Published in final edited form as:

Soc Sci Med. 2010 October ; 71(8): 1418–1427. doi:10.1016/j.socscimed.2010.06.046.

Disability and self-rated health among older women and men in rural Guatemala: The role of obesity and chronic conditions

Kathryn M. Yount,

Emory University, Atlanta, GA UNITED STATES

John Hoddinott, DPhil, and

International Food Policy Research Institute

Aryeh D. Stein, PhD

Emory University

Kathryn M. Yount: kyount@sph.emory.edu

Abstract

Unprecedented population aging in poorer settings is coinciding with the rapid spread of obesity and other chronic conditions. These conditions predict disability and poor self-rated health and often are more prevalent in women than men. Thus, gender gaps in obesity and other chronic conditions may account for older women's greater disability and worse self-rated health in poor, rural populations, where aging, obesity, and chronic conditions are rapidly emerging. In a survey of 604 adults 50 years and older in rural Guatemala, we assessed whether gender gaps in obesity and other chronic conditions accounted for gender gaps in disability and self-rated health. Obesity strongly predicted gross-mobility (GM) disability, and the number of chronic conditions strongly predicted all outcomes, especially in women. Controlling for gender gaps in body mass index (BMI) and especially the number of chronic conditions eliminated gender gaps in GM disability, and controlling for gender gaps in the number of chronic conditions eliminated gender gaps in self-rated health. We recommend conducting longitudinal cohort studies to explore interventions that may mitigate adult obesity and chronic conditions among poor, rural older adults. Such interventions also may reduce gender gaps in later-life disability and self-rated health.

Keywords

Guatemala; chronic disease; disability; gender differences; obesity; population ageing; self-rated health

Obesity and other chronic health conditions are emerging rapidly in poor countries. This trend imposes mounting public and private costs, partly because these conditions predict disability and poor self-rated health (Stenholm, Alley, Bandinelli, Griswold, Koskinen, & Rantanen et al., 2009). The burden of later-life disability and poor self-rated health is of special concern where families are the main source for later-life care (e.g., Palloni, Pinto, & Wong, 2009). In such settings, obesity and chronic conditions typically are more prevalent

© 2010 Elsevier Ltd. All rights reserved.

Correspondence to: Kathryn M. Yount, kyount@sph.emory.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

in women than men (e.g., Knai, Suhrcke, & Lobstein, 2007; Zunzunegui, Alvarado, Béland, & Vissandjee, 2009), and these gender gaps may account for similar gaps in later-life disability and self-rated health.

Gender depicts the socially prescribed aspects of *femaleness* or *maleness* (Johnson, Greaves, & Repta, 2009), which reflect and reinforce prescribed roles for women and men (Fausto-Sterling, 2005). *Sex* is a multi-dimensional, biological construct that encompasses genes, anatomy, physiology, and hormones and affects how people are labeled and treated (Wizeman & Pardue, 2001). Thus, we are at the same time *gendered* and *sexed* (Krieger, 2003), and we acknowledge their joint influence when we refer to *gender gaps*. Here, we estimate among 604 older adults in rural Guatemala gender gaps in physical disability and self-rated health, and we assess whether such gaps are attributable to gender gaps in body-mass index (BMI, in kg/m²) and other chronic conditions.

Later-life disability and self-rated health in women and men

Gaps in disability between older women and men are widespread. In wealthier countries, older women more often than older men face functional impairments and activity limitations, higher age-specific incidences of activity limitation, longer durations of disability, and more remaining years of life disabled (e.g., Leveille, Resnick, & Balfour, 2000). Compared to older men in Latin American and Caribbean (LAC) cities, older women more often have mobility and lower-extremity mobility limitations (Alvarado, Guerra, & Zunzunegui, 2007; Zunzunegui, Alvarado, Béland, & Vissandjee, 2009) and more often are frail and are more severely frail than older men (Alvarado, Zunzunegui, Béland, & Bamvita, 2008).

Women's greater disability partly is attributed to their greater susceptibility to some pathologies and impairments (Goldman, Weinstein, Cornman, Singer, Seeman, & Chang, 2004), such as lower bone-mineral density, the single best predictor of fractures in premenopausal women (Lips, 1997). Among older adults in LAC cities, cognitive impairment, depression, and the number of reported chronic conditions (including hypertension, diabetes, cancer, heart disease, stroke, hip fracture, and arthritis) predict gross mobility (GM) limitations and account for some of women's greater GM disability (Alvarado et al., 2007). Some studies of older adults in LAC cities (Alvarado et al., 2007; Zunzunegui et al., 2009) did not examine BMI as a predictor of disability, but obesity has been positively associated with frailty among older women in LAC cities (Alvarado et al., 2008).

Women's greater disability also is attributed to gender gaps in the intellectual, economic, and social capitals predicting disability (Yount & Agree, 2005). Schooling may affect physical functioning through employment and health behaviors (e.g., Ross & Wu, 1995). In adulthood, work status and occupation predict chronic conditions that underlie disability, and gender gaps in work and occupation account for some of the gender gap in chronic conditions (e.g., Salinas & Peek, 2008). Lower social activity and social contact predict lower functioning (Stuck, Walthert, Nikolaus, Büla, & Beck, 1999), and women's greater propensity to be widowed and living alone may partly account for their worse physical functioning (Yount & Agree, 2005). Still, in LAC cities, measures across the life course of intellectual, economic, and social capital account for little of women's greater difficulty with mobility and activities of daily living (ADL) (Alvarado et al., 2007; Zunzunegui et al., 2009).

Self-rated health predicts mortality (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006) and may capture subclinical aspects of personal health (e.g., Brunner, 2006). Self-rated health also may reflect broader views of well being, including lifestyle, social support, and

economic status (e.g., Nicholson, Bobak, Murphy, Rose, & Marmot, 2005). Gender gaps in self-rated health are widespread. In LAC cities, women report worse self-rated health than men (Palloni & McEniry, 2007; Zunzunegui et al., 2009). Such gaps tend to be smaller at older ages (e.g., Gorman & Read, 2006), perhaps partly because of mortality selection, especially among men. Among older adults in Barcelona, Spain, gender gaps in health-related quality of life are largely attributable to gender gaps in objective functional capacity and the number of reported chronic conditions (including arthritis, chronic bronchitis, deafness, diabetes, back problems, heart problems, high blood pressure, depression, stroke, and cataract) (Orfila, Ferrer, Lamarca, Tebe, Domingo-Salvany, & Alonso, 2006). Lastly, gender gaps in self-rated health may result from accrued gender gaps in socioeconomic capital. In the U.S., schooling predicts self-rated health directly, as do work status, occupation, social support, and health behaviors (Ross & Wu, 1995). Across European cultures, the correlates of self-rated health are similar, even though mean levels differ systematically (Jylhä, Guralnik, Ferrucci, Jokela, & Heikkinen, 1998). Childhood conditions and adult socioeconomic status, however, do not explain older women's poorer self-rated health in LAC cities (Zunzunegui et al., 2009).

Compared to men in wealthier countries and LAC cities, women often report greater disability and poorer self-rated health. In wealthier countries, more prevalent obesity and selected chronic conditions in women account for their greater disability and poorer self-rated health. In LAC cities, chronic conditions, depression, and cognitive impairment do not account for all of women's greater GM disability (Alvarado et al., 2007), and obesity has been excluded from some studies of gender gaps in health (Alvarado et al., 2007; Zunzunegui et al., 2009). For older adults in rural LAC settings, the contributions of gender gaps in obesity and other chronic conditions to gender gaps in disability and self-rated health are unknown.

Chronic disease, overweight, and obesity in Latin America and the Caribbean

Central America, including Guatemala, is undergoing a major epidemiologic transition. Cardiovascular disease (CVD) and cancer accounted for 27% of deaths in 1980–1985 and as much as 43% of deaths in 1997–2002 (Pan American Health Organization [PAHO], 2007a). CVD is the main cause of death in most Central American countries (PAHO, 2006). The rate of mortality for diabetes mellitus is about 25.2 per 100,000 residents and is higher in women (30.2) than men (20.8) (PAHO, 2008). The ratio of mortality from non-communicable and communicable causes rose from 0.96 in 1980–1985 to 3.1 in 1990–1995 in Central America (Castillo-Salgado, Mujica, & Loyola, 1999) and from 0.25 in 1986 to 1.2 in 1999 in Guatemala (Flores-Ramirez, 2003).

In Central American, several risk factors for CVD and disability are common, including diabetes, high blood pressure, overweight, low physical activity, arthritis, osteoporosis, and lung diseases. In the region's capital cities, prevalences for adults 20 years and older range from 6% to 12% for diabetes mellitus, 13% to 29% for high blood pressure, 56% to 76% for overweight, and 34% to 85% for low physical activity (Orellana-Pontaza, Ramirez-Zea, Barcelo, Gil, Gregg, & Meiners et al., 2007; PAHO, 2007b). Among older adults in LAC cities, the prevalence of self-reported arthritis ranges from 24% in Mexico City to 56% in Havana (e.g., Al Snih, Ray, & Markides, 2006), and the prevalence of chronic obstructive pulmonary disease ranges from 18% in Mexico City to 32% in Montevideo, Uruguay (Menezes, Perez-Padilla, Jardim, Muiño, Lopez, & Valdivia et al., 2005). Among Latin American women 50 years and older, the prevalence of vertebral osteoporosis ranges from 12% to 18% (Riera-Espinoza, 2009).

Gender gaps in overweight/obesity and other chronic conditions are notable. In Guatemalan adults 19 years or older, overweight is more prevalent among women (49%) than men (34%) (Marini & Gradnolati, 2003), and in LAC cities, mean BMI is higher among older women (25.5–28.6 kg/m²) than older men (23.2–26.9 kg/m²) (Alvarado et al., 2008). In Mexico and LAC cities, reported arthritis, diabetes, and hypertension are more prevalent in older women than older men (e.g., Al Snih, Ray, & Markides, 2006; Salinas & Peek, 2008).

Thus, overweight/obesity and other chronic conditions are increasingly prevalent in LAC settings, especially among middle- and older-aged women. Such trends raise questions as to whether these conditions account for older women's higher disability and poorer self-rated health.

Setting

Study participants originated from four Ladino (mixed Spanish-Mayan heritage), Spanish-speaking villages in the department of El Progreso, 100km northeast of Guatemala City. The Institute of Nutrition of Central America and Panama (INCAP) selected these villages for a study during 1969–1977 to assess the effects of protein and energy supplementation on the growth and development of preschool children (Habicht & Martorell, 1992). The four villages were chosen for their comparable size, social isolation, low schooling, and prevalent malnutrition and gastrointestinal and respiratory infections. Multiple follow-up studies have ensued.

Village economies before the late 1960s, when the subjects under study were younger adults, relied on small-scale subsistence agriculture. From the 1980s, a growing share of young adults left the villages for non-agricultural wage work or continued schooling (Maluccio, Melgar, Mendez, Murphy, & Yount, 2005). Seasonal migration for agricultural wage labour has been common in all villages, but the rates have varied with local demands for labour. As roads and bus services have improved, unskilled non-agricultural wage work has become more accessible. Masonry for men and petty trade and piecework for women are common forms of self-employment in the villages (Maluccio et al., 2005). Public primary schools have been available in all villages since the 1960s, but their physical infrastructure at that time was poor. Only four grades were offered until the 1970s, and teachers had limited training. In 1975, men 20–29 years had attained a mean of 2.0 grades, compared to 1.4 grades among their female peers; by 2002, these figures were 5.8 and 5.0, respectively (Maluccio et al., 2005).

Method

Sample and Data

Our sample comes from the last round of data collection (2005–2007) on the original INCAP birth cohort and their family members. We gathered data on three generations: the INCAP birth cohort members who were traced and interviewed in 2002–2004, the biological parents of traced INCAP cohort members and the parents' partners in 2005–2007, and the children of traced INCAP cohort members (Melgar, Ramirez, McNiven, Mejia, DiGirolamo, Hoddinott et al., 2008). Here, we included parents and parents' partners who were 50 years or older at interview, the ages typically included in studies of older adults in poor settings. Of the 756 biological parents or parents' partners identified, 40 were below age 50 ($n = 39$) or had a missing age ($n = 1$) and were excluded. Of 716 age-eligible participants, 90% ($n = 644$) were interviewed. This analysis was based on 604 participants with complete data on disability and self-rated health. The sex, age, schooling, wealth at the time of the intervention, number of children, and birth year of the first child did not differ between participants ($n = 644$) and non-participants ($n = 72$), nor between participants with ($n = 604$)

and without ($n = 40$) complete outcome data (Melgar et al., 2008). Those in Santo Domingo, the closest village to Guatemala City, were slightly more often not interviewed. Some of these villagers commute to the city, making them somewhat harder to interview. Because we first ascertained the parents of the INCAP cohort in the 1960s, we do not know about prior migration of the parental cohort. Still, 541 of the 604 were living in the four INCAP study villages in 2005–2007.

In face-to-face interviews, data were collected on marital history, subjective well-being, and objective and subjective disability. Data also were collected on economic and health-related shocks as well as crime victimization experienced in the prior five years by participants or their immediate kin; transfers of money, goods, and services between participants and their immediate kin; and wage, agricultural, and business labour and income. By interview and physical exam, data were obtained on reported physical health and nutrition as well as objective cognitive functioning and anthropometrics. All data collection followed protocols approved by the institutional review boards at the International Food Policy Research Institute, Emory University, and Latin Ethics, a certified institutional review board based in Guatemala City, Guatemala. Study participants gave informed consent for data collected by interview and by measurement.

Variables

The outcomes were scores for difficulty with gross mobility (GM, 0 – 10), range of motion (ROM, 0 – 12), and activities of daily living (ADLs, 0 – 12), as well as self-rated health in the prior month (1 = *very good*, 2 = *good*, 3 = *regular*, 4 = *poor*, and 5 = *very poor*). The scores for GM and ROM disability were based on standard algorithms (Simonsick, Kasper, Guralnik, Bandeen-Roche, Ferrucci, & Hirsch et al., 2001). GM disability reflected the sum of scores for the respondent's reported difficulty (0 = *none*, 1 = *some*, 2 = *a lot*, 3 = *unable*) walking 500 meters without resting, standing for two hours, and sitting for two hours, as well as his or her reported difficulty (0 = *none*, 1 = *any*) bending down or kneeling. ROM disability reflected the sum of scores for the respondent's reported difficulty (0 = *none*, 1 = *some*, 2 = *a lot*, 3 = *unable*) raising his or her hands overhead, extending his or her arm to shake someone's hand, using his or her fingers to hold or grasp something, and lifting something about 25 pounds. ADL disability reflected the sum of scores for reported difficulty (0 = *none*, 1 = *some*, 2 = *a lot*, 3 = *unable*) bathing, getting dressed, eating, and sitting and getting up from a chair or bed. To assess gaps between women and men in thresholds of disability and self-rated health, the above scores were dichotomized to capture *no* versus *any* GM, ROM, and ADL difficulty and *poor* or *very poor* (hereafter *called poor*) versus *better* self-rated health. Thus, binary measures captured *the prevalence* of any disability and poor self-rated health, and scales captured *the average severity* of disability and poor self-rated health. Together, these measures depicted the burden of disability and poor self-rated health in terms of prevalence and severity.

During the fieldwork, we considered collecting various objective measures for disability; yet, only flexibility and hand-grip strength were assessed. So, we relied here on the fuller set of reported measures. Age and objective measures of BMI, handgrip strength, and cognitive functioning for low-literate populations largely or fully accounted for gender gaps in reported GM and ROM disability, suggesting that reported GM and ROM disability were reasonable measures for our purposes.

Our main explanatory variables were gender (woman = 1, man = 0), BMI, and reported chronic conditions. BMI was coded to compare normal weight ($18.5 \leq \text{BMI} < 25.0$) with underweight ($\text{BMI} < 18.5$), overweight ($25.0 \leq \text{BMI} < 30.0$), and obese ($\text{BMI} \geq 30.0$). Chronic conditions included any major illness of the respondent or his or her spouse in the prior five years and a sum of eight reported doctor-diagnosed chronic conditions: arthritis,

cancer, diabetes, heart disease, high blood pressure, lung disease, osteoporosis, and stroke. These conditions were selected because they reflect major epidemiological shifts in the region, have been associated with obesity or our outcomes, or have differed by gender. We considered separate indicators for each chronic condition but included a sum of reported chronic conditions to corroborate prior research (e.g., Alvarado et al., 2008; Alvarado & Zunzunegui, 2007; Orfila, et al., 2006). Although we measured two chronic conditions objectively (blood pressure and blood glucose level), we relied on the fuller set of reported measures for the analysis.

Measures for *socioeconomic capital* in childhood (before turning 12 years old) included the respondent's community of origin, the respondent's father's and mother's grades of schooling, the presence of a latrine in the respondent's childhood residence, death of the respondent's mother, and the respondent's own grades of schooling (*completed primary or more* versus *less than completed primary*). The respondent's *z*-score for height with reference to Dutch adults 60 years or older in 2004 captured his or her *biological capital*, or cumulative exposure to infection and malnutrition in childhood (data available at <http://dined.io.tudelft.nl/dined/>). Older Dutch adults were the chosen reference because they depict a wealthier population not subject to chronic under-nutrition in childhood and in which men and women probably achieved their maximum possible height in the absence of gender inequity in access to food and health care. Measures for *socioeconomic capital* in adulthood included the respondent's occupation at age 50 years, experience of an economic shock in the prior five years, score for household standard of living, and whether the respondent was living alone at interview. The score for household standard of living was derived from the first component of a principal components analysis of the respondent's household's ownership of 14 consumer durables and 8 housing amenities. These items captured the success of these individuals and their spouses in accumulating assets over their lifetimes. Because 24% of women and 12% of men were widowed, and 11% of women and 5% of men were divorced or separated, the respondent's marital status also was considered as a measure of social capital. Being formerly married, however, was associated with living alone and was not significant in models that controlled for the respondent's age, village of origin, and gender. Arguably, living alone better captured a respondent's social isolation in this setting.

Analysis

Mean scores for GM, ROM, and ADL difficulty, as well as level of self-rated health were compared for women and men, overall and across age groups (50–59, 60–69, and 70 years). The relative frequencies of all covariates were computed to assess their completeness and distributions. For covariates with non-responses, the median or modal value in the observed data was imputed, and an indicator for non-response was included (Table 1). The variables for which any responses were imputed were respondent's father's ($n = 77$) and mother's ($n = 93$) schooling, presence of a latrine in respondent's childhood home ($n = 3$), death before respondent's age 12 of his or her mother ($n = 2$), *z*-score for height ($n = 10$), respondent's occupation ($n = 6$), economic shock to respondent or respondent's spouse in the prior five years ($n = 6$), and respondent's BMI ($n = 11$). Overall, 137 of the 604 respondents had any missing data. Inferences based on samples with ($n = 604$) and without ($n = 467$) imputed data were similar (available upon request). We present the results based on the sample of 604 cases.

We used two multivariate approaches to assess gender gaps in disability and self-rated health. We used ordinary least squares (OLS) regression to estimate the associations of scores for disability and self-rated health with the covariates and logistic regression to estimate the odds of reporting any disability (by type) and poor self-rated health for the same covariates. In all models, we adjusted for gender only, then sequentially adjusted for the

respondent's (2) age, (3) socioeconomic and intellectual capital in childhood, (4) z-score for height or biological capital in childhood, (5) socioeconomic capital in adulthood, (6) BMI, and (7) chronic conditions in adulthood. Model (8) for self-rated health added levels of GM and ROM disability. For all models, we estimated χ^2 tests for the joint significance of newly added covariates and assessed their contribution to the model R^2 . We estimated the full multivariate models separately for men and women and tested for differences in the coefficients across these models for the same outcome (Chow, 1960).

Based on a final model that included significant, gender-differentiated effects of other chronic conditions, we estimated predicted levels of disability and self-rated health as well as predicted probabilities for any disability and poor self-rated health. Our first predictions assumed the 75th percentile of observed values for men and women separately of BMI and other chronic conditions, and in the case of self-rated health, also of GM and ROM disability. This percentile reflected men and women who, respectively, were overweight and obese (according to the standard cutoffs for BMI in adulthood), had one other chronic condition, and had relatively high scores for GM disability (2 for men; 4 for women) and ROM disability (1 for men; 3 for women). Our second predictions assumed that overweight/obesity, other chronic conditions, and in the case of self-rated health, GM and ROM disability were eliminated for men and women, and these predictions were compared to the first sets. For all predictions, the other covariates were set to their mean or mode in the pooled sample so that gender gaps in these other attributes were controlled.

Notably, this sample is not a random sample of older adults but of the parents of a birth cohort and the parents' partners, so it under-represents the oldest-old, in which women predominate and in which gender gaps in disability and self-rated health may be smaller. As such, the unconditional means for disability and self-rated health in our sample may differ slightly from those in a random sample of older adults, but the age-specific means should be representative, and all analyses are age-adjusted. A majority (370 of 604) of the participants had partners in the sample and responses within couples may not be independent. We used robust variance estimation to account for the possible clustering of responses within age cohort, village of origin, and couple. The inferences from these analyses were similar, so those derived from standard estimation procedures are presented. Third, we estimated multivariate models using transformations of some covariates and outcomes to balance the goals of best model fit and consistency with prior research. We compared the proportion of the variance in the outcomes accounted for and the significance levels of the coefficients for the respondent's grades of schooling versus completed primary schooling, continuous versus categorical z-score for height, continuous versus categorical BMI, and the sum of eight chronic conditions versus these separate conditions. Because the scales for disability were right skewed, we also regressed the covariates on transformations of these outcomes. The coefficients for gender were robust to different model specifications, and the presented results reflect the best model fits using standard estimation procedures and the variables described in the prior section.

Results

On average, women in the sample were younger than men (63 versus 67 years) (Table 1), regardless of their marital status (not shown). Men and women had similar childhood measures (village of origin, parental schooling, experience of a maternal death, and z-score for height), but men reported marginally less often having a latrine in their childhood home and more often had completed primary schooling (9% versus 3%). Most measures of socioeconomic capital in adulthood were similar, but men more often reported agricultural work (69% versus 17%) and non-skilled, non-agricultural work (11% versus 6%) at age 50. Compared to women, men on average reported fewer doctor-diagnosed chronic conditions

(0.3 versus 0.6), and less often reported diabetes (4% versus 16%), high blood pressure (10% versus 23%), or stroke (1% versus 5%). Men had a lower mean BMI than women (23.9 versus 26.4 kg/m²) and less often were overweight (28% versus 40%) or obese (7% versus 23%). The frequency of item non-response did not differ by gender (Table 1).

Compared to men, women reported higher mean difficulties with GM (2.3 versus 1.5) and ROM (1.9 versus 0.8), as well as poorer self-rated health (3.2 versus 2.8) (Table 2). A higher percentage of women than men reported any difficulty with GM (72% versus 58%), any difficulty with ROM (54% versus 31%) and poor self-rated health (49% versus 33%). GM, ROM, and self-rated health tended to be worse at older ages. Although male-female gaps in disability were larger after age 59, gaps in self-rated health were smaller after age 69. Across all ages, women and men had similar levels of difficulty with ADLs (e.g., 0.6 overall) and similar prevalences of any difficulty with ADLs (e.g., 27% and 29% overall). Having difficulty with ADLs reflects more severe disability and tends to be less common than GM or ROM disability (Table 2). Observing gender gaps in ADL disability, thus, is less likely, and so this outcome was not analyzed further.

Table 3 shows the coefficients for gender in unadjusted models (Models 1) and sequentially adjusted models for disability (Models 2–7) and self-rated health (Models 2–8). Also shown are R^2 values for each model and p -values for the joint significance of sequentially added covariates. Our purpose is to account for gender gaps in disability and self-rated health, as reflected in substantial reductions in the magnitudes and significances of coefficients for gender. We stress these changes in the remainder of the results.

Adjusting for age improved model fits and widened women's disadvantages in disability and self-rated health (Table 3 Models 2 versus 1). Adjusting further for socioeconomic and intellectual capital in childhood neither improved model fit nor altered gender gaps in disability and self-rated health (Models 3 versus 2). Adjusting for biological capital in childhood improved model fits for GM disability and marginally improved model fit for any ROM disability, but did not alter gender gaps in disability or self-rated health (Models 4 versus 3). Adjusting for socioeconomic capital in adulthood modestly improved model fit for GM and ROM disability, and reduced the magnitudes and significances of the gender gaps in GM disability and self-rated health (Models 5 versus 4). Adjusting for BMI also modestly improved model fits for GM disability and self-rated health, substantially reduced the magnitude and significance of the gender gap in GM disability, and further reduced the magnitude of the gender gap in self-rated health (Models 6 versus 5). Inclusion of the number of chronic conditions substantially increased the model R^2 values for all three outcomes, contributed to larger proportionate reductions than did inclusion of BMI in the gender gaps in ROM disability and self-rated health, and made non-significant the gender gap in self-rated health (Models 7 versus 6). Adjusting further for GM and ROM disability in models for self-rated health substantially improved model fits and further reduced the magnitude of already non-significant gender gaps in this outcome (Models 8 versus 7).

Table 4 displays, for the pooled sample and for men and women separately, the full OLS models of disability and self-rated health, as well as p -values for tests of equality in the coefficients across the men's and women's samples. Results for the full logit models (available upon request) were largely consistent. An increase in the number of reported chronic conditions was strongly associated with higher GM and ROM disability as well as worse self-rated health. The positive associations of chronic conditions with GM and ROM disability were stronger for women than men, and the positive association of chronic conditions with self-rated health was stronger for men than women. Compared to being normal weight, being obese was associated with a 0.63 higher score for GM disability, and being underweight was associated with a 0.51 higher (or worse) score for self-rated health.

Being underweight was more strongly associated with GM and ROM disability for women than men, but in most cases the coefficients for BMI did not differ across gender. Otherwise, these models clarify the weak direct associations of capital stocks in childhood with later-life disability and self-rated health. These models also reveal which aspects of adult socioeconomic capital were associated primarily with disability among men: living alone was positively associated with GM and ROM disability, and working at age 50 was negatively associated with these outcomes. The latter association may suggest some reverse causality in that not being previously disabled may have enabled men to work at age 50. As not working at age 50 was rare among men, this association should be interpreted with caution.

Table 5 shows, for men and women separately, predicted levels of GM disability, ROM disability, and self-rated health, as well as predicted probabilities of any GM disability, any ROM disability, and poor self-rated health. Given the consistent gender-differentiated effects of chronic conditions, all predictions were based on the full multivariate models (Models 7 and 8, Table 3) that included a gender-by-chronic-conditions interaction. The values for BMI, number of chronic conditions, GM disability, and ROM disability used in the predictions are described in the Methods and footnoted in Table 5, and other covariates were set to their mean or mode in the pooled sample.

Several points regarding the predictions for GM disability are noteworthy. At the 75th percentile values for BMI (which, again, correspond to the threshold values of overweight in men and obesity in women) and chronic conditions, 63% of men compared to 76% of women reported any GM disability. If overweight/obesity and chronic conditions were eliminated, 19% fewer men and 22% fewer women would have any GM disability; also, their mean levels of GM disability would fall by 22% (from 1.55 to 1.21) and 45% (from 2.67 to 1.48) respectively. These patterns are similar, albeit less marked, for ROM disability because obesity is not associated with ROM disability, and the gender gap in ROM disability persists with controls for BMI and other chronic conditions.

Regarding the predictions for self-rated health at the 75th percentile values for BMI, other chronic conditions, and GM and ROM disability, 45% of men and 62% of women would rate their health as poor. Eliminating overweight/obesity, other chronic conditions, and GM and ROM disability would have a substantial influence on self-rated health for men and women. In this case, 62% fewer men and 62% fewer women would rate their health as poor, and their mean scores for self-rated health would fall by 21% (from 3.09 to 2.45) and 24% (from 3.35 to 2.70), respectively.

Conclusions

We have assessed whether gender gaps in obesity and other chronic health conditions account for women's greater disability and worse self-rated health in a sample of older adults in rural Guatemala. Ours is the first study to address this question in a poor, rural population. Our focus is salient, because such populations are experiencing rapid demographic, epidemiologic, and nutrition transitions along with higher burdens of obesity and other chronic health conditions among women than men.

Reported levels of GM and ROM disability were on the lower end of the disability scales, and self-ratings of health were around *average*. Compared to men, women more often had some difficulty with GM and ROM and more often rated their health as poor. Women also reported higher mean levels of GM and ROM disability, as well as poorer self-rated health. The average woman had between some and a lot of difficulty with two measures for GM; whereas, the average man had between some and a lot of difficulty with one measure for

GM. The average woman also had some difficulty with two measures for ROM; whereas, the average man had some difficulty with one measure for ROM. These findings corroborate those from LAC cities (e.g., Alvarado et al., 2007; Alvarado et al., 2008; Zunzunegui et al., 2009) and other lower-income settings (e.g., Kaneda, Zimmer, Fang, & Tang, 2009).

Compared to men, women, on average, reported more chronic conditions and more often were overweight or obese. The number of reported chronic conditions strongly predicted all three outcomes, and obesity significantly predicted GM disability. In models that adjusted for other gender gaps in individual capital, further adjustment for BMI substantially reduced the magnitude and significance of the gender gap in GM disability and reduced the magnitude of the gender gap in self-rated health. Further adjustment for chronic conditions resulted in larger proportionate reductions (than did adjustment for BMI) in the gender gaps in ROM disability and self-rated health, and made non-significant the gender gap in self-rated health. Further adjustment for GM and ROM disability virtually eliminated the gender gap in self-rated health. In simulations, eliminating overweight/obesity, chronic conditions, and disability from their observed 75th percentile values in women and men, the probabilities of reporting poor health were reduced by 62%. Because poor self-rated health predicts care seeking and institutionalization (Luppa, Luck, Weyerer, König, Brähler, & Riedel-Heller, 2010), reducing the incidence and prevalence of these conditions may alleviate growing demands for formal care that may occur as poor, rural populations continue to age.

Notably, gender differences in *reporting* on chronic conditions may have arisen from gender gaps in care seeking, knowledge of chronic conditions, and the propensity to report known conditions. Norms of masculinity may encourage men to disguise illness (Courtenay, 2000); whereas, norms of femininity may make it more acceptable for women to admit illness (Oksuzyan, Juel, Vaupel, & Christensen, 2008). Comparing the prevalences of high blood pressure, an asymptomatic condition and the only one that was assessed by self-report and objective measurement, showed that men tended to under-report it (10% self-reported and 21% measured), whereas women tended to over-report it (23% self-reported and 18% measured). Such differences are likely to be smaller for symptomatic chronic conditions; however, any greater tendency for men than women to under-report chronic conditions may have resulted in over-estimation of the male-female gap in chronic conditions, and its contribution to explaining gender gaps in disability. The contribution of gender gaps in reported chronic conditions to explaining the gender gap in self-rated health, however, would be unbiased, if male-female differences in knowledge and propensity to report health conditions similarly affect their reporting of chronic conditions and self-rated health.

Our sample also was exposed, as younger parents in the 1960s and 1970s, to a nutrition supplementation trial. Pregnant and lactating women (including many women in this sample) were encouraged to consume a supplement, which also was available to men (including men in this sample); however, no special efforts were made to have men consume this supplement. Differential exposure to the intervention may have altered gender gaps in dietary practices, perhaps in the direction of reducing overweight and obesity in women. We have no data to assess the validity of this proposition, but if accurate, our results may underestimate the influence of gender gaps in overweight/obesity (and associated chronic conditions) on gender gaps in disability and self-rated health among older rural Guatemalans.

Finally, contrary to studies of cognitive aging in this sample (e.g., Yount, Hoddinott, Stein, & DiGirolamo, 2009), some measures of individual capital in childhood, such as own schooling and z-score for height, did not predict disability or self-rated health. These capital stocks, however, may operate indirectly, by altering capital stocks or chronic conditions in

adulthood (results available upon request). In models for GM disability, the coefficient for the *z*-score for height lost magnitude but retained marginal significance in models that included adult BMI and other chronic conditions. In models for ROM disability, the coefficient for the death of the respondent's mother changed little in magnitude and retained marginal significance with controls for adult BMI and other chronic conditions. Lastly, in models for self-rated health, the coefficient for having a latrine in the childhood home changed little in magnitude and remained significant with controls for BMI and other chronic conditions. Also, the coefficient for village of origin dropped in magnitude and lost significance with controls for BMI and other chronic conditions. Thus, some childhood conditions may be associated with later-life disability and self-rated health, directly and indirectly through adult BMI and other chronic conditions. Caution in the interpretation of these results is warranted, however, because potentially important capital stocks in childhood were unmeasured, including father's occupation, size at birth, and pace of weight gain (e.g., Adair, Martorell, Stein, Hallal, Sachdev, & Prabhakaran et al., 2009; Bowen, 2009). Also, some observed capital stocks in childhood were too rare and insufficiently variable (e.g., mother's schooling) to have observable associations with the outcomes studied here. Thus, more research is needed on the pathways by which childhood conditions influence disability and self-rated health in poor and rural older populations.

With the exception of primary schooling observed measures for intellectual, socioeconomic, and biological capital in childhood did not differ significantly by the respondent's gender. The lack of any gender difference in village and parental attributes would be expected because, in the absence of sex-selective abortion, such attributes would be randomly distributed across male and female births. For other measures, such as the *z*-score for achieved height, significant discrimination against women was not evident in this sample. Lastly, controlling for measures of childhood capital did not alter any of the gender gaps in disability and self-rated health (Table 3). Thus, reducing gender gaps in childhood capitals, such as schooling, may lessen gender gaps in later-life *cognitive* functioning (Yount, 2008), but interventions to diminish gender gaps in *physical* functioning and self-rated health might better focus on gender gaps in adult occupation, BMI, and other chronic conditions (Table 3).

Our findings underscore the contributions of obesity and other chronic conditions to older women's greater GM disability and of the contributions of other chronic conditions to women's poor self-rated health. This analysis, however, was based on cross-sectional observational data, precluding causal inferences from the associations presented. A second caveat to making causal inferences is potential sample selection, for example from the influence of obesity on the risk of mortality (e.g., Finkelstein, Brown, Wraage, Allaire, & Hoerger, 2009). The most pertinent BMIs for elevating this risk, however, were rare, in that no respondents had BMI $\geq 40 \text{ kg/m}^2$ and only 16 (14 women; 2 men) had BMI $\geq 35 \text{ kg/m}^2$.

Given the speed of demographic, epidemiologic, and nutrition transitions in poor settings, our findings warrant further investigation through longitudinal cohort studies, and eventually controlled interventions to address the childhood and behavioural risk factors for prevalent chronic conditions in such settings. Researchers also might explore whether such interventions have greater impacts for women, for whom chronic conditions and obesity more strongly predict disability and frailty (Alvarado et al., 2008). Finally, reductions in disability may improve self-rated health in later life, which may mitigate demands for formal and informal care in such populations. Longitudinal studies of older adults in such settings, thus, should track disability and self-rated health and explore their effects on individual demands for care.

Acknowledgments

Author Comments: The Generational Transfers Study 2005-7 would not have been possible without the dedication and outstanding work of a field team coordinated by Dr. Paul Melgar of INCAP. We also gratefully acknowledge data management assistance on this paper by Meng Wang and manuscript preparation assistance by Ms. Teresa Parker, both at Emory University. And, we gratefully acknowledge the financial support of the US National Institutes of Health (5 RO1 HD45627-05: PI Hoddinott) for present activities and the many organizations (US National Institutes of Health, Thrasher Research Fund, Nestle Foundation) that have funded the work of the INCAP Longitudinal Study since inception. Finally, the investigators thank the participants of the INCAP Longitudinal Study for their cooperation and past investigators and staff for establishing and maintaining this invaluable sample.

References

- Adair LS, Martorell R, Stein AD, Hallal PC, Sachdev HS, Prabhakaran D, Wills AK, Norris SA, Dahly DL, Lee NR, Victora CG. Size at birth, weight gain in infancy and childhood, and adult blood pressure in 5 low- and middle-income-country cohorts: When does weight gain matter? *American Journal of Clinical Nutrition*. 2009; 89(5):1383–1392. [PubMed: 19297457]
- Al Snih S, Ray L, Markides KS. Prevalence of self-reported arthritis among elders from Latin America and the Caribbean and among Mexican Americans from the southwestern United States. *Journal of Aging Health*. 2006; 18(2):207–223.
- Alvarado BE, Guerra RO, Zunzunegui MV. Gender differences in lower extremity function in Latin American elders: Seeking explanations from a life-course perspective. *Journal of Aging and Health*. 2007; 19:1004–1024. [PubMed: 18165293]
- Alvarado BE, Zunzunegui MV, Béland F, Bamvita JM. Life course social and health conditions linked to frailty in Latin American older men and women. *Journal of Gerontology: Medical Sciences*. 2008; 63A(12):1399–1406.
- Bowen ME. Childhood socioeconomic status and racial differences in disability: Evidence from the health and retirement study (1998-2006). *Social Science and Medicine*. 2009; 69(3):433–441. [PubMed: 19541400]
- Brunner RL. Understanding gender factors affecting self-rated health. *Gender and Medicine*. 2006; 3(4):292–294.
- Castillo-Salgado C, Mujica O, Loyola E. A subregional assessment of demographic and health trends in the Americas: 1980-1998. *Statistical Bulletin of the Metropolitan Insurance Company*. 1999; 80(2):2–12.
- Chow GC. Tests of equality between sets of coefficients in two linear regressions. *Econometrica*. 1960; 28(3):591–605.
- Courtenay WH. Constructions of masculinity and their influence on men's well-being: A theory of gender and health. *Social Science and Medicine*. 2000; 50:1385–1401. [PubMed: 10741575]
- DeSalvo KB, Bloser N, Reynolds K, He J, Muntner P. Mortality prediction with a single general self-rated health question. A meta-analysis. *Journal of General Internal Medicine*. 2006; 21(3):267–275. [PubMed: 16336622]
- Fausto-Sterling A. The bare bones of sex: Part 1—Sex and gender. *Signs: Journal of Women in Culture and Society*. 2005; 30(2):1491–1527.
- Finkelstein EA, Brown DS, Wrage LA, Allaire BT, Hoerger TJ. Individual and aggregate years-of-life-lost associated with overweight and obesity. *Obesity*. 2009; 18(2):333–229. [PubMed: 19680230]
- Flores-Ramirez, C. *Boletín Epidemiológico Nacional*. Vol. 20. Ministerio de Salud Pública y Asistencia Social de Guatemala; 2003. Análisis y tendencias de la mortalidad en Guatemala, 1986 a 1999; p. 4-24.
- Goldman N, Weinstein M, Cornman J, Singer B, Seeman T, Chang MC. Sex differentials in biological risk factors for chronic disease: Estimates from population-based surveys. *Journal of Women's Health*. 2004; 13:393–403.
- Gorman BK, Read JG. Gender disparities in adult health: an examination of three measures of morbidity. *Journal of Health and Social Behavior*. 2006; 47:95–110. [PubMed: 16821505]
- Habicht JP, Martorell R. Objectives, research design, and implementation of the INCAP longitudinal study. *Food Nutrition Bulletin*. 1992; 14(3):176–190.

- Jylha M, Guralnik JM, Ferrucci L, Jokela J, Heikkinen E. Is self-rated health comparable across cultures and genders? *The Journals of Gerontology: Social Sciences*. 1998; 53B(3):S144–S152.
- Johnson JL, Greaves L, Repta R. Better science with sex and gender: Facilitating the use of a sex and gender-based analysis in health research. *International Journal for Equity in Health*. 2009; 8:14. [PubMed: 19419579]
- Kaneda T, Zimmer Z, Fang Z, Tang Z. Gender differences in functional health and mortality among the Chinese elderly. *Research on Aging*. 2009; 31(3):361–388. [PubMed: 20703370]
- Knai C, Suhrcke M, Lobstein T. Obesity in Eastern Europe: An overview of its health and economic implications. *Economics and Human Biology*. 2007; 5:392–408. [PubMed: 17920000]
- Krieger N. Genders, sexes, and health: what are the connections—and why does it matter? *International Journal of Epidemiology*. 2003; 32:652–657. [PubMed: 12913047]
- Leveille SG, Resnick HE, Balfour J. Gender differences in disability: Evidence and underlying reasons. *Aging (Milano)*. 2000; 12:106–112. [PubMed: 10902052]
- Lips P. Epidemiology and predictors of fractures associated with osteoporosis. *American Journal of Medicine*. 1997; 103(2A):3S–11S. [PubMed: 9302892]
- Luppa M, Luck T, Weyerer S, König HH, Brähler E, Riedel-Heller SG. Prediction of institutionalization in the elderly. A systematic review. *Age & Ageing*. 2010; 39(1):31–38. [PubMed: 19934075]
- Maluccio JA, Melgar P, Mendez H, Murphy A, Yount KM. Social and economic development and change in four Guatemalan villages: Demographics, schooling, occupation and assets. *Food and Nutrition Bulletin*. 2005; 26(2/S1):S25–S45. [PubMed: 16060210]
- Marini, A.; Gradnolati, M. *Malnutrition and Poverty in Guatemala Policy Research Working Paper 2967*. Washington, D.C.: The World Bank; 2003 Jan.
- Melgar P, Ramírez LF, McNiven S, Mejía RM, DiGirolamo A, Hoddinott J, Maluccio JA. Resource flows among three generations in Guatemala study (2007–2008): Definitions, tracking, data collection, coverage, and attrition. *Middlebury College Economics Discussion Paper NO. 2008:08–03*.
- Menezes AM, Perez-Padilla R, Jardim JR, Muiño A, Lopez MV, Valdivia G, Montes de Oca M, Talamo C, Hallal PC, Victora CG. PLATINO Team. Chronic obstructive pulmonary disease in five Latin American cities (the PLATINO study): A prevalence study. *Lancet*. 2005; 366(9500):1875–81. [PubMed: 16310554]
- Nicholson A, Bobak M, Murphy M, Rose R, Marmot M. Socio-economic influences on self-rated health in Russian men and women—A life course approach. *Social Science and Medicine*. 2005; 61(11):2345–2354. [PubMed: 16140447]
- Oksuzyan A, Juel K, Vaupel JW, Christensen K. Men: Good health and high mortality. Sex differences in health and aging. *Aging Clinical and Experimental Research*. 2008; 20(2):91–102. [PubMed: 18431075]
- Orellana-Pontaza, P.; Ramirez Zea, M.; Barcelo, A.; Gil, E.; Gregg, E.; Meiners, M.; Valdez, R.; E, P.; Cafiero, E. *Survey of diabetes, hypertension and chronic disease risk factors*. Washington D.C.: Pan American Health Organization; 2007.
- Orfila F, Ferrer M, Lamarca R, Tebe C, Domingo-Salvany A, Alonso J. Gender differences in health-related quality of life among the elderly: The role of objective functional capacity and chronic conditions. *Social Science and Medicine*. 2006; 63:2367–2380. [PubMed: 16884840]
- Palloni A, McEniry M. Aging and health status of elderly in Latin America and the Caribbean: Preliminary findings. *Journal of Cross-Cultural Gerontology*. 2007; 22:263–285. [PubMed: 17021957]
- Palloni, A.; Pinto, G.; Wong, R. *Family support networks and population aging*. Paper presented at the seminar on family Support Networks and Population Aging, Doha International Institute for Family Studies and Development, UNFPA and Institute for Policy Research; 3–4 June; Doha, Qatar. 2009.
- Pan American Health Organization (PAHO). *Health situation in the Americas: Basic indicators*. Washington D.C.: Pan American Health Organization; 2006.
- PAHO, Health Analysis and Statistics Unit. *Regional core health data initiative: Technical health information system*. Washington D.C.: PAHO; 2007a.

- PAHO. VIIIth CAMDI workshop: Diabetes surveillance and control in Central America. Pan American Health Organization; 2007b. Retrieved from <http://www.paho.org/common/Display.asp?Lang=E&RecID=10296>
- PAHO. Health situation in the Americas: Basic indicators 2008. Washington, D.C.: PAHO; 2008.
- Riera-Espinoza G. Epidemiology of osteoporosis in Latin America. *Salud pública de México*. 2009; 51(Suppl 1):S52–S55. [PubMed: 19287895]
- Ross CE, Wu C. The links between education and health. *American Sociological Review*. 1995; 60:719–745.
- Salinas JJ, Peek MK. Work experience and gender differences in chronic disease risk in older Mexicans. *Annals of Epidemiology*. 2008; 18(8):628–630. [PubMed: 18652980]
- Simonsick EM, Kasper JD, Guralnik JM, Bandeen-Roche K, Ferrucci L, Hirsch R, Leveille S, Rantanen T, Freid LP. Severity of upper and lower extremity functional limitation: Scale development and validation with self-report and performance-based measures of physical function. WHAS Research Group. Women's health and aging study. *Journal of Gerontology B: Psychological Sciences and Social Sciences*. 2001; 56(1):S10–S19.
- Stenholm S, Alley D, Bandinelli S, Griswold ME, Koskinen S, Rantanen T, Guralnik JM, Ferrucci L. The effect of obesity combined with low muscle strength on decline in mobility in older persons: Results from the In CHIANTI study. *International Journal of Obesity (London)*. 2009; 33(6):635–644.
- Stuck AE, Walthert JM, Nikolaus T, Büla CJ, Hohmann C, Beck JC. Risk factors for functional status decline in community-living elderly people: a systematic literature review. *Social Science & Medicine*. 1999; 48(4):445–469. [PubMed: 10075171]
- Wizemann, TM.; Pardue, M. *Exploring the Biological Contributions to Human Health: Does Sex Matter?*. Washington, DC: National Academy Press; 2001.
- Yount KM, Hoddinott J, Stein A, DiGirolamo A. Individual capital and cognitive aging in Guatemala. *Population Studies*. 2009; 63(3):295–306. [PubMed: 19851938]
- Yount KM. Gender, resources across the life course, and cognitive functioning in Ismailia, Egypt. *Demography*. 2008; 45(4):907–926. [PubMed: 19110904]
- Yount KM, Agree E. Differences in disability between older women and men in Egypt and Tunisia. *Demography*. 2005; 42(1):169–187. [PubMed: 15782901]
- Zunzunegui MV, Alvarado BE, Béland F, Vissandjee B. Explaining health differences between men and women in later life: A cross-city comparison in Latin America and the Caribbean. *Social Science & Medicine*. 2009; 68:235–242. [PubMed: 19036488]

Table 1
Attributes of the sample, by gender, adults 50 years or older in rural Guatemala

	Men (<i>n</i> = 255)		Women (<i>n</i> = 349)		<i>p</i>
	Mean or %	(<i>SD</i>)	Mean or %	(<i>SD</i>)	
Age	66.5	(8.5)	62.5	(8.0)	***
Childhood social, economic, & intellectual capital					
Village of origin, Conacaste	26.3		26.9		
Espiritu Santo	32.9		29.2		
San Juan	18.4		20.6		
Santo Domingo	22.4		23.2		
Father's grades of schooling	0.6	(1.2)	0.6	(1.3)	
Father's grades of schooling missing	12.9		12.6		
Mother's grades of schooling	0.5	(1.2)	0.5	(1.3)	
Mother's grades of schooling missing	17.3		14.0		
Latrine inside or outside (ref: none)	22.8		29.5		†
Latrine missing	0.4		0.6		
Completed primary schooling (ref: no)	8.6		3.2		**
Mom died in childhood, under 12 years	6.7		9.5		
Mom died in childhood missing	0.0		0.6		
Childhood biological capital (infection/nutrition)					
z-score for height, greater than -1 SD below reference median	11.4		8.9		
-1 to -1.99 SD below reference median	27.5		31.5		
-2 or more SD below reference median	61.2		59.6		
Height missing	2.0		1.4		
Adult social and economic capital					
Type of occupation at age 50, no occupation	0.4		59.9		***
Agricultural	69.4		16.6		
Non-agricultural, non-skilled	11.0		6.0		
Non-agricultural, skilled	19.2		17.5		
Occupation missing (ref: no)	1.2		0.9		
Economic shock last five year (ref: no)	47.8		44.4		

	Men (<i>n</i> = 255)		Women (<i>n</i> = 349)		<i>p</i>
	Mean or %	(SD)	Mean or %	(SD)	
Economic shock missing (ref: no)	1.2		0.6		
Household standard of living score	0.0	(1.0)	0.0	(1.0)	
Household standard of living score missing (ref: no)	1.2		0.6		
Living alone (ref: no)	5.9		6.6		
Adult health conditions					
Illness of self/spouse in last five years (ref: no)	50.2		48.7		
Illness of self/spouse in last five years missing (ref: no)	1.2		0.6		
Number of reported doctor-diagnosed chronic conditions	0.3	(0.6)	0.6	(0.9)	***
Diabetes	3.9		15.5		***
High blood pressure	9.8		23.2		***
Stroke	0.8		4.6		**
Heart disease	2.4		3.4		
Lung disease	2.8		5.4		
Arthritis	10.6		8.9		
Osteoporosis	1.6		2.3		
Cancer	0.4		0.3		
Body Mass Index [BMI] in kg/m ²	23.9	(3.8)	26.4	(4.8)	***
BMI normal: 18.5 BMI < 25.0	62.4		33.2		***
underweight: BMI < 18.5	3.5		4.3		
overweight: 25.0 BMI < 30.0	27.5		39.5		
obese: BMI 30.0	6.7		22.9		
BMI missing (ref: no)	2.0		1.7		

[†] *p* < .10,

* *p* < .05,

** *p* < .01

*** *p* < .001

Note. For continuous variables, indicators for missing values reflect the percentage of values that were missing and imputed. The categorical measure for BMI was derived from the continuous measure for BMI after imputation.

Table 2
Reported disability and self-rated health, by age and gender, adults 50 years or older in rural Guatemala

Difficulty with GM ^a				Difficulty with ROM ^b				Difficulty with ADLs ^c				Self-rated health ^d			
(n)	Mean	(SD)	p	(prop)	(SD)	p	(prop)	(SD)	p	(prop)	(SD)	Mean	(SD)	p	Poor ^a
All ages															
Men (255)	1.49	(1.89)	***	0.58	(0.49)	***	0.31	(0.46)	***	0.29	(0.45)	2.82	(0.97)	***	0.33
Women (349)	2.26	(2.28)		0.72	(0.45)		0.54	(0.50)		0.27	(0.44)	3.15	(0.99)		0.49
Age 50 – 59															
Men (63)	1.41	(1.95)	†	0.51	(0.50)	*	0.24	(0.43)	*	0.25	(0.44)	2.70	(0.99)	**	0.30
Women (150)	1.97	(2.27)		0.66	(0.48)		0.42	(0.50)		0.22	(0.42)	3.14	(0.97)		0.48
Age 60 – 69															
Men (95)	1.34	(1.81)	***	0.57	(0.50)	**	0.25	(0.44)	***	0.23	(0.42)	2.69	(0.92)	**	0.26
Women (131)	2.43	(2.31)		0.75	(0.44)		0.57	(0.50)		0.27	(0.44)	3.12	(1.02)		0.48
Age 70 – 79															
Men (97)	1.70	(1.93)	**	0.65	(0.48)	†	0.42	(0.50)	***	0.37	(0.49)	3.03	(0.97)		0.42
Women (68)	2.57	(2.18)		0.78	(0.42)		0.74	(0.44)		0.38	(0.49)	3.25	(0.98)		0.51

† $p < .10$,
* $p < .05$,
** $p < .01$
*** $p < .001$

^a0 (no difficulty)–10 (unable to do) score for level of difficulty with GM & 0–1 indicator for any difficulty with GM

^b0 (no difficulty) – 12 (unable to do any) score for level of difficulty with ROM & 0–1 indicator for any difficulty with ROM

^c0 (no difficulty) – 12 (unable to do any) score for level of difficulty with ADLs & 0–1 indicator for any difficulty with any ADLs

^d1 (very good)–5 (very poor) score for self-rated health & 0–1 indicator for poor/very poor self-rated health

Table 3
OLS and logistic regressions of gender gap in disability and self-rated health, adults 50 years or older in rural Guatemala ($n = 604$)

OLS						Logistic				
B_{woman}		(se)	p	$p>\chi^2$	R^2	B_{woman}	(se)	p	$p>\chi^2$	Pseudo- R^2
Difficulty with GM ^a										
Model 1	0.76	(0.17)	***		0.03	0.59	(0.17)	***		0.01
Model 2	0.90	(0.18)	***	***	0.05	0.74	(0.18)	***	***	0.03
Model 3	0.89	(0.18)	***		0.06	0.76	(0.19)	***		0.04
Model 4	0.87	(0.18)	***	*	0.08	0.75	(0.19)	***	*	0.05
Model 5	0.73	(0.24)	**	*	0.11	0.46	(0.25)	$\dagger$	$\dagger$	0.07
Model 6	0.57	(0.25)	*	*	0.125	0.35	(0.26)			0.08
Model 7	0.45	(0.24)	$\dagger$	***	0.17	0.30	(0.26)		*	0.09
Difficulty with ROM ^b										
Model 1	1.04	(0.17)	***		0.06	0.94	(0.17)	***		0.04
Model 2	1.23	(0.17)	***	***	0.10	1.24	(0.19)	***	***	0.08
Model 3	1.18	(0.17)	***		0.12	1.22	(0.19)	***		0.09
Model 4	1.18	(0.17)	***		0.12	1.22	(0.19)	***	$\dagger$	0.10
Model 5	0.98	(0.23)	***		0.13	1.20	(0.26)	***	$\dagger$	0.12
Model 6	0.93	(0.24)	***		0.139	1.22	(0.27)	***		0.12
Model 7	0.80	(0.23)	***	***	0.19	1.16	(0.27)	***	***	0.14
Self-rated health ^c										
Model 1	0.33	(0.08)	***		0.03	0.64	(0.17)	***		0.02
Model 2	0.38	(0.08)	***	*	0.04	0.73	(0.18)	***	*	0.02
Model 3	0.39	(0.08)	***		0.06	0.78	(0.18)	***	$\dagger$	0.04
Model 4	0.38	(0.08)	***		0.07	0.77	(0.18)	***		0.05
Model 5	0.32	(0.11)	**		0.09	0.62	(0.25)	*		0.06
Model 6	0.27	(0.12)	*		0.10	0.53	(0.25)	*	*	0.08
Model 7	0.21	(0.11)	$\dagger$	***	0.14	0.40	(0.26)		***	0.11
Model 8	0.14	(0.11)		***	0.18	0.24	(0.27)		***	0.14

$\dagger$ $p < .10$.

$\dagger p < .10$,

* $p < .05$,
 ** $p < .01$
 *** $p < .001$

Note:

Model 1: Woman (= 1, man = 0) only

Model 2: Woman + age

Model 3: Model 2 plus village of origin, father's schooling, mother's schooling, latrine in childhood home, own schooling, & maternal death in childhood

Model 4: Model 3 plus z-score for height with reference to the median in the standard

Model 5: Model 4 plus job at age 50, economic shock in last five years, household standard of living, & living alone at interview

Model 6: Model 5 plus BMI

Model 7: Model 6 plus number of reported doctor-diagnosed chronic health conditions and major illness in prior five years (self/spouse)

Model 8: Model 7 plus difficulty with ROM & difficulty with GM

^a 0 (no difficulty)–10 (unable to do) score for level of difficulty with GM & 0–1 indicator for any difficulty with GM

^b 0 (no difficulty)–12 (unable to do) score for level of difficulty with ROM & 0–1 indicator for any difficulty with ROM

^c 1 (very good)–5 (very poor) score for self-rated health & 0–1 indicator for poor/very poor self-rated health

Table 4
OLS regressions of disability and self-rated health, by gender, adults 50 years or older in rural Guatemala

Variable	Difficulty with GM						Difficulty with ROM						Self-rated Health					
	Men (n = 255)			Women (n = 349)			Men (n = 255)			Women (n = 349)			Men (n = 255)			Women (n = 349)		
	B	(se)	p	B	(se)	p	B	(se)	p	B	(se)	p	B	(se)	p	B	(se)	p
Constant	3.11	(2.18)		-1.05	(1.20)		-1.20	(0.86)		5.06	(1.92)	**	-1.85	(1.17)		2.23	(1.10)	*
Woman (ref: man)							0.45	(0.24)	†				-1.48	(0.83)	†	3.02	(0.53)	***
Age/years	0.02	(0.02)		0.03	(0.02)	†	0.03	(0.01)	*	0.01	(0.01)		0.80	(0.23)	***	0.00	(0.01)	
Social, economic, & intellectual capital in childhood													0.03	(0.01)	**	0.00	(0.01)	
Village of origin, Conacaste																		
Espiritu Santo	0.02	(0.32)		-0.09	(0.33)		-0.10	(0.23)		0.06	(0.28)		-0.04	(0.32)		-0.08	(0.16)	†
San Juan	0.08	(0.38)		0.04	(0.41)		0.08	(0.27)		-0.09	(0.34)		0.62	(0.40)		-0.02	(0.19)	
Santo Domingo	0.45	(0.36)		0.13	(0.34)		0.17	(0.24)		0.20	(0.31)		0.39	(0.33)		-0.20	(0.18)	
Father's grades of schooling	0.00	(0.12)		0.02	(0.11)		0.01	(0.08)		0.04	(0.11)		0.04	(0.10)	†	0.06	(0.05)	
Mother's grades of schooling	-0.02	(0.12)		0.03	(0.11)		-0.03	(0.08)		-0.18	(0.11)		0.05	(0.10)		0.00	(0.05)	
Latrine inside or outside childhood home	0.31	(0.29)		-0.10	(0.27)		0.00	(0.19)		-0.03	(0.26)		-0.07	(0.26)		-0.37	(0.15)	*
Completed primary school (ref: no)	-0.21	(0.45)		-0.58	(0.70)		-0.31	(0.39)		-0.40	(0.40)		-0.48	(0.68)		0.42	(0.31)	
Mother died before age 12	0.47	(0.47)		-0.15	(0.41)		0.14	(0.30)		0.48	(0.41)		0.56	(0.40)		0.11	(0.18)	
Biological capital in childhood																		
z-score for height > -1 SD below reference median																		
-1 to -1.99 SD below reference median	0.63	(0.42)		0.29	(0.46)		0.53	(0.31)	†	-0.08	(0.37)		-0.14	(0.45)		0.17	(0.21)	
-2 or more SD below reference median	0.08	(0.39)		0.30	(0.45)		0.27	(0.30)		-0.13	(0.34)		-0.02	(0.44)		0.13	(0.19)	
Social and economic capital in adulthood																		
Type of occupation (ref: no occupation)																		
Agricultural	-4.00	(1.93)	*	0.03	(0.39)		-0.18	(0.27)		-5.44	(1.70)	**	-0.11	(0.38)	***	-0.51	(0.99)	
Non-agricultural/non-skilled	-3.49	(1.97)	†	-1.12	(0.52)	*	-0.29	(0.35)		-5.61	(1.73)	***	-1.06	(0.51)	*	-0.51	(1.00)	

Variable	Difficulty with GM						Difficulty with ROM						Self-rated Health					
	Men (n = 255)			Women (n = 349)			Pooled (n = 604)			Men (n = 255)			Women (n = 349)			Men (n = 255)		
	B	(se)	p	B	(se)	p	p ^a	B	(se)	p	B	(se)	p	B	(se)	B	(se)	p
Non-agricultural/skilled	-4.22	(1.94)	*	-0.01	(0.33)		***	-0.22	(0.27)		-5.41	(1.71)	**	-0.23	(0.32)	-0.34	(0.99)	
Economic shock in last five years	0.04	(0.25)		0.34	(0.25)			0.26	(0.17)		0.29	(0.22)		-0.12	(0.24)	0.16	(0.13)	
Score for household standard of living	-0.06	(0.15)		0.02	(0.14)			-0.02	(0.10)		0.09	(0.13)		-0.16	(0.13)	-0.19	(0.07)	**
Living alone at interview	1.87	(0.52)	***	0.43	(0.50)		†	1.17	(0.36)	***	1.55	(0.46)	***	0.30	(0.49)	0.28	(0.27)	
BMI and other chronic conditions in adulthood																-0.09	(0.22)	
BMI (ref: normal weight, 18.5 BMI < 25.0)																		
Underweight, BMI < 18.5	-0.42	(0.69)		0.80	(0.61)		†	0.32	(0.45)		-0.74	(0.61)		0.99	(0.60)	0.43	(0.34)	
Overweight, 25.0 BMI < 30.0	0.09	(0.30)		0.35	(0.30)			0.17	(0.21)		0.01	(0.26)		0.06	(0.29)	0.25	(0.15)	†
Obese, BMI ≥ 30.0	0.59	(0.52)		0.55	(0.34)		*	0.63	(0.27)	*	-0.17	(0.46)		-0.04	(0.34)	0.19	(0.26)	
Major illness of self/spouse last five years	0.38	(0.24)		0.84	(0.25)	***	***	0.59	(0.17)	***	0.08	(0.21)		0.78	(0.25)	-0.03	(0.12)	
Number of doctor-diagnosed chronic conditions	0.20	(0.21)		0.61	(0.15)	***	†	0.49	(0.12)	***	0.13	(0.19)		0.66	(0.14)	0.39	(0.11)	***
Difficulty with GM																0.10	(0.04)	**
Difficulty with ROM																0.03	(0.04)	*
R ²	0.19			0.20				0.17			0.15		0.22			0.24	0.18	

† $p < .10$,

* $p < .05$,

** $p < .01$

*** $p < .001$

^a P ($> \chi^2$) or “chow test” for difference in coefficient across models for men and women (Chow, 1960)

Table 5
Predicted values for disability and self-rated health, by gender, adults 50 years or older in rural Guatemala (255 men, 349 women)

	Level^a	P(any)^b
Difficulty with GM		
75 th percentile for observed values on BMI & chronic conditions		
Men ^c	1.55	0.63
Women ^d	2.67	0.76
No overweight/obesity or chronic conditions		
Men	1.21	0.51
Women	1.48	0.60
Difficulty with ROM		
75 percentile for observed values on BMI & chronic conditions		
Men ^c	0.84	0.27
Women ^d	2.00	0.47
No overweight/obesity or chronic conditions		
Men	0.77	0.21
Women	1.34	0.45
Self-rated health		
75 th percentile for observed values on BMI, chronic conditions, GM, & ROM disability		
Men ^e	3.09	0.45
Women ^f	3.35	0.62
Eliminate overweight/obesity, GM, & ROM disability		
Men	2.45	0.17
Women	2.70	0.24

Note: Other variables are set to their mean or mode in the pooled sample.

^a 0 – 10 score for GM disability, 0 – 12 score for ROM disability, & 1 – 5 score for self-rated health

^b 0 – 1 indicator of any GM, ROM disability & 0 – 1 indicator for poor/very poor self-rated health

^c Overweight & 1 doctor-diagnosed chronic condition

^d Obese & 1 doctor-diagnosed chronic condition

^e Overweight, 1 chronic condition, GM disability score 2, & ROM disability score 1

^f Obese, 1 chronic condition, GM disability score 4, & ROM disability score 3