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Abstract

In developed countries, socioeconomic status has been identified as one of the most important demographic and social determinants of older adult health. The relationship has not been well studied or contrasted across much of the developing world. Yet, with population aging occurring rapidly in much of Asia, understanding the factors that distinguish between those in better and worse health becomes important. To this end, the current study has two main aims. It first examines the degree to which two measures commonly used to indicate socioeconomic status, education and income, relate to the physical functioning of older adults in three Asian societies—Taiwan, Thailand, and the Philippines. These three societies are all experiencing population aging, although to varying degrees. They are also characterized by differences in levels of national economic development, a factor that may influence the extent to which health care is available for those in varying socioeconomic positions. Second, the study explores the degree to which these associations are consistent across the three settings. The study results in both expected and unexpected findings. Socioeconomic status indicators are linked to health, but inconsistently across the three settings. Associations are strongest in Taiwan, weaker in Thailand, and almost nonexistent in the Philippines. This leads to questions regarding the universality of the relationship. The paper concludes with a discussion of the possible reasons that socioeconomic status may not influence the health of older adults in consistent ways across different societies, including the effect that economic development can have on health outcomes.

The current study examines the degree to which two socioeconomic indicators, education and income, are associated with physical functioning among older adults in three Asian societies—Taiwan, Thailand, and the Philippines—and the degree to which these associations are consistent. Population aging occurring in these societies will produce some of the oldest age structures in the world (Kinsella 2000; Knodel, Ofstedal, and Hermalin 2002). Inevitably, population aging will lead to challenges related to population health and will exert pressures on health care systems (Hermalin 1995; Hermalin and Myers 2002; Phillips 2000). Physical functioning is an important aspect of health and health care, related to the capacity to carry out necessary daily functions in an independent fashion. In turn, an area of research beneficial for understanding how health and health care will be challenged is an examination of correlates of physical functioning (Pol and Thomas 1992). Determining what distinguishes between those in better and worse functional health in later life can assist in planning for the aging of Asia in several ways: by determining how population health might change as societies are composed of more and more older adults, ascertaining which groups will be at higher risk for contracting functional disorders, and assisting in creating interventions to improve overall population health.

SOCIOECONOMIC STATUS AND HEALTH

Measures of socioeconomic status, such as education and income, have proven to be persistent and robust correlates of health among adults of all ages, as they have an effect on mortality, morbidity, and a host of health disorders (Preston and Taubman 1994). In the Western world, recognition of the association dates back centuries, and can be seen in the concern of Engels and Marx for the living conditions of the working-class poor in London (Turner and Beeghley 1981). Empirical studies go as far back as 1839 with Gavin's examination of the average age of death by occupation of household heads in a London suburb (Antonovsky 1967). Influential works that have fueled the modern-day discourse include Kitagawa and Hauser (1973), Townsend and Davidson (1982), and Marmot, Shipley, and Rose (1984). These studies are still frequently cited, but over the last ten years other studies have reported consistent findings across Western indus-

trialized societies (Dennis et al. 1993; Fox 1989; Hay 1988; Illsley and Svenson 1990; Pappas et al. 1993; Rogers 1992; Rogers, Rogers, and Belanger 1992, to name a few).

The association is now considered to be so well established that the National Research Council recently asserted, "[I]n all societies, health and functioning vary according to socioeconomic position" (National Research Council 2001, p. 221). This statement seems somewhat strong given that very little research has considered non-Western developing societies such as those in Asia. In addition, little is known about the magnitude of the association and how it varies across settings where cultural norms, values, and levels of socioeconomic development differ. Testing for these associations is necessary in order to develop further theoretical perspectives and to affirm the universality of the association.

Associations between socioeconomic indicators and health are often attributed to psychological and sociological mechanisms such as health-related behaviors, social support, stress, feelings of self-efficacy, and environmental factors, all of which influence the relationship between status and health (House et al. 1994; Williams 1990). Some researchers have posited a reverse causality whereby those in poor health drift downward on measures of socioeconomic status as their health deteriorates (Smith and Kington 1995). Others have argued that this relationship can only explain a small portion of the association, particularly when education, which is determined early in life, is used as an indicator of status (Fox, Goldblat, and Jones 1986; Haan, Kaplan, and Syme 1989; Winkleby et al. 1992). There is also a clear connection between socioeconomic status and access to health care in Western developed societies (Anderson and Armstead 1995).

The association between socioeconomic indicators and health among those at older ages may be somewhat less straightforward (Thorslund and Lundberg 1994). Convergence in rates of mortality have been found by Elo and Preston (1995) and Makuc et al. (1990), and House et al. (1994) found narrowing of rates after age 75. But when physical functioning is considered, researchers have found strong associations (Rogers, Rogers, and Belanger 1992; Ross and Wu 1996). Using the Alameda County Study, Camacho et al. (1993) found education to be associated with better functioning, meas-

ured as the ability to perform 18 self-maintenance, mobility, and physical performance tasks, while Berkman and Gurland (1998) showed similar associations when examining differentials by income. Liang et al. (2000) showed gradients in mortality among older adults in China by socioeconomic indicators such as education, but there is otherwise a dearth of research on Asian societies.

There are good theoretical reasons to believe that associations in Asia would be similar to those seen elsewhere. With respect to mediating influences, Preston and Taubman (1994) distinguish between influences that are economic and those that are psychosocial. On the economic side is access to better living and working conditions and the ability to purchase health care, both of which are associated with greater well-being. It is likely that these factors operate in a similar fashion in Asia as health care tends to be purchased, and living conditions are associated with education, income, and occupation. With respect to social and psychological explanations, Link and Phelan (1995) suggest there is persistence in the mechanisms that link socioeconomic status to health across settings as socioeconomic condition is a "fundamental cause" of health. We would thus expect that House et al.'s (1994) empirical test of psychosocial intervening mechanisms that connect socioeconomic status to health outcomes would be generalizable to Asian cultures. That is, in Asia as elsewhere, those with higher socioeconomic status would tend to have a greater understanding of behaviors that lead to better health, including diet, exercise regimens, and avoidance of risky behaviors. They would also tend to have lower levels of stress, a higher quality of social support, a greater feeling of personal control over their lives, and a higher likelihood of seeking medical attention.

Comparative Research on the Health of Older Adults

The value of cross-national and cross-cultural research for understanding the factors that determine the health of older adults has been emphasized in a number of recent publications (Albert and Cattell 1994; Bengtson et al. 2000; Chi, Chappell, and Lubben 2001; Hermalin 2002; National Research Council 2001). These have underscored sev-

eral advantages to comparative research, which include providing a sense of generalizability of observations made in specific national contexts, raising questions about universality versus uniqueness of the aging experience, and revealing variations in the underlying dynamics of aging processes. Jointly, these benefits suggest that such investigations have the potential to highlight the diversity that exists in aging across cultures and geographical locations and to call into question persistent notions in mainstream social science. Given the universality that is often attributed to the association between socioeconomic status and health, comparative research on this topic would clearly be instructive.

Yet, in conducting cross-national studies on aging and health in developing regions, researchers are faced with a number of obstacles. It is rare to find data that can be used to test for the consistency of associations across geographic settings. Surveys that collect information on the health of older adults in non-Western developing settings are not as abundant as those conducted in the United States and other developed countries, and the comparability of the data that do exist can be questioned. Researchers must also rely on surveys conducted over long spans of time and using different ways of measuring health. These limitations exist in addition to the general difficulty of interpreting responses provided by individuals living in a variety of cultural settings. Interpretation problems mean that reliance on a single measure of health generally, and physical functioning specifically, may not be sufficient to make confident inferences.

We attempt to overcome some of these problems in the current study while recognizing the limitations involved. First, we use recent data collected in Taiwan, Thailand, and the Philippines. These data were collected in 1995 and 1996 under a single survey program. Second, we examine physical functioning outcomes measured in a variety of ways, and we assess the consistency of results across these measures. Third, we conduct two types of analyses. Using survey items that determine the ability to perform similar but not identical physical functioning tasks, we limit the analysis to whether associations exist across settings, and, if so, whether the directions are similar. Then, using outcomes that are more readily comparable, we pool data across the three samples and test for associations that include interaction terms between the country (Taiwan,

Thailand, or the Philippines) and the socioeconomic measure (education or income). Only when measures are readily comparable do we attempt to assess consistency.

Taiwan, Thailand, and the Philippines, all located in East Asia, are characterized by close familial relations, reciprocity between older and younger family members, and the notion that the health of older adults is a family concern (Asis et al. 1995; Casterline et al. 1991). Yet, while this part of Asia is often described as rapidly developing, there is variation in the amount of development that has occurred. Taiwan's level of development is the most advanced and that of the Philippines the least. By the same token, life expectancy is about 75 years in Taiwan, 72 in Thailand, and only about 67 in the Philippines (Population Reference Bureau 2000). National economic standing can affect health in a number of ways, such as through the availability of health care resources and technology. Some have reported, for instance, a growing number of public health services in tandem with the growth of Taiwan's economy, including the recent inauguration of a universal health care program (Favereau 1995; Chiang 1997). It is likely that these national inputs will affect the micro-level association between socioeconomic status and health—for example, through making access to health services more readily available to those with higher income, or making this access more equitable across status levels. Yet, little research has been conducted to determine the exact mechanisms through which development affects the association in question. The current study may lead to some indication.

METHODS

Data

Data are from the Study of Rapid Demographic Change and the Welfare of the Elderly, a series of surveys conducted in Taiwan, Thailand, and the Philippines in 1995 and 1996. Each survey consists of a nationally based sample that, when weighted, is nationally representative. Multi-stage stratified samples were chosen in each country so that appropriate administrative units were first selected (for example, counties in Taiwan, provinces in Thailand, and *barangays* in the Philippines), leading to the selection

of households within units. (The term "country" for Taiwan is used for purposes of consistency only and is not meant to indicate its political status.) Finally, one eligible respondent was chosen within each household through random selection. Each survey employed proxy respondents when individuals were unable to respond on their own. More detailed information on these surveys can be found in Chang and Hermalin (1997), Chayovan and Knodel (1997), Hermalin (2002), and Natividad and Cruz (1997).

The current study considers men and women aged 60 and older at the time of the survey; there were 3,626 such individuals in the Taiwan survey, 4,486 in Thailand, and only 1,311 in the Philippines. Samples were not weighted across countries to be regionally representative. This can pose a problem in comparative analyses in which data are pooled across samples. Hence, an extra procedure is conducted prior to pooled analyses in which observations are weighted so that sample sizes represent the same proportion of the 60-and-older population in all three countries. Doing this means that sampling fractions after reweighting are equivalent across samples, but the total sample size does not change. Specifically, the additional weighting procedure uses a sampling fraction of one respondent for every 1,186 individuals aged 60 and older living in each of the three countries.

Measuring Physical Functioning

Physical functioning tasks are often classified either as "activities of daily living" (Katz et al. 1963), which include those necessary for personal care, or as "instrumental activities of daily living" (Lawton and Brody 1969), which are necessary to maintain a living environment. The difficulty in using these types of items in comparative studies is that they may be tied to socially defined roles and environmental circumstances that can make responses culturally dependent and therefore difficult to interpret. Nagi (1976, 1991) advanced a more useful distinction by identifying the loss of ability to perform tasks as a specific "impairment," or physiological abnormality, and "disability," or behavior patterns that evolve from impairment (see also Kelly-Hayes et al. 1992). Functional limitations, defined this way, involve basic body movements and are therefore less tied to and biased by social circumstance (Freedman and Martin 1999). In the cur-

rent study we adopt this conceptualization and consider the ability to conduct four bodily movements: climbing stairs, lifting objects, walking, and crouching. The self-assessed ability to conduct these movements was measured in the three surveys with the question, "Do you have any difficulty doing the following without assistance from others and without assistance from a device?" In each survey, responses to each item can be divided into three categories: no difficulty, a little difficulty, and a lot of difficulty (the last includes not being able to conduct the task at all without assistance).

Unfortunately, the exact task differed across surveys for three of the four items, and we wish to be particularly sensitive to these differences in our analyses and interpretation. For instance, older adults in Taiwan were asked whether they had difficulty climbing a greater number of stairs than were those in Thailand or the Philippines, which in turn elicited a higher proportion of affirmative responses (about 18 percent versus about 12 percent and 16 percent). We do not use the un-identically measured items directly in pooled analyses. Instead, we use them only to determine whether the direction and significance of associations are similar across countries. However, we use the one identically measured item (crouching) and a normalized physical functioning scale in pooled analyses.

Specifically, we construct three physical functioning measures. The first is having at least a little difficulty with at least one of the four bodily movements, where those who had difficulty are coded 1 and those who did not are coded 0. Second, we create a single measure from the one item that is identical across surveys: crouching ability. This is also coded 1 if an individual has difficulty crouching and coded 0 if not. Third, we use all items and response categories to create a composite index of functioning difficulties. Here, we give scores of 0 (have no difficulty), 1 (have a little difficulty), and 2 (have a lot of difficulty) for each item and sum the scores to create a composite scale ranging from 0 to 8. This score will be related to the specific nature of the tasks. For instance, because climbing fewer steps (asked in Thailand) is an easier task than climbing more steps (asked in Taiwan), we expect mean scores for climbing to be higher in Taiwan than in Thailand. To adjust for the specific difficulty of the tasks, we normalize scores so that the measure has a mean of 0 and a standard deviation of 1 in each country. Technically,

this original index is a discrete measure, but we treat the normalized scores as continuous in our analysis.

Table 1 presents distributions for physical functioning outcomes. The current study is not intended as a comparison of the level of functioning across these populations; rather we focus on the nature of specific associations. Thus, we omit any interpretation or analysis of these figures, except to say that the percentage of individuals who had difficulty within specific tasks appears to be related to the degree of difficulty of the task, and that overall the elderly sample in Taiwan appear to be functionally healthier than those in the Philippines and Thailand.

Measuring Education, Income, and Other Covariates

Socioeconomic status is often represented as education, income, or occupation, and previous research has demonstrated associations employing all three indicators (Anderson and Armstead 1995; Williams and Collins 1995). We do not have comparable occupational data across samples, and therefore consider only education and income in the analysis. Regarding education, participants in this study were generally born between the turn of the twentieth century and 1936, a period of colonial rule in

Table 1 Distribution of physical functioning outcomes by country

Percent with	Taiwan	Thailand	Philippines
Difficulties crouching[a]	27.4	37.8	35.2
Difficulties climbing[b]	25.0	17.2	20.8
Difficulties lifting[c]	31.8	51.0	30.2
Difficulties walking[d]	16.4	35.1	28.4
At least one limitation	42.2	63.8	47.5
Mean physical functioning score	1.58	2.25	1.77

[a] Crouching question is the same in all three countries: Do you have any difficulties crouching?
[b] Climbing question: Do you have any difficulties . . .
Taiwan: . . . walking up two or three flights of stairs?
Thailand: . . . walking up two or three steps?
Philippines: . . . going up and down the stairs (about 3–5 steps)?
[c] Lifting question: Do you have any difficulties lifting . . .
Taiwan: . . . something weighing 11–12 kg (like 2 pecks of rice)?
Thailand: . . . about 10 kg in weight?
Philippines: . . . something as heavy as a 5 kg bag of rice?
[d] Walking question: Do you have any difficulties walking . . .
Taiwan: . . . 200–300 meters?
Thailand: . . . one kilometer?
Philippines: . . . 200–300 meters?

Asia. If they attended school, these individuals were influenced by the educational systems established by the colonial rulers. The Philippines was under American rule after 1898, and Taiwan was under Japanese rule after 1895, while Thailand is the only country in the region that was never occupied. Because the systems of education differed, we use broad divisions and recode years of education into three categories. The first consists of those with no formal schooling, the second those with at least some primary schooling. The number of years of schooling considered as completed primary differed across countries at the time that the individuals in our sample were completing their education (four years in Thailand, six years in Taiwan and the Philippines). These specifications are used to create the third category, more than primary.

Older adults in the Philippines, on balance, have the highest levels of education and those in Taiwan the lowest. This is the result of historical circumstances, as the United States promoted at least a minimum level of schooling in the Philippines during its occupation and even provided teachers (Carroll et al. 1970). During the same period, Taiwan was occupied by Japan, which did not promote higher levels of schooling (Tsurumi 1977). Specifically, the distribution of education (none, primary, more than primary) is 17 percent, 59 percent, and 24 percent in the Philippines; 41 percent, 39 percent, and 21 percent in Taiwan; and 31 percent, 63 percent, and 6 percent in Thailand.

While level of education is determined fairly early in life and a good case can be made for the direction of causality from education to health in old age (Ross and Wu 1995; Winkleby et al. 1992), the causal direction between wealth and health is less clear, although some U.S.-based data show that income can be a function of health status (Smith 1999). While recognizing the inherent endogeneity, we consider associations between income and physical functioning and avoid interpreting results as causal. For those who are married, income is measured as the combined income of husband and wife, while for the unmarried it is measured as individual income. We use a measure of combined income because we are interested in determining the income that is available for the "purchase" of health and health care, and we assume that in most cases a couple's income would be pooled. Because of differences in monetary units, economic conditions across countries, and proportions who do not report income, we again categorize this measure. Respondents in each country were asked to

report their income as a single figure. Those not listing a figure were asked to place themselves within categories that were provided, and the midpoint or median of the category was used to estimate a single income amount. Ignoring missing responses, we divided income into quartiles in each country, although categories do not strictly represent quartiles since the nature of the coding meant there was heaping around certain responses. This quartile division works out very evenly in the Philippines and Thailand, but there is definite imbalance in Taiwan, where most responses were provided within categories rather than as actual amounts; and heaping of responses means that the percentage in one category of income is as low as 7.4 percent of the population, and, in another category, as high as 39.4 percent. To account for missing income data, we constructed a fifth category for those whose income is not reported, and we include the missing category in multivariate models.

Several other covariates are included in the models. These include comparable measures that have been shown, in the past, to be important determinants of functional health. We adjust models for age (measured in five-year categories), sex (1=female) of the respondent, marital status (1=married), and rural/urban residence (1=rural).

Hypotheses and Analytical Strategy

We test two primary hypotheses:

(1) Older adults with higher income and higher levels of education will be less likely to report a functional limitation and will have lower physical functioning difficulty scores than will others regardless of whether they live in Taiwan, Thailand, or the Philippines.

(2) The magnitude of the relationships between socioeconomic indicators and physical functioning outcomes will be consistent across samples.

The first hypothesis refers simply to whether the association exists in the three settings and does not involve comparing exact magnitudes of associations. The second, referring to the consistency of the association across settings, requires equivalent outcome measures, and thus we test this hypothesis using crouching difficulties and normalized functioning difficulty scores.

Starting with the measure of having at least one of the four functional limitations, we fit separate sample logistic equations predicting having any limitation for each individual country. Although this represents three independent tests, for convenience we combine results into a single table. Since there is a good deal of overlap between measures of education and income, separate models are constructed for each indicator, and these also control for other covariates. The significance of the socioeconomic status indicator is determined by the change in the –2 X log-likelihood statistic, distributed as $\chi 2$, which is the difference in the –2 log-likelihood between a model that contains the specific socioeconomic indicator being tested with covariates and one model that contains only covariates. This is the preferred method of testing for significance in logistic regression (Hosmer and Lemeshow 1989). In separate procedures, not shown in tabular form, we tested for the sensitivity of these results after using robust variance estimation, clustering cases by the specific stratification unit for each sample (county for Taiwan, province for Thailand, *barangay* for the Philippines). The results were not substantially different from those reported here.

To ascertain whether education and income associations are consistent, we use a pooled sample technique. We fit two logistic models predicting having crouching problems for each indicator. The first assumes no difference in education or income effects across countries. The second assumes that education and income effects differ across country samples, and we fit equations with terms that interact education and income with country. We employ a likelihood ratio test to determine whether the second model provides a better fit. If not, we then assume that influences of education and income are consistent across countries, confirming the second hypothesis. To predict the functioning difficulty score, we fit OLS equations in a similar fashion, but we use the F-ratio test to determine whether the interaction model provides a better fit. Because interactions can be difficult to interpret intuitively, we also provide figures that plot predicted values across countries by education and income.

We also control for age, sex, marital status, and residence, factors that past research has identified as determinants of health in adults. We expect, then, that those who are older, are female, and are not married are more likely to have functional problems

and are more likely to have higher functioning difficulty scores than are others (Goldman, Korenman, and Weinstein 1995; Murphy, Glaser, and Grundy 1997; Ortmeyer 1974; Sickles and Taubman 1997; Verbrugge 1989). There is little evidence of the effect of rural versus urban residence on health in the countries being studied, but research in developed countries suggests that the elderly in urban areas are healthier (Lee and Cassidy 1985; Palmore 1983).

RESULTS

We begin by looking at bivariate associations. Table 2 shows the percentage of older adults with at least one difficulty, the percentage with difficulty crouching, and mean normalized functioning difficulty scores across levels of education and income, for each sample separately. For descriptive purposes, the table also includes the percentage within categories of education and income for each country. Looking at the upper panel, we see that, in general, there are strong associations with education in the expected direction: the elderly with less education are more likely to report one or more limitations and crouching problems and more likely to have higher functioning difficulty scores. Initial indications are that there is some difference in the nature of the association across settings, but it is difficult to confirm or quantify these using this bivariate procedure. Still, it appears as if the association is particularly strong in Taiwan, where the percentage with at least one limitation and the percentage with problems crouching are more than twice as great for those with no formal education in comparison to those with more than primary education. The association appears weakest in the Philippines. The bivariate association between education and having crouching problems is not significant in the Philippines, and the association between education and normalized functioning difficulty score is less significant in the Philippines than elsewhere.

The bottom panel looks at associations with income level. Again, these are generally in the expected directions and nearly all are significant, except for the association between having crouching problems and income in the Philippines, which borders on a 0.05 level of significance. In all three samples, respondents with missing income tend to have a fairly high likelihood of reporting limitations. Those who are most physically

Table 2 Bivariate physical functioning distributions by education and income

	% distribution	% with at least one limitation	% with problems crouching	Mean normalized functioning difficulty score (standard deviation in parentheses)
Education				
Taiwan				
None	43.7	56.8	37.4	0.216 (1.081)
Primary	36.1	35.7	22.0	–0.213 (0.855)
More than primary	20.2	25.7	17.7	–0.368 (0.712)
P		0.000	0.000	0.000
Thailand				
None	32.9	75.6	44.1	0.263 (1.047)
Primary	59.8	58.9	34.7	–0.241 (0.891)
More than primary	7.3	53.7	37.1	–0.223 (1.000)
P		0.000	0.000	0.000
Philippines				
None	16.3	54.7	39.9	0.129 (1.074)
Primary	59.4	46.2	34.2	–0.053 (1.009)
More than primary	24.4	40.5	30.7	–0.032 (0.994)
P		0.010	0.109	0.045
Income				
Taiwan				
Lowest	27.7	55.9	39.1	0.198 (1.068)
Second	30.7	38.5	25.5	–0.145 (0.901)
Third	13.7	28.5	16.6	–0.378 (0.664)
Highest	5.8	24.3	15.0	–0.389 (0.719)
Missing	22.1	45.7	27.0	0.017 (1.033)
P		0.000	0.000	0.000 (0.960)
Thailand				
Lowest	21.1	79.8	44.7	0.340 (1.014)
Second	21.2	64.7	38.8	–0.063 (0.948)
Third	23.8	56.0	32.4	–0.303 (0.837)
Highest	22.9	48.9	32.6	–0.378 (0.841)
Missing	11.0	79.2	45.2	0.351 (1.077)
P		0.000	0.000	0.000
Philippines				
Lowest	23.3	59.1	41.9	0.206 (1.046)
Second	23.1	45.9	35.3	–0.048 (0.961)
Third	23.6	44.4	33.9	–0.095 (0.950)
Highest	23.8	41.3	30.2	–0.113 (0.976)
Missing	6.3	46.3	33.8	0.061 (1.152)
P		0.000	0.054	0.001

limited may be less able to report income accurately because they are least involved in paid employment.

We now turn to models that control for age, sex, marital status, and rural/urban residence. Table 3 examines logistic regression odds ratios for reporting at least one of four functional problems separately in each of the three samples. Although we avoid a comparison of the magnitude of the association across settings owing to direct incompatibility of this outcome measure, we are able to make some indirect observations about associations, which exist in Taiwan, exist to some extent in Thailand, and are very weak in the Philippines. In some ways, differences in the bivariate results above become more distinct when controlling for age, sex, marital status, and residence. In Taiwan, for instance, the odds of reporting a limitation are almost two and a half times greater for those with no education versus those with more than primary. Both education and income result in significant changes in log-likelihood. In Thailand and the Philippines the odds ratio of having a limitation is highest for those without education and lowest for those with more than primary schooling, but the associations are not strong enough to be statistically significant. There is a significant association between income level and having a functional limitation in Thailand. In the Philippines, this association runs in the expected direction, but differences in odds ratios are not great enough to be significant, with the exception of the comparison between the lowest and highest levels of income, which reaches borderline significance. Table 3 also shows that age and sex associations with physical functioning are in the expected directions and are significant in all three samples.

Tables 4 and 5 report pooled data results that introduce interaction effects to determine whether associations between socioeconomic indicators and physical functioning outcomes are consistent. Table 4 displays odds ratios for having crouching difficulties. Models 1 and 2 show main effects only, that is, before adding the interactions. In these first two models we observe country differences in the likelihood of reporting crouching problems, with fewer problems being reported in Taiwan than elsewhere. The interaction models are 3 and 4. To determine socioeconomic status effects in Thailand and the Philippines it is necessary to view the main education and income odds ratios

Table 3 Separate sample odds ratios for having at least one of four functional limitations in Taiwan, Thailand, and the Philippines

	Taiwan		Thailand		Philippines	
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Education						
More than primary	1.00		1.00		1.00	
Primary	1.59**		1.13		1.20	
None	2.32**		1.22		1.38	
Δ –2LL	58.27**		1.83		2.65	
Income						
Highest		1.00		1.00		1.00
Second		1.13		1.24^		1.19
Third		1.48*		1.46**		1.13
Lowest		2.38**		2.23**		1.47^
Missing		1.73**		2.30**		0.98
Δ –2LL		49.25**		70.51**		5.16
Age						
60–64	1.00	1.00	1.00	1.00	1.00	1.00
65–69	1.63**	1.63**	1.47**	1.44**	1.02	1.01
70–74	2.53**	2.57**	2.54**	2.32**	1.69**	1.83**
75–79	3.98**	4.00**	4.24**	3.64**	2.81**	2.81**
80 and older	8.33**	8.47**	10.56**	8.68**	5.79**	6.09**
Sex						
Male	1.00	1.00	1.00	1.00	1.00	1.00
Female	2.50**	2.84**	2.95**	2.85**	1.64**	1.69
Marital status						
Married	1.00	1.00	1.00	1.00	1.00	1.00
Not married	0.93	0.90	1.08	0.95	1.19	1.14
Residence						
Rural	1.00	1.00	1.00	1.00	1.00	1.00
Urban	1.08	1.06	0.99	1.07	1.19	1.17
LL	–2,122.27	–2,126.78	–2,571.76	–2,537.45	–790.11	–809.16
Δ –2 LL (model)	470.34**	459.79**	332.35**	367.96**	89.32**	95.28**

** $p < 0.01$; * $0.01 < p < 0.05$; ^ $0.05 < p < 0.10$

together with the interaction effects, while for Taiwan, which is the comparison category, the effects can be determined from the main effect odds ratios. Associations between education and having a crouching problem are strong in Taiwan. The odds ratio of

having this problem is more than twice as great for those without education as for those with more than primary. But the interaction effects show that impact of education is weaker in Thailand and the Philippines. For instance, having no education in the Philippines reduces the main effect odds by a factor of 0.43. If calculated out (various effects can be multiplied to get a total odds ratio), the odds ratios of having crouching problems in the Philippines and Thailand are virtually the same across levels of education. Look-

Table 4 Pooled sample odds ratios for having crouching difficulties

	Main effect models		**Interaction effect models**	
	Model 1	**Model 2**	**Model 3**	**Model 4**
Country				
Taiwan	1.00	1.00	1.00	1.00
Thailand	1.81**	1.51**	3.07**	3.06**
Philippines	1.48**	1.90**	1.94**	2.18**
Education				
More than primary	1.00		1.00	
Primary	1.18		1.34*	
None	1.33*		2.09**	
Income				
Highest		1.00		1.00
Second		1.06		1.06
Third		1.19		1.66*
Lowest		1.37**		2.75**
Missing		1.11		1.61*
Age				
60–64	1.00	1.00	1.00	1.00
65–69	1.12	1.11	1.12	1.12
70–74	2.16**	1.62**	1.60**	1.64**
75–79	2.19**	2.13**	2.19**	2.14**
80 and older	3.40**	3.35**	3.46**	3.38**
Sex				
Male	1.00	1.00	1.00	1.00
Female	1.70**	1.74**	1.69**	1.73**
Marital status				
Married	1.00	1.00	1.00	1.00
Not married	0.97	0.93	0.97	0.92
Residence				
Rural	1.00	1.00	1.00	1.00
Urban	1.27**	1.28**	1.27**	1.29**

continued

Table 4 *continued*

	Main effect models		Interaction effect models	
	Model 1	**Model 2**	**Model 3**	**Model 4**
Interactions				
Country × Education				
Thailand × Primary			0.87	
Thailand × None			0.63^	
Philippines × Primary			0.70^	
Philippines × None			0.43**	
Δ –2LL			22.90**	
Country × Income				
Thailand × Second				0.92
Thailand × Third				0.68
Thailand × Lowest				0.42**
Thailand × Missing				0.70
Philippines × Second				1.18
Philippines × Third				0.76
Philippines × Lowest				0.49**
Philippines × Missing				0.61
Δ –2LL				29.67**
LL	–5,677.83	5,713.21	–5,666.38	–5,698.38
Δ –2LL (model)	335.81**	321.69**	391.62**	392.94**

** p < 0.01; * 0.01 < p < 0.05; ^ 0.05 < p < 0.10

ing at interaction effects with income, a similar situation exists, that is, the association is significant and strong in Taiwan, while the main effect odds ratios for income are generally lower in Thailand and the Philippines. Changes in the log-likelihood for the education and income interaction effects are both significant, verifying that the associations are not consistent across the three samples.

Table 5 examines OLS estimates predicting the normalized functioning difficulty score, and although the measure is different, the results are largely consistent with those found above. Country effects by themselves are not interpretable across samples because scores have a mean of 0 and a standard deviation of 1 in each. Models 1 and 2 show that across the pooled samples, the elderly with less education and less income tend to have higher scores and thus a greater number of and more severe difficulties. But the interaction effects in Model 3, all of them negative in direction, indicate that the associations with education are weaker in Thailand and the Philippines than in Taiwan.

The income interactions show a different picture. Income associations appear almost as strong in Thailand as in Taiwan, but are weaker in the Philippines. Although the explained variance increases by only about 1 percent when introducing the interaction terms, the changes in F-ratio are significant. Tables 4 and 5 also confirm the expected

Table 5 Pooled sample OLS estimates for normalized functioning difficulty score

	Main effect models		**Interaction effect models**	
	Model 1	**Model 2**	**Model 3**	**Model 4**
Country				
Taiwan	—	—	—	—
Thailand	0.031	0.073**	0.154*	0.015
Philippines	0.051	0.082*	0.203**	0.148*
Education				
More than primary	—		—	
Primary	0.040		0.145**	
None	0.172**		0.325**	
Income				
Highest		—		—
Second		0.029		–0.028
Third		0.108**		0.120*
Lowest		0.278**		0.322**
Missing		0.245**		0.204**
Age				
60–64	—	—	—	—
65–69	0.061*	0.054^	0.065*	0.056^
70–74	0.306**	0.307**	0.309**	0.306**
75–79	0.623**	0.609**	0.625**	0.603**
80 and older	1.103**	0.980**	1.015**	0.969**
Sex				
Male	—	—	—	—
Female	0.316**	0.320**	0.308**	0.315**
Marital status				
Married	—	—	—	—
Not married	0.015	–0.015	0.018	–0.016
Residence				
Rural	—	—	—	—
Urban	0.070*	0.068*	0.069*	0.074*

continued

Table 5 *continued*

	Main effect models		Interaction effect models	
	Model 1	**Model 2**	**Model 3**	**Model 4**
Interactions				
Country × Education				
Thailand × Primary			–0.127^	
Thailand × None			–0.174*	
Philippines × Primary			–0.154*	
Philippines × None			–0.280*	
Δ F-ratio			2.35*	
Country × Income				
Thailand × Second				0.076
Thailand × Third				0.056
Thailand × Lowest				0.070
Thailand × Missing				0.203*
Philippines × Second				0.066
Philippines × Third				–0.094
Philippines × Lowest				–0.201*
Philippines × Missing				–0.140
Δ F-ratio (interactions)				2.11*
Constant	–0.603	–0.665	–0.703	–0.663
F-ratio (model)	82.93**	66.99**	72.03**	56.34**
R-square	0.164	0.173	0.165	0.176

** p < 0.01; * 0.01 < p < 0.05; ^ 0.05 < p < 0.10

associations with age and sex, and show some significant influences of residence, with those in urban areas presenting greater limitations than those in rural areas.

Figures 1–4 assist in the interpretation of the interaction models by plotting predicted values. Figures 1 and 2 show the predicted probability of having difficulty crouching in each country by education and income. The predicted probability is very similar among those with no education and among those with the lowest level of income in each setting, that is, a probability between roughly 0.35 and 0.40. But this probability difference becomes wide with rising levels of education and income so that those in Taiwan appear to benefit the most from higher socioeconomic status. For example, the probability of reporting a crouching difficulty declines to about 0.20 in Taiwan for those with more than primary education but remains between roughly 0.30 and 0.40 for those with more than primary in the Philippines and Thailand.

Figure 1 Predicted probability of reporting difficulties crouching in the three samples by education

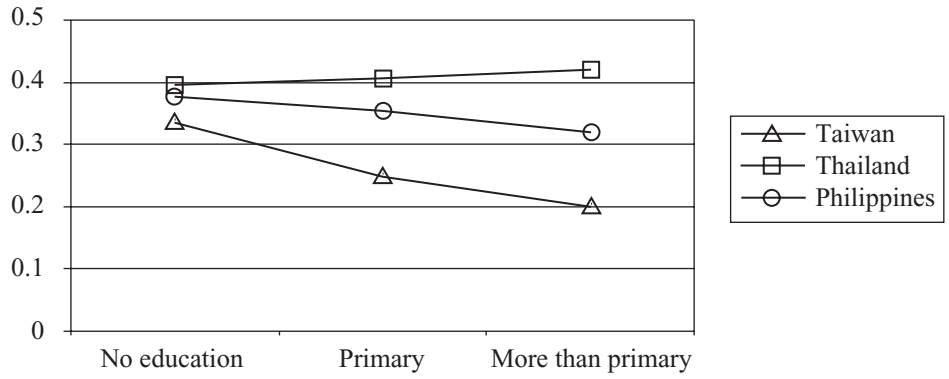
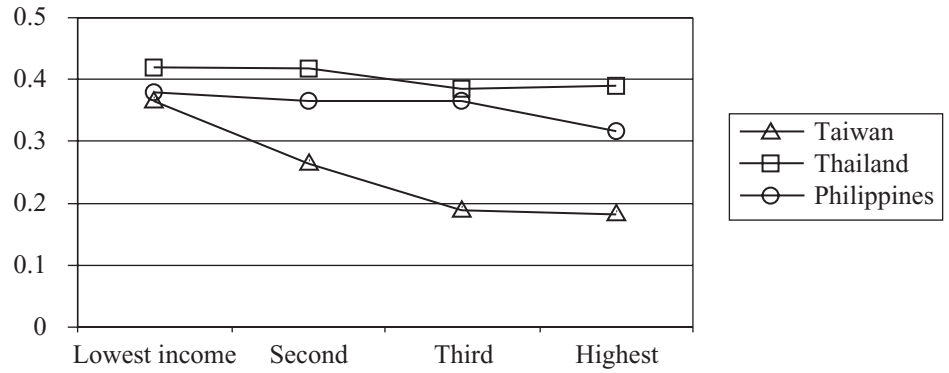


Figure 2 Predicted probability of reporting difficulties crouching in the three samples by level of income



Figures 3 and 4 show the predicted normalized functioning difficulty scores by education and income across samples. The mean score is 0 in each country, so the slope of the line in these figures indicates how much better off those with high education and income are in comparison to the mean and how much worse off those with low education and income are in comparison to the mean within each individual sample. The education result is con-

Figure 3 Predicted normalized functioning difficulty score in the three samples by education

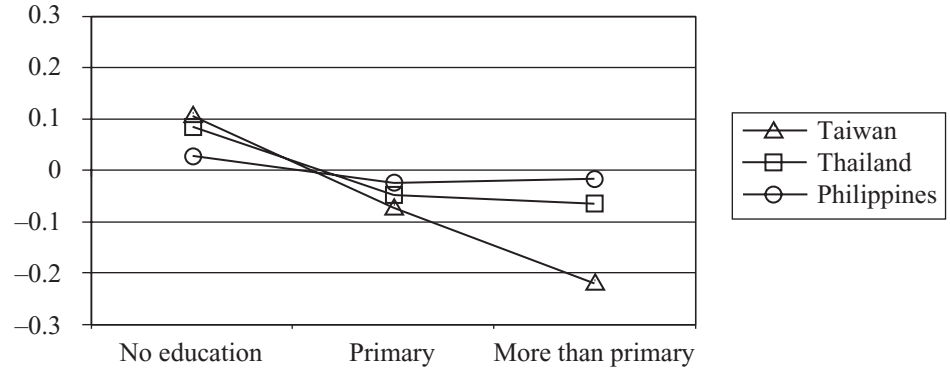
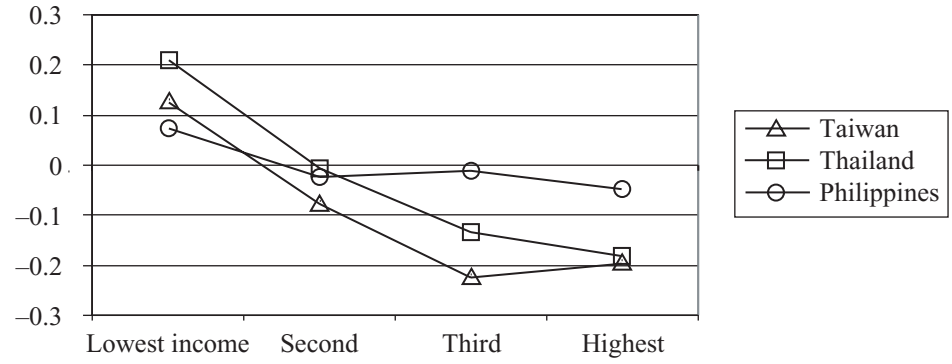


Figure 4 Predicted normalized functioning difficulty score in the three samples by level of income



sistent with the results seen in the previous figures. There is a sharp decline in the predicted score as education increases in Taiwan, indicating that those with more education have fewer and less severe limitations. A slight decline by level of education is found in Thailand and very little change in the Philippines. For income, there are sharp declines in the scores in both Taiwan and Thailand, but very little change by level of income in the Philippines.

DISCUSSION

We conclude by offering five possible explanations as to why the socioeconomic status indicators used in our study might affect physical functioning in different ways among older adults in different settings. These include differences in the way socioeconomic status influences health, possible reporting differences, differences in the way individuals perceive health problems, environmental barriers that can diminish the advantage of those of higher status, and differences in stratification systems. A combination of these is quite possible, and we suggest that future research attempt to distinguish between these explanations.

First, differences in the way education and income influence physical functioning of older adults may be accounted for by variations in socioeconomic development across settings. Socioeconomic status may have less of an effect on the physical functioning of older adults in settings where there are tangible limitations to medical care and barriers to the attainment of health-related knowledge. Consider again that most of the research that confirms a strong association has taken place in advanced Western societies where those with higher socioeconomic status have access to advanced resources that can benefit their health. Of the three societies included in the current study, Taiwan is by far the most advanced economically and is therefore closest to Western nations with respect to development. In turn, results in Taiwan appeared to be most comparable to those of previous studies conducted in the West. In short, it seems reasonable that individuals who have high socioeconomic status benefit most when there is access to resources that may be more conducive to ensuring well-being, such as the availability of better-quality health care.

Second, differences in reporting may exist. Lower-status individuals in some settings may be more modest about reporting health problems. In addition, reporting of health disorders may vary by cultural circumstance. Angel and Guarnaccia (1989) found that Hispanics who responded to a survey in Spanish rather than English were more likely to report their health in negative terms, suggesting even linguistic differences. If individuals are more likely to report limitations in a particular setting, the influence of education or income on physical functioning may be muted.

Third, there may be differences in the way different socioeconomic groups perceive and consequently report health problems in different settings. Waidmann, Bound, and Schoenbaum (1995) found that the reporting of health problems increased in the United States during the 1970s as a result of better and earlier diagnosis. In settings where medical access is limited to those in higher-status groups, these individuals are likely to be more aware of and sensitive to health difficulties and therefore may be more likely to report problems. This would explain the lack of association between higher socioeconomic status and reporting of functioning limitations seen in the Philippines. That is, despite having functional problems, those with lower education and income may be less likely to interpret their disorders as something serious enough to report.

Fourth, barriers may exist in certain settings that could make some individuals more likely to report functioning disorders. For instance, a number of areas in the Philippines are underdeveloped. Elderly individuals of higher socioeconomic status in these areas may be faced with environmental barriers when conducting functional tasks, such as roads that are difficult to walk or longer distances to walk between locations. Because of this, they may be more likely to perceive a functional disorder as being worth reporting. Similar barriers might exist in Thailand. Traffic congestion in Bangkok, for instance, may make it difficult for older adults to get around, especially as curbs are high and there are few pedestrian crossways. Regardless of levels of socioeconomic status, walking a given distance might present, on average, fewer difficulties in Taipei, which is friendlier to those with functional problems. Consequently, differences in environment can remove some of the advantages normally associated with higher levels of socioeconomic status.

Finally, where education and income appeared to have less of an effect on functional outcomes, it is possible that our measures of status do not adequately reflect the stratification system in place and therefore do not encompass the access and other psychosocial differentials that exist across groups. For example, in Thailand, why did income distinguish between some functional outcomes while education did not? Because few older adults in Thailand have more than a low level of education, this measure might not be specific enough. As another example, the elderly in the Philippines would have obtained their schooling during the American occupation. One of the consequences

of American rule in the Philippines was an increase in educational attainment and more egalitarian access to education (Hunt 1993). Hence, few older adults in that country in the current sample have no education. Thus, across the three Asian samples, different socioeconomic status indicators might have varying effects on physical functioning if the stratification structures are themselves different.

While future cohorts of older adults in Asian societies will have higher levels of education and income and will maintain a higher standard of living, concern has been expressed over the erosion of traditional support for older adults (Mason 1992). Some may point to the decreasing proportion of older adults who live in extended family arrangements as evidence of this trend (Asis et al. 1995). In addition, future cohorts of the elderly will have smaller families and therefore smaller network resources regardless of their living arrangements. Our study suggests that changes in socioeconomic characteristics such as education may play a role in offsetting transitions in age structure and available support in some societies, such as Taiwan. Future research should examine further whether there are discrepancies in the effect of socioeconomic status across settings and, if so, why these occur. In particular, there is need for research that examines how individuals perceive and report similar health disorders across diverse cultural and geographical settings and how these reporting differences can influence the perceived association between socioeconomic status and health.

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