Profile and Determinants of Successful Aging in the Ibadan Study of Ageing

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OBJECTIVES: To determine the profile and determinants of successful aging in a developing country characterized by low life expectancy and where successful agers may represent a unique group.

DESIGN: Community-based cohort study.

SETTING: Eight contiguous states in the Yoruba-speaking region of Nigeria.

PARTICIPANTS: A multistage clustered sampling of households was used to select a representative sample of individuals (N = 2,149) aged 65 and older at baseline. Nine hundred thirty were successfully followed for an average of 64 months between August 2003 and December 2009.

MEASUREMENTS: Lifestyle and behavioral factors were assessed at baseline. Successful aging, defined using each of three models (absence of chronic health conditions, functional independence, and satisfaction with life), was assessed at follow-up.

RESULTS: Between 16% and 75% of respondents could be classified as successful agers using one of the three models while 7.5% could be so classified using a combination of all the models. Correlations between the three models were small, ranging from 0.08 to 0.15. Different features predicted their outcomes, suggesting that they represent relatively independent trajectories of aging. Whichever model was used, more men than women tended to be classified as aging successfully. Men who aged successfully, using a combination of all the three models, were more likely never to have smoked (adjusted odds ratio (aOR) = 4.7, 95% confidence interval (CI) = 1.55–14.46) and to report, at baseline, having contacts with friends (aOR = 4.2, 95% CI = 1.0–18.76) or participating in community activities (aOR = 16.0, 95% CI = 1.23–204.40). In women, there was a nonlinear trend for younger age at baseline to predict this outcome.

CONCLUSION: Modifiable social and lifestyle factors predicted successful aging in this population, suggesting that health promotion targeting behavior change may lead to tangible benefits for health and well-being in old age. **J Am Geriatr Soc 62:836–842, 2014.**

Key words: successful aging; community-based cohort; functional independence; life satisfaction; chronic health conditions

Worldwide, the growing population of elderly adults and the challenges that this growth poses[1] are, in part, giving rise to interest in the study of factors that may help to increase the number of years of healthy aging.[2] The concept of successful aging, in which elderly adults continue to enjoy good social, physical, and psychological well-being,[3] derives from this interest. The growth of the elderly population is particularly striking in the developing world. Of the current population of persons aged 60 and older in the world, approximately 64% reside in developing countries.[4] The projection that these countries will account for 700 million of the expected 1 billion elderly persons in 2020 is a further indication of this dramatic growth.[5]

In spite of the demographic transition occurring in developing countries, much of what is currently known about successful aging has been derived from studies conducted in high-income countries,[6–9] but the profile and determinants of health outcomes in elderly adults may be different in low- and middle-income countries, such as those in sub-Saharan Africa, from those in developed high-income countries. In Nigeria, for example, life expectancy is currently approximately 50 years for men and 52 years for women, which is at least 2 decades less than in Western Europe and North America.[10] In such a setting, it is plausible to suspect that persons who survive to the age of 65 and older constitute a uniquely resilient subgroup and may have features that differentiate them from older populations in high-income countries. In short, aging successfully in low- and middle-income countries may follow a

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different trajectory from what has been described elsewhere. In this regard, paradoxically, even though healthy life expectancy at birth in Nigeria, for example, is 50 for men and 52 for women, men and women who live to the age of 60 can expect another 9 and 10 years of healthy life, respectively.[11]

There is no consensus on which model of successful aging functions best to capture the complexity of the concept.[12] Although several studies have used objective health outcomes such as absence of chronic health conditions and absence of functional role impairment,[6] there is also growing acknowledgment that the subjective report of well-being by elderly persons is a valid index of aging outcome.[13,14] This article explores successful aging in a cohort of community-dwelling elderly persons from the perspectives of chronic health conditions, functional role independence, and self-report of life satisfaction.

METHODS

Sample

The Ibadan Study of Ageing (ISA) is a longitudinal community study of the profile and determinants of healthy aging. A full description of the baseline methodology has been provided elsewhere.[11,15,16] Baseline assessments were conducted between August 2003 and November 2004 on 2,149 individuals aged 65 and older selected through a process of clustered multistage random sampling of households in the Yoruba-speaking southwest and north-central parts of Nigeria. This cohort was followed up annually between 2007 and 2009. Of the 2,149 with a complete assessment at baseline, 957 were successfully followed up in 2009, approximately 5 years later. Figure 1 shows the yield at each wave of the study. The present report is based on 930 respondents for whom full data were obtained at follow-up.

Assessments of Components of Successful Aging at Follow-Up (2009)

Chronic Health Conditions

Physical Conditions. Three blood pressure measurements were taken, in the right arm, at 5-minute intervals with subjects seated. Hypertension, based on the average of the three readings, was defined as systolic blood pressure of 140 mmHg or greater or diastolic blood pressure of 90 mmHg or greater. Whether respondents had arthritis, diabetes mellitus, heart disease, or asthma in the previous 12 months was assessed according to self-report using a symptom-based checklist, a method of proven reliability and validity.[17,18]

Neuropsychiatric conditions were assessed as previously described.[11,16,19] Depression was assessed using the World Health Organization Composite International Diagnostic Interview (CIDI), version 3, a fully structured diagnostic interview.[20] Dementia was assessed using previously validated tools, the 10-Word Delayed Recall Test and the Clinician Home-based Interview to assess Function, followed by a review of all available information, including those of functional status obtained during interviews with

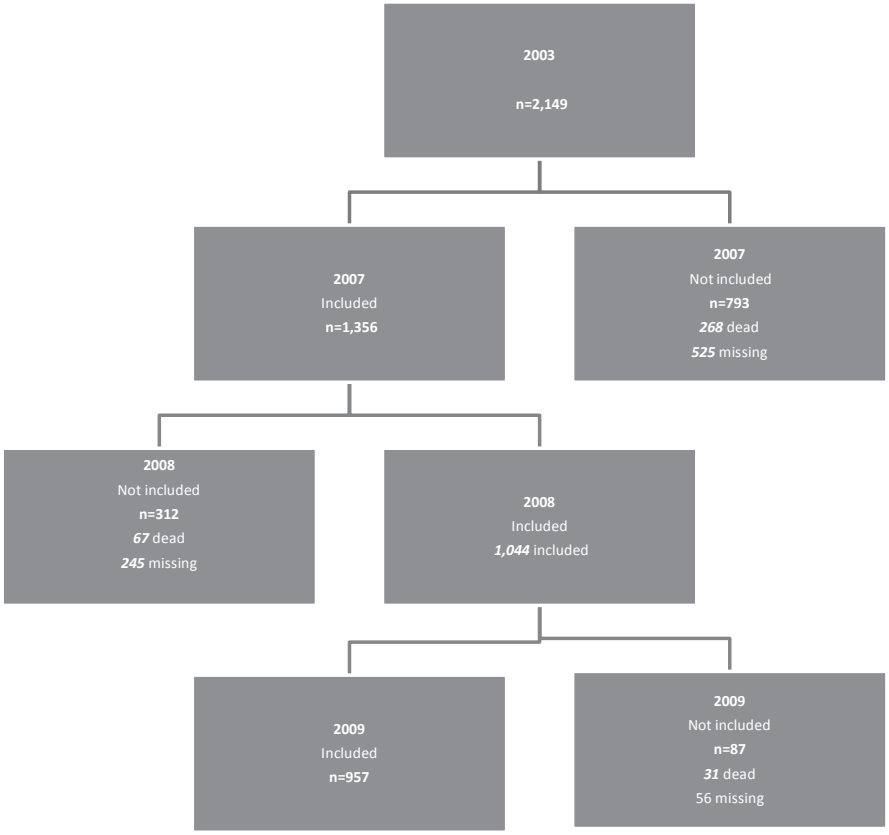

Figure 1. Flowchart of the Ibadan Study of Ageing.

subjects and relatives by a psychiatrist. Major depression was diagnosed according to *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, criteria.[21]

Functional Limitation. As described elsewhere, all respondents were assessed for functional limitations in six activities of daily living (ADLs) and seven instrumental activities of daily living (IADLs).[15,22,23] Each of the activities in the two domains was rated (1) can do without difficulty, (2) can do with some difficulty, (3) can do only with assistance, or (4) unable to do activity. In defining successful aging using this model, for full functional independence, a respondent had to be rated (1) or (2) on each of the activities. The rating of functional limitation achieved good to excellent test–retest reliability, with a kappa range from 0.65 to 1.0 on all items.

Life Satisfaction

Respondents' own evaluation of their lives was examined using reported life satisfaction as the index. The Satisfaction with Life Scale (SWLS), a five-item questionnaire that assesses overall satisfaction with life, rather than with specific domains of life, was used.[24,25] (e.g., "In most ways, my life is close to my ideal"; "The conditions of my life are excellent.") Responses are on a seven-item Likert scale, ranging from strongly agree to strongly disagree, with a midpoint of neither agree or disagree. For the purpose of the exploration of successful aging, herein reported, all three agree statements were collapsed into one response category, "agree," and all other responses were classified as "disagree." In this cohort, SWLS had good internal reliability (Cronbach alpha 0.81) and high stability from one annual wave to another (correlation coefficient = 0.25, $P < .001$).

Assessment of Predictors at Baseline (2003–04)

Physical Activity

Respondent's physical activity was assessed using the International Physical Activity Questionnaire, a widely used tool with demonstrated cross-cultural validity.[26] The questionnaire measures physical activity in all domains of leisure time, work, transportation, and household tasks. The summary indicator was used to categorize the respondents into three levels of physical activity: low (or physically inactive), moderate, and vigorous. These categories were based on standard scoring criteria (http://www.ipaq.ki.se).

Social Engagement

Two items adapted from the World Health Organization Disability Assessment Schedule, version 2, were assessed (participation in household activities, participation in community activities):[27] "During the last 30 days, how much did you join in family activities such as eating together, talking with family members, visiting family members, working together?" and "During the last 30 days, how much did you join in community activities such as festivities, religious activities, talking with community members, working together?" Possible answers were not at all, a little bit, quite a bit, and a lot. For this report, responses to each of the items were dichotomized as not at all versus all others.

Social Network

Social network was assessed using items from the CIDI.[20] The relevant items inquire about frequency of the respondent's contact with family members who do not live with the respondent and frequency of contact with friends. The responses were dichotomized to no contacts at all versus contacts varying from less than once per month to daily.

Self-Report of Overall Health

Self-report of overall health was made on a 5-point scale (excellent, very good, good, fair, or poor). The ratings were dichotomized as excellent, very good, or good versus fair or poor.

Lifestyle

Respondents were asked about use of alcohol and tobacco. Responses were dichotomized as ever versus never use for each.

Economic Status

Economic status was assessed by taking an inventory of household and personal items.[28] Respondents' economic status was categorized by relating each respondent's total possessions to the median number of possessions of the entire sample. Thus, economic status was rated low if its ratio to the median was 0.5 or less, low-average if the ratio was 0.5 to 1.0, high-average if it was 1.0 to 2.0, and high if it was >2.0.

Residence

Residence was classified as rural (<12,000 households), semi-urban (12,000–20,000 households), or urban (>20,000 households).

The Yoruba versions of all of the instruments used in the present survey were derived using standard protocols of iterative back translation conducted by panels of bilingual experts.

The University of Ibadan/University College Hospital, Ibadan joint ethical review board approved the ISA.

Analysis

To account for the stratified multistage sampling procedure and the associated clustering, weights were derived and applied to all of the rates reported.

Successful aging is defined as presence of all three components assessed: absence of chronic health condition, complete functional independence, and self-reported satisfaction with life. Absence of chronic health conditions was defined as having none of the assessed physical or neuropsychiatric disorders. For full functional independence, respondents were required to have complete independence in the performance of ADLs and IADLs. Persons who self-reported satisfaction with life were those who agreed with each of the five items of the SWLS.

The proportions of participants meeting each definition of successful aging and those meeting all three definitions were examined. The relationships between the three definitions were examined using tetrachoric correlations.

A series of bivariate and multivariable logistic regression analyses were conducted to explore the predictors of successful aging, using each of the three definitions. Similar analysis was conducted for persons meeting all three definitions, separately for men and women. The results are presented in the form of odds ratios with 95% confidence intervals. All analyses were conducted using the Stata statistical package (StataCorp., College Station, TX).

RESULTS

Table 1 shows the characteristics of the cohort at baseline. At follow-up, the mean age of the sample was 79.0 (standard error (SE) 0.26). Women (79.7 (SE 0.37)) were significantly older than men (78.1 (SE 0.36); $P < .01$). Persons in the oldest group and those in the lowest economic groups were less likely to be followed up. No other features significantly differentiated those who were successfully followed up from those who were not (data not shown).

Proportions of Successful Agers

Between 16% and 75% of respondents met the criteria for at least one of the three components of successful aging (Table 2). Fifty-five persons (7.5%) satisfied all three components of successful aging (31% female, 69% male). Men were more likely to age successfully than women overall and on each component, although this was significant only for functional independence.

The correlations between the three components of successful aging were small even though statistically significant. The correlation between absence of chronic health conditions and functional independence was the highest, but even here it was a mere 0.15 ($P < .001$), whereas that for life satisfaction and absence of chronic health condition was 0.08 ($P = .02$; data not shown).

Baseline Predictors of Successful Aging

Absence of Chronic Health Conditions

In this model of successful aging, there was no difference according to sex, but younger individuals (65–69) at baseline were more likely to have aged successfully (Table 3).

Functional Independence

In bivariate analyses that adjusted for baseline functional status, predictors of this dimension of successful aging included younger age, male sex, low levels of formal education as well as semi-urban and rural residence. A significant linear relationship was observed between levels of reported physical activity at baseline and likelihood of full functional independence at follow-up. When examined separately for sex, the relationship was particularly striking in women; those in the vigorous activity group were almost 10 times as likely to be aging successfully as those in the low activity group (data not shown). Contacts with family showed a strong but nonsignificant trend to predict this component of successful aging.

Table 1. Characteristics of the Sample at Baseline (N = 930)

Characteristic	%
Sex	
Male	61.1
Female	38.9
Age	
≥80	12.4
75–79	18.4
70–74	32.8
65–69	36.4
Education, years	
≥13	7.7
7–12	13.6
1–6	26.2
0	52.5
Residence	
Urban	23.9
Semi-urban	42.2
Rural	33.9
Economic status	
Low	19.2
Low-average	34.7
High-average	30.1
Highest	16.0
Ever smoked	
Yes	44.6
No	55.4
Ever used alcohol	
Yes	22.6
No	77.4
Physical activity	
Low	27.5
Moderate	50.6
Vigorous	21.9
Self-reported health	
Fair or poor	5.2
Good or excellent	94.8
Contact with family	
No	0.3
Yes	99.7
Contact with friends	
No	7.6
Yes	92.4
Participation in household activities	
No	8.6
Yes	91.4
Participation in community activities	
No	7.7
Yes	92.3

Multiple regression analyses were next conducted, adjusting for the effects of all of the variables that were significantly associated with functional independence on bivariate analysis. In men, the analysis was adjusted for age, years of education, lifetime use of alcohol, and physical activity. Significant predictors of successful aging using this model were absence of formal education (OR = 5.03, 95% CI = 1.07–23.76), 1 to 6 years of education (OR = 4.28, 95% CI = 2.18–31.18), moderate physical activity (OR = 3.60, 95% CI = 1.70–7.66), and vigorous physical activity (OR = 8.11, 95% CI = 2.31–28.43). In women, the analysis was adjusted for age and level of physical activity. The only feature that continued to predict

Table 2. Weighted Proportions Meeting Each Component of Successful Aging

Components of Successful Aging	Men, n = 454	Women, n = 476	Total, N = 930
	Proportion (SE)		
No chronic health condition	19.1 (2.13)	12.5 (2.30)	16.5 (1.61)
Functional independence[a]	80.4 (2.46)	64.5 (2.65)	74.2 (1.58)
Life satisfaction	42.9 (3.34)	40.1 (3.17)	41.8 (2.0)
Successful agers	8.4 (1.08)	6.0 (1.71)	7.5 (0.93)

[a] $P < .01$, comparing men with women.

functional independence at follow-up was vigorous physical activity at baseline (OR = 9.00, 95% CI = 2.33–34.79).

Self-Rated Life Satisfaction

Participants in the highest economic category were more likely to rate themselves as being satisfied with their lives than those in the other categories (Table 3). Successful aging, using this definition, was three times as likely in those who had reported their overall health as excellent or good and two times as likely in those who had reported having frequent contacts with friends at baseline.

Fifty-five persons (7.5%) satisfied the definition for successful aging by meeting the criteria for all three components of successful aging used in this study (31% women, 69% men). Table 4 shows the predictors of this outcome in the entire group. In view of the large difference in the proportions of women and men with this outcome, this outcome was explored for each of the sexes. In multivariate analysis in which all significant features on bivariate analysis were adjusted for, predictors of this outcome in men were never having smoked (OR = 4.7, 95% CI 1.55–14.46), having contacts with friends (OR = 4.2, 95% CI 1.0–18.76), and community participation (OR = 16.0, 95% CI 1.23–204.40). In women, predictors were being aged 76–79 (OR = 10.9, 95% CI 1.47–81.09) or 65–69 (OR = 8.9, 95% CI 1.36–57.62) at baseline.

DISCUSSION

This study explored, for the first time to the knowledge of the authors, the profile and predictors of successful aging, defined using multiple dimensions, in a population of elderly persons residing in a sub-Saharan African community. The cohort, composed of persons aged 65 and older at baseline, is unique not only because of a paucity of studies focused on its health, but also because it is derived from a population in which life expectancy is approximately 50 years. The factors that determine successful aging in this population may therefore be of particular

Table 3. Predictors of Indices of Successful Aging

Predictor	Absence of Chronic Health Conditions	Functional Independence	Self-Reported Satisfaction with Life
	Odds Ratio (95% CI) *P*-Value		
Age (reference ≥80)			
75–79	2.2 (0.89–5.50) .08	0.7 (0.41–1.05) .07	0.8 (0.44–1.51) .51
70–74	1.6 (0.71–3.71) .24	1.8 (1.04–3.13) .04[b]	0.9 (0.57–1.46) .69
65–69	2.3 (1.09–4.97) .03[a]	3.0 (1.89–4.92) <.001[b]	1.0 (0.63–1.74) .85
Male	1.7 (0.09–2.76) .05[a]	2.0 (1.29–3.04) .003[b]	1.1 (0.71–1.73) .64
Education, years (reference ≥13)			
7–12	1.5 (0.43–5.17) .51	2.9 (1.20–6.94) .02[b]	1.4 (0.65–3.16) .36
1–6	1.7 (0.60–4.79) .31	2.8 (1.27–6.10) .01[b]	1.7 (0.93–3.16) .08
0	1.3 (0.42–4.11) .62	3.2 (1.61–6.28) .002[b]	1.5 (0.86–2.72) .14
Residence (reference urban)			
Semi-urban	1.1 (0.63–1.93) .70	1.2 (0.73–1.95) .47	1.2 (0.81–1.67) .41
Rural	1.2 (0.65–2.30) .51	1.5 (1.03–2.24) .03[b]	0.8 (0.53–1.18) .24
Economic status (reference highest)			
High-average	1.1 (0.57–2.10) .79	0.9 (0.42–2.13) .89	0.4 (0.24–0.57) <.001[a]
Low-average	0.9 (0.42–1.96) .80	1.3 (0.54–3.01) .57	0.5 (0.30–0.71) .001[a]
Low	0.8 (0.51–1.40) .50	1.3 (0.56–3.17) .50	0.4 (0.21–0.68) .002[a]
Never smoked	1.2 (0.65–2.27) .52	0.9 (0.56–1.32) .49	1.2 (0.93–1.67) .13
Never used alcohol	0.8 (0.52–1.28) .36	0.8 (0.53–1.22) .29	1.1 (0.86–1.44) .41
Physical activity (reference low)			
Moderate	1.0 (0.49–2.04) .99	1.7 (1.08–2.80) .02[b]	0.7 (0.49–1.15) .18
Vigorous	1.2 (0.57–3.32) .69	5.4 (2.42–11.9) <.001[b]	0.8 (0.41–1.37) .34
Self-reported health good or excellent (reference fair or poor)	1.9 (0.33–11.18) .45	1.8 (0.86–3.84) .11	3.0 (1.20–7.15) .02[a]
Contact with family	—	4.2 (0.85–20.5) .08	—
Contact with friends	1.6 (0.61–4.41) .31	1.4 (0.73–2.65) .30	1.7 (0.98–3.06) .06
Participation in household activities	0.9 (0.43–1.79) .72	1.1 (0.56–2.18) .77	1.0 (0.55–1.93) .92
Participation in community activities	0.8 (0.32–1.87) .56	0.9 (0.53–1.52) .69	1.6 (0.76–3.36) .21

[a] $P < .05$; all comparisons controlled for functional disability at baseline.
[b] $P < .05$; all comparisons controlled for age, sex, and functional disability at baseline.

Table 4. Predictors of Successful Aging

Predictor	Male	Female	Total	*P*-Value
	Odds Ratio (95% CI)			
Age (reference ≥80)				
75–79	1.1 (0.19–6.23)	11.2 (1.31–94.73)[a]	2.9 (0.83–10.16)	.09
70–74	1.4 (0.36–4.66)	3.9 (0.47–32.45)	2.1 (0.61–9.67)	.23
65–69	2.8 (0.95–8.54)	8.8 (1.34–58.44)[a]	4.4 (1.65–11.89)	.004[a]
Male	—	—	1.4 (0.71–2.88)	.31
Education, years (reference ≥13)				
7–12	1.1 (0.14–8.25)	9.0 (0.69–117.79)	1.2 (0.20–7.68)	.82
1–6	0.8 (0.15–4.65)	11.1 (1.07–114.81)[a]	1.1 (0.19–5.92)	.95
0	0.8 (0.10–7.07)	15.1 (1.01–225.19)[a]	1.2 (0.22–6.11)	.85
Residence (reference urban)				
Semi-urban	1.1 (0.53–2.28)	2.2 (0.45–10.06)	1.4 (0.67–2.70)	.38
Rural	0.7 (0.24–1.83)	1.15 (0.18–7.37)	0.8 (0.36–1.72)	.53
Economic status (reference highest)				
High-average	0.5 (0.25–1.15)	1.0 (0.17–6.23)	0.6 (0.29–1.37)	.24
Low-average	0.6 (0.23–1.34)	0.3 (0.58–1.58)	0.4 (0.21–0.92)	.03[a]
Low	0.3 (0.02–0.77)[a]	0.6 (0.13–2.40)	0.4 (0.21–0.75)	.006[a]
Never smoked	4.7 (1.61–14.52)[a]	0.4 (0.22–1.13)	1.6 (0.71–3.46)	.25
Never used alcohol	0.5 (0.10–2.73)	0.3 (0.47–2.18)	1.0 (0.51–2.10)	.92
Physical activity (reference low)				
Moderate	0.9 (0.31–2.42)	1.2 (0.28–5.25)	1.0 (0.35–2.61)	.93
Vigorous	0.8 (0.27–2.46)	2.5 (0.33–18.16)	1.0 (0.40–3.21)	.80
Self-reported health good or excellent (reference fair or poor)	0.8 (1.22–21.80)[a]	—	1.1 (0.10–11.30)	.95
Contact with family	—	—	—	—
Contact with friends	5.2 (1.22–21.80)[a]	—	15.7 (3.69–66.51)	.001[a]
Participation in household activities	0.6 (0.10–3.73)	1.5 (0.28–7.65)	0.8 (0.23–2.88)	.74
Participation in community activities	24 (2.78–206.65)[a]	—	45.3 (5.89–348.89)	.001[a]

[a] $P < .05$; all comparisons controlled for functional disability at baseline.

relevance to the understanding of social and environmental factors that select people out for healthy aging outcomes even in circumstances that may presumably be hostile to longevity.

Before considering these findings further, several caveats are in order. First, predictors of successful aging were examined in persons aged 65 and older at baseline. Although it is possible that lifestyle factors examined may reflect lifelong ways of doing things in these elderly persons, it is also likely that distal factors operating earlier in life, and not examined in this study, may be important in determining aging outcomes. Second, predictors were studied in elderly persons who remained alive through the follow-up period and not in those who died. Thus, the findings relate to healthy aging in those who were living and did not include factors that may have been associated with this outcome in those who had died. Third, in view of the fact that most of the outcome and antecedent factors were based on self-report rather than objective investigations, the likelihood of reporting bias cannot be excluded, although the fact that the information on the antecedent or predictor factors were obtained several years before that on outcomes should obviate this.

Unlike most previous studies, three relatively independent models of successful aging were first explored before doing the same for a composite definition, because there has been little agreement in the literature on the number and combination of models that best define successful aging. In doing this, the study sought to address the dilemma that researchers often confront in this area, whether objective measures are necessarily more valid than subjective reports of elderly persons.[13,14,29] The observation that the relationship between the three models is modest supports the approach taken. In this regard, a striking observation is that the definition of successful aging used was critical in determining the proportion of elderly persons who could be described as successful agers. Thus, while 74% of the cohort could be described as successful agers using the model of functional independence, only 17% could be so described using absence of chronic health condition. Subjective perception of aging, as assessed according to self-reported life satisfaction, classified approximately 42% as aging successfully. On the other hand, only 7.5% of the cohort met all three definitions. A review of 28 studies found that the reported proportion of successful agers ranged from 0.4% to 95%, with one of the most important sources of variability being the definitions used.[6] For example, in a study in which successful aging was defined as having optimal overall functioning (measured in three domains: physical, social, and psychocognitive functioning) and subjective well-being, only 10% of the sample could be classified as successfully aging.[9]

The findings of the exploration of predictors of successful aging lend themselves to several interesting interpretations. First, the three models of successful aging examined represent the outcomes of different life trajectories. For example, while predictors of the absence of chronic health condition could not be identified, several factors were associated with functional independence. Perhaps more distal factors, rather than the proximal ones

examined in this study, were predictive of the absence of chronic health conditions. Second, predictors of successful aging were essentially modifiable factors. Among the most salient were social and lifestyle factors such as availability of social network, not smoking, and engagement in physical activity. These factors have been noted in some previous studies.[6,12,30–32]

The findings of this study show that, depending on the model used, between 7.5% and 75% of community-dwelling elderly persons in this developing country with low life expectancy could be classified as successful agers. Modifiable factors such as physical exercise and availability of supportive social network predict successful aging. The findings emphasize the potential value of health promotion in older people that targets behavior and that may lead to demonstrable benefits in health and overall well-being.

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