Onset of Disability and Mortality in Older Adults in Mexico: the role of co-morbidities
Cesar Gonzalez-Gonzalez, Rafael Samper-Ternent, and Rebeca Wong

Introduction

Mexico's population is growing older. Life expectancy at birth has increased constantly from 34 years in 1930 to 75 years in 2010 (INEGI, 2010). The elderly are becoming a numerically important group; in 2007 the proportion of older adults represented 8% of the total population; in 2030, the proportion will be 17%; and by 2050, over 28% (CONAPO, 2007).

Also, it is well-known that disabilities are more prevalent among adults at advanced ages. In Mexico, according to figures from 2010 Census sample, 5.1% of the total population reports having disability (at least one of 6 physical or mental disabilities), but among older adults the percentage ranged from 16.7 (60-69 years old) to 51.1 percent (80+ years old).

Parallel to the aging process, an increase in the prevalence of non-communicable chronic diseases will have a profound impact on disability and mortality. According to the WHO Global Disability Report (2011), "diabetes, cardiovascular diseases (heart disease and stroke), mental disorders, cancer, and respiratory illnesses, are estimated to account for 66.5% of all years lived with disability in low-income and middle-income countries". Estimates from the Mexican Health Department report that 84% of deaths in Mexico are due to non-communicable diseases and injuries, and 53% are concentrated in those over 65 years (Secretaría de Salud, 2007)

In addition to the epidemiological changes manifested by the increasing prevalence of non-communicable diseases, communicable diseases are still an important cause of health and functional impairments in developing countries like Mexico. While some communicable diseases are more likely to lead to disability than others (Hardy and Gill, 2004), many of these diseases affect different life domains among older adults, such that in combination with non-communicable diseases may produce higher rates of disability compared to populations in developed countries.

A wide range of factors are related with disability, including individual, socioeconomic, cultural, and environmental. Evidence shows that people with disabilities experience higher rates of poverty, lower employment rates, and have less education compared to people without disabilities. They also have unequal access to health care services and therefore have unmet health care needs compared with the general population" (WHO, 2011).

Given the current and projected scenario of fast aging, increased prevalence of non-communicable chronic diseases in the presence of significant rates of communicable diseases, unfavorable economic, social and family conditions in developing countries, it is imperative to identify the impact that comorbidity of these two types of diseases is likely to have on the onset of disability and mortality among older adults in developing countries. The purpose of this paper is to examine the effect of this comorbidity using a national longitudinal study of older adults in Mexico. The overarching hypothesis is that, compared to individuals who report having only-non-communicable diseases, the joint presence of a communicable disease increases the odds of disability onset and mortality. If this is true, then this implies that developing countries that are aging fast are likely to experience higher burden of disability compared to the experience of developed countries that aged earlier, under more advanced socioeconomic conditions.

Methods

Data

We use data from the Mexican Health and Aging Study (MHAS), the first panel study of health and aging in Mexico, which was a national and urban/rural representative sample of the population aged 50 and older in Mexico at the baseline, in 2001. MHAS was designed to study the process of aging, including illness, disability, and mortality with a broad socioeconomic perspective. Information from adults aged 50 years and older in the two waves of the study (2001 and 2003) is used in this paper. Adults with incomplete information on disability measures at the baseline are excluded (n=3,151), resulting in a final analytical sample of 12,251 subjects representing around 13 million adults in Mexico.

Measures

Disability

Disability is defined as self-reported difficulty to perform any of the following activities of daily living (ADL): walking, bathing, eating, getting in and out of bed, toileting, and dressing. The ADL functional capacity is dichotomized into "No ADL disability" (no ADL limitation) and "ADL disability" (at least one ADL limitation).

For those without disability at baseline we identified 4 transitions between baseline and follow-up, a) same no ADL disability, b) onset of ADL disability, c) no ADL disability to death, and d) no ADL disability to Lost-to-Follow-up. For example, an individual reporting no ADL disability at baseline, who in 2003 reports difficulty with at least one ADL, is included under the onset of ADL disability category.

Comorbidities

To identify medical conditions, subjects were asked if a doctor or medical personnel had ever told them that they have specific chronic diseases. Seven non-communicable diseases were considered: hypertension, diabetes, cancer, heart attack, lung disease, stroke, and arthritis. Conditions were analyzed individually and also in categories; four categories were created, 1) cardiovascular diseases (CVD), 2) CVD and others, 3) other combination), and 4) without disease.

Subjects were also asked if a doctor or medical personnel had ever told them that they have specific communicable diseases. Four were considered: liver or kidney infection, tuberculosis and pneumonia; we grouped the communicable diseases through time and created four categories, a) without communicable diseases in both years, b) communicable diseases only in 2001, c) communicable diseases only in 2003 and d) communicable diseases in both years.

Covariates

Other variables included in the analysis are age (continuous), sex, education (continuous), residence (more urban vs. less urban), falls in the last two years and total income (less than one minimum wage vs. one minimum wage or more[1]).

Statistical Analysis

The analysis includes descriptive statistics and three multinomial regression models for disability onset or mortality to account for: a) the effect of non-communicable diseases, b) the effect of communicable diseases, and c) the combined effect of both groups of disease (see table 3). All models control for sex, age, education, locality size of residence, falls and total income.

Results

[1] Monthly minimum wage was around 145 American dollars in 2001.

At baseline, 91.8% of the population reports having no disability. Of this group 87.4% reported No ADL disability in 2003, 4.8% reported onset of Disability, 2.5% died, and 5.3% are lost to follow-up (LTF).

According to the results presented in table 1, there is a group where disability is present even in the absence of disease. Higher number of diseases is associated with an increase in the percentage of people going from No disability at baseline to disability and death at follow-up. Also, people at older ages, women, the less educated and those living in less urban localities are more likely to have an onset of Disability or to die by 2003.

Table 1: Percentage distribution of health and demographic characteristics of the population without disability in 2001 by outcome in 2003.

Variables	Outcome in 2003				Total
	Same No ADL	Onset of ADL	No ADL Death	No ADL to LTF	
N	9,707	630	282	614	11,233
Total (%)	87.4	4.8	2.5	5.3	
Number of non-communicable diseases in 2001					
0	88.9	3.8	1.4	6.0	
1	88.7	4.1	2.8	4.4	
2+	82.0	8.6	4.6	4.7	
Age (years)	61.5	67.2	69.2	60.5	
Sex (%)					
Women	86.7	5.9	1.9	5.6	
Men	88.2	3.6	3.2	5.0	
Education (years)	4.1	2.6	3.4	5.9	4.1
Locality size (%)					
Less urban	88.1	6.1	2.4	3.4	
More urban	86.6	3.3	2.6	7.5	

For those reporting just one non-communicable disease in 2001, disability transitions were calculated for each disease. The purpose is to identify which type of disease has the greatest impact on onset of disability or death. Reporting a stroke at the baseline has the highest impact on onset of ADL with 14.7% of subjects falling in this category. 5.7% of those reporting diabetes in 2001 were reported as dead in 2003, and for those reporting stroke in 2001, 7.3% are LTF in 2003 (see table 2).

Table 2: Percentage distribution of self-reported non-communicable diseases in 2001 of the population without disability in 2001 by outcome in 2003.

With just …	**Outcome in 2003**			
	Same No ADL	Onset of ADL	No ADL Death	No ADL to LTF
One disease	86.2	5.8	3.5	4.5
Hypertension	85.8	6.0	3.7	4.6
Diabetes	82.1	6.4	5.7	5.8
Cancer	87.1	6.9	4.2	1.9
Heart Attack	81.0	7.5	5.5	6.0
Lung disease	86.1	5.0	4.1	4.9
Stroke	73.0	14.7	5.0	7.3
Arthritis	85.3	7.8	3.3	3.7

Three multinomial regression models were calculated. Model one examines the effects of non-communicable diseases, the second one the effects of communicable diseases, and the third model includes both type of diseases, all models were controlled by socio-demographic characteristics.

In model 1, for those reporting no disability in 2001 (N = 11,233), diabetes, stroke and arthritis increased the Relative Risk Ratio (RRR) of reporting disability in 2003 compared to those that remained without disabilities. Only diabetes, when present alone, increases the RRR of transition from no disability to death. Almost all the non-communicable disease combinations lead to disability or death. The more educated, those living in urban areas and those with higher wealth have lower RRR of onset of disability. In model 2, communicable diseases at follow-up increase the RRR of transition into disability or death in comparison to remaining without disability.

In Model 3, where communicable and non-communicable diseases are together, the direction and magnitude of the RRR remains very similar to what is observed in the preceding models with few exceptions. For example, for communicable diseases, the category only in 2001 become non-significant for onset of disability; the same happens with education. Falls and age increase the RRR to have an onset of disability, meanwhile those living in a more urban locality, with higher income and women have lower risk of developing disability. Also, the model shows that population at older ages and men are at higher risk of death.

Conclusions

Among older adults without disability, communicable and non-communicable diseases have an effect on disability progression and the transition to death, but not on the group lost to follow-up. Disease combinations (2+), CVD and CVD and others, have a significant effect on mortality; and any disease combination increases the risk of disability onset. Communicable diseases at follow up have a greater impact on mortality, meanwhile non-communicable have it on onset of disability.

The full paper includes the conceptual framework, a more-detailed descriptive section with the types and number of disabilities by types of disease, as well as details of statistical significance. The conclusions and discussion in the paper speculate about the way in which the predicted prevalence of infectious and chronic conditions will impact the burden of disability in poor countries that are aging fast.

References

CONAPO (2007), “8.5 millones de mexicanos tienen 60 años o más”, *Comunicado de prensa 30/07*. México, D.F. Agosto de 2007.

WHO and World Bank (2011), “World Report on Disability”.

Secretaría de Salud (2007), “Programa Nacional de Salud 2007-2012. Por un México sano: construyendo alianzas para una mejor salud”. México: Secretaría de Salud.

Multinomial regression for disability status in 2001 and the effect of prevalence of comorbidity in 2001 on disability transitions between 2001 and 2003 (RRR)

Reference category (Same No ADL)

	Model 1. Non-communicable Diseases						Model 2. Communicable Diseases						Model 3. Communicable and Non-communicable					
	Onset of ADL		No ADL to Death		No ADL to LTF		Onset of ADL		No ADL to Death		No ADL to LTF[5]		Onset of ADL		No ADL to Death		No ADL to LTF[5]	
	RRR	Z	RRR	Z	RRR	Z	RRR	Z	RRR	Z	RRR	Z	RRR	Z	RRR	Z	RRR	Z
Non-communicable																		
Hypertension	1.154		1.136		0.903								1.139		1.096		0.914	
Diabetes	1.778	**	2.780	***	1.049								1.744	**	2.632	***	1.081	
Cancer	0.473		2.081		1.002								0.438		1.765		1.112	
Heart	0.521		2.604		0.797								0.507		2.547		0.813	
Lung	1.312		1.634		0.968								1.263		1.462		1.011	
Stroke	4.766	***	0.996		1.372								4.806	***	1.072		1.393	
Arthritis	2.059	***	0.920		1.070								2.010	***	0.888		1.105	
COMBINATIONS (more than one disease)																		
CVD[1]	2.479	***	2.924	***	0.912								2.309	***	2.482	***	0.979	
CVD and others[2]	3.280	***	1.927	***	1.076								3.008	***	1.597	*	1.170	
Another combination	2.612	***	1.832		0.251	*							2.300	***	1.396		0.284	*
Communicable (Without in both years)[3]																		
Only in 2001							1.558	**	1.689836	*	1.119		1.308		1.569	*	1.098	
Only in 2003							2.692	***	5.616597	***			2.462	***	5.219	***		
Both years							2.627	***	4.836077	***			2.114	***	4.278	***		
Falls	1.274	**	1.062		0.845		1.316	**	1.067367		0.889		1.244	*	1.023		0.868	
Age	1.060	***	1.085	***	0.990		1.064	***	1.087161	***	0.989	*	1.062	***	1.087	***	0.988	*
Sex (men)	0.751	**	1.428	**	0.956		0.680	***	1.379535	*	0.946		0.756	**	1.434	**	0.949	
Education (continuous)	0.974	*	0.974		1.034	***	0.973	*	0.9800396		1.033	***	0.977		0.977		1.033	***
More urban Locality	0.836	*	1.213		1.942	***	0.872		1.295319		1.893	***	0.836	*	1.220		1.931	***
Total income (1+ minimum wage)[4]	0.805	*	0.942		1.325	**	0.817	*	0.9538354		1.317	**	0.803	*	0.932		1.314	**

*** P-value < .001, ** P-value < .01, * P-value < .05.

[1] Includes: Hypertension, Diabetes, Heart Attack or Stroke

[2] Other include: Arthritis or Lung disease or Cancer

[3] Includes: Kidney or Liver infection, tuberculosis and pneumonia

[4] Minimun wage were around 145 american dollars in 2001

[5] In 2003 there is no information on communicable diseases for the LTF population.