Effect of Early Conditions on Functional Status among Elderly in Latin-America and the Caribbean

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I. Background

The effect of early conditions on later health conditions and socio-economic status has become a very rich area of study. Research findings continue to confirm that conditions in utero, at and around birth and during early childhood could irreversibly affect the risk of suffering chronic conditions later in life. Although the exact nature of the process and the underlying mechanisms are not yet well understood, a number of conjectures based on empirical relations have been formulated. According to them, malnutrition in utero and during early childhood as well as exposure to certain infectious diseases (such as rheumatic heart fever) increase the risk of experiencing cardiovascular and coronary disease, stroke, diabetes and chronic bronchitis (Barker, 1998). Exposure to systemic infections increases the risk of vascular diseases, Alzheimer, ischemic heart disease and also accelerates the aging process (Finch and Vaupel 2001). Recently, studies in Bolivia and Philippines identified prenatal and early postnatal factors that shape immune function (McDade, 2005).

We also know that chronic conditions such as diabetes, circulatory and cardiovascular diseases, stroke, pulmonary diseases (including asthma), Alzheimer and others strongly affect individual's functional capacity. This suggests that there could be at least an indirect connection between early conditions and functional limitations. In this paper we set out to investigate the nature of indirect connections implied by the existing body of evidence. We also attempt to identify the existence and magnitude of potential direct relations between early child conditions and functional limitations

II. Objectives and importance

Current cohorts of elderly people in Latin America and the Caribbean (LAC) are unique since they survival to old ages is due largely to medical interventions and to a lesser extent, to significant improvements in standards of living. This means that most childhood morbidity responsible for higher mortality before medical improvements were put in place continued to affect these cohorts, albeit with reduced lethality (Palloni, McEniry, Wong, Pelaez, 2006). This fact provides a target group of people for which the effect of poor early conditions can be captured at older ages because the selection phenomenon due to mortality is significantly reduced. Some evidence of early malnutrition and higher risk of suffering diabetes among elderly people in LAC has been found and even stronger evidence supports the connection between rheumatic fever and adult heart diseases (Palloni et al., 2006). However, there are so far no studies linking early conditions to the risk of experiencing disability.

The aim of the present study is to assess differentials in the risk of being disabled according to the early conditions experienced by the populations of LAC. We also study the underlying mechanisms related to non-communicable diseases that could be

increasing the risk of being disabled for those who have been exposed to poor early conditions.

III. Data, Model and Methods

Data

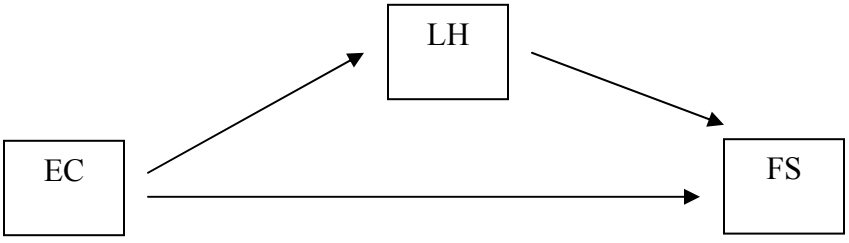
We use data from the Puerto Rican Elderly: Health Conditions survey -PREHCOI, 2000- (Palloni, 2000) and from the survey of Salud, Bienestar y Envejecimiento en América Latina y El Caribe - SABE, 2000 (Peláez et al, 2003). The PREHCO study is a national-level representative and longitudinal survey of Puerto Rican people over 60 years old. We use the first wave of the PREHCO study (PREHCO I), which is currently available. The sample size of PREHCO I is 4,293 individuals, 90% of whom have survived and are being followed-up (PREHCOII, 2006-2007).

The SABE survey is a cross-sectional study of people aged 60 years and over which was carried out in 7 cities of Latin America and the Caribbean (Bridgetown, Barbados; Buenos Aires, Argentina; La Havana, Cuba; Mexico City, Mexico; Montevideo, Uruguay; Santiago de Chile, Chile; Sao Paulo, Brazil), at the end of 1999. The sample design allows for strict comparability among the cities. Sample sizes range from 1,043 individuals in Buenos Aires to 2,143 in São Paulo (Palloni and Peláez, 2002).

Both sets of surveys offer the opportunity to study functional conditions, adjusting not only for demographic factors, socio-economic conditions and behavioral and health characteristics, but also for a wide range of retrospective variables that capture the early socio-economic and health conditions around which the interviewed individuals grew up. Most measures of health conditions were collected by means of self-reported questions, but anthropometric measures and some types of physical tests were also collected in order to provide objective measurements of health and functional status.

The Model

FIGURE 1



EC: early conditions
LH: Later health (in adulthood and old ages)
FS: Functional status (disabled or active)

Figure 1 displays the hypothesized relationships between early conditions and later functional status that we analyze in this paper. Early conditions could directly affect functional performance later in life directly (EC-FS), because some physical problems

have their origins at birth or during childhood. Alternatively, early conditions could have an indirect effect on functional performance (EC-LH-FS) by increasing the risk of experiencing some diseases whose secondary effects could impair functionality

To estimate the differential risk of being disabled as an older adult for an individual who has experienced poor early conditions, relative to a person who did not, and to identify the mechanisms through which the poor early conditions could affect later functional performance we use a simple decomposition analysis. We define the probability of being a disabled person for individuals who experienced poor early conditions as:

$$a)\ d_{x(pec)} = d_{x(pec,\ Ii)} * pr_{x(pec,\ Ii)} + d_{x(pec,\ \bar{I}i)} * pr_{x(pec,\ \bar{I}i)}$$

Where:

$d_{x(pec)}$ = *probability of being disabled having experienced poor early conditions;*

$d_{x(pec,\ Ii)}$ = *probability of being disabled having experienced poor early conditions and suffer illness i;*

$pr_{x(pec,\ Ii)}$ = *probability of suffering illness i having experienced poor early conditions;*

$d_{x(pec,\ \bar{I}i)}$ = *probability of being disabled having experienced poor early conditions and does not suffer illness i;*

$pr_{x(pec,\ \bar{I}i)}$ = *probability of does not suffer illness i having experienced poor early conditions.*

Similarly, we decompose the probability of being disabled for those who did not experience poor early conditions as follow:

$$b)\ d_{x\ (\bar{pec})} = d_{x\ (\bar{pec},\ Ii)} * pr_{x\ (\bar{pec},\ Ii)} + d_{x(\bar{pec},\ \bar{I}i)} * pr_{x(\bar{pec},\ \bar{I}i)}$$

In order to measure the conditional probabilities of being disabled and the conditional probability of suffering from illness "i" we estimate logistic regression models adjusting for age, sex, early conditions and also controlling for confounding variables such as current socio-economic conditions and behavioral characteristics (such as smoking status). To estimate the probability of being disabled we control for illnesses which are not related (or at least could be less related) to poor early conditions but that could affect functional performance. Examples are cancer, arthritis, rheumatism and osteoporosis (confounding health variables). We also control for illnesses that are related to poor early conditions such as diabetes, stroke, coronary diseases and pulmonary and respiratory problems.

Armed with estimates of the components in equations (A) and (B) we are able to assess both the difference in risk of being disabled for people exposed to poor early conditions (relative to people who did not have such an experience) and the relative importance of each illness.

Measures of Disability and Early Conditions

To separate the sample into groups of disabled and non-disabled individuals, we use a general definition according to which individuals who suffer at least one limitation in ADL or IADL or has serious cognitive problems (they fail a cognitive test), are

considered disabled. Non-disabled individuals are those who do not suffer any ADL, IADL limitation and also have no serious cognitive impairment. We will test the sensitivity of results to these definitions by using other criteria to classify individuals according their functional conditions.

Since there are many variables that inform us about early conditions in both the PREHCO and SABE databases, we use a multivariate method that allows us to reduce dimensions into a few "new variables" (clusters) which contain homogeneous groups of individuals with respect to early experiences. Since the variables describing early conditions attempt to tap different domains we divide them into two sub-groups (according to the nature of the information elicited). The first group is related to the socio-economic conditions that the individual's family experienced during his/her childhood. Here we consider responses to questions such as: "did your father lose his work when you were a child?" or "did you mother know how to read and write at that time?". The second group is comprised of indicators for illnesses and health status during childhood, such as general health conditions, how often individuals suffered illness, and responses to questions eliciting experience with specific diseases such as rheumatic fever, typhus fever, hepatitis, tuberculosis, polio, malaria, dengue, measles, chickenpox, mumps, smallpox, pneumonia, asthma and bronchitis. Using each group of early-condition variables and applying cluster analysis, we obtain three clusters for socio-economic early conditions and two clusters for early health conditions.

The SABE study included only a few questions about socioeconomic conditions during childhood (general socioeconomic situation of the family and nutritional intake during the first 15 years of life). Thus, in this data base we define three clusters which jointly comprise all early-condition variables,. The principal variables related to early health in the SABE survey are nephritis, hepatitis, tuberculosis, rheumatic fever, asthma and chronic bronchitis.

IV. Preliminary Results

Tables 1a and 1b display estimates for the logistic regressions where the dependent variables are disabled/non-disabled. We observe that illnesses such as arthritis, rheumatism, osteoporosis, hypertension, asthma, pulmonary disease, heart attack, heart disease and stroke have powerful and significant effects on functional limitations. In the case of Puerto Rico the effect of severe diabetes (insulin-dependent) remains significant even after controlling for high blood pressure. Remarkably, the parameters of the variables proxying for poor early conditions are highly significant for all countries even after controlling for both confounding effects and the aforementioned diseases. This result suggests that, in addition to the effect of current health status on functional performance, **poor early conditions affects functional status via direct mechanisms.**

Tables 2a and 2b display results of estimating logistics models for each disease (presence/absence dichotomous dependent variables). Note that we only select diseases that are potentially related to functional limitations. Of these, we only show the diseases for which the estimated parameters associated with early conditions are significantly different from zero

Table 2a shows results for Puerto Rico. We observe that the estimated effects of poor early conditions are statistically significant for diseases such severe diabetes (insulin-dependent), hypertension, asthma, heart attack and heart disease. On the other hand,

results for Argentina, Mexico and Uruguay (Table 2b) indicate that poor early conditions affect the risk of suffering hypertension, asthma, heart attack and stroke.

To the extent that early conditions affect the prevalence of chronic conditions that are known to being disabling, these results suggest **that poor early conditions could affect later functional limitations via indirect mechanisms.**

To estimate the relative importance of the indirect mechanism through which early conditions affect functional status by heightening the risk of potentially disabling diseases, we apply the decomposition analysis described before. As a result of this exercise we are able to calculate the differential risk of being disabled among those with poor early conditions and among those with no poor early conditions associated with each disease.. In Puerto Rico we find that hypertension, heart disease, asthma and severe diabetes are the main mechanisms through which poor early conditions affect functional status later in life. This is due both to the higher risk of suffering the diseases as well as the higher risk of being disabled among people who experienced poor early conditions. In the case of hypertension (the most important indirect mechanism for Puerto Rico) the main component of the total effect is the higher conditional risk of suffering hypertension having experienced poor early conditions.

Hypertension is also the main indirect mechanism through which poor early conditions increase the risk of being disabled in Argentina, Mexico and Uruguay. In these countries we also find that heart attack, asthma and stroke are important conduits through which poor early conditions translate into functional impairments.

Contrary to our initial expectation, diabetes does not appear to be an important mechanism for the onset of disability in any of the populations studied. We suspect that this is due to the high correlation between hypertension and diabetes as most people experiencing even mild diabetes are at higher risk of hypertension.

TABLE 1a
Statistics of Adjusted Logistic Regression
PUERTO RICO

Y variable: Disabled **Independent variable**	**Coefficient**	
Quart1_Income	0.740	***
Quart2_Income	0.543	***
Quart3_Income	0.501	***
Write	0.869	***
Sex	0.040	NS
Age	0.058	***
Dummy poor SS condition	0.182	*
Dummy poor health condition	0.507	***
Cancer	0.127	NS
Arthritis or Rheumatism	0.531	***
Osteoporosis	0.535	***
Insulin-dependent	0.500	***
Non insulin-dependent	0.140	NS
Hypertension	0.335	***
Asthma	0.399	***
Pulmonary disease	0.520	**
Heart attack	0.377	**
Heart disease	0.439	***
Stroke	1.498	***
Smoked or smoke	0.177	**
_cons**	-7.648	***

* p-value < 0.10 ** p-value < .05 *** p-value < 0.01 NS non-significant

TABLE 1b
Statistics of Adjusted Logistic Regression
SABE cities[1]

Y variable: Disabled	Coefficient		
Independent Variables	**Buenos Aires**	**Mexico City**	**Montevideo**
Poor early conditions	0.18 ***	-	**reference category**
Poor early conditions (worst)	0.28 ***	0.26 ***	
Good early conditions	**reference category**	**reference category**	-0.67 ***
Good early conditions (best)			-0.83 ***
Age	0.08 ***	0.05 ***	0.07 ***
Sex (ref. category: man)	0.60 ***	0.59 ***	1.06 ***
Hypertension	0.40 ***	0.18 ***	0.03 ***
Diabetes no insulin	0.27 ***	0.03 ***	0.26 ***
Diabetes insulin	1.29 ***	0.60 ***	0.72 ***
Heart attack	0.81 ***	0.36 ***	0.71 ***
Stroke	1.20 ***	0.76 ***	2.07 ***
Asthma/ bronchitis	0.14 ***	0.60 ***	0.47 ***
Cancer	0.54 ***	0.41 ***	0.64 ***
Rheumatism	0.46 ***	0.43 ***	0.71 ***
Years of schooling	-0.07 ***	-0.14 ***	-0.08 ***
Smoked but not now	-0.35 ***	-0.01 NS	0.42 ***
Still smoke	-0.14 ***	-0.32 ***	0.18 ***
Constant	-7.42 ***	-4.60 ***	-6.52 ***

* p-value < 0.10 ** p-value < .05 *** p-value < 0.01 NS non-significant

TABLE 2a
Statistics of Adjusted Logistic Regression
PUERTO RICO

Independent variables	**Y variable: Insulin Dependent**		**Y variable: Hypertension**		**Y variable: Asthma**		**Y variable: Heart Attack**		**Y variable: Heart Disease**	
Quart1_Income	0.15	NS	0.04		0.08		0.261		0.27*	*
Quart2_Income	-0.02	NS	-0.05		0.04		-0.096		0.03	
Quart3_Income	0.07	NS	-0.05		-0.05		0.093		0.22	
Sex	0.37	**	0.33	***	0.70	***	-0.330	**	-0.07	
Age	-0.03	***	0.01		-0.02	***	0.019	**	0.02**	**
Dummy poor SS condition	0.159	NS	0.10		0.13		0.059		0.26**	**
Dummy poor health condition	0.26	*	0.29	***	0.69	***	0.480	***	0.51***	***
_cons	-1.47	**	-0.77	**	-1.99	***	0.215	***	-3.07***	***
Smoke							-3.403	**		

* p-value < 0.10 ** p-value < .05 *** p-value < 0.01

[1] For this preliminary version of our paper, we display the results for some SABE cities that we have already analyzed.

TABLE 2b
Statistics of Adjusted Logistic Regression
SABE – cities [2]

Independent Variables	Y Variable: HYPERTENSION		Y Variable: HEART ATTACK		Y Variable: ASTHMA		Y Variable: STROKE	
				BUENOS AIRES				
Poor early conditions	0.30	***	0.22	***	0.26	***	0.40	***
Poor early conditions (worst)	0.17	***	0.31	***	1.14	***	0.73	***
Age	0.01	***	0.02	***	0.02	***	0.04	***
Sex	0.15	***	0.04	***	-0.59	***	-0.73	***
Years of schooling	-0.01	***	-0.01	***	-0.06	***	-0.01	***
Smoked but not now	0.20	***	0.51	***	-0.04	***	0.28	***
Still smoke	-0.04	***	0.02	**	-0.14	***	-0.42	***
Constant	-0.90	***	-2.81	***	-3.72	***	-5.66	***
Independent Variables				**MEXICO CITY**				
Poor early conditions	0.22	***	0.49	***	0.47	***	0.05	***
Age	0.02	***	0.03	***	0.03	***	0.03	***
Sex	0.30	***	0.19	***	0.44	***	-0.30	***
Years of schooling	0.003	***	0.004	***	-0.07	***	-0.02	***
Smoked but not now	-0.12	***	0.63	***	0.52	***	0.32	***
Still smoke	-0.33	***	0.25	***	0.40	***	0.08	***
Constant	-1.59	***	-4.68	***	-4.40	***	-4.59	***
Independent Variables				**MONTEVIDEO**				
Good early condition	-0.38	***	-0.42	***	-1.44	***	-1.11	***
Good early condition (best)	-0.41	***	-0.59	***	-1.35	***	-0.88	***
Age	-0.03	***	0.02	***	0.02	***	0.02	***
Sex	0.32	***	0.05	***	-0.18	***	-0.20	***
Years of schooling	-0.01	***	-0.03	***	0.01	***	-0.02	***
Smoked but not now	-0.02	***	0.30	***	0.51	***	-0.78	***
Still smoke	-0.92	***	-0.83	***	0.03	*	-0.98	***
Constant	2.52	***	-2.32	***	-2.61	***	-3.24	***

* p-value < 0.10 ** p-value < .05 *** p-value < 0.01 NS non-significant

[2] For this preliminary version of our paper, we display the results for some SABE cities that we have already analyzed.

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