# Obesity and Health among Mexicans Aged 50 Years and Older: The Role of Childhood Conditions

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**Abstract**

The health dynamics of the older population in Mexico are fused by an unusual interaction between chronic conditions and infectious disease (Palloni et al. 2002). Recent studies show that adverse childhood conditions have long-term consequences for the risk of obesity and related co-morbid chronic conditions in later life. In this paper, we use two waves (2001 and 2003) from the Mexican Health and Aging Study (MHAS) to: *one,* validate measured leg length as a reliable proxy for adverse childhood circumstances in the context of a developing country; *two*, examine the relationship between various measures of childhood conditions, parental background, and own education and assets and the risk of obesity in later life; and*, three*, assess the impact of obesity on selected health measures of function.

## INTRODUCTION

Obesity is a risk factor for a number of diseases including coronary heart disease, diabetes, hypertension, obstructive pulmonary disease, arthritis, and cancer (Conway and Rene, 2004; Himes, 2000; Thorpe and Ferraro, 2004; Zhang et al., 2004). In addition, a number of studies show that obese persons are more likely to report poorer health and higher levels of physical impairment (Launer et al., 1994; Okoro et al., 2004; Yan et al., 2004). Recent research also has shown that onset of disability is about 10 years earlier among obese person compared to those of normal weight (Ferraro et al., 2002). Like smoking obesity is a primary, but preventable, cause of death (McGinnis and Foege, 1993).

The emerging epidemic of obesity is not confined strictly to developed economies in which high levels of caloric consumption can be sustained for the vast majority of the population even as the changing structure of the work no longer requires commensurately high level of energy (WHO, 2003). Obesity is now an important health issue for many developing economies, with the exception of some African countries (WHO, 2003).

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Obesity is becoming more prevalent among not only children, adolescents, and adults, but also, the aged in low- and middle-income countries. It is estimated that more than half of the population in Argentina, Colombia, Mexico, Paraguay, Peru, and Uruguay are overweight and over 15% are obese (Eberwine, 2002). Despite the increasing relevance of obesity in old age, "research on the causes and consequences of obesity has largely ignored the older population" (Himes, 2004:3). This is even more so for the old population in developing countries.

Obesity results from in imbalance of life-long nutrition and activity regimes (Himes, 2004), genetic factors, and environmental factors. In the developing countries recently, there has been more interest in childhood conditions as it is argued that adverse conditions experienced early on in life have long-lasting impact on health and on the incidence of chronic diseases later in life (Davey Smith et al., 1998; Davey Smith and Hart, 1997). Poor maternal childhood nutrition and environments recently have been shown to affect future offspring through low birth weight and increased risk of cardiovascular diseases (Lawlor et al., 2003). As early as 1951, Isabell Leitch identified leg length as a good proxy for childhood socioeconomic conditions as poor nutritional status especially in early life years causes an interruption in growth of the later developing body parts and results in longer torso and shorter legs. Since then, a number of studies supported her argument and found relatively high correlation between leg length and other indicators of childhood conditions and dietary exposures (Gunnel et al., 1998; Lawlor et al., 2002) as well as a positive association between maternal leg length and offspring birth weight (Lawlor et al., 2003). Moreover, leg length but not trunk length is inversely associated with cardiovascular mortality and type II diabetes and the relationship persists even after controlling for other childhood and adult socioeconomic conditions or birthweight (Gunnel et al., 1998; Lawlor et al., 2002).

New findings suggest that unfavorable childhood circumstances and childhood stunting are associated with abdominal obesity in later life (Blane et al., 1996; Power and Moynihan, 1988). In Scotland, Davey Smith and Hart (1997) found that men whose fathers were manual workers had higher body mass index and greater level of triglyceride concentrations than those whose fathers had non-manual occupations. Power and Parsons (2000) identified three potential explanations for the relationship between social class in childhood and obesity in adult life: imbalanced diet in childhood followed by over-nutrition, emotional deprivation in childhood, and acquired social norms about diet and weight during childhood.

However, the deleterious effects of obesity in elderly population are still debated with some studies arguing that the hazard of obesity on health declines with age (Bender et al., 1999). In their research, Mattila et al. (1986 as cited in Rossner, 2001), however, did not detect negative effects of obesity among those aged above 85 years in Tampere, Finland. These authors argue that being "moderate[ly] overweight may, in fact, be a sign of good health". Others found that after age 50, obesity affects mortality indirectly through co-morbid health conditions (Thorpe and Ferraro, 2004).

In this paper, we consider the effect of childhood circumstances on late life obesity using a nationally representative prospective panel data on Mexicans aged 50 years and older. We utilize the 2001 and 2003 waves of the Mexican Health and Aging Study (MHAS). The specific objectives of this paper are the following:

1. To validate measured leg length as a proxy of childhood conditions in a developing country context. This is important because most of our knowledge about the validity of leg length as a proxy for childhood conditions is derived from studies in developed countries, particularly Britain. We consider the association between self-reported childhood circumstances and measured leg length, standardized to the sample distribution, in lieu of available standards for the Mexican population.
2. To examine the relationship between retrospective childhood circumstances amd leg length, own and parental education, own and paternal occupation, and own wealth and the risk of obesity in later life using both body mass index (BMI), waist circumference and waist hip ratio as measures of obesity. We also test for the interaction between childhood condition (leg length) and adult conditions (wealth) on the risk of obesity.
3. To assess how obesity affects the prevalence of select chronic conditions -- diabetes, hypertension and stroke -- as well as current self-reported heath status.

## WHY FOCUS ON MEXICO?

Mexico is a country in the midst of the demographic and epidemiological transitions. The elderly population of Mexico consists of individuals who survived a mortality regime with high levels of infectious diseases (Palloni and Lu 1997). Those who will celebrate their 60th birthday in this century, on the other hand, will have reaped the benefits of an epidemiological regime dominated less by infectious diseases and substantially more by chronic conditions. Thus, the health dynamics of the elderly Mexican population are shaped by an unusual interaction between chronic conditions, which increasingly dominate the current schedule of morbidity and mortality risks, and infectious diseases that are residual to an early epidemiological regime. This is coupled with an increasing prevalence of obesity and diabetes among the elderly.

In 2000, it is estimated that 3.6 million Mexicans suffered from type II diabetes (Barquera et al, 2003). The prevalence of obesity is also high with over 30% of Mexican women classified as obese (20.4% for men) and 36.5% as overweight (40.8% for men) (Fernald et al., 2004).We do not yet have complete knowledge how the exposure to such highly interactive environments as those observed not only in Mexico but throughout Latin America (Palloni et al 2002) affect health dynamics at older ages. Thus, the study of the relationship between childhood conditions, obesity, and chronic conditions in an older population characterized by exposure to transitional health regimes is a potentially useful way to understand how structural changes in morbidity and mortality risks affects adult health and longevity, and how this process relates to social and economic determinants throughout the life course of the elderly individuals.

## METHODS

*Sample*

The Mexican Health and Aging Study (MHAS)/Encuesta Nacional Sobre Salud y Envejecimiento en Mexico (ENASEM), modeled after the U.S. Health and Retirement Study (HRS), is a panel study that provides a unique opportunity to address a broad research agenda on the effects of childhood conditions, individual behaviors, migration history, community characteristics, socioeconomic status and transfers on multiple health outcomes of elderly Mexicans aged 50 years and older.

At its baseline in 2001, MHAS was representative of the 13 million Mexicans born prior to 1951. Respondents were selected in conjunction with the 4th Quarter 2000 National Employment Study/Encuesta Nacional de Empleo (ENE), a nationally representative survey conducted by the Instituto Nacional de Estadistica, Geografia, e Informatica (INEGI), the counterpart of the U.S. Census. The ENE provides coverage of both urban and rural residents in all 32 states of Mexico. The entire MHAS sample was drawn from the 64,475 ENE households of which about 40.5% contained one or more persons eligible for MHAS. Interviews averaging 82 minutes in length were conducted with 15,186 eligible respondents and their spouse/partners for a 90.1% response rate. Households in the 6 Mexican states accounting for 40% of all migrants to the U.S. were over-sampled at a rate slightly less than 2:1. All interviews were conducted in-person by full-time INEGI interviewers trained by MHAS Co-PIs and INEGI supervisors in the unique aspects of MHAS, e.g., securing appropriate contact information for follow-up, administering cognitive performance tests, and using unfolding brackets to reduce measurement error in reports of amounts (e.g., hours of time help and pesos earned or transferred). Field supervisors administered to a 20% random subsample a series of anthropometric measures, including height, weight, knee height, hip and waist circumference, and timed one-leg stands and in 2003, sitting height.

Follow-up interviews with surviving respondents were conducted in 2003 and are now completed. As in the HRS, spouses or partners who separated are independently followed. New spouse/partners (and children from an earlier marriage or union) are also included in the second wave of MHAS in 2003. Next-of-kin proxy respondents provided information for 455 deceased respondents from the 2001 baseline.

The merits of MHAS are that the data do not only collect exhaustive listing of chronic diseases but also inventory major chronic conditions that are life-threatening and it conveys risk factors for other more lethal health conditions such as high blood pressure or diabetes. The survey also includes a broad range of health and mortality relevant information on disease symptoms, functional status, sensory problems, cognitive status, anthropometric measures, hygienic behaviors, and life time episodes of TB, cholera, rheumatic fever, and other health conditions common in Mexico earlier in this century which may have lagged effects on adult health and mortality.

*Anthropometry*

Respondents were asked to report their height and weight. In addition, measurement of height, weight, and circumferences of waist and hip were carried out for 20% of the sample. This would allow comparison between self-reported height and weight and measured ones. The respondents were asked to wear light clothes while they were being measured. Persons who were totally immobile or cannot stand on their own were excluded from the anthropometric measures. Weight was measured without shoes and heavy accessories using a scale placed on flat surface. Measurements of standing and seated height were taken without shoes on a flat surface. Trunk length was calculated by subtracting the height of the chair from seated height. Waist and hip circumferences was measured with a metric tape. Hip circumference was measured at the most outstanding part of the gluteus---the largest circumference below the waist. All measurements were rounded to the nearest integer (e.g. 67.5 kg is recorded as 68 kg).

In the study, we use leg length measured as standing height minus trunk length as a proxy for childhood circumstances. We also use the following measures: body mass index (BMI) based on measured height and weight: weight in kg divided by the square of height in meters; body mass index calculated from measured height and weight; waist circumference measured in meters; waist-hip ratio (WHR): waist circumference divided by hip circumference. We divide BMI into five categories: BMI less than 18.5 kg $m^{-2}$ is classified as underweight; between 18.5 and 24.9 kg $m^{-2}$ is normal; from 25 to 29.9 kg $m^{-2}$ is overweight; between 30 and 34.9 kg $m^{-2}$ is obese class I; and $\geq$ 35 kg $m^{-2}$ is obese class II.

Discussion continues as to threshold for defining obesity (Inelmen et al., 2003; James et al., 2001). In the U.S, obesity is commonly defined as BMI $\geq$ 30 kg $m^{-2}$, while morbid obesity is at BMI $\geq$ 40 kg $m^{-2}$. WHO classifies individuals with a BMI between 30.0 and 34.9 kg $m^{-2}$ as moderately obese; BMI from 35.0 to 39.9 kg $m^{-2}$ indicates severe obesity, and BMI $\geq$ 40 kg $m^{-2}$ as very severe obesity. Asian researchers proposed a different classification system such that BMI of 22.9 kg $m^{-2}$ is the upper limit of normal weight and BMI >25 kg $m^{-2}$ is regarded as obese (James et al., 2001). Independent of reliable cutpoints is the more general question of the reliability of BMI as a measure of obesity at the older ages in light of the evidence of loss of lean tissues with advanced ages (Himes, 2004) and the fact that it is the amount of excess fat that is associated with impaired health (Prentice and Jebb, 2001). Some researchers have argued that visceral adiposity-measured by waist-hip ratio or waist circumference are better predictors of cardiovascular risk and mortality than BMI (Turcato et al., 2000; Visscher et al., 2001; Zhang et al., 2004). Zhang et al. (2004) found that only waist-hip ratio but not BMI predicted coronary heart disease among women aged 55 years and older in China.

*Health Measures*

In MHAS, respondents were asked to report whether a doctor had even told them that they have diabetes, hypertension, or stroke. We test the effect of obesity on the odds of having each of the three conditions. Respondents are also asked to rate their health

(excellent, very good, good, fair, and poor). We use self-rated health as one of the dependent variables and test how childhood conditions and obesity affect subjective assessment of one's health. Many studies have shown self-reported health to be a good summary measure of overall health status. Moreover, the significant effect of self-reported health on mortality persists even after controlling for objective health conditions and physical disabilities (Benyamini and Idler 1999; Idler and Benyamini 1997).

*Analyses*

To examine the influence of childhood conditions on obesity we apply ordered logit model with BMI as the dependent variable using WHO classification and we fit quartile regression models when waist circumference and waist-hip ratio are used as measures of obesity. We control for age, gender, region of residence, parental and own education, assets, smoking status, and level of physical activity. We specially examine how childhood conditions predict obesity in the absence as well as presence of leg length in the analyses. We also test for interactions between leg length and assets in their effect on adult obesity. Next, we estimate a three logit specifications models to examine whether obesity (measured in three different ways) and leg length increases the odds of diabetes, hypertension and stroke controlling for other factors. Finally, we use multinomial logit analyses to examine the association between obesity and self-reported health.

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