

# RISK FACTORS FOR DEMENTIA IN A RURAL AREA OF NORTHEASTERN BRAZIL

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**Abstract – Objective:** To identify risk factors for dementia among the elderly in a rural area of Northeastern Brazil. **Method:** The subjects assessed were all 60 years old or older, and lived in a rural region of Bahia, a Northeastern State of Brazil. CAMDEX, a structured clinical evaluation protocol, was used for diagnosis, and applied at the home of the subjects. **Results:** The risk factors identified were divided in accordance with socio-demographic characteristics, the presence of co-morbid conditions, and the use of medications. The variables with strong association with dementia were age, history of stroke, arterial hypertension, and sight impairment. **Conclusion:** Advanced age, arterial hypertension, and vascular brain injury were the main risk factors associated with dementia, which suggests that public health measures adopted to prevent and control modifiable risk factors can mitigate the prevalence of high rates of dementia.

KEY WORDS: dementia, elderly, population aging, prevalence, risk factors.

## Fatores de risco para demência em uma área rural do nordeste do Brasil

**Resumo – Objetivo:** Identificar fatores de risco para demência entre idosos de uma área rural do nordeste do Brasil. **Método:** Os indivíduos avaliados tinham 60 anos ou mais e viviam numa região rural na Bahia, Estado do nordeste brasileiro. Um protocolo de avaliação clínica estruturada – CAMDEX – foi utilizado para diagnóstico e aplicado no domicílio dos indivíduos participantes. **Resultados:** Os fatores de risco identificados foram divididos de acordo com características sócio-demográficas, a presença de comorbidades e o uso de medicações. As variáveis com forte associação para demência foram idade, história de acidente vascular encefálico, hipertensão arterial e comprometimento visual. **Conclusão:** Idade avançada, hipertensão arterial e lesão vascular cerebral foram os principais fatores de risco associados com demência, o que sugere que medidas de saúde pública adotadas para prevenir e controlar fatores de risco modificáveis podem diminuir a prevalência de altas taxas de demência.

PALAVRAS-CHAVE: demência, envelhecimento, prevalência, fatores de risco.

Dementia is a generic term that describes a chronic or progressive dysfunction of cortical and subcortical function that results in a complex cognitive decline. These dysfunctions are usually accompanied by personality, mood and/or behavior disorders<sup>1</sup>. Dementia is also a condition characterized by impairment of memory and of at least one other cognitive function (aphasia, apraxia, agnosia, executive dysfunction). The impairment must represent a decline from previous level of function, and must be severe enough to interfere with daily functions and independence<sup>2</sup>. The prevalence of dementia increases with age, and doubles every five years, ranging between 1% among people aged 60-64 years and 45% in individuals

aged 85 or older<sup>3-6</sup>. Today, dementia is considered one of the major social burdens in developing countries<sup>3,7</sup> and accounts, worldwide, for 11.2% years lived with incapacity, in people aged 60 or older, a percentage higher than that of strokes, cardiovascular disease (CVD) and cancer<sup>8</sup>.

In Europe and North America, Alzheimer's disease (AD) is the main cause of dementia, but in China, Japan and Russia, vascular dementia (VaD) is more prevalent than AD<sup>1,9</sup>. Established risk factors for AD are age, family history and presence of apolipoprotein E (ApoE). Higher levels of education have also been associated with lower prevalence of AD. However, this may be due to a delay in the detection of the disease. Regarding VaD, the identified risk fac-

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tors are age, male gender, hypertension, acute myocardial infarction (MI), diabetes mellitus (DM), high cholesterol levels, smoking, and history of stroke<sup>10-15</sup>. Cardiovascular diseases are controversial risk factors for AD<sup>13,16</sup>. Evidence supporting this association includes premature presence of senile plaques in individuals with coronary artery disease, and both senile plaques and neurofibrillary tangles in individuals with hypertension, which may cause an impact on the progression of the disease and on death<sup>13</sup>.

The present population-based study intends to identify risk factors for dementia among old people in a rural region in the Northeast of Brazil.

## METHOD

The town of Santo Estevão is situated in Bahia - Brazil, 147 km from the State's capital city, Salvador. Lagoa Pequena, a rural area of Santo Estevão, was chosen for its rural characteristics, easy access, significant number of old people, and its existing social programs.

The studied population includes all individuals aged 60 or above living in Lagoa Pequena. Excluded from the study were individuals with disabilities such as blindness, deafness and speech dysfunction that could interfere with the evaluation process.

The team of geriatricians, cardiologists and neurologists administered the standardized questionnaire, measured blood pressure and heart rate, and performed neurological evaluation at the subject's home.

We used a version of the CAMDEX (Cambridge Examination for Mental Disorders of the Elderly) translated and adapted to

the Portuguese language by Bottino<sup>17</sup>. It includes a structured clinical interview covering the individual's current psychic and physical state, past history and family history, a mental state examination, a physical examination, laboratory tests, a structured interview with a relative or other informant, and CAMCOG (Cambridge Cognitive Examination)<sup>18</sup>. The maximum score of CAMCOG is 107 with a cut-off score of 80 for dementia.

Dementia was diagnosed in individuals who fulfilled CAMDEX criteria for definitive, probable or possible dementia through a combination of clinical criteria, organicity indices  $\geq 5$  and CAMCOG  $< 80$ .

We considered hypertensive all individuals who had a history of hypertension, and high blood pressure ( $\geq 140 \times 90$  mmHg)<sup>19</sup> at the moment of examination and/or made regular use of antihypertensive medication. The individual was considered literate if he/she had attended school for some time. The criteria used to diagnose DM and high cholesterol levels was the use of medication for these diseases. Vascular brain injury (VBI) was determined in individuals who had history of stroke and/or hemiparesis at neurological evaluation.

All individuals gave informed consent and data were analyzed through *SPSS 9.0 for Windows*. For the comparison of the frequency of the studied variables between genders, and to compare the prevalence between those presenting risk factors or not we used the chi-square test or, when the expected value was below 5, Fisher's exact test was performed. To establish the power of association between possible risk factors with the diagnosis of dementia, we calculated the prevalence ratio with 95% CI. Finally, the existence of possible confounding factors

Table 1. Frequency of the studied risk factors for dementia in the population of 466 old people of Lagoa Pequena, Santo Estevão, Northeast of Brazil, 2005.

Variable	Frequency (%)			p
	Total	Male	Female	
Hypertension	55.7	42.8	66.1	<0.001
Vascular brain injury	7.5	7.2	7.7	0.589
MI history	6.1	4.5	7.4	0.210
DM history	11.0	7.3	14.2	0.023
Smoking	17.7	24.0	12.3	0.002
Sight impairment	27.9	22.8	31.9	0.035
Hearing impairment	13.5	15.3	12.0	0.310
Use of antihypertensive agent	44.8	31.4	55.6	<0.001
Use of aspirin	1.9	2.4	1.5	0.497
Use of serum sugar-lowering drug	6.2	5.3	6.9	0.468
Use of cholesterol-lowering drug	1.3	0.5	1.9	0.233
Use of thyroid hormone agents	0.2	0.5	0.0	0.444
Use of antidepressants	0.2	0.0	0.4	1.000
Use of anti-ischemic drugs	0.6	1.2	0.0	0.258
Use of anti-arrhythmic drugs	0.6	0.5	0.8	1.000

p value= difference between gender.

was minimized by the multiple logistic regression model, using the diagnosis of dementia as the dependent variable.

## RESULTS

From July 2004 to April 2005, 508 individuals were evaluated. Among these, 15 passed away before the interview, 14 were not found (3 moved away, 6 were traveling, 4 were not at home during more than two of our visits, and one lived in an area of difficult access), 7 declined to participate in the study, and 6 were excluded (2 due to psychiatric disease, 2 due to blindness and 2 were deaf).

The population evaluated consisted of 466 elderly, age between 60 and 97 years, with a mean of 71.4, SD=8.4. In this population, 48.3% were between 60 and 69 years, 31.8% between 70 and 79, 15.7% between 80 and 89 and 3.2% were 90 or older. Five individuals were not included in this analysis because they did not have a proper identification document, even though we knew they were over 60. Regarding gender, 55.6% were women, and 74.7% were illiterate (72% of the men and 76.8% of the women,  $p=0.231$ ).

Table 1 presents the frequencies of main risk factors in the studied population, distributed by gender. Hypertension alone was the single most frequent risk factor found, and, along with smoking, were the most frequent ones in males. Medical history of diabetes, sight impairment, and use of anti-hypertensive drugs were more common in females.

Risk factors for dementia were divided into sociodemographic characteristics (Table 2), co-morbidities (Table 3) and drugs (Table 4). Two of the 9 individuals who were taking aspirin had a history of myocardial infarction (MI), seven were hypertensive, one reported a stroke, and two had hemiparesis. Dementia was diagnosed in 7 of them. We found 7.9% of this population suffering from hypertension (HTN) and DM, of which 54.1% had dementia. HTN and VBI were present in 6.4% of the subjects, of which 80% presented dementia. Twenty individuals had HTN and history of MI, 45% with dementia. Five individuals had HTN, VBI and MI, 3 of them (60%) with dementia. Among individuals with hearing and sight impairment 75.8% had dementia.

Table 5 shows that age  $\geq 90$  years old, vascular brain injury, sight impairment and hypertension are isolated risk factors to dementia in our population. In the final model of multivariate analysis of the risk factors for the diagnosis of dementia, we included level of education and gender, despite lack of statistical significance, because these variables could play an important role as confounding factors.

As age  $\geq 90$  years old was statistically different for prevalence of dementia, it was defined as a cut-off point for further analysis. Hearing impairment and antihyper-

Table 2. Prevalence of socio-demographic characteristics as risk factors for dementia in 466 old people of Lagoa Pequena, Santo Estevão, Northeast of Brazil, 2005.

Risk factor	N	n	P (%)	PR	95% CI
<b>Age (years)</b>					
60–69*	225	99	44.0		
70–79	148	78	52.7	1.20	0.97–1.48
80–89	73	39	53.4	1.21	0.94–1.57
90–97**	15	13	86.7	1.97	1.54–2.52
<b>Gender</b>					
Male*	207	101	48.8		
Female	259	130	50.2	1.03	0.86–1.23
<b>Education</b>					
Literate*	118	54	45.8		
Illiterate	348	177	50.9	1.1	0.89–1.39

N, number of individuals included in analysis; n, number of individuals with diagnosis of dementia; P, prevalence of dementia; PR, prevalence rate; CI, confidence interval of the PR. \*Reference; \*\* $p<0.05$

Table 3. Prevalence of co-morbidities as risk factors for dementia in 466 old people of Lagoa Pequena, Santo Estevão, Northeast of Brazil, 2005.

Risk factor	N	n	P (%)	PR	95% CI
<b>MI history</b>					
No*	402	189	47.0		
Yes	26	11	42.3	0.90	0.57–1.43
<b>DM history</b>					
No*	372	174	46.8		
Yes	46	23	50.0	1.07	0.78–1.45
<b>Hypertension</b>					
No*	199	82	41.2		
Yes**	250	139	55.6	1.35	1.10–1.65
<b>Vascular brain injury</b>					
No*	431	203	47.1		
Yes**	35	28	80.0	1.70	1.40–2.06
<b>Hearing impairment</b>					
No*	386	182	47.2		
Yes**	60	44	73.3	1.55	1.30–1.87
<b>Sight impairment</b>					
No*	323	148	45.8		
Yes**	125	80	64.0	1.40	1.17–1.67
<b>Smoking</b>					
No*	349	163	46.7		
Yes	75	34	45.3	0.97	0.74–1.27

N, number of individuals included in analysis; n, number of individuals with diagnosis of dementia; P, prevalence of dementia; PR, prevalence rate; CI, confidence interval of the PR; MI, myocardial infarction; DM, diabetes mellitus; \*Reference; \*\* $p<0.05$

*Table 4. Prevalence of the use of medication as a risk factor for dementia in old people of Lagoa Pequena, Santo Estevão, Northeast of Brazil, 2005.*

Risk factor	N	n	P (%)	PR	95% CI
Use of antihypertensive					
No*	257	115	44,7		
Yes**	209	116	55.5	1.24	1.03–1.49
Use of aspirin					
No*	457	224	49.0		
Yes**	9	7	77.8	1.59	1.10–2.28
Use of anti-ischemic drugs					
No*	463	229	49.5		
Yes	3	2	66.7	1.35	0.60–3.02
Use of serum sugar lowering drug					
Yes*	29	9	31.0		
No	437	222	50.8	1.64	0.94–2.84
Use of cholesterol-lowering drug					
Yes*	6	2	33.3		
No	460	229	49.8	1.49	0.48–4.65
Use of anti-arrhythmic drugs					
Yes*	3	1	33.3		
No	463	230	49.7	1.49	0.30–7.40

N, number of individuals included in analysis; n, number of individuals with diagnosis of dementia; P, prevalence of dementia; PR, prevalence rate; CI, confidence interval of the PR; \*Reference; \*\*p<0.05

*Table 5. Studied variables in a final logistic regression model for dementia.*

Variable	$\beta$	SE	P	OR	CI 95%
Male gender	0.15	0.21	0.470	1.17	0.77–1.77
Illiteracy	0.14	0.23	0.562	1.14	0.72–1.81
Age $\geq$ 90 years	2.15	1.06	0.043	8.56	1.07–68.26
Hypertension	0.57	0.21	0.007	1.77	1.17–2.70
Vascular brain injury	1.15	0.45	0.011	3.15	1.31–7.62
Sight impairment	0.60	0.24	0.011	1.83	1.15–2.91
Use of serum sugar lowering drug	-0.77	0.45	0.091	0.47	0.19–1.13
Use of aspirin	0.87	0.86	0.309	2.40	0.45–12.88
Constant	-0.72	0.28	0.011	–	–

$\beta$ , beta value of the logistic regression; SE, standard error of the beta value; P, p value; OR, odds ratio; CI 95%, confidence interval of the OR.

tensive drugs use were withdrawn from the analysis because they showed no significant association in the tested models, and for turning the logistic regression unstable. These variables were related to age  $\geq$ 90 and HTN.

Aspirin use was not shown to be an independent risk factor, as evidenced in the bivariate analysis model, probably being confounded with vascular brain injury. The use of serum sugar lowering drugs showed a tendency to be

a statistical risk factor for dementia. The variables that showed a clear statistical difference as independent risk factors were age  $\geq$ 90, HTN, VBI and sight impairment.

## DISCUSSION

This study shows that the main risk factors for dementia in a rural population of Northeastern Brazil are advanced age, hypertension, vascular brain injury, and

sight impairment, which is in accordance with data found in earlier studies. However, some specific aspects of this population deserve to be mentioned.

We observed in our sample that there was a significant increase in dementia cases with age, being even higher in individuals age 90 or older. Only, 3.2% of the studied population was of this age group, and 86.7% of them were diagnosed with dementia. Very advanced age has been considered controversial with respect to the increase in prevalence of dementia. This can be explained because studies typically do not include the very old<sup>20</sup>. However, Ritchie<sup>21</sup> reported an exponential increase in dementia with age, which agrees with our data.

In the group studied, we could not confirm data collected by Herrera<sup>22</sup> who reported dementia to be more common among the illiterate. Little education is related to high risk of AD, although its mechanisms are not fully understood<sup>17,23</sup>. It is possible that the instrument used was not appropriate to identify the association between dementia and low schollarity in this particular setting, because our population have a high prevalence of little educated subjects, even among those who were considered literate. Even though studies clearly show a higher prevalence of dementia in women<sup>22,24</sup>, our studies did not show a significant difference between genders.

We found strong relation between sight impairment and dementia. As sight impairment is frequently related to ageing, and is accountable for the individual's social and cultural isolation, it can be a confounding factor for the diagnosis of dementia, although the multivariate analysis have shown sight impairment as an independent risk factor for dementia.

Recently published scientific data suggests that traditional risk factors for cardiovascular disease in the elderly are also involved or are accountable for dementia. Although the association of some of these factors such as DM is inconsistent, it has been demonstrated that others, such as high cholesterol levels and hypertension are related in to elevated risk for AD and VaD<sup>25</sup>.

Considering the main epidemiologic studies, significant evidence was found that the control of hypertension seems to lessen the progression of brain lesion. Hypertension is a predictor for hippocampal atrophy in persons untreated<sup>16</sup>, it can impair cognitive function, and is related to VaD and AD<sup>26</sup>. Gorelick<sup>12</sup> suggests that the control of hypertension in midlife may be the main intervention to reduce the risk of vascular cognitive impairment and AD.

Hypertension was very prevalent (53.6%) among the population studied, as well as the number of individuals with high blood pressure, even under medication. This suggests that hypertension was poorly treated.

Cases of VBI, however, when compared to the high prevalence of hypertension, were few. But when hypertension and VBI were combined, we found a strong association with dementia.

Diabetes mellitus in men between the age of 40 and 65 is associated with an increased risk of dementia 3 decades later. Evidence points more strongly at VaD than AD although the mechanisms are not clear yet<sup>27</sup>. In our study we considered DM when there was a history of DM or the use of hypoglycemic agents, with a possible loss of data when the patient was unaware of the disease.

The presence of multiple cardiovascular risk factors substantially increases the risk of dementia regardless of age, gender and education. Considering the accepted theories in which dementias have a common cause and strong association with vascular risk factors, and if vascular risk factors really accelerate the pathogenesis of AD as well as VaD, then it is extremely important to control hypertension, DM and cholesterol levels.

Our main instrument, CAMDEX, is sufficient for the diagnosis, but we did not collect complementary laboratory data which could have helped in the identification of other diseases considered as risk factors, and image data for the differentiation of the etiology of dementia.

We concluded that advanced age, hypertension, cerebrovascular disease and sight impairment were the main factors associated with dementia, which suggests that adopting public health measures for the prevention and control of potentially modifiable risk factors can reduce the high prevalence levels of dementia.

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