

AGEING IN LATIN AMERICA AND THE CARIBBEAN: IMPLICATIONS OF PAST MORTALITY

Alberto Palloni and Mary McEniry, University of Wisconsin-Madison
Rebeca Wong, University of Maryland
*Martha Pelaez, Pan American Health Organization**

Ageing in Latin America and the Caribbean will proceed along different paths from those followed by the more developed countries. Several features distinguish the ageing process in the region. One of the most important is that it is difficult to predict the future health profile of the older population, due to factors associated with prevailing disease regimes and with the demographic history of those entering old age now and in the decades to come. Their demographic history may make these cohorts vulnerable, even if economic and institutional conditions develop more favourably than recent trends suggest. This paper focuses on health profiles of the older population and examines evidence for the conjecture that health status of older persons has been significantly impacted by the evolution of mortality in countries of the region. The paper employs data from SABE (Survey on Health and Well-Being of Elders), a cross-sectional representative sample of over 10,000 persons aged 60 or over in private homes in seven major cities in Latin America and the Caribbean. Data from the United States Health and Retirement Study (HRS) provide a benchmark for comparison with SABE. Attention is given to patterns of self-reported health, self-reported chronic conditions and disability, as well as relationships between early childhood conditions and adult health, with a focus on diabetes. Although this investigation finds only weak empirical support for the hypotheses regarding the lingering effects of past health conditions, this may be due to limitations of the available data. We may have examined just the tip of the iceberg, and the possibility remains that the new cohorts reaching old age in the next twenty years will indeed be frailer and more vulnerable because of their demographic history and the current ecology of disease.

A BECOMING OLD IN LATIN AMERICA AND THE CARIBBEAN

Conjecture and questions about older persons' health status

This paper reviews empirical evidence to examine the conjecture that the past evolution of mortality in countries of the region will have important implications for the health status of those entering old age now and in the next 20-30 years. The nature of the mortality decrease in the Latin American and Caribbean region is hypothesized to have important effects on health in later life. In particular, a substantial fraction of those who attain their sixtieth birthday after 1990 may be of higher frailty than preceding cohorts, who were exposed to more severe mortality regimes. When mortality declined, it did so largely in the absence of improved standards of living. Many of the children who earlier would have died came from disadvantaged economic and social groups; such children survived to grow up in conditions of poverty and malnutrition and subject to a heavy burden of disease. If there are strong connections between levels of malnutrition in infancy and childhood, experience with poverty and

* This paper was made possible thanks to the collaboration of the principal investigators of the SABE study, Cecilia Albala, Anselm Hennis, Roberto Ham, Maria Lucia Lebrao, Esther de Leon, Edith Pantelides, and Omar Pratts. We are thankful to Dr. Guido Pinto for many discussions and for extensive work on the data set. We thank the Pan American Health Organization through its Interagency Agreement with NIA for its support of this research. The research for this paper was supported by NIA grants R01 AG16209, R03 AG15673 and R01 AG18016 and NICHD grant R03 HD37889. Research work for UW-Madison researchers is supported by core grants to the Center for Demography and Ecology, University of Wisconsin (R24 HD47873) and to the Center for Demography of Health and Aging, University of Wisconsin (P30 AG017266).

exposure to (and escape from) childhood illnesses, the new cohorts may be marked by higher than average risk of certain chronic conditions with late-adult onset. Provided that it is possible reliably to assess individuals' socio-economic conditions during early childhood, we expect to find large health disparities in later life according to earlier socio-economic status. Finally, there is reason to expect a strong relationship between adult prevalence of certain chronic conditions and indicators of early childhood conditions, particularly those associated with nutrition, growth and development, and exposure to disease.

The evidence supporting the aforementioned features of the ageing process in the Latin American and Caribbean region is heterogeneous. Considerably more data are available to support hypotheses about the demographic speed of ageing than the conjecture regarding the special conditions that may influence older persons' health status. Up to now very little was known about adult health in the region and, therefore, it has been virtually impossible to investigate such hypotheses. This paper employs a unique, newly released data set on older people living in seven major cities in countries of Latin America and the Caribbean to document salient properties of the health status profile of older persons in the region and to answer a set of four questions regarding its nature and determinants:

- What is the health profile of older persons in the region?
- How does this profile compare with other known profiles, such as that of older persons in the United States?
- Is there evidence of poorer health and functional status, as expected if some of the conjectures proposed above are on the mark? And, finally,
- Are there indications of relationships between early childhood conditions and adult health status?

In answering these questions, this study identifies what appear to be singularities in an otherwise standard landscape of ageing. Even if the hypotheses are verified only partially, they may point to a need for policies that are significantly different from those undertaken elsewhere.

Speed of ageing

The speed of demographic ageing in Latin America and the Caribbean will be unprecedented. The time it will take a typical country in Latin America and the Caribbean to attain a substantial proportion of people above age 60, say around 15 per cent, from current levels of around 8 per cent is less than two fifths the length of time it took the United States, and between one fifth and two fifths of the time it took an average Western European country to attain similar levels (Palloni, Pinto and Pelaez, 2002; Kinsella and Velkoff, 2001). By 2030, in many countries in Latin America and the Caribbean the number of persons aged 60 or over will be 2.5 to 3.5 times as large as it was in 2000. Barring unexpected demographic upheavals, for the next three to five decades the speed of ageing in the region will continue on a singularly rapid course, a result of the momentum of demographic forces set in motion long ago.

Disjuncture between ageing and standards of living

Rapid ageing is taking place in countries that have not been able to generate sustained high standards of living. Comparisons between countries in Latin America, on the one hand, and developed countries such as the United States or Japan, on the other, are revealing. First, even optimistic projections of growth in GNP per capita imply that when the fraction of people over age 60 begins to exceed 10 per cent,

countries of the region will have attained no more than a small fraction of the levels of GNP per capita enjoyed by developed countries when they reached similar levels of ageing.

Second, adopting even an optimistic forecast with fairly rapid economic growth, driven by annual rates of increase in GNP per capita of about 3 per cent (which is about 15 per cent higher than the average in the region during the last 50 years) would not alter this conclusion. Indeed, even in this rosy scenario, when the countries of the region reach 10 per cent over age 60, most will have a GNP per capita far below \$10,000, which is itself modest by present standards in more developed countries. By comparison, the United States spent 95 per cent of the time after reaching that level of ageing, and Japan 100 per cent of the time, with a per capita income above that level¹ (World Bank, 2004). Barring unprecedented economic conjunctures, the fate of countries in Latin America and the Caribbean will be dominated by rapid ageing paired with precarious standards of living.

Socio-political context and ageing: institutional volatility

Even more striking is the conjuncture of the speed and magnitude of ageing in the Latin American and Caribbean region with the social and political contexts within which the process is taking place. First, a traditional order whereby older persons' well-being rested on the shoulders of the younger generation is being gradually subverted by shifts in norms regulating living arrangements and by rapid fertility declines (Devos, 1990; Devos and Palloni, 2002; Palloni, 2001). Admittedly, traditional living arrangements gave way in North America and Western Europe as well, but those changes were under way well before the onslaught of rapid ageing (Palloni, 2001; Ruggles, 1996). In countries in Latin America and Caribbean, the safety net articulated around families and kin relations is being dismantled *concurrently* with rapid ageing. This leaves little room for error and no time to seek adequate substitutes.

Secondly, ageing is occurring in a fragile institutional environment, one where sources guaranteeing a safety net or minimum levels of social and economic support for older persons are being reformulated, reformed and, often, eliminated. A good example is the widespread drive towards reform of social security systems (Mesa-Lago, 1994; Barrientos, 1997; Klinsberg, 2000). In all cases the reforms are designed to replace pay-as-you-go systems that operated uninterruptedly in many of these countries since the First World War, with privatised schemes. New plans will supplant a system that, though flawed, was successful in reducing inequalities and protecting the most vulnerable segments of the older population. Income receipts of those retiring from the labour force during the first ten years of the 21st century will depend on stop-gap arrangements during a prolonged transition to the establishment of the new system. An important fraction of these cohorts, but especially older women, received minimal earnings throughout their occupational careers and could not possibly accumulate sufficient wealth to secure adequate standards of living. In addition, the sheer growth of the older population will result in an increase in the demand for health services precisely during a time when access to health care will become more expensive under the onslaught of privatisation schemes.

In summary, no country in the Latin American and Caribbean region is blessed with institutional contexts designed to cope with changed demands from a growing older population. In almost all cases a highly compressed ageing process will take place in the midst of weak economic performance, tense intergenerational relations, fragile institutional contexts, and restricted access to health care services.

Health status

Latin American and Caribbean birth cohorts reaching age 60 after 1990 are unique, in that they are the product of medical interventions that increased childhood survival largely in the absence of significant improvements in standards of living. It is estimated that between 50 and 70 per cent of the mortality decline that took place after 1945 was associated with medical interventions (Preston, 1976; Palloni and

Wyrick, 1981). The remaining decline was probably associated with better standards of living, increased knowledge about exposure and resistance to illnesses, and assorted other factors. Furthermore, a large fraction of these gains were concentrated early in the life of individuals, between birth and age 5 or 10.

Implications of past mortality decline

The pattern of mortality decline just described has an important but little-noted implication: the revolution that produced unprecedented gains in life expectancy half a century ago is a powerful driver of the growth of the older population today and for many years to come. Understanding this requires a detour.

Just as the natural rate of increase expresses the proportionate change in the size of a population between two points in time, so age-specific rates of increase express the proportionate change of the size of the population in an age group between two points in time, t and $t+dt$. A number of inferences can be derived from this elementary fact (Preston and Coale, 1982; Horiuchi and Preston, 1988; Preston and others, 1989). Horiuchi and Preston (1988) show how the value of an age-specific growth rate is determined by a population's demographic past.

Past changes in both fertility and mortality have contributed to today's growth of the population aged 60 or over in Latin America and the Caribbean. In considering the contribution of mortality, it is important to note that it is not just mortality gains at older ages that matter. Changes in mortality risks below the age of 60 have a large effect on the number of persons who reach age 60 from one year to the next.

More concretely, the rate of change in the number of persons aged 60 or over during the period 1990-2025, can be divided into 3 additive components² representing, respectively:

Component 1: the rate of change in the number of births during 1930-1965;

Component 2: changes in the probability of surviving to age 60 for the cohorts born during 1930-1965;

Component 3: changes in average survival (the sum of differences between mortality rates) above age 60 during 1990-2025.

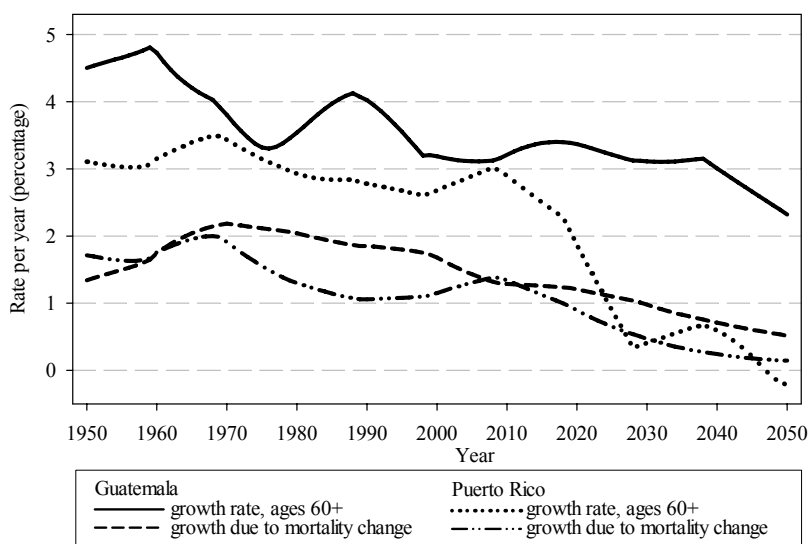
Increase in the absolute size of the population aged 60 or over during a time interval will occur due to any combination of the three factors: cohorts reaching age 60 at a particular time, t , may experience improved mortality before reaching their sixtieth birthday (increases in the probability of surviving to age 60), may experience lower mortality thereafter (increases in life expectancy at age 60) or, alternatively, the size at birth of the cohort that reaches its 60th birthday between times t and $t+dt$ may be larger than the preceding one. Component 3 above is entirely due to changes in mortality conditions at older ages whereas Component 2 is determined by improvements in mortality in early childhood and, to a lesser extent, by improvements in mortality at adult ages. Finally, Component 1 is solely dependent on *past* fertility.

We have employed trend data for countries in Latin America and the Caribbean to analyse the demographic sources of growth of the older population in terms of the three components. With a handful of exceptions, all countries in the region experienced high fertility levels (TFR above 5 children per woman) before 1950, and large mortality declines beginning within the period 1930-1940, but particularly after 1950. Between 1950 and 1965-1970, some of these countries experienced moderate increases in fertility. Countries such as Argentina and Uruguay are oddities since they started the period with relatively low levels of fertility (TFR around 4). In Chile, Cuba and Costa Rica, fertility began to decline slowly between 1930 and 1940, but rapid fertility decline in these countries occurred only after 1950, and after 1975 in the remaining countries of the region.

Two consequences of these trends for the ageing process are worth noting. First, cohorts attaining their sixtieth birthday between 2000 and 2025 are inflated by the small but ubiquitous increase in fertility during 1950-1970. Thus the rate of increase of the age group 60 or over will increase in part because of this transient rise in fertility levels (Component 1). Second, and most importantly, cohorts attaining their sixtieth birthday between 2000 and 2025 will benefit from unusually large improvements in survival, particularly during early childhood. Thus, for example, individuals born in 1960 experienced lower levels of early child mortality than those born in 1955. This will increase the relative size of the cohort attaining age 60 in 2020 relative to cohorts reaching that age in 2015 (Component 2).

Based on adjusted historical series of birth rates and life tables, we estimated the magnitude of the component of growth of the population aged 60 and above associated with past mortality decline. Figure 1 displays the total rate of growth of the population over 60 and the amount that is attributable to cumulated changes in mortality before age 60 for cohorts that attained, or will attain, age 60 during the interval 1950-2050. The figure shows these quantities for Puerto Rico and Guatemala, two countries that exemplify extremes in the demographic transition: the former experienced early mortality and fertility decline while the latter experienced late declines in mortality and fertility. Patterns in other countries are similar (Palloni, Pinto and Pelaez, 2002).

Figure 1. Annual growth rate of the population aged 60 or over, and contribution of cumulated mortality changes, Guatemala and Puerto Rico, 1950–2050



Source: Authors' calculations.

Since the bulk of mortality decline, particularly during early childhood, occurred after the Second World War, the peak rates of growth, as well as the largest contribution of mortality changes before age 60, are attained by cohorts born between 1940 and 1960, whose earlier members began to reach age 60 in 2000. The effects of the rapid mortality decline will begin to be washed away only after 2010 in Puerto Rico and more than a decade later in Guatemala. Note that the contribution of mortality change to the growth of the population older than 60 is substantial, exceeding 50 per cent for several years after 2000. Other countries in the Latin American and Caribbean region will experience population dynamics that fall within the range set by Puerto Rico and Guatemala.

Figure 1 shows that a substantial fraction of future increases in the growth of the over-60 population and, therefore, of ageing as reflected in changes in the proportion of the population over age 60, is attributable to mortality changes experienced during the period 1930-1990. As shown elsewhere (Palloni and Lu, 1995), about 70 per cent of this change is due to changes in mortality associated with parasitic and infectious diseases in the first ten years of life. This is a revealing statistic: it suggests that the relatively compressed schedule of ageing in the region can, at least in part, be traced to the medical and public health revolution that triggered the mortality decline nearly half a century ago. This legacy of the past has implications for the health and disability status of the older population after year 2000.

The “stickiness” of early health status

The discussion above established, first, that a significant part of the ageing process that countries in Latin America and the Caribbean will undergo during the period 1990-2050 is attributable to the contribution of the mortality decline experienced during the period following 1930, and secondly, that the bulk of those mortality changes were due to an assortment of medical innovations and public health interventions rather than, as many analysts believe was the case for developed countries, to increases in standards of living or to improvements in levels of nutrition (McKeown, 1976; Fogel, 1994, 2003).

As a rule, when mortality falls the surviving members of cohorts experiencing changes are of higher average frailty (Vaupel and others, 1979; Alter and Riley, 1989). This is purely an artefact of the changing composition by frailty and will tend to happen regardless of the origin of the mortality decline. However, the lives saved by the mortality decline in the Latin American and Caribbean region were certainly not randomly distributed with regard to conditions affecting health status. Indeed, they were more likely to have been drawn from populations exposed to higher risks, those whose morbidity and mortality experiences were dominated by parasitic and infectious diseases and inadequate early nutrition. Whenever the root origin of mortality improvements triggers increases in survival among those whose nutritional status and experiences with illness is worse than average, the frailty composition of the corresponding cohorts will become less favourable than under a regime of survival gains that induces evenly spread mortality reductions.

Under conditions described above, most causes of childhood morbidity that were responsible for higher mortality *before* the interventions continued to affect children, albeit with reduced lethality. A growing proportion of survivors drawn from high mortality subpopulations shared the ongoing effects of these causes of morbidity. This has important implications if early childhood conditions exert an impact on adult health and mortality.

Evidence that early childhood conditions affect adult health has been mounting, even if much remains to be established regarding the size and universality of the effects. It is conjectured that detrimental conditions including poor nutritional status, illness and faltering growth, some of which occur *in utero* and others around the time of birth and during early childhood, increase the susceptibility to certain chronic diseases during adulthood and old age. Empirical data as well as theoretical arguments (Elo and Preston, 1992; Schaffer, 2000) implicate a very broad array of mechanisms, from those involving latent effects (Barker, 1998) to those requiring circuitous pathways (Hertzman, 1994), critical periods (Barker, 1998; Cynader, 1994; Hertzman, 1994; Schaffer, 2000) or accumulation effects (Barker, 1998; Elo and Preston 1992; Hertzman, 1994). The first mechanism is closely associated with the work of Barker, concentrating on the *sequelae* of processes that may start *in utero* or develop shortly before or around the time of birth (“foetal origin hypothesis”). In general, these effects result either from fixed traits that individuals are born with or as a result of stresses and uneven development of physiological systems following periods of moderate or severe deprivation and that remain latent until late in life. To test this conjecture empirically, it is necessary to have indicators of early deprivation; such indicators have been developed, for instance, from information about birth weight, placental weight, length of gestation, or

length of the newborn. None of the latter markers is available in the data employed in this paper. Instead, the present analysis relies upon indirect measures of early nutritional status, including height (adjusted for age), knee height (a proxy for leg length), and the ratio of hip-to-waist circumference. These measures have previously been used with some success by nutritionists as surrogate measures among adults.

A second mechanism identified in the literature focuses on episodes of illness in early childhood and their influence on the late onset of some chronic diseases (Elo and Preston, 1992; Wadsworth, 1986; Wadsworth and Kuh, 1997; Kuh and others, 2004; Davey Smith and Lynch, 2004; Blackwell and others, 2001). The best known example of this is the relationship between rheumatic fever—a common complication of streptococcal infections in developing countries, at least prior to the massive mortality decline that took place after the Second World War—and the onset of heart disease. Because the data used here contain information on retrospectively recalled childhood diseases, it is possible at least to attempt to assess the size of the effects. The strategy is by no means optimal since not only may the data be affected by faulty recall but there is a serious selection problem, since individuals with the most serious cases of disease may not have survived to be in the survey sample.

Finally, some research focuses on broader mechanisms, attempting to find associations between socio-economic conditions experienced in early childhood and adult health status (Wadsworth, 1986; Hertzman, 1994; Wadsworth and Kuh, 1997; Rahkonen and others, 1997; Kuh and Ben-Shlomo, 2004; Davey Smith and Lynch, 2004; Lundberg, 1991; Warner and Hayward, 2003; Hayward and Gorman, 2004). This type of work is an indirect way to find some of the connections concerning the two mechanisms mentioned before. This work generally looks beyond simple associations between socio-economic status (SES) early in life and health status among older persons, since such associations might merely reflect the relation between current or recent SES and health. For the most part this work aims at finding *net* effects of early SES on adult or health, that is, effects that remain after appropriately controlling for current or recent SES. The interpretation of the net effects conventionally invokes either the existence of Barker-type effects, as discussed above, or the influence of early illnesses. The data sources used here make it possible to test for this as they contain retrospective evaluation of markers of early childhood poverty, deprivation and SES.

If any of the above mechanisms has a substantial effect, increases in frailty among older persons whose earlier experiences fit the description provided above are likely to be pronounced.³ Understanding of the relationships between early childhood exposures and adult health status is still too primitive to support precise predictions regarding the nature of expected health impairments. But the conjecture regarding such effects can at least be used as a guide to explore the evidence available.

Health status in a new disease environment

There is another important, but often neglected, set of conditions that may influence the health status of older persons in the region. As others have observed, the regimes of morbidity and mortality experienced by older people in developing countries are unusual. First, as one would expect (Omran, 1982) there is an increase in chronic conditions, such as heart and lung disease, cancers, diabetes, and arthritis, but at the same time older people continue to be assaulted by significant levels of parasitic and infectious diseases (Frenk and others, 1991). Such a “mixed mode” of exposure is especially prevalent in Latin American countries with a late demographic transition, such as Guatemala, Honduras, Bolivia, Peru and Ecuador. No one knows the health effects of exposure to highly interactive environments like these. What should one expect, for example, under conditions where older people are simultaneously weakened by malaria and exposed to higher risks of congestive heart disease? Or, where increases in diabetes due to the adoption of a westernized diet (Popkin, 1993; Albala and others, 2000) are combined with recurrent intestinal infections and high prevalence of respiratory tuberculosis? What are the implications of a mixed

mode of exposure for comorbidities, disability and impairments among the older population? What are the implications for treatment? What are the effects of this situation on demand for health care?

B. DESCRIPTION OF DATA SETS

While the objective in this paper is to focus on countries of Latin America and the Caribbean, it is useful also to compare patterns observed in this region with a benchmark, to yield comparisons with other populations. For practical reasons of data availability, the benchmark data chosen for comparison are from the United States, from that country's Health and Retirement Survey (HRS).

SABE

SABE (SABE, 2003) is a data collection project anchored in seven major cities (six of them capital cities) of the region: Buenos Aires (Argentina), Bridgetown (Barbados), Sao Paulo (Brazil), Santiago (Chile), Havana (Cuba), Mexico City (Mexico) and Montevideo (Uruguay). All seven surveys were administered to representative samples of populations aged 60 or over in each city and were strictly comparable though translated to three different languages (Spanish, Portuguese and English). In some cases, interviewers selected a target older person and his/her surviving spouse. All sample frames were drawn either from recent population censuses or from nationally representative surveys carried out periodically in the capital cities of the region.⁴ The fieldwork took place between June 1999 and June 2000, and a preliminary final report was completed in December of 2002. An important feature of the survey is that, with one exception (Buenos Aires), the rates of response were significantly higher than those in similar surveys in other countries. Table 1 displays basic information on sample sizes, rates of response and selected dimensions of the demographic profile (composition by age, sex, marital status, race) and of the socio-economic composition of the samples (by education). Table 2 displays information on a few health-related characteristics that will be the object of study in this paper, namely, self reported health status, Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL), chronic conditions, and anthropometric measures.⁵

HRS

The University of Michigan Health and Retirement Study (HRS) (2000) surveys more than 22,000 Americans over the age of 50 every two years. The study paints an emerging portrait of an ageing America's physical and mental health, insurance coverage, financial status, family support systems, labour market status, and retirement planning. The sample employed in this paper included 12,527 target respondents (no spouses) aged 60 or over.

C. SELF-REPORTED HEALTH

Self-reported health status is an indicator of general health with good construct validity (Smith, 1994; Manton, Stallard and Corder, 1997; Wallace, 1995; Soldo and Hill, 1995), and it is a strong predictor of mortality risks (Idle and Benyamini, 1997; Idler and Kasl; 1991), disability (Idler and Kasl, 1995) and morbidity (Schechter, Beatty and Willis, 1998; Beckett and others, 2000), though these properties vary somewhat with national or cultural contexts (Idler and Benyamini, 1997). Less is known, however, about whether and to what degree self-reported health status is affected by cultural idiosyncrasies, heterogeneous conceptualization of disease and ill health, and differential assessment of gradations of ill health. Even less is known about the impact of such factors on the validity of direct cross-cultural comparisons of self reports (Sen, 2002).

TABLE 1. BASIC CHARACTERISTICS OF SURVEY RESPONDENTS

Condition/ Variable	SABE Total (n=10,902)	Argentina (n=1043)	Barbados (n=1808)	Brazil (n=2143)	Chile (n=1306)	Cuba (n=1905)	Mexico (n=1247)	Uruguay (n=1450)	United States HRS (12,527)
<i>Response Rate (%)</i>	..	60	85	85	84	95	85	66	87
<i>Age (mean years)</i>	72 (8)	71 (7)	72 (8)	73 (8)	72 (8)	72 (9)	70 (8)	71 (7)	72 (8)
Percentage:									
60-64	23	23	19	20	22	25	31	22	26
65-69	23	24	23	18	25	21	25	25	23
70-74	19	24	21	16	19	18	18	23	17
75-79	17	15	17	22	16	13	13	17	15
80-84	11	8	11	14	10	11	8	9	10
85+	8	5	9	10	8	11	6	5	8
<i>Gender (%)</i>									
Females	62	63	60	59	66	63	59	63	59
<i>Education (%)</i>									
Primary or less	71	71	77	85	68	57	74	65	7
Secondary	20	23	18	5	24	37	11	21	58
Higher	9	6	5	10	9	7	15	14	35
<i>Race (%)</i>									
White	55	..	5	71	43	63	..	90	84
Black	34	..	93	16	1	36	..	4	13
Mestizo	6	..	1	8	30	0	..	6	—
Other	4	..	1	5	26	1	..	0.1	3
<i>Marital Status (%)</i>									
Never married	7	6	18	5	7	3	4	4	3
Married/union	46	43	45	52	44	37	54	49	60
Separated	9	9	9	6	13	13	9	6	1
Widowed	34	42	24	35	36	35	32	37	27
Divorced	4	1	5	1	0.4	11	1	5	9

Source: Tabulated from SABE and HRS 2000, (for HRS, target respondents aged 60 years or over), unweighted data.
 NOTES: Numbers in parentheses are standard deviations where appropriate. Numbers rounded to nearest whole number. For race: the category Black includes blacks and mulattos.
 The category Other for SABE includes indigenous, Asian and all other. Information on race is not available for Mexico or Argentina. Values may not sum to 100 per cent due to rounding.

TABLE 2: HEALTH AND OTHER ATTRIBUTES OF SURVEY RESPONDENTS

Condition/ Variable	Overall SABE (n=10,902)	Argentina (n=1043)	Barbados (n=1808)	Brazil (n=2143)	Chile (n=1306)	Cuba (n=1905)	Mexico (n=1247)	Uruguay (n=1450)	HRS (12,527)
Diabetes (%)	17	13	22	18	14	15	22	13	16
Cancer (%)	4	5	4	4	5	3	2	6	14
Respiratory (%)	10	8	4	13	13	13	10	9	10
Heart (%)	21	20	12	21	34	24	10	23	25
Stroke (%)	7	5	6	8	7	10	5	4	7
Arthritis (%)	42	53	47	33	32	58	25	47	62
Obesity (%)	24	..	24	20	30	14	30	34	22
Poor health (%)	11	5	5	9	21	13	20	7	8
ADL (%)	20	19	14	24	26	21	19	17	21
IADL (%)	18	15	15	29	21	18	18	8	11
Height (cm)	158 (10)	..	163 (10)	157 (9)	155 (10)	158 (10)	154 (9)	160 (9)	168 (10)
Knee height (cm)	50 (5)	..	53 (5)	50 (3)	48 (3.3)	50 (5)	49 (4)	48 (6)	..
Weight (kg)	67 (16)	..	72 (20)	64 (13)	67 (14)	61 (14)	66 (12)	72 (15)	80 (42)
BMI	27 (6)	..	27 (8)	26 (5)	28 (5)	25 (5)	28 (5)	28 (7)	27 (5)

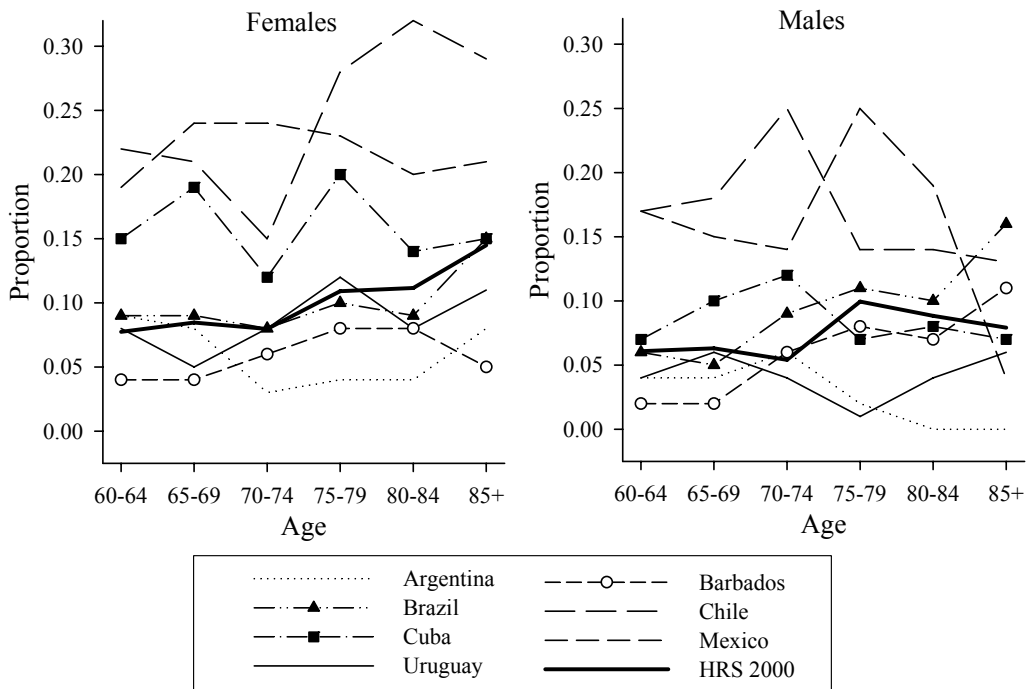
Source: Tabulated from SABE and HRS 2000 (for HRS, target respondents aged 60 years or over); unweighted data.

NOTES: Numbers rounded to nearest whole number. Poor health: 1=Poor, 0=All other. ADL=difficulty performing at least one ADL. IADL=difficulty performing at least one IADL. No height and weight measurements were taken in Argentina; no knee height measurements were taken in the HRS study. Numbers in the parentheses are standard deviations. BMI is calculated as weight in kg, divided by the square of height in meters. Obesity is defined as BMI>=30; extreme BMI outliers were omitted.

Heterogeneity of self-reported health

Figure 2 displays the proportions reporting their health as “poor” (“mala”) by age and gender for all seven cities. For comparison, a similar measure is shown for persons aged 60 and over who were participants in the United States Health and Retirement Survey (HRS). The first feature to note is the large inter-country heterogeneity. The cities with the highest proportions of older individuals in poor health are Santiago (21 per cent), Mexico City (20 per cent) and Havana (13 per cent). Those with the lowest are Buenos Aires, Bridgetown, and Montevideo (5 to 7 per cent). The latter three cities are in the countries that, until the beginning of the twenty-first century, enjoyed the highest standards of living, as measured by GNP per capita. They are also those with the most modern demographic regime, with near-replacement fertility and life expectancies at birth exceeding 75 years.

Figure 2. Proportion reporting poor health by age and gender



Source: SABE; HRS.

The second feature to note is the age and sex patterns of self-reported poor health. Women everywhere are more likely than men to report being in poor health, a recurrent finding with this type of data. Proportions in poor health appear to increase with age in some countries, although the age patterns are irregular.

A third feature is that older persons living in the cities with the best economic standing among SABE countries (Buenos Aires, Bridgetown and Montevideo) are, if anything, less prone than those in the United States to report their health as poor, while older persons living in Santiago, Havana and Mexico City are considerably more likely to do so.

These visual regularities are confirmed in multivariate analyses of the proportion self-reporting poor health. The analysis is based on individuals within countries as units of observation and the logit of the probability of self reporting poor health as dependent variable. Predictors include dummy variables to represent cities, age groups and sex (see categories in table 1). The results from the most complete model, model I, are presented in panel A of table 3. A comparison of the fits of models I and II indicates that there is significant inter-country heterogeneity in prevalence of poor health. Gender differentials are substantial, while effects of age are more irregular. In model I only the effects of age groups 75-79 and 85+ are significantly different from the value for the reference category, ages 60-64. This indicates that there is no firm basis to infer the existence of an age gradient in the proportion of individuals reporting that they are in poor health. This is not unlike the pattern found in HRS.

Model III, in panel C of table 3, examines whether there are significant differences between the United States and the seven cities in Latin America and the Caribbean. The data from the seven cities were pooled and then compared to the data from HRS. On balance, older people in the United States report themselves to be in somewhat better health than the average of the seven cities in Latin America and the Caribbean. The odds of reporting poor health among older persons in the United States are 0.73 ($= e^{-0.31}$) as large as among the pooled sample, and this difference is statistically significant.

D. FUNCTIONAL LIMITATIONS

Self-reported limitations in Activities of Daily Living (ADLs) or Instrumental Activities of Daily Living (IADLs) are a mainstay of population-based information on disability. They are arguably better gauges than self-reported health of the extent of physical impairment in population-based studies and are widely used in national surveys such as the HRS and other major surveys in the United States including the National Health and Nutrition Examination Survey, National Health Interview Survey and Longitudinal Studies of Aging, and they have also been employed in surveys in other countries. Limitations in ADLs reflect impairments associated with underlying conditions that induce physiological limitations and deterioration. ADL measurements provide a useful benchmark to calibrate demand for care, assistance and support. ADLs are good indicators of physical functioning, particularly lower body functionality (Smith, Branch and Scherr, 1990), and reflect impairment created by chronic conditions as well as cognitive and affective functioning (Stump and others, 1977; Wray, Herzog and Park, 1996; Wary and Lynch, 1998). IADLs are less closely tied to morbidity *per se* as they are sensitive to more generalized impairments and limitations in unassisted and independent living. The analysis discussed below focuses on the proportion of older persons with at least one ADL, or at least one IADL (see the annex for a list of the ADLs and IADLs⁶). ADL/IADL classifications were defined according to whether the person either had difficulty with a task or was unable to perform the task.

The age patterns of the proportions with at least one ADL or IADL difficulty are displayed in figures 3 and 4. There are strong age gradients and large gender differences but little intercity heterogeneity. The United States' HRS sample stands out (along with Uruguay) only for females at higher ages, who are relatively less likely than women in other countries to have difficulty in carrying out at least one IADL.

ADL and IADL patterns can be studied with the same tools used earlier for the study of self-reported health. Tables 4 and 5 presents results of multivariate analysis of probabilities of reporting at least one ADL (table 4) or at least one IADL (table 5), with dummy variables for sex, age categories and countries as predictors. For ADL, age and sex patterns are salient, but inter-country heterogeneity is trivial.⁷ For IADL, on the contrary, inter-country differences are highly statistically significant (based on a comparison of the fit of Models I and II of table 5). Curiously, Montevideo, which has one of the lowest proportions of older persons reporting themselves in poor health, also has one of the lowest proportions with at least one ADL or IADL.⁸

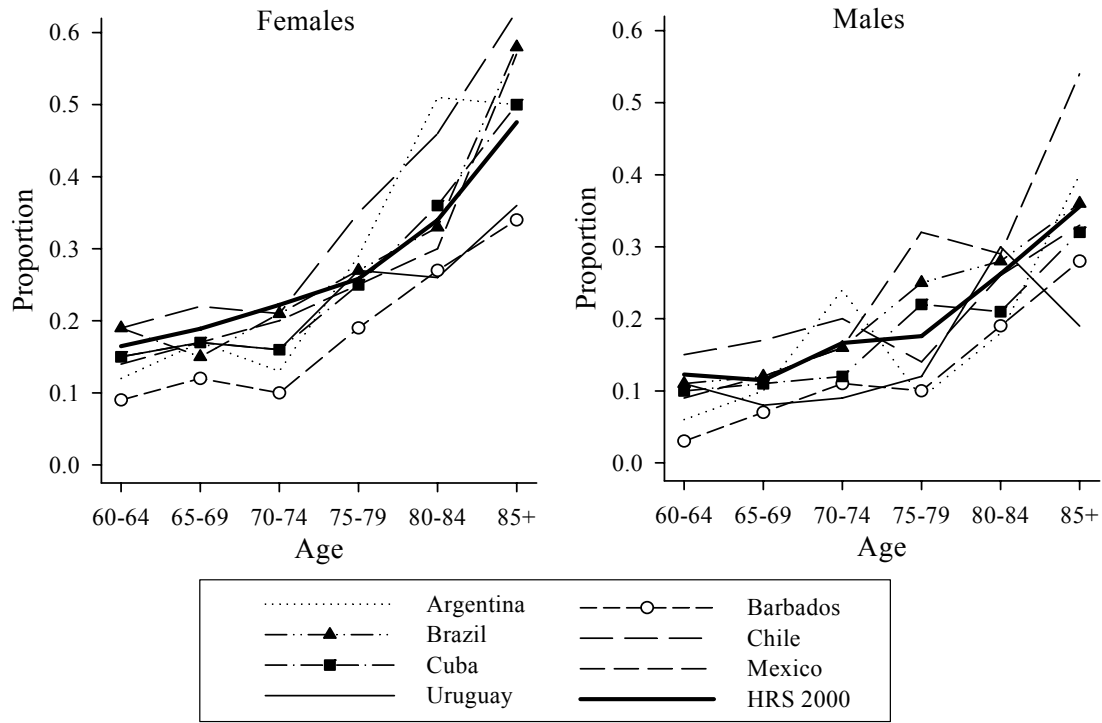
TABLE 3: RELATIONSHIP BETWEEN POOR SELF-REPORTED HEALTH AND AGE, GENDER AND COUNTRY

<i>Predictors</i>	<i>Dependent variable: Whether health status is poor (logit transformation)</i>					
	<i>A. Model I</i>		<i>B. Model II</i>		<i>C. Model III</i>	
	<i>Effect (log odds)</i>	<i>SE</i>	<i>Effect (log odds)</i>	<i>SE</i>	<i>Effect (log odds)</i>	<i>SE</i>
Constant	-3.00 ***	(0.13)	-2.36 ***	(0.08)	-2.41 ***	(0.06)
Female	0.35 ***	(0.07)	0.36 ***	(0.07)	0.33 ***	(0.05)
<i>Age (years)</i>						
60-64 (reference)	..	..	..	..	..	..
65-69	0.07	(0.09)	0.03	(0.09)	0.05	(0.06)
70-74	0.03	(0.10)	-0.07	(0.10)	-0.04	(0.07)
75-79	0.29 **	(0.10)	0.18	(0.10)	0.30 ***	(0.07)
80-84	0.20	(0.12)	0.11	(0.11)	0.25 **	(0.08)
85+	0.34 **	(0.13)	0.26 *	(0.12)	0.42 ***	(0.09)
<i>Country</i>						
Argentina	-0.25	(0.18)	..	..	..	..
Barbados	-0.22	(0.15)	..	..	..	..
Brazil	0.36 **	(0.13)	..	..	..	..
Chile	1.35 ***	(0.13)	..	..	..	..
Cuba	0.77 ***	(0.13)	..	..	..	..
Mexico	1.28 ***	(0.13)	..	..	..	..
Uruguay (reference)	..	..	..	..	..	..
United States/HRS	..	..	..	..	-0.31 ***	(0.04)
N	10 679		10 679		23 200	
Log likelihood	-3 533		-3 711		-7 290	
LR chi square	399		42		155	
Degrees of freedom	12		6		7	

Source: See table 1.

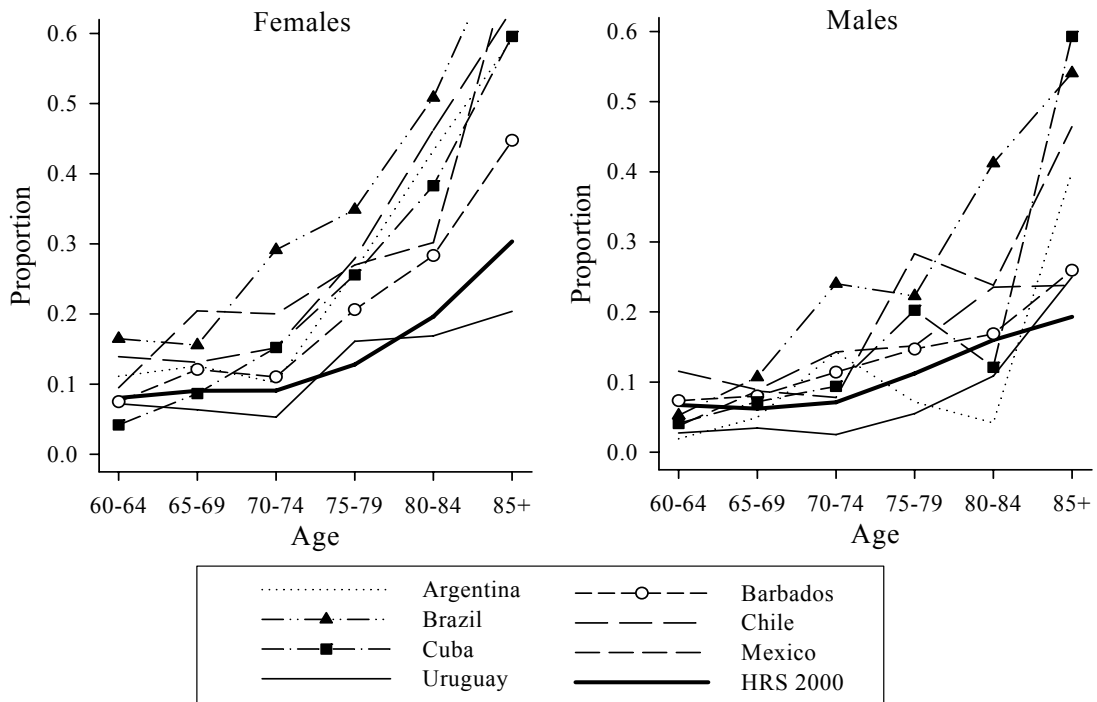
NOTES: Numbers in parentheses are standard errors. Significance: * p<0.05; ** p<0.01; ***p<0.001.

Figure 3. Proportion reporting restriction in at least one activity of daily living (ADL), by age and gender



Source: SABE; HRS.

Figure 4. Proportion reporting restriction in at least one instrumental activity of daily living (IADL), by age and gender



Source: SABE; HRS.

TABLE 4. RELATIONSHIP BETWEEN DIFFICULTY WITH ADLS AND AGE, GENDER AND COUNTRY

<i>Predictors</i>	<i>Dependent variable: respondent has limitations in one or more ADL (logit transformation)</i>					
	<i>A. Model I</i>		<i>B. Model II</i>		<i>C. Model III</i>	
	<i>Effect (log odds)</i>	<i>SE</i>	<i>Effect (log odds)</i>	<i>SE</i>	<i>Effect (log odds)</i>	<i>SE</i>
Constant	-2.37 ***	(0.10)	-2.23 ***	(0.07)	-2.17 ***	(0.05)
Female	0.45 ***	(0.05)	0.45	(0.05)	0.44 ***	(0.04)
<i>Age (years)</i>						
60-64 (reference)	..	..	..	..	..	..
65-69	0.16	(0.08)	0.15	(0.08)	0.11	(0.06)
70-74	0.28 ***	(0.09)	0.25 **	(0.09)	0.30 ***	(0.06)
75-79	0.76 ***	(0.08)	0.75 ***	(0.08)	0.63 ***	(0.06)
80-84	1.15 ***	(0.09)	1.14 ***	(0.09)	1.04 ***	(0.06)
85+	1.74 ***	(0.09)	1.71 ***	(0.09)	1.59 ***	(0.06)
<i>Country</i>						
Argentina	0.14	(0.11)	..	..	..	..
Barbados	-0.36 ***	(0.10)	..	..	..	..
Brazil	0.27 **	(0.09)	..	..	..	..
Chile	0.48 ***	(0.10)	..	..	..	..
Cuba	0.13	(0.09)	..	..	..	..
Mexico	0.23*	(0.10)	..	..	..	..
Uruguay (reference)	..	..	..	..	..	..
United States/HRS	..	..	..	..	0.10 **	(0.03)
N	10 824		10,824		21 322	
Log likelihood	-5 041		-5 087		-10 272	
LR chi square	706		614		1082	
Degrees of freedom	12		6		7	

Source: See table 1.

NOTES: Numbers in parentheses are standard errors. Significance: * p<0.05; ** p<0.01; ***p<0.001. Panel C is a pooled HRS-SABE sample.

TABLE 5. RELATIONSHIP BETWEEN DIFFICULTY WITH IADLS AND AGE, GENDER AND COUNTRY

<i>Dependent variable: respondent has limitations in one or more IADL (logit transformation)</i>						
<i>Predictors</i>	<i>A. Model I</i>		<i>B. Model II</i>		<i>C. Model III</i>	
	<i>Effect (log odds)</i>	<i>SE</i>	<i>Effect (log odds)</i>	<i>SE</i>	<i>Effect (log odds)</i>	<i>SE</i>
Constant	-3.81 ***	(0.13)	-2.81 ***	(0.09)	-2.45 ***	(0.06)
Female	0.59 ***	(0.06)	0.55 ***	(0.06)	0.43 ***	(0.04)
<i>Age (years)</i>						
60-64 (reference)	..	..	..	..	..	..
65-69	0.35 ***	(0.10)	0.30 **	(0.10)	0.17 **	(0.07)
70-74	0.67 ***	(0.10)	0.62 ***	(0.10)	0.36 ***	(0.07)
75-79	1.21 ***	(0.10)	1.23 ***	(0.09)	0.89 ***	(0.07)
80-84	1.72 ***	(0.10)	1.74 ***	(0.10)	1.38 ***	(0.07)
85+	2.60 ***	(0.10)	2.59 ***	(0.10)	2.05 ***	(0.07)
<i>Country</i>						
Argentina	0.81 ***	(0.14)	..	..	..	..
Barbados	0.66 ***	(0.12)	..	..	..	..
Brazil	1.49 ***	(0.11)	..	..	..	..
Chile	1.11 ***	(0.13)	..	..	..	..
Cuba	0.85 ***	(0.12)	..	..	..	..
Mexico	1.11 ***	(0.13)	..	..	..	..
Uruguay (reference)	..	..	..	..	..	..
United States/HRS	..	..	..	..	-0.61 ***	(0.04)
N	10,798		10 798		23 303	
Log likelihood	-4453		-4 576		-8 768	
LR chi square	1413		1 168		1 700	
Degrees of freedom	12		6		7	

Source: See table 1.

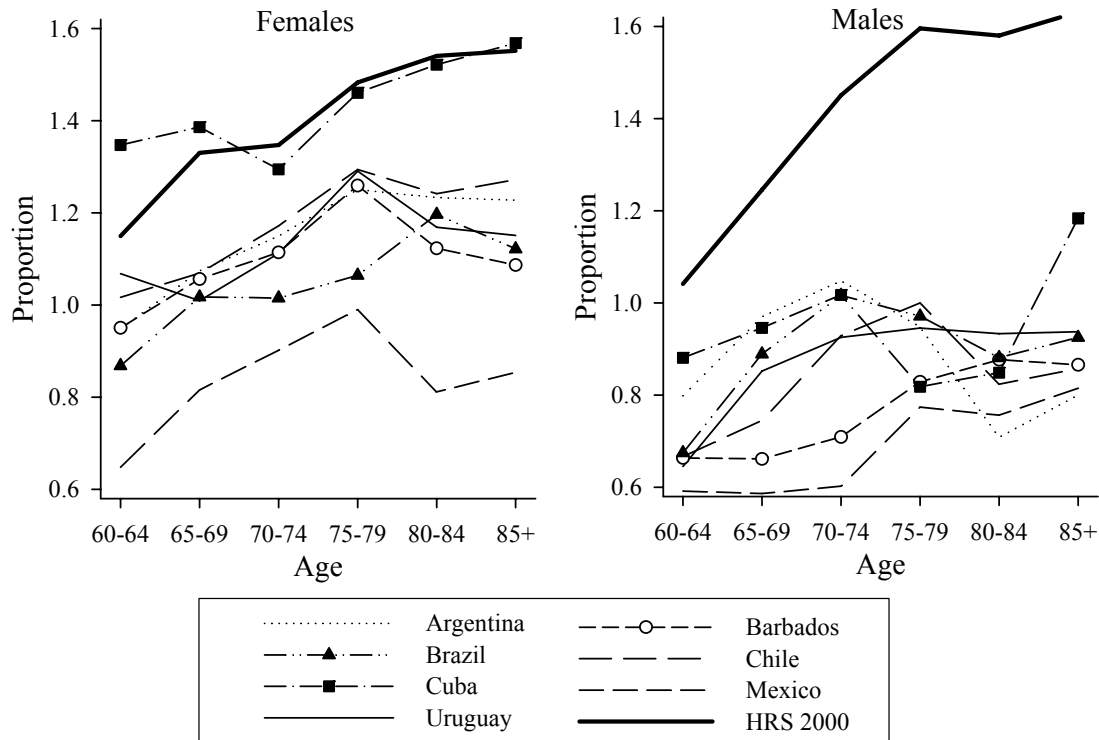
NOTES: Numbers in parentheses are standard errors. Significance: * p<0.05; ** p<0.01; ***p<0.001. Panel C is a pooled HRS-SABE sample.

The contrasts between ADL and IADL patterns in SABE cities and HRS are strong (see Model III in tables 4 and 5). An individual in the HRS population is about 1.11 times as likely to experience at least one ADL difficulty as an individual in the pooled SABE sample, a statistically significant difference. By contrast, the HRS population is much less likely (odds of 0.54 or $e^{-0.61}$) to report difficulty with at least one IADL than are respondents in the pooled SABE sample. This pattern could result from heavier mortality selection among those with compromising morbid conditions or, alternatively, from cultural idiosyncrasies in the interpretation of limitations in the SABE cities. Lower prevalence of IADLs in the HRS could also be influenced by greater access to assistive technologies or services in the United States, although this possibility cannot be explored with the data examined here.

E. CHRONIC CONDITIONS

Figure 5 displays the mean number of chronic conditions⁹ by age and gender. The number of chronic conditions increases with age, and women exhibit a more unfavourable profile than do men. A simple regression analysis reveals that inter-country heterogeneity in the number of chronic conditions is quite low and that the strongest effects are those of age and sex (not shown). A comparison with HRS shows that the older population of HRS exhibits a higher average number of chronic conditions than any of the countries in the SABE sample, with the possible exception of women in Cuba. This, again, is a pattern that could be expected under heavier mortality selection in SABE countries or, alternatively, could be due to underreporting of chronic conditions in those countries.

Figure 5. Number of chronic conditions by age and gender

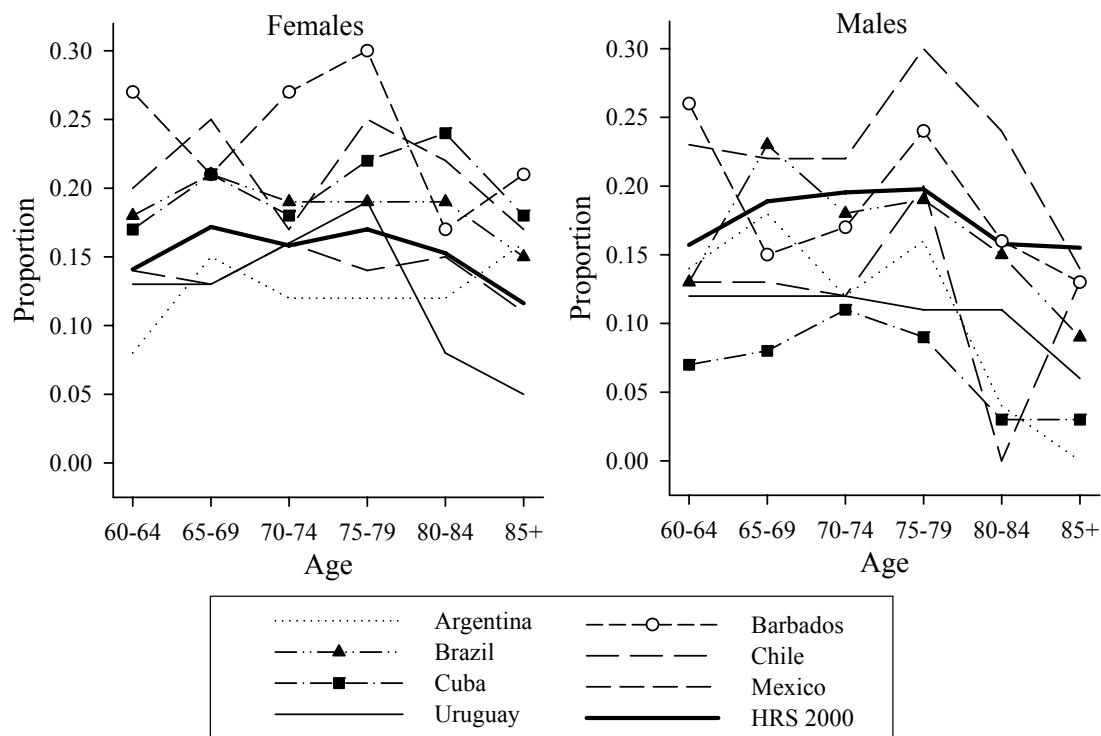


Source: SABE; HRS.

Of the chronic conditions highlighted in table 2 and included in figure 5, arthritis, heart disease, obesity and diabetes are the most common.¹⁰ The latter two conditions are of particular interest here. First, other research has reported that developing countries, particularly in Latin America and the Caribbean, are in the midst of a diabetes and obesity epidemic, in part as the result of unfavourable shifts toward a “Western” diet rich in saturated fats, simple carbohydrates and sugar, coupled with a marked trend towards sedentarism (Popkin, 1993; and Albala and others, 2000). But never before has this been documented on a large scale for countries of the region and for older populations. Second, diabetes and coronary heart disease have been linked to unfavourable early childhood conditions that express themselves either in unfavourable nutritional status or as after-effects of infectious disease (Barker, 1998; Kuh and Ben-Shlomo, 2004). The case of diabetes is of special interest, for there is evidence that diabetes is related to early childhood malnutrition (Palloni and others, 2004; Barker, 1998; Hales and Barker, 1992; Hales and others, 1991; Lithell and others, 1996).

Figure 6 displays the proportion of individuals who self-reported diabetes for all SABE samples and HRS, by age and gender.¹¹ The pattern by age is very distinct and is similar across countries: first rising with age and then falling, with a peak around ages 70-74. The declining pattern at high ages is probably a result of the heavier attrition of diabetics as age increases. Men are less likely than women to report diabetes. For the most part, the population in HRS is as likely as the average individual in the pooled SABE sample to report diabetes. Additional regression analyses, not shown here, reveal that within the SABE sample there is substantial heterogeneity; Cuba, closely followed by Argentina and Uruguay, exhibits the lowest level of self-reported diabetes (almost 17 per cent at the peak age group for women), whereas Barbados, Mexico and Brazil show the highest levels (about 29 per cent at the peak age for women). Prevalence of self-reported diabetes in the HRS sample is not significantly different from the weighted average in SABE.¹²

Figure 6. Proportion reporting diabetes by age and gender



Source: SABE; HRS.

Cuba's low level of self-reported diabetes, especially among men, is undoubtedly due, at least in part, to the fact that the adoption of a Western life style has simply not been an option in this country and, therefore, the risk factors associated with a new diet and sedentary life styles are absent. But to explain the very high levels in Barbados, Brazil and Mexico one probably needs to explore the role of population composition by early nutritional status and/or the influence of ethnic composition as well as diet and physical activity patterns. In fact, ethnic compositions differ significantly among the SABE countries: Barbados and Brazil have a substantial component of population of African descent whereas Mexico has the highest percentage of indigenous and mestizo population. Whether the foetal origin explanation, the one resting on ethnic-related genetic endowments, the more conventional one invoking a Western diet and sedentary life style, or some combination of these, explain the distinctive patterns in these countries must remain a conjecture until it becomes possible to test directly the influence exerted by each factor.

F. THE CONNECTION BETWEEN EARLY CHILDHOOD AND ADULT HEALTH STATUS

This section of the paper focuses on adult diabetes, examining the connection between early childhood and adult health status. The assessment presented earlier identified diabetes as one of the key chronic conditions with high prevalence among older adults in the SABE cities. Development of diabetes in adulthood also appears to be affected by early childhood conditions (Barker, 1998; Aboderin and others, 2002). Is there any evidence in countries of the region that current diabetes status is related to early childhood conditions and development?

A simple way to identify the direction and magnitude of effects is to estimate for each city the relationship between indicators of early health status and the probability of self-reporting diabetes. This is a blunt tool for a number of reasons. First, focusing on current diabetes status constrains the universe of study to those who were able to survive with the disease. It is likely that those in worst health were less likely to survive to be interviewed. Secondly, although self-reports of diabetes are generally accurate (Palloni and others, 2003; Goldman and others, 2002), even small measurement errors can lead to powerful attenuation of estimated effects. In addition, the indicators of early childhood conditions available here—anthropometric measurements and retrospective questions—were assessed in a population-based study, carried out using person-to-person interviews, rather than in a clinical setting. As a consequence, the anthropometric indicators may be subject to random errors, with the consequent distorting effects on estimates of association between variables.

Table 5 displays the estimated effects of three anthropometric indicators (see the annex for details) on the log-odds of reporting diabetes. Table 6 displays the effects associated with indicators of childhood economic and health status as reported in retrospective histories. In both tables 5 and 6, the models included controls for gender, age, race, education and obesity.¹³

The results for the anthropometric indicators are mixed. Unlike findings obtained by other authors for the United States (Fogel, 1994; Costa, 2002; Kim, 1993) this analysis provides little support for the idea that height is related to the probability of diabetes once the effects of *current* nutritional status, as reflected in the Body Mass Index (BMI), are controlled for.¹⁴

Knee height is not only a good predictor of current height in populations whose skeletal mass is compressed by age-related processes (Chumlea and others, 1998; Palloni and Guend 2005), but it, as well as leg length, is a marker of early malnutrition. Yet there is little evidence from the SABE data that early malnutrition as reflected in knee height is related to current diabetes status.

TABLE 5. EFFECTS OF ANTHROPOMETRIC VARIABLES ON DIABETES

<i>Country and predictor</i>	<i>Dependent variable: respondent has diabetes (logit transformation)</i>		
	<i>N</i>	<i>Effect (log odds)</i>	<i>SE</i>
<i>Height</i>			
Barbados	1665	0.05	0.16
Brazil	1765	-0.03	0.17
Chile	733	-0.04	0.29
Cuba	1669	0.07	0.17
Mexico	1022	0.27	0.21
Uruguay	1282	-0.21	0.23
Pooled SABE	8668	-0.05	0.08
<i>Knee height</i>			
Barbados	1660	-0.15	(0.15)
Brazil	1763	0.05	(0.16)
Chile	729	0.12	(0.27)
Cuba	1668	-0.09	(0.17)
Mexico	1022	0.32	(0.19)
Uruguay	1243	-0.21	(0.21)
Pooled SABE	8617	-0.07	(0.08)
<i>Waist/hip ratio</i>			
Barbados	1651	0.88 ***	(0.15)
Brazil	1752	0.63 ***	(0.15)
Chile	733	0.59	(0.31)
Cuba	1664	0.29	(0.20)
Mexico	1019	0.18	(0.20)
Uruguay	1229	0.71 **	(0.23)
Pooled SABE	8577	0.47***	(0.08)

Source: See table 1.

NOTES: Height and knee height: 1=lowest 20% of distribution. Waist/hip ratio: 1=top 20 per cent of distribution. Significance: * p<0.05; ** p<0.01; ***p<0.001. Anthropometric measures were not available for Argentina. Each line of the table reports results from a separate analysis (country-specific except in the case of the "pooled SABE" data set). All models include controls for gender, age, education, race and obesity except for Mexico where there were no data on race. The lower sample size for Chile is primarily due to missing values for race. The analysis for the pooled SABE sample also includes country-specific dummy variables and does not include race so as to include Mexico. The sample size for pooled SABE is larger than the sum of the individual country sample sizes because excluding race increased the sample size for Chile.

TABLE 6. EFFECTS OF EARLY CHILDHOOD CONDITIONS ON DIABETES

<i>Country and predictor</i>	<i>Dependent variable: respondent has diabetes (logit transformation)</i>		
	<i>N</i>	<i>Effect (log odds)</i>	<i>SE</i>
<i>Barbados</i>			
Economic	1636	-0.005	(0.16)
Health		-0.37	(0.55)
<i>Brazil</i>			
Economic	1740	0.04	(0.14)
Health		0.40	(0.25)
<i>Chile</i>			
Economic	726	-0.17	(0.23)
Health		0.49	(0.41)
<i>Cuba</i>			
Economic	1657	-0.08	(0.16)
Health		0.29	(0.32)
<i>Mexico</i>			
Economic	1018	0.27	(0.20)
Health		0.42	(0.33)
<i>Uruguay</i>			
Economic	1270	-0.11	(0.18)
Health		0.30	(0.41)
<i>Pooled SABE</i>			
Economic	8566	0.02	(0.07)
Health		0.26 [†]	(0.14)

Source: See table 1.

NOTES: Early childhood economic situation: 1=fair/poor, 0=good. Early childhood health: 1=poor, 0=excellent/good. Significance: [†]p<0.1; *p<0.05; **p<0.01; ***p<0.001. Anthropometric measures were not available for Argentina. Separate analyses were conducted for each country and for the pooled SABE data. All models include controls for gender, age, education, obesity and race except for Mexico where there were no data on race. The lower sample size for Chile is primarily due to missing values for race. The analysis for the pooled SABE sample also includes country-specific dummy variables and does not include race so as to include Mexico. The sample size for pooled SABE is larger than the sum of the individual country sample sizes because excluding race increased the sample size for Chile.

In contrast, the waist-to-hip ratio (WHR) is a powerful predictor of current diabetes status in four of the seven countries. This finding is interesting but admits two very different interpretations. On the one hand, evidence for poor populations suggests that WHR is affected by early malnutrition (Schroeder and others, 1999; Martorell and others, 2001). If so, the estimated effects shown in the table could reflect the impact of early malnutrition on propensity to develop diabetes as an adult. On the other hand, WHR is a measure of central adiposity and could also reflect hormonal and metabolic disorders produced, for example, by sustained stress (Adler and others, 2000; Ostrove and others, 2001). If so, the estimated effects shown in the table would only reflect the relationship between stress in the recent past, metabolic imbalances, and diabetes. This mechanism could be independent of early malnutrition.

It may be noted that the SABE data provide evidence of a connection between early nutrition and WHR (Palloni and McEniry, 2004). Results not shown here indicate that, in SABE countries, being in the lowest quintile of knee height strongly affects the odds of being in the upper quintile of WHR. Indeed, the ratio of the odds of being in the upper quintile of WHR for a person in the lowest quintile of knee height is on the order of 1.4. This relationship is highly statistically significant. In contrast, neither the retrospective measure of health status nor that of childhood socioeconomic status is related to WHR.

Turning to the relationship between retrospective indicators of early economic and health conditions and current diabetes status, table 6 shows that the results are mostly negative. When the SABE data are pooled, the estimated effect for early health status has the expected sign but is only marginally statistically significant. In all other cases the effects are statistically insignificant.

To summarize: the evidence for connections between early childhood conditions and current diabetes status is largely negative, irrespective of whether one uses anthropometric or direct (retrospective) assessments of childhood conditions. In only one case, the measure of WHR, are the estimated effects substantively large and properly signed. In the remaining cases, the data reveal no relationships of importance.

G. CAN WE MAKE INFERENCES ABOUT MORTALITY?

The discussion below ventures into uncharted territory, attempting to infer expected relative mortality risks for obese and non-obese individuals. The SABE study does not provide information on actual mortality and, therefore, does not permit direct estimation of mortality risks for any particular subgroup. There is, however, an indirect way of doing so using those samples for which information on anthropometric measures is available (that is, excluding Argentina, which did not gather this information). The idea is to estimate the relationships between height, weight and relative mortality risk using so-called Waaler surfaces. These surfaces are derived from the work of Waaler (1984) and others (Fogel, 2003; Kim, 1993; Costa 2002), which mapped risks of mortality according to height and weight, originally using data from Norway. We are now examining the applicability of Waaler surfaces to Latin American and Caribbean countries (Palloni and McEniry, 2005). Assuming that Norwegian relative mortality risks associated with height-weight combinations apply to countries in SABE, and considering that Norwegians in general were probably exposed to better living conditions than individuals in the SABE samples of older persons, Waaler surfaces identify lower bounds for the relative risks associated with height-weight combinations (i.e., less risk than might actually be the case). Conversely, it is likely that older persons in the United States are in better health than were the Norwegians whose mortality Waaler examined. In this case Waaler surfaces identify an upper bound of relative mortality risks for older persons in the United States (higher relative risk than might actually be the case).

For any health status indicator that leads to a partition of the sample into classes or groups (in the present case, obese and non-obese), relative mortality risks can be approximately identified for each class or group by calculating their mean weight and height and locating the corresponding point on a Waaler

surface. The first step is to estimate Waaler-type surfaces, using Waaler's original data (Waalder, 1984), for (the log of) relative mortality risks as quadratic functions of height (cm.) and weight (kg.) plus interaction terms.¹⁵ Next, *optimal lines* are identified as the locus of points yielding a weight that minimizes the mortality risk for a given height, and *severe obesity lines* are defined as the locus of points where the height-weight combination yields a body-mass index of 35. Finally, average height and weight for obese and non-obese 60-74 year-old respondents are calculated from SABE and HRS data, and these points are plotted on the surfaces.¹⁶ Under the assumptions stated earlier, the location of these points on the surfaces identifies a minimum mortality risk among obese (and non-obese) individuals in SABE countries and a maximum mortality risk for obese (and non-obese) HRS respondents.

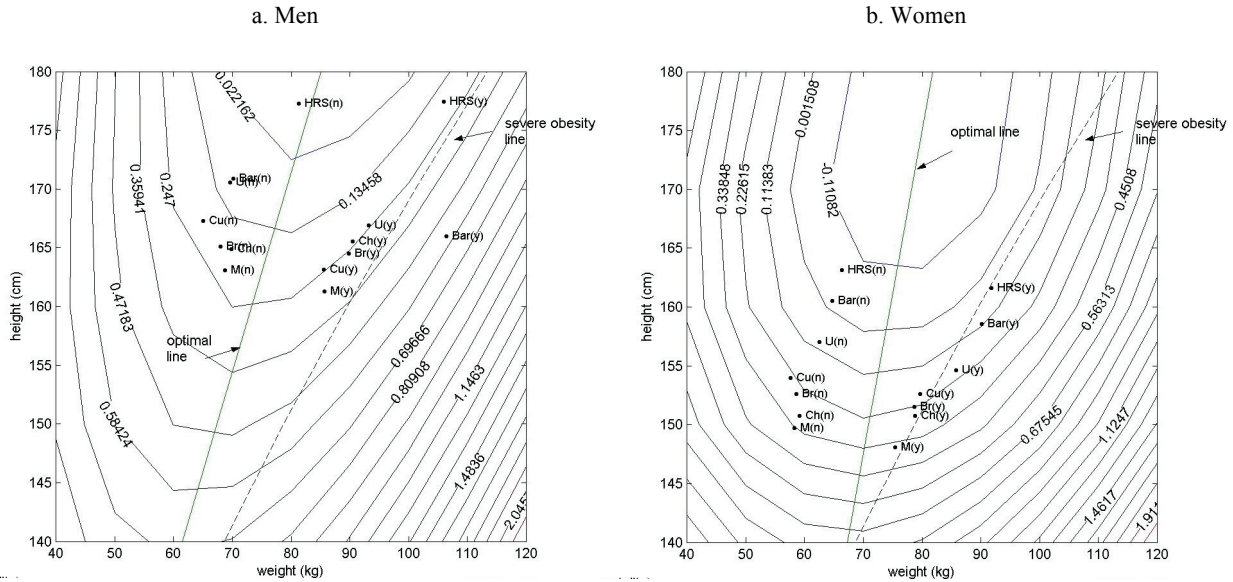
Figures 7 and 8 display curves of the logarithm of the relative mortality risks for various combinations of height and weight among Norwegian males and females respectively. The figures also display the points corresponding to the average weight-height combinations among obese and non-obese males and females in the SABE and HRS data sets. The relative mortality risks in the reference population for different height-weight combinations are indicated in the graphs for selected iso-risk lines. For example, a male 140 cm tall and weighing 68.6 kg would be on the borderline of severe obesity (BMI=35) shown in figure 7. The iso-risk lines show that this weight-height combination corresponds to a relative mortality risk of 0.69666 or, after exponentiation, a mortality risk approximately twice as high as total mortality in the reference population. Relative mortality risk increases as height decreases and, as weight increases for a particular height, there is a set of optimal points where mortality risk is minimized ("optimal line"). A particular height-weight combination always yields higher mortality risks for males than for females; this is a feature inherent in the Norwegian data and is likely to apply to other societies as well.

Two patterns deserve attention. First, non-obese older men (represented with points bearing the symbol "(n)") can be located in an area of lower mortality risks than for the obese (represented with points bearing the symbol "(y)"). Indeed, the latter are always to the right and almost always below the level of the former (lower height). This is evidence of a clear mortality divide between obese and non-obese males as the former are always located in *loci* closer to the curve representing higher mortality risks whereas the latter cluster very close to the optimal line. This is a feature characterizing all data sets under examination and is also present among females (figure 7), albeit in a more attenuated fashion. The fact that the observed mortality divide between obese and non-obese is in the expected direction gives some basis for using the Waaler surfaces to draw stronger inferences.

The second pattern to note is that older persons in the SABE countries are in a disadvantageous position relative to those in the United States, and that the ranking of relative mortality risks in the SABE countries is related, in a general way, to the type of demographic regimes they experienced in the past. Thus, Barbados, Cuba and Uruguay, which experienced very early mortality decline (mostly associated with eradication of infectious diseases) appear to have a more advantageous relative risk profile, regardless of obesity status or gender. Indeed, the points (n) and (y) for these countries are always below (lower height) the points corresponding to the United States but are above all the others.

Waalder surfaces are a blunt tool to examine mortality risks. However, in the absence of direct data, they do show that, at least with respect to the obese vs. non-obese contrast, older persons in the SABE samples, as conjectured, have an anthropometric profile that places them at a disadvantage in terms of mortality risks relative to older persons in countries that are either wealthier (United States) or where the growth of the older population was produced by a different array of demographic forces.

Figure 7. Waaler mortality surfaces showing obese and non-obese groups aged 60-74



Country:
 Bar: Barbados
 Br: Brazil
 Obesity: (n) = No (y) = Yes

Ch: Chile
 Cu: Cuba

M: Mexico
 U: Uruguay

HRS: United States/HRS

Source: Authors' calculations based on data from SABE and HRS.

H. DISCUSSION

This paper has employed cross sectional data on older Latin American and Caribbean populations to examine the conjecture that the past evolution of mortality in countries of the region may have important implications for the health status of those approaching old age now and in the next 20-30 years. If the conjecture holds merit, one would expect to observe (a) higher frailty among older persons born in the Latin American and Caribbean region than, for example, in developed countries such as the United States; (b) strong effects of early childhood conditions on adult health status; and (c) higher expected mortality risk than in the United States.

Examining the conjecture more fully would require observing a cohort of individuals over time. However, a cross-sectional analysis using comprehensive and recent data from the Latin American and Caribbean region provides an opportunity to conduct a preliminary examination of the conjecture. This paper set out to examine the conjecture by answering a set of four questions regarding (a) the nature of health profiles of the ageing in the Latin American and Caribbean region; (b) specifically, whether those profiles showed evidence of poor health and functional status; (c) comparisons with countries such as the United States; and (d) whether there was evidence of high impact of early childhood conditions.

The results reported above suggest that the conjecture has merit, even though the evidence available from the SABE data is weak. These new data show that the characteristic health profile of older persons in the region exhibits a high prevalence of chronic disease and disability, suggesting more frailty among the old in the region than in the United States.

Self-reported health status shows substantial inter-country variability. On average, countries in the region display patterns by age and sex that are similar to those found elsewhere. Women and the very old

are more likely to declare themselves in poor health. The proportion reporting difficulty carrying out at least one ADL or IADL is strongly related to age and gender. Prevalence of difficulty with ADLs displays remarkable inter-country invariance, though this is not the case for IADLs. Self-reported health, on the one hand, and ADL and IADL, on the other, are only moderately related to each other. The mean number of self-reported chronic conditions increases with age and is higher for women than men.

Of all chronic conditions there are three that stand out: arthritis, cardiovascular disease and diabetes. Diabetes was chosen as a focus of analysis because of its significant increase in the region and because of its potential connection with childhood experiences. Women are especially affected by this condition. Obesity, a risk factor for diabetes, is also high among older persons in the region, particularly among women. There is large inter-country variance in both diabetes and obesity, and the causes of this deserve further investigation. In some countries that are highly modernized and Westernized, such as Argentina, the prevalence of diabetes is fairly low and in other countries, such as Mexico and Barbados, where high percentages of the population are of African descent or mestizo, the prevalence is very high.

The new data show that in some cases the health profile of older persons in Latin America and the Caribbean is worse than in the United States, but this depends on the indicator; on some indicators health status appears worse in the United States. Age and gender patterns of self-reported health, ADLs and IADLs are comparable. Older persons in SABE countries are, on average, more likely than those in the United States to report difficulties with IADLs though not ADLs. The United States population reports a much higher mean number of chronic conditions at all ages, particularly among males. In contrast, SABE countries on average display levels of self-reported diabetes and obesity that are as high as if not higher than those found in the United States.

The investigation also found indications of an association between early childhood conditions and adult health status and diabetes, although the evidence available from these data is weak. The analysis was limited to examining the relationship between anthropometric indicators and retrospective measures of early childhood conditions. It was possible to document only the strong relationship between diabetes and waist-to-hip ratio, which persisted even after controlling for the effects of obesity. We interpret this relationship as a partial reflection of early malnutrition and propensity to develop adult diabetes. However, other interpretations are possible, and the data examined here do not permit us to discriminate among them.

Waller-type surfaces were employed to estimate expected relative mortality risk in SABE countries. The approach met with some success in indicating, as expected, higher mortality risks associated with obesity. The results also clearly suggest, as conjectured, a pattern of lower mortality risk in those countries that experienced a more gradual mortality decline accompanied by improved standards of living.

The conjecture regarding the implications of the evolution of mortality trends for health status of the region's older persons received some support in the present study, and deserves future cross-national study across a larger sample of developing countries with different mortality histories. However, the results of this analysis are not intended merely to examine the past. The aim is to gain a better understanding of the likely implications of the past for the present and future health of older adults. What was learned in the present investigation adds to our understanding of older persons' health status in the region and underlines the importance of developing sound social and health policies—policies that will invest sufficient resources to prepare for a future in which conditions such as diabetes and obesity will be highly prevalent. These health conditions will pose a challenge to Latin American and Caribbean institutions and to policy-makers. As older persons in the region become an increasingly important part of society over time, this study's exploration of the implications of the past hopefully will help guide future directions in the care of Latin American and Caribbean older persons.

ANNEX

DEFINITIONS AND OPERATIONALIZATION OF VARIABLES IN SABE

1. Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL)

ADLs:

Walking across the room
Dressing
Bathing
Eating
Getting in and out of bed
Using bathroom

IADLs:

Preparing meals
Managing money
Difficulty with getting to places¹
Buying food or clothing
Using the phone (in SABE only for those with a phone)
Doing light housework
Doing heavy housework
Taking medicine(s)

2. Chronic conditions

Arthritis
Cancer
Diabetes
Respiratory illness
Heart disease
Stroke

3. Targets, spouses and proxies

In three countries (Argentina, Chile, and Uruguay) only one individual per household was interviewed. In two countries, Brazil and Mexico, interviewers proceeded to interview all individuals 60 or over found in selected household. In virtually all these cases, the additional interviews corresponded to spouses (one per household). In Cuba interviewers selected a target individual and a spouse.

The present analyses include all individuals interviewed. This has the advantage of maximizing observations at the expense of introducing dependence of observations in the countries where more than one individual per household was interviewed. As a check for sensitivity of results to effects of within-household clustering, some of the analyses were repeated using clustering procedures to adjust for lack of independence; but, since the inferences remain unchanged we have chosen to present results based on the larger samples.

4. Sampling weights

Only the sample from Santiago is self-weighted. All others require weights to expand the sample population to the city population. Since in two countries no sample weights were available we chose to ignore them in all the others. However, to ensure that none of the conclusions was sensitive to this choice, we re-estimated models using sampling weights for those countries that had them available. None of the inferences changed, and it is thus unlikely that this factor has appreciably affected the results reported here.

NOTES

¹ The United States is estimated to have surpassed a per capita GDP of \$10,000 per year (in 2000 dollars) by the early 1940s (cf. <http://eh.net/hmit/gdp>).

² This is a simplified decomposition that assumes a population that is closed to migration.

³ The argument assumes that the effects of mortality selection are small and if the effects of changes in behavioural profiles and medical technology (exogenous or not) are weak.

⁴ For more information on the nature of the samples see Palloni and Pelaez (2002).

⁵ The definition of ADL, IADL, and self-reported conditions selected for study in this paper appears in the annex. They are strictly comparable to those used in other surveys of older populations, particularly the Health and Retirement Survey (HRS) (2000).

⁶ For the purpose of the analysis shown here, attention is restricted to five IADLs for which measures were strictly comparable between SABE and HRS: preparing meals; managing money; buying food or clothing; using the phone and taking medicine.

⁷ Analyses of variance (Palloni and McEniry, 2004) indicate that the fraction of total variance explained by country variability is statistically insignificant.

⁸ Montevideo is also the only city in the SABE sample where more than a trivial proportion of the elderly live in institutions. (The samples are household-based and exclude those in institutions.) The peculiar relationship between self-reported health and ADL and IADL in Montevideo might be a result of heavy selection among elderly who remain independent instead of becoming institutionalized.

⁹ See annex for definition of chronic conditions.

¹⁰ In this paper the term diabetes refers to a mixture of diabetes 1 and diabetes mellitus or type 2. However, for the most part those individuals self reporting diabetes are afflicted by diabetes type 2.

¹¹ Self-reports of diabetes tend to underestimate true prevalence. But self reports are quite accurate (with very high specificity), though with lower sensitivity, in very different cultural contexts (Palloni, Soldo and Wong, 2003; Goldman, Weinstein and Y-Hsung, 2002).

¹² In HRS, the predicted probability at the peak age for women is 0.22, slightly higher than the weighted average for SABE. However, this difference is statistically insignificant.

¹³ A control for obesity is required since the tenor of the conjecture is emphasis on the direct effects of early childhood conditions, not the gross effects. Since part of the latter operate via increased predisposition to develop obesity, it is important to control for current obesity.

¹⁴ The Body Mass Index (BMI) is the ratio of weight in kilograms to the square of height in meters. Persons with a BMI of 30 or over are considered to be obese.

¹⁵ The relative mortality risk is defined as the ratio of the mortality rate for a particular weight-height combination to the average mortality rate in the population.

¹⁶ The sample was limited to those younger than 75 in order to include the older population to whom the conjecture is most likely to apply, namely, those born after the period 1925-1930.

REFERENCES

- Aboderin, Isabela, and others (2002). Life course perspectives on coronary heart disease, stroke and diabetes: key issues and implications for policy and research. Report. Geneva: World Health Organization.
- Albala, Cecilia, and others (2000). *Obesidad: un desafío pendiente*. Santiago, Chile: Editorial Universitaria, Universidad de Chile.
- Adler, Nancy E., and others (2000). Relationship of subjective and objective social status with psychological and physiological functioning: preliminary data in healthy white women. *Health Psychology* 19(6):586-92.
- Alter, G. and J.C. Riley (1989). Frailty, sickness and death. *Population Studies* 43(1):25-46.
- Barker, D. J. P. (1998). *Mothers, babies and health in later life (2nd Edition)*. Edinburgh: Churchill Livingstone.
- Barrientos A. (1997). The changing face of pensions in Latin America: design and prospects of individual capitalization pension plans. *Social Policy and Administration* 31(4) (December):336-353.
- Beckett M., and others (2000). Do health interview surveys yield reliable data on chronic illness among older respondents? *American Journal of Epidemiology* 151(3):315-323.
- Blackwell, Debra L., Mark D. Hayward and Eileen M. Crimmins (2001). Does childhood health affect chronic morbidity in later life? *Social Science and Medicine* 52:1269-1284.
- Chumlea, Cameron W. M., and others (1998). Stature prediction equations for elderly non-Hispanic white, non-Hispanic black, and Mexican-American persons developed from NHANES III data. *Journal of the American Dietetic Association* 98:2:137-142.
- Costa, Dora L. (2002). Changing chronic disease rates and long-term declines in functional limitation among older men. *Demography* 39(1):119-37.
- Cynader, Max S. (1994). Mechanisms of brain development and their role in health and well-being. *Daedalus* 123(4):155-65.
- Davey Smith, George and John Lynch. (2004). Life course approaches to socioeconomic differentials in health. In: Kuh, Diana and Yoav Ben-Shlomo (eds). *A life course approach to chronic disease epidemiology*. Pages 77-115. Oxford: Oxford University Press.
- Devos, S. (1990). Extended family living among older people in six Latin American Countries. *Journal of Gerontology* 45(3):S87-S94.
- Devos, S., and A. Palloni (2002). Living arrangements of elderly people around the world. Working paper. Center for Demography and Ecology. University of Wisconsin-Madison.
- Elo, I. T., and S. H. Preston (1992). Effects of early-life conditions on adult mortality: a review. *Population Index* 58(2):186-212.
- Fogel, Robert W. (1994). Economic growth, population theory, and physiology: the bearing of long-term processes on the making of economic policy. *American Economic Review* 84:369-395.
- _____ (2003). Changes in the process of aging during the twentieth century: findings and procedures of the early indicators project. Working paper 9941. National Bureau of Economic Research, University of Chicago.

- Frenk, J., and others (1991). Elements for a theory of the health transition. *Health Transition Review* 1(1):21-38.
- Goldman N., and others (2002). Evaluating the quality of self-reports on hypertension and diabetes. Princeton University: Office of Population Research.
- Hales, C. N., and D. J. P. Barker (1992). Type 2 (non-insulin-dependent) diabetes mellitus: the thrifty phenotype hypothesis. *Diabetologia*. 35:595-601.
- _____, and others (1991). Fetal and infant growth and impaired Glucose tolerance at age 64. *British Medical Journal*. 303:1019-22.
- Hayward, Mark D., and Bridget K. Gorman (2004). The long arm of childhood: The influence of early-life social conditions on men's mortality. *Demography* 41(1): 87-107.
- Health and Retirement Study, HRS Core (Final) (v 1.0) public use dataset (2000). Produced and distributed by the University of Michigan with funding from the National Institute of Aging, (U01 AGO 9740), Ann Arbor, MI.
- Hertzman C. (1994). The lifelong impact of childhood experiences: a population health perspective. *Daedalus* 123(4):167-180.
- Horiuchi, Shiro and Samuel H. Preston (1988). Age-specific growth rates: the legacy of past population dynamics. *Demography* 25:429-41.
- Idler, E. L., and Y. Benyamini (1997). Self-rated health and mortality: a review of twenty-seven community studies. *Journal of Health and Social Behavior* 38:21-37.
- _____, and S. Kasl (1991). Health perceptions and survival: do global evaluations of health status really predict mortality? *Journal of Gerontology* 46(2):S55-S65.
- _____ (1995). Self-ratings of health: do they also predict change in functional ability? *Journal of Gerontology* 50B(6):S344-S353.
- Kim, John M. (1993). Economic and biomedical implications of Waaler surfaces: A new perspective on height, weight, mortality, and morbidity. University of Chicago.
- Kinsella, K., and V. Velkoff (2001). *An Aging World*. United States Government Printing Office, Washington DC: United States Bureau of the Census.
- Klinsberg, B. (2000). *America Latina: una region en riesgo, pobreza, inequidad e institucionalidad social*. Washington, DC: Inter American Development Bank.
- Kuh, Diana and Yoav Ben-Shlomo (eds) (2004). *A life course approach to chronic disease epidemiology*. Oxford: Oxford University Press.
- _____, and others (2004). Socioeconomic pathways between childhood and adult health. In: Kuh, Diana and Yoav Ben-Shlomo (eds). *A life course approach to chronic disease epidemiology*. Pages 371-395. Oxford: Oxford University Press.
- Lithell, H. O., and others (1996). Relation of size at birth to non-insulin dependent diabetes and insulin concentrations in men aged 50-60 years. *British Medical Journal*. 312:406-10.
- Lundberg, O. (1991). Childhood living conditions, health status, and social mobility: a contribution to the health selection debate. *European Sociological Review* 7(2) (September):149-162.

- Manton K. G., E. Stallard and L. Corder (1997). Changes in age dependence of mortality and disability: cohort and other determinants. *Demography* 34(1):135-157.
- Martorell, R., A. Stein, and D. Schroeder (2001). Early nutrition and later adiposity. *Journal of Nutrition* 131:874S-880S.
- McKeown, T. (1976). *The Modern Rise of Population*. London, England: Academic Press.
- Mesa-Lago, C. (1994). *Changing social security in Latin America: toward alleviating the costs of economic reform*. Boulder and London: Lynne Rienner Publishers, Inc.
- Omran, A. R. (1982). Epidemiologic Transition. Pp.172-83 in *International Encyclopedia of Population*. New York: The Free Press.
- Ostrove, J. M., and others (2001). Resources and rankings: objective and subjective assessments of socioeconomic status and their relationship to health in an ethnically diverse sample of pregnant women. University of California, San Diego.
- Palloni, A. (2001). Living arrangements of older persons. *United Nations Population Bulletin*. 42/43.
- _____, and H. Guend (2005). Stature prediction equations for elderly Hispanics by gender and ethnic background developed from SABE data. *Journal of Gerontology: Medical Sciences*. Vol 60A, No 6, pp. 804-810
- _____, and Hsien-Hen Lu (1995). Patterns of adult mortality in Latin America: 1950-1990. Population Association of America. San Francisco, CA.
- _____, and M. McEniry (2004). Health Status of Elderly People in Latin America. Working paper. Center for Demography and Ecology, University of Wisconsin-Madison.
- _____ (2005). Early life influences on later-life morbidity: exploring Waaler surfaces. Working paper. Center for Demography and Ecology. University of Wisconsin-Madison.
- _____, and M. Pelaez (2002). Survey of Health and Well-Being of Elders, Final Report. Pan American Health Organization.
- _____, G. Pinto and M. Pelaez (2002). Demographic and health conditions of ageing in Latin America. *International Journal of Epidemiology* 31:762-771.
- _____, B. Soldo and R. Wong (2003). The accuracy of self reported anthropometric measures and self reported diabetes in nationally representative samples of older adults in Mexico. Minneapolis, Minnesota. May 1-3. Population Association of America.
- _____, and R. Wyrick (1981). Mortality decline in Latin America: Changes in the structures of causes of deaths, 1950-1975. *Social Biology* 28(3-4):187-216.
- _____, and others (2004). Health among Puerto Ricans: Analysis of a New Data Set. Center for Demography and Ecology. University of Wisconsin-Madison.
- Popkin, B. M. (1993). Nutritional patterns and transition. *Population Development Review* 19:138-157.
- Preston, S. H. (1976). *Mortality Patterns in National Populations with Special Reference to Recorded Causes of Death*. New York: Academic Press.

- Preston, Samuel H., and A. J. Coale (1982). Age structure, growth, attrition, and accession: A new synthesis. *Population Index* 48(2):217-59.
- _____, and others (1989). Demographic conditions responsible for population aging. *Demography* 26:691-704.
- Rahkonen O., E. Lahelma and M. Huuhka (1997). Past or present? childhood living conditions and current socioeconomic status as determinants of adult health. *Social Science and Medicine* 44(3):327-336.
- Ruggles, S. (1996). Living arrangements of the elderly in America. In: Tamara K. Hareven, ed. *Aging and Generational Relations Over the Life Course: A Historical and Cross-Cultural Perspective*. Pages 254-271. New York: Walter de Gruyter and Co.
- SABE. Salud y Bienestar en el Adulto Mayor, SABE, version No 1, restricted circulation data set. (2003). Produced and distributed by the Pan American Health Organization (PAHO) and the Center for Demography and Health of Aging (CDHA) with the support of the National Institute of Aging, R03 AG15673.
- Schaffer, R. H. (2000). The early experience assumption: Past, present, and future. *International Journal of Behavioral Development* 24(1):5-14.
- Schechter, S., P. Beatty and G. B. Willis (1998). Asking survey respondents about health status: judgment and response issues. In: Schwarz N, Park D, Knauper B, Sudman S, eds. *Cognition, Aging, and Self-Reports*. Ann Arbor, Michigan: Taylor and Francis.
- Schroeder, Dirk G., Reynaldo Martorell and Rafael Flores (1999). Infant and child growth and fatness and fat distribution in Guatemalan adults. *American Journal of Epidemiology* 149(2):177-85.
- Sen, A. (2002). Perception versus observation. *British Medical Journal* (324):859-860.
- Smith, J. (1994). Measuring health and economic status of older adults in developing countries. *Gerontologist* 34(4):491-496.
- Smith, L. A., L. G. Branch and P. A. Scherr (1990). Short-term variability of measures of physical function in older people. *Journal of American Geriatric Society* 38:993-998.
- Soldo, B. J., and M. Hill (1995). Family structure and transfer measures in the health and retirement study: background and overview. *Journal of Human Resources, Supplement* 108-137.
- Stump, T. E., and others (1977). The structure of health status among Hispanic, African American, and white older adults. *Journals of Gerontology* 52B (Special Issue):49-60.
- Vaupel, J., K. Manton and E. Stallard (1979). The impact of heterogeneity in individual frailty on the dynamics of mortality. *Demography* 16(3):439-454.
- Waller, H. T. (1984). Height, weight, and mortality: the Norwegian experience. *Acta Med Scand, Supplementum* 1984; 679:1-56.
- Wadsworth, Michael (1986). Serious illness in childhood and its association with later life achievements. In: *Class and health: research and longitudinal data*. Pages 50-74. Tavistock Publications, London.
- Wadsworth, Michael and Diana Kuh (1997). Childhood influences on adult health: a review of recent work from the British 1946 national birth cohort study, the MRC National Survey of Health and Development. *Paediatric and Perinatal Epidemiology* 11:2-20.

- Wallace, A. R. (1995). Overview of the health measures in health and retirement study. *Journal of Human Resources, Supplement* 84-107.
- Warner, David and Mark D. Hayward (2003). A life course model of race disparities in men's mortality: the role of childhood social conditions. Working paper, Population Research Institute and Department of Sociology, Pennsylvania State University.
- World Bank (2004). World Development Indicators 2004 CD-ROM. Washington D.C.
- Wray, L. A., A. R. Herzog and D. C. Park (1996). Physical Health, Mental Health, and Function Among Older Adults. Presented at the Annual Meetings of the Gerontological Society of America, November, Washington, DC.
- Wray, L. A., and Lynch J. W. (1998). The role of cognitive ability in links between disease severity and functional ability in middle-aged adults. Presented at the Annual Meetings of the Gerontological Society of America, November, Philadelphia.