Gender differences in life expectancy and disability-free life expectancy among older adults in São Paulo, Brazil

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[PLEASE DO NOT INCLUDE ENTIRE MANUSCRIPT IN THE MEETING PROCEEDINGS – PAPER IS UNDER REVIEW]
Abstract

The goal of the present study is to investigate gender differences in total life expectancy (TLE), disability-free life expectancy (DFLE), disabled life expectancy (DLE), and personal care assistance among older adults in São Paulo, Brazil and to discuss the implications for public policies. The sample was drawn from the dataset of Salud, Bienestar, y Envejecimiento (SABE), a large longitudinal study conducted in São Paulo (N=2,143). The study assessed disability through the Activities of Daily Living (ADL) measure. The interpolation of Markov Chains method was used to estimate differences in the TLE, DLE, and DFLE by gender. TLE at age 60 is approximately five years higher for women than men. Women aged 60 are expected to live 28% of their remaining lives—twice the percentage for men—with at least one ADL limitation. These women also face more years (M=2.71, SE=0.42) with three or more ADL limitations than men (M=0.82, SE=0.16). In terms of personal care assistance, women receive more years of assistance than men. Among older adults in São Paulo, results indicate that women live longer lives, but face a higher and more severe disability burden than men. In addition, although women receive more years of personal assistance than men; they face larger unmet care assistance needs.

KEYWORDS: aging, gender, Brazil, life expectancy, disability.
Gender Differences in Life Expectancy and Disability-Free Life Expectancy among Older Adults in São Paulo, Brazil

Recent studies have observed an aging process affecting developing countries that is accelerated in comparison with developed countries in North America and Europe (Palloni, Pinto-Aguirre, & Peláez, 2002; Palloni, Mc Eniry, Wong & Peláez, 2006; United Nations, 2009). By 2050, approximately four of every five older adults in the world are expected to live in developing countries (United Nations, 2009). In particular, the Latin American and Caribbean region has experienced a drastic and fast-paced growth of the elderly population as a result of significant demographic transformations in the past decades (Palloni, et al., 2002; Palloni et al., 2006). Brazil is one of the countries experiencing a rapid aging process. The proportion of older adults (age 60 and over) increased from 4.6% in 1950 to 8.7% in 2010 (CELADE, 2000). By 2050, one in every five persons in Brazil will be 60 or more years of age (CELADE, 2000). In 2010, 18.7 million individuals in Brazil were age 60 and over and this number will reach 60 million by 2050 (CELADE, 2000). Population growth is even faster among the oldest-old (80 years and older). By 2050, Brazil will be one of the six countries with the largest numbers of oldest-old citizens (about 14 million) (United Nations, 2009).

Life expectancy at birth in Brazil has increased from 51 years in 1950 to nearly 72 years in 2005; further increases are expected in the upcoming decades (CELADE, 2007). Older women outnumber older men in Brazil. In 2010, women constituted 56% of the population age 60 and over and 63% of the oldest-old population. Older Brazilian women have higher life expectancies than men and their gains in life expectancy have been larger
than among men. Life expectancy at age 65 increased 5.6 years among women, while the gains reached 3.6 years among men over a period of 50 years (CELADE, 2007).

Research on life expectancy has demonstrated the negative impact of disability on the health of older adults and its differential effects on women as measured by their higher disabled life expectancy (Gispert, Ruiz-Ramos, Bares, Viciana, & Clot-Razquin, 2007). This literature has contributed to a growing debate about whether greater life expectancy implies better health for the expanding surviving elderly female population (Andrade, 2009a; Andrade 2009b; Camargos, Perpetuo, & Machado, 2005; Camargos, Machado, & Rodrigues, 2007; Gispert et al., 2007).

Previous studies demonstrated that while women live longer (Verbrugge, 1989), they are more likely to report worse self-rated health and to have a higher prevalence and incidence of disability, lower mobility and decreased strength than men at older ages (Al Snih, Fisher, Raji, Markides, Ostir, & Goodwin, 2005; Case & Paxson, 2005; Oman, Reed, & Ferrara, 1999). Consequently, findings have shown that women live a larger proportion of their later years with disability compared to men (Camargos et al., 2007; Crimmins & Saito, 2001; Laditka & Laditka, 2002; Reyes-Beaman, Jagger, Garcia-Peña, Muñoz, Beaman & Stafford, 2005; Reyes-Ortiz, Ostir, Peláez, & Ottenbacher, 2006; Robine, Romieu, & Cambois, 1997).

Few studies have focused on gender differences in health expectancies in Latin America and the Caribbean (Barbosa, Souza, Lebrao, Laurenti, & Marucci, 2005; Camargos et al., 2007; Camargos, Machado, & Rodrigues, 2008; Guerra, Alvarado, & Zunzunegui, 2008; Zunzunegui, Alvarado, Beland, & Vissandjee, 2009). Findings have indicated that, compared to men, women report experiencing worse health conditions and
more frequent functional limitations (Camargos et al., 2007; Camargos et al., 2008; Del Duca, Silva, & Hallal, 2009; Palloni, et al., 2006; Zunzunegui et al., 2009). Previous analyses based on data from the first wave of the Salud, Bienestar, y Envejecimiento (SABE) in São Paulo, Brazil show that women are more likely to report having difficulties performing the activities of daily living (Duarte, Lebrão, & Lima, 2005; Guerra et al., 2008) and have higher prevalence of disability as measured by the physical performance test (Barbosa et al., 2005). Camargos and colleagues used the Sullivan method to estimate disability life expectancy among men and women (Camargos, et al., 2005; Camargos et al., 2007). The authors’ results confirmed that older women had higher life expectancies, but were more likely to be functionally disabled and to live a higher proportion of their remaining lives with severe functional limitation than men (Camargos, et al., 2008).

Recent studies on gender differences in health and functional status in Latin America have focused on the impact of socio-economic and health factors throughout the life course to explain gender differences in mobility (Alvarado, Guerra, & Zunzunegui, 2007; Zunzunegui et al., 2009). Findings have shown that worse health among women is not related to poor socioeconomic status at early ages. Rather, results have suggested that the gender gap might be explained by other socio-economic, psychological, and biological factors such as health care access, lack of autonomy, biological differences (e.g., immune markers, hormones, and body composition), physical activity, domestic violence, and other stressors throughout the life course (Alvarado et al., 2007; Zunzunegui et al., 2009).
Although previous studies have revealed a great deal about health differentials between men and women and the factors responsible for these differentials, most previous studies are based on cross-sectional data. The availability of data, in particular longitudinal data pertaining to functional disability, on Latin America and the Caribbean is relatively recent (Camargos et al., 2008). Therefore, most studies have used cross-sectional data and the Sullivan method to estimate healthy life expectancies; this has been the case in studies on Brazil (Camargos et al., 2005; Camargos et al., 2007; Camargos et al., 2008). The Sullivan method provides estimates of health expectancy with few data requirements—age-specific prevalence of the health state (usually obtained in cross-sectional surveys) and age-specific mortality from a life table. However, the adoption of this method fails to account for possible changes in the health conditions of the population (e.g., recovery and incidence rates). The current study is the first to use a multi-state model and longitudinal data to estimate disability-free life expectancy by gender in Brazil.

The objective of this study is to investigate differences in total life expectancy (TLE), disability-free life expectancy (DFLE), and disabled life expectancy (DLE) between older adult males and females in São Paulo, Brazil. Because the duration of disability has an impact on the demand for personal care, we also explore differences in the number of years that individuals with and without disability will require assistance to perform ADL activities. Finally, this study addresses the public policy implications of these findings.

**Methods**

This study analyzes data from two waves of SABE São Paulo, Brazil. SABE is a
multi-center survey with respondents in seven capital/major cities throughout the countries of Latin America and the Caribbean that investigates the health and well-being of older adults (age 60 and over). The Pan American Health Organization (PAHO/WHO), the Center for Demography and Ecology at the University of Wisconsin-Madison, and the National Institute on Aging provided funding and support for the general survey. In Brazil, the São Paulo State Research Foundation (FAPESP) provided additional support. Faculty members at the School of Public Health (Faculdade de Saúde Pública) and São Paulo University (Universidade de São Paulo) coordinated data collection in Brazil. The study was approved by Institutional Review Boards at the collaborating institutions (Palloni et al., 2002; Peláez, et al., 2005; Wong, Peláez, Palloni, & Markides, 2006). Participants provided consent to have their data used for research purposes.

The baseline sample in São Paulo was obtained using a two-stage stratified sampling based on the 1995 National Household Survey master sampling frame. Individuals age 75 and over were oversampled. Data in the first wave was collected in two stages. The first stage was a household interview conducted by a single interviewer using a standardized questionnaire that included several questions about the living conditions and health status of the older adult. The second stage of data collection was a household visit by a pair of interviewers who completed anthropometric and physical performance measurements. Data for the first wave was collected during 2000 and the first quarter of 2001. In the baseline, response rates reached 84.6% in São Paulo. The first stage contains information on 2,143 individuals, while the second stage measurements were taken for 1,894 subjects (88.4% of the first stage respondents). The main reasons for non-participation in the second stage were refusal to participate (7.5%) and address
change (2.0%). Additional characteristics of the baseline data collection process have been described elsewhere (Albala et al., 2005; Duarte et al., 2005; Lebrão & Laurenti, 2005; Palloni & Peláez, 2002; Wong et al., 2006).

In 2006, the São Paulo researchers developed the first follow-up of the 2000 baseline survey. The researchers used mortality data from the Fundação Sistema Estadual de Análise de Dados (SEADE foundation, which analyzes relevant social, demographic, and economic data in the São Paulo state) and the Programa de Aprimoramento das Informações de Mortalidade, which collects and organizes mortality data for the São Paulo municipality) to identify subjects who had died between 2000 and 2006. The search was based on the names, sex, dates of birth, and addresses listed in the 2000 database.

Trained interviewers visited the addresses and neighbourhoods of the surviving participants from the 2000 survey in order to re-establish contact. For those not found during these visits, interviewers used the additional contact information collected in the baseline (e.g., telephone numbers of children or other relatives) to obtain information about their current location. In 2006, researchers collected data via face-to-face interviews using a standardized questionnaire. The 2006 questionnaire was very similar to the 2000 questionnaire but included additional questions which complemented the previous study. In the core questionnaire, respondents provided information about possible limitations on ADL measures. In this section of the questionnaire, the questions were the same in the baseline and in the first follow-up in 2006. Lebrão & Duarte (2008) outlined detailed information about the second data collection. Of the 2,143 participants in the first wave of SABE (Lebrão & Duarte, 2008) São Paulo, 544 (25.4%) died between
waves.

Measures

Self-reported limitations in six ADL—dressing, bathing, eating, getting in and out of a bed (transferring), toileting, and getting across a room—were used to measure disability. We dichotomized the ADL measure; a score of “0” indicated that the respondent did not have any limitations, and a score of “1” was assigned to those who reported having difficulty performing at least one activity in each scale. Individuals with 3 or more ADL limitations were classified as having “severe” ADL limitations. Finally, one additional measure captured the need for help with basic life activities. Respondents were asked whether a spouse or other person assisted them in performing any ADL. This information was converted into a binary measure in which respondents scored “0” if they indicated no need for assistance and “1” if they reported requiring assistance with at least one activity.

Statistical Methods

We used STATA 10.1 to perform a two-sided test for equality of proportions. A nonparametric test (‘nptrend’) that is an extension of the Wilcoxon rank-sum test was used to assess the trend in proportions across ordered age groups.

Estimates of DFLE and DLE were obtained using the multistate life table method. Usually, four transitions are measured in multistate models: incidence (disability-free to disabled), recovery (disabled to disability-free), and two types of mortality (disability-free to dead or disabled to dead) (Laditka & Hayward, 2003). There are also two retention statuses, as respondents declare being disability-free or disabled in both waves.

We used the 0.98g version of the IMaCh (Interpolative Markov Chain) software
developed by Brouard and Lièvre (2006) and cross-longitudinal data from MHAS to compute transition probabilities. Sample weights were employed in the analysis. IMaCh generates estimates of total and state-specific life expectancies and their standard errors, based on the methodology introduced by Laditka and Wolf (Lievre, Brouard, & Heathcote, 2003). The embedded Markov chain introduced by Laditka and Wolf (1998) and incorporated in the IMaCh software, applies the multistate life table model to shorter transition periods, which are embedded within the longer interval between surveys. For the current analysis, monthly transitions were computed.

To assess age and gender differences in health outcomes, we used multinomial (polytomous) logistic regression. The regressions were weighted using 2000 survey weights. Different trajectories were modeled as competing risks and two multinomial regressions were performed. The first included only subjects who did not have ADL limitations at the baseline, so we considered four health outcomes: a) remained non-disabled at wave 2 (baseline category), b) incidence of disability, c) mortality, and d) lost in the follow-up or missing data. In the second regression, we limited the analysis to those with ADL limitations at the baseline; therefore, the possible outcomes were: a) continue to have ADL, b) recovery from ADL, c) mortality, and d) lost in the follow-up or missing data.

**Results**

Table 1 presents the prevalence rates of ADL limitations and assistance by age group and sex in Brazil for the year 2000. Weighted estimates indicate that 19.2% of Brazilians age 60 and over reported having difficulty performing at least one ADL. The prevalence of ADL limitations was higher among women (22.3%) than among men
(14.9%) \((p < .01)\) and increased significantly with age \((p < .0001)\). Women ages 60-69 presented a greater prevalence of ADL limitations than men in the same age group \((p < .05)\), but between ages 70-79 the differences were not statistically significant. At older ages (80 and over), women were more likely to report ADL limitations than men \((p < .01)\). About 6% of Brazilians over 60 years of age were severely disabled. At ages 60-69, about 3% of the population faces severe ADL limitations, but this proportion reaches 18.5% at older ages \((p < .0001)\). The prevalence rates of severe ADL limitations were not statistically different between men and women at any age. The percentages of men and women receiving personal care assistance in 2000 were very similar; however gender differences were statistically significant for the oldest age group \((p < .05)\). Personal care assistance increases significantly with age for both males and females \((p < .0001)\).

Table 1 about here

Results in Table 2 are consistent with previous findings showing that, compared to men, women experience limitations for more years and for a greater proportion of their remaining lives. In fact, at age 60 women are expected to live twice as much of their remaining lives (6.1 years, 28%) with at least one ADL limitation as men (2.4 years, 14.2%). However, gender differences in DLE decrease with age. For both men and women, the proportion of years to be lived with ADL limitations increases with age. At age 60, men can expect to live, on average, 0.8 years with severe ADL limitations, whereas women can expect to live 2.7 years. Among men, DLE due to severe ADL limitations increases with age, reaching 1.6 years at age 80; in contrast, no trend is found among women. As age increases, DLE due to severe ADL limitations becomes increasingly greater as measured by the proportion DLE/TLE. At age 60, women can
expect to live 4.9% of their remaining lives with severe disability, whereas men can expect to live 12.7% of their lives in this manner. At age 80, DLE/TLE percentages are 22.5% and 31.9%, for women and men, respectively. Based on assistance data, the results indicate that men receive fewer years of personal assistance than women. However, the percentage of time individuals with ADL limitations live without personal care assistance is higher for women than for men at all ages. For instance, women aged 60, reported receiving assistance for 1.6 years out of the 6.1 years with ADL (27%), whereas men will receive for 0.8 years out of the 2.4 years with ADL (34.7%). This means that women with disability have higher unmet needs for assistance than men in Brazil.

[Table 2 about here]

Table 3 presents the results of the two multinomial logistic regressions. Women are more likely than men to develop ADL limitations between wave 1 and wave 2. Age is positively associated with incidence of ADL limitations and risk of mortality. In the second regression, the baseline category includes respondents with limitations in both waves. The results show that women and men are equally likely to recover (versus having a disability in both waves). However, women are less likely to die between waves than men. Mortality risks increase with age, whereas the likelihood of recovery decreases with age.

[Table 3 about here]

**Discussion**

The current paper has three goals. First, to examine the impact of gender on TLE, DFLE, and DLE taking health transitions into account. By using multistate models that incorporate health transitions (e.g., disability incidence and recovery) to provide
estimates of TLE and DFLE, findings from this study move beyond those from previous studies that used cross-sectional data from SABE-São Paulo (Camargos et al., 2005; Camargos et al., 2007; Guerra et al., 2008). The current method provides a more accurate model than the previously used Sullivan method. Results indicated that, compared to men, women at age 60 are expected to live twice as long with ADL limitations and nearly three times as long as with severe ADL limitations. These findings corroborate findings by Camargos and colleagues (Camargos et al., 2008); in addition, the current results show that gender differences in DLE are linked to longer life expectancy and a higher incidence of functional limitations among older women. There were no gender differences in recovery rates among those with ADL limitations in the baseline survey.

The second goal of the study was to examine the prevalence of unmet needs for personal care support. These estimates are particularly important for assessing the future need for personal care assistance among the aging Brazilian population. Results indicate that despite the fact that women will live more years with a disability, their need for personal care assistance goes unmet for a greater proportion of that time than for men. For example, among respondents with ADL limitations in the baseline survey, women are approximately 30% less likely to receive personal assistance than men after controlling for age ($p = 0.07$) (results not shown).

Finally, this study aims to address the policy implications of these findings. Data on the prevalence of disability in later life may be used to set priorities for public and health policy, specifically to estimate the human and financial resources required to face the pressing demands for health care that will arise from demographic changes. By drawing attention to gender differences in functional disability in later life, this study
illustrates the current demand for personal care and assistance due to the growth in the female population. Health care costs associated with disability impose a considerable economic burden for Latin American countries (Villarreal-Ríos et al., 2000). However, most estimates exclude unpaid assistance provided by family members. This exclusion is particularly significant for research on developing countries, where personal assistance is primarily the responsibility of families. Within households in most countries, women usually assume the role of caregiver, and this is the case in Brazil (Filmer, 2008; Medeiros, Diniz, & Squinca, 2006). Informal caregivers usually have to reduce or shift work hours to accommodate caretaking work (Donelan, Falik, & DesRoches, 2001) and, as a result, they face higher vulnerability later in life, either via having their opportunity for social security benefits reduced (Medeiros et al., 2006) and/or by being exposed to poverty (Camarano et al., 1999).

In the context of Latin America, Brazil stands out for its universal social pension system, which in 2005 covered nearly 90% of persons with disabilities and those age 65 years and older (Camarano & Pasinato, 2007; Lloyd-Sherlock, 2006; Lloyd-Sherlock, 2008; Medeiros et al., 2006). The expansion of the system since 1993 to include non-contributory pension coverage explains much of the impact that the system has had on reducing poverty and vulnerability among households containing older people, particularly elderly women and individuals in rural areas (Camarano & Pasinato 2007; Medeiros et al., 2006). However, the social security system is highly regressive—most of the spending is channeled to the wealthiest recipients (Lloyd-Sherlock, 2006).

Given the existing evidence, what conclusions can be drawn about the future of elderly individuals, particularly elderly women with disabilities, in Brazil? While the
social pension system in Brazil is universal, it does not currently include programs that assist family caregivers, most of whom are women, although there are ongoing proposals to extend their protection (Medeiros et al., 2006). In addition, some studies have revealed important clues for evaluating the impact of pensions on inter-generational relationships and caring (Lloyd-Sherlock, 2006). Some scholars have raised the argument that pension sharing and inter-generational co-residence prompted an increase in “family reciprocity” (Lloyd-Sherlock, 2006). Some of these authors have observed that the directionality of financial support flows from the elders to their children and grandchildren, who also benefit from co-residence in their parents’ houses and from grandparents’ care of grandchildren (Camarano & Pasinato, 2007; United Nations, 2009). Others have observed that these “solidarities” are challenged by specific inter-generational politics that affect marginal households and foster abusive relationships to the detriment of elderly members (Lloyd-Sherlock & Locke, 2008). Other studies have pointed out that there is no clear association between the receipt of income benefits and the probability of care by family members (Lloyd-Sherlock, 2006). While pensions might not guarantee support for elderly in general and elderly disabled individuals in particular, these studies agree in that pension reform has increased the probability of companionship for elderly individuals.

**Limitations**

This study has some limitations. Data used in the study is self-reported. Although this could be a possible source of bias, methodological studies have shown that self-reported data on functional disability correspond to medical diagnosis (Zunzunegui et al., 2009). Another limitation arises from the fact that the first wave of SABE focuses on the
civilian population not residing in institutions. As a result, estimates may be biased if one expects that institutionalized individuals, particularly those residing in nursing homes, are likely to have a higher prevalence of disability than the non-institutionalized population. However, the institutionalized population in Brazil is relatively small (Camarano et al., 2009), and therefore this bias is likely to be small. Other limitations of the paper are due to the empirical application of multistate methods (for a detailed discussion of the drawbacks of this method, see Laditka & Hayward, 2003). For instance, the estimation of DFLE is subject to more error and variance than traditional estimates of life expectancies because DFLE estimates are based on survey data rather than vital statistics. In other words, because sample sizes are smaller, the variance is larger (Laditka & Hayward, 2003).

**Final remarks**

Using longitudinal data from São Paulo, Brazil, this study confirms previous studies that illustrated women face a higher disability burden than men. Given their higher prevalence of disability and longer periods of DLE compared to older men, older women will face more social and economic marginalization tied to the stigma associated with disability (Filmer, 2008; Robb, Small, & Haley, 2008). The findings have important implications for policy makers in Brazil and other developing countries facing rapidly aging populations.

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