Functional status and associated factors in older persons living on the island of Fernando de Noronha: a cross-sectional study

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Abstract

Objective: To analyze the functional status profile and associated factors in older persons living on Fernando de Noronha Island/Pernambuco, Brazil. *Method:* This was a cross-sectional, analytical study, and data collection was conducted between August and October 2019. The study population comprised 176 older persons living on the island. The collection protocol was applied through an interview to respond to the behavior of demographic, social, clinical and environmental variables, and to the assessment instruments. The functional status was determined from the Analysis of Latent Classes, evaluated by the protocols of the domains: cognition, mood, instrumental activities of daily living, mobility and communication. *Results:* The chosen analysis model had two classes, named as: "Good autonomy and independence" and "Moderate autonomy and partial dependence". Most older persons had good functional status and the associated factors were: being male, being separated or divorced, living alone, visiting friends or relatives, having worked more than 36 years, being literate, not having a visual or hearing impairment, taking one or two medications and having a history of falls. *Conclusion:* The functional status of island older persons was presented as a multifactorial phenomenon, as demographic, social and clinical factors remained independently associated with good functionality. It is important that the maintenance of the functional state is encouraged in the implementation of public policies aimed at the specificities of populations residing on islands.

Keywords: Aged. Islands. Functional status. Activities of daily living. Personal autonomy.

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INTRODUCTION

Functional status constitutes a crucial component for successful aging and was initially described as the ability to perform basic activities of daily living (BADLs) and instrumental activities of daily living (IADLs) in an independent manner[1]. The World Health Organization (WHO)[2] conceptualizes functional status as a combination of two components: functional ability and intrinsic capacity. In this context, functional ability denotes the meeting of basic needs to ensure standard of living, learning, decision-making, mobility, building/maintaining relationships, and contribution to society. Intrinsic capacity refers to the composite of all physical and mental capacities: physical movement, vitality, cognition, and psychological and sensory capacity.

More recently, the term Functional Status has been included as the descriptor of the official list of Descritores em Ciências da Saúde (DECS) – Health Sciences Descriptors, and is defined as the ability for basic physical and cognitive activities such as walking or reaching, focusing attention, and communicating, and for life situations such as school or play/leisure, work outside the home or maintaining a household.

The use of functional status as an indicator of health of older populations is important for health policy planning. Public authorities should join forces to promote healthy aging, by preserving functional status and maintaining quality of life of older adults[4] in different social contexts.

Minority isolated populations, either geographically, ethnically or culturally, should be respected, and their lifestyles, socioeconomic and health status elucidated[5]. Among the different circumstances in which older people live, the situation of the geographical isolation of island dwellers has been little explored[6].

Islands are associated with the notion of vulnerability and permanent dependence. Numerous difficulties and potentialities can be found on islands, particularly those covering a small land mass. These areas are fertile ground for conducting scientific studies[7,8].

Brazil has only one inhabited oceanic island, a status conferred for its geographic isolation, namely, Fernando de Noronha (part of Pernambuco state). From a scientific standpoint, little is known about the older population living on this island. Although the older population represents a small minority (3.7% of general population), the Aging Index is rising steadily as the older contingent on the island continues to grow[9].

Determining the profile of functional status of older individuals and identifying its associated factors is important for interventions for health promotion, prevention and control of health conditions in this group. Therefore, the objective of the present study was to analyze functional status and its associated factors in older individuals from Fernando de Noronha Island, Pernambuco state.

METHOD

An analytical cross-sectional study, previously approved by the Research Ethics Committee under permit no. 3.371.307, was conducted.

The study population comprised individuals aged >60 years who had lived on the island of Fernando de Noronha, Pernambuco state for at least 1 year and were registered at the island´s only Family Health Clinic. Fernando de Noronha island is considered a district of Pernambuco state. Exclusion criteria were older individuals not present on the island at the time of the study, and subjects who failed to fully complete the collection protocol.

Data collection was carried out between August and October 2019. The interview and application of instruments for the assessment of functional status were performed during home visits from community health workers by a trained, degree-qualified professional. The tests assessing cognition, mood, ADLs and mobility were conducted together with the older individual. Communication was evaluated based on answers given by the caregiver or family member[10]. In cases of cognitive impairment or other impediment, the questions were addressed to the caregiver or family member, since the study sought not to exclude participants with low functional status.

The data collection protocol consisted of a questionnaire devised by the authors covering 43 independent variables plus validated assessment instruments. Information was collected from participants on social characteristics (sex, years living on the island, age, race/color and marital status), demographics (main source of income, main breadwinner, number of people sharing household, water supply, literacy, time working, education, religion, health care, participation in group of representatives, visits friends or relatives, channel of information), clinical status (Systemic Arterial Hypertension – SAH, diabetes, osteopenia/osteoporosis, visual deficit, hearing deficit, number of comorbidities, history of falls in past year, number of medications used, physical exercise, body mass index (BMI), leisure, general health status rating, nutritional health status rating, alcohol and tobacco use) and environmental aspects (quality public transportation, main mode of transport used and frequency of leaving house). The interview entailed applying the closed digital questionnaire, allowing data collection via tablets.

Given the difficulty measuring the dependent variable (functional stratus) through direct observation of performance on activities, Latent Class Analysis was performed. In this process, functional status was the latent phenomenon which was not observed directly, but measured indirectly by the protocols for the domains proposed by Moraes (2012) and adapted for the present study[11].

The concept of Moraes (2012) was adapted by including the assessment of IADLs among the domains: cognition, mood, mobility and communication, given that autonomy and independence are important for carrying out daily activities. The domains of functional status of participants were measured using the tests: Mini-Mental State Exam[12], Geriatric Depression Scale short[13], Lawton & Brody scale[1], Short Physical Performance Battery[14], and the ASHA FACS protocol[10].

The profiles of functioning were identified according to the homogeneity of responses of the population, found in models with different numbers of classes[15]. The final categorization of each instrument used in the assessment of each of the 5 domains was determined.

The following statistical criteria were employed to select the optimal statistical model of the latent variable: Akaike information criterion (AIC), Bayesian information criterion (BIC) and adjusted BIC, observing the lowest values when comparing the k models with k-1 class. The highest entropy value was also considered. On the assessment of statistical significance ($p<0.05$) for evaluating the LCA models, three likelihood ratio tests (LRTs) were used: the Lo, Mendell and Rubin likelihood ratio test (LMR-LRT), the Vuong, Lo, Mendell and Rubin likelihood ratio test (VLMR-LRT) and the Bootstrap likelihood ratio test (BLRT).

Data analysis was carried out using descriptive and analytical procedures. Initially, quantitative independent variables were transformed into qualitative variables and their absolute and relative frequency determined.

Pearson´s chi-square test or Fisher´s Exact test was used among qualitative and dependent variables, with a 5% significance level, together with the Standardized Residuals analysis with one-tailed test and standardized large values of over 1.96 ($p<0.025$ one-tailed).

Simple analysis revealed whether the distribution of demographic, social, clinical and environmental factors, according to functional status, was random or a pattern determined by dependence among the variables. Standardized Residual Analysis between dependent and independent variable category pairs enabled comparison of characteristic patterns of each category.

Measures of effect were calculated to check the magnitude and direction of the association of factors related to functional status, and were expressed as Odds Ratio (OR) and respective 95% Confidence Intervals. Binary logistic regression models were constructed and confounding factors were controlled using the analytical approach.

Thus, for the multiple analysis, variables with p-value <0.25 on the chi-square test were elected and the other conclusions reached for a 5% significance level. After applying the stepwise forward method, variables with $p<0.05$ remained. The choice of final model was based on the highest number of

significant variables, lowest confidence interval values, highest log-likelihood value, a Nagelkerke R^2 value nearest 1, and >0.05 significance on the Hosmer and Lemeshow test, besides the possibility of the existence of a fit variable.

RESULTS

A total of 176 older adults of both genders from Fernando de Noronha island took part in the study. From the initial sample of 241 older users followed at the health clinic, 65 individuals were excluded: 61 for being away from the island during the study and 4 for not having at least one of the domains of functional status assessed, not having fully completed the collection protocol.

Functional status of the participants was determined using the 5-model test for LCA. The most parsimonious model identified was that containing 2 classes, exhibiting significant LRT values, along with lower AIC. BIC and adjusted BIC values (Table 1).

Naming of the 2 classes found was derived from the analysis of response patterns in each of the 5 protocols applied to assess functional status. The response patterns identified in the population analyzed were: normal cognition and cognitive decline (Cognition); absence of Depression and possible Depression (Mood); partial dependence and total independence (IADLs); moderate capacity and good capacity (Mobility), and; no assistance and moderate assistance (Communication) (Table 2).

Names were attributed according the 2 patterns of responses. Class 1, denoted "Good autonomy and independence", had a high response rate for: normal cognition, absence of depression (normal mood), total independence for IADLs, good mobility, and lower response rate for moderate assistance in communication, compared to Class 2. Class 2 was called "Moderate autonomy and partial dependence", and had lower response rate for: normal cognition, absence of depression (normal mood), and good mobility; and higher response rate for moderate assistance in communication compared to Class 1. In addition, Class 2 had a high response rate for partial dependence in IADLs (Table 2).

With regard to functional profile of the study population, the prevalence of good autonomy and independence among the older islanders was 80.7%, whereas the percentage exhibiting moderate autonomy and partial independence was 19.3%.

The population of older individuals investigated was characterized according to social, demographic, clinical and environmental variables. Regarding demographic aspects, of the 176 individuals analyzed, most (78.4%) were aged 60-69 years, i.e. young-old adults. Mean age was 66 years (range 60-99 years).

In terms of gender distribution, there was a slight predominance of females (51.1%) over males (48.9%). For skin color, 31.3% were white, 66.5% black/brown, and 2.8% yellow or indigenous. Regarding marital status, 48.3% were married, 22.7% single, and 16.5% widowed (Table 3).

Table 1. Analyses of models with different patterns of responses on LCA. Fernando de Noronha, Pernambuco state, 2019.

Number of Classes	Model 2	Model 3	Model 4	Model 5	Model 6
AIC	909,005	916,199	921,966	929,313	938,876
BIC	943,881	970,097	994,888	1,021,257	1,049,843
Adjusted BIC	909,046	916,263	922,052	929,422	939,006
Entropy	0.613	0.833	0.934	0.902	0.915
LRT VLMR-LRT	$p = 0.0200$	$p = 0.3693$	$p = 0.1531$	$p = 0.1038$	$p = 0.3701$
LRT LMR-LRT	$p = 0.0226$	$p = 0.3801$	$p = 0.1583$	$p = 0.1089$	$p = 0.3806$
LRT BLRT	$p = 0.0000$	$p = 1.0000$	$p = 1.0000$	$p = 0.5000$	$p = 0.5000$

Legend: LCA – Latent Class Analysis; AIC - Akaike Information Criterion; BIC - Bayesian Information Criterion; LRTs – Likelihood Ratio Tests; LMR-LRT - Lo, Mendell & Rubin Likelihood Ratio Test; VLMR-LRT - Vuong, Lo, Mendell & Rubin Likelihood Ratio Test; and BLRT - Bootstrap Likelihood Ratio Test.

Table 2. Distribution for response patterns on each domain of functional status, according to result on Latent Class Analysis. Fernando de Noronha, Pernambuco state, 2019.

Domains and categories	Total	Latent Classes of Functional Status**	
	n (%)	Class 1 – Good autonomy and independence	Class 2 – Moderate autonomy and partial dependence
Cognition			
Normal cognition	123 (69.9)	73.6%	57.9%
Cognitive decline	53 (30.1)	26.4%	42.1%
Mood			
Absence of depression	117 (66.5)	79.4%	72.9%
Possible depression	39 (33.5)	20.6%	27.1%
IADLs*			
Total independence	130 (73.9)	87.5%	29.6%
Partial dependence	46 (26.1)	12.5%	70.4%
Mobility			
Moderate capacity	17 (9.7)	0%	41.0%
Good capacity	159 (90.3)	100.0%	59.0%
Communication			
Moderate assistance	127 (72.2)	70.0%	93.6%
No assistance	43 (24.4)	30.0%	6.4%

Legend: * IADLs: Instrumental Activities of Daily Living.

Table 3. Distribution of demographic and social variables according to functional status of participants. Fernando de Noronha, Pernambuco, 2019.

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
DEMOGRAPHIC				
Sex				**0.001***
Male	86(48.9)	8 (23.5)	**78 (54.9‡)**	
Female	90 (51.1)	**26 (76.5‡)**	64 (45.1)	
Years living on island				0.127
Below median (≤39)	88 (50.0)	13 (38.2)	75 (52.8)	
Above median (>39)	88 (50.0)	21 (61.8)	67 (47.2)	
Age in categories				**0.000***
60-69 years	138(78.4)	19 (55.9)	**119 (83.8‡)**	
70 years	38 (21.6)	**15 (44.1‡)**	23 (16.2)	
Race/ Color				0.373
White	54 (30.7)	9 (26.5)	45 (31.7)	
Black/Brown	117 (66.5)	23 (67.6)	94 (66.2)	
Yellow or Indigenous	5 (2.8)	2 (5.9)	3 (2.1)	

to be continued

Continuation of Table 3

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
Marital status				**0.001***
Married	85 (48.3)	12 (35.3)	73 (51.4)	
Single, separated or divorced	62 (35.2)	9 (26.5)	53 (37.3)	
Widowed	29 (16.5)	**13 (38.2‡)**	16 (11.3)	
SOCIAL				
Main source of income				**0.001†**
Formal/informal work	100 (56.8)	11 (32.4)	**89 (62.7‡)**	
Retirement/social security benefit	51 (29.0)	10 (29.4)	41 (28.9)	
Pension	15 (8.5)	**7 (20.6‡)**	8 (5.6)	
Third-party	10 (5.7)	**6 (17.6‡)**	4 (2.8)	
Main breadwinner				**0.000***
Older individual and family member	86 (48.9)	11 (32.4)	**75 (52.8‡)**	
Older individual	71 (40.3)	12 (35.3)	59 (41.5)	
Other family member	19 (10.8)	**11 (32.4‡)**	8 (5.6)	
Number of people sharing household				0.098
1	42 (23.9)	5 (14.7)	37 (26.1)	
2	54 (30.7)	8 (23.5)	46 (32.4)	
≥3	80 (45.5)	21 (61.8)	59 (41.5)	
Water supply				**0.002***
Well or spring	8 (4.5)	**5 (14.7‡)**	3 (2.1)	
Mains network	168 (95.5)	29 (85.3)	**139 (97.9‡)**	
Literacy				**0.000***
Yes	146 (83.0)	20 (58.8)	**126 (88.7‡)**	
No	30 (17.0)	**14 (41.2‡)**	16 (11.3)	
Education				**0.001†**
No formal education	11 (6.3)	**6 (17.6‡)**	5 (3.5)	
1-3 years	14 (8.0)	4 (11.8)	10 (7.0)	
4-7 years	50 (28.4)	14 (41.2)	36 (25.4)	
>7 years	101 (57.4)	10 (29.4)	**91 (64.1‡)**	
Time working				**0.000***
0-35 years	37 (21.0)	**18 (52.9‡)**	19 (13.4)	
> 36 years	139 (79.0)	16 (47.1)	**123 (86.6‡)**	
Health care				0.114
Hospital	96 (54.5)	23 (67.6)	73 (51.4)	
Health Clinic	47 (26.7)	8 (23.5)	39 (27.5)	
Pharmacy	18 (10.2)	0 (0.0)	18 (12.7)	
Other	15 (8.5)	3 (8.8)	12 (8.5)	

to be continued

Continuation of Table 3

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
Participation in group of representatives				0.214
Yes	34 (19.3)	4 (11.8)	30 (21.1)	
No	142 (80.7)	30 (88.2)	112 (78.9)	
Visits friends or relatives				**0.010***
Yes	92 (52.3)	11 (32.4)	**81 (57.0‡)**	
No	84 (47.7)	**23 (67.6‡)**	61 (43.0)	
Religion				**0.024┼**
Protestant/Evangelist	63 (35.8)	**18 (52.9‡)**	45 (31.7)	
Catholic	88 (50.0)	15 (44.1)	73 (51.4)	
Spiritist or other religion	7 (4.0)	1 (2.9)	6 (4.2)	
No religion	18 (10.2)	0 (0.0)	**18 (12.7‡)**	
Channel of information				**0.019***
TV	103 (58.5)	**25 (73.5‡)**	78 (54.9)	
Internet	61 (34.7)	5 (14.7)	**56 (39.4‡)**	
Radio, Newspaper/Magazine, other	12 (6.8)	4 (11.8)	8 (5.6)	
TOTAL	**176 (100.0)**	**34 (19.3)**	**142 (80.7)**	

Legend: n: number of participants; *Chi-square test; ┼ Fisher Exact test; ‡ standardized residuals > 1.96 p < 0.05

On the analysis of social conditions, 83% of participants were literate. Regarding number sharing household: 23.9% lived alone, 30.7% lived with one other person, and 45.5% lived with 2 people or more. For time working, 79% had worked for over 35 years (Table 3).

In terms of pertinent clinical conditions, 35.2% had visual deficit, 14.8% hearing deficit, and 35.8% had at least one fall in the past year. Regarding lifestyle and number of medications used, 25% used no medications, 40.3% 1 or 2 medications, and 34.7% used 3 or more medications (Table 4).

On the simple analysis, the factors associated with functional status were identified: age, sex, marital status, literacy, main source of income, main breadwinner, time working, education, water supply, information channel, religion, SAH, diabetes, osteopenia/osteoporosis, visual deficit, hearing deficit, number of comorbidities, number of medications used, remaining teeth, physical exercise, BMI, visits friend or relatives, leisure, general health rating, alcohol use, quality public transportation, main mode of transport used, and frequency leaving the home.

Of the 43 variables analyzed, 41 yielded p-values<0.25 and were included in the multiple model test. Subsequently, 10 variables remained independently associated with functional status. The final model was selected based on the highest number of significant variables, lowest values for confidence intervals, highest log-likelihood value, a Nagelkerke R^2 value nearest 1, and $p>0.05$ significance on the Hosmer and Lemeshow test (Table 5).

Table 4. Distribution of clinical and environmental variables according to functional status of participants, Fernando de Noronha, Pernambuco state, 2019.

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
CLINICAL - MORBIDITY				
Diabetes mellitus				**0.048***
Yes	53 (30.1)	**15 (44.1‡)**	38 (26.8)	
No	123 (69.9)	19 (55.9)	**104 (73.2‡)**	
SAH				**0.034***
Yes	101 (57.4)	**25 (73.5‡)**	76 (53.5)	
No	75 (42.6)	9 (26.5)	**66 (46.5‡)**	
Osteopenia/Osteoporosis				**0.004***
Yes	21 (11.9)	**9 (26.5‡)**	12 (8.5)	
No	155 (88.1)	25 (73.5)	**130 (91.5‡)**	
Visual deficit				**0.045***
Yes	62 (35.2)	**17 (50.0‡)**	45 (31.7)	
No	114 (64.8)	17 (50.0)	**97 (68.3‡)**	
Hearing deficit				**0.007***
Yes	26 (14.8)	**10 (29.4‡)**	16 (11.3)	
No	150 (85.2)	24 (70.6)	126 (**88.7‡**)	
Number of comorbidities				**0.005***
0	13 (7.4)	3 (8.8)	10 (7.0)	
1	39 (22.1)	1 (2.9)	**38 (26.8‡)**	
2	42 (23.9)	6 (17.6)	36 (25.4)	
≥3	82 (46.6)	**24 (70.6‡)**	58 (40.8)	
History of falls in past year				0.207
0	113 (64.2)	25 (73.5)	88 (62.0)	
≥1	63 (35.8)	9 (26.5)	54 (38.0)	
CLINICAL – LIFE STYLE				
Physical exercise				**0.006***
Inactive (<3 days)	108 (61.4)	**29 (85.3‡)**	79 (55.6)	
Active (3-4 days)	28 (15.9)	3 (8.8)	25 (17.6)	
Active (≥5 days)	40 (22.7)	2 (5.9)	**38 (26.8‡)**	
Sleep per night (hours)				0.196
Below median (≤7)	90 (51.1)	14 (41.2)	76 (53.5)	
Above median (>7)	86 (48.9)	20 (58.8)	66 (46.5)	
General health status				**0.034***
Excellent or good	120 (68.2)	18 (52.9)	**102 (71.8‡)**	
Fair, poor, very poor	56 (31.8)	**16 (47.1‡)**	40 (28.2)	
Nutritional health status				0.256
Excellent or good	118 (67.0)	20 (58.8)	98 (69.0)	
Fair, poor, very poor	58 (33.0)	14 (41.2)	44 (31.0)	

to be continued

Continuation of Table 4

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
Smoking status				0.381
Smoker	22 (12.5)	2 (5.9)	20 (14.1)	
Non-smoker	72 (40.9)	16 (47.1)	56 (39.4)	
Ex-smoker	82 (46.6)	16 (47.1)	66 (46.5)	
Alcohol use				**0.040***
Non-user	83 (47.2)	21 (61.8)	62 (43.7)	
Ex-user	34 (19.3)	8 (23.5)	26 (18.3)	
User	59 (33.5)	5 (14.7)	**54 (38.0‡)**	
Leisure				0.012*
Yes	106 (60.2)	14 (41.2)	**92 (64.8‡)**	
No	70 (39.8)	**20 (58.8‡)**	50 (35.2)	
Number of medications				0.001*
0	44 (25.0)	5 (14.7)	39 (27.5)	
1-2	71 (40.3)	7 (20.6)	**64 (45.1‡)**	
≥3	61 (34.7)	**22 (64.7‡)**	39 (27.5)	
Body Mass Index				0.009*
Underweight	16 (9.1)	**7 (20.6‡)**	9 (6.3)	
Normal weight	47 (26.7)	4 (11.8)	**43 (30.3‡)**	
Excess weight	113 (64.2)	23 (67.6)	90 (63.4)	
ENVIRONMENTAL				
Quality public transportation				0.009*
Yes	94 (53.4)	**25 (73.5‡)**	69 (48.6)	
No	82 (46.6)	9 (26.5)	**73 (51.4‡)**	
Mode of transport used				0.005*
None	90 (51.1)	9 (26.5)	**81 (57.0‡)**	
Personal/family vehicle	52 (29.5)	14 (41.2)	38 (26.8)	
Taxi, public transport or third	34 (19.3)	**11 (32.4‡)**	23 (16.2)	
Frequency leaving home				0.000*
Always	125 (71.0)	14 (41.2)	**111 (78.2‡)**	
Sometimes	36 (20.5)	11 (32.4)	25 (17.6)	
Rarely	15 (8.5)	**9 (26.5‡)**	6 (4.2)	
TOTAL	176 (100.0)	34 (19.3)	142 (80.7)	

Legend: n: number of participants; Chi-square test; ┼ Fisher Exact test; ‡ standardized residuals > 1.96 $p < 0.05$

Table 5. Multiple analysis of association of functional status of participants with independent variables, odds ratios and estimated confidence intervals, Fernando de Noronha, Pernambuco, 2019.

VARIABLE	Good autonomy and independence		
	OR	CI	*p*-value
Sex			
Male	6.93	(1.471-32.685)	0.014
Female	1.00	-	-
Marital status			
Married	2.82	(0.553-14.355)	0.212
Separated or divorced	**14.87**	(1.212-82.413)	**0.035**
Single	3.24	(0.495-21.195)	0.220
Widowed	1.00	-	-
Number of people sharing household			
1	**5.49**	(1.058-28.560)	**0.043**
2	**5.30**	(1.221-23.016)	**0.026**
≥3	1.00	-	-
Time working			
0-35 years	1.00	-	-
>36 years	**6.38**	(1.622-25.089)	**0.008**
Literacy			
Yes	**13.19**	(2.874-60.535)	**0.001**
No	1.00	-	-
Visits friends or relatives			
Yes	**5.20**	(1.478-18.311)	**0.010**
No	1.00	-	-
Visual deficit			
Yes	1.00	-	-
No	**4.96**	(1.284-19.171)	**0.020**
Hearing deficit			
Yes	1.00	-	-
No	**9.23**	(1.846-46.192)	**0.007**
Number of medications used			
0	3.93	(0.712-21.691)	0.117
1-2	**7.23**	(1.697-30.822)	**0.007**
≥3	1.00	-	-
Falls History			
0 falls	1.00	-	-
≥ 1 fall	**4.72**	(1.200-18.564)	**0.026**
Hours sleep per night*			
Below median (≤7)	3.18	(0.942-10.751)	0.062
Above median (>7)	1.00	-	-

Legend: OR - odds ratio; CI – confidence interval; * fit variable of final model.

Regarding the demographic aspects, sex and marital status were independently associated with functional status. Male participants had a 6.93 times greater chance of having good autonomy and independence compared to females. Subjects who were separated or divorced had a 14.87 times greater chance of having good functional status than individuals who were widowed (Table 5).

For social characteristics, the variables number of people sharing household, time working, visits friends or relatives, and literacy showed an independent association with functional status, as measured by OR analysis. Participants that lived alone (OR=5.49 or with 1 other person (OR=5.30), visited friends or relatives at least twice a week (OR=5.20), had worked for longer than 36 years (OR=6.38) and were literate (OR=13.19), all had a greater chance of exhibiting good autonomy and independence (Table 5).

Of the clinical characteristics assessed, the variables exerting a positive effect on good functional status were: not having visual (OR=4.96) or hearing (OR=9.23) deficits; having at least 1 fall in past year (OR=4.72) and using 1 or 2 medications (OR=7.23), as opposed to using no medication or ≥3 medications (Table 5).

DISCUSSION

Overall, the profile of functional status of the older people from Fernando de Noronha island, Pernambuco state, was good, where 80% exhibited good autonomy and independence. Demographic, social and clinical factors were independently associated with functional status of the older islanders. It is important to point out that the findings of the present study represent the functional status of the participants prior to the COVID-19 pandemic.

Maintaining autonomy and independence during the aging process is a fundamental goal for individuals and public authorities[16]. Functional status can be strongly influenced by a variety of different demographic and socioeconomic factors, associated with the physical and social environments, as well as with life style[2,17].

Some studies carried out on islands have investigated functional status of older residents. However, the situation on isolated (remote) islands such as Fernando de Noronha has been less explored. The findings on the functional status of the older residents of Fernando de Noronha proved similar to that of other populations, albeit with different spatial characteristics of the island.

In a study of the rural community of Yoita city, located on a Japanese island, 84.7% of the 1,274 subjects showed maintenance or improvement in IADLs. Moreover, the authors found that positive self-rated health and cognition predicted protection against decline in functional status[18]. A longitudinal study of 505 older individuals from the city of Tosa, on a large Japanese island, found that 85.7% of participants maintained good functional status, as assessed by performance in BADLs, and that psychological wellbeing can have a favorable effect on maintaining this status[19].

Assessing IADL is an approach commonly used for measuring functional status in a number of studies[18-20]. However, in this type of analysis, key aspects are not considered, such as the domains of cognition, mood, mobility and communication. Disparities in the different methods used hampers comparison of results across studies, highlighting the need for standardizing this measure. Environmental aspects related to the type of community in which the older person lives are also often overlooked in these studies.

With regard to the demographic profile of the older Fernando de Noronha islanders, most were female and younger-old individuals. These data match the profile of the older Brazilian general population, which features more women than men and a predominance of individuals aged 60-69 years[21]. In the present study, however, the proportion of older islanders in this age group was 78.4%, characterizing a larger contingent of younger-old compared to the 55.7% in the Brazilian population as a whole.

This island´s population consisting of predominantly younger-old individuals might be explained by the fact that many individuals whose

functional status declines or who require more intensive care tend to migrate back to the mainland. This occurs because the healthcare available on the island is of lower quality. Also, if the population has not reached more advanced age, it does not manifest significant functional decline, a scenario which can explain the overall good functional status of the islanders assessed. On a national level, migratory movements have led to spatial heterogeneity of aging in the Brazilian population. A phenomenon of "expulsion" of oldest-old individuals from the towns has occurred owing to shortcomings in social policy, health care and social support at older ages[22].

In the present study, the demographic, social and clinical aspects that impact functioning of the older islanders were identified. Sex and marital status were demographic factors retained in the final multiple analysis model. Males were more likely to have good functional status than females, corroborating an earlier study which identified an association between female gender and functional decline[23].

Having separated or divorced status was associated with a 14 times greater probability of having good functional status compared to being a widow/widower. This finding, however, conflicts with the literature. A previous study of community-dwelling Brazilians found that dependence for IADLs and/or BADLs was associated with not having a partner[24]. In the present study, information bias may have occurred due to incorrect classification of individuals in terms of marital status. Alternatively, this may represent a case of reverse causality, whereby more autonomous independent older individuals may be a marker of the categories (separated or divorced) and not of its effect.

With regard to the social variable "time working", participants working for 36 years or longer had a higher probability of having good functional status. Carrying on working, even after retirement, is a characteristic of most of the older people evaluated, likely because of the high cost of living on the island. These data corroborate a 2004 study investigating the socioeconomic and epidemiological profile of the older population on the island, which revealed that 66.3% were engaged in paid work[25]. It is noteworthy that Brazil´s workforce includes a large contingent of older people. The proportion of older individuals that stop working upon retirement is shrinking[26]. On the island of Shikoku, positive self-rated health, self-maintenance of instrumental tasks, and working at least 1 day a week, were strong protective factors against functional decline[27].

Paying visits to friends and relatives at least twice a week was associated with a 5 times greater chance of good functional status. A Brazilian study found that not having formal and informal social network components was associated with disability for performing IADLs and BADLs. According to the authors, not engaging in group social or work activities can play an important role in the deterioration of functioning of older people. The study also revealed that not having family members to rely on and not living with a partner can have a greater impact on older women[28].

By contrast, in the present study, individuals living alone, or with one person, was associated with a 5-fold greater chance of having good functional status than those living with 3 or more others. The present study was cross-sectional, precluding any conclusions on whether number of people sharing the household influenced functional status or otherwise.

This study, besides its design, had some limitations, including memory bias, given that the older participants interviewed could potentially have answered questions inaccurately, while caregivers and family members may also have reported erroneous information on the older subject´s independence for communication. The small sample size and dearth of previous investigations of islanders also limited the discussion of the results of the present study.

Strengths of the study include the fact that it was conducted within a primary care setting and employed validated instruments, designed specifically for assessing older populations, that were both fast and easy to apply. Studies conducted in situations closely reflecting real-life circumstances can help promote the introduction of more effective actions to improve the health of community-dwelling older people.

Being literate correlated with a high likelihood of good functional status, mirroring the findings in the literature. In a study of community-dwelling older individuals, limited formal education was associated with lower cognitive performance, functional disability and frailty[29].

Concerning clinical aspects assessed in the present study, having a history of at least one fall in the past year was associated with greater odds of good functional status, a relationship possibly explained by reverse causality. Older individuals who fall are possibly more exposed to the environment than those who remain housebound. A study of community-dwelling older individuals from Hokkaido island concluded that being homebound predicted functional decline for BADLs, where as those having a history of falls were at greater risk of worse functional status compared to those who were homebound without falls[30].

In the present investigation, using one or two medications, as opposed to not using 3 or more medications, was associated with good functional status. This finding may constitute an information bias, because use of no medications was associated with lower chance of good functional status. Only 7.4% of older islanders reported no comorbidities and 25% of the older population used no medications, indicating possible poor control of diseases and consequent erroneous information. This raises the questions as to whether participants who reported not using any medications should in fact be using them. The literature shows that the use of numerous medications (polypharmacy) is negatively associated with functional status[31,32], a relationship confirmed by the current study.

In the present study, absence of visual or hearing deficits was associated with greater likelihood of good functional status. Impaired vision and hearing can negatively impact social life and physical functioning, while also causing mobility and communication problems and negatively impacting functional status[25].

Overall, few of the variables in the final multiple analysis model were independently associated with functional status, replicating the findings of other studies of older islanders worldwide. Difference among regions (developed or underdeveloped) and settings (rural or urban) might be a more plausible explanation for this phenomenon. Moreover, the spatial status of being on an island was not explored by studies in community-dwelling older people.

Continued participation in social, economic, cultural, spiritual and community affairs characterizes active aging[16,33]. To this end, stimulating improvement in the physical and social environment, mobilizing groups and individuals to support health, and greater dissemination of knowledge and skills toward promoting and protecting health of older people are critical.

Further studies should be conducted to elucidate the possible differences in factors affecting older islanders, particularly for islands that are smaller, more remote and with sparse populations, as is the case for Fernando de Noronha. It is important that, in any social setting of older people, actions to help maintain functional status during the aging process be fostered, along with the implementation and improvement of public policies for community-dwelling older adults, including those who live on islands.

CONCLUSION

The majority of the older islanders from Fernando de Noronha had good autonomy and independence. Functional status was shown to be a complex multifactorial phenomenon, in as far as demographic, social and clinical factors were independently associated with good functioning.

The variables sex, marital status, number sharing the household, time working, literacy, visits friends or relatives, visual and hearing deficits, number of medications used, falls history, and hours sleep per night all proved factors associated with good autonomy and independence in older Fernando de Noronha islanders.

Identifying the factors which positively influence functional status of older individuals from Fernando de Noronha is valuable for promoting the implementation of public policies addressing the specificities of the local population.

Lastly, the study findings highlight the importance of further investigating this small community population, isolated from the continent, residing on Brazil´s only inhabited oceanic island.

AUTHORSHIP

- Amanda Maria Santiago de Mello – conception, data analysis and interpretation, writing and critical review of article; approval of version for publication; and involvement in all aspects of the study, vouching for issues related to the accuracy or integrity of any part of the work.
- Rafael da Silveira Moreira – data analysis and interpretation, critical review, approval of version for publication.
- Vanessa de Lima Silva – conception, design, data analysis and interpretation, writing or critical review of article; approval of version for publication.

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