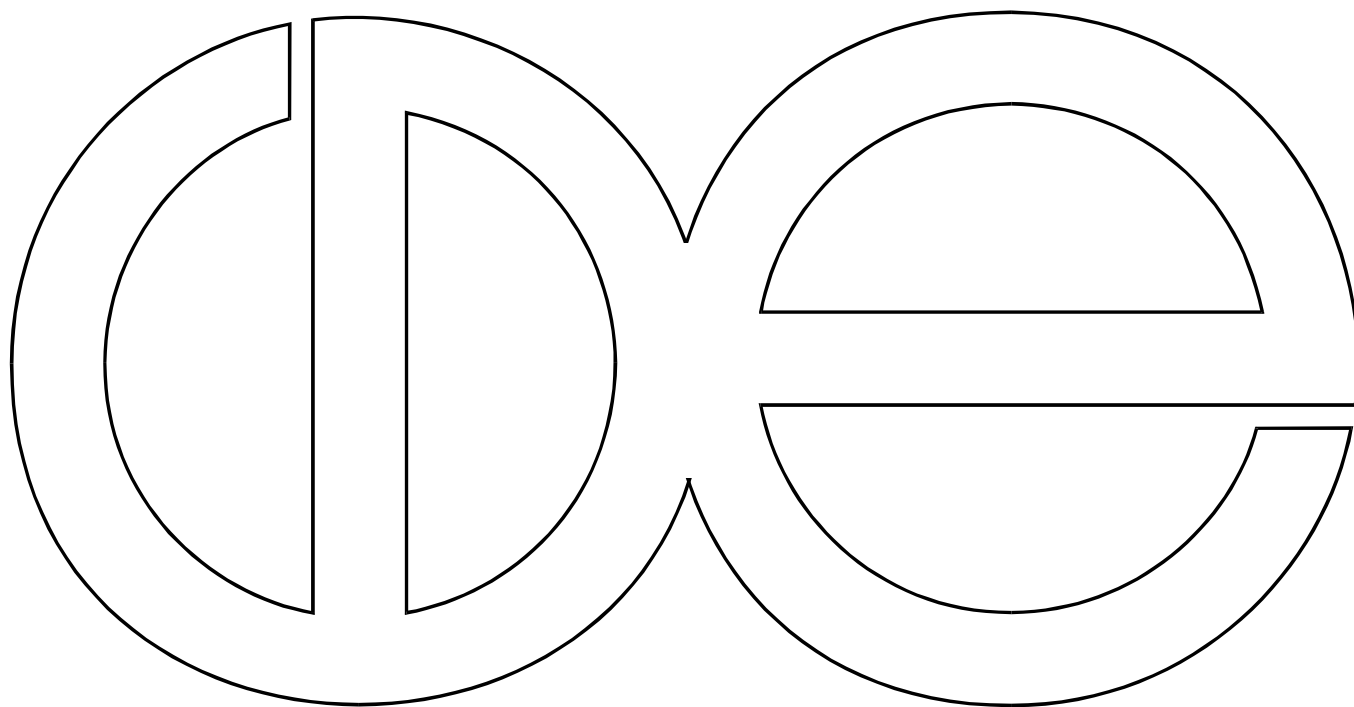


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**Health Status in a National Sample of Elderly Mexicans**

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## HEALTH STATUS IN A NATIONAL SAMPLE OF ELDERLY MEXICANS

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**ABSTRACT**

**Context.** We know precious little about adult health in developing countries in general and Latin America in particular. We know even less about the health conditions of elderly individuals. Since Mexico and many other countries in Latin America and the Caribbean region are and will continue to experience a very rapid process of aging, it is important to generate pertinent information and analyze it promptly to identify key features that could be used to formulate and design health policies. This is particularly useful in Mexico, and other countries of the region, which have embarked in sweeping reforms of the health sector.

**Objective.** We aim to investigate the health profile of elderly Mexicans aged 50 and over. We are guided by two overarching concerns. First, does the health profile of elderly Mexicans reveal any special features, distinct from what one would expect from extant research on elderly individuals? Second, is there any evidence of relations between current health status and conditions to which these individuals were subject early during their childhood?

**Design, setting and population.** MHAS (Mexican Health and Aging Study) is a two-wave panel of a nationally representative sample of the non-institutionalized elderly Mexican population (50 and over) and their surviving spouses. The sample included approximately 9,806 target individuals and 5,424 spouses. The rate of response for targets was 89.2% and for spouses 97.2%. The interviews for the first panel on which we focus in this paper took place during 2001 and lasted about 1.5 hours. They included modules on demographic characteristics, physical and mental health, limited marital and migration history, early childhood characteristics, family and kin, intergenerational transfers and pension, income and assets. Limited anthropometry (height, weight, knee height, waist and hip circumference) and mobility (one leg stand) was obtained for 20% of the sample.

**Main outcome measures.** The main outcome measures obtained by MHAS were self-reported health, functional limitations (Activities of Daily Living [ADLs] and Instrumental Activities of Daily Living [IADLs]), anthropometric measures (height, weight, knee height, waist and hip circumference) as well as self-reported chronic conditions.

**Results.** (a) Age patterns by self-reported health behave as expected: the proportion reporting in bad health increases by age, and females are more likely than males to report themselves in bad health; (b) Similarly, the proportion reporting at least one ADL or at least one IADL increases sharply with age, and females are more likely than males to report at least one ADL (or IADL); (c) Of all the chronic conditions examined the most salient is self-reported diabetes. Even though we know that self-reports result in underestimates of diabetes prevalence, the

observed prevalence is very high for both males and females but more so for females. The same patterns are observed for obesity; (d) Comparisons with the Health and Retirement Study (HRS) in the U.S. reveal that elderly in Mexico are particularly disadvantaged in terms of self reported health and IADL but not with regard to ADL. However, the most salient contrast is, once again, the one that emerges with diabetes and obesity: MHAS individuals display a higher propensity of being diabetic and obese; (e) Relations between diabetes and obesity, on the one hand, and early conditions reflected in anthropometry and retrospective reports, on the other, are not very strong but the evidence from the data is indicative of potentially important connections.

**Conclusions.** Preliminary findings from MHAS reveal a mixed picture. On the one hand we find that self reports of health status, ADL and IADL are in line with expectations and deviate only weakly, for example, from patterns among U.S. elderly. On the other hand we find high prevalence of diabetes and obesity, higher than among elderly in HRS, but only partial support to establish a connection between these conditions and early childhood characteristics.

## I. INTRODUCTION

Profound reforms of the Mexican health system are about to be enacted.<sup>1</sup> In the last ten years, slowly but surely, similarly consequential changes have radically transformed the entire landscape of health care delivery services and pension systems in many countries of Latin America and the Caribbean. Coincidentally a less visible but equally powerful transformation is altering the demographic profile of most of these societies: rapid aging is sweeping age structures, feeding a transition from youthful to aged populations in a fraction of the time it took developed countries to undergo a similar change. Up to now, and mostly because of lack of information, researchers have been unable to characterize such processes.

In this paper we examine a new, very rich data set for Mexico with the goal of identifying key features of elderly health status. We search for indications revealing the existence of particular relations, rooted in the actual origins of the new cohorts of elderly people. In doing so, we produce new materials for fast increasing activity in the area of relations between adult health and early childhood conditions. Finally, we contrast the health profile of elderly Mexicans with the U.S. elderly population and find intriguing contrasts but also unexpected similarities.

## II. AGING IN MEXICO: THE MOMENTUM OF THE DEMOGRAPHIC PAST

Over the next forty to fifty years Mexico, like other nations in Central and South America and the Caribbean, will experience a massive and unusually fast process of aging. Some of the growth of the elderly population aged 60 and over, but a somewhat trivial part, will surely be related to as yet unrealized gains in survival at adult ages, particularly at ages over 60. But the bulk of the process, and its most extreme characteristics, results from demographic forces that were set in motion many years ago and which are therefore unavoidable.

Aging is measured in a number of ways. For the most part, each indicator responds to a different combination of demographic forces. The proportion of the population aged 60 and above, for example, is a widely used indicator of the age distribution. It depends not only on the size of the older age groups but on the size of the younger subpopulations as well. For this reason, increases in the *proportion* at older ages may be a result not only of growth among the elderly but of fertility decline that reduces the absolute size of younger cohorts. In the U.S., for example, the proportion of the population older than 60 increased from 12.5 percent in 1950 to about 16.6 percent in 1990 and is expected to increase even more to 24.7 percent in 2025. Mexico, on the other hand, started from a level of about 7.1 percent in 1950, experienced a decrease to 5.9 percent in 1990, and is expected to reach a level of about 14 percent in 2025.

Aging can also be assessed by the *rate of growth* of the population sixty and above. This indicator is less

sensitive to fertility fluctuations in the recent past and more responsive to forces that determine the original size at birth of cohorts and to those that shaped their mortality experience. During the 1950's the U.S. population older than 60 experienced rates of growth of the order of .023. In 1990 the rate of growth had decreased to .016, and by 2020 is expected to increase again to about .025. In Mexico, on the other hand, the rate was on the order of .026 in 1950, attained values around .030 in 1990 and is expected to climb to about .040 in 2020. Note that a rate of growth of .040 implies doubling times of about 5 years for as long as those rates are maintained. And in Mexico those rates will persist for a good part of the first half of the 21st century.

The velocity with which the older population is growing in Mexico and other developing countries leads to a formidable compression of the aging process. The length of time it will take Mexico to attain relatively high proportions of population above age 60, say above 15 percent from current levels of around 7 percent, is 2.5 times as fast as the length of time it took the U.S. and 2 to 5 times as fast as the length of time it took an average Western European country.<sup>2,3</sup>

### III. THE PAST AND ITS EFFECTS ON CURRENT CONDITIONS

It is estimated that upwards of 50 percent of the growth that the older population in Mexico and other countries in Latin America will experience during the first thirty years of the 21st century is attributable to the mortality decline in the period 1940-1970, a time when the cohorts who began aging in 1990-2000 had just been born, were in infancy or early childhood.<sup>3</sup> A mortality decline that began in earnest fifty to sixty years ago is the main force behind the current and prospective speed of aging in these countries. This, however, is neither its only nor its main effect.

Birth cohorts who will reach age 60 and above after 1990 in Mexico experienced mortality levels that were improving sharply as a consequence of medical interventions, not because of amelioration in standards of living. Between 50 to 70 percent of the mortality decline that took place after 1945 was associated with medical interventions.<sup>4,5</sup> The remaining decline could be attributable to improved standards of living, increased knowledge, and assorted other factors. Furthermore, most of these gains were experienced by infants and children between one and ten years of age.

An important consequence of sharp mortality declines such as those that swept Latin America and the Caribbean in the fifties and sixties is that average levels of frailty among surviving members of cohorts affected by the decline will be higher (and so will the variance of frailty) than it would have otherwise been. The lives saved by vaccination campaigns and the use of antibiotics were almost surely not random relative to conditions affecting

health status. Survival gains are more likely to accrue to populations that are more exposed and susceptible to infectious diseases and weakened by lack of proper nutrition.

Another consequence of the peculiar modality of mortality decline is that though the exposure to illnesses was certainly reduced, gains in survival were attained by altering resistance to and recovery from diseases. Exposure to most childhood conditions responsible for higher mortality before the interventions changed only slowly during the period of mortality decline and their influence was felt by an expanding number of survivors who benefited from lifesaving technologies. Because conditions that sustain proper levels of early nutrition, growth and development changed very slowly and did not account for a significant part of mortality decline, the pool of survivors who experienced precarious early life conditions and who also were exposed to assaults from infections and other illnesses grew in size. If there is a connection between early life conditions and adult health, the cohorts who will reach adulthood and older ages after 1990 or so in Mexico and elsewhere in Latin America are like no other cohorts before them. One would expect, *ceteris paribus*, that their health status would be more compromised than it is among more heavily selected elderly populations or among those whose early life experiences are more significantly touched by better standards of living.

The evidence that early childhood conditions affect adult health is still fuzzy and somewhat weak,<sup>6</sup> and our understanding of the mechanisms relating to early childhood exposures and adult health status is too primitive to enable us to make precise predictions or conjectures regarding the nature of expected health impairments.<sup>7,8,9</sup> If, however, these mechanisms have more than modest effects, the increases in frailty among elderly in Mexico whose earlier experiences fit the description provided above are likely to be pronounced. This means that the health status composition of elderly in Mexico should be worse than if the growth of the recent and forthcoming cohorts of elderly had been associated with improving standards of living on early childhood mortality.

There is another aspect of morbidity and mortality patterns in these countries that makes them unique. The regime of morbidity and mortality experienced by elderly people in developing countries in general are quite unusual. As expected, they experience expansion of chronic conditions, such as heart and lung disease, cancers, diabetes, and arthritis. But simultaneously, they continue to be assaulted by non trivial levels of infectious diseases. We do not yet understand what the health effects are of exposure to highly interactive environments like these. Do people with congestive heart disease experience the same impairments and comorbidities when they are also exposed to malaria than when they are not? What complications emerge among those affected by systemic respiratory problems who are also TB positive and experience poor levels of nutrition? Are elderly people with

circulatory problems on an equal footing when they experience recurrent intestinal infections than when they do not?

#### **IV. ELDERLY HEALTH STATUS IN MEXICO: CONJECTURES**

Compression of aging and peculiar conditions affecting health status of the elderly are not the only distinguishing markers of Mexico's aging process. It has been argued elsewhere<sup>3</sup> that aging in Mexico and other parts of Latin America and the Caribbean will occur within institutional contexts that increase the vulnerability of elderly as traditional systems of support and intergenerational transfers are dismantled or abandoned. Furthermore, none of these countries are fortunate enough to experience healthy economic growth. Quite the contrary, most of these countries are classic examples of economies perennially strangled by international debt, subject to recurrent crises, and always carrying a burden of substantial subpopulations enjoying no more than mediocre standards of living. The elderly, and particularly elderly women, are part of those subgroups.<sup>3</sup>

The constellation of factors identified above increase the urgency of an examination of elderly health status and mortality in these countries. Up to now we have had no evidence to examine a fact that limits our discourse to speculation and conjectures. A new data set on elderly in Mexico and new information from samples of elderly in various cities of Latin America and the Caribbean changes all this. We are now in a position to assess whether or not the actual conditions affecting elderly people are any different from what is expected or from the conditions of elderly status elsewhere in the developed world.

The main objective of this paper is to begin the analyses of health status among elderly in Mexico. We do so by pursuing a fairly descriptive strategy and attempt to highlight key features of the elderly health status profile. But we also seek to identify evidence supporting some of the conjectures regarding early childhood conditions offered before. Because these conjectures invoke the distinctiveness of the aging process in Mexico relative to others, it is to our advantage to compare the health profile of elderly Mexicans with that of another population. We choose the elderly population of the Health and Retirement Survey (HRS) in the U.S. for two reasons. First, the survey of Mexican elderly is strictly comparable to HRS both in terms of content and in terms of sampling strategy. Second, an important part of the elderly population in the U.S. is or will be of Mexican origin in the near future. And although because of sample size limitations we cannot pursue direct comparisons between elderly Mexicans in Mexico and elderly Mexicans in the HRS, the comparison will provide indications of what we should expect of future trends among the U.S. elderly population.



## V. DESCRIPTION OF THE DATA SET

To identify salient characteristics related to the health status of elderly Mexicans we use a preliminary release file of the Mexican Health and Aging Study (MHAS). This is a prospective panel study of Mexicans born prior to 1951 and their spouses and partners. Collection of baseline data was completed late in the summer of 2001 and a second wave is contemplated in 2003.

### **The data base: MHAS**

The MHAS sample was drawn from the 4<sup>th</sup> Quarter wave of the 2002 ENE survey.<sup>a</sup> Like its parent sample, the MHAS is representative only of the non-institutionalized component of the population aged 50 and over in 2000. This is not nearly as serious an omission as it would be in the U.S. Only 0.4% of individuals aged 60 and over lived in any type of facility, including convents and penal institutions, and those providing residential care for the chronically disabled, at the time of the 1990 Census in Mexico. About 7.8% of all interviews were conducted with the help of a proxy. Self or proxy interviews were conducted with 9,806 sampled respondents for a response rate of 89.15%. Of the eligible 5583 spouse/partners, interviews were obtained with 5424, yielding a conditional response rate of 97.15%. In total, MHAS interviewed 15,230 respondents for an overall response rate of 91.85%. Unless otherwise specified we only use interviews conducted directly with the selected respondent and exclude proxy interviews. This means that our estimates of disease and disability prevalence are a lower bound. The age-sex distribution of respondents of the 2001 MHAS that we use in this study are shown in Table 1.

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<sup>a</sup> ENE or National Employment Survey (Encuesta Nacional de Empleo), is an ongoing and nationally representative survey conducted by INEGI, Mexican National Institute of Statistics, Geography and Informatics/Instituto Nacional de Estadística, Geografía e Informática, the Mexican equivalent of the U.S. Bureau of the Census. The ENE provides coverage of urban and rural residents in all of the 32 states of Mexico. Households containing at least one resident born prior to 1951 were eligible for MHAS. In sampled households containing two or more non-married/non-partnered individuals, one was randomly chosen prior to the start of fieldwork. If these individuals were married (partnered), an interview was also attempted with that person, regardless of his/her age. The 2000 sample of the ENE-INEGI survey included 64,475 households, of which about 25,720 (40.5%) contained one or more persons born prior to January 1, 1951 (i.e., aged 50 and over at some time during calendar year 2000). Fewer than half of ENE-eligible households (about 11,000) were randomly selected for inclusion in MHAS. Beginning in early March 2001, experienced full-time interviewers associated with ENE began to conduct face-to-face interviews averaging 90 minutes in length in wave-1. Proxy interviews were obtained for respondents unable to complete their own (because of illness, hospitalization, or work absence).

[Table 1 about here]

Sampled unmarried persons were asked to complete the entire interview by themselves. In households where there was a couple, we attempted to distribute the respondent burden across spouses, paralleling the HRS/AHEAD interviewing strategy.<sup>10</sup> In general, each spouse/partner provided information on his/her own demographic background, parents, health, and use of health care services. The spouse most knowledgeable about financial matters provided the economic content for the household (e.g., private or public sector benefits -- received or expected).

### **Health status information retrieved from MHAS**

All population health surveys (as distinct from clinical studies) share the goal of collecting self-reported data with credible validity. We are guided by the construct validity of the self-reported health data from the Indonesian and Malaysian Family Life Surveys,<sup>11</sup> other developing country surveys,<sup>12</sup> as well as population-based studies of health dynamics in the U.S.<sup>13,14</sup> Our approach to designing the health content of MHAS balances the need for comparability with U.S. health surveys to test hypotheses regarding migration selectivity with concern for cross-national differences in access to health care services, knowledge and recognition of health problems and symptoms, and expectations of age-related changes in physical and cognitive abilities. Health is a multidimensional construct and to varying degrees, MHAS provides coverage of the most important ones.

## **VI. ANALYSIS**

In the analyses that follow we make use of four MHAS items: self reported health status, self-reported limitations in Activities of Daily Living (ADL), self reported chronic illnesses, and some anthropometry, including height and weight to assess BMI. The latter was obtained from two different sources. For a subsample of respondents numbering about 2,300, measures of height and weight were obtained via application of standard protocols by qualified interviewers. For the remainder of the sample we used self reported height and weight.<sup>b</sup> For comparison we use information from the Health and Retirement Study (HRS), a well-known and continuing study of elderly in the U.S.<sup>10</sup> Our intention is less to draw exact inferences about differences in the processes determining health in each country than to offer a benchmark to interpret the estimates for the Mexican population.

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<sup>b</sup> In a different paper we show that there is tight correspondence between BMI calculated from actual measurement and from self-reports.<sup>3</sup>

## Health self reports

What we know about the validity of health self reports is confined to their performance in developed countries. It is, for example, acknowledged that they are acceptable predictors of mortality,<sup>15</sup> disability,<sup>16</sup> and morbidity.<sup>17,18</sup> But we know little about their validity in developing countries in general, and Mexico in particular. Unlike self-reporting of chronic conditions that, by definition, require some form of medical diagnosis to be of any use, self-reported health is less tied to accessibility and use of medical services. But they suffer from a number of shortcomings limiting their use in comparative settings.<sup>19</sup> Despite these and other problems, the information reproduced in the left hand side panel of Table 2 is the first glimpse we have at self-reported health status in a national sample of older adults anywhere in Latin America. This table displays the proportion of individuals by broad age groups and gender who report themselves in bad health for both MHAS and HRS. Figure 1 displays observed proportions reporting in bad health by single age groups in MHAS and, for comparative purposes, among U.S. adults interviewed in HRS.

Table 2 and Figure 1 about here

Three inferences follow: (i) as is generally the case in other surveys of elderly, the prevalence of self reported bad health increases gradually with age; (ii) women are more likely to report themselves in worse health than males at all ages but differences are not statistically significant at any age five year age group ( $p > .05$ ); (iii) the proportion of the sample who self-report themselves in bad health in Mexico are higher than those in the HRS sample in the U.S. for comparable age groups. Although the age group-specific differences in self reports between HRS and MHAS are statistically significant (see Table 1), their absolute magnitude is large only at ages above 60.<sup>c</sup>

## ADL

Self-reported limitations in basic activities of daily living (bathing, toileting, dressing, etc...) are relatively good measures of the influence of underlying morbid conditions that impair normal, day-to-day functioning. Table 2 (right hand side panel) displays the proportions reporting at least one ADL limitation by age groups and sex in both MHAS and HRS. Figure 2 displays the proportions by single year age groups. As one would naively expect, prevalence of at least one ADL-related limitation rises smoothly with age. Females and males appear to be equally likely to experience at least one ADL limitation, and observed gender differences do not pass a significance test

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<sup>c</sup> The discrepancies increase two-fold if instead of using “bad” health, we combine the categories “bad” and “fair” health.

( $p > .05$ ).

Comparison of MHAS and HRS reveals an interesting feature: **except for the oldest age group**, male and female prevalence of at least one ADL limitation is almost always more than 1.3 times as high in the HRS sample as it is among elderly Mexicans in MHAS. These differences are statistically significant ( $p < .01$ ). Assuming the worst status for no response in MHAS (do not know/does not respond), leads to higher estimates of ADL prevalence but the adjusted levels for the first two age groups remain slightly below those in the U.S. Instead, the prevalence of at least one ADL for the oldest age groups is almost twice as high among MHAS females as it is among HRS females, and 1.5 times as high among MHAS males as among HRS males. The poorer performance among the very old in Mexico is consistent with their poorer self-reported health. The sharp increase in ADL limitations among the very old in MHAS is also consistent with the pattern of prevalence of key (self reported) chronic conditions whose effects may be triggered late in life (see below).

Self-reports of health status among Mexican in MHAS may reflect generalized experiences with a number of conditions, including recurrent infections, none of which has a durable, persistent influence on ADL. If so, one would expect the observed pattern, namely, worse health reports and better performance in ADL. This interpretation is consistent with the idea that elderly Mexicans experience a unique disease environment, one blending infectious and chronic diseases.<sup>d</sup>

### **Chronic conditions**

Even in societies with widespread access to medical care, self-reports of chronic conditions are often a less-than-ideal gauge to determine overall levels of prevalence. In societies where visits to physicians or para-medical personnel are infrequent due to difficulties in access, self reported conditions may reflect only cases of active and advanced conditions. They will measure only poorly the prevalence of incipient morbidity or underlying conditions. It follows that self reported chronic conditions will, at best, yield lower bounds for their true prevalence.

Tables 3a-3d display proportions self-reporting hypertension, diabetes, arthritis and one or more in the combined category of cancer, heart disease, lung disease and stroke. This is done for broad age groups and by sex. Comparing with similar proportions calculated from HRS data we find an important regularity: with the notable exception of diabetes, self-reported conditions in HRS are higher than in MHAS. It is, however, unlikely that these differences reflect true differences in actual prevalence. Note that the observed estimates are the product of true

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<sup>d</sup> The pattern of contrast between Mexico and the U.S. is replicated for other countries in Latin America. See reference 20.

prevalence, on the one hand, and the fraction of the population with access to physicians or para-medical personnel (e.g., the opportunity for a diagnosis), on the other. Equivalence between HRS and MHAS in the prevalence of, say, hypertension, could still exist (but be unobservable) if only between 55% and 66% of elderly Mexicans had access to a proper hypertension diagnosis. Consistent with this, about only 63% of the respondents acknowledges having visited a physician (or other medical personnel) during the year prior to the survey. Thus, the disparities between HRS and MHAS -- on hypertension at least -- could all but disappear and even reverse if we adjust for underreporting.

Tables 3a-3d about here

Before drawing any inferences from these figures, it is useful to understand what the effect of underreporting is on observed estimates. We use a very simple procedure to estimate lower and upper bounds for the reported prevalence of chronic conditions in MHAS. We first calculate reported prevalence among those who visited a physician or medical personnel during the year before the survey and then among those who did not do so. A substantial fraction among the former may have had contacts precisely because of the existence of a condition. Thus, their reports lead to an overestimate of the “true” rate of self-report, e.g., what would have been reported in the absence of underreporting associated with lack of access. By the same token and an obverse reasoning, the reports among those who did not visit a physician or medical personnel must lead to a lower bound of prevalence since among them there is a subpopulation of undiagnosed individuals who cannot possibly report it. The resulting range for diabetes and hypertension are displayed in square brackets in Tables 3a and 3b. Analogous bounds for the remaining conditions are not shown since their inclusion does not alter our inferences.<sup>e</sup>

The results from Tables 3a and 3b deserve comments. For diabetes and hypertension, MHAS reports are equal to or higher than HRS reports. Using the upper bounds simply amplifies the Mexican disadvantage. Using the lower bounds alters the conclusion that MHAS respondents are worse off in at most two cases (out of six possible

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<sup>e</sup> We do not mean to dismiss other potentially serious sources of errors potentially affecting self-reports of chronic conditions. Even among those with easy access to medical services there may be under- or over-reporting of certain conditions. The exercise we perform here is meant to provide a suggestive range of values. Their interpretive value ultimately depends on whether or not there is systematic *over-reporting* among those who did not visit a physician during the last year and systematic *under-reporting* among those who did.

combinations of sex and age groups) for each condition.

Are these estimates of diabetes and hypertension reasonable? To offer a measure of external validity we resort to three comparisons. First, we compare our estimates with those obtained in an independently conducted study that elicited self-reports of diabetes but that also performed glucose tolerance tests in a representative sample of the adult Mexican population. Estimates from this study appear in Table 4. A comparison of columns 1 and 3 of this table with those of Table 3a reveals two glaring regularities. First, self reports for both males and females are virtually identical across sources. This is either an unlikely coincidence or a marker of the accuracy of elicited self-reports. It tells us nothing, however, about the actual validity of self-reports. Evidence regarding the latter is contained in the remaining two columns of Table 4: the glucose intolerance test produces estimates of prevalence of diabetes that are higher than self reports for the first two age groups and somewhat lower for the oldest one. The net consequence of this is that MHAS self reports on diabetes *underestimate* the overall prevalence of diabetes by about 15 to 20 percent.

Tables 4a-4c about here

The second comparison confronts MHAS results with new estimates of self-reports of chronic conditions in seven samples of elderly people (60 and above) in seven capital cities in Latin American countries, including Mexico.<sup>3</sup> These results yield a range of values for hypertension and diabetes displayed in Table 4b.<sup>3</sup> The inference from these ranges is immediate: self reported diabetes in MHAS falls in the middle of the range observed in these samples. Levels of hypertension in MHAS hugs closely the lower bounds for other Latin American countries. This comparison shows that results from MHAS are not an aberration or a singularity but part of a widespread regularity in the region.

Finally, the third comparison enables us to contrast diabetes prevalence between MHAS respondents and an advance sample of Puerto Rican elderly.<sup>21</sup> The corresponding values are displayed in Table 4c. The new comparison simply reinforces the idea that if anything, diabetes and hypertension from MHAS represent **lower bounds within a larger context including other countries of the region**. And yet, they are quite high relative to those experienced in the U.S.

### **Obesity**

Although obesity (specially morbid obesity) has been identified as a risk factor for a number of chronic conditions, such as coronary heart disease, diabetes, kidney failure, stroke and others,<sup>22</sup> empirical findings are not always transparent and conclusive. It is widely believed though that obesity is a correlate, if not a risk factor, for

glucose intolerance and diabetes.<sup>23,24,25,26,27</sup> If so, the higher levels of diabetes (self reported) found in MHAS could be accompanied by higher prevalence of obesity among elderly Mexicans.

We define “morbid obesity” as a BMI that exceeds 35 among females and 36 among males and reserve the term “obese” for individuals whose BMI exceeds 30. Table 5a displays the prevalence of obesity (obese plus morbid obese) for males and females for three major age groups in MHAS and in HRS. The graphs in Figure 3 displays *observed* BMI (absolute values of frequencies) distributions among male and female respondents in MHAS and HRS. Figure 4 displays the proportions who are obese by single years of age and gender in both data sets.

Tables 5a-5d and Figures 3 and 4 about here

The following three regularities stand out: (i) as was the case with diabetes, obesity is more prevalent among females in both data sets, but the gender differences are more salient in MHAS than they are in HRS; (ii) the gradient of obesity with age is similar in both data sets, e.g, obesity decreases with age, but the slope among females is less pronounced than among males; (iii) obesity among MHAS males is lower than among HRS males but the differences are statistically significant ( $p < .01$ ) only in the youngest age group. The differences are higher among females at all age groups and are also statistically significant ( $p < .01$ ) for the two oldest groups. The net consequence of these contrasts is that prevalence of obesity is about 10 percent higher among MHAS elderly than among HRS elderly. Because obesity is increasingly becoming a widespread condition among children and adults in developing countries<sup>28,29,30,31,22</sup> we are not surprised to find relatively high levels in the MHAS sample. What is remarkable is that these levels are even higher than those prevailing in the U.S.<sup>f</sup>

The BMI age gradient is not difficult to explain: aging leads to changes in BMI via skeletal compression and corresponding loss of height through increasing morbidity-related weight loss. Thus, the observed age gradient in both MHAS and HRS is as expected, though it is likely to be attenuated by cohort differences in achieved height.

The pattern of differences between HRS and MHAS is considerably more difficult to explain. Could the observed patterns of male-female differences be due to measurement problems? As we did before, we compared our estimates to those obtained in three alternative data sources, ENSA, SABE and PREHCO. (Tables 5b and 5c).

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<sup>f</sup> The comparison may seem inappropriate for, after all, we are comparing crude rates, namely, unadjusted for age distribution and correlated factors. However, it should be noted that (a) the Mexican population 50 and over is younger and less affluent than the U.S. population 50 and over. Consequently if diabetes increases with age (at least up until some old ages) and is associated with the life style of the affluent, the crude figures we are working with will understate the disadvantage of the Mexican population.

These figures lead to the same conclusion as before: obesity patterns among MHAS elderly closely tracks those observed elsewhere in the region. What we see in Table 4 is neither an aberration nor can it possibly be the result of measurement artifacts. It is part of a generalized regional trend.

### **Correlates of diabetes and obesity**

Both obesity and diabetes have been frequently associated with economic affluence. Yet there are good reasons to suspect that this characterization is at best incomplete. Although the precise etiology of adult onset (Type II) diabetes is not completely known, there is a generalized belief that is also associated with diet and sedentary life styles. Some research suggests that obesity is likely to occur in populations that suddenly shift away from a low-calorie, low-fat diet, one devoid of processed and refined carbohydrates.<sup>31,32,33,34,35,36,37</sup> Adult onset diabetes has been linked to malnutrition early in life and, to the extent that there are strong synergisms between malnutrition and infectious conditions, it may well be associated with repeated contraction of infectious diseases in early childhood.<sup>38,7</sup> Furthermore, a conjecture of significance to us is that adult onset diabetes (and obesity), may be triggered by sedentary life styles and modern diets in general, but especially in populations that evolved exposed to effects of recurrent and prolonged periods of famine and malnutrition.<sup>31</sup>

If these conjectures regarding the nature of diabetes and obesity are taken seriously, they help to identify mechanisms that should leave traces in the data. First, prevalence of obesity and diabetes among Mexican elderly could be a result of adoption of sedentary life styles and of modern diet (rich in fats, simple carbohydrates and sugary staples), by a population previously exposed to moderate to high levels of physical activity and a low-calorie diet. This effect should lead to an association between poverty and prevalence of both obesity and diabetes.

Second, obesity and diabetes may be the outcome of precarious levels of nutrition experienced early in the life of these cohorts due to poor food intake and to the interaction between food intake and infectious diseases insults. Increased obesity, non-insulin dependent diabetes, and impaired glucose tolerance among adults are associated with low birth weight, poor maternal levels of nutrition, and maternal diabetes in pregnancy.<sup>39,7</sup> If, as argued before, a progressively higher fraction of children exposed to these conditions manage to survive to older ages, we should see a concomitant increase in the prevalence of the above mentioned chronic conditions, diabetes among them, among surviving members of these cohorts. Thus, we should expect (a) that the prevalence of obesity and diabetes is higher among cohorts most affected by mortality decline, and (b) an association between early childhood conditions and the current prevalence of obesity and diabetes.

A rough test of these hypotheses can be achieved by estimating a number of logistic models for the



probabilities of: diabetes (self-reported), BMI $\geq$ 30 (obese), BMI $\geq$ 35 (morbid obese) and the combination of both diabetes and obesity or diabetes and morbid obesity. We use a handful of discrete independent variables: age (in three categories), gender (two categories), a proxy for poverty (three levels of schooling), urban-rural residence (two categories) and, finally, whether or not the respondent experienced severe health problems during childhood. The main results are in Table 6a. The table displays the estimated effects on the log odds of obesity, morbid obesity, diabetes and the two joint conditions. Table 6b displays predicted values for the probability of a condition for selected categories while holding all other variables included in the model at their sample mean. Table 6c displays the predicted age patterns for selected subgroups.

The most important predictors of obesity and morbid obesity are gender, age, education and early childhood health. Females are more likely to be obese than males: the estimated effects imply that roughly twice as many females as males are obese (.30 vs .19 in Table 6b). Obesity decreases sharply with age and is less likely to occur among those at the extremes of the educational hierarchies, namely, with more than primary education and the illiterate. To the extent that education proxies for poverty (wealth), this finding implies that obesity is less likely to occur among the more affluent and the poorest. Surely, among those with highest education, acquisition of a westernized life style is more likely to be accompanied by awareness of its deleterious effects and the adoption of preventive countermeasures such as frequent exercise, moderation in diet and alcohol consumption. Among those at the bottom of the educational ladder, the influence of a westernized life style may still be incipient and its negative consequence not yet felt. An interesting feature is that those who report serious health problems during childhood are more likely to be obese as adults. However, the effect is not large (see Table 6b) and is only marginally significant ( $p < .05$ ).

Examination of diabetes reveals different results. First gender effects disappear altogether. Second, the effects of age are only important when associated with the second age group (60-74): being in the youngest and oldest age groups is protective. Third, the two most important predictors of diabetes are residence in an urban area and the experience of health problems in early childhood. Estimates in Table 6b indicate that urban elderly are about 20 percent more likely to self-report diabetes than rural elderly whereas those who experience health problems during early childhood are 30 percent more likely to self-report the condition.

Finally, the joint occurrence of diabetes and obesity is mostly influenced by gender, health in early childhood and, to a lesser extent, age. These findings confirm at least one of the aforementioned conjectures, namely, that early childhood conditions (reflected in retrospective self reports) are associated with the onset of

obesity and diabetes. Neither the estimated age effects nor those associated with education (and, by association, with income) confirm expectations. First, it is not the case that a more powerful impact on diabetes and obesity is found among younger cohorts, the ones who benefited the most from the mortality decline initiated in 1940. Second, poverty (as reflected by illiteracy) does not increase the risks of obesity or diabetes. These conditions are least prevalent among the illiterate and the relatively well educated.<sup>g</sup>

#### VII. A MORE DIRECT TEST

At the expense of drastically altering the sample, we can provide a more robust test of the hypothesis that early childhood conditions are related to a metabolic disorder such as diabetes. In a sub-sample of about 20% interviewees obtained direct anthropometric measurements of height, weight, knee height, waist and hip circumference. In this subsample it is possible to estimate the direct (net) effects of markers of under-nutrition during early childhood and current diabetes status. First, knee height is correlated with both height<sup>40</sup> and leg length<sup>41</sup> and is, by itself, an indicator of developmental and growth problems early in life. Second, there is evidence suggesting that in populations of poor countries at least, malnutrition in early childhood leads to high WHR. If these two measures, knee height and WHR, do reflect early nutritional status and if these conditions do predispose individuals to higher risk of diabetes we should be able to detect important associations in the data. However, in neither case is there enough prior research on the relations to offer strong support to the conjectures.

A very general representation of relations is displayed in Figure 5. Childhood conditions, including those in utero, can have an effect on patterns of early nutrition, growth and development as well as in other physiological and metabolic processes (paths " and \$). These, in turn, may affect the propensity for developing adult diabetes and/or adult obesity (paths C<sub>1</sub> and C<sub>2</sub> respectively and \*<sub>1</sub> and \*<sub>2</sub> respectively). Obesity is by itself a risk factor for diabetes (path , ) and the association between diabetes and obesity may also be due to unmeasured conditions (path O). If this representation is limited, the same must be said of our estimation: we hypothesize that both knee height (being in the lowest quintile of the distribution of knee height) and WHR (being in the upper quintile of the distribution of WHR) are responsive to early malnutrition, but also that WHR is a late signal that develops after long-bone development has been completed. Thus, we surmise that WHR should be predicted by knee height. Finally, retrospective measures of early child conditions (socioeconomic and health status) may reflect environments that while producing effects on early nutrition could also be more generally related to other physiological and

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<sup>g</sup> In a representative sample of elderly living in Mexico City the results are somewhat different as diabetes

metabolic process.

We estimate several models. In the first of these, the dependent variable is the log odds of diabetes (self-reported). In the second the dependent variable is the log odds of obesity and in the third the log odds of falling in the upper quintile of WHR. In all cases we control for age, gender, and education. The model for diabetes also controls for obesity. The sample is restricted to individuals with available anthropometry. The results are displayed in Table 7.<sup>h</sup>

The model for self-reported diabetes is somewhat uninformative: of all the conditions that interest us only being in the upper quintile of WHR is marginally significant and properly signed (estimate of path  $\beta_1$ ). Neither being in the lowest quintile of knee height or of height exert any significant influence. The model for obesity reveals a very strong and properly signed effect of WHR (estimate of path  $\beta_2$ ). And while the effect of belonging to the lowest quintile of knee height is very powerful, it also has a sign opposite to the expected one: individuals in the lowest quintile of knee height are less prone to obesity than those in the central parts of the distribution. This may indicate that if knee height does indeed reflect early malnutrition, it also represents effects that do not necessarily translate to metabolic disorders such as those implicated in diabetes or obesity. The third model confirms the importance of early childhood socioeconomic conditions for WHR (estimate of path  $\beta_3$ ), which is what we would expect if WHR indeed reflects nutritional status early in life.

In summary, these results offer only partial confirmation for the representation in Figure 5. First, the relation between obesity and diabetes is confirmed in these data, as it has already in many other data sets. The effects of WHR on diabetes are strong but only marginally significant whereas those on obesity are large and very significant. The relations might be more complex than what we make them out to be. While Figure 5 may be a good starting point, it is also a gross simplification that requires fine-tuning if not a more nuanced and refined articulation of relations.

Figure 5 about here

### VIII. SUMMARY AND CONCLUSIONS

MHAS, the new data set on elderly in Mexico, identifies a number of interesting features. First, self-reported health shows higher prevalence of bad health than among elderly in the U.S. The 'prevalence' of bad

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prevalence follows a clear gradient with both education and income.<sup>22</sup>

health deteriorates with age and this suggests that self-reports behave according to expectations, even though they may still be systematically contaminated. Surprisingly, prevalence of ADL limitations is lower than expected (given self reported health) and lower than observed in a comparable sample in the U.S. With the exception of diabetes and hypertension, estimates of chronic conditions tell us a similar story, namely, that elderly in Mexico experience lower levels of self-reported chronic conditions. Corrections for underreporting are unlikely to change the direction of the differences but will increase the magnitude of the disadvantage of Mexicans with respect to diabetes and hypertension.

We find that the high levels of hypertension, obesity and self-reported diabetes are comparable with what is found in other countries of the region. Some but not all the evidence reviewed above is consistent with the notion that elderly Mexicans -- and their counterparts in other countries of the region -- may be experiencing poorer health status as a result of the composition of cohorts entering old age. These findings are suggestive since obesity and diabetes are two conditions linked to past levels of nutrition.

The multivariate analysis suggests that early childhood health may have an effect in late life, even though the mechanisms involved are hypothetical and cannot be confirmed with our data. But although the estimated effects on obesity and diabetes are fairly high (relative risks are of the order of 1.22; see Table 6), the fraction experiencing bad health early in childhood is relatively low (about 11 percent of respondents). This means that the population attributable risk is low, not larger than 3 or 4 percent. Thus, while this is undeniably an important factor it cannot possibly account for the glaring disadvantage of Mexican elderly relative to elderly in other countries. While age patterns of BMI are consistent with expectations, those associated with diabetes are not consistent with the idea that it is among the youngest cohorts where we should see the worst effects. Finally, education effects are ambiguous: they seem to protect those at the extremes of the distribution. This finding is also at odds with our expectation that it is among the poorest (less educated) where we should find the highest prevalence.

In sum, the MHAS data enabled us to glance at what was heretofore a rather unexplored phenomenon, the health status of elderly in a country of the Latin American and Caribbean region. Although the findings are not entirely consistent with conjectures formulated at the outset, they do provide rich materials to confirm (or not) some of the peculiarities of the aging process in those countries.

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<sup>h</sup> The estimated models do not always reflect the relations in Figure 5. In the case of diabetes we introduce one anthropometric measure at a time and when we do so, we leave out retrospective indicators of health and



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Table 1: Distribution of MHAS respondents by broad age groups and gender <sup>(\*)</sup>(†)

Age	Males	Females	Total
50-59	2550(.44)	3230(.48)	5781
60-74	2353(.41)	2647(.39)	5000
75+	854(.15)	852(.13)	1705
Total	5757	6728	12485

\* All frequencies calculated using sampling weights standardized to sample size. Thus, the proportional distributions by age and sex (numbers in parentheses) reflect the population distribution.

† Counts exclude individuals whose responses were obtained via proxies.

Table 2: Proportions of MHAS and HRS respondents self reporting in “bad” health and declaring at least one ADL limitation <sup>(\*)</sup>(†)(‡)

Age	MHAS				HRS				HRS	
	“Bad” Health		At least one ADL		“Bad” health		At least one ADL		sample sizes	
	M	F	M	F	M	F	M	F	M	F
50-59	.10	.13	.03	.05	.07	.07	.09	.12	3417	3751
60-74	.17	.19	.06	.07	.10	.09	.11	.16	3667	4554
75+	.30	.27	.21	.21	.14	.14	.21	.33	1721	2736

\* All calculations in MHAS and HRS account for sampling weights

† The base sample number for HRS were calculated using sample weights so that proportional distributions match those of the population. The base numbers for MHAS are displayed in Table 1.

‡ Non-response was ignored. In both HRS and MHAS, the proportion of non-response by age never exceeded 3% in self reported health and ADL limitations

Table 3a: Proportions self-reporting diabetes in MHAS and HRS <sup>(\*)</sup>

Age group	MHAS		HRS	
	Males	Females	Males	Females
50-59	.12 [.07-.17]	.16 [.08-.19]	.11	.09
60-74	.17 [.08-.22]	.19 [.09-.24]	.17	.14
75+	.12 [.05-.18]	.18 [.16-.19]	.15	.14

\* Values in square brackets are estimated ranges that account for under-reporting due to lack of contact with medical personnel. See text for explanation.

Table 3b: Proportions self-reporting hypertension in MHAS and HRS <sup>(\*)</sup>

Age group	MHAS		HRS	
	Males	Females	Males	Females
50-59	.21 [.13-.30]	.41 [.30-.45]	.12	.36
60-74	.32 [.18-.48]	.48 [.49-.54]	.16	.48
75+	.31 [.15-.49]	.49 [.58-.56]	.33	.49

\* Values in square brackets are estimated ranges accounting for underreporting. See text for explanation.

Table 3c: Proportions self-reporting combination of conditions in MHAS and HRS <sup>(\*)</sup>

Age group	MHAS		HRS	
	Males	Females	Males	Females
50-59	.08	.13	.21	.22
60-74	.12	.12	.41	.35
75+	.20	.14	.56	.67

\* The combination includes heart disease, lung disease, cancer, and stroke.

Table 3d: Proportions self-reporting arthritis in MHAS and HRS

Age group	MHAS		HRS	
	Males	Females	Males	Females
50-59	.12	.20	.31	.43
60-74	.19	.27	.49	.61
75+	.24	.30	.56	.67

Table 4a: Estimated prevalence of diabetes in an independent study in Mexico (ENSA) <sup>(\*)</sup>

Age Group	Males		Females	
	Self reported	G+ test	Self reported	G+test
50-59	.12(n=1740)	.11(n=92)	.16(n=3486)	.21(n=171)
60-74	.16(n=2812)	.31(n=88)	.20(n=3136)	.36(n=131)
75+	.11(n=706)	.02(n=22)	.14(n=1023)	.07(n=45)

\* The glucose test in ENSA was performed on fasting individuals and the marker of glucose intolerance was set at 126 mg/dl for glucose plasma.

Table 4b: Range (lowest/highest values observed) of estimated self-reports of diabetes and hypertension from samples of elderly residing in seven Latin American capital cities <sup>(\*)</sup>

Age Group	Males			
	Diabetes		Hypertension	
	Lowest	Highest	Lowest	Highest
60-74	.08	.22	.36	.50
75+	.05	.24	.24	.53
Age Group	Females			
	Diabetes		Hypertension	
	Lowest	Highest	Lowest	Highest
60-74	.11	.25	.49	.57
75+	.12	.24	.45	.61

\* Data from the study SABE database,<sup>42</sup> available only for individuals aged 60+. All sample sizes larger than 1500 individuals.

Table 4c: Estimated self-reported diabetes and hypertension in an advanced data release of a national sample of elderly Puerto Ricans <sup>(\*)</sup>

Age group	Diabetes		Hypertension	
	Males	Females	Males	Females
60-74	.29(n=179)	.33 (n=332)	.65(n=179)	.55(n=332)
75+	.23(n=119)	.30 (n=228)	.59(n=119)	.67(n=228)

\* Estimated from advance data from a 22% sub-sample of a representative sample of 4,300 elderly Puerto Ricans. About 70% of the respondents in the sample are from San Juan. The sample is part of the study PREHCO.<sup>21</sup>

Table 5a: Proportion of respondents with BMI>30: MHAS and HRS <sup>(\*)</sup>

Age	MHAS		HRS	
	M	F	M	F
50-59	.15(n=2200)	.27(n=2386)	.25 (n=3311)	.25 (n=3843)
60-74	.18(n=1987)	.27(n=1760)	.19 (n=3553)	.21 (n=4565)
75+	.08(n=571)	.19(n=430)	.10 (n=1668)	.12 (n=2804)

\* Estimation of BMI in MHAS rests on a mixed strategy. A group of MHAS respondents (a sub-sample of about 1300 individuals) was measured following standard protocols and asked to self-reported weight and height. Another sub-sample was only asked for the self reports of height and weight. Estimates of BMI were the observed values for those actually measured and predicted (from self-reported height and weight) values for the rest. The procedure followed is outlined in detail elsewhere.<sup>43</sup> The important point to keep in mind is that none of the conclusions draw from this table would have changed had we only used the sub-sample with actual measurements. The absolute frequencies on which calculations are based (in parentheses) correspond to individuals with non-missing self reports on height and weight and/or those with available measures.

Table 5b: Proportion of respondents with BMI>30: ENSA and PREHCO <sup>(\*)</sup>

Age	ENSA		PREHCO	
	M	F	M	F
50-59	.26 (n=1832)	.41(n=3657)	na	na
60-74	.23 (n=2900)	.35(n=3267)	.19(n=179)	.36(n=322)
75+	.11 (n=728)	.22(n=1068)	.11(n=119)	.22(n=228)

\* See footnote to Tables 4a and 4c.  
na: not available

Table 5c: Lower and upper bounds for proportions with BMI>30 in SABE (\*)

Age	M	F	M	F
50-59	.15	.27	.25	.25
60-74	.18	.27	.19	.21
75+	.08	.19	.10	.12

\* See footnote to Table 4b

Table 6a: Logistic models with estimated effects of several traits on the log odds of six different conditions <sup>(+)</sup> <sup>(†)</sup>

Variables	Conditions				
	Obesity	Mb.Obesity	Diabetes	Mixed I	Mixed II
Constant	-1.30(.12)	-2.92(.20)	-2.16(.13)	-3.85(.28)	-5.55(.48)
female	.61(.10)**	.75(.17)**	.19(.12)	.79(.21)**	1.27(.51)**
age 60-74	-.06(.11)	-.32(.19)*	.35(.12)**	.21(.21)	.31(.45)
age 75+	-.69(.18)**	-.58(.37)*	.25(.26)	-.69(.44)	-1.31(.65)**
urban	.09(.11)	-.05(.18)	.36(.14)**	.33(.24)	-.16(.55)
illiterate	-.38(.13)**	-.59(.23)**	.10(.14)	.12(.27)	-.05(.55)
primary+	-.28(.11)**	-.32(.22)	-.10(.18)	-.10(.25)	-.00(.70)
child-health	.23(.14)*	.57(.24)**	.29(.14)**	.49(.27)*	1.18(.49)**
Observations	9335				
Wald					
x <sup>2</sup> (df)	79.40(7)	40.30(7)	28.20(7)	28.50(7)	49.70(7)

<sup>+</sup> The categories of the variables employed are as follows: male and female for gender; age 50-59, 60-74 and 75+ for age; urban and rural for residence; illiterate, primary and primary incomplete and more than primary for education; and health problems during early childhood for early childhood health. The dependent variables are: Obesity (BMI>=30), Morbid Obesity or Mb.Obesity ( BMI>=35), Diabetes (self reported diabetes), Mixed I (diabetes and obesity) and Mixed II (diabetes and morbid obesity)

<sup>†</sup> Standard errors are in parentheses; \* significant at p<.05; \*\* significant at p<.01

Table 6b: Predicted probabilities for selected categories and conditions <sup>(\*)</sup>

Categories	Conditions		
	Obesity	Diabetes	Mixed I
Gender:			
females	.30	.18	.06
males	.19	.15	.03
Age			
50-59	.26	.15	.04
60-74	.25	.20	.05
75+	.15	.18	.02
Residence			
urban	.25	.18	.05
rural	.23	.14	.04
Education			
illiterate	.19	.19	.05
less primary	.27	.17	.04
more primary	.23	.16	.04
Early childhood			
health probl.	.28	.20	.07
no health probl.	.23	.14	.04

\* Values calculated as predicted probabilities for the corresponding subgroups keeping all other variables at their sample means.



Table 6c: Age patterns of predicted probabilities for obesity and diabetes for various subgroups<sup>(\*)</sup>

Obesity									
Age	Males	Females	Urban	Rural	Illit	Prim-	Prim+	No Problem	Problem
50-59	.21	.32	.25	.27	.22	.29	.24	.26	.30
60-74	.19	.30	.23	.26	.21	.27	.23	.24	.29
75+	.11	.19	.13	.16	.12	.17	.13	.14	.26

Diabetes									
Age	Males	Females	Urban	Rural	Illit	Prim-	Prim+	No Problem	Problem
50-59	.13	.16	.12	.15	.15	.15	.14	.14	.18
60-74	.18	.21	.16	.21	.21	.19	.19	.19	.24
75+	.17	.20	.15	.20	.19	.18	.18	.18	.22

\* See footnote to Table 6b.

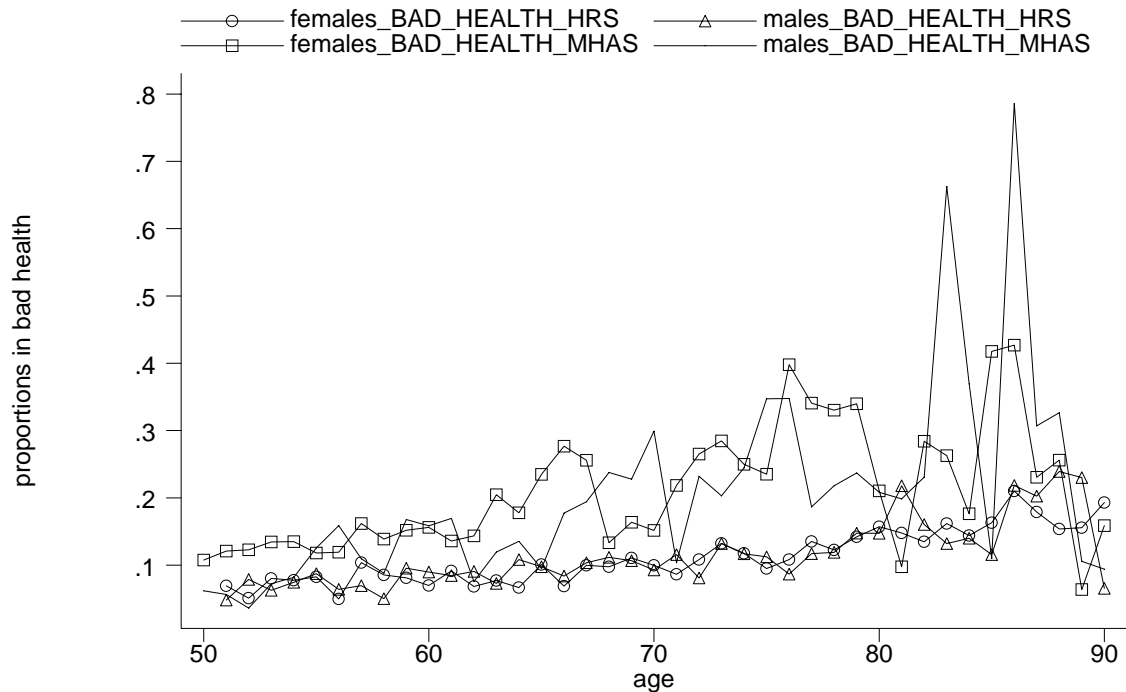


Figure 1: Proportions self-reporting in bad health:HRS and MHAS

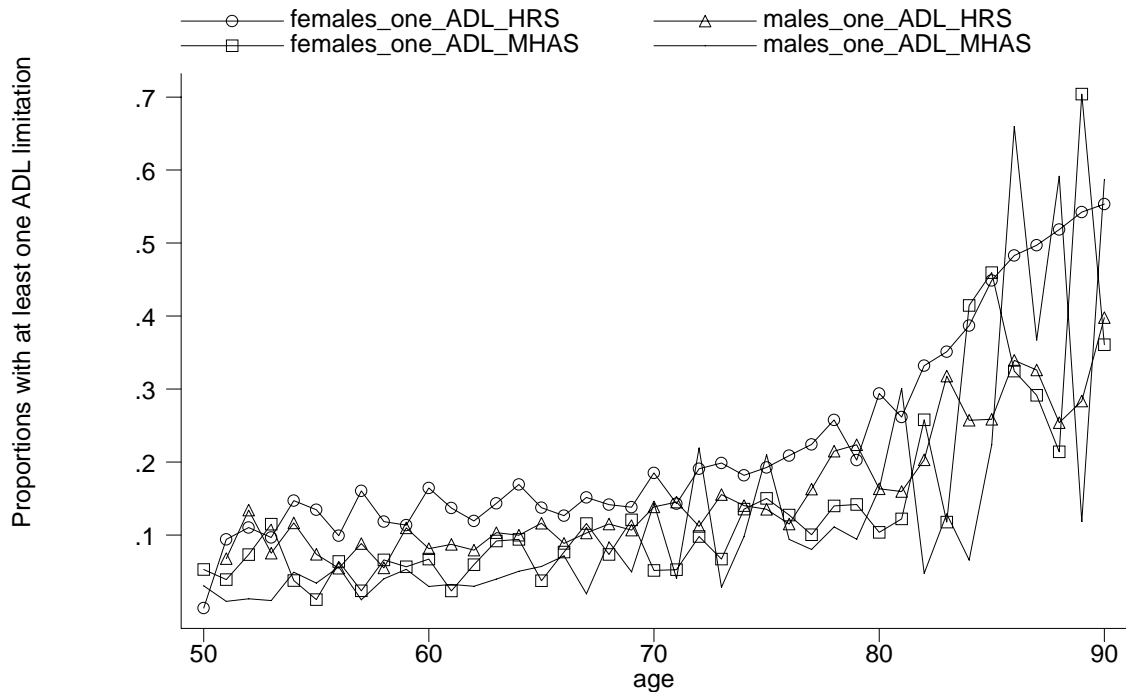


Figure 2: Proportions with at least one ADL limitation: HRS and MHAS

# Figure 3: Observed BMI Distributions among Male and Female Respondents: HRS and MHAS

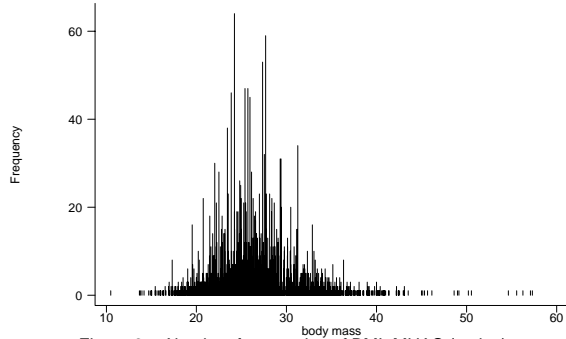


Figure 3a: Absolute frequencies of BMI; MHAS (males)

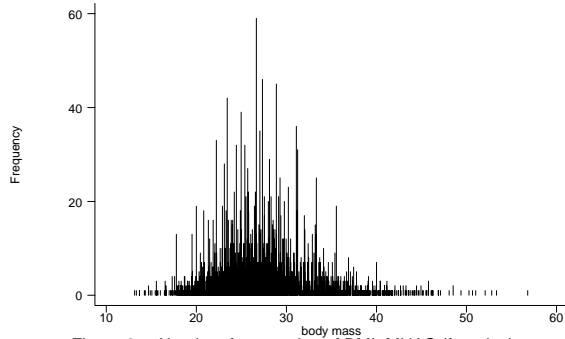


Figure 3a: Absolute frequencies of BMI; MHAS (females)

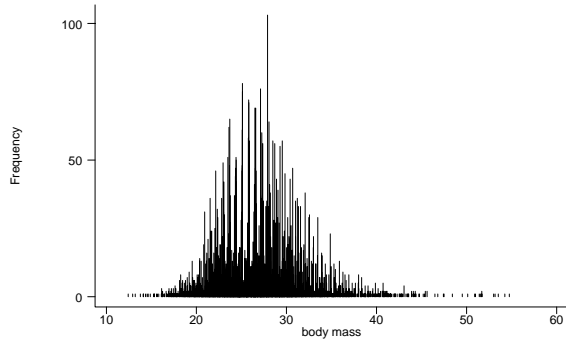


Figure 3b: Absolute frequencies of BMI; HRS (males)

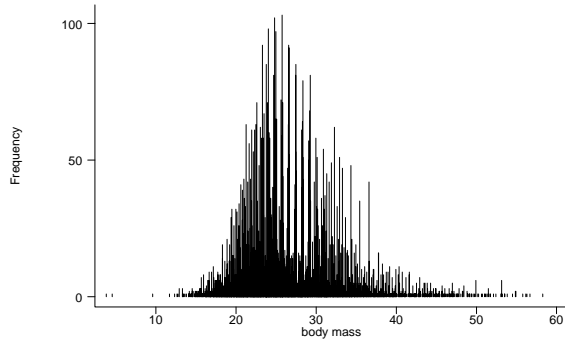


Figure 3b: Absolute frequencies of BMI; HRS (females)

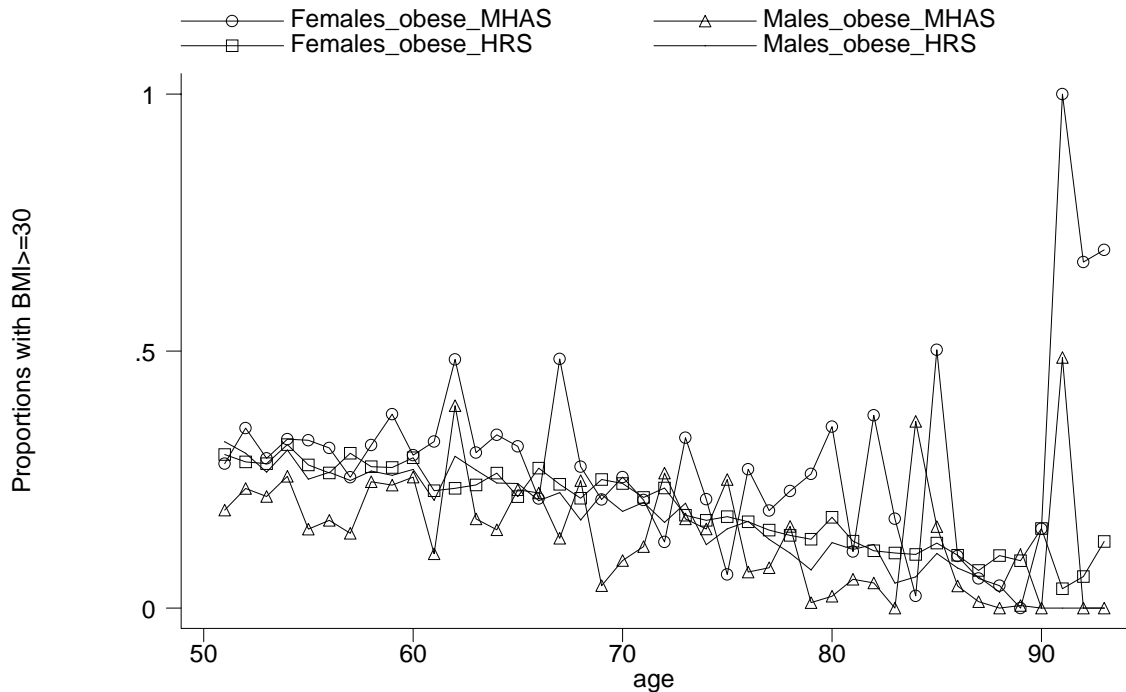


Figure 4: Age-specific prevalence of obesity (BMI >= 30): MHAS and HRS

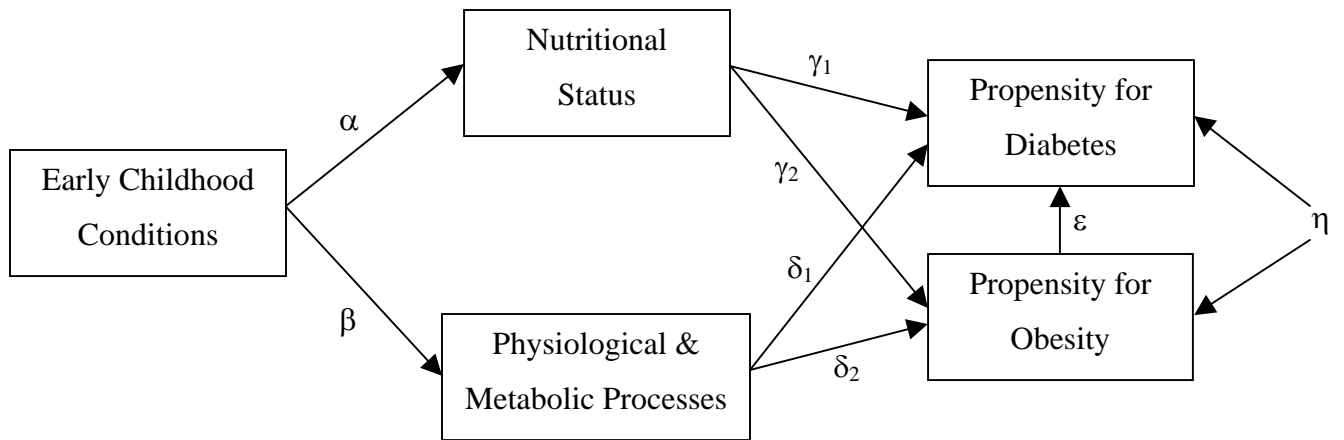


Figure 5: Association between early childhood conditions and adult health status

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