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Socioeconomic differences in health among older adults in Mexico

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ABSTRACT

Although the relationship between socioeconomic status (SES) and health is well-established in Western industrialized countries, few studies have examined this association in developing countries, particularly among older cohorts. We use the Mexican Health and Aging Study (MHAS), a nationally representative survey of Mexicans age 50 and older, to investigate the linkages between three indicators of SES (education, income, and wealth) and a set of health outcomes and behaviors in more and less urban areas of Mexico. We consider three measures of current health (self-rated health and two measures of physical functioning) and three behavioral indicators (obesity, smoking, and alcohol consumption). In urban areas, we find patterns similar to those in industrialized countries: higher SES individuals are more likely to report better health than their lower SES counterparts, regardless of the SES measure considered. In contrast, we find few significant SES-health associations in less urban areas. The results for health behaviors are generally similar between the two areas of residence. One exception is the education-obesity relationship. Our results suggest that education is a protective factor for obesity in urban areas and a risk factor in less urban areas. Contrary to patterns in the industrialized world, income is associated with higher rates of obesity, smoking, and excessive alcohol consumption. We also evaluate age and sex differences in the SES-health relationship among older Mexicans. The results suggest that further economic development in Mexico may lead to a widening of socioeconomic inequalities in health. The study also provides insight into why socioeconomic gradients in health are weak among Mexican-Americans and underscores the importance of understanding health inequalities in Latin America for research on Hispanic health patterns in the U.S.

INTRODUCTION

The relationship between socioeconomic status (SES) and health is well-established in Western industrialized countries. Individuals with lower SES experience higher rates of mortality and are more likely to suffer from numerous health conditions. This so-called "social gradient" in health has been observed across different time periods and age groups using a wide range of SES indicators, health measures, and methodologies (see Smith, 1999 and Goldman, 2001). However, fewer studies have considered the linkages between SES and health in developing countries, particularly at older ages. Understanding the determinants of health among older adults is critical in developing countries where rapid population aging is requiring governments to respond to the growing health-related needs of elderly populations with limited economic resources.

Researchers have attributed SES-related differences in health to a broad set of mechanisms that include living and working conditions, exposure to stress and the availability of psychosocial coping resources, health-related knowledge and behaviors, and access to medical care (Williams, 2005). The underlying pathways are likely to vary with a country's stage of economic development as well as with social and cultural factors. For example, income level can influence epidemiological conditions, along with choices in housing, education, work, diet, medical care, and social support. As standards of living rise, variability across individuals in exposure to health-enhancing or health-damaging factors can also increase. The magnitude of resulting health inequalities at older ages will depend on social welfare policies and cultural context, such as health insurance, social security, and the availability of familial or other forms of social support. Disparities in health will also be influenced by health-related behaviors (such as diet, exercise, smoking, and drinking), which themselves are likely to change over the course of development (Popkin & Gordon-Larsen, 2004; Kim, Symons, & Popkin, 2004).

To date, research in developing countries on SES differences in health at older ages has been fragmented and few studies have considered behavioral risk factors. This paper seeks to address these gaps by using the Mexican Health and Aging Study (MHAS) to examine variations by SES in health

behaviors and health outcomes among older adults in a middle-income developing country. The extensive information on SES and health collected in the MHAS permits a more comprehensive examination of the SES-health relationship than most studies previously conducted in a developing country.

Mexico has undergone a rapid demographic transition and significant socioeconomic and epidemiological change over the past six decades. Between 1940 and 2002, infant mortality fell from 126 to 21 deaths per 1,000 live births, life expectancy increased from 41 to 75 years, and the total fertility rate dropped from over 7 to just above 2 (OECD 2005a, Oxford 2005). This is resulting in a significant change in Mexico's age structure, with the percentage of the population over age 65 estimated to increase from 5% in 2000 to 18% in 2050 (UN, 2002). In contrast to older industrialized countries, Mexico's rapid ageing is taking place in the context of relatively low living standards and inadequate benefit and health care systems (Palloni, Soldo, & Wong, 2002). Approximately 40% of Mexico's elderly are estimated to live in poverty, with only one-third of adults 60 and older covered by a public or private pension and half by health insurance (Parker & Wong, 2001). As a result, Mexicans continue to rely on familial support in old age, but such traditional support systems are weakening (De Vos, Solis, & Montes de Oca, 2004; Palloni et al., 2002).

Mexico is also characterized by vast regional differences. Most of Mexico's economic growth has occurred through urbanization, with almost one-third of the population now residing in four major metropolitan areas, and 20 million people living in Mexico City alone (OECD, 2005b). As a result, living standards, employment, consumption patterns, and access to health care and social services differ considerably between urban and rural areas. An estimated one-third of rural residents live in extreme poverty versus one-tenth of urban residents (World Bank, 2005). In rural areas, infectious diseases and malnutrition continue to be major causes of mortality whereas mortality in urban areas is dominated by chronic disease and other health problems associated with industrialization.

In light of these regional contrasts, we investigate how the relationship between SES and health differs between more and less urban areas of Mexico, an often-neglected dimension in research on social gradients in developing countries. We also extend the previous literature by examining the extent to

which the relationship between various SES and health indicators varies by age and sex among older adults in Mexico.

PREVIOUS RESEARCH

Socioeconomic status and health outcomes

In view of the rapid growth of elderly populations, considerable attention has been devoted to the social determinants of health at older ages in Western industrialized countries. Most of this research has concluded that SES gradients in health persist into old age for a broad range of health measures, including mortality (Elo & Preston, 1996; Marmot & Shipley, 1996), functional limitations (Berkman & Gurland, 1998; Camacho, Strawbridge, Cohen, & Kaplan, 1993), disease onset (Crimmins, Mayward, & Seeman, 2004), and self-rated health (Huisman, Kunst, & Mackenbach, 2003; Robert & House, 1996).

The relationship between SES and health is less clear in developing countries. Several studies in Asia show that higher education and affluence are associated with better self-rated health and lower mortality, but that the association with functional limitations and chronic conditions is less consistent and generally weaker (Zimmer, Natividad, Ofstedal, & Lin, 2002; Zimmer, Chayovan, Lin, & Natividad, 2004; Zimmer & Amornsirisomboon, 2001; Zimmer & Kwong, 2004; Hurt, Ronsmans, & Saha, 2004; Liang, McCarthy, Jain, Krause, Bennett, & Gu, 2000). In contrast, a recent comparative study of seven cities in Latin America finds that higher education is associated with better self-rated health and less disability in almost all cities, though the strength of the association varies across countries. The pattern is less clear for economic indicators of SES (Wong, Pelaez, & Palloni, 2005; PAHO, 2003). Similarly, a longitudinal study in a peri-urban area of Costa Rica finds that mortality tends to be lower among the more educated, but is not related to wealth (Rosero-Bixby, Dow, & Lacle, 2005).

Few studies in Latin America are based on broad population-based samples. One exception is a recent study using MHAS data by Wong (2003), who finds that better self-reported health is associated with higher levels of education, income, and wealth among older Mexican adults.

Socioeconomic status and health behaviors

Relatively little attention has been paid to SES differences in health behaviors later in life, even though health behaviors are often posited as mediators through which SES affects health. In Western industrialized countries, the greater prevalence of adverse behavioral factors (such as physical inactivity, obesity, and smoking) among lower SES individuals is well-documented in the general population (Kaplan & Keil, 1993; Winkleby, Jatulis, Frank, & Fortmann, 1992; Sobal & Stunkard, 1989) and, to a lesser extent, among older adults (Wray, Alwin, & McCammon, 2005; Kaplan, Huguet, Newsom, McFarland, & Lindsay, 2003). One exception is alcohol consumption, which is inconsistently related to SES across studies (Van Oers, Bongers, Van de Groor, & Garretsen, 1999).

The relationship between SES and behavioral risk factors in developing countries is more complex. Older (pre-1990) studies in Asia and Latin America show that obesity and unhealthy behaviors are associated with higher SES, but more recent studies, including those based on older adults, suggest that the opposite pattern is emerging in some middle-income countries and in metropolitan areas (Sobal & Stunkard, 1989; Zimmer et al, 2002; Monteiro, Moura, Conde, & Popkin, 2004; Yu, Nissinen, Vartiainen, Song, Guo, Zheng, et al., 2000; Carter, Hambleton, Broome, Fraser, & Hennis, 2006). However, the pattern within countries can be diverse. Studies in several Latin American countries show obesity to be inversely related to education but directly related to income, and that the SES-obesity relationship varies by region and sex (Monteiro, Conde, & Popkin, 2001). Reverse SES gradients in smoking and drinking behaviors have been reported among younger populations in this region (Vázquez-Segovia, Sesma-Vázquez & Hernández-Avila, 2002; Caballero, Madrigal, Hidalgo, & Villaseñor, 1999).

Age and sex differences in the SES-health relationship

A substantial body of research, mostly in Western industrialized countries, has considered how the SES-health relationship varies by age and sex. Many studies suggest that SES differences in health expand through late middle-age and decline thereafter (Kitagawa & Hauser, 1973; Beckett, 2000; Deaton and Paxson, 1998). Declining health inequalities in later life have been attributed to selective mortality,

social sector programs targeting older adults, the dominance of biological versus social determinants at older ages, and cohort effects (see Herd, 2006). However, some researchers have found that these differentials continue to widen after middle-age, possibly reflecting the accumulated effects of social disadvantage (Ross & Wu, 1996).

Research on sex differences in the SES-health relationship has been similarly mixed. Many studies in industrialized countries report stronger SES gradients in health and mortality for men than women (e.g., Koskinen & Martelin, 1994; Elo & Preston 1996), while other studies have found that the sex difference is reversed (Duncan, Daly, McDonough, & Williams, 2002; Thurston, Kubzansky, Kawachi, & Berkman, 2005) or absent (McDonough, Williams, House, & Duncan, 1999; Marmot, Ryff, Bumpass, Shipley, & Marks, 1997). Little is known about how the SES-health link differs by sex in developing countries. In Mexico, Wong (2003) finds that income differentials in self-reported health are smaller for older women than men, but that sex differences are negligible for education and wealth. In developing and industrialized countries, SES gradients in obesity tend to differ by sex and be less consistent among men than women (Sobal & Stunkard, 1989; Monteiro et al., 2004).

Current study

The current study expands on that of Wong (2003) by examining the strength and robustness of SES-health linkages across multiple health and behavioral outcomes and between more and less urban areas of Mexico. Because major urban centers in Mexico are highly industrialized and "Westernized", SES gradients in health are likely to resemble those in industrialized countries. However, in less urban areas, where socioeconomic opportunities and access to medical care tend to be constrained regardless of level of SES, differentials in health may be weaker. We also examine how socioeconomic differences in health interact with age and sex among older Mexicans. In a context of weak safety nets for the elderly, socioeconomic resources may become increasingly important in maintaining health at older ages. Moreover, due to traditional gender roles in Mexico, SES may be less important for older women than men in Mexico. Mexican women historically have lower labor force participation than men and, as a

result, may have less control over household resources or access to employment-related benefits, potentially making women less able to translate higher SES into health-enhancing resources. However, there is also evidence to suggest that Mexican families provide more support for elderly women than men (Parker & Wong, 2001).

METHODS

Data

Data for this analysis come from the 2001 (baseline) Mexican Health and Aging Study (MHAS). Modeled after the U.S. Health and Retirement Survey (HRS), the MHAS collected data on various SES measures, including educational attainment, 38 different components of income, and 19 types of assets. The MHAS sample is representative of the non-institutionalized population aged 50 and over in 2000. Based on a sampling frame used by the National Employment Survey, 11,000 households with at least one resident aged 50 or older (born prior to 1951) were selected for the baseline survey. If more than one age-eligible individual resided in the household, one was randomly selected. The sample covers all 32 states in Mexico, has urban and rural representation, and includes an over-sample of six states with high out-migration to the U.S (Wong & Espinoza, 2004a). To account for the complex sampling design, sampling weights are used for descriptive analyses and variables used in the construction of sampling weights (rather than weights) are included in the multiple regression models, including residence in a high out-migration state, age, sex, and urban residence (Winship & Radbill, 1994).

A total of 9,806 age-eligible persons and their respective spouses/partners (regardless of age) were interviewed, resulting in a total response rate of 90% (Wong & Espinoza, 2004a). We include proxy interviews, which account for approximately 7% of the sample, but exclude spouses/partners of selected respondents to maintain a representative sample. Of the 9,806 original respondents, 288 observations (2.94%) were dropped due to missing data on one or more explanatory variables, resulting in an analysis sample of 9,518.

Outcome measures

Health outcomes

We examine three indicators of health status at older ages, each of which is based on self-reported information (the MHAS does not include 'objective' measures of health such as physician's assessments or functional performance tests). The first measure is self-rated health (SRH), reported on a scale of 1-5 with 1 = Excellent, 2 = Very good, 3 = Good, 4 = Fair, and 5 = Poor. In industrialized countries, SRH has been shown to be a strong predictor of mortality and morbidity (Idler and Benyamini, 1997). There has been less opportunity to validate the use of SRH in developing country contexts. However, there is a high degree of consistency between SRH and other health indicators in the 2001 MHAS (Wong, 2003). Because SRH information was not collected from proxy respondents, this outcome is missing for approximately 7% of the sample.

We also consider two measures of functional limitations, which are less subject to reporting biases than SRH. The first is physical activity limitations, which is measured by self-reported difficulty with the following seven activities: (a) walking several blocks, (b) climbing several flights of stairs, (c) getting up from a chair after sitting for long periods, (d) stooping, kneeling, or crouching, (e) reaching or extending arms above shoulder level, (f) lifting or carrying objects weighing over 5 kilograms, and (g) picking up a 1 peso coin from the table. A score of 0 is given if the respondent reports no difficulty and 1 if the respondent reports some difficulty or an inability to perform the activity. A scale was generated by summing the scores for the seven activities, a common approach used in other studies (e.g., Smith & Kington, 1997). The second measure of physical functioning is self-reported difficulty performing one or more of the following "activities of daily living" (ADL): dressing, walking across a room, bathing, eating, getting into or out of bed, and toileting (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963). The ADL outcome is coded as 1 if the respondent reported difficulty or could not perform an ADL, 0 otherwise.

Health Behaviors

This study also considers three behavioral risk factors for health among older adults: (1) obesity, (2) excessive drinking, and (3) current smoking. While there are several possible causes of obesity, including genetic and biological factors, obesity is used in this analysis as a proxy for dietary habits and exercise. Obesity in older adults has been associated with higher mortality and chronic disease risks, as well as accelerated functional decline (Villareal, Apovian, Kushner, & Klein, 2005; Krueger, Rogers, Hummer, & Boardman, 2004). We measure obesity by body mass index (BMI = weight (kg)/ height (m^2)). Following WHO global BMI cut-points, we define obesity as BMI $\geq$ 30 (WHO, 2000). In the MHAS, BMI is measured in two ways: (1) through self-reports of height and weight and (2) for a sub-sample of 2,300 respondents, through the application of standard measurements by interviewers. The correlation between self-reports and actual measures of height and weight in the MHAS sample is high (.80), suggesting that self-reports provide a useful, if imperfect, measure of BMI. Therefore, self-reported values were used to calculate BMI when measurements were unavailable. After utilizing both self-reports and measurements, obesity data were missing on approximately 20% of observations. Further analysis (not shown) indicates that the probability of having missing data on obesity is significantly associated with education, income, age, and sex, suggesting that estimates of the association between SES and obesity presented below are more likely to be biased than estimates for the other outcomes, which have low frequencies of missing data.

The excessive drinking variable indicates whether the respondent is a heavy or binge drinker. Heavy drinking is defined as having an average of four or more drinks on days that alcohol was consumed during the last three months, whereas binge drinking is defined as having four or more drinks on any one occasion in the last three months (Goldman, Kimbro, Turra, & Pebley, 2006). Current smoking is an indicator for whether the respondent reported smoking cigarettes at the time of the survey. Three-quarters of current smokers reported smoking 10 or fewer cigarettes per day.

Explanatory variables

Socioeconomic status

The measurement of SES at older ages presents particular challenges, with each measure having advantages and weaknesses. Education is generally considered the best indicator of SES at older ages because it is typically completed early in life (and therefore less affected by health impairments that develop in adulthood), is a key factor determining subsequent occupation and income, and can be easily measured. However, variation in economic status for a given education level suggests that education may not capture important aspects of SES (Braveman, Cubbin, Egerter, Chideya, Marchi, et al., 2005). Thus, we also consider two measures of economic status, income and wealth, while recognizing that these measures are more likely than education to reflect the consequences of health status (Smith, 1999; Smith & Kington, 1997). The correlation coefficients between each pair of SES indicators are sufficiently low (0.05 to 0.29) to suggest that education, income, and wealth are capturing different aspects of SES at older ages, a finding reported elsewhere (Braveman et al, 2005; Zimmer & Kwong, 2004).

Education is measured as years of completed schooling, categorized into four levels: no formal education, 1-5 years, 6 years (completion of primary school), and 7 or more years. For income and wealth, we use variables created by the MHAS research team (Wong and Espinoza, 2004b). The income measure was created by summing income from the respondent's and spouse's/partner's labor, pensions, businesses, real estate, financial assets, and private transfers and subtracting business and property expenditures. Net wealth includes the estimated net value of assets owned singly or jointly by the respondent and spouse/partner in the form of homes, businesses, rental properties, capital, vehicles, other assets, and other debts. As in the HRS, unfolding bracket techniques were used to minimize non-response to income and wealth questions, resulting in response rates comparable to the HRS. In cases of non-response, the MHAS research team imputed income and wealth values. Response rates and the imputation procedure are described in detail elsewhere (Wong and Espinoza, 2004b). In our statistical models, we use terciles of income and of wealth (created by sorting individuals by income/wealth and constructing three equal sample-size groups), which have been used in other analyses based on the MHAS and HRS (Wong, 2003; Smith, 1999).

Other Variables

All multiple regression analyses control for the following demographic variables previously shown to be related to SES and health: age, sex, marital status, and household size (e.g., Elo & Preston, 1996). Urban is defined as living in a major urban area with at least 100,000 residents; residence outside of a major urban is referred to as "less urban". The MHAS does not allow for further regional disaggregation. Age is specified as continuous, and, where significant, a squared term is also included in the models. Marital status is classified into four categories: currently married or in a consensual union, divorced or separated, widowed, and never-married. We use the log of household size, measured as the total number of individuals residing in the respondent's household. A binary variable denoting residence in a high out-migration state is included because of its use in the MHAS sampling design.

Analysis

We begin by presenting descriptive statistics and unadjusted bivariate associations between the SES and health indicators using weighted data (Tables 1 and 2). We next use multiple regression models to estimate the association between education, income, and wealth and each health-related outcome after controlling for socio-demographic variables that may confound the SES-health relationship. The nature of the regression model varies across outcome variables. Ordinal logit regression is used for SRH and the physical activity limitations scale. Logit models are used for the ADL, obesity, smoking, and drinking outcomes, all of which are binary variables.

For each health outcome, two regression models are estimated. First, we estimate the effect of each of the three SES indicators separately, after controlling for the socio-demographic variables. The results of these models are displayed in the first column (labeled "Gross Effect") under each health outcome in Tables 3 and 4. Second, education, income, and wealth are included in the same model to determine the effects of each SES indicator net of the others. These results are displayed in the second column under each health indicator (labeled "Net Effect") in Tables 3 and 4. All models are estimated

separately on the urban and less urban samples. This decision was based on exploratory models that revealed many statistically significant interactions between urban residence and the SES measures.

In the final stage of the analysis, we examine variations in the SES-health associations by age and sex for the urban and non-urban samples. To do so, we add interaction effects between age (a continuous variable) or sex and a given SES variable (education, income or wealth) to the "Net Effect" models in Tables 3 and 4. Therefore, each model includes all three SES variables and interaction terms between a single SES variable and age or sex, along with the control variables used in previous models. Likelihood ratio tests are used to determine the joint significance of the set of interaction terms for a given categorical SES measure. We do not examine sex differences in drinking due to the low (< 1%) prevalence of excessive drinking among women.

Because all outcome variables have been coded so that higher values reflect worse outcomes or behaviors, SES gradients that characterize industrialized countries would be reflected by *negative* coefficients in the regression models – i.e., higher levels of SES would be *inversely* associated with poorer health and riskier behaviors. Similarly, to the extent that "reverse gradients" are present, these would be reflected by *positive* coefficients for SES.

RESULTS

Sample description and bivariate analysis

Table 1 presents (weighted) descriptive statistics for Mexicans 50 and older based on 2001 MHAS data. Statistics are presented for the full sample and separately by area of residence. Approximately 45% of older Mexicans live in a major urban area. The majority (63%) report themselves in fair or poor health, with residents in less urban areas reporting relatively worse health. The prevalence of functional limitations is similar across residential areas. On average, older Mexicans report 1.7 physical activity limitations and 11% percent report difficulty with 1+ ADL. Approximately 20% of older

Mexicans are obese and a similar percentage smoke. The prevalence of smoking is slightly higher in urban areas. Fewer than 8% of older Mexicans report excessive drinking.

With respect to socioeconomic indicators, urban residents have substantially higher levels of education and economic resources than less urban residents. Average educational attainment is 5.7 years in urban areas and 2.5 years in less urban areas. Mean and median income and wealth are also higher in urban areas, with urban residents less likely to be in the lowest and more likely to be in the highest income/wealth tercile.

Table 2 shows (unadjusted) differences in health and health behaviors across SES categories (using weighted data). In both urban and less urban areas, older adults with more education are less likely to report being in poor health and having functional limitations than their less-educated counterparts. The association between education and behavioral health risks is not as clear-cut. In urban areas, education is inversely related to obesity and directly related to smoking, but there is no apparent relationship for the less urban sample. The data for income suggest that higher income is associated with better health outcomes in both regions, but that greater wealth is related to health status only in urban areas. As with education, the relationship between economic status and behavioral risk factors is mixed. Higher income is associated with a greater prevalence of smoking and drinking in urban areas and a greater prevalence of obesity and smoking in less urban areas. The associations between wealth and behavioral factors are generally weak and non-monotonic.

Results from multiple regression models

Table 3 presents the results from multiple regression models of the three health outcomes: self-rated health, physical activity limitations, and ADL limitations. For urban areas, the negative coefficients on the SES variables in the Gross Effect models indicate that higher education, income, and wealth are significantly associated with better health outcomes. While the coefficients become smaller (less negative) in the Net Effect models, all three SES indicators remain significant predictors of health status. The magnitude and level of significance of the SES coefficients, however, vary across measures. Estimates for

the less urban sample (shown in the second panel) suggest that SES-related health inequalities are weaker in these areas. Fewer SES differentials are statistically significant, and the coefficients are generally smaller (less negative) than in urban areas.

Table 4 presents the SES coefficients for regression models of obesity, smoking, and excessive drinking. The findings for obesity are noteworthy: a higher level of schooling is significantly associated with a lower prevalence of obesity in urban areas, but a higher prevalence in less urban areas. This "reverse" education gradient for obesity in less urban areas also holds for income and wealth. The results differ somewhat for smoking and drinking behaviors. The prevalence of smoking and excessive drinking is not associated with education in either region, but smoking (urban only) and drinking (both regions) are positively associated with higher income levels. In general, and in contrast to income, wealthier older Mexicans are less likely to engage in smoking and drinking, but this association is significant in only a few cases.

We examine how these SES differences in health and health behaviors vary by age and sex by adding interaction terms between a single SES indicator and age or sex to the Net Effect models. Due to space limitations, we do not present the estimates, but they are available from the authors upon request. Because we recognize that these comparisons entail a large number of statistical tests, we consider the results from these models to be tentative. Our findings suggest that income differentials in SRH and functional limitations—but not behavioral risk factors—decrease after middle-age in both urban and less urban areas of Mexico. In contrast, we find that education and wealth differences in health do not vary significantly as a function of age in this sample. With respect to sex differences, we find almost universally smaller SES differentials in health and health behaviors for women than men, but that these sex differences are generally statistically significant only in urban areas. Specifically, in urban areas, we find significant sex differences in the association between: education and physical activity limitations, obesity, and smoking; income and SRH, ADL limitations, and smoking; and wealth and ADL limitations, obesity and smoking. In less urban areas, only two SES-sex interaction terms are significant: income and physical activity limitations, and wealth and smoking. In all cases except for the education-obesity

relationship in urban areas, the sign of the SES coefficients for men and women are the same. In this one exception, we find that obesity is more prevalent among more (versus less) educated men and less prevalent among more educated women.

DISCUSSION

We use a nationally-representative sample of older adults in Mexico to examine how three components of SES are associated with a set of health outcomes and behaviors. Our results generally support our hypotheses. We find that, in cities in Mexico, the relationship between SES and health is similar to that observed in industrialized countries: higher education and affluence are associated with better SRH and physical functioning (e.g., Berkman & Gurland, 1998; Robert & House, 1996). This result is also consistent with recent research conducted in seven Latin American cities, which finds evidence of a SES gradient in SRH and disability (Wong et al., 2005; PAHO, 2003). By contrast, there are very few significant SES-health associations in less urban areas. To our knowledge, this is the first study in Latin America that has examined how the SES-health relationship varies between industrialized urban centers and less urban areas.

There are several possible reasons for the contrasting results between urban and less urban areas. First, the extent to which better socioeconomic circumstances can lead to greater health-enhancing opportunities, knowledge, and resources may differ across regions. In major metropolitan areas, higher SES is likely to be associated with less hazardous working conditions, better housing, more education, improved nutrition, and access to higher quality health care. In less urban areas, however, employment opportunities and access to education and health services may be inadequate across SES groups (Parker & Pier, 2001; World Bank, 2005). Second, cultural beliefs and practices, as well as schooling quality, which influence health-related behaviors (including diet and health care utilization), may underlie these regional patterns. Familial support systems for the elderly in less urban areas may also be stronger and serve as an equalizing factor at older ages. Lastly, it is possible that conventional SES measures may be poor

indicators of SES in less urban areas, where average educational attainment is very low and where residents with relatively more education and assets may still experience low living standards.

In contrast to the results for the three health outcomes, the associations between SES and the three behavioral health risks are generally similar between the two residential areas. One important difference is the relationship between education and obesity, which suggests that schooling is a protective factor for obesity in urban areas and a risk factor in less urban areas. This finding is consistent with studies showing that the nature of the SES-obesity relationship changes with economic development and "Westernization" (Monteiro et al., 2004; Popkin & Gordon-Larsen, 2004). Both regions are characterized by reverse income gradients in obesity, smoking, and alcohol consumption, a result also found in studies of younger populations in Mexico (Vázquez-Segovia et al., 2002; Caballero et al., 1999). These patterns may reflect the greater frequency with which higher earners purchase higher calorie diets, cigarettes, and alcohol and lead more sedentary lifestyles (Kim et al., 2004). However, the negative relationship between wealth and smoking and drinking suggests that the reverse income gradient may be due in part to the better health of those who continue to drink and smoke at older ages.

This study also provides preliminary evidence on age and sex differences in SES-health linkages in developing countries. Contrary to our hypothesis, we find that income inequalities in health decline after late middle-age in Mexico, perhaps because income constitutes a smaller proportion of household net worth at older ages (Wong & Espinoza, 2002). We do not find significant age variation in the effects of education and wealth. As expected, we find that SES differentials in health and behavioral risk factors are smaller for older women than men, particularly in urban areas. This finding may reflect differences in traditional gender roles, or that Mexican women receive higher levels of support from family and kin in older age than men (Parker & Wong, 2001). Explaining such sex differences in the relationship between SES and health is an important topic for future research.

A limitation of this analysis is its reliance on cross-sectional data, which precludes any interpretation of causal relations between SES and health. In addition, with the exception of height and weight measurements, this study relies on self-reported measures of health and functioning. Nonetheless,

the analysis provides insight into the extent to which socioeconomic indicators are related to a range of health-related measures among older adults in a developing country setting, and how the patterns of association differ by urbanization, age, and sex. The findings strongly suggest that socioeconomic factors are significant correlates of health among older adults in middle-income developing countries such as Mexico, particularly in urban areas. The results also imply that further economic development in Mexico is likely to spawn wider social inequalities in health in the future.

Findings from this and similar studies may also provide new insights into patterns of health among Hispanics in the U.S. Several studies have shown that Mexican-Americans have considerably weaker education-health gradients than non-Hispanic whites in a broad range of health and survival measures. Evidence of this weak gradient is based on several U.S. datasets, including one that focuses on elderly Mexican-Americans living in the southwestern region of the U.S. (Goldman et al., 2006; Turra & Goldman, 2006; Patel, Peek, Wong, & Markides, 2006). Goldman et al. (2006) speculate that flatter or reverse gradients in countries of origin may be one of several mechanisms generating these patterns. According to this hypothesis, Mexican immigrants may "import" SES gradients to the U.S. through their adherence to the cultural norms and practices of people living in Mexico. The present study provides preliminary evidence in support of this hypothesis, particularly in light of the higher propensity of Mexicans from less urban areas to migrate to the U.S. (Durand, Massey, & Zenteno, 2001). The findings also underscore the importance of understanding health inequalities in Latin America for research on Hispanic health patterns in the U.S.

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Table 1: Descriptive statistics for older adults in Mexico[a], MHAS 2001

Variable	Full Sample (n = 9,518)	n[b]	Urban (n=6,353)	n	Less urban (n=3,165)	n
HEALTH						
Self-rated health %						
Excellent	1.8	167	2.4	146	1.1	21
Very good	4.4	392	6.0	321	3.0	71
Good	31.2	2,698	33.7	1898	28.9	800
Fair	46.0	4,121	45.0	2755	46.8	1,366
Poor	16.7	1,457	12.9	855	20.2	602
Difficulty with 1+ ADL %	10.7	1,143	9.9	766	11.5	377
Number of physical activity limitations (S.D.)	1.66 (0.04)	9,518	1.69 (0.05)	6,353	1.62 (0.64)	3,165
Health risk factors %						
Obese	21.1	1,791	21.8	1,298	20.2	493
Smokes	18.2	1,732	20.0	1,153	16.6	579
Binge/heavy drinker	7.7	846	8.2	578	7.2	268
SOCIOECONOMIC						
Years of education (S.D.)	4.0 (0.08)		5.7 (0.12)		2.5 (0.10)	
Education category %						
No formal education	31.2	2,448	17.5	1,224	42.8	1,224
1-5 years	34.5	3,285	29.3	1,984	38.9	1,301
6 years (completed primary school)	15.6	1,675	21.7	1,283	10.5	392
7+ years	18.8	2,110	31.6	1,862	7.8	248
Median monthly income[c] (pesos)	$1,958	9,518	$2,961	6,353	$1,300	3,165
Mean monthly income[c] (pesos) (S.D.)	$7,005 (1,347)	9,518	$9,578 (2,773)	6,353	$4,812 (796)	3,165
Income %						
1st tercile	39.8	3,522	29.4	2,006	48.7	1,516
2nd tercile	30.1	3,065	31.8	2,129	28.7	936
3rd tercile	30.1	2,931	38.9	2,218	22.6	713
Median wealth[d] (pesos)	$165,000	9,518	$208,000	6,353	$121,500	3,165
Mean wealth[d] (pesos) (S.D.)	$335,259 (13,250)	9,518	$388,126 (17,583)	6,353	$290,137 (19,392)	3,165
Wealth %						
1st tercile	38.0	3,450	32.0	2,057	43.2	1,393
2nd tercile	31.9	3,076	32.3	2,090	31.5	986
3rd tercile	30.1	2,992	35.7	2,206	25.3	786
SOCIO-DEMOGRAPHIC						
Male %	46.2	4,339	42	2,752	50.8	1,587
Age (S.D.)	63.2 (0.22)		62.1 (0.26)		64.1 (0.34)	
Married %	54.7	5,410	52.3	3,498	56.7	1,912
Household size (S.D.)	4.0 (0.04)		3.8 (0.05)		4.1 (0.07)	
Residence in major urban area %	45	6,353	100		0.0	

[a] Means and proportions are weighted using sampling weights provided by MHAS.

[b] Unweighted sample sizes

[c] Income includes net income of the respondent and spouse or cohabiting partner, if applicable. Monthly income is in pesos (US$1=9.47 pesos in 2000)

[d] Wealth includes net income of the respondent and spouse or cohabiting partner, if applicable. Wealth is in pesos (US$1=9.47 pesos in 2000)

Table 2: Bivariate associations between socioeconomic status and health indicators, MHAS 2001
(Numbers are percentages with a given characteristic, unless otherwise noted)[a]

	Education				Income			Wealth			n
	0 years	1-5 years	6 years	7+ years	1st Tercile	2nd Tercile	3rd Tercile	1st Tercile	2nd Tercile	3rd Tercile	
URBAN											
Health outcomes											
Poor Health	21	16.4	11.4	6.3	17.7	14.2	7.1	14.3	15.4	9.1	5,975
Difficulty with 1+ ADL	14.6	8.6	7.6	3.6	12.9	6.1	4.9	11.9	6.4	5	6,353
Physical limitations (mean)	2.3	2	1.6	1.2	2.3	1.7	1.3	2	1.7	1.4	6,353
Health risk factors											
Obese	23.6	25.8	22.9	17	21.4	23.1	21	21.2	22.4	21.9	5,396
Smokes	14.9	16.1	22.1	25.1	14	22.3	23.3	16.3	22.2	21.9	6,353
Binge/heavy drinker	5.9	8.8	7.3	9.5	4.8	9.2	10.3	7.3	9.6	7.7	6,353
LESS URBAN											
Health outcomes											
Poor Health	25.5	18.2	14.8	8.2	24.2	15.6	15.9	23.3	16.1	19.1	2,860
Difficulty with 1+ ADL	13.9	6.5	5.1	2.4	11.5	6.8	6.7	11.3	6.2	9	3,165
Physical limitations (mean)	1.8	1.6	1.3	0.9	1.8	1.7	1.6	1.7	1.6	1.5	3,165
Health risk factors											
Obese	15.3	20.3	29.8	25	14.9	24.3	25.4	18.4	21.8	21.6	2,219
Smokes	13.2	20.5	16.5	16.5	14.8	17.4	20	17.2	16.7	15.2	3,165
Binge/heavy drinker	6.7	8.1	5.5	7.9	6.9	7.9	7.1	6.5	9.5	5.6	3,165

[a] All data are weighted using sampling weights provided by MHAS.

Table 3: Coefficients (standard errors) for multiple regression models[a] of the association between socioeconomic status and three health outcomes, MHAS 2001

	URBAN						LESS URBAN					
	Self-rated health		Physical Activity Limitations		Difficulty with 1+ ADL		Self-rated health		Physical Activity Limitations		Difficulty with 1+ ADL	
	Gross Effect	Net Effect	Gross Effect	Net Effect	Gross Effect	Net Effect	Gross Effect	Net Effect	Gross Effect	Net Effect	Gross Effect	Net Effect
EDUCATION (reference: 0 years)												
1-5 years	-0.108	-0.076	-0.049	-0.025	0.158	0.197	-0.04	-0.023	0.08	0.093	-0.129	-0.14
	(0.07)	(0.07)	(0.07)	(0.07)	(0.10)	(0.10)	(0.08)	(0.08)	(0.07)	(0.08)	(0.13)	(0.13)
6 years (completed primary school)	-0.412***	-0.344***	-0.286***	-0.234***	-0.077	0.004	-0.338**	-0.295*	-0.248*	-0.217	-0.185	-0.208
	(0.08)	(0.08)	(0.08)	(0.08)	(0.13)	(0.13)	(0.12)	(0.12)	(0.11)	(0.11)	(0.21)	(0.21)
7+years	-1.269***	-1.063***	-0.664***	-0.512***	-0.615***	-0.465***	-0.752***	-0.665***	-0.259	-0.118	-0.455	-0.524
	(0.08)	(0.08)	(0.07)	(0.08)	(0.13)	(0.14)	(0.14)	(0.15)	(0.14)	(0.14)	(0.30)	(0.31)
INCOME (reference: 1st tercile)												
2nd tercile	-0.292***	-0.227***	-0.226***	-0.190***	-0.252*	-0.217*	-0.133	-0.102	0.013	0.018	-0.09	-0.069
	(0.06)	(0.06)	(0.06)	(0.06)	(0.10)	(0.10)	(0.08)	(0.08)	(0.08)	(0.08)	(0.14)	(0.14)
3rd tercile	-0.866***	-0.520***	-0.570***	-0.397***	-0.348**	-0.130	-0.313**	-0.155	-0.434***	-0.432***	0.057	0.114
	(0.07)	(0.07)	(0.06)	(0.06)	(0.10)	(0.11)	(0.10)	(0.10)	(0.09)	(0.09)	(0.15)	(0.16)
WEALTH (reference: 1st tercile)												
2nd tercile	-0.074	-0.009	-0.124*	-0.088	-0.226*	-0.206*	-0.075	-0.014	0.083	0.125	-0.053	-0.021
	(0.06)	(0.06)	(0.06)	(0.06)	(0.10)	(0.10)	(0.08)	(0.08)	(0.08)	(0.08)	(0.14)	(0.14)
3rd tercile	-0.478***	-0.163*	-0.317***	-0.137*	-0.572***	-0.464***	-0.222*	-0.119	0.047	0.154	0.061	0.091
	(0.06)	(0.06)	(0.06)	(0.06)	(0.10)	(0.11)	(0.09)	(0.09)	(0.08)	(0.09)	(0.15)	(0.15)
Socio-demographic controls included?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	5975	5975	6353	6353	6353	6353	2860	2860	3165	3165	3165	3165

*** p<0.001;** p<0.01; * p<0.05 (two-tailed test of significance)

[a] The nature of the regression model varies across outcome variables: an ordinal logit model is used for self-rated health and physical activity limitations and a logit model for ADL difficulty. “Gross Effect” models includes one SES measure (education, income, or wealth).”Net Effect” models include all three SES measures. All models control for age, sex, marital status, household size, and residence in high out-migration states.

Table 4: Coefficients (standard errors) for logit regression models[a] of the association between socioeconomic status and three behavioral risk factors, MHAS 2001

	URBAN						LESS URBAN					
	Obese		Current smoker		Excessive alcohol consumption		Obese		Current smoker		Excessive alcohol consumption	
	Gross Effect	Net Effect	Gross Effect	Net Effect	Gross Effect	Net Effect	Gross Effect	Net Effect	Gross Effect	Net Effect	Gross Effect	Net Effect
EDUCATION (reference: 0 years)												
1-5 years	0.001	-0.014	-0.045	-0.044	-0.02	-0.017	0.336**	0.273*	0.109	0.154	0.023	-0.019
	(0.10)	(0.10)	(0.10)	(0.10)	(0.15)	(0.15)	(0.13)	(0.13)	(0.11)	(0.11)	(0.16)	(0.16)
6 years (completed primary school)	-0.153	-0.187	-0.073	-0.074	-0.267	-0.264	0.474**	0.349*	-0.082	-0.015	-0.457	-0.538*
	(0.11)	(0.11)	(0.11)	(0.12)	(0.16)	(0.16)	(0.17)	(0.17)	(0.16)	(0.17)	(0.24)	(0.24)
7+years	-0.448***	-0.528***	0.146	0.152	-0.194	-0.179	0.562**	0.380	0.063	0.255	0.028	-0.077
	(0.10)	(0.11)	(0.11)	(0.11)	(0.15)	(0.16)	(0.19)	(0.20)	(0.19)	(0.20)	(0.24)	(0.26)
INCOME (reference: 1st tercile)												
2nd tercile	0.116	0.145	0.212*	0.199*	0.379**	0.379**	0.443**	0.398**	0.031	0.04	0.337*	0.363*
	(0.09)	(0.09)	(0.09)	(0.09)	(0.13)	(0.13)	(0.13)	(0.13)	(0.11)	(0.11)	(0.16)	(0.16)
3rd tercile	0.034	0.166	0.228*	0.195*	0.269*	0.347*	0.459***	0.325*	-0.219	-0.198	0.317	0.368*
	(0.09)	(0.09)	(0.09)	(0.10)	(0.13)	(0.14)	(0.13)	(0.14)	(0.13)	(0.14)	(0.18)	(0.19)
WEALTH (reference: 1st tercile)												
2nd tercile	0.07	0.088	0.01	-0.009	-0.107	-0.111	0.308*	0.221	-0.256*	-0.260*	0.266	0.244
	(0.08)	(0.08)	(0.08)	(0.08)	(0.12)	(0.12)	(0.12)	(0.13)	(0.12)	(0.12)	(0.16)	(0.16)
3rd tercile	0.043	0.15	-0.086	-0.149	-0.261*	-0.235	0.366**	0.245	-0.284*	-0.265*	-0.113	-0.147
	(0.08)	(0.09)	(0.09)	(0.09)	(0.12)	(0.12)	(0.13)	(0.14)	(0.12)	(0.13)	(0.18)	(0.19)
Socio-demographic controls included?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	5,396	5,396	6,353	6,353	6,353	6,353	2,219	2,219	3,165	3,165	3,165	3,165

*** p<0.001;** p<0.01; * p<0.05 (two-tailed test of significance)
[a] "Gross Effect" models includes one SES measure (education, income, or wealth)."Net Effect" models include all three SES measures. All models control for age, sex, marital status, household size, and residence in high out-migration states.