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Vulnerability and associated factors among older people using the Family Health Strategy

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Abstract *The objective of this study was to analyze the prevalence of vulnerability and associated factors among older people using family health strategies in Várzea Grande, Brazil. A cross-sectional study was performed with 377 community-dwelling older people. The dependent variable, vulnerability, was assessed using the Vulnerable Elders Survey. The independent variables included sociodemographic characteristics and the health status of the study population assessed using the following validated instruments: the Mini-Mental State Examination; Katz ADL scale and Lawton and Brody IADL scale; Geriatric Depression Scale; and Mini Nutritional Assessment Short-Form. Bivariate analysis was conducted using the Mantel-Haenszel chi-squared test with prevalence ratios and multivariate analysis was performed using Poisson regression. The data showed that 49% of the study population were vulnerable. The variables that showed the strongest association with vulnerability were dependence in IADLs (PR = 4.43), presence of depressive symptoms (PR = 1.34), and being aged 80 and over (PR = 1.34). The prevalence of vulnerability found by the present study was high when compared to other studies with community-dwelling older people. The VES-13 was shown to be easy to use in primary healthcare settings and particularly practical for screening vulnerability among older people.*

Key words *Aging, Vulnerable populations, Older people*

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Introduction

Population aging is a worldwide phenomenon and is growing faster in developing countries. In 1950, there were around 205 million people aged 60 years and over. In 2012, this figure had increased to almost 810 million and is expected to more than double to over 2 billion by 2050[1].

In Brazil, the pace of population aging has been faster than the global average[1]. In 2000, there were 14.2 million older people. This figure increased to 19.6 million in 2010 and is expected to rise to 41.5 million in 2030 and 73.5 million in 2060[2]. This poses major challenges for health professionals and healthcare services and requires the development of new forms of healthcare and monitoring for this population group. As a result, protection and care actions tailored towards this group have assumed a prominent position in the public agenda.

A number of factors influence healthy ageing, including physical and mental health status, financial independence, control and prevention of chronic diseases, and the existence of social support[3].

The morphological, functional, biochemical and psychological changes that take place during aging can make older people vulnerable due to a reduction in their capacity to adapt to their environment[4]. Thus, identifying vulnerable groups in the elderly population enables the formulation of effective policies and strategies to prevent undesirable outcomes and promote recovery from disabilities. The Vulnerable Elders Survey (VES-13) is an assessment instrument developed to identify older people at risk of health deterioration or death, where vulnerability is defined as increased risk of functional decline or death[5]. Studies have shown that the version adapted and validated for use in Brazil was easily understood and accepted by older people and has consistent and adequate psychometric properties[6,7].

With a view to gaining a better understanding of this phenomenon, the aim of the present study was to determine the prevalence of vulnerability and identify associated factors among community-dwelling older people using primary healthcare services in Várzea Grande in the State of Mato Grosso, Brazil.

Methods

A cross-sectional study was conducted with people aged 60 years and over registered in family health strategies (*Estratégias de Saúde da Família*-ESF)in Várzea Grande, located in the Metropolitan Region of Cuiabá in the State of Mato Grosso. The study was conducted in accordance with the ethical standards and procedures for research with human beings set out in Resolution 466/2012issued by the National Health Council and approved by the Research Ethics Committee at Júlio Müller University Hospital in Cuiabá (application Nº 1.243.299).

Eleven ESFs were selected from the 15 ESFs in Várzea Grande using cluster sampling. The sample size was divided proportionally among the selected ESFs according to the number of older people registered in each ESF. Sample size was calculated using the procedures proposed for finite populations[8], adopting a 95% confidence level, tolerable sampling error of 0.05, and assumed prevalence of 0.50. The resulting sample size was increased by 10% to compensate for potential losses. Older people with cognitive impairment, suffering the effects of a stroke, or with a severe vision, language, or hearing impairment were excluded from the sample. Refusals, respondents who were not at home at the time of the visit to conduct the interview, and individuals who met the above exclusion criteria were replaced by the closest resident registered in the ESF. Cognitive impairment was assessed using the version of the Mini-Mental State Examination adapted for use in Brazil, adopting two cut-off points according to level of schooling[9]. A total of 213 older people with cognitive impairment and 30 refusals were excluded and replaced. The final sample comprised 377 older people. All respondents signed an informed consent form.

Data was collected between March and June 2016 using structured interviews conducted in the respondents' homes by previously trained and standardized interviewers.

The dependent variable was vulnerability, which was assessed using the Brazilian version[6,7] of the VES-13, developed to identify persons aged 65 years and older at increased risk of death or functional decline[5]. This13-item questionnaire considers age, self-rated health, functional capacity, and physical condition. Scores range from 0 to 13, where the cut-off point for vulnerability is greater than or equal to 3[5].

Theindependent variables were the following sociodemographic characteristics: sex (male,female);age group (60 to 69 years,70 to 79 years, and80 years and over);per capita income (up to half a minimum salary, between half and one minimum salary, > one minimum salary);race/skin color (brown, black, and white);family situation

(living with someone; living alone); and marital status (living with partner; living without partner). Level of schooling, originally obtained from the questions *Do you know how to read or write a simple note?*"and "*what level of schooling do you have?*, was reclassified as "literate" or "illiterate", due to the generally low level of education of the study population. The following dimensions of health status were also investigated: ability to perform activities of daily living (independent; dependent), ability to perform instrumental activities of daily living (independent; dependent), depression (without depressive symptoms; with depressive symptoms), nutritional status (malnutrition/at nutritional risk; without nutritional risk), comorbidity (without comorbidity with severity level 3 or 4; with comorbidity with severity level 3 or 4), and polypharmacy(yes; no).

Ability to perform activities of daily living (ADLs)and instrumental activities of daily living(IADLs) was assessed using the Katz ADL scale and Lawton and Brody IADL scale, respectively, both adapted and validated for use in Brazil[10,11]. Depression was assessed using the 15-item Geriatric Depression Scale (GDS-15)[12], while nutritional status was assessed using theMini Nutritional Assessment Short-Form (MNA-SF)[13]. Comorbidity was evaluated using theCumulative Illness Rating Scale for Geriatrics (CIRS-G)[14]. Polypharmacy was defined as the continued use of five or more medications[15]. Medication use was self-reported; however, to minimize recall bias, respondents were asked to show the medication labels or prescriptions.

The questionnaires were coded and the data was double entered into the software program Epi Info version 3.5.2.. Data entry errors detected by the application Data Compare were corrected. Statistical analysis was undertaken using Stata version 13.0.

The descriptive analysis of the above characteristics of the study population was performed using absolute and relative frequencies for the categorical variables and mean, median, and standard deviations for the numerical variables. Bivariate analysis was conducted using the Mantel -Haenszel chi-squared test and prevalence ratios (with CI 95%) to measure the association between the dependent variable(vulnerability) and independent variables.

For multivariate analysis, Poisson regression was used including the variables that showed ap-value of < 0.20. An explanatory model was used maintaining all statistically significant variables ($p \leq 0.05$).

Results

The average age of the study population was 69.6 (± 7.5) years. The majority of the sample were women (60.2%), aged between 60 and 69 years (56.8%), and declared themselves brown(59.2%). Approximately 44% of respondents did not have a partner and 72% were illiterate. Over half the sample (56%) had a per capita income of between half and one minimum salary (Table 1).

The data showed that prevalence of vulnerability was 49%. Our findings also showed that while 72.7% of the respondents were independent in ADLs, 62.3%were dependent in IADLs. In relation to the other dimensions investigated by this study, 68.7% of respondents did not have depressive symptoms, 60.5% did not have a severe comorbidity, 54.4% were not at nutritional risk, and 78.3%did not use multiple medications (Table 2).

The results of the bivariate analysis (Table 3) show that the likelihood of vulnerability was greater among women, respondents aged 80 years and over, and those who were illiterate. These associations were statistically significant (PR = 1.41, CI95% 1.12-1.78; PR = 1.81,CI95% 1.44-2.27; and PR = 1.50,CI95% 1.23-1.83, respectively) (Table 3).

With regard to health status (Table 4), the findings show that the likelihood of vulnerability was greater among respondents who demonstrated deficits in the six dimensions investigated. Statistically significant associations were found for being dependent in ADLs (PR = 1.62, CI95% 1.33-1.96) and IADLs (PR = 4.99, CI95% 3.29-7.55), presence of depressive symptoms (PR = 1.87, CI95% 1.54-2.26), being at nutritional risk/malnourished (PR = 1.31, CI95% 1.07-1.61), having a severe comorbidity (PR = 1.33, CI95% 1.09-1.63), and using multiple medications (PR = 1.30, CI95% 1.04-1.61).

In the multivariate model, statistically significant associations were maintained between vulnerability and being 80 years and over, dependence in IADLs, and presence of depressive symptoms (PR = 1.32, CI95% 1.07-1.63; PR = 4.12, CI95% 2.69-6.33; and PR = 1.29, CI95% 1.10-1.52, respectively) (Table 5).

Discussion

The data presented show a high overall prevalence of vulnerability, showing that almost half the patients were vulnerable. A study realized in João

Table 1. Sociodemographic characteristics of the study population. Várzea Grande, Brazil 2016 (N = 377).

Variable	N	%
Sex		
Female	227	60.2
Male	150	39.8
Age group		
60-69 years	214	56.8
70-79 years	117	31.0
≥80 years	46	12.2
Race/Skin color		
Brown	222	59.2
Black	80	21.3
White	73	19.5
Marital status		
Married andliving with partner	212	56.2
Widow	118	31.3
Divorced, separated, single	47	12.5
Education level		
Literate	270	71.6
Illiterate	107	28.4
Per capita income		
Up to ½ minimum salary	122	32.4
½ to 1 minimum salary	211	56.0
> 1 minimum salary	44	11.7

Minimum salary = R$ 880 (US$ 200).

Table 2. Health status of the study population. Várzea Grande, Brazil, 2016 (N = 377).

Variables	N (377)	%
Vulnerability		
Yes	185	49.1
No	192	50.9
Ability to performADLs		
Dependent	103	27.3
Independent	274	72.7
Ability to performIADLs		
Dependent	235	62.3
Independent	142	37.7
Depressive syndromes		
Yes	118	31.3
No	259	68.7
Nutritional assessment		
Malnutrition	37	9.8
At risk	135	35.8
No risk	205	54.4
Comorbidity(severity level 3 or 4)		
Yes	149	39.5
No	228	60.5
Polypharmacy		
Yes	82	21.8
No	295	78.3

Pessoa (Paraíba) with a study population with similar characteristics to that of the present study and also using the VES-13 reported a slightly higher vulnerability prevalence rate (52.2%)[16]. A study that assessed the validity of the VES-13 conducted in the United States with 6,205 community-dwelling older peopleaged65 years and over reported a prevalence rate of 32.3%[5], while a study undertaken in Ireland with 2,033 community-dwelling older people showed a prevalence rate of 32.1%[17]. It is interesting to note that the vulnerability prevalence rates observed in the present study and that conducted in João Pessoa are higher than those reported by the studies in Ireland and the United States, despite the fact that the former involved a younger age group(individuals aged 60 years and over).

This difference may be partially explained by differences in socioeconomic conditions between developed and developing countries, bearing in mind that health status is influenced by socioeconomic factors and the context of people's lives[18].

Other possible explanations include the poor sanitary conditions and health status of the study population. Várzea Grande's Human Development Index is well below the average of the cities where the other studies were conducted[19], indicating poorer living conditions among the study population. Furthermore, it is well-known that healthcare in our country often leaves a lot to be desired and that access to primary and moderately and highly complex care is poorer in Brazil than in the other countries[20]. In this respect, it is necessary to improve the quality of care and local health practices in order to ensure the early detection of health problems and risk factors associated with loss of functional capacity among older people[21], given that the latter is strongly associated with vulnerability.

The association between vulnerability and dependence in ADLs and IADLs was expected. In this respect, the variable that showed the strongest association with vulnerability was dependence in IADLs. Generally, loss of functional capacity in IADLs, which are more complex functions, precedes dependence in ADLs, which develops later[22,23]. It is also important to note that IADLs and ADLs are collinear variables, given that both are measures of loss of functional capacity. A study conducted in the United States with older people undergoing treatment for prostate cancer and a study in Poland involving 864 hospitalized elderly patients reported an association between dependence in ADLs and vulnerability[24,25]. Aging leads to a gradual, progressive decline in func-

Table 3. Prevalence and prevalence ratio of vulnerability according to the sociodemographic characteristics of the study population. Várzea Grande, Brazil, 2016 (N = 377).

Variables	Vulnerability			
	N	%	Crude PR (CI95%)	P-value
Sex				
Male	59	39.3	1	0.002
Female	126	55.5	1.41 (1.12-1.78)	
Age group				
60 to 69 years	90	42.1	1	
70 to 79 years	60	51.3	1.22 (0.96-1.54)	0.108
80 years and over	35	76.1	1.81 (1.44-2.27)	< 0.001
Per capita income				
Over ½ minimum salary	99	47.6	1	0.525
Up to ½ minimum salary	86	50.9	1.07 (0.87-1.31)	
Race/skin color				
Black andbrown	145	78.8	1	0.407
White	39	21.2	0.96 (0.87-1.06)	
Family situation				
Living with someone	156	48.9	1	0.878
Living alone	29	50.0	1.02 (0.77-1.35)	
Marital status				
Living with partner	85	46.0	1	0.403
Living without partner	100	54.1	1.10 (0.88-1.39)	
Education level				
Literate	116	43.0	1	< 0.001
Illiterate	69	64.5	1.50 (1.23-1.83)	

PR – Prevalence ratio; CI – Confidence interval. Minimum salary = R$880/US$ 200.

Table 4. Prevalence and prevalence ratio of vulnerability according to the health status of the study population, Várzea Grande, Brazil, 2016 (N = 377).

Variable/Instrument	Vulnerability			
	N	%	Crude PR (CI95%)	P-value
Ability in ADLs (Katz Scale)				
Independent	115	42.0	1	<0.001
Dependent	70	68.0	1.62 (1.33-1.96)	
Ability in IADLs (Lawton Scale)				
Independent	20	14.1	1	<0.001
Dependent	165	70.2	4.99 (3.29-7.55)	
Depressive symptoms (GDS-15)				
No	100	38.6	1	<0.001
Yes	85	72.0	1.87 (1.54-2.26)	
Nutritional status (MANR)				
Without risk	88	42.9	1	0.009
At risk/malnourished	97	56.4	1.31 (1.07-1.61)	
Comorbidity (CIRS-G)				
Without comorbidity severity level 3 or 4	99	43.4	1	0.006
With comorbidity severity level 3 or 4	86	57.7	1.33 (1.09-1.63)	
Polypharmacy				
No	136	46.1	1	0.028
Yes	49	59.8	1.30 (1.04-1.61)	

PR – Prevalence ratio; CI – Confidence interval.

Table 5. Multiple regression model with adjusted prevalence rations among the study population. Várzea Grande, Brazil, 2016 (N = 377).

Variable	Adjusted PR	CI (95%)	P-value
Age group			
60-69 years	1		0.012
70 to 79 years	1.10	(0.90-1.35)	
80 years and over	1.32	(1.07-1.63)	
Ability to perform IADLs			
Independent	1	(2.69-6.33)	< 0.001
Dependent	4.12		
Depressive symptoms (GDS-15)			
No	1	(1.10-1.52)	0.003
Yes	1.29		
Ability to perform ADLs			
Independent	1	(0.99-1.35)	0.070
Dependent	1.16		

tional capacity and this decline is often the only change in health status identified in older people, particularly in healthier subjects[26]. Determining the functional capacity of older people and classifying their degree of independence, autonomy, and quality of life[27] is therefore important for identifying vulnerable individuals.

The presence of depressive symptoms was also associated with vulnerability, corroborating the findings of other studies using the VES-13. A study conducted in Italy using the GDS reported a moderate correlation between the presence of depressive symptoms andvulnerability[28]. Other studies have also shown an association between depressive symptoms andvulnerability[17,29]. Depressive disorders constitute a distinct categorical entity or independent syndromes characterized by low mood. Among older people, these disorders are commonly attributed to the loss of physical and mental functions that invariably accompanies aging. It is therefore important to diagnose depression before it becomes more advanced[30], when, together with the presence of vulnerability, it can lead to a deterioration in health status.

The multivariate model revealed an association between being aged 80 years and over and vulnerability. It is important to highlight that individuals aged 85 years and over are automatically classified as vulnerable because they come within the cut-off point set by the VES-13.Various studies have also reported that prevalence of vulnerability is greater in older age groups[5,17,31]. A population-based cohort study conducted with older people living in São Paulo using a different vulnerability assessment tool also showed that the prevalence of vulnerability was higher in older people aged80 years and over[32]. It is important to mention that older age groups are also more likely to show poorer scores in the other dimensions of overall health[33].

Our findings show that the prevalence of vulnerability was higher among women. Population aging in Brazil is characterized by "feminization"[34], where women tend to show worse health status, increased social isolation and are more likely to be widowed and have emotional disorders[35]. A study undertaken in Ireland with community-dwelling older people[17] and another in the United States with hospitalized older persons with cardiovascular problems[29] also showed that the prevalence of vulnerability was higher among women.

The data presented also show that the prevalence de vulnerability was higher among illiterate individuals, corroborating the findings of other studies[29,31]. Education level is a determinant of health and studies have shown that people with a higher level of education typically have healthier life styles and are more likely to seek preventive healthcare[36,37]. It is important to stress that the level of education of the study population was generally low, thus preventing a stratified analysis according to education level to better explain the influence of this factor on vulnerability.

With regard to health status, the presence of comorbidity, nutritional risk, and multiple use of medications showed associations with vulnerability only in the bivariate analysis. However, other studies have reported a significant association in the same direction.

Researchers in Italy who used the CIRS-G and VES-13 to assess 419 individuals aged 70 years and over with cancer reported an association between comorbidity and vulnerability[28]. Other studies using the VES-13 with different comorbidity assessment instruments also showed associations in the same direction[24,38]. Comorbidity has also been shown to be an important predictor of other complications and adverse outcomes among older persons[39]. In this respect, a study in Brazil with 104 hospitalized older people found an association between comorbidity and increased risk of death after hospitalization[40].

A study conducted in Italy using the same instruments also found an association between nutritional risk/malnourishment andvulnerability[28]. Nutrient deficiency is a significant problem among older people, since physiological changes influence food intake and nutrient absorption, increasing the risk of malnutrition[3].

Bivariate analysis also revealed an association between polypharmacy and vulnerability. A study using the same definition of polypharmacy as the present study found an association between multiple medication use and vulnerability assessed using the VES-13[28]. A similar association was reported by a study conducted in Portugal with 206 older persons with gastrointestinal cancer using the VES-13and a different definition of polypharmacy[41]. Likewise, the study in Italy mentioned above highlighted a correlation between vulnerability and multiple drug use[28]. The use of multiple medications by older persons can lead to an increased occurrence of adverse effects. In this respect, the possibility cannot be excluded that many common comorbidities among older persons are caused or potentiated by the action of certain medications or different combinations of drugs[42]. Thus, the association between polypharmacy and vulnerability may be explained by the link between adverse effects caused by multiple medication use and vulnerability.

This study has some limitations. First, cross-sectional studies analyze exposure variables and outcome simultaneously, meaning they are limited in their ability to determine the cause-and-effect relationship between variables. Second, the information collected was self-reported, which could have led to an underestimation of the prevalence of conditions that are commonly underdiagnosed. In this respect, due care was taken to check the data with family members and/carers and with interviewee training and the standardization of data collection. Thirdly, it is possible that recall bias may have occurred; however, its overall effect was minimized by excluding older persons with cognitive impairment and information checking, as mentioned above. Finally, since the study was conducted with ESF service users, caution should be taken when extrapolating the results to the general elderly population of Várzea Grande.

Positive aspects of the study include the fact that it is one of the first studies in the country to assess the prevalence of vulnerability and associated factors among community-dwelling older peopleusing primary care services. The importance of identifying vulnerability in older people to prevent adverse health outcomes is demonstrated by the findings of the VES-13 study, conducted with community-dwelling older people (aged 65 years and older) who were Medicare beneficiaries[5]. The study found that respondents identified as vulnerable had 4.2 times the risk of functional decline or death over a two- year period, compared to those who were not vulnerable.

Studies using the VES-13 with hospitalized older people and cancer patients in the United States reported vulnerability prevalence rates of between 52 and 58%[29,43,44]. Follow-up studies have demonstrated that the VES-13 has good predictive ability[28,45]. An analysis with patients undergoing treatment for cancer conducted in the United States found a vulnerability prevalence rate of around 50%[24,28], while a study undertaken in Rio de Janeiro and Campo Grande with older persons with prostate cancer reported a similar prevalence rate to that found by the present study[31]. However, since these studies were carried out with specific population groups, the comparability of their respective results is limited.

Conclusion

The prevalence of vulnerability found by the present study was high when compared to other studies with community-dwelling older people. The presence of dependence in IADLs and depressive symptoms and being aged80 years and over were associated with vulnerability. It is therefore important that older persons who are screened and identified as vulnerable are followed up more effectively by primary healthcare professionals. Our findings suggest that new approaches to healthcare for community-dwelling older persons that go beyond existing policies and programs should be adopted.

The early detection of vulnerability can help meet the primary health needs of older persons by allowing care professionals to elaborate care plans that prevent functional decline and early death.

The majority of studies involving older people are conducted in long-term care institutions, where sociodemographic profiles are different and morbidity rates tend to be higher than among the general population. Further longitudinal studies focusing on multifunctional geriatric assessment should be conducted in primary care settings to inform the development of effective health promotion and protection strategies tailored to this population group.

Collaborators

JF Cabral, AMC Silva, and AQ Neves participated in study conception and design anddata analysis and interpretation; DB Ferreira and LM Santiago participated in the critical revision of the manuscript for important intellectual content. IE Mattos, LL Luz, and CN Carmo participated in the final approval of the version to be published and in ensuring data accuracy and integrity.

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