





Disability on performing daily living activities in the elderly and history of falls: an analysis of the National Health Survey, 2013

Dificuldade de realizar atividades de vida diária e histórico de quedas em idosos: uma análise da Pesquisa Nacional de Saúde, 2013

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ABSTRACT: *Objective:* The aim of this study was to verify the association between types of dependence for basic and instrumental activities of daily living and the occurrence of falls in the elderly. *Methods:* A cross-sectional, population-based study using data from 23,815 elderly people drawn from the National Health Survey (NHS) in 2013. The NHS, conducted by the Brazilian Institute of Geography and Statistics (IBGE) and the Ministry of Health, presents data collected in 81,767 households in more than 1,600 municipalities. The association between the independent variable (ADL disabilities) and the dependent variable (history of falls) was performed through multiple and crude analyses, regression. *Results:* There was a greater association between *using the toilet* and *transfers* (ABVD) and falls, and between *shopping* and *taking care of finances* (IADL) and falls. In addition, the association between Basic Activities of Daily Living and falls was greater for up to four activities, and the Instrumental Activities of Daily Living for up to three activities. *Conclusion:* Thus, the results obtained in the NHS reinforce the planning of preventive strategies considering the functional dependence.

Keywords: Accidental falls. Aged. Cross-sectional studies. Health services.

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RESUMO: *Objetivo:* O objetivo do estudo foi verificar a associação entre os tipos de dependência para as atividades básicas e instrumentais de vida diária e a ocorrência de quedas de idosos. *Metodologia:* Estudo transversal, de base populacional, com a utilização dos dados de 23.815 idosos, extraídos da Pesquisa Nacional de Saúde (PNS) de 2013. A PNS, realizada pelo Instituto Brasileiro de Geografia e Estatística (IBGE) e o Ministério da Saúde, apresenta dados coletados em 81.767 domicílios, em mais de 1.600 municípios. A associação entre a variável independente (incapacidades nas AVD) e a dependente (histórico de quedas) foi realizada por meio de análises brutas e múltipla, e de regressão. *Resultados:* Houve maior associação entre usar banheiro e fazer transferências (ABVD) e quedas, e entre fazer compras e cuidar das finanças (AIVD) e quedas. Ainda, a associação entre as ABVD e quedas foi maior para até quatro atividades, e as AIVD para até três atividades. *Conclusão:* Assim, os resultados obtidos na PNS reforçam o planejamento de estratégias preventivas, considerando a dependência funcional.

Palavras-chave: Acidentes por quedas. Idoso. Estudos Transversais. Serviços de saúde.

INTRODUCTION

The occurrence of falls is a prevalent event among the elderly population and has been the target of different loco-regional and national studies¹⁻³. The National Health Survey (NHS) 2013, one of the largest epidemiological surveys in Brazil, showed a prevalence of falls of 7.8% in Brazilian population, with a homogeneous distribution among the regions⁴. The analysis of the occurrence by the Brazilian administrative regions confirms the discrepancy of values between North and Midwest (8.5%) and Southeast (7.3%). Between states, there is a variation from 5.36 (Rondônia) to 11.3% (Sergipe)⁴. In Spain, the study by Molinero et al. showed a prevalence of falls of 13.9%⁵, and in Canada, the value is 5.8%, according to the study by Chang and Do (2015)⁶, similar to Brazilian values.

Due to its consequences, including seek for high complexity health services, falls are considered an important public health problem. Among the associated factors, we highlight hospitalizations, institutionalization, fear of falling, number of medications, and rheumatic diseases^{3,7-9}.

In addition, falls may be related to the inability to perform activities of daily living independently, whether basic (BADL) or instrumental (IADL)^{8,10}. BADL refers to the capacity to self-care, specifically the ability to dress, take a bath, transfer, feed, go to the bathroom, and have urinary and fecal continence. IADL is related to the functional capacity of managing the environment in which they live and socially interact, such as using a transport, using the telephone, preparing meals, washing clothes, handling money, administering medicines, and shopping¹¹⁻¹⁴.

Brazilian and international studies^{3,15,16} have demonstrated a negative relationship between the abilities to perform ADL and the prevalence of falls among elderly. However, there are few evidences in the literature analyzing the association between the types of BADL or IADL and falls. Knowledge of these disabilities may help health professionals and managers in planning preventive strategies for the event, especially with regard to the elderly seeking

health care. Society in general may also be aware of specific care regarding the maintenance of ADL for elderly people with a history of falls.

Thus, the aim of the study was to verify the association between the type of dependence for basic and instrumental activities of daily living and the occurrence of falls in the elderly.

METHODS

The present study used data from the NHS-2013, a population-based survey conducted by the Brazilian Institute of Geography and Statistics (IBGE) in 2013, in partnership with the Ministry of Health. The NHS was approved by the National Commission of Ethics in Research for Human Subjects, registration number 328,159 2013.

The sample size was approximately 81 thousand households in order to obtain an estimate of some parameters of interest at different levels of disaggregation. The NHS uses IBGE's Master Sample of the Integrated Household Survey System (SIPD), with greater geographic spread and increased precision of the estimates being a representative sample of Brazil, macro regions, Federative Units (UF), metropolitan regions, capitals, and others UF.

The sample plan was organized in three-stage clusters: the first stage refers to stratification of the primary sampling units (PSU) composed of the census tracts or set of sectors; the second stage comprised households; and 18-year old residents or older have defined the third-stage units. After the collection was completed, records of interviews were obtained in 64,348 households and information were collected from approximately 205,000 residents. In this study, selected volunteers aged 60 or over of both sexes, totaled to 23,815 volunteers.

Data collection was performed between August of 2013 and February of 2014, by using a personal digital assistant programmed for the critique of the variables. Seeking better performance, IBGE collecting agents, coordinators, and supervisors were trained to understand the research^{17,18}. The questionnaire was divided into three parts: information about household; information about all the residents of the household in which one resident responded for the others; information of specific demands answered by a resident over the age of 18. More details of the design and methodology of NHS can be obtained in a previous publication¹⁷.

The dependent variable analyzed was: "Have you fallen in the last 12 months that led you to seek health service?"⁵. This information composes the questionnaire referring to all residents of the household. The independent variables studied were: sex (male and female); age range (60–64, 65–74, 75 years and over) and functional disability.

Functional disability was determined by BADL and IADL. BADL evaluated *eating, bathing, using the toilet, dressing, transferring, and getting up*^{11,19}. IADL analyzed *shopping, taking care of finances, taking medicines, and using transportation*¹⁴. For both BADL and IADL the response alternatives were:

- Cannot;
- Has great difficulty;
- Has little difficulty;
- Has no difficulty.

The elderly who either had difficulty in performing the activities or could not perform them were classified with incapacity for both BADL and IADL. Data analyses were performed using Stata software version 12.0. Sampling weights were defined for PSU, for households and all their residents, and the weight for the selected resident. The survey module (svy) was used to consider the design effect and the sample weights. The prevalence of falls and their 95% confidence intervals (95%CI) were estimated according to the independent variables. To test the association between the dependent variable and independent variables, crude and multiple analyses were performed by means of Poisson regression. A Poisson multiple regression model was developed in three models. In the first model, BADL disabilities were adjusted for gender and age. In the second model, in addition to adjusting for gender and age, BADL was adjusted by IADL and vice versa. Finally, in the third model they were adjusted for all BADL and IADL, gender and age. The stepwise-forward method was used to include the variables in the multiple model.

RESULTS

According to NHS, of the 23,815 elderly, 56.4% were women, 41.9% were between 65 and 74 years old, 54.5% declared white, 52.9% were married, and 77.6% knew how to read and to write, as demonstrated on Table 1.

Table 2 shows that all BADL and IADL presented significant associations with falls. For BADL, the highest prevalence was observed in *transfers* (23%) and *bathroom use* (22%).

Table 1. Socio-demographic profile of elderly people in National Health Survey (NHS), 2013.

Variables	Sample (%)
Sex	
Male	43.6
Female	56.4
Age (years)	
60–64	32.1
65–74	41.9
≥ 75	26.0
Color skin	
Black	8.9
White	54.5
Brown	36.6

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Table 1. Continuation.

Variables	Sample (%)
Marital status	
Married	52.9
Divorced/separated	7.7
Widower	26.7
Single	12.7
Can read and write	
Yes	77.6
No	22.4

Table 2. Prevalence of falls and Crude Prevalence Ratio (PR) according to type of Basic (BADL) and Instrumental Activity of Daily Living (IADL) in the elderly of National Health Survey (NHS). 2013.

Variables	Sample %	Prevalence % (95%CI)	Crude PR (95%CI)
Types of BADL			
Transfer	3.9	23.0 (19.0 – 27.5)	3.20 (2.61 – 3.90)
Using the toilet	3.2	22.1 (17.7 – 27.1)	3.00 (2.40 – 3.77)
Dressing	4.2	20.2 (16.5 – 24.6)	2.78 (2.23 – 3.45)
Bathing	4.2	19.9 (16.1 – 24.4)	2.72 (2.20 – 3.40)
Getting up	3.3	19.2 (15.4 – 23.8)	2.60 (2.05 – 3.25)
Eating	2.2	17.3 (13.0 – 22.7)	2.28 (1.71 – 3.04)
Types of IADL			
Shopping	12.0	19.1 (16.9 – 21.6)	3.04 (2.61 – 3.53)
Using transportation	14.8	17.8 (15.9 – 19.9)	2.92 (2.54 – 3.36)
Taking care of finances	8.6	18.0 (15.5 – 20.8)	2.61 (2.20 – 3.09)
Taking medicines	5.4	17.1 (14.2 – 20.6)	2.34 (1.91 – 2.89)

95%CI: interval of confidence of 95%.

For IADL, the highest prevalence was in the group with the following inability *shopping* (19.1%) and *taking care of finances* (18%).

Regarding the number of BADL involved, it was observed that the prevalence of falls increased in elderly who have up to four activities with some degree of dependence. However, there was a tendency to decrease the prevalence from five or six activities. For IADL,

the prevalence of falls increased in people with some degree of dependence in up to three activities. Table 3 presents these data.

On Table 4, there are four models of fit between variables. In model 1a, adjusting each type of ADL by sex and age, it was observed that all of them maintain an independent association of these variables. Model 2b, adjusting each type of ABVD between them, sex and age, it was observed that only *transfer* and *dressing* were associated. In Model 2c, adjusting the IADL to each other, gender and age, remained associated with *shopping* and *using transportation*. In model 3d, where BADL and IADL were adjusted by sex and age, *transfer*, *shopping*, and *using transportation* were associated with falls.

DISCUSSION

This study analyzed each type of ADL and the prevalence of falls. The results showed that *using the toilet* and *transfers* (BADL), *shopping* and *taking care of finances* (IADL) had an independent association with the occurrence of falls. These results are important for clinical

Table 3. Prevalence of falls and Crude Prevalence Ratio (PR) according to the number of Basic (BADL) and Instrumental Activities of Daily Living (IADL) in the elderly of National Health Survey (NHS). 2013.

Variables BADL	Sample %	Prevalence % (95%CI)	Crude PR (95%CI)
None	92.7	6.8 (6.5-7.5)	1.00
One	2.6	16.1 (12.2-21.0)	2.31 (1.74-3.05)
Two	0.7	17.6 (10.6-28.0)	2.53 (1.54-4.20)
Three	0.5	28.6 (18.3-41.6)	4.09 (2.68-6.26)
Four	0.6	33.5 (21.9-47.6)	4.81 (3.21-7.20)
Five	1.1	20.6 (14.2-28.9)	2.95 (2.04-4.30)
Six	1.3	17.2 (11.3-25.0)	2.45 (1.64-3.68)
Number of committed IADL			
None	82.7	5.9 (5.5-6.5)	1.00
One	5.3	11.7 (9.5-14.4)	1.96 (1.56-2.45)
Two	4.6	17.8 (14.3-22.0)	2.99 (2.38-3.75)
Three	3.4	20.2 (15.9-25.2)	3.39 (2.63-4.35)
Four	4.0	19.1 (15.5-23.5)	3.21 (2.55-4.03)

95%CI: interval of confidence of 95%.

practice since they point out the necessity for vigilance and follow-up of these ADL to prevent future falls.

Although these four ADL have a greater strength of association with the occurrence of falls, it was observed that the types of disability according to the prevalence of falls was high, ranging from 17.3 to 23%. Previous studies that analyzed the association between functional disability and falls also identified a similar prevalence, however the authors did not specify the type of activity^{1,16,20}. A study developed in Ribeirão Preto, São Paulo, showed that the alteration in the capacity to perform the IADL was correlated with the occurrence of falls¹⁶. Inability for daily activities is a variable that is highlighted in the studies, due to its intrinsic relation with falls. Disability of ADL usually indicates changes in the mobility and autonomy of the elderly, that is, their capacity for self-care^{21,22}.

Adjustment of the model according to sex and age did not modify the association effect between types of ADL and falls. However, the adjusted analysis for all BADL and IADL revealed that for the BADL, *transfer* maintained association with falls, and for IADL *shopping* and *using transportation* were the variables that were associated with the dependence on others activities.

Table 4. Multiple analysis models between falls and types of Basic (BADL) and Instrumental Activities of Daily Living (IADL) in the elderly of National Health Survey (NHS). 2013.

Variable	PR adjusted ^a (95%CI)	PR adjusted ^{b,c} (95%CI)	PR adjusted (95%CI)
Type of BADL			
Transfer	2.51 (2.02-3.12) ^a	2.39 (1.50-3.80) ^b	1.60 (1.23-2.10) ^d
Using the toilet	2.31 (1.81-2.93) ^a	1.10 (0.67-1.80) ^b	1.21 (0.79-1.84) ^d
Dressing	2.23 (1.77-2.81) ^a	1.56 (1.01-2.41) ^b	1.24 (0.86-1.80) ^d
Bathing	2.11 (1.66-2.66) ^a	1.00 (0.60-1.66) ^b	0.82 (0.54-1.24) ^d
Getting up	2.01 (1.57-2.57) ^a	0.65 (0.41-1.05) ^b	0.70 (0.46-1.04) ^d
Eating	1.84 (1.5-2.50) ^a	0.85 (0.58-1.25) ^b	0.86 (0.60-1.24) ^d
Type of IADL			
Shopping	2.54 (2.14-3.00) ^a	1.69 (1.30-2.19) ^c	1.60 (1.22-2.10) ^d
Using transportation	2.46 (2.10-2.89) ^a	1.71 (1.35-2.17) ^c	1.69 (1.33-2.15) ^d
Taking care of finances	2.07 (1.72-2.51) ^a	1.03 (0.80-1.33) ^c	1.01 (0.79-1.30) ^d
Taking medicines	1.84 (1.46-2.30) ^a	0.89 (0.68-1.16) ^c	0.82 (0.62-1.08) ^d

^aModel 1: Adjusted by sex and age in each BADL and IADL; ^bModel 2: adjusted by sex, age, transfer, using the toilet, dressing, bathing, getting up, eating; ^cModel 2: adjusted by sex, age, shopping, using transportation, taking care of finances and taking medicines; ^dModel 3: adjusted by sex, age, transfer, using the toilet, dressing, bathing, getting up, eating, shopping, using transportation, taking care of finances, taking medicines; 95%CI: interval of confidence of 95%; PR: prevalence ratio.

Some authors have presented data of falls producing functional limitations²³ and this can lead to a vicious cycle. The study by Choi et al.²⁴, conducted in the United States, considered as functional dependent the elderly who reported being unable to perform one or more daily activities. In total 2,120 volunteers were followed for ten years and the authors described that the elderly, with at least one fall in the previous two years, had some basic or instrumental functional dependence. However, the authors did not report specific types of ADL, only the final result of the functionality. We also need to point out that, since it is a cross-sectional study, in which a causal relationship between the variables is not established, it is possible that the ADLs interfered with the falls.

The association between *transfer* and falls is expected since this activity requires integrity of joint mobility and maintenance of body balance (static and dynamic)²⁵. The systematic review study by Sousa et al. showed that lower extremity strength, balance, and mobility are physiological risk factors for falls²¹. Changing these abilities directly interferes with the capacity to develop functional activities²⁶. The association between *bathing* and falls was also expected, not only because it is an environmental risk factor for falls, but it is also one of the main activities in which there is concern in falling, as well as walking on a slippery floor²⁷. One possible hypothesis is that the elderly may be more careful about some activities that require greater motor skills for their execution, and that is why bathing does not represent the most prevalent disability²⁸.

Regarding IADL, dependence on *shopping* and *taking care of finances* was more closely associated with falls. The probability of falls in older people who are more dependent on these tasks is higher due to exposure to environmental risk factors, such as fear of falling due to walking defects or the fear of crossing the street²⁸. In addition, the IADL are tasks of greater complexity than the BADL and require, besides the motor skills, the cognitive capacity for its execution²⁹. It is now possible to manage finances and to shop through electronic means such as smartphones, computers, or tablets, but technological education is not yet a reality for the elderly in Brazil, limiting its use to facilitating certain tasks thus, promoting autonomy²². This probably links the activity to the need to do it *in loco*.

A household-based study developed in São Paulo³⁰ that used the Health, Well-being, and Aging Study (Saúde, Bem-Estar e Envelhecimento — SABE), analyzed data collected in 2000, 2006, and 2010 in order to identify and rank difficulties related to the performance of ADL in the elderly. The activities that presented greatest difficulty were: using transportation, performing heavy tasks, and taking care of finances. The results of the authors corroborate the findings of the present study, not only in the types of activities reported, but also in relation to the higher prevalence of IADL difficulty when compared to BADL.

About the number of BADL, it was observed that the occurrence of falls increased in the elderly with up to four committed activities, but decreased in the case of five or six activities. It is possible that older people who presented more disability will be less exposed to fall risk factors and thus fall less. A national representative study conducted in the United States also showed that older adults with mild to moderate functional impairment are more likely to report a history of falls than those unable to perform any activity²². As for IADL, the

prevalence was higher for those who were dependent on up to three activities and decreased for dependents in more functions. This result shows that there may be less social participation in reducing exposure to risk factors for falls outside the homes themselves, but there is an effort to try to maintain independence for self-care.

Since it is a cross-sectional study, it is not possible to establish the order of causality between the dependence of the BADL or IADL types and falls. However, the NHS is composed of a large sample of the Brazilian population, which gives precision to the results. Another limitation refers to the outcome that, in the question about falls, includes seek for health services. In general, research on falls prevalence includes only falls occurring in the last year. If the period is greater, the results may be different in terms of the history of falls and the fear of falling, according to the confirmation of a study carried out with elderly men in Portugal³¹. The authors considered the report of falls in the last five years, as well as the fear of falling. Therefore, the discussion of the prevalence of falls and of the factors associated with the event may be broader in this case.

CONCLUSION

All activities that have functional dependence are associated with falls. However, the variables *using the toilet* and *transfer* (BADL) and *shopping* and *taking care of finances* (IADL) showed stronger associations. Adjustment by gender, age, and BADL and IADL allow us to conclude that the variables *transfer*, *shopping*, and *using transportation* are dependent on the functional disabilities of the other abilities. According to the number of activities, the association between falls and the BADL was greater for up to four activities, and the IADL for up to three activities. These results enable a targeted assessment of the functional needs of the elderly and the improvement of the preventive work of falls.

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