



Published in final edited form as:

Aging Ment Health. 2013 ; 17(6): 773–783. doi:10.1080/13607863.2013.781119.

Sex differences in trajectories of depressive symptoms among older Taiwanese: the contribution of selected stressors and social factors

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Abstract

Objectives—We assessed female-male differences in depressive symptoms among older Taiwanese and quantified the contribution of sex differences in exposure and response to selected covariates in explaining the gap.

Methods—Using data from six survey waves over 18 years for a nationally representative cohort of 4049 Taiwanese aged 60+, we employed growth curve analysis to model individual-level trajectories of depressive symptoms across age.

Results—Among older Taiwanese, women’s disadvantage with respect to social position and employment accounted for about 40% of the sex difference in depressive symptoms. Sex differences in decision control and exposure to widowhood and financial decline played surprisingly little role. Although we found no evidence that the effects of marriage, recent widowhood or recent child death varied by sex, living apart from one’s children appeared to be more detrimental for women than for men in this society. Moreover, the effect of living with children depended on the arrangement: living with an unmarried son was more strongly associated with depressive symptoms than living with a married son and daughter-in-law.

Conclusion—Sex differentials in social position and employment are major contributors to the sex difference in depressive symptoms among older Taiwanese, yet sex differences in exposure or response to selected stressors appear to play little role. Differential vulnerabilities to particular living arrangements may also contribute to women’s excess psychological distress, although more research is needed to elucidate the mechanisms by which living arrangements influence depressive symptoms in Taiwan.

Keywords

Depression; sex differences; socioeconomic status; Taiwan; living arrangements

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Introduction

Women are more likely to report depressive symptoms than men in a wide range of countries, with varying magnitudes of the female disadvantage across populations (Van de Velde, Bracke, & Levecque, 2010; Zunzunegui et al., 2007). Although it is possible that sex differences in depressive symptoms result from reporting biases, several reviews of the literature on sex differences in depression have concluded that there is little evidence that men under-report symptoms compared with women (Kuehner, 2003; Nolen-Hoeksema, 1987; Piccinelli & Wilkinson, 2000) or that there are substantial sex differences in symptom profiles (Addis, 2008; Bebbington, 1996; Piccinelli & Wilkinson, 2000). Most studies of sex differences in depressive symptoms are based on Western populations, with relatively few studies conducted in Asian countries.

Sex differences in depressive symptoms may arise because women have higher *levels* of exposure to potential risk factors than men or because the *effects* of those factors are greater for women or both. For example, women are more likely to be widowed than men (because they live longer and because husbands tend to be older than their wives). Furthermore, the impact of stressors on depressive symptoms may differ by sex. The ‘cost of caring hypothesis’ (Kessler & McLeod, 1984; Turner & Avison, 1989) argues that women are more vulnerable than men to stressors that affect others in their social network. Indeed, some studies show that the death of a loved one in general or death of a friend or relative other than one’s spouse has a greater effect on women than men (Kendler, Thornton, & Prescott, 2001; Kessler & McLeod, 1984; Maciejewski, Prigerson, & Mazure, 2001). In contrast, research suggests that spousal death has a greater psychological impact on men than on women (Lee, DeMaris, Bavin, & Sullivan, 2001; Stroebe & Stroebe, 1983; van Grootheest, Beekman, Broese van Groenou, & Deeg, 1999), which would narrow the sex difference in depressive symptoms.

The key explanatory factors that account for sex differences in depressive symptoms may be different among older Taiwanese compared with their Western counterparts. First, gender roles in Chinese populations tend to be highly differentiated: among the older generations, women are much less educated than men, less likely than men to have ever worked in the paid labor force, and if ever employed, are less likely to have held a high status occupation. These differences in social position may render women more vulnerable than men to depressive symptoms and to the psychological impact of financial stressors and other events such as widowhood that may have financial consequences.

Second, social ties with family are likely to be more influential in Taiwan compared with Western countries. The tradition of elders living with their children (we will refer to this practice as “co-residence”), typically a married son and his family, remains common. Chinese culture emphasizes the primacy of childrens’ obligation to their parents (*hsiao*, translated as “filial piety”); in particular, adult sons in Taiwan (Lee, Parish, & Willis, 1994) are expected to provide financial support for their elderly parents (Fricke, Chang, & Yang, 1994; Lee et al., 1994). Co-residence and support from family may cushion against social isolation and the financial strains associated with aging and widowhood. Nonetheless, the implications of intergenerational co-residence for social roles and decision control may

differ by sex. Jeon et al. (2007) note that, in co-residential households, generational shifts in gender roles have increased the traditional social burdens for older women who take greater responsibility for housework and care of grandchildren while members of the younger generation—of both sexes—are working. In contrast, men tend to lose their traditional social roles in later life (Jeon, Jang, Rhee, Kawachi, & Cho, 2007), which could lead to a loss of control over finances and decision-making. The social effects of co-residence could be positive (less social isolation) or negative (increased conflict), but it is not clear whether those effects would differ by sex. Chiao, Weng, & Botticello (2009) found that living with family was associated with fewer depressive symptoms among older Taiwanese with no significant sex difference in the effect. Two other studies in China suggest that co-residence may be associated with better psychological well-being, but they did not examine whether the effects varied by sex (Chen & Short, 2008; Silverstein, Cong, & Li, 2006).

In this paper we address two questions. First, to what extent do sex differences in *exposure* to selected stressors and social factors account for the sex difference in depressive symptoms? Second, what is the contribution of sex differences in the *response* to those risk factors? We use a nationally-representative sample of persons aged 60 and older in Taiwan who were surveyed six times over 18 years. Few studies of sex differences in depressive symptoms are based on such a long follow-up of a population-based sample.

Hypotheses

We hypothesize that the following mechanisms result in older Taiwanese women having higher rates of depressive symptoms than their male counterparts:

- a. Women occupy a lower social position and are less likely to be employed than men;
- b. Women have less control over household decisions than men;
- c. Women have greater exposure than men to some stressors, specifically death of a spouse and financial decline; and
- d. Women have a stronger response to the recent death of a child than men.

There are two other hypotheses regarding sex differences in response that may be salient in Western countries, but we do not expect the same effect among older Taiwanese because of counteracting influences. First, studies in Western countries generally find marriage to be more beneficial for men than for women. Although Taiwanese married men are likely to benefit from better household management and a wife's care, as do Western married men, marriage is likely to have especially important financial benefits for Taiwanese women because of gender stratification. Moreover, remaining single may have carried a particular stigma for older cohorts of Taiwanese women because of a strong cultural imperative to marry and bear descendants to continue the family lineage (Fricke et al., 1994).

Second, research in Western countries finds death of a spouse to be more detrimental for men than women. The impact of spousal death is likely to be weaker for Taiwanese compared with Western men because co-residence with children provides greater stability in domestic arrangements for widowers. Conversely, loss of a spouse is likely to have a bigger

effect for older women in Taiwan compared with Western women because gender stratification renders them more financially dependent on their spouse. For similar reasons, we anticipate that co-residence with children is beneficial for both sexes in Taiwan.

Methods

Data

The Taiwan Longitudinal Survey of Aging (TLSA) began in 1989 with a nationally representative sample of 4049 persons aged 60 and older (response rate: 92%). Follow-up interviews were completed in 1993, 1996, 1999, 2003, and 2007. Detailed information about the survey is provided elsewhere (Chang et al., 2012; Taiwan Provincial Institute of Family Planning, Population Studies Center, & Institute of Gerontology, 1989).

Measures

Depressive symptoms—The dependent variable was measured by an 8-item subset of the 20-item Center for Epidemiologic Studies Depression scale (CES-D) (Radloff, 1977); see note to Table 1 for more details. Shortened forms of the CES-D have been shown to demonstrate similar internal consistency, factor structure, and accuracy in detecting depressive symptoms as the full 20-item CES-D among elderly Chinese (Boey, 1999; Cheng & Chan, 2005) as well as other populations (Andresen, Malmgren, Carter, & Patrick, 1994; Kohout, Berkman, Evans, & Cornoni-Huntley, 1993; Rouch-Leroyer, Sourgen, Barberger-Gateau, Fuhrer, & Dartigues, 2000; Shrout & Yager, 1989; Turvey, Wallace, & Herzog, 1999). Although the items included in these short-form versions vary, most of the items are the same as in our version.

Stressors—We included four major stressors that are common among older people and have been targeted as potentially stressful in prior studies (Brugha & Cragg, 1990; Casado & Sacco, 2011; Miller & Rahe, 1997; Pinquart & Sorensen, 2003; Pinquart & Sorensen, 2004; Turner, Wheaton, & Lloyd, 1995). The first two stressors—death of a spouse; death of a child—were evaluated for the 3–4 year period prior to each survey. The third stressor, financial decline, was based on a question that asked respondents about their financial situation compared with the prior survey wave or, in the case of the baseline wave, compared with 10 years earlier. The responses were coded on a five-point scale from “much better” to “much worse.” The final stressor identified respondents serving as a caregiver (i.e., assisting a spouse or another adult with activities of daily living such as bathing or eating) at the time of the survey.

Social factors—Many social factors could be both a cause and a consequence of depressive symptoms. For example, Chao (2011) demonstrated an association between social relationships and depressive symptoms in Taiwan, but the direction of causation is not clear: do social connections protect individuals from depressive symptoms, or do depressed people withdraw from social interaction? To minimize this potential problem of reverse causality, we used only baseline measures of social position, social roles, decision control, and social relationships.

Social position was measured by years of education and status of the respondent's major lifetime occupation. For social roles, we included two dichotomous variables indicating whether the respondent was married or lived with a companion and whether s/he was employed and a categorical measure of living arrangements: with a son and daughter-in-law, with an unmarried son, with a daughter, or apart from their children. We also controlled for the number of sons and daughters, which could have affected living arrangements. Decision control was measured by a dichotomous variable indicating whether the respondent made the final decisions on major economic issues for the household and a categorical variable indicating how often the respondent was consulted in family decisions.

Finally, we included indices to capture three components of social relationships: social connections, perceived availability of social support and social strain. Following the strategy used by Cornwell & Waite (2009), we measured social connections based on seven indicators of network size, network range, household size, number of friends, number of children, number of grandchildren living in Taiwan, and socializing. The index of perceived availability of social support was based on four questions that were asked separately with reference to the respondent's a) spouse, b) children/grandchildren, and c) friends/neighbors/relatives: their willingness to listen, how much they made the respondent feel loved, the respondent's satisfaction with the emotional support s/he received, and how much the respondent could count on them when s/he was ill. The index of social strain was based on two questions that asked whether each of the three groups (spouse, children/grandchildren, others) made too many demands on the respondent and was critical of the respondent.

Analytical Strategy

Of the original cohort (n=4049), 2634 died during the 18 years of followup. Among survivors at any given wave, 9–11% were lost-to-followup and another 7–18% were missing data. Most persons with missing data were interviewed by proxy and thus, were not administered the CES-D or other subjective questions. We used multiple imputation (Rubin, 1996; Schafer, 1999) to retain observations for all respondents across all survey waves prior to the respondent's death (more detailed information is available upon request). Thus, the analysis sample included a total of 16,385 observations for 4,049 respondents across six survey waves.

The statistical analysis was based on a growth curve strategy (Bollen & Curran, 2006), which is well-suited to the analysis of repeated measures of outcome data from a longitudinal survey. Specifically, we modeled repeated measures of the CES-D score across six survey waves over 18 years to estimate individual-level trajectories of depressive symptoms. We accounted for age effects by using chronological age as the underlying time scale; the result of this stage of analysis was an estimate of the age trajectory of depressive symptoms. We subsequently enhanced the model by the inclusion of stressors as time-varying covariates that directly affected the CES-D score at the corresponding survey wave, while controlling for social factors as fixed covariates (measured at baseline) that influenced the underlying age trajectory.

We estimated a series of three nested models. In a preliminary model, we found no evidence that the age trajectory followed a non-linear pattern. Thus, we modeled the trajectory for the

CES-D as linear within the age range of the sample (60 and older); sex was allowed to affect both the intercept and the slope components. Because of a slight change between 1993 and 1996 in the wording of the response categories for the CES-D, all models controlled for a survey (period) effect represented by a dichotomous variable that identified observations from 1996 and later waves. In the first model, we controlled only for the survey effect in order to evaluate how the observed age trajectory of depressive symptoms differed by sex. Model 2 added stressors and social factors in order to determine the extent to which sex differences in exposure to those conditions accounted for the sex difference in depressive symptoms. Based on expectations consistent with the stress-buffering hypothesis (Cohen & Wills, 1985; Wheaton, 1985)—social relationships and other psychosocial resources may buffer the impact of stressors—and the findings of previous studies (Ennis, Hobfoll, & Schroder, 2000; Krause, 1987a; Krause, 1987b; Pu, Huang, Tang, & Chou, 2011; Sicotte, Alvarado, Leon, & Zunzunegui, 2008), we also included several interactions terms in Model 2 to assess whether education, social connections, and perceived support moderated the effects of financial decline. In Model 3, we introduced the interaction terms mentioned in the hypothesis section in order to ascertain whether the effects of recent child death, being recently widowed, being married (at baseline), and living arrangements (at baseline) varied by sex. All models were estimated in Stata 10.1 using the *xtmixed* procedure with the maximum likelihood estimator.

Prior to fitting the growth curve models, we specified age in terms of years after age 60 and rescaled continuous covariates (so that zero represented the lowest observed value) in order to ensure that the intercept was meaningful. Thus, the intercept can be interpreted as the mean CES-D score at age 60 for an individual in the reference group for categorical variables and with the lowest observed value for continuous variables. In order to quantify the contribution of each covariate to the sex difference in depressive symptoms, we used the method described by Althausser and Wigler (1972) to decompose the sex difference into the components resulting from differences in: a) the means of each covariate (“exposure”), b) the effects of those covariates (“response”), and c) the residual (details regarding the decomposition method are available upon request).

Results

Women consistently scored higher on depressive symptoms than men (Table 1). In our sample of respondents aged 60+ in 1989, the mean CES-D score was 2.6 for men and 3.9 for women (difference=1.3).

Tabulations of the level of exposure to the selected stressors by sex and survey wave (Table 2) showed that, in general, women were more likely to be recently widowed than men, and they were at greater risk of experiencing a recent child death. Compared with men, Taiwanese women in our sample were older, were more likely to have ever been married, and more likely to have ever had children. Among those with children, women had a higher average number of children. Nonetheless, these factors only partly explain why women report more child deaths than men. The residual sex difference may have resulted from misreporting. There were no consistent sex differences in recent financial decline or current caregiving.

A comparison of social factors (at baseline) demonstrated large sex differences in social position (Table 3): women were highly disadvantaged relative to men in terms of educational attainment and occupational prestige. In fact, 34% of women (vs. <1% of men) had no major lifetime occupation other than homemaking (data not shown). Women were also less likely than men to be married or live with a companion, be employed, make final economic decisions for the household, and be consulted in family decisions. Compared with men, women were more likely to live with their son and daughter-in-law and had more social connections, yet they reported lower levels of perceived social support.

Estimates from the baseline model (Model 1, Table 4) depict how the observed age trajectory of depressive symptoms differed by sex. We found a substantial sex difference in the intercept: the coefficient for female showed that the CES-D score at age 60 was 1.5 points higher for women than men. However, the age slope did not differ significantly by sex: for both men and women, the CES-D score increased by 0.05 per year of age—or half a point per decade. Consequently, the sex difference in depressive symptoms remained unchanged across ages 60 and older.

In Model 2, we adjusted for stressors and social factors, which reduced the sex difference in depressive symptoms by 30% (from 1.54 to 1.08; Table 4). In Model 3, we investigated whether the response to selected factors differed by sex. We found no evidence that the effects of recent child death, being recently widowed, or being married (at baseline) differed by sex. Nonetheless, women living apart from their children experienced significantly higher levels of depressive symptoms than men under those circumstances. Relative to those living with a son and daughter-in-law, women who lived apart from their children had more depressive symptoms, but the coefficient was not significant for men. An auxiliary model that disaggregated those living apart from offspring into three categories (i.e., with spouse only, with others, or alone) showed that the coefficient did not differ significantly between the three groups for either sex (results not shown). Among those living with their offspring, co-residence with a son and daughter-in-law was associated with a significantly lower CES-D score than living with an unmarried son; this effect did not differ significantly by sex.

The contribution of each variable to the sex difference in depressive symptoms depended on three factors: (1) the observed sex difference in exposure to that variable; (2) the magnitude and direction of its effect on depressive symptoms; and (3) how that effect differed by sex. In Table 5, we quantified these contributions using a decomposition method that distinguished between the contribution of sex differences in exposure and sex differences in the response to each covariate.

Overall, differences in the levels and the effects of these covariates accounted for 51% of the sex difference in depressive symptoms. Most of this contribution stemmed from sex differences in *exposure* to risk factors. In particular, women's disadvantage with respect to levels of social position and employment accounted for the largest share. The contribution of education resulted primarily from its effect in buffering the impact of financial decline. Exposure to financial decline was similar between the sexes. However, women experienced higher levels of depressive symptoms than men because women's educational disadvantage rendered them more vulnerable to emotional distress in the face of financial decline.

Although women were at greater risk of losing a spouse than men, widowhood played surprisingly little role because the proportion who were recently widowed was low even among women (7–12% at any given wave, Table 2). Decision control and social relationships made little contribution to explaining the sex difference.

Sex differences in the *response* to covariates accounted for a smaller part of the sex difference in depressive symptoms (0.30/1.67=18%). The largest share of this contribution resulted from the effects of living arrangements, largely because women who lived apart from their children were more vulnerable to depressive symptoms than their male counterparts. Differences in the effects of marital status also accounted for a notable share of the sex gap. Although the sex difference was not significant, the direction of the coefficients suggests that having no spouse or companion had a worse effect for women (i.e., $b = -0.26 + 0.33 = 0.07$; absence of a spouse associated with higher depressive symptoms) than for men (i.e., $b = -0.26$; absence of a spouse associated with lower depressive symptoms).

Discussion

As expected, sex differentials in social position and employment are major contributors to the sex difference in depressive symptoms. The negative association of social position and employment with depressive symptoms is consistent with prior work (Chiao et al., 2009; Van de Velde et al., 2010; Zunzunegui et al., 2007). However, these variables are especially important in this study primarily because of the large social disparities between older Taiwanese men and women. In Western countries—and even among younger Taiwanese—levels of education and employment are much more similar between the sexes.

Contrary to our expectations, sex differences in decision control and exposure to widowhood and financial decline play little role in explaining the sex difference in depressive symptoms. In general, exposure to the stressors included in our study make little contribution because sex differences in levels of exposure are relatively small. Sex differences in decision control are larger, but the effects of decision control on depressive symptoms are smaller and thus, the net contribution is small.

In this study, sex differences in the response to covariates account for 18% of the sex difference in depressive symptoms. We find no evidence that child death has a bigger effect for women than men as one might expect based on the cost of caring hypothesis. Nonetheless, given that recent child death is infrequent (<10% at any given wave, Table 2) in this older population, our power to detect such a sex difference is limited. Unlike some prior studies, we do not find sex differences in the effects of marriage or being recently widowed. Many cross-sectional studies suggest more detrimental effects of widowhood on depression for men than women (Lee et al., 2001; Stroebe & Stroebe, 1983; van Grootheest et al., 1999), but several longitudinal studies find no sex difference (Lee & DeMaris, 2007; Li, Liang, Toler, & Gu, 2005; Simon, 2002). Some possible explanations for this discrepancy are selection (i.e., men are more likely than women to remarry or die, and, thus, remain widowed for a shorter time) (Lee et al., 2001; Umberson, Wortman, & Kessler, 1992) and an anticipatory effect for men that is not evident for women—that is, men may already be depressed prior to their wife's death (Lee & DeMaris, 2007). In addition, some

studies suggest that the impact of widowhood results primarily from financial strain for women, but may be more related to household management for men (Lee et al., 2001; Umberson et al., 1992). In Taiwan, co-residence with children may mitigate the household disruption for men, while women may be especially vulnerable in the absence of a spouse because of their disadvantaged social position and employment. One study in Hong Kong finds that death of a spouse had a bigger impact for women than for men (Chou & Chi, 2000).

In contrast to some of the other findings, living arrangements appear to affect men and women differently. Living apart from one's children appears to be more detrimental for women than for men in this society. Prior studies in countries where older people frequently co-reside with their children, such as China (Silverstein et al., 2006) and Cuba (Sicotte et al., 2008), find that such co-residence is beneficial to psychological well-being. Among studies investigating the effects of living arrangements on depressive symptoms among older populations, two studies report that the effects do not differ by sex (Chiao et al., 2009; Sicotte et al., 2008), but most do not test a sex interaction (Chen & Short, 2008; Ramos & Wilmoth, 2003; Silverstein et al., 2006; Zunzunegui, Beland, & Otero, 2001). Thus, further research is needed to determine the robustness of this finding. We can only speculate about why living apart from offspring might be worse for women than for men in Taiwan. One possibility is that women may be more dependent than men on their children for financial support in old age.

We were also surprised to find that, in Taiwan, the effect of living with children depends on the arrangement. Even with the inclusion of covariates, living with an unmarried son is more strongly associated with depressive symptoms than living with a son and daughter-in-law. Living with a daughter also appears to have an adverse effect, particularly for women, although the estimate is not statistically significant because there are few respondents in that situation. Among the oldest-old in China, Chen and Short find no difference in negative affect between those living with a son versus a daughter, although they do not distinguish between married and unmarried sons (Chen & Short, 2008). Cong & Silverstein (2008) note that in Chinese cultures primary responsibility for hands-on support of elders is placed on the daughter-in-law; they argue that assistance from the culturally appropriate source (daughter-in-law) may reduce psychological distress, whereas assistance from inappropriate sources (sons/daughters) could have the opposite effect. On the one hand, then, it may be that the advantage of living with a son and daughter-in-law results from conformity to cultural norms and expectations about who should support older parents. On the other hand, the benefits of living with a married son could be diminished by conflict between a mother-in-law and daughter-in-law, which appears to characterize many multigenerational Taiwanese families (Fricke et al., 1994).

Another explanation for the differences between living with a married versus unmarried son is that the son's marital status may reflect his ability to provide for a family including his parents. The percentage of respondents receiving financial support from the co-resident child is higher for those living with a married son (75%) than for those living with an unmarried son (47%) or daughter (44%). Moreover, respondents rarely *provide* financial support to a co-resident married son (1%), whereas financial support from parent to child is

more common among those living with an unmarried son (12%) or daughter (8%). Aside from financial issues, respondents living with an unmarried son may worry about their son's future marriage prospects and the continuation of the family lineage.

Our study has several limitations. First, as with all studies, some of the covariates may be endogenous. For example, mental health may influence living arrangements. We measure living arrangements at baseline to reduce the potential for reverse-causality, but that does not eliminate the problem because those arrangements may reflect earlier psychological health.

Second, our analysis considers stressors that may have occurred anytime in the 3–4 year window prior to a survey wave; information about the exact timing of the event is not available. Thus, if the effects of stressful events on depression are short-lived, as others suggest (Kendler, Kuhn, Vittum, Prescott, & Riley, 2005), then we may under-estimate the impact. Nonetheless, that would not affect the sex difference unless the duration of the effect differs by sex.

Third, unobserved variables are likely to contribute to the sex difference in depressive symptoms. For example, sexual abuse and other stressors—particularly interpersonal stressors that may affect women more than men—may be important. Sex differences in coping styles and biological factors (e.g., hormones, HPA axis reactivity) may also play a role. Some studies, including several in Taiwan (Chiao et al., 2011; Huang et al., 2011; Ku, Fox, Chen, & Chou, 2012; Lee et al., 2012; Lin, Hsu, & Chang, 2011), show that physical health problems are correlated with depressive symptoms. However, if physical and mental health are observed simultaneously, it is impossible to determine the direction of causation. When we add controls for baseline measures of mobility limitations and chronic health conditions, the model accounts for about two-thirds of the sex difference in depressive symptoms. Yet, the effect of physical health is probably overestimated (i.e., inflated by reverse-causality): depression can precipitate other illnesses and may affect reporting of disability. Nonetheless, given higher morbidity among older women compared with older men, physical health may explain at least part of the sex difference in depressive symptoms.

Finally, mortality attrition may affect our results. As with any longitudinal study of older persons, many respondents died over the 18-year follow-up period. If both exposure to stressors and depressive symptoms are positively associated with mortality, then we may underestimate the effect of stressors on depressive symptoms. To explore that possibility, we modeled age-specific mortality during the period 1989–2007 as a function of the CES-D score and the covariates shown in Table 4. The CES-D score was positively associated with mortality, but the effect was stronger for men than for women. Thus, our estimates of the age-related increase in depressive symptoms may be attenuated by mortality attrition, especially for men. Recent death of one's child was also associated with increased mortality, suggesting that our results may underestimate the impact of child death on depressive symptoms. In contrast, caregivers exhibited *lower* mortality than non-caregivers, probably because of reverse-causality (i.e., only those who are healthy are able to care for someone else).

One implication of this study is that the large sex differences in depressive symptoms observed here among older Taiwanese should become smaller in younger generations, among whom men and women share more similar levels of education and employment. Whether co-residence with children is beneficial for older people may depend not only on whether societal norms favor intergenerational versus independent living, but more specifically on the expectations for who should provide such support. As Chen & Short (2008) note, the same living arrangement can have different effects in different contexts because of variations in societal expectations regarding living arrangements and family responsibilities. In Taiwan, where tradition dictates that support of older parents is the responsibility of a son and daughter-in-law, this arrangement appears to be more beneficial than living with an unmarried son or with a daughter. Admittedly, it is not clear whether this difference is a result of cultural preferences or more tangible factors such as greater availability of financial and other assistance from a married son and daughter-in-law. In any case, this tradition is declining: among Taiwanese aged 60 and older, the percentage living with any son or daughter fell from 71% in 1989 to 60% in 2007, while the percentage living with a married son and daughter-in-law decreased from 44% to 36%. Thus, the effects of living arrangements observed here may evolve in future generations. More research is needed to elucidate the mechanisms by which co-residence with a son and daughter-in-law is protective against depressive symptoms and, more generally, to provide insights into whether the weakening of traditional living arrangements will ultimately prove more harmful for women's mental health than for men's.

Our findings highlight subpopulations of older people in Taiwan who may be especially vulnerable to psychological distress and among whom services might be targeted. Efforts to address excess mental distress among women in particular should focus on women with low social position. More generally, mental and social services should pay special attention to women and men who experience financial decline as well as those who suffer losses such as death of a spouse or child and those with caregiving responsibilities. Finally, providers and researchers should further explore how living arrangements, participation in family-decision making, and strains that may result from family interactions might play a role in the psychological wellbeing of older Taiwanese and how the effects may differ by sex.

Acknowledgments

This work was supported by the Demography and Epidemiology Unit of the Behavioral and Social Research Program of the National Institute on Aging (grant numbers R01AG16790, R01AG16661); and the Eunice Kennedy Shriver National Institute of Child Health and Human Development (grant number R24HD047879). Funding for the TLISA came from the Taiwan Department of Health, the Taiwan National Health Research Institute [grant number DD01-86IX-GR601S] and the Taiwan Provincial Government.

We gratefully acknowledge the hard work and dedication of the staff at the Center for Population and Health Survey Research, Bureau of Health Promotion, Taiwan Department of Health. We thank Germán Rodríguez and Scott Lynch for their comments, suggestions, and statistical advice. We are also grateful to I-Fen Lin for her insights regarding intergenerational coresidence and family relations in Taiwan.

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Table 1

Sex differences in the CES-D by survey wave

| Survey wave | Age range | N | CES-D, mean (SD) | | Sex Difference | |
|-------------|-----------|-------|------------------|-------------|----------------|---------|
| | | | Males | Females | (F – M) | p value |
| 1989 | 60+ | 4,049 | 2.58 (3.91) | 3.93 (4.68) | 1.35 | <0.001 |
| 1993 | 64+ | 3,459 | 3.17 (4.50) | 4.77 (5.43) | 1.60 | <0.001 |
| 1996 | 67+ | 2,989 | 3.16 (4.74) | 5.09 (5.50) | 1.93 | <0.001 |
| 1999 | 70+ | 2,560 | 3.31 (4.88) | 4.92 (5.64) | 1.60 | <0.001 |
| 2003 | 74+ | 1,913 | 2.79 (4.30) | 4.49 (5.39) | 1.70 | <0.001 |
| 2007 | 78+ | 1,415 | 3.81 (5.07) | 4.86 (5.57) | 1.05 | 0.003 |

Note: Based on an 8-item subset of the Center for Epidemiologic Studies Depression scale (CES-D), coded according to standard practice (potential range 0 to 24; higher scores indicated more frequent symptoms; $\alpha=0.82$ to 0.86 across the six survey waves). Four of the items reflected somatic symptoms (poor appetite, everything an effort, poor sleep, no energy), three items represented depressive affect (bad mood, lonely, sad), and one item reflected interpersonal relations (people unfriendly).

Table 2

Descriptive statistics for stressors by sex and survey wave

| Survey wave | Recently widowed ^a , % | | Child died recently ^a , % | | Recent financial decline ^b , mean (SD) | | | | Current caregiver, % | | | |
|-------------|-----------------------------------|---------|--------------------------------------|-------|---|--------|-------------|-------------|----------------------|---------|-----|--------|
| | Males | Females | p value | Males | Females | Males | Females | Males | Females | p value | | |
| 1989 | 3.2 | 6.8 | <0.001 | 3.0 | 3.8 | 0.190 | 1.59 (1.07) | 1.59 (1.03) | 0.876 | 3.1 | 9.3 | <0.001 |
| 1993 | 3.5 | 7.6 | <0.001 | 4.0 | 7.3 | <0.001 | 1.87 (0.84) | 1.83 (0.79) | 0.189 | 4.7 | 4.1 | 0.425 |
| 1996 | 5.2 | 6.5 | 0.206 | 2.7 | 5.0 | 0.002 | 2.13 (0.70) | 2.07 (0.70) | 0.103 | 2.2 | 3.2 | 0.131 |
| 1999 | 4.5 | 7.0 | 0.016 | 2.7 | 5.3 | 0.002 | 2.23 (0.67) | 2.18 (0.65) | 0.038 | 2.0 | 1.9 | 0.891 |
| 2003 | 8.2 | 11.7 | 0.019 | 4.8 | 8.1 | 0.005 | 2.40 (0.74) | 2.44 (0.74) | 0.317 | 1.9 | 1.6 | 0.600 |
| 2007 | 7.2 | 8.9 | 0.261 | 4.6 | 9.5 | 0.001 | 2.32 (0.73) | 2.24 (0.73) | 0.096 | 2.5 | 1.7 | 0.307 |

^a 1989: during the past three years; 1993–2007: during the three or four years since the previous survey wave.

^b 1989: financial situation compared to 10 years ago; 1993–2007: financial situation compared with prior wave. Ranges from 0 (much better) to 4 (much worse).

Table 3

Descriptive statistics for baseline social factors by sex, 1989

| Variable (observed range) | Males | Females | <i>p</i> value |
|--|-------------|-------------|----------------|
| Years of education (0–17), mean (SD) | 5.41 (4.81) | 1.73 (3.25) | <0.001 |
| High status major lifetime occupation, ^a % | 52.7 | 12.9 | <0.001 |
| No spouse/companion, % | 25.3 | 48.6 | <0.001 |
| Employed, % | 39.8 | 12.1 | <0.001 |
| Number of living sons, mean (SD) | 2.16 (1.52) | 2.48 (1.49) | <0.001 |
| Number of living daughters, mean (SD) | 2.14 (1.66) | 2.48 (1.62) | <0.001 |
| Living arrangements | | | |
| Lives with son and daughter-in-law, % | 36.7 | 53.6 | <0.001 |
| Lives with unmarried son, % | 22.6 | 14.5 | <0.001 |
| Lives with daughter, % | 7.6 | 8.5 | 0.306 |
| Lives apart from children, % | 33.1 | 23.5 | <0.001 |
| Respondent makes final economic decisions, % | 57.6 | 18.0 | <0.001 |
| Respondent consulted in family decisions | | | |
| Most of the time, % | 51.9 | 39.0 | <0.001 |
| Sometimes, % | 19.0 | 25.9 | <0.001 |
| Never or not very often, % | 29.1 | 35.1 | <0.001 |
| Social connections (0–3.6), ^b mean (SD) | 1.61 (0.67) | 1.73 (0.54) | <0.001 |
| Perceived availability of social support (0–4), ^c mean (SD) | 2.43 (0.78) | 2.29 (0.74) | <0.001 |
| Social strain (0–4), ^d mean (SD) | 0.45 (0.50) | 0.42 (0.49) | 0.075 |
| N | 2,311 | 1,738 | |

^aBased on a socioeconomic index developed for Taiwan (Tsai & Chiu, 1991). Occupations scoring above 60 (which included professional, clerical, sales, supervisory, and other skilled positions) were defined as high status, while the reference group comprised semi-skilled workers, service workers, laborers, farmers, and fisherman as well as those with no major lifetime occupation.

^bThe social connections index was constructed by standardizing each item to have a mean of 0 and SD of 1, calculating the mean across the seven items ($\alpha=0.73$), and then rescaling so that zero represents the lowest observed score.

^cThe perceived support index was computed as the mean across relevant items (range 0–4, $\alpha=0.89$); each item was coded on a 5-point ordinal scale. All 12 items were included for a married respondent with children/grandchildren, whereas the four items pertaining to a spouse were not relevant for unmarried respondents and the four items pertaining to children/grandchildren were not relevant for those with no surviving descendants.

^dAs with perceived support, this index was calculated by taking the mean across relevant items (range 0–4, $\alpha=0.80$), each coded on a 5-point ordinal scale.

Table 4

Parameter estimates from growth curve model of depressive symptoms

| | (1) Baseline Model | (2) Add Stressors & Social Factors | (3) Add Sex Interactions |
|--|--------------------|------------------------------------|--------------------------|
| Intercept ^a | 2.36*** | 0.54 | 0.56 |
| Survey wave 1996–2007 | 0.27* | 0.05 | 0.06 |
| Female | 1.54*** | 1.08** | 0.83** |
| Age – 60 | 0.05** | 0.02 | 0.02 |
| (Age – 60) x female | –0.00 | –0.01 | –0.01 |
| Recently widowed | -- | 0.95*** | 1.20** |
| Recently widowed x female | -- | -- | –0.42 |
| Recent child death | -- | 1.13** | 1.01** |
| Recent child death x female | -- | -- | 0.22 |
| Recent financial decline | -- | 2.15*** | 2.15*** |
| Recent financial decline x education | -- | –0.04** | –0.04** |
| Recent financial decline x social connections | -- | –0.16 | –0.16 |
| Recent financial decline x perceived social support | -- | –0.28** | –0.27** |
| Current caregiver | -- | 0.62* | 0.63* |
| Education | -- | 0.00 | 0.00 |
| High status occupation | -- | –0.34* | –0.32* |
| No spouse/companion | -- | –0.12 | –0.26 |
| No spouse/companion x female | -- | -- | 0.33 |
| Employed | -- | –0.55** | –0.57** |
| Number of sons | -- | –0.11* | –0.12* |
| Number of daughters | -- | –0.01 | –0.01 |
| Living arrangements (ref=with son and daughter-in-law) | | | |
| Lives with unmarried son | -- | 0.51** | 0.52* |
| Lives with unmarried son x female | -- | -- | –0.18 |
| Lives with daughter | -- | 0.30 | 0.10 |
| Lives with daughter x female | -- | -- | 0.38 |
| Lives apart from children | -- | 0.15 | –0.13 |
| Lives apart from children x female | -- | -- | 0.71* |
| Makes final economic decisions | -- | 0.13 | 0.14 |
| Consulted in family decisions (ref=most of the time) | | | |
| Sometimes | -- | 0.28 | 0.29 |
| Never/not very often | -- | 0.67** | 0.72*** |
| Social connections | -- | –0.06 | –0.07 |
| Perceived social support | -- | 0.12 | 0.13 |
| Social strain | -- | 0.25* | 0.24* |
| <u>Random Effects</u> | | | |

| | (1) Baseline Model | (2) Add Stressors & Social Factors | (3) Add Sex Interactions |
|---------------------|---------------------|------------------------------------|--------------------------|
| SD of the intercept | 2.21 ^{***} | 1.70 ^{***} | 1.68 ^{***} |
| SD of the slope | 0.09 ^{***} | 0.09 ^{***} | 0.09 ^{***} |
| SD of the residuals | 4.20 ^{***} | 4.12 ^{***} | 4.12 ^{***} |

^aTo ensure that the intercept is meaningful, we specify age in terms of years after age 60 and we rescale continuous variables so that zero represents the lowest observed value. Thus, the intercept represents the CES-D score at age 60 (in 1989/93) for an individual in the reference group for categorical variables and with the lowest observed value for continuous variables.

^{***}
 $p < 0.001$,

^{**}
 $p < 0.01$,

^{*}
 $p < 0.05$

Table 5

Contributions to sex difference in depressive symptoms

| Covariate | Exposure | Response | Total | Percent |
|--|----------|----------|-------|---------|
| Recently widowed | 0.04 | -0.03 | 0.00 | 0% |
| Recent child death | 0.03 | 0.01 | 0.04 | 2% |
| Recent financial decline | -0.03 | -- | -0.03 | -2% |
| Current caregiver | 0.01 | -- | 0.01 | 1% |
| Education | 0.01 | -- | 0.01 | 1% |
| Education x recent financial decline | 0.33 | -- | 0.33 | 20% |
| High status occupation | 0.13 | -- | 0.13 | 8% |
| No spouse/companion | -0.05 | 0.14 | 0.09 | 9% |
| Employed | 0.19 | -- | 0.19 | 11% |
| Number of sons | -0.05 | -- | -0.05 | -3% |
| Number of daughters | 0.00 | -- | 0.00 | 0% |
| Living arrangements (ref=with son and daughter-in-law) | | | | |
| Lives with unmarried son | -0.05 | -0.03 | -0.07 | -4% |
| Lives with daughter | 0.00 | 0.03 | 0.03 | 2% |
| Lives apart from children | 0.01 | 0.17 | 0.18 | 11% |
| Makes final economic decisions | -0.06 | -- | -0.06 | -4% |
| Consulted in family decisions (ref=most of the time) | | | | |
| Sometimes | 0.02 | -- | 0.02 | 1% |
| Never/not very often | 0.03 | -- | 0.03 | 2% |
| Social connections | -0.01 | -- | -0.01 | -1% |
| Social connections X recent financial decline | -0.05 | -- | -0.05 | -3% |
| Perceived social support | -0.02 | -- | -0.02 | -1% |
| Perceived social support x recent financial decline | 0.08 | -- | 0.08 | 5% |
| Social strain | -0.01 | -- | -0.01 | -1% |
| Total contribution | 0.55 | 0.30 | 0.85 | 51% |
| Residual | -- | -- | 0.82 | 49% |
| Overall sex difference | -- | -- | 1.67 | 100% |

Note: Based on the coefficients from Model 3 (Table 4), we identify contributions resulting from sex differences in: a) the means of covariates ("exposure"), b) the effects of those covariates ("response"), and c) the residual. The residual represents the estimated sex gap at age x for an individual in the reference group for categorical variables and with the lowest observed value for continuous variables, and it is the only quantity that depends on age. In the table above, we show the residual at age 60 (0.82); at age 90, the residual would be smaller (0.53) because the sex*age interaction is negative (albeit not significant). Thus, at age 90, our model would account for 61% ($1 - 0.53 / (0.82 + 0.53)$) of the sex difference.