Associations between socioeconomic status and obesity in six middle-income countries: Results from the Study on global AGEing and adult health (SAGE).

MA Liebert[1] and TE Gildner[1]. [1]Department of Anthropology, University of Oregon, Eugene, OR.

EXTENDED ABSTRACT

INTRODUCTION

Obesity has emerged as an important health concern in virtually every country in the world (Houssain et al., 2007; Malik et al., 2012). Globally, more than 1.4 billion adults are overweight, and at least 300 million of these individuals are classified as obese (WHO, 2008). In particular, obesity prevalence among older adults (aged ≥ 50 years) has recently increased due to a concurrence of factors, including increased life expectancy as well as age-associated changes in physical activity, diet, and body composition (Inelmen et al., 2003). Obesity among older adults is often linked to an array of chronic diseases and disabilities (e.g., heart disease, hypertension, metabolic syndrome) (Ferraro et al., 2003; Salihu et al., 2009). Given these findings, it is imperative that future research investigates the sources and consequences of obesity among aging populations in order to mitigate the disease burden and develop appropriate treatment strategies.

Moreover, recent studies have documented differences in obesity prevalence across various levels of economic development. In fact, socioeconomic status (SES) represents one of the strongest predictors of individual health outcomes (Winkleby et al., 1992; Matthews and Gallo, 2011). SES is often conceptualized as a combination of financial and educational factors that may differentially affect obesity patterns through lifestyle and behavior. For example, income primarily influences the resources available to purchase food and participate in leisure activities, while education shapes the acquisition of beliefs and knowledge, thereby enabling individuals to integrate healthy behaviors into a coherent lifestyle (Wardle et al., 2002).

Current research further suggests that the links between SES and obesity are multifaceted, with national level of economic development and sex structuring the directionality and strength of associations. For instance, SES and obesity generally have a positive association in lower-income countries, whereby high SES individuals experience increased obesity risks (Sobal and Stunkard, 1989; McLaren, 2007). Conversely, SES and obesity are negatively associated in higher-income countries; this pattern is particularly pronounced among women (Sobal and Stunkard, 1989; Monteiro et al., 2004; McLaren, 2007). Moreover, evidence suggests that lower-income countries will begin to mirror higher-income nations over time, in which high SES will become associated with decreased obesity risks due to rapid changes in economic growth, diet, and lifestyle (Seubsman et al., 2010).

While recent studies have illuminated the complex links between SES and obesity, few studies have systematically evaluated this relationship among older adults in low- and middle-income countries. Given that obesity and comorbidities lead to high costs in terms of health-care expenditure and quality of life, especially among aging populations, it is imperative that future research explores this topic in order to develop effective interventions and reduce the global disease burden.

To address these issues, the current study presents results from the World Health Organization's Study on global AGEing and adult health (SAGE) Wave 1, a longitudinal project designed to gather comprehensive information on the aging process among six lower- and upper-middle-income countries (China, Ghana, India, Mexico, Russian Federation, and South Africa). These six nations, in particular, demonstrate a range of economic development, thereby providing an opportunity to examine the links between SES factors and obesity. Accordingly, this paper uses SAGE data in order to: 1) examine obesity patterns, quantified by body mass index (BMI) and waist circumference (WC), among older adults by sex and country; and 2) investigate the relative contribution of SES factors, including wealth (as an alternative measure of income) and education, to variation in BMI and WC measurements by sex and country.

METHODS

SAGE Project and Study Participants

SAGE Wave 1 (2007-2010) collected data on respondents aged 50 years and older from nationally representative samples in six countries (China, Ghana, India, Mexico, Russian Federation, and South Africa) (Kowal et al., 2012). According to World Bank classifications of gross national income (GNI) per capita, Ghana and India are identified as lower-middle income countries ($1036 to $4085 GNI per capita), while China, Mexico, and South Africa are upper-middle income countries ($4086 to $12,615 GNI per capita). Recently, the Russian Federation moved from an upper-middle income nation to a high-income nation ($12,616 or more GNI per capita).

Face-to-face interviews were conducted to collect household and individual-level data, including: demographic and socioeconomic information, health state and chronic conditions as well as anthropometric and other physical measurements.

Obesity Measures

Height (cm) and weight (kg) were measured according to standard procedures, and body mass index (BMI; kg/m2) was calculated. This study used established WHO cut-offs for BMI: underweight (<18.5 kg/m2), normal (18.5-24.9 kg/m2), overweight (25.0-29.9 kg/m2), and obese (≥30 kg/m2) (WHO, 2000). Since the relationships among BMI, body fat percentage, and health risk are different in Asian populations compared to other groups, we used modified BMI cut-offs for China and India: underweight (<18.5 kg/m2), normal (18.5-22.9 kg/m2), increased risk (23.0-27.5 kg/m2), and higher high risk (≥27.5 kg/m2) (WHO, 2004).

Waist circumference (WC) was also measured using standard procedures, and values were interpreted based on WHO (2011) categories: normal (<94 cm) and increased risk (≥94 cm) for males, and normal (<80 cm) and increased risk (≥80 cm) for females. Modified WC cut-offs were used for China and India; however, these revised categories only adjust the risk classifications for males: normal (<90 cm) and increased risk (≥90 cm) (IDF, 2006).

SES Measures: Wealth and Education

Measurements of SES were quantified based on the assessment of wealth (asset-based assessment) and education. A composite wealth variable was derived from the household ownership of material goods (e.g., tables, cars, television), housing characteristics (e.g., floor type, walls, use of cooking stove), and access to services (e.g., improved water, sanitation). A total of 21 household assets were included with overlaps and differences in the asset lists by country. Responses were recoded into dichotomous variables (0 = No possession or access to good; 1 = Had possession or access to good), reshaped, and fit as a pure random effect model based on multiple items per household. These results provided set incremental levels of assets for each country that were less likely to be biased by respondent inconsistencies. Households were then arranged in increasing order of assets using a Bayesian post-estimation (empirical Bayes) method, and the raw continuous income estimates were adjusted into quintiles using the asset order. These resulting quintiles were used as wealth estimates for each participant (He et al., 2012).

To assess educational attainment, the International Standard Classification of Education (1997) was used to standardize the levels of education across the countries (UNESCO, 2006). Accordingly, the educational grades and years for each country were converted to the following standard categories: (1) no formal schooling or less than primary school; (2) completed primary school; (3) completed secondary school; (4) completed high school; (5) completed college/university; and (6) completed a post-graduate degree. The highest level of education was then recorded for each participant using this classification scheme.

Statistical Analyses

Descriptive statistics for BMI and WC (as continuous variables) were calculated for men and women. Weighted prevalence estimates were calculated for BMI categories (underweight, normal, overweight/increased risk, obese/higher high risk), and WC categories (normal, increased risk) by sex and country. Independent-samples t-tests (two-tailed) were conducted to measure sex differences in continuous BMI and WC measurements. A series of multiple linear regressions were used to estimate the relative association of SES factors to variation in continuous BMI and WC measures while controlling for several covariates (age, physical activity, smoking behavior, alcohol use, marital status, and urban vs. rural residence). Given that obesity patterns vary according to the measure of SES used (Winkleby et al., 1992; Wardle et al., 2002), wealth and education were included as independent predictors of BMI and WC in separate regression analyses. All analyses were conducted separately by sex and country using SPSS 21.0. Results were considered statistically significant at $p < 0.05$.

PRELIMINARY RESULTS

Obesity Measures by Sex and Country

For men, results indicate major differences between countries in prevalence of underweight (from 0.5% in Mexican men to 40.3% in Indian men) and obesity/higher high risk (from 4.3% in Indian men to 39.3% in South African men). There was also substantial variation between countries in the prevalence of increased risk WC (17.3% in men from Ghana to 62.1% in Mexican men).

For women, there were also major differences between countries in prevalence of underweight (from 0.7% in Mexican women to 38.7% in Indian women) and obesity/higher high risk (from 8.4% in Indian women to 52.7% in South African women). Women also displayed variability by country in prevalence of increased risk WC (51.9% in Indian women to 91.0% in Mexican women).

Independent samples t-tests identified a significant sex difference in continuous BMI across all countries ($p < 0.001$), with women displaying higher levels than men. For WC, women in Ghana and South Africa had significantly higher levels than men ($p < 0.001$), whereas men had significantly higher levels than women in Mexico ($p < 0.001$).

Associations between Wealth, Education, and Obesity Measures by Sex and Country

Linear regressions were used to estimate the effects of wealth and education on variation in BMI and WC levels for men and women in each country (while controlling for key variables). For men, wealth was a significant predictor of BMI and WC in all countries except Russia ($p < 0.05$), whereby greater wealth was positively associated with higher BMI and WC levels. Further, education was a significant predictor of BMI and WC for men in India and China ($p < 0.05$), identifying a positive association between greater education and higher BMI and WC levels for men in these countries.

For women, wealth was a significant predictor of BMI for Russian women only ($p = 0.010$), demonstrating that greater wealth was positively associated with higher BMI levels for women in this country. Wealth was not a significant predictor of WC for women in all countries, while education was not a significant predictor of BMI and WC.

PRELIMINARY DISCUSSION POINTS

Obesity has emerged as one of the leading contributors to the global burden of chronic diseases and disability, particularly among older adults. Recent studies have identified differences in obesity rates across various levels of economic development; for example, evidence suggests that SES and obesity are positively associated in lower-income countries but negatively associated in higher-income countries. However, limited research has examined these patterns among older adults in middle-income countries, thereby restricting our understanding of the global burden of obesity. The present study investigates

these issues with data from the World Health Organization's Study on global AGEing and adult health (SAGE).

Our findings identified substantial variation in prevalence of underweight (0.5% in Mexican men to 40.0% in Indian men) and obesity/higher high risk (from 4.3% in Indian men to 51.0% in South African women) when using BMI as a measure of body composition. There were also substantial differences between countries in the prevalence of increased risk WC, ranging from 17.5% in Indian men to 79.9% in South African women. These results provide evidence of the global prevalence of obesity levels, particularly among aging populations in Mexico and South Africa.

Moreover, the present study identified significant differences in the relationship between obesity and SES, as quantified by wealth and education, by sex and country. For men, wealth was positively related to BMI and WC levels in all countries except Russia. These results are consistent with previous studies demonstrating that greater wealth may increase obesity risks for individuals in lower-income countries. For Indian and Chinese men, education was positively associated with BMI and WC, suggesting that men with more education in these countries may experience increased obesity risks. This pattern may result from differences in energy expenditure due to more sedentary occupations associated with more education.

Further, this study revealed a non-significant relationship between SES and BMI and WC for women in all countries except Russia. These null findings may reflect a tipping point, whereby increasing economic development and rapid urbanization have substantially modified the relationship between SES and obesity for women in middle-income countries. Thus, it is possible that the present study is capturing an ongoing transition, in which high SES may become associated with decreased obesity risks due to rapid changes in socioeconomic conditions, lifestyle, and behavior.

Overall, the findings of the present study elucidate the multifaceted links between SES and obesity, while further demonstrating that SES does not have a simple, homogenous effect on health. As the global burden of obesity increases throughout the world, particularly among aging populations, it is important that future research investigates these issues in order to develop effective health care policies and to improve the quality of life of older adults.

FUNDING

NIH NIA Interagency Agreement YA1323-08-CN-0020); NIH R01-AG034479; University of Oregon.

REFERENCES CITED

Ferraro KF et al. 2002. Body mass index and disability in adulthood: A 20-year panel study. Am J Public Health 92: 834-840.

He W et al. 2012. Shades of gray: A cross-country study of health and well-being of the older populations in SAGE Countries, 2007–2010.

Houssain P et al. 2007. Obesity and diabetes in the developing world - A growing challenge. NEJM 356: 213.

IDF [International Diabetes Federation]. 2006. The IDF consensus worldwide definition of the metabolic syndrome.

Idelmen EM et al. 2003. Can obesity be a risk factor in elderly people? Obes Rev 4: 147-155.

Kowal P et al. 2012. Data Resource Profile: The WHO Study on global AGEing and adult health (SAGE). Int J Epidemiol 41: 1639.

Malik VS et al. 2012. Global obesity: Trends, risk factors, and policy implications. Nat Rev Endocrinol.

Matthews KA, Gallo LC. 2011. Psychological perspectives on pathways linking socioeconomic status and physical health. Annu Rev Psychol 62: 501-530.

McLaren L. 2007. Socioeconomic status and obesity. Epidemiol Rev 29: 29-48.

Monteiro CA et al. 2004. Obesity and inequities in health in the developing world. Int J Obesity 28: 1181-1186.

Salihu HM et al. 2009. Obesity: What is an elderly population growing into? Maturitas 63: 7-12.

Seubsman S et al. 2010. Socioeconomic status, sex, and obesity in a large national cohort of 15-87-year-old open university student in Thailand. J Epidemiol 20: 13-20.

Sobal J, Stunkard AJ. 1989. Socioeconomic status and obesity: A review of the literature. Psychol Bull 105: 260-275.

United Nations Educational, Scientific and Cultural Organization (UNESCO). 2006. ISCED 1997: International Standard Classification of Education

Wardle J et al. 2002. Sex differences in the association of socioeconomic status with obesity. Am J Public Health 92: 1299-1304.

Winkleby MA et al. 1992. Socioeconomic status and health: How education, income, and occupation contribute to risk factors for cardiovascular disease. Am J Public Health 82: 816-820.

WHO [World Health Organization]. 2000. Obesity: Preventing and Managing the Global Epidemic. Geneva: World Health Organization.

WHO [World Health Organization]. 2008. The Global Burden of Disease: 2004 Update. Geneva: World Health Organization.

WHO [World Health Organization]. 2004. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 363: 157-63.