







# Complexity of care of hospitalized older adults and its relationship with sociodemographic characteristics and functional independence

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## Abstract

**Objectives:** To investigate the relationship between the complexity of care of hospitalized older adults and sociodemographic and functional independence characteristics. **Method:** A quantitative cross-sectional and descriptive study was carried out in the medical and surgical clinics of the University Hospital of the Universidade de São Paulo, in the state of São Paulo SP, Brazil. A total of 382 older adults were assessed through a socio-demographic inventory, the Mini Mental State Exam, the Katz Index of Independence in Activities of Daily Living and the Interdisciplinary Medicine Instrument Method. **Results:** The complexity of care of participants was associated with the female sex ( $p=0.003$ ), not having a partner ( $p=0.003$ ), having a lower income ( $p=0.022$ ), cognitive decline ( $p<0.001$ ) and dependence in basic activities of daily living (BADL) ( $p<0.001$ ). In the multiple logistic regression model, variables such as the female sex (OR=1.76;  $p=0.018$ ), dependence in one or more activities of daily living (OR=1.26;  $p<0.001$ ) and cognitive decline (OR=3.31;  $p<0.001$ ) remained associated with complexity of care. **Conclusion:** The complexity of care of hospitalized older adults, as it is associated with limitations in BADL and cognitive decline, requires actions by the interprofessional team to ensure the rehabilitation, integration of long-term care and planning of care resources for older patients. Thus, it is necessary to adopt integrated services that include home care and care networks for the elderly, in order to provide qualified post-hospital discharge care and promote the health of the hospitalized older population.

**Keywords:** Needs Assessment. Comprehensive Health Care. Hospital Care. Health of the Elderly.

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## INTRODUCTION

Population aging challenges health service professionals and managers to create actions that can respond to the physical, social, emotional and health demands of the final stage of the life cycle, old age<sup>1</sup>. In literature, the group of older people most susceptible to adverse health outcomes are the longest-lived individuals, with uncontrolled chronic diseases, difficulties in self-care, frailty, sarcopenia and dependence in basic activities of daily living (BADL)<sup>2-6</sup>. These factors predispose such people to difficulties in accessing services, adhering to health guidelines and acute exacerbations of their health conditions<sup>2-6</sup>.

Thus, properly conducted functional assessment can provide important information, as the prevalence of functional disability in older Brazilians is high, especially among women, and is the main health indicator for older adults<sup>7</sup>.

The assessment of functional status is therefore considered an important measure for hospital prognosis<sup>8</sup>. Disabilities seem to influence the effects of multimorbidity, which may be associated with an increased risk of death<sup>9</sup>.

A study using data from the Hospital Information System/Ministry of Health on the characteristics of hospitalizations of Brazilian older adults in the SUS between 1998 and 2013, observed that such hospitalizations represented an expense to the country's public health system in excess of 33 billion reais<sup>10</sup>. It was also observed that the average value of hospitalizations increased from 845.15 million reais in 1998 to 3,971.82 million in 2013, despite the reduction in the number of hospital admissions by 5.9% and the number of beds by 34.1%<sup>10</sup>. These data suggest that the reduction in hospitalizations can be explained by an increase in the quality of life of the older population and, consequently, a reduction in the needs for hospitalization. However, hospitalizations became more complex, given that the growth in the updated average cost of a hospitalization grew by more than 45%<sup>10</sup>.

Thus, the provision of care for this complex profile of needs requires a continuous and interprofessional organization of treatment from the health system, modifying the work process and

ensuring the performance of health actions and services that promote the health and well-being of the older population on a permanent basis. A set of measures is necessary, such as the assessment of the needs of the older population, and the efficient management of the clinical treatment and care for older adults, in order to prevent adverse outcomes, optimizing specialized and high-cost care<sup>10,11</sup>.

Literature has described how the Interdisciplinary Medicine Instrument Method (INTERMED) has proved to be effective in identifying biopsychosocial and health system aspects, allowing professionals and health managers to provide better, more qualified care for hospitalized older adults<sup>12-15</sup>. In clinical practice, the use of INTERMED may allow nursing managers to identify patients with greater psychosocial needs and specify the challenges that patients face individually. By using data profiles from the application of the INTERMED method, healthcare teams can direct care and organize resources to improve the patient's clinical results. This can reduce medical costs and prevent spending on future medical appointments, addressing the psychosocial challenges outlined by the method<sup>16</sup>.

In a previous study, there was a relationship between the psychological domain of INTERMED and cognitive decline in hospitalized older adults, and relationships between the INTERMED Method and performance in BADL<sup>15</sup>.

However, in Brazil, few studies have documented information on sociodemographic characteristics and measures of functional independence according to the complexity of care of hospitalized older adults. Therefore, the collection of this information can assist in the planning of care and the identification of the demand for long-term care in hospitalized older adults. In this sense, the objective of the present study was to investigate the relationship between the complexity of care of hospitalized older adults and characteristics of sociodemographic and functional independence.

## METHOD

A quantitative, cross-sectional and descriptive study was carried out at the medical clinic and

surgical clinic of the Hospital Universitário da Universidade de São Paulo (the University Hospital of the University of São Paulo, or HU-USP), located in the west of the city of São Paulo, Brazil, from 2010 to 2012, a period in which the INTERMED method had already been adapted and validated for use in Brazil. Thus, the study resulted in a database that allowed detailed analyzes of the life and health profile of the hospitalized older people investigated and which can help to understand the needs of this population.

From the 258 beds at HU-USP and the total of 11,956 hospital admissions to the medical and surgical clinics, 382 older people were evaluated. This sample number was chosen as it is close to the 384 cases necessary to reach the degree of complexity of care of at least 50% of the population and with a 95% confidence interval in finite samples. The sample was selected for convenience criteria. The recruitment of participants was carried out based on the records of hospitalized patients aged 60 years or older, updated periodically by the nursing staff of the medical and surgical clinics. The inclusion criteria for the participants were: age 60 years or older and having been hospitalized for more than 48 hours. Patients with aphasia and who had a diagnosis of advanced dementia were excluded.

To characterize the participants, socio-demographic data (name, sex, age, ethnicity, income, and marital status) and total days of hospitalization, information present in the medical records, were collected. To survey the complexity of care and measures of functional independence, patients were interviewed individually, using standardized instruments. The first instrument applied was the INTERMED method, a tool based on data from the medical records, and a semi-structured interview conducted with the patient.

The INTERMED method is composed of 17 questions that allow the completion of a table, and consists of 20 variables that cover history, current state and vulnerability, in relation to the biological, psychological, social and health system domains, to be completed based on the answers of the interviewees. Its purpose is to improve information

and communication among professionals about the health risks of patients and their needs, in order to neutralize these risks and promote preventive and cost-effective care<sup>12</sup>.

The scores for each variable in the INTERMED method domains follow a Likert scale with values estimated from 0 to 3. The scores are classified in an increasing order of complexity, with the score 0 (zero) corresponding to the absence of complexity and 3 (three) corresponding to the highest level of complexity of a given variable. The total sum of the 20 variables can vary from 0 to 60 points, indicating the degree of complexity of the patient's care<sup>11,12</sup>. In this study, the older adults were classified by the INTERMED method as complex or non-complex. Older adults with a score less than 20 were classified as non-complex and older people with a score equal to or greater than 20 were classed as complex<sup>12-14</sup>.

In Brazil, the instrument was translated, adapted and used to identify biopsychosocial and health system aspects, as well the complexity of care of patients<sup>15,17,18</sup>.

For overall cognitive assessment, the Mini Mental State Examination (MMSE) was used and the score equivalent to standard deviation below the medians was considered: illiterate - 17 points; 1 to 4 years of schooling - 21 points; 5 to 8 years - 24 points; 9 to 11 years - 26 points; 12 years or more - 27 points<sup>19,20</sup>. To assess functional independence in activities of daily living related to self-care, the Katz Index of Independence in Activities of Daily Living was applied and the sample was classified as independent, semi-dependent or dependent<sup>21</sup>.

The data were analyzed using non-parametric statistical tests, as most variables did not follow normal distribution. Chi-square or Fisher's exact tests were used for the categorical variables, in the case of variables with categories with less than five cases. For the discrete quantitative variables, the Mann-Whitney test was used for comparisons between two groups and the Kruskal-Wallis test for comparisons between three groups or more, followed by post-hoc analyzes of comparisons between pairs. The variables with  $p$  value below

0.20 in the bivariate associations were hierarchized to compose a multiple logistic regression model. The final model was constructed using Wald's Forward Stepwise method, with adjustments for sociodemographic variables, functional dependence, and days of hospitalization, composed of variables with  $p$  below 0.05. The dependent variable was categorized as 0 and 1, with 0 corresponding to non-complex older adults according to INTERMED and 1 to complex older adults according to INTERMED. For all analyzes, a significance level of 5% ( $p < 0.05$ ) was used.

The present study complied with the recommendations of Resolution 196/2012 and was approved by the Ethics Committee for Research Involving Human Beings of the USP University Hospital under CAAE number – 0102.0.000.198-10, approval registration CEP-HU/USP - 973/10.

## RESULTS

The complexity of care of hospitalized older people was associated with sex, marital status, income, dependence in Basic Activities of Daily Living (BADL), cognitive decline and higher scores in the INTERMED domains (Tables 1 and 2). It was also observed that complex care participants had higher averages in all the INTERMED domains and more days of hospitalization (Table 2).

As shown in Table 3, in the multiple logistic regression model the variables sex, dependence in one or more BADL and cognitive decline in the MMSE remained associated with complexity of care. The other variables lost statistical significance. Together, these data indicated that participants classified as having complex care were more often women and participants with a decline in cognition and BADL.

**Table 1.** Sociodemographic characteristics associated with the INTERMED complexity of care of hospitalized older adults. São Paulo, Brazil, 2010-2012.

Variables	Non-complex (n=245) n (%)	Complex (n=137) n (%)	<i>p</i> -value
Age range (years)			0.309*
60  - 69	103 (42.8)	52 (38.7)	
70  - 79	94 (38.4)	47 (34.3)	
80  - +	46 (18.8)	37 (27.0)	
Sex			0.003*
Female	118 (48.2)	88 (64.2)	
Male	127 (51.8)	49 (35.8)	
Marital status			0.002*
Married	127 (51.8)	51 (37.2)	
Widower	80 (32.7)	50 (36.5)	
Single or separated	38 (15.5)	36 (26.3)	
Education			0.443*
No schooling	44 (18.0)	29 (21.2)	
Incomplete elementary	177 (72.2)	96 (70.1)	
Complete Elementary/high school	24 (9.8)	12 (8.8)	
Income (minimum wages)			0.022*
No income	68 (27.9)	55 (40.1)	
1	119 (48.8)	58 (42.3)	
2	36 (14.8)	12 (8.8)	
3	7 (2.9)	5 (3.6)	
4 or more	14 (5.7)	7 (5.1)	

to be continued

Continuation of Table 1

Variables	Non-complex (n=245) n (%)	Complex (n=137) n (%)	p-value
Reported ethnicity			
White	167 (68.2)	87 (63.5)	0.67**
Brown (Mixed Race)	32 (13.1)	27 (19.7)	
Black (Afro-Brazilian)	41 (16.7)	22 (16.1)	
Yellow (Asian-Brazilian)	5 (2.0)	1 (0.7)	

\* Chi-squared test; \*\*Fisher's exact test –  $p \leq 0.05$ **Table 2.** Functional performance and INTERMED domains associated with the INTERMED complexity of care of hospitalized older adults. São Paulo, Brazil, 2010-2012.

Variables	Non-complex (n=245)			Complex (n=137)			p-value
	Mean	(sd)	Median (Quartiles 25-75)	Mean	(sd)	Median (Quartiles 25-75)	
Days of Hospitalization	14.82	(12.5)	11 (7 – 12)	18.54	(17.21)	12 (9- 24)	0.010*
INTERMED domains							
Biological	7.22	(2.21)	7 (6 – 9)	9.06	(2.08)	10 (8 – 11)	0.000*
Psychological	0.82	(1.41)	0 (0 – 1)	5.07	(2.83)	5 (3 – 7)	0.000*
Social	1.53	(1.68)	1 (0 – 2)	5.35	(3.36)	5 (3 – 7)	0.000*
Health System	3.85	(1.44)	3 (3 – 4)	5.13	(2.32)	4 (3 – 6)	0.000*
INTERMED Total	13.48	(3.30)	14 (12- 16)	25.21	(5.43)	24 (21 – 27)	0.000*
	n (%)			n (%)			
BADLS - Katz							
Independent	184	(75.1)		57	(41.6)		0.000+
Semi-independent	26	(10.6)		35	(25.5) <sup>a</sup>		
Dependent	35	(14.3)		45	(32.8) <sup>b</sup>		
MMSE							
No cognitive decline	176	(71.8)		53	(38.7)		0.000*
Cognitive decline	69	(28.2)		84	(61.3)		

\* Mann-Whitney Test; + Kruskal-Wallis Test –  $p \leq 0.05$ ; <sup>a</sup>Semi-independent < Independent ( $p=0.000$ ); <sup>b</sup>Dependent < Independent ( $p=0.000$ ).**Table 3.** Final multiple logistic regression model – Forward Stepwise Method. São Paulo, Brazil, 2010-2012.

Variables*	B (EP)	OR	CI (95%)	p-value
Sex				
Female	0.56 (0.24)	1.76	1.10-2.82	0.018
MMS				
Cognitive decline	1.19 (0.23)	3.31	2.07-5.27	0.000
BADLs – Katz				
One or more difficulties	1.26 (0.23)	3.54	2.21-5.66	0.000
Constant (B0)	-1.94 (0.23)			0.000

\*Final model: chi-squared of model of 75.01; degrees of freedom: 3,  $p < 0.001$ ;  $R^2 = 0.245$ .

The reference condition for the dependent variable was the condition of “non-complex” older adults, while for the sex variable it was the group composed of men, and for the MMSE and Katz, it was older adults with no cognitive decline and independence in BADL respectively.

## DISCUSSION

In the present study, the complexity of care of hospitalized older people was associated with the female sex, not having a partner, having a lower income, cognitive decline and dependence in BADL. However, after inserting the variables in the multiple logistic regression model, the following variables remained: sex, cognitive decline and dependence in one or more BADL. Together these findings indicate that the complexity of care of hospitalized older people is related to demands related to care and the female gender.

In terms of the association between complexity of care and sex, studies have highlighted that in comparison with older men, women constitute a longer-lived sample with greater access to health services<sup>22,23</sup>. Recent data from the Brazilian multicenter study (or ELSI) indicated that women played the role of primary caregivers more often (72.1% versus 27.9% compared to men), but in return, reported receiving less help in BADL (16% versus 5.6% in relation to men)<sup>24</sup>. In this context, it is necessary to investigate the life and health conditions associated with older women, especially morbidities, functional dependence, and use and access to health services.

Functional dependence, in turn, proved to be a guiding measure of health care in old age, in line with the World Health Organization (WHO) and Brazilian health policies<sup>25,26</sup>. This is because functional dependence increases the demands of care, which are not always met by the family and health services, revealing insufficient health care or a lack of care<sup>24</sup>. In this sense, the hospital becomes the gateway for the most dependent, frail and clinically complex users. A study carried out in a medical clinic at the Hospital Universitário de Ribeirão Preto (the University Hospital of Ribeirão Preto) (São Paulo) found that of 85 hospitalized older adults, 95.2% were considered frail<sup>27</sup>. Other studies suggest a relationship between functional impairment and high prevalences of hospital readmission, which can be explained by the high demands of care and scarcity of time, resources and long-term care services.<sup>28-31</sup>

Thus, functional dependence can bring together a set of changes that lead to greater complexity of care and, consequently, greater biological, social, psychological and health vulnerability, given that the classification as “complex” grouped participants with higher scores in all the domains that make up the INTERMED Method. However, the relationship between functional dependence and the components needs to be further explored, as well as the analysis of the social, family, individual (emotional and psychological) and health resources that predisposed hospitalization<sup>32,33</sup>. Another limitation relates to the absence of previous data from the participants, as well as the use of screening instruments, instead of more specific instruments to assess functional independence. In this sense, new studies are justified.

Despite these limitations, INTERMED proved to be an important tool for measuring complexity of care due to its association of variables of functional independence, living conditions and health. In a study carried out with 56 hospitalized older Japanese people (24 men and 32 women) using the INTERMED method, it was observed that the psychological domain was the most important variable for classifying participants in clusters, followed by sex, the social domain and the health system domain. In this study, Cluster 1 was composed of non-complex, male participants<sup>33</sup>. Cluster 2 participants (median of 11 points in INTERMED) were all female, with high scores in biological complexity<sup>34</sup>. The participants in cluster 3, considered complex, were mainly women with higher scores in all domains and with longer hospital stays, death within the hospital, and medical expenses<sup>34</sup>. In the present study, complex participants also had longer hospital stays, however the associations between complexity and hospital stay lost significance after adjustments to the multiple model.

In relation to cognitive decline, the findings in this study confirm that participants with cognitive changes had more complex care, which may be associated with reduced autonomy and independence<sup>15,33</sup>. In view of this, the creation of services such as day centers for older adults, psychoeducational programs for caregivers and the creation of psychogeriatric services can be alternatives for medium and long-term care,

maximizing the well-being of the family, the older adult and the community<sup>15,35</sup>.

It is important to note that the prevalence of cognitive decline in the present study was higher than in older adults residing in the community and may have been associated with clinical conditions resulting from hospitalization. In this sense, in the context of mental health, it is possible that INTERMED can collaborate in the identification of patients' needs and provide more specialized care<sup>35</sup>. Additionally, INTERMED has the potential to identify a considerable subset of complex patients admitted to a medical clinic, for whom corrective actions related to non-biological risk factors can be adopted and properly implemented, in order to assess domains that are not discovered during normal medical assessments<sup>35</sup>.

Literature also revealed that through the retrospective use of INTERMED, it was possible to quantify the biopsychosocial complexity of patients with clinical comorbidities, mental illnesses and substance use disorders, with these being the most complex patients<sup>16</sup>. Finally, the INTERMED method has good applicability with other instruments and

was effective in identifying patients who needed complex care<sup>35</sup>.

## CONCLUSION

The results of the present study indicate that the conditions associated with the complexity of care determined by INTERMED in hospitalized older adults were: being female, suffering cognitive decline and experiencing dependence in BADL, alerting managers and nursing professionals to the importance of instruments for measuring functional independence when assessing the complexity of care of hospitalized older adults. Limitations in BADL and cognitive decline require actions by interprofessional teams in both the health and social areas aimed at rehabilitation, integration of care and planning of care resources for older adults. In this sense, it is necessary to adopt services that are integrated with home care and health care networks for older adults, in order to implement follow-up services in the post-hospital discharge period and prevent deaths, unsatisfactory health outcomes and new hospitalizations.

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