health of older adults shown in Table 2 provide support for Hypothesis 1. However, we found little evidence to support Hypothesis 4: only one gender interaction—with the respondent's own education—was significant.

Table 3 displays a series of nested models. Model 2 adds respondent's own education to Model 1 (father's education). The coefficient of father's education decreased from −.073 to −.009, indicating that respondent's own education largely mediated the association between father's education and depressive symptoms. The interaction term between gender and respondent's schooling was negative ($\beta = -.061$; $p < .05$), indicating a larger inverse association for women than men. In Model 3, we find that having a more educated spouse was significantly associated with lower levels of depressive symptoms after taking father's and respondent's education into account. The coefficient of respondent's education continued to be significant, although the magnitude was attenuated and the gender interaction term was no longer significant. Model 4 adds children's education to Model 3. Although both respondent's and spouse's education remained statistically significant, the magnitude of the coefficient for children's education was greater than the corresponding coefficients for respondent's education ($p < .01$) and spouse's education ($p < .01$). With the

inclusion of children's education in Model 4, the coefficient of spouse's education was attenuated by 43% compared with Model 3. Similarly, the association with respondent's education weakened by 32% for men and 30% for women, compared with Model 3. To summarize, we found that even after accounting for an individual's own education, the education of all family members except fathers' was negatively associated with depressive symptoms (Hypothesis 1) and the association was strongest for children's education (Hypothesis 2).

In Model 5, we found that the association between a child's schooling and parental depressive symptoms diminished as parents age, thus supporting the age-as-leveler hypothesis (Hypothesis 3). The interaction term between age and children's education was positive and significant even after accounting for other family members' education. In Figures 1a and 1b, we illustrate the association between three values of the children's education variable (one SD above the average, the average, and one SD below the average) and the age trajectories of CES-D scores for men and women, based on the coefficients in Model 5. Specifically, men whose children have about 14 years of schooling (one SD above the average level of education) are predicted to score .288 of a SD below the mean on the log (CES-D) at age 50, whereas those whose children have about 7 years of schooling (one SD below the average level of education) are predicted to score .190 of a SD above the mean (Figure 1a). Similarly, among women with well-educated children (~14 years of schooling), the log (CES-D) is close to the mean at age 50 *vs.* one half of a SD above the mean for women with poorly-educated children (~7 years of schooling). For both genders, the gap narrows as age increases so that by age 85, there is only about one-fifth of a SD difference in the log (CES-D) between parents with well-educated children and those with poorly-educated children (Figure 1b).

DISCUSSION

Close social relationships, such as family ties, have important health consequences, and a growing body of research has shown that the socioeconomic resources of family are an important determinant for individuals' health over the life course. Using a nationally representative sample from Taiwan, this study examined the extent to which family members' education is associated with mental health and whether those associations differ by gender. Based on the theory of social capital, we proposed that the educational attainments of family members matter above and beyond a person's own education (Hypothesis 1). As predicted we found that individuals with well-educated family members had better mental health.

Motivated by a life course perspective and social control theory, we further expected that the primary agent of this association would change over the life course and that the education of children, as opposed to other family members, would have the strongest association with mental health at older ages (Hypothesis 2). Indeed, we found that the association between children's education and depressive symptoms was the strongest among the various family members, although the coefficients for the respondent's and spouse's education remained significant. Our findings are in line with evidence from recent studies, which have suggested that children's education has an independent association with parental health after taking the

respondent's own SES into account (Friedman and Mare 2014; Torssander 2013; Zimmer et al. 2007). At the same time, we expanded on prior studies by taking into account the educational resources of family members across three generations.

Does the effect of children's education on the mental health of older adults change over the life course? Supporting Hypothesis 3, our findings show that the gap in depressive symptoms between parents with well-educated children and those with poorly-educated children decreased in later life. To confirm the robustness of these findings, we repeated the analysis using two alternative samples: 1) respondents with at least three measurements for CES-D and 2) the sub-group aged 65–84. We also considered a binary cutoff for CES-D scores (Andresen et al. 1994) instead of continuous scores. These analyses produced results similar to those described above. While the age-as-leveler hypothesis helps to explain the declining effects of children's education over time, there may be other explanations for these results. For example, our finding may be partially driven by reverse causality. That is, respondents may have developed depressive symptoms before their children completed their schooling, which may have negatively affected their children's educational attainments. This problem of endogeneity is more likely to be evident among middle-aged respondents (whose children may still be attending school) than the oldest respondents (most of whose children completed their schooling decades ago). Respondents' level of depressive symptoms at age 85 is probably not representative of their symptoms 30 or 40 years earlier when they were raising and educating their children because other factors that contribute to depressive symptoms, such as health issues, may have developed later in life. Given that we have no information regarding respondents' depressive symptoms during young adulthood, we cannot investigate this possibility.

Based on the theory of resource substitution and the cultural context in Taiwan, we anticipated that having well-educated children would be more beneficial for women than men (Hypothesis 4). Contrary to our expectations, the interaction term between children's education and parent's gender was not significant. The association between children's education and the mental health of adults at age 65 was similar in magnitude for men and women and the association weakened for both as they age. Prior work on parental mortality based on data from Taiwan and the United States has not found gender differences in the effect (Friedman and Mare 2014; Zimmer et al. 2007). Using data from Sweden, Torssander (2013) found that mortality risk related to children's education was lower for mothers than fathers, but the association was not statistically significant. We conclude based on this evidence that either: (a) mothers and fathers benefit similarly from having well-educated children or (b) the gender gap is too small to be detected. Since only a few studies have investigated gender differences, with limited health outcomes (e.g., mortality and functional limitations), more work is needed before we can draw firm conclusions about whether the relationship between children's education and parent's health differs by gender.

Our study has limitations. Our analysis reduced potential bias by including an extensive set of covariates and controlling for other SES measures in the family, such as the occupational status of the respondent, spouse, and father (in the models not shown here). Yet, omitted variables, for example, parents' intelligence and their willingness to invest money and time into their children's schooling, may affect both children's education and parents' mental

health and bias our results. In addition, our measures of educational attainment are based on respondents' reports. Compared with other SES indicators, such as occupation and income, education is more reliably reported, more stable over time, and less subjective (Elo 2009), but retrospective reports of family members' schooling are still susceptible to recall bias. Finally, findings from this study may be better understood in light of social, historical, and institutional changes in Taiwan. Older adults who were born before World War II had very limited educational opportunities, but their children benefitted from rapid economic development and compulsory basic education established by 1950 in many areas and subsequently spread widely throughout the population (Thornton and Lin 1994). Intergenerational transfers of educational benefits may not be generalizable to other cohorts. The influence of children's education on parental mental health may be greater in societies like Taiwan, where co-residence of adult children and their parents was common and parents and children have strong ties. Thus, it would be interesting to replicate these analyses using data from societies having different family norms and educational opportunities.

Despite these limitations, the current study extends our understanding of social relationships and mental health by integrating several theoretical frameworks. Social capital derived from family ties can influence the mental health of older adults. Social control theory with a life course perspective is particularly useful for understanding the extent to which family members influence one another during different stages of life. Older adults may receive various forms of support from their grown-up children, indicating psychological benefits that may differ by children's education. Yet, these benefits may diminish at the oldest ages. Taiwan, like other developed countries, has faced rapid social and demographic changes in family structure. The living arrangements of older adults in Chinese society have changed dramatically in recent decades, occurring in tandem with the erosion of the traditional family model of co-residence of married sons with elderly parents (Chu et al. 2011; Logan and Bian 1999). Although older adults may now rely less on their children to ensure their later life wellbeing, having well-educated offspring may be still advantageous to their health. Few studies have explicitly investigated the underlying mechanisms that link children's education to parents' health. More research is needed to illuminate the psychosocial and behavioral pathways that explain how mothers and fathers who have well-educated children maintain their health in old age.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1a

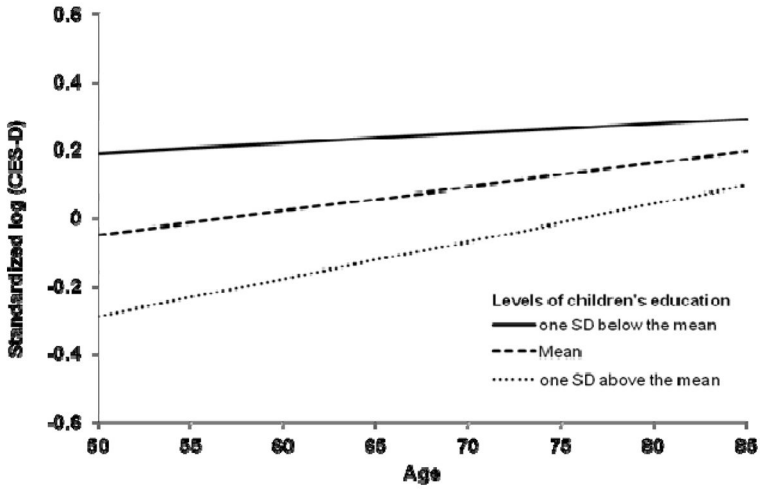

Figure 1b

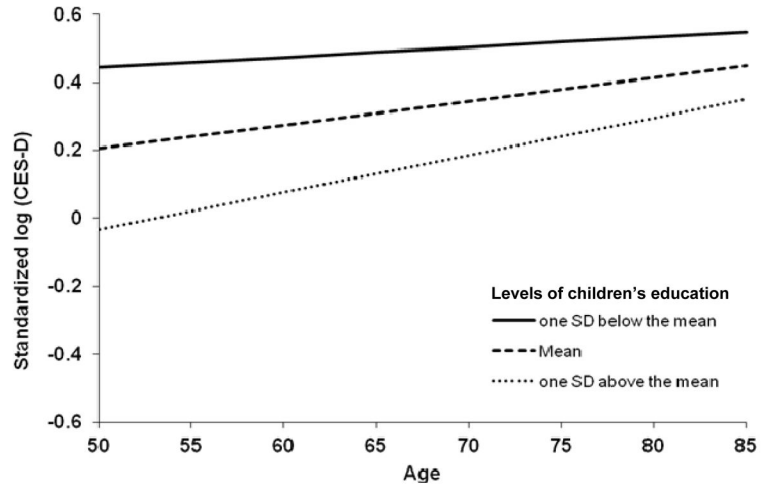

Figure 1.

Figure 1a. Age Trajectories of Depressive Symptoms by Children's Education: Growth Curve Model Estimates for Men

Note. Figure 1a is based on Model 5 in Table 3. The estimated values represent the predicted log CES-D (standardized) at each age for men who were in the reference group for each of the categorical variables (no spouse/partner, lives in an urban area, not living with children, no child under age 25) and who have mean values for continuous variables (average number of living children and mean levels of schooling for each family member).

Figure 1b. Age Trajectories of Depressive Symptoms by Children's Education: Growth Curve Model Estimates for Women

Note. Figure 1b is based on Model 5 in Table 3. The estimated values represent the predicted log CES-D (standardized) at each age for women who were in the reference group for each of the categorical variables (no spouse/partner, lives in an urban area, not living with

children, no child under age 25) and who have mean values for continuous variables (average number of living children and mean levels of schooling for each family member).

Table 1

Means (Standard Deviations [SD]) or Percentages for Analysis Variables by Gender

Variable (observed range)	N	Total (n = 4,716)	Women (n = 2,239)	Men (n = 2,477)	Gender Differences *p*-value
CES-D score (range:0–30), mean (SD)					
In 1996 (aged 50+)	4,532	5.73 (6.03)	6.70 (6.44)	4.86 (5.49)	< .001
In 1999 (aged 53+)	3,835	5.35 (6.01)	6.36 (6.34)	4.41 (5.54)	.003
In 2003 (aged 57+)	3,237	5.22 (5.77)	6.28 (6.24)	4.20 (5.06)	< .001
In 2007 (aged 61+)	2,620	5.24 (5.78)	6.09 (6.11)	4.38 (5.29)	.055
In 2011 (aged 65+)	1,964	5.31 (6.10)	6.40 (6.59)	4.15 (5.30)	.004
Family education (range: 0–17), mean (SD)					
Father's education	4,716	1.80 (3.52)	1.62 (3.32)	1.97 (3.69)	< .001
Respondent's education	4,716	4.69 (4.55)	2.81 (3.72)	6.40 (4.55)	< .001
Spouse's education	4,716	4.61 (4.34)	5.32 (4.54)	3.97 (4.04)	< .001
Children's education	4,716	10.69 (3.22)	10.26 (3.36)	11.07 (3.04)	< .001
Controls at baseline					
Age (range: 50–97), mean (SD)	4,716	65.70 (9.26)	65.58 (9.45)	65.81 (9.09)	.388
Married/cohabitation,%	4,716	74	63	84	< .001
Living in rural area,%	4,716	39	40	39	.455
Co-residence with children,%	4,716	73	74	72	.048
Number of living children (range:1–12), mean (SD)	4,716	4.35 (1.82)	4.55 (1.81)	4.16 (1.82)	< .001
Child under age 25,%	4,716	19	12	26	< .001

Note. Children's education indicates the average educational attainment of all living children.

Table 2

Growth Curve Estimates of Standardized Coefficients of Each Family Member's Education on Log (CES-D)

		(a) Intercept difference by education	(b) Slope difference by education	(c) Gender difference
Model 1	Intercept	−.009	−.010	−.010
Father's education	Female	.292***	.292***	.293***
	Father's education	−.073***	−.073***	−.067***
	Father's education × Female	----	----	−.015
	Linear age slope (Age – 65)	.009***	.009***	.009***
	Female × (Age – 65)	.001	.001	.001
	Father's education x (Age – 65)	----	.000	----
Model 2	Intercept	.071	.077*	.061
Respondent's education	Female	.174***	.170***	.173***
	Respondent's education	−.179***	−.186***	−.155***
	Respondent's education x Female	----	----	−.062*
	Linear slope (Age – 65)	.009***	.008***	.009***
	Female × (Age – 65)	.001	.002	.000
	Respondent's education × (Age – 65)	----	.001	----
Model 3	Intercept	−.026	−.024	−.027
Spouse's education	Female	.366***	.367***	.365***
	Spouse's education	−.158***	−.161***	−.164***
	Spouse's education × Female	----	----	.011
	Linear slope (Age – 65)	.009***	.009***	.009***
	Female × (Age – 65)	.001	.001	.002
	Spouse's education × (Age – 65)	----	.001	----
Model 4	Intercept	.001	.023	.021
Children's education	Female	.285***	.285***	.288***
	Children's education	−.209***	−.240***	−.240***
	Children's education x Female	----	----	.000
	Linear slope (Age – 65)	.008***	.007***	.007***

		(a) Intercept difference by education	(b) Slope difference by education	(c) Gender difference
	Female × (Age – 65)	.001	.000	.000
	Children's education × (Age – 65)	----	.005 ***	.004 **
	Children's education × (Age – 65) × female			.001

Notes.

[a] Models 1 though 4 tested the association between a respondent's depressive symptoms and the education of the father, respondent, spouse, and children, respectively. Prior to model fitting, measures of each family member's education were standardized (to mean = 0 and standard deviation [SD] = 1).

[b] All models control for marital status, residential area, co-residency with children, number of living children, and having a child under age 25 (results not shown) in addition to gender and the education variable specified.

[c] The intercept can be interpreted as the mean of log CES-D (standardized) at age 65 for respondents who are in the reference group for each of the categorical variables (men, no spouse/partner, lives in an urban area, not living with children, no child under age 25) and who have mean values for continuous variables (average number of living children and mean levels of schooling for each family member).

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Table 3

Growth Curve Estimates of Standardized Coefficients of Family Members' Education on Log (CES-D)

	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	−.009	.060	.033	.031	.056
Female	.292***	.175***	.248***	.251***	.254***
Father's education	−.073***	−.009	.001	.004	.005
Respondent's education		−.152***	−.110***	−.075***	−.086***
Spouse's education			−.088***	−.050**	−.051***
Children's education				−.147***	−.179***
Respondent's education × Female		−.061*	−.044	−.033	
Linear slope (Age – 65)	.009***	.009***	.009***	.008***	.007***
Female × (Age – 65)	.001	.000	.000	.000	.001
Children's education × (Age – 65)					.004***

Notes.

[a] All models control for marital status, residential area, co-residence with children, number of living children, and having a child under age 25 (results not shown) in addition to gender and the education variable specified. Prior to model fitting, measures of each family member's education were standardized (to mean = 0 and standard deviation [SD] = 1)

[b] The intercept can be interpreted as the mean of log CES-D (standardized) at age 65 for respondents who are in the reference group for each of the categorical variables (men, no spouse/partner, lives in an urban area, not living with children, no child under age 25) and who have mean values for continuous variables (average number of living children and mean levels of schooling for each family member).

[c] Model 5 includes an age interaction with children's education but not age interactions with other family members because those interactions were not significant.

* $p < .05$,

** $p < .01$,

*** $p < .001$

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