



## Original article

# Gender Differences in Life Expectancy and Disability-Free Life Expectancy Among Older Adults in São Paulo, Brazil

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## ABSTRACT

**Background:** Research on life expectancy has demonstrated the negative impact of disability on the health of older adults and its differential effects on women as evidenced by their higher disabled life expectancy (DLE). The goal of the present study was to investigate gender differences in total life expectancy (TLE), disability-free life expectancy (DFLE), and DLE; examine gender differences on personal care assistance among older adults in São Paulo, Brazil; and discuss the implications for public policies.

**Methods:** The sample was drawn from two waves (2000, 2006) of the dataset of *Salud, Bienestar, y Envejecimiento*, a large longitudinal study conducted in São Paulo ( $n = 2,143$ ). The study assessed disability using the activities of daily living (ADL). The interpolation of Markov Chain method was used to estimate gender differences in TLE, DLE, and DFLE.

**Findings:** TLE at age 60 years was approximately 5 years longer for women than men. Women aged 60 years were expected to live 28% of their remaining lives—twice the percentage for men—with at least one ADL disability. These women also lived more years ( $M = 0.71$ ,  $SE = 0.42$ ) with three or more ADL disabilities than men ( $M = 0.82$ ,  $SE = 0.16$ ). In terms of personal care assistance, women received more years of assistance than men.

**Conclusion:** Among older adults in São Paulo, women lived longer lives but experienced a higher and more severe disability burden than men. In addition, although women received more years of personal assistance than men, women experienced more unmet care assistance needs.

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Recent studies have observed that the population aging process is accelerated in developing countries compared with developed countries in North America and Europe (Palloni, Pinto-Aguirre, & Peláez, 2002; Palloni, McEniry, Wong & Peláez, 2006; United Nations, 2009). By 2050, approximately four out 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  $\geq 60$ ) increased from 4.6% in 1950 to 8.7% in 2010 (Centro Latinoamericano de Demografía [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 aged 60 and over, and this number will reach 60 million by 2050 (CELADE, 2000). Population growth is even faster among the oldest-old ( $\geq 80$  years). 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 coming decades (CELADE, 2007). Older women outnumber older men in Brazil. In 2010, women constituted 56% of the population aged 60 years and over and 63% of the oldest-old population. Older Brazilian women have longer life

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expectancies than men and their gain in life expectancy has been greater than that in men. Life expectancy at age 65 years increased by 5.6 years among women, whereas the gain 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 given their higher disabled life expectancy (DLE; 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, 2009, 2010; Camargos, Perpetuo, & Machado, 2005; Camargos, Machado, & Rodrigues, 2007; Gispert et al., 2007).

Previous studies demonstrated that although women lived longer (Verbrugge, 1989), they were 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 et al., 2005; Case & Paxson, 2005; Oman, Reed, & Ferrara, 1999). Consequently, findings have shown that women lived a greater proportion of their later years with a disability compared with men (Camargos et al., 2007; Crimmins & Saito, 2001; Laditka & Laditka, 2002; Reyes-Beaman et al., 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 with men, women reported 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, showed that women were more likely to report having difficulties performing the activities of daily living (ADL; Duarte, Lebrão, & Lima, 2005; Guerra et al., 2008) and had a greater prevalence of disability as measured by the physical performance test (Barbosa et al., 2005). Camargos et al. used the Sullivan method to estimate the DLE among men and women (Camargos et al., 2005; Camargos et al., 2007). The authors' results confirmed that older women had longer life expectancies, but were more likely to be disabled and to live a higher proportion of their remaining lives with severe functional limitations 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 socioeconomic 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 exposure to hunger during childhood was related to lower extremity limitations in women but not in men (Alvarado et al., 2007). However, differences in conditions throughout the life course (childhood, adulthood, and current conditions) did not fully explain the higher prevalence of mobility limitations, ADL, and instrumental ADL disabilities among women in Latin America (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 studies were based on cross-sectional data. Data, particularly longitudinal data on functional disability, from Latin America and the Caribbean have

become only recently available (Camargos et al., 2008). Most studies have used cross-sectional data and the Sullivan method to estimate healthy life expectancies, and this has been the case in studies from 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 such as 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 was the first to use a multi-state model and longitudinal data to estimate disability-free life expectancy (DFLE) by gender in a major city in Brazil.

The objective of this study was to investigate differences in total life expectancy (TLE), DFLE, and DLE between older adult men and women in São Paulo, Brazil. Because the duration of disability has an impact on the demand for personal care, we also explored differences in the number of years that individuals with and without disability would require assistance to perform ADL activities. Finally, this study addressed the public policy implications of these findings.

## Methods

We analyzed data from the two waves (2000 and 2006) of SABE São Paulo, Brazil. The SABE is a multicenter survey with respondents in seven capital/major cities throughout the countries of Latin America and the Caribbean that has been investigating the health and well-being of older adults (age  $\geq 60$  years). The Pan American Health Organization, 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 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 the 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 aged 75 years and over were oversampled. The data in the first wave were 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 the data collection was a household visit by a pair of interviewers who completed anthropometric and physical performance measurements. The data for the first wave were collected in 2000 and the first quarter of 2001. At baseline, the response rates reached 84.6% in São Paulo. In the first stage, we collected information on 2,143 individuals, and in the second stage, we took measurements on 1,894 subjects (88.4% of the first-stage respondents). The main reasons for nonparticipation in the second stage were refusal (7.5%) and address changes (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 conducted the first follow-up interviews to the 2000 baseline survey. The researchers used mortality data from the *Fundação Sistema Estadual de Análise de Dados* (the SEADE foundation, which has analyzed relevant social, demographic, and economic data in the São Paulo state) and from the *Programa de Aprimoramento das Informações de Mortalidade*, which has collected and organized mortality data for the city of São Paulo to identify subjects who had died between 2000 and 2006. The search was based on the names, gender, dates of birth, and addresses listed in the 2000 database.

Trained interviewers visited the addresses and neighborhoods of the surviving participants from the 2000 survey to reestablish contact. For those not found during these visits, interviewers used the additional contact information collected at 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 that complemented the previous study. In the core questionnaire, respondents provided information about possible disabilities on the ADL measures. In this section of the questionnaire, the questions were the same at baseline and at the first follow-up in 2006. Lebrão and Duarte (2008) described the detailed information about the second data collection. Of the 2,143 participants in the first wave of SABC (Lebrão & Duarte, 2008) São Paulo, 1,658 (77.4%) had valid information from the follow-up. Among these, 1,114 (52.0% of the baseline sample) were re-interviewed in 2006, and 544 (25.4%) had died between the baseline and first follow-up. The remaining 485 (22.6%) had missing data in the 2006 follow-up. Those with missing data in the follow-up were younger (71.8 years) than those with complete data (73.6 years;  $p < .0001$ ) and more likely to be female (66% vs 57%, respectively;  $p < .001$ ). The prevalence of ADL disability was also lower among those with missing data on the second wave (17%) than among those with complete data (25%;  $p < .001$ ).

## Measures

Self-reported disability in six ADL measures—dressing, bathing, eating, getting in and out of a bed (transferring), toileting, and getting across a room—were used to measure disability. We dichotomized each of the ADL measures; a score of 0 indicated that the respondent did not have any disability, and a score of 1 indicated that the respondent had difficulty performing at least one activity in each scale. Individuals with three or more ADL disabilities were classified as having “severe” ADL disability. 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 ADLs. 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 S.E. 10.1 (STATA Corp., Inc., College Station, TX) 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 multi-state life table method. Usually, four transitions are measured in multi-state models: incidence (disability-free to disabled), recovery (disabled to disability-free), and two types of mortality (mortality during a disability-free state or mortality during a disabled state; Laidtka & Hayward, 2003). There were also two retention statuses, as respondents declared being disability-free or disabled in both waves.

We used the 0.98g version of the interpolative Markov chain (IMaCh) software developed by Brouard and Lièvre (2006) and the cross-longitudinal data from the MHAS (Mexican Health and Aging Study) to compute transition probabilities. The IMaCh generates estimates of total and state-specific life expectancies and their standard errors, based on the methodology introduced by Laidtka and Wolf (Lièvre, Brouard, & Heathcote, 2003). The embedded Markov chain, which was introduced by Laidtka and Wolf (1998) and incorporated into the IMaCh software, applies the multi-state life table model to shorter transition periods that are embedded within the longer interval between surveys. For the current analysis, monthly transitions were computed.

To assess age and gender differences in subjects’ trajectories between baseline and follow-up, we used multinomial (polytomous) logistic regression. Different trajectories were modeled as competing risks, and two multinomial regression analyses were performed. The first regression model included only subjects who did not have an ADL disability at baseline, so we considered four outcomes: 1) remained nondisabled at wave 2 (reference category), 2) incidence of disability, 3) mortality, and 4) lost to follow-up or missing data. In the second regression model, we limited the analysis to those with an ADL disability at baseline; therefore, the possible outcomes were: 1) continued having the ADL, 2) recovery from ADL, 3) mortality, and 4) lost to follow-up or missing data. Sample weights were employed in all the analyses.

## Results

Table 1 presents the prevalence estimates of ADL disability and assistance by age group and gender in São Paulo, Brazil for 2000. Weighted estimates indicate that 19.2% of individuals aged 60 years and over in São Paulo reported having difficulty in

**Table 1**  
Prevalence Estimates (in percentage) of Functional Limitations by Gender and Age Groups, Brazil, SABC, 2000 (weighted estimates)

Gender and Age (yrs) Groups	Sample Size	Limitation in $\geq 1$ ADL	Limitation in $\geq 3$ ADL	Assistance Needed With ADL
Males ( $\geq 60$ )	878	14.9** <sup>†</sup>	4.8 <sup>†</sup>	7.5 <sup>†</sup>
60–69	310	10.9*	2.2	5.2
70–79	338	18.3	6.9	9.1
$\geq 80$	230	32.0**	16.5	18.9*
Females ( $\geq 60$ )	1265	22.3 <sup>†</sup>	6.2 <sup>†</sup>	7.6 <sup>†</sup>
60–69	495	17.2	3.5	3.2
70–79	470	23.4	5.7	8.1
$\geq 80$	300	42.8	19.5	26.0
Total ( $\geq 60$ )	2143	19.2 <sup>†</sup>	5.6 <sup>†</sup>	7.6 <sup>†</sup>
60–69	805	14.5	3.0	4.1
70–79	808	21.4	6.2	8.5
$\geq 80$	530	39.2	18.5	23.6

Abbreviations: ADL, activities of daily living; SABC, Salud, Bienestar, y Envejecimiento.

Gender comparison: \*\*  $p < .01$ ; \*  $p < .05$ .

Age trends: <sup>†</sup>  $p < .0001$ .

performing at least one ADL. The most prevalent types of ADL disabilities were difficulties in dressing and getting out of bed. The prevalence of ADL disability was higher among women (22.3%) than among men (14.9%;  $p < .01$ ). In analyses controlling for age (data not shown), compared with men, women were 84% more likely to have difficulty getting in and out of bed ( $p < .0001$ ) and were 51% more likely to have difficulty walking across the room ( $p < .05$ ). As expected, the prevalence of ADL disability increased significantly with age ( $p < .0001$ ). Women aged 60 to 69 years presented a greater prevalence of ADL disability than men in the same age group ( $p < .05$ ), but for those aged 70 to 79 years, the gender differences were not statistically significant. At older ages ( $\geq 80$ ), women were more likely to report ADL disability than men ( $p < .01$ ). The prevalence of severe ADL disability reached about 6% among individuals aged 60 years and over in São Paulo. At ages 60 to 69 years, about 3% of the population had severe ADL disability, but this proportion reached 18.5% at older ages ( $p < .0001$ ). The prevalence estimates of severe ADL disability 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 significant only for the oldest age group ( $p < .05$ ). Needing personal care assistance as an ADL disability increased significantly with age for both men and women ( $p < .0001$ ).

Among those who had at least one ADL disability in 2000, 25.3% continued to have the ADL disability in 2006, 21.9% recovered, 33.4% who initially had ADL died between 2000 and 2006, and 19.5% were lost to follow-up. Among those without an ADL disability in 2000, 46.3% reported having no ADL disability in 2006, 12.8% developed at least one ADL disability, and 16.1% died between 2000 and 2006. The remaining 24.9% who initially had no ADL could not be re-interviewed in 2006.

The results presented in Table 2 and Figure 1 take into account the health transitions (i.e., incidence of and recovery from ADL, death) between 2000 and 2006. The results shown in Table 2 are consistent with previous findings that showed that, compared with men, women lived longer lives and lived more years in good health but they also experienced disability for more years and for a greater proportion of their remaining lives. At age 60 years, women in São Paulo were expected to live, on

average, 21.7 years, over 5 years more than their male counterparts (16.5 years). The DFLE was also higher among women. At age 80 years, the female advantage in TLE remained. Women at age 80 years were expected to live, on average, 8.6 years, whereas the TLE among their male counterparts reached 7.0 years. The DFLE was also higher among women at all ages, but the differences decreased considerably with age. On the other hand, the DLE was considerably higher among women at all ages, and the proportion of their remaining years to be lived without disability was lower than those for men at all ages (Figure 1). For instance, at age 60 years, women were expected to live 28% (6.1 years) of their remaining lives with at least one ADL disability, whereas men will live a shorter period with disability (14.2%, 2.4 years). In any case, for both men and women, the proportion of years to be lived without an ADL disability decreased with age (Figure 1).

Women also lived more years with a severe ADL disability (Table 2). At age 60 years, men were expected to live, on average, 0.8 years with a severe ADL disability, whereas women were expected to live 2.7 years. Among men, the DLE owing to a severe ADL disability increased with age, reaching 1.6 years at age 80 years; in contrast, no trend was found among women. With increases in age, the proportion of DLE/TLE increased for both men and women. At age 60 years, women lived 12.7% of their remaining lives with severe disability, whereas this proportion reached only 4.9% among men. At age 80 years, the DLE/TLE percentages continued to be higher for women (31.9%) than for men (22.5%).

For personal assistance, men received fewer years of personal assistance than women. However, the percentage of time individuals with ADL disability lived without personal care assistance was higher for women than for men at all ages. For instance, women aged 60 years reported receiving assistance for 1.6 years out of the 6.1 years with ADL (27%), whereas men received assistance for 0.8 years out of the 2.4 years with ADL (34.7%). This meant that women with disability had more unmet needs for assistance than men in São Paulo, Brazil.

Table 3 presents the results of the two multinomial logistic regression analyses. Women were more likely than men to develop ADL disability between 2000 and 2006. Age was positively associated with the incidence of ADL disability and risk of

**Table 2**

TLE, DFLE, and DLE (in years) by Gender and Age, Brazil, SABE, 2000–2006

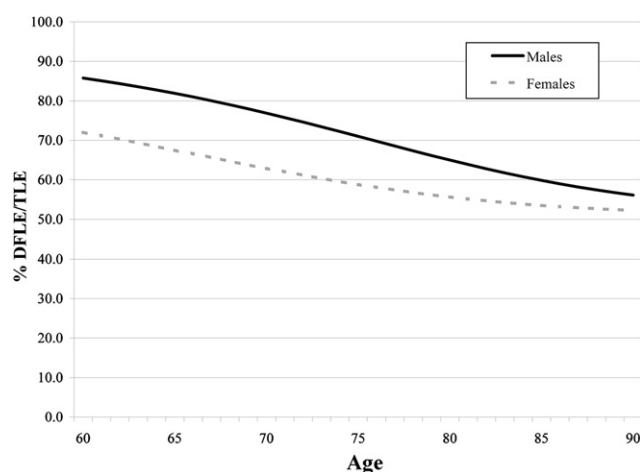
Impairment	Age 60		Age 70		Age 80	
	Males	Females	Males	Females	Males	Females
Limitation in at least one ADL						
TLE*	16.5 ± 0.650	21.7 ± 0.633	10.9 ± 0.539	14.3 ± 0.532	7.0 ± 0.579	8.6 ± 0.508
DFLE*	14.2 ± 0.548	15.6 ± 0.498	8.4 ± 0.417	9.0 ± 0.347	4.6 ± 0.365	4.8 ± 0.283
DLE*	2.4 ± 0.262	6.1 ± 0.388	2.5 ± 0.271	5.3 ± 0.306	2.5 ± 0.300	3.8 ± 0.259
DLE/TLE (%)	14.2%	28.0%	23.1%	37.1%	35.0%	44.4%
Limitation in at least three ADL						
TLE*	16.6 ± 0.846	21.3 ± 0.801	11.3 ± 0.550	14.2 ± 0.517	7.2 ± 0.516	8.6 ± 0.481
DFLE*	15.3 ± 0.634	18.5 ± 0.608	9.9 ± 0.490	11.5 ± 0.457	5.6 ± 0.467	5.8 ± 0.415
DLE*	0.8 ± 0.164	2.7 ± 0.416	1.4 ± 0.261	2.7 ± 0.290	1.6 ± 0.304	2.7 ± 0.322
DLE/TLE (%)	4.9%	12.7%	12.2%	19.0%	22.5%	31.9%
Assistance needed with ADL						
TLE*	16.5 ± 0.639	21.5 ± 0.633	10.9 ± 0.522	14.5 ± 0.518	7.0 ± 0.567	8.7 ± 0.499
Without assistance*	15.7 ± 0.581	19.9 ± 0.551	9.8 ± 0.449	12.6 ± 0.436	5.5 ± 0.435	6.7 ± 0.410
With assistance*	0.8 ± 0.164	1.6 ± 0.217	1.0 ± 0.210	1.8 ± 0.245	1.4 ± 0.302	2.1 ± 0.289
With assistance/DLE	34.7%	27.0%	41.1%	34.7%	58.7%	53.5%

Abbreviations: ADL, activities of daily living; DFLE, disability-free life expectancy; DLE, disabled life expectancy; TLE, total life expectancy.

Values are presented as means ± standard errors.

\* In years.





**Figure 1.** Proportion of the TLE expected to be lived without ADL disability by gender and age, Brazil, SABE, 2000 to 2006.

mortality. In the second regression model, the baseline category includes respondents with disability in both waves. The results showed that women and men were equally likely to recover (versus having a disability in both waves). However, women were less likely to die between waves than men. Mortality increased with age, whereas the likelihood of recovery decreased with age.

## Discussion

The current paper had three goals. The first was to examine the impact of gender on the TLE, the DFLE, and the DLE, while taking health transitions into account. Women in Brazil were more likely than men to have difficulty getting in and out of bed and walking across the room. Difficulties performing these activities could be lessened with the use of assistive devices such as a walkers or grab bars. There were no differences between men and women in other ADL disability measures more closely related to personal care such as eating, bathing, dressing, or toileting. Results indicated that women at age 60 years were expected to live, on average, 6.1 years (standard error [SE], 0.4) with ADL disability, while their male counterparts were expected to live 2.4 years (SE, 0.3). These results were very similar to those of Camargos et al. (2005), which estimated the DLE with the Sullivan method and the baseline data from the SABE São Paulo 2000 survey. In fact, their estimate for DLE owing to ADL disability among women in 2000 was 0.2 lower than our

estimate (5.8 years), whereas their estimate of DLE among men was 0.6 years higher (3.0 years; Camargos et al., 2005). At age 80 years, the DLE among women was estimated at 3.8 years (SE, 0.3) in the current study and at 4.0 years in the cross-sectional study (Camargos et al., 2005). Among men, the multi-state models estimated the DLE at 2.5 years (SE, 0.3) versus 2.3 years for the year 2000 based on the Sullivan method (Camargos et al., 2005). These findings corroborate those by Camargos et al. (2005). Our study also provided estimates of the impact of severe ADL disability on DLE. We found that women aged 60 years lived nearly three times as long as men in São Paulo with severe ADL disability. In addition, the current results showed that gender differences in the DLE were linked to longer life expectancy and a greater incidence of disability among older women. There were no gender differences in recovery rates among those with ADL disability in the baseline survey. By using multi-state models that incorporated health transitions (e.g., disability incidence and recovery) in estimating TLE and DFLE, this study moved beyond the methods used in previous studies that analyzed the cross-sectional data from SABE-São Paulo (Camargos et al., 2005; Guerra et al., 2008) and was able to provide a better understanding of the disablement process. In addition, the results based on the multi-state models allowed for the analyses of conditional probabilities of being in a certain health state while taking into account the baseline health state and allowed for decomposing life expectancy by health state (results not shown, but available upon request).

The second goal of the study was to examine the prevalence of unmet needs for personal care support. These estimates were particularly important for assessing the future needs for personal care assistance in this aging population. These results indicated that, although women lived more years with a disability, their need for personal care assistance went unmet for a greater proportion of that time than for men. For example, among respondents with ADL disability in the baseline survey, women were approximately 30% less likely to receive personal assistance than men after controlling for age ( $p = .07$ ; results not shown).

Finally, this study aimed to address the policy implications of these findings. The 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 deal with the increasing demands for health care that arise from demographic changes. By drawing attention to gender differences in functional disabilities in later life, this study illustrated the current demand for personal care and assistance owing to the growth in the female population. Health care costs associated with disabilities 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 in 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 may face greater vulnerability later in life, either by having their opportunity for social security benefits reduced (Medeiros et al., 2006) and/or by descending into poverty (Camarano et al., 1999).

In Latin America, Brazil stands out for its universal social pension system that, in 2005, covered nearly 90% of persons with disabilities and those aged 65 years and older (Camarano &

**Table 3**  
Multinomial Logistic Regression Results: Brazil, SABE 2000–2006

	Age		Female	
	RRR	95% CI	RRR	95% CI
Reference category: no ADL in both waves				
Incidence of disability	1.10	[1.07–1.12]	2.20	[1.57–3.08]
Mortality	1.12	[1.09–1.14]	0.54	[0.37–0.78]
Lost to follow-up	1.03	[1.01–1.06]	1.32	[1.01–1.74]
Reference category: ADL at both waves				
Recovery from disability	0.93	[0.89–0.96]	0.74	[0.35–1.58]
Mortality	1.08	[1.05–1.11]	0.34	[0.17–0.69]
Lost to follow-up	0.99	[0.94–1.04]	1.08	[0.03–40.65]

Abbreviations: ADL, activities of daily living; RRR, relative risk ratio.

Pasinato, 2007; Lloyd-Sherlock, 2006, 2008; Medeiros et al., 2006). The expansion of the system since 1993 to include noncontributory pension coverage explains much of the impact that the system has had on reducing poverty and vulnerability among households with 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 predictions can be made about the future of elderly individuals, particularly elderly women with disabilities, in São Paulo, Brazil? Although 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 intergenerational relationships and caring (Lloyd-Sherlock, 2006). Some scholars have raised the argument that pension sharing and intergenerational co-residence prompted an increase in “family reciprocity” (Lloyd-Sherlock, 2006). Some of these authors have observed that the directionality of financial support is from the elders to their children and grandchildren, who also benefit from co-residence in their parents’ houses and from the grandparents’ care of grandchildren (Camarano & Pasinato, 2007; United Nations, 2009). Others have observed that these “solidarities” are challenged by specific intergenerational 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). Although pensions might not guarantee support for the elderly in general and for elderly disabled individuals in particular, these studies agree that pension reform has increased the probability of companionship for elderly individuals.

### Limitations

This study has some limitations. The data used in the study were self-reported. Although this could be a possible source of bias, methodologic studies have shown that self-reported data on functional disability were consistent with medical diagnoses (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 greater prevalence of disability than the noninstitutionalized population. However, the institutionalized population in Brazil is relatively small (Camarano et al., 2009), and therefore, this bias is likely to be small. Missing data on the second wave also limited the analyses. Individuals with missing data in the second wave were younger and more likely to be women. They were also less likely to have ADL disability at baseline than those with complete data. Younger age and a lower prevalence of ADL among those missing in the data may have biased the estimates of TLE and DLE. More specifically, given the higher proportion of older adults and individuals with ADL with complete data, estimates of the DLE for the São Paulo population may have been slightly overestimated, whereas the TLE may have been underestimated (because ADL status at baseline is associated with higher

mortality; results not shown). Missing data on the second wave were more common among women than among men. However, gender differences persisted even after imputation procedures were used (results available upon request). Other limitations of the paper stem from the empirical application of multi-state methods (for a detailed discussion of the drawbacks of this method, see Laditka & Hayward [2003]). For instance, the estimation of the DFLE was subject to more errors and larger variances than the traditional estimates of life expectancies because the DFLE estimates were based on survey data rather than vital statistics. In other words, because sample sizes in the data used for these estimates were smaller, the variances were larger (Laditka & Hayward, 2003).

### Conclusion

Using longitudinal data from São Paulo, Brazil, this study confirmed previous studies that found that older women faced a greater disability burden than men. Given the greater prevalence of disability and longer periods of DLE compared with older men, older women 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 São Paulo, Brazil and other developing countries facing rapidly aging populations.

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