

Predictors of Normal and Successful Aging Among Urban-Dwelling Elderly Brazilians

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The association of successful aging with demographic, socioeconomic, and medical characteristics in healthy community-dwelling Brazilian individuals aged 60 years and older ($N = 345$) was investigated. Participants were classified as successful ($n = 214$, 62%) or normal ($n = 131$, 38%) agers. Successful agers participated in significantly more leisure activities (34%) than did normal agers (21%). Multivariate logistic regression analysis revealed that the number of living children was a risk factor, whereas confidants and family income were protective factors for successful aging.

Key Words: Aging—Brazil—Community-dwelling elderly—Successful aging.

A focus on the developing world is currently necessary because of the growing impact of aging and the burden of noncommunicable disease. By 2025, 70% of the world's older people will live in developing countries; similar proportions of most deaths from noncommunicable diseases will also occur in developing countries. At the same time, many developing countries will continue to face the problems of persisting infectious disease, thus experiencing a double burden. In the developing world, including Latin America, a rapid increase in life expectancy has emerged in recent decades. For example, according to the 2000 census, 6.8% of the Brazilian population was more than the age of 60 years (Instituto Brasileiro de Geografia e Estatística [IBGE], 2001); by 2025, this proportion is expected to more than double to about 15%. Increases in the population of older adults and shifts in morbidity suggest the need to investigate health and well-being among both typical and exceptional groups of aging adults.

Population changes in Brazil have been very impressive because the life expectancy of Brazilians has doubled during the 20th century (Veras, 1991). The cause of this recent rapid increase in life expectancy was the substitution of heart disease and cancer for infectious and parasitic diseases as causes of death, which has been described as the “epidemiologic transition” (Omran, 2005). As the risk of dying from infectious diseases is reduced, those saved from dying from such diseases survive into middle and older age and are faced with an elevated risk of dying from degenerative diseases. Because degenerative diseases tend to kill at older ages than infectious diseases, this transition in mortality causation is generally characterized by a redistribution of deaths from the young to the old.

The epidemiologic transition theory points to population trends that are intricately connected to socioeconomic and demographic differences (Gaylin & Kates, 1997). In this

context, examination of normal versus successful aging can contribute to understanding how aging Brazilians adapt to these changes.

The conceptual framework for the present study relies on the considerable variation in the effects of aging on healthy individuals, with some people exhibiting extensively altered physiological function with age and others, little or none. Rowe and Kahn (1997, 1999) distinguished between “normal agers” who have a constellation of age-related or lifestyle-dependent changes that convey risk of disease or dysfunction and “successful agers” who exhibit avoidance of disease and disability, maintenance of high physical and cognitive function, and sustained engagement in social and productive activities (Rowe & Kahn 1997, 1999). The most frequent variables studied and significantly correlated with successful aging have been age, absence of disability, arthritis, and diabetes (Depp & Jeste, 2006). Other important variables that should be studied in assessing successful aging are cognitive status (Baltes & Baltes, 1990), physical activity, self-rated health, depressive symptoms, and other medical conditions (Depp & Jeste). Leisure activity, everyday activities, full engagement in life, and other life satisfaction variables have also demonstrated an association (Garfein & Herzog, 1995; Jorm et al., 1998; Li et al., 2006; Menec, 2003). Such variables as gender, income, education, and marital status have shown less of an association with successful aging (Depp & Jeste).

Interdisciplinary studies from the MacArthur studies of successful aging combining physiology, epidemiology, and social and behavioral sciences have identified lifestyle, nutritional, psychosocial, and other factors important in maintaining or improving high physical and cognitive function (Albert, Schepkin, & Budinger, 1995; Amin et al., 1994; Berkman et al., 1993; Bruce, Seeman, Merrill, & Blazer, 1994; Glass, Seeman, Herzog, Kahn, & Berkman,

1995; Malmrose et al., 1993; Seeman et al., 1995; Seeman, Singer, Rowe, Horwitz, & McEwen, 1997). Genes alone do not determine the rate of physical aging because lifestyle factors also have powerful influence (Kaye, 2002).

The World Health Organization (WHO) has updated estimates of disability-adjusted life expectancy (DALE), an estimate of years lived with disability, adjusted for age and sex, for 14 subregions of the world (Mathers, Sadana, Salomon, Murray, & Lopez, 2001). The DALE's broad range was observed between the world's healthy life expectancy leader, Japan (74.5 years), and the 191st country, the Republic of Sierra Leone (25.9 years). Brazil occupied 111th place, with a healthy life expectancy of 59.1 years. Observing the positions of countries throughout the list shows that the socioeconomic conditions of the different regions clearly influence life expectancy. Individuals with lower incomes may be less likely to achieve successful aging because of the higher prevalence of health risk factors. Income is a component of socioeconomic status, one of the most enduring of all risk factors (Seeman et al., 2004). Evidence of income-related social inequalities in health shows that individuals of lower socioeconomic status consistently experience poorer health than those with more economic resources (Babones, 2008; Wilkinson & Pickett, 2006).

A previous investigation of predictors of successful aging in Brazil was performed in Porto Alegre (De Moraes & de Azevedo e Souza, 2005). In this survey, family relations, friendship, health and perceived well-being, functional capacity, and psychosocial support were significantly and independently associated with successful aging. However, in this study, participants were not all from the same city and were chosen by convenience from organizations for elderly people or from groups of older individuals who were still working. This sample was, therefore, not representative of community elderly individuals and was biased toward higher functional and better quality of life of individuals. Consequently, to carry out an investigation with a random and representative sample of healthy and independent community-dwelling elderly persons would add actual information on predictors of successful aging in Brazil. This is the objective of the present investigation.

We hypothesized that variables associated with successful aging in Brazil would show a different pattern from those observed in studies carried out in developed countries. Elderly Brazilians are exposed to a series of adverse conditions that are different from those that may affect older persons in developed countries, even if they are at a comparable socioeconomic status, and so require greater efforts during life to age successfully. These adverse conditions include health care barriers, poor infrastructure to deal with the needs of the elderly population, paucity of social network variables, and poor educational strategies. We hypothesized that the primary predictors of successful aging would be income, parental longevity, and psychosocial variables such as social support and involvement in the social network. Thus, we

evaluated the association of successful aging with demographic characteristics, socioeconomic status, medical status, vital status of first-degree relatives, sources of social support, and social network activities. This is a baseline analysis from a longitudinal population-based cohort study of healthy community-dwelling participants, aged 60 years and older, in the largest Brazilian southernmost city, Porto Alegre.

METHODS

Data were collected in Rio Grande do Sul, Brazil. According to data from the 1992 census (IBGE, 2001), 5,500 individuals aged 60 years and older resided in the catchment area of the Hospital de Clínicas de Porto Alegre. During a 10-month period in 1996, we visited 2,305 households in that area and selected, according to a multistage random stratification by age, one person aged 60 years or older per household for a total of 1,216 participants. Each participant underwent a standardized neuropsychological and neurological evaluation. A collateral informant was also used to verify participant data.

Interviewers were medical students and physicians from the residency training program at the Hospital de Clínicas de Porto Alegre. The study was approved by the Ethics Committee for Research at the Hospital de Clínicas de Porto Alegre. All subjects gave informed written consent.

All participants were assessed for medical and psychiatric conditions, memory, orientation, judgment and problem solving, community functioning, home and hobbies, and personal care using information from a standardized protocol adapted from Kaye and colleagues (Kaye et al., 1994). These screening instruments comprised the first part of the evaluation. Requirements for entry were functional independence, Blessed Information–Memory–Concentration Test score of 11 or more (Thal, Grundman, & Golden, 1986), Clinical Dementia Rating (CDR) scale score = 0 (Chaves et al., 2007; Hughes, Berg, Danziger, Coben, & Martin, 1982), willingness to participate in the follow-up, and provision of informed consent. Major exclusion criteria were medical conditions such as myocardial infarction, diabetes mellitus, chronic pulmonary or renal disorders, hypertension (supine blood pressure more than 160/95), active cancer, seizure disorder, stroke, Parkinson's disease and other neurological disorders, major surgeries, previously diagnosed psychiatric conditions (schizophrenia, major affective disorder, and alcohol or drug abuse), and uncorrectable vision or hearing impairments.

Of the 1,216 interviewed elders, 369 without cognitive deficit or major medical disorders were selected and 23 (6.3%) declined to participate. The final baseline sample comprised 345 participants. This sample size was sufficient to detect a frequency of 5% cognitive impairment (Hänninen, Hallikainen, Tuomainen, Vanhanen, & Soininen, 2002), with an error of 2.5% and a confidence interval (CI) of 95%. The sample was composed of 103 men (30%) and 242

Table 1. Description of the Medical and Demographic Data in the Whole Sample ($N = 345$)

| Variables | Frequency or central tendency | |
|---------------------------------------|-------------------------------|-----------|
| | <i>n</i> | % |
| Marital status | | |
| Married | 161 | 46.7 |
| Widow/widower | 146 | 42.3 |
| Divorced | 11 | 3.2 |
| Single | 27 | 7.8 |
| Medical appointments—yes ^a | 167 | 48 |
| Medication—yes ^a | 260 | 75 |
| Health problems—yes | 47 | 14 |
| DSM IV—nondepressed | 329 | 95 |
| Leisure activities—yes | 99 | 29 |
| Get help when ill—yes | 249 | 72 |
| Functional impairment (any item)—yes | 31 | 9 |
| | <i>M</i> | <i>SD</i> |
| Age | 70.3 | 7.2 |
| Education | 9.06 | 5.50 |
| Family income (monthly US\$) | 4,150 | 4,725 |
| Persons with income in family | 2.0 | 1.2 |
| Mini-Mental State Examination | 25.4 | 3.4 |
| Depressive symptoms | 6.7 | 6.2 |
| General psychiatric symptoms | 3.4 | 2.9 |
| Number of appointments | 1.1 | 0.8 |
| Children living | 2.6 | 1.98 |
| Siblings living | 2.83 | 2.75 |
| Number of confidants | 2.3 | 1.8 |

Note: ^aLast month. DSM IV = *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed.

women (70%). Descriptive characteristics of the sample are displayed in Table 1.

The 345 selected participants were assigned for the second evaluation 1 week later. This assessment was composed of detailed demographic and medical data, vital status of first-degree relatives (parents, siblings, and children), social support and social network activity variables, engagement in leisure activities, a scale rating symptoms of depression (Montgomery-Asberg Rating Depression Scale; Dratcu, Costa Ribeiro, & Calil, 1987), a questionnaire for general psychiatric symptoms (WHO Self-Report Questionnaire; Mari & Williams, 1986), the *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. criteria for major depression, and the Mini-Mental State Examination (MMSE; Chaves & Izquierdo, 1992; Folstein, Folstein, & McHugh, 1975). Functional status was assessed with the activities of daily living (ADL) scale (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963).

Social Support and Network Interaction Variables

Social support was measured through social relationships that provided resources or helpful functions to an individual from other persons (Ganster & Victor, 1988). The variables for social support were (a) to have friends, (b) to have confidants, (c) to have relatives, (d) to have children living, (e) to get help when ill, and (f) to have recreational groups. For friends, confidants, relatives, and children, answers

were counted and expressed as the mean of each item. For the categorical items (to get help when ill and to have recreational groups), answers were dichotomous (*yes* or *no*). The items were analyzed individually.

Social network variables included whether participants had performed the following activities in the past 2 weeks: (a) talk on the telephone with friends or neighbors or relatives, (b) got together with friends and neighbors, and (c) got together with relatives. The answers were categorical (*yes* or *no*). Items were analyzed separately. Leisure activities were also assessed in terms of whether the person had (a) participated as a volunteer in the past 12 months and whether the person had in the past 2 weeks, (b) used a senior center, (c) gone to church or temple, and (d) gone to the movies, a sporting event, and so forth. The answers were categorical and were grouped into an index with a cutoff. The cutoff was participation in two or more activities. Study participants who did not take part in any activity or in only one were classified as “poor engagement in leisure activity.”

Normal and Successful Aging

Successful aging was defined as good health condition, the complete absence of functional disability and mood changes, and no cognitive impairment (MMSE above the education-adjusted cutoff). This definition was based on the concepts of Garfein and Herzog (1995), Rowe and Kahn (1997), and Jorm and associates (1998). The criteria were corroborated by the successful aging definition review of Depp and Jeste (2006). A total of 214 participants fulfilled the successful aging criteria, representing 62% of the sample.

Individuals who had age-determined responses and behaviors without contamination by specific disease processes were considered normal agers (Rowe & Kahn, 1987). They showed typical nonpathologic age-linked losses. At study entry, all individuals scored 0 on CDR and were functionally independent. However, some participants showed minor health problems, a level of cognitive frailty (lower MMSE scores), and some functional disability (lower scores on the Katz ADL scale). These 131 participants (38% of the sample) were classified as normal agers.

Data Analysis

Statistical analysis was performed with the “Statistical Package for the Social Sciences” (SPSS for MacOs 11.0) software. Descriptive statistics (mean, standard deviation, and frequency) were calculated for the variables of interest. The comparison of parametric variables between successful and normal aging groups was performed by the Student’s *t* test for independent samples. Association analysis of categorical variables with successful or normal aging groups was evaluated by χ^2 tests (with Yates correction or Fisher’s exact test). A multivariate logistic regression model was used for the analysis of associations with successful aging as the outcome because the procedure calculates a coefficient of

Table 2. Comparison of Demographic and Medical Data Between the Successful ($n = 214$) and the Normal ($n = 131$) Aging Groups

| Variables | Successful aging | | Normal aging | | <i>t</i> |
|---------------------------------------|------------------|-----------|--------------|-----------|----------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | |
| Age | 69.5 | 6.6 | 71.7 | 7.8 | -2.63** |
| Education | 9.6 | 5.5 | 8.1 | 5.4 | 2.53* |
| Family income (monthly) | 5,175 | 5,425 | 2,425 | 2,400 | 5.99** |
| Persons with income in family | 2.1 | 1.3 | 1.9 | 1.1 | 1.37 |
| Children living | 2.4 | 1.8 | 3.0 | 2.9 | -2.68** |
| Siblings living | 3.0 | 2.9 | 2.6 | 2.5 | 1.04 |
| Parents living | 0.16 | 0.41 | 0.07 | 0.30 | 1.70 |
| Confidants | 2.6 | 3.3 | 1.8 | 1.7 | 2.87** |
| Friends | 0.87 | 0.55 | 0.92 | 0.57 | -0.85 |
| | <i>n</i> | % | <i>n</i> | % | χ^2 |
| Sex—males | 66 | 31 | 37 | 28 | 0.26 |
| Marital status—married (with partner) | 104 | 49 | 76 | 58 | 1.43 |
| Medical appointments (last month)—yes | 100 | 47 | 67 | 51 | 0.64 |
| Medication (last month)—yes | 158 | 74 | 102 | 78 | 1.21 |
| Leisure activities—yes | 72 | 34 | 27 | 21 | 6.75** |
| Help when ill—yes | 151 | 71 | 98 | 75 | 0.73 |

Note: * $p < .05$; ** $p < .01$.

specific weight for the outcome for each variable in the equation. Values for the coefficients of regression (*B*), adjusted odds ratios, and 95% (CI) are presented for all variables in the model. Statistical significance was taken as $p < .05$.

RESULTS

The successful aging group had significantly lower mean age than the normal agers (Table 2), more years of schooling, and higher family income. A significantly larger proportion of successful agers than normal agers participated in leisure activities. Successful agers also had more confidants and fewer children living than the rest of the sample.

As indicated previously, the purpose of this study was to estimate exceptional aging in this sample by evaluating the association of hypothesized predictors with successful aging. A multivariate logistic regression model, with the independent variables age, education, family income, leisure activities, number of confidants, and number of living children, showed that fewer children, more confidants, and higher family income were strongly associated with successful aging and explained 72.6% of the variance (Table 3). The number of children living was a risk factor, whereas confidants and family income were protective factors for successful aging.

DISCUSSION

These are preliminary data on healthy aging from a community-dwelling elderly sample from a well-characterized population in the catchment area of a large urban university hospital. We analyzed the baseline demographic, cognitive, and functional characteristics of a southern Brazilian cohort.

Table 3. Results From the Logistic Regression for Successful Aging

| Variables | <i>B</i> | <i>SE</i> | OR (95% CI) |
|--------------------|----------|-----------|--------------------|
| Age | 0.029 | 0.019 | 1.0 (0.99–1.1) |
| Education | 0.016 | 0.028 | 1.0 (0.98–1.1) |
| Children living | 0.275 | 0.075 | 1.3 (1.14–1.52)** |
| Confidants | -0.151 | 0.065 | 0.86 (0.76–0.98)* |
| Leisure activities | 0.466 | 0.306 | 1.6 (0.86–2.9) |
| Family income | -0.054 | 0.013 | 0.95 (0.92–0.97)** |
| Constant | -2.656 | 1.441 | — |

Note: * $p < .05$; ** $p < .01$.

Data from developing regions of the world, especially on aging, are not common. Information of this kind is, in itself, an innovative contribution to a comprehensive understanding of aging worldwide.

The criteria of successful aging used in our study, reflecting general well-being in elderly individuals, are similar to those applied in previous investigations (Garfein & Herzog, 1995; Jorm et al., 1998; Li et al., 2006). More than half of the sample (62%) fulfilled these criteria because selection for the study was aimed at healthier and more independent older people from the community. This kind of multidimensional definition, which includes physical and cognitive function, mood status, and absence of disability, has been used by different authors (Garfein & Herzog; Jorm et al.; Rowe & Kahn, 1997) and by the WHO (2001) as well.

Taking into account the socioeconomic and environmental heterogeneity observed in developing countries, we hypothesized that socioeconomic status and psychosocial variables would significantly influence the aging of the population. We also hypothesized that a longer parental longevity would represent a genetic contribution for successful aging. Only three significant variables (number of confidants, family income, and number of children living) predicted successful aging in the present study. This finding validates the expectation that, in developing countries such as Brazil, socioeconomic status and social network structure may prevail over biological determinants, such as age and parental longevity, to achieve successful aging. These results differ from those observed in developed countries, where health-related and biological variables were the strongest factors related to successful aging (Depp & Jeste, 2006).

As predicted, income had a protective effect on successful aging – the higher the family income the better the aging process. This finding contrasts with results for developed countries, where income has not been observed as an important predictor of successful aging. In Brazil, income as an indicator of inequality may be a determinant of aging quality.

The successful aging group in the present study presented higher socioeconomic background (i.e., income and education). Education, work opportunities, leisure options, and social activities are less structured across all ages in developing countries in comparison with more developed regions worldwide. Despite the independence of the effect of significant variables in the final logistic regression equation,

income could also be another explanation for the protective effect of fewer children living. It is known that fertility rates are lower in developed countries in comparison with less developed regions. Although during the past decades of the 20th century the world total fertility fell from an average of 4.5 children per woman in 1970–1975 to 2.6 children per woman in 2000–2005, this decline was less marked among the least developed countries where fertility remains high (their average fertility declined from 6.6 children per woman in 1970–1975 to 5.0 in 2000–2005; United Nations, Department of Economic and Social Affairs, Population Division, 2008). Nonetheless, the finding of fewer children living as a protective factor deserves further evaluation in larger samples. Unlike in previous studies (Garfein & Herzog, 1995; Jorm et al., 1998; Li et al., 2006; Menec, 2003), in this Brazilian sample, marital status, leisure activity, health indicators, and life satisfaction variables were not associated with successful aging. Although leisure activity was selected for the logistic model because it was associated with successful aging in the univariate analysis, it was not significantly associated with successful aging in the multivariate model. We investigated only recent or current leisure and social activities, which could in part explain these results.

Contrary to our hypothesis, social network variables were not important to achieving successful aging in a developing country. Although the social network variables are used worldwide and included some of the participant's activities performed during the past 2 weeks, they may not be representative of the whole social network and also can be influenced by culture. For these elderly individuals, other measures of network may be more relevant (e.g., meeting neighbors or friends rather than talking on the telephone). Probably for these reasons, the social network variables were not associated with successful aging. On the other hand, the presence of social relationships that provided resources or helpful functions to an individual from other persons in itself may be more important than the assortment of the social network.

Among the social support variables measured in this study, more confidants and fewer children living were the only ones significantly associated with successful aging. The individuals' personal social support reflects multiple aspects of relationships, and different interpersonal constellations support well-being. A larger number of confidants can represent a more comprehensive and complex set of opportunities through which older adults can adapt and age successfully (Fiori, Smith, & Antonucci, 2007). The burden of raising children would be increased with the coexistence of violence and other social problems that are typical in developing countries. Additionally, raising more children in the family may leave parents with less time to be actively engaged in mental, physical, social, and leisure activities during their lives. Katzman (1993) proposed that individuals with higher educational levels were more resistant to the effects of dementia because of having greater cognitive reserve and increased complexity of neuronal synapses. Like education, participation in leisure

activities may lower the risk of dementia by improving cognitive reserve (Verghese et al., 2003). It is reasonable to assume that participants in this investigation with more children have had higher levels of care demands. This fact may have reduced opportunities to be engaged in their own self-care and in preventive health behaviors.

In a previous study carried out in Porto Alegre, Brazil, on factors related to successful aging, psychosocial variables (family relations and friendship, health and perceived well-being, functional capacity, and psychosocial support) were significantly and independently associated with successful aging (De Moraes & de Azevedo e Souza, 2005). However, in that study, participants were not all from the same city and were chosen by convenience from organizations for elderly people or from groups of older individuals who were still working.

The strength of this study includes the use of a community-based sample, providing a representative range of socioeconomic characteristics of older residents of urban areas in Brazil. The study also provided baseline data about the extent and predictors of successful aging in Porto Alegre, Brazil, contributing important information on elderly people living in undeveloped areas of the world.

Concurrent with the rapid aging of the Brazilian population, increased attention should be concentrated on understanding factors to be promoted by medical and social service professionals, probably related to quality of life, for those who are aging. The results of this study suggest that multidimensional strategies should be employed to address individual, environmental, and psychosocial aspects of life. Given the findings related to family income, public health policies should aim to diminish social and health inequalities in the population, allowing more homogeneous life conditions and, consequently, more widespread successful aging.

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