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Relationship between personal and environmental factors and prevalence of acquired physical impairment in Brazil - a population-based study

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Abstract *The aim of this study was to estimate the relationship between personal and environmental factors and the prevalence of acquired physical impairment in adults and older persons in Brazil. We conducted a cross-sectional study using data from the 2013 National Health Survey. The response variable was self-reported acquired physical impairment. The explanatory variables were sex, race/skin color, education level, social class, paid employment, private health insurance, running water, and connection to a sewer network. The strength of association between the explanatory variables and response variable and respective 95% confidence intervals were estimated using Poisson Regression. Physical impairment was reported by 1.25% of the study population (n=55,369). After complete adjustment, being male and non-white, having a lower level of education, living alone, not being in paid employment, not having private health insurance, not having running water, and not living in a house connected to a sewer network were associated with higher prevalence of acquired physical impairment. The findings show that prevalence of physical impairment was higher among vulnerable groups and that personal and environmental factors are important elements that need to be assessed at the population level.*

Key words *Health of people with disabilities, Population studies in Public Health, Social Vulnerability*

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Introduction

The concept of impairment has changed over the years with the increase in knowledge of population health and influencing factors. According to the World Health Organization's International Classification of Functioning, Disability and Health (ICF), impairments are "problems in body function or structure such as a significant deviation or loss". An impairment can be influenced positively or negatively by (and can also influence) environmental and personal factors, activities and participation[1]. Environmental factors "make up the physical, social and attitudinal environment in which people live and conduct their lives", while personal factors refer to an individual's particular life context. Both factors are important constructs in the ICF, making up the individual's contextual factors[1,2].

The literature shows that people with disabilities experience social disparities and find it harder to get and hold a job[3,4]. In addition, studies show that higher levels of education are associated with lower risk of acquiring and coping with disability[5]. Chiu observed that people living alone have lower disability-free life expectancy than people living with partners and that life expectancy is lower among men[6].

A national survey in the United States conducted between 2001 and 2005 showed that people with disabilities were more likely to be smokers, physically inactive in leisure activities and obese, while another study related this association with potential environmental barriers faced by this population[7]. Given that disability is a broad and complex concept, it is important to recognize the benefits of a multidisciplinary approach for developing effective policies, assessments, and interventions that are less biomedical-centered[8]. Understanding the complete context of an individual's life and that environmental and personal factors can be facilitators or barriers to functioning is essential to improving our understanding of the population's health conditions.

The aim of this study was to determine the association between personal (sex, race, education level, social class, paid employment and private health insurance) and environmental (running water and connection to a sewer network) factors and prevalence of acquired physical impairment in adults and older persons in Brazil.

Methods

Study population and design

We conducted a cross-sectional study using data from the National Health Survey (NHS). Part of the epidemiologic surveillance system, one of the aims of the NHS is to collect information on the population's health conditions. Using the collected data, it is possible to verify the association between chronic non-communicable diseases and risk factors.

The survey was conducted by the Brazilian Institute of Geography and Statistics (IBGE) in partnership with the Ministry of Health[9] in 2013 with a sample of 60,202 people across 1,600 municipalities. The survey adopted a stratified sampling design to ensure that the data were representative of the Brazilian population[9]. The NHS is a household survey and the study population comprised individuals living in private households in rural and urban areas.

The expected sample was 63,900 households or individual interviews, based on a sample size of 79,875 households and adopting non-response rate of 20%. The actual non-response rate was 8.1%. The reasons for losses were as follows: household members absent or housing unit vacant; unable to make contact after three attempts; refusal. The NHS was approved by the research ethics committe[10] and the database is accessible to the public via internet.

Of the 60,202 survey participants, 4,833 were excluded, resulting in a final sample of 55,369 individuals. The exclusion criteria were: individuals with other impairments (intellectual - 279; visual - 3,220; hearing - 1,375); and individuals with congenital impairments (41). There were 82 individuals with more than one impairment.

Response variable

The dependent variable was self-reported acquired physical impairment (yes or no), determined by the following questions: "Do you have a physical impairment?", "Were you born with the impairment or was it acquired through a disease or accident?".

Explanatory variables

The independent variables related to personal factors were: *Sex* (male, female); *race/skin color* (white, non-white [black, brown, yellow, indigenous]); *education level* (degree or above, com-

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pleted high school, completed junior high school, has not completed junior high school) – the question on the NHS questionnaire was "*what is the highest level of education that you have attained?*". The options were: reading and writing, youth and adult literacy course, old elementary school, old junior high school, elementary school, elementary youth and adult education, old high school, high school, high school youth and adult education, degree, master's, PhD; *social class* (based on the Economic Classification Criteria Brazil[11] and categorized into quintiles, where the first quintile is the highest class and the last is the lowest); *living with another person* (yes, no); *in paid employment* (yes, no); *has private health insurance* (yes, no).

The variables related to environmental factors were: *running water in at least one room* (yes, no) and *connected to a sewer network* (general sewer network or drainage system, others [septic tank, cesspit, ditch, discharged directly into a river, lake or sea, other]).

Statistical analysis

The study population's characteristics were described according to the presence of acquired impairment using frequencies and their respective 95% confidence intervals (95%CI). The relationship between the variables was measured using Pearson's chi-squared test. The association between the explanatory variables (sex, race, education level, social class, paid employment, private health insurance, running water and connected to a sewer network) and response variable was tested using Poisson regression. Subsequently, the model was mutually adjusted for the variables that remained associated in the Poisson regression and age. Strength of association was measured using prevalence ratios and their respective 95% confidence intervals CI. Sample weighting was performed using the Stata 14.0 survey package, adopting a significance level of 5%.

Results

Most of the participants were women (51.88%), non-white (52.87%), had not completed junior high school (46.93%), lived with another person (61.59%), were in the three lowest social class quintiles (58.03%), were in paid employment (59.57%), did not have private health insurance (69.44%), had running water (94.10%), and were not connected to a sewer network (84.20%).

Acquired physical impairment was reported by 1.25% of the study population. Those with an impairment were predominantly male (63.09%), non-white (59.75%), had not completed junior high school (65.01%), were in the three lowest social class quintiles (71.99%), were not in paid employment (72.77%), did not have private health insurance (73.78%), lived alone (50.94%), had running water (92.7%), and were not connected to a sewer network (85.63%) (Table 1). The mean age of the individuals with acquired physical impairment was 54.40 years (95%CI 52.43-56.38), compared to 41.67 years among those without an impairment (95%CI 41.39-41.95). The mean age of the overall study population was 41.83 years (95%CI 41.55-42.10) (data not shown).

Table 2 shows the association between the explanatory variables and response variable. The findings show that being male and non-white, having a lower level of education, belonging to the lowest social class quintile, living alone, not being in paid employment, not having private health insurance, not having running water, and not being connected to a sewer network were associated with higher prevalence of physical impairment. After mutually adjusting the variables of interest, the associations remained statistically significant, albeit weaker.

Discussion

Acquired physical impairment was reported by 1.25% (n=691) of the study population. After adjusting the data for personal and environmental factors, prevalence of impairment was higher among men, non-whites and individuals with a lower level of education, in the lowest social class quintile, not in paid employment, who didn't have private health insurance, and living in house that is not connected to a sewer network. The findings therefore show that prevalence of self-reported acquired physical impairment was higher among groups who are more socially vulnerable.

Prevalence of physical impairment was higher in men than in women, corroborating the findings of previous studies, such as a study in Florianópolis assessing the profile of individuals with physical disability[12]. Studies in Austrália[13] and Canadá[14] also showed that the risk of diabetes-related amputation was higher in men, while a study in Brazil reported that prevalence of stroke and stroke-related disability was higher

Table 1. Study population characteristics.

Variables	Physical impairment No		Physical impairment Yes		Total population	
	N (55,467)	% (98.75)	N (691)	% (1.25)	N (55,369)	% (100.00)
Sex						
Male	23,334	46.91	420	63.09	23,754	47.11
Female	31,344	53.08	271	36.90	31,615	52.88
Race/skin color						
White	21,734	47.21	248	40.24	24,982	47.12
Non-white	32,944	52.78	443	59.75	33,387	52.87
Education level						
Degree or higher	10,208	19.34	77	8.09	10,285	18.22
Completed high school	18,374	35.01	136	20.80	18,510	34.84
Completed junior high	5,411	10.06	56	6.08	5,467	10.01
Did not complete junior high	20,685	36.57	422	65.01	21,107	36.92
Social class quintile						
5 (Highest)	10,079	22.53	70	11.79	10,149	22.40
4	9,409	19.59	96	16.19	9,505	19.55
3	11,269	21.02	120	17.80	11,389	20.98
2	10,868	17.75	164	26.18	11,032	17.85
1 (Lowest)	13,053	19.09	241	28.01	13,294	19.20
Living with another person						
Yes	31,890	61.64	339	49.05	32,229	61.59
No	22,788	38.35	352	50.94	23,140	38.40
Paid employment						
Yes	32,001	59.98	200	27.22	32,201	59.57
No	22,677	40.01	491	72.77	23,168	40.42
Private health insurance						
Yes	15,036	30.60	151	26.21	15,187	30.55
No	39,642	69.39	540	73.78	40,182	69.44
Running water						
Yes	50,198	94.12	624	92.7	50,822	94.10
No	4,480	5.87	67	7.24	4,547	5.89
Sewage						
Connected to sewer network	11,759	15.81	149	14.36	11,908	15.79
Other	42,919	84.18	542	85.63	43,461	84.20

Source: Authors.

in men[15]. These health conditions can lead to acquired physical disability. However, it is important to highlight that there is no consensus about these findings in the literature. Other studies show that women had poorer health and showed higher levels of self-reported disability[16], while a study published in 2020 reported that the worldwide prevalence of disability in people who may need rehabilitation is almost the same in men and women[17].

The findings of the present study show that men are more likely to have an acquired impairment. Although there is no consensus in the literature, this finding may be used as an element to guide the design and implementation of men's health policies focusing on acquired physical impairment, such as the prevention and care of conditions like diabetes and strokes and prevention of injuries caused by traffic accidents, which are more common among men[18].

Table 2. Associations between personal and environmental factors and prevalence of physical impairment. National Health Survey, 2013.

Variable	Crude PR	95%CI	Adjusted PR#	95%CI
Sex				
Female	1		1	
Male	1.48	1.48-1.48	1.01	1.01-1.01
Race/skin color				
White	1		1	
Non-white	1.48	1.48-1.48	1.03	1.03-1.04
Education level				
Degree or higher	1		1	
Completed high school	1.99	1.99-1.99	1.03	1.03-1.03
Completed junior high	1.99	1.98-1.99	1.04	1.03-1.04
Did not complete junior high	1.97	1.97-1.98	1.03	1.03-1.03
Social class quintile				
5 (Highest)	1		1	
4	1.98	1.97-1.98	1.08	1.07-1.08
3	1.98	1.98-1.99	1.09	1.09-1.10
2	1.98	1.98-1.99	1.12	1.11-1.12
1 (Lowest)	1.99	1.99-1.99	1.15	1.15-1.16
Living with another person				
Yes	1		1	
No	1.53	1.53-1.53	1.03	1.03-1.04
Paid employment				
Yes	1		1	
No	1.52	1.52-1.52	1.00	1.01-1.01
Private health insurance				
Yes	1		1	
No	1.45	1.44-1.45	1.06	1.06-1.06
Running water				
Yes	1		1	
No	1.82	1.81-1.83	1.20	1.19-1.21
Sewage				
Connected to sewer network	1		1	
Other	1.98	1.98-1.98	1.06	1.05-1.06

Abbreviations: PR=prevalence ratio; CI=confidence interval; #model adjusted for all variables that remained statistically significant and (continuous) age in years.

Source: Authors.

The results also show that prevalence of impairment was higher in non-whites, which is consistent with the findings of a study undertaken in the United States in 2013 with non-institutionalized adults, which showed that overall prevalence of any disability (vision, cognition, mobility – mainly arthritis and back problems – self-care, and independent living) was higher among black adults[19]. One possible explanation for this is that the non-white population tend to have lower levels of income and education[20,21]. Socioeconomic disparities can influence different areas of an individual's life. In this regard, data on adult health in 2008 from the United States reveal that African Americans show lower levels of physical activity and disproportionately high rates of disease (heart disease, high blood pressure, diabetes mellitus, among others), illustrating that this population is more vulnerable[22]. The same study, conducted by Brand *et al.*[22], defends that proximate factors such as behavioral and risk factors (stress, high blood pressure, diabetes), which are common in low-income populations, may influence health outcomes and physical ac-

tivity. These aspects combine with distal factors, such as socioeconomic and social characteristics (African Americans tend to have lower income and education levels), which act as mediators[22]. It is important to highlight that other factors not investigated by the present study may influence the relation between skin color and impairment. Future studies should therefore take an in-depth look at other variables not examined by the current study.

Reinforcing the influence of socioeconomic factors, our findings show that prevalence of physical impairment was higher in individuals with lower education levels, those belonging to the lowest social class quintile and those not in paid employment. Education is an important factor in social inclusion and low education levels can lead to poorer access to health services and information on disease prevention and health promotion, influencing self-care[12,23]. Data from the 2008 National Household Survey show that lower education level and per capita family income and being economically inactive were associated with functional disability[24]. Despite advances in policies targeting this population[12], a large proportion of people with disabilities are unemployed, even in developed countries with comprehensive social policies like Switzerland[25].

Prevalence of disability was lower in individuals living with another person, which is consistent with the literature[26]. In addition, studies show that people with disabilities living alone are more likely to report lower life satisfaction[26] and have lower life expectancy and disability-free life expectancy[6]. Combined with the results of the present study, these findings support evidence showing that people with disabilities experience social isolation[27]. Health providers should therefore pay special attention to people with disabilities living alone.

The relationship between disease, water, sanitation and hygiene has been widely described in the literature and is addressed by one of the Sustainable Development Goals[28], with a number of studies stressing the importance of these factors for child development[29]. Our findings show that people with physical impairment were less likely to have running water and live in houses connected to the general sewer network. A study conducted in four countries (Bangladesh, Cameroon, Malawi and India) showed that people with disabilities reported difficulties collecting water themselves and accessing the same sanitation facilities as other household members[30]. It is important to highlight that environmental and personal factors need to be considered, given their potential association with disability.

As shown by previous studies, the findings of the present study reinforce evidence of the association between disabilities and variables linked to social vulnerability[31,32]. Brazil's National Social Assistance Policy (PNAS) prioritizes people with disabilities, providing that these individuals should receive basic social protection, which aims to prevent situations of risk through the development of potential and possessions and strengthening family and community support networks. Measures include the Continuous Cash Benefit (*Benefício de Prestação Continuada – BPC*) program, which provides monthly cash benefits to people with disabilities. In addition, the PNAS provides that people with disabilities should receive special social protection, providing assistance to people at social or personal risk due to abandonment, abuse (physical, sexual, psychological) and use of illicit substances, young offenders, the homeless, children engaging in child labor, among others. According to the PNAS, community habilitation and rehabilitation services and social surveillance and protection actions should specifically target people with disabilities[33]. Effective social protection policies such as the PNAS can reduce the effects of social vulnerability among people with disabilities at the population level.

The main limitation of this study is that physical impairment was self-reported. However, it is important to highlight that we used data from a national household survey of the population in both rural and urban areas, thus enabling a comprehensive investigation of prevalence of impairment in a representative sample. In addition, the NHS is conducted on a periodic basis, thus permitting future comparisons of trends in the profile of this population.

Conclusions

The findings show that prevalence of acquired physical impairment was higher among men, non-whites and individuals with a lower level of education, in the lowest social class quintile, living alone, not in paid employment, who didn't have private health insurance, and living in house that is not connected to a sewer network. These findings show that prevalence of physical impairment is higher among vulnerable groups living in precarious situations and that personal and environmental factors are important elements that need to be assessed at the population level.

Collaborations

MCA Barreto worked on the conception, design and interpretation of data, drafting the article and approval of the version to be published. LF Araújo worked on the design or analysis and interpretation of data; revising it critically and approval of the version to be published. SS Castro worked on the conception and design or analysis and interpretation of data; revising it critically; and approval of the version to be published.

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