Socioeconomic position and disability: "The Belo Horizonte, Brazil Health Study"

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Abstract *This study aims to investigate the association of socioeconomic status and comorbidities of self-reported disability. Data were obtained from a population survey in Belo Horizonte from 2008 to 2009. The sample was probabilistic and stratified by conglomerates in three stages: census tracts, households and individuals. The outcome variable was disability, defined by the self-reported problems in bodily functions or structures. The explanatory variables were gender, age, self-reported morbidity and socioeconomic status index that included variables mother and respondent schooling and household income. The factorial analysis was used to evaluate the socioeconomic status index and logistic regression. The prevalence of disability was 10.43% (95% CI: 9.1-11.7%). Self-reported disability was associated with age (OR = 1.02; 95% CI: 1.01-1.03) and reporting of two or more diseases (OR = 3.24; CI 95%; 2.16-4.86) and socioeconomic status index (OR = 0.96; 95% CI: 0.95-0.97). The worse socioeconomic status and occurrence of diseases appear to contribute to the occurrence of disability. These results show health inequities among people with disabilities, and BPC relevance supporting vulnerable populations.*

Key words *People with disabilities, Socioeconomic status, Prevalence, Continuous Cash Benefit (BCP)*

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Introduction

The theme about people with disabilities has gained prominence in studies on public health and national policies, caused by the keen interest of researchers, the increased prevalence of individuals with this health condition and by the poor socioeconomic condition faced by people with disabilities when compared to the general population[1-3]. More recently, accelerated population aging and increasing numbers and severity of chronic diseases[2,4] have greatly affected the higher prevalence of disability and greater interest in the subject.

The 2015 National Health Survey (PNS)[1] estimated the prevalence of disability in Brazil at 6.2%, a percentage below the 2010 census[2], of 24%. Different concepts of disability explain the discrepancy between reported prevalence and the difficulty of comparing surveys[5].

Socioeconomic status represented by income and schooling has been associated with several health problems. It reflects different realms of the life-cycle context, ranging from childhood to adulthood and old age[6,7]. While education precedes the occurrence of health problems, because it is determined early in life, income is determined by educational level and influences health by directly affecting access to material resources[8].

According to the theoretical model of the course of life, the poor health condition of individuals can be partly attributed to the low socioeconomic status of parents during the initial phase of the life cycle, childhood and adolescence, associated to the increased risk of cardiovascular and respiratory diseases, diabetes and functional disability in adult life[7,9,10].

An inverse association has been consistently described between mother's level of education and prevalence of disability; as the level of mother's schooling decreases, the odds of disability increase progressively[9,10]. Mothers with better schooling are more likely to provide the necessary care for their children, higher income, greater access to information, increased use of health services and are less exposed to risk factors such as alcohol consumption, drug use and sedentary lifestyle[9].

Studies have shown that individuals with disabilities and with greater socioeconomic deprivation have a high prevalence of comorbidities, lower access to health services and rehabilitation, which increases health inequities[11-18]. These studies already provide some evidence of the relevance of social policies focused on populations with a high level of vulnerability, such as those with disabilities.

To date, few Brazilian studies have been found, mainly population-based, which investigated the association of socioeconomic status and self-reported diseases with the presence of disability[5,12,13,19].

Disability, social policies and poverty

Social welfare policies aimed at social development from reduced poverty and inequality have settled on the political agenda of Western Hemisphere countries since the beginning of the twentieth century[20-22]. In Brazil, social welfare policies have been implemented since the 1930s. The most striking case of that decade was the Consolidation of Labor Laws (CLT), which implemented a series of worker protection benefits in Brazil. However, in addition to the corporatist element, the moments of rupture of the democratic rule of law represented threats and obstacles to the development of Brazilian social welfare policies[22].

As shown by Marshall[23], the democratic regime is a precondition for the development of social welfare policies – although, as well pointed out by Esping-Andersen[20,21], it is not a sufficient cause. Andersen argues that, for the development of social welfare, historical experience shows that a leftist party or coalition should govern for a good period of time (at least a decade). This would have occurred both in the US (in the New Deal period of Franklin Roosevelt) and in European countries (with Labor in the United Kingdom and with Social Democrats and Socialists in continental Europe). It is no coincidence that only with the 1988 Federal Constitution, which resulted from the country's re-democratization process, after more than two decades of authoritarian rule, Brazil experienced once again new advances in social welfare policies. Table 1 shows some important social development indicators for the period 1988-2014 as well as the change that occurred in the period. It is observed that, since the 1988 Federal Constitution (FC-88), Brazil has undergone an important process of social development, with improved health (in particular reduced child mortality), inequality and poverty indicators.

Despite the importance of the FC-88, until the 1990s, social welfare policies in Brazil did not show a path towards more egalitarian models[23]. More significant transformations were observed in the following decade. The BPC, in many ways,

Table 1. Social development indicators, 1988 and 2014.

Name of indicator	1988	2014	Δ%
Life expectancy at birth	64.6	74.4	15.2
Child mortality rate up to 1 year (per 1000 live births)	54.8	14.4	-73.7
Gini coefficient of income distribution	61.4	51.5	-16.1
Population below the poverty line *	22.4	3.66	-83.5

Source: World Bank.

* Poverty line defined by the World Bank at US $ 1.90 per capita per day (amounts defined by Purchasing Power Parity with reference point in 2011).

anticipated an important feature of the new Brazilian social policies – targeting. Like the BPC, the most important social policies that have emerged in the past decade – such as the Family Grant Program (PBF) – are targeted by means testing measures based on per capita household income. This characteristic of the new Brazilian social welfare policies is often identified as a neoliberal approach to social policies, but it is also often seen as an intermediary between the traditional (Keynesian) model of well-being and the neoliberal model. Regarding this intermediate model, Esping-Andersen[21] points out that: "While some perception of this trade-off between equality and efficiency has always dominated debates on social policy, there is a broad consensus, in the last few decades, that the Keynesian welfare state provided a positive sum solution. Today, few people are optimistic about finding an unproblematic "third way". Even so, many of the countries we studied pursue strategies designed to mediate or soften this trade-off. A group represented by Australia and Canada combines liberalization and change towards greater selectivity and targeting with a concomitant expansion of benefits to the most vulnerable. This selective approach is broad and aims at security against abject misery and severe inequalities. Comparative data on income and poverty suggest that such a strategy is somehow successful, at least compared to the United States. These countries enjoyed employment performance that equals the US, but without alarming impoverishment rates" (our emphasis).

The BPC and the new social welfare policies in Brazil follow precisely this model of selectivity and targeting, seeking to extend the benefits to the most vulnerable and, thus, to eliminate extreme poverty[24,25]. The BPC was evidenced by the FC-88, in its Art. 203. Costa et al.[26] state the following on this matter: "Article 203 of the FC-88 establishes the protection of family, maternity, childhood, adolescence, old age and persons with disabilities, regardless of contribution to social security. It assures to the last two segments a monthly benefit of a minimum wage if they are unable to cater for their own livelihood or have it provided by their families. [...] The BPC was established to transfer income to elderly people and people with disabilities, integrating the Basic Social Protection within the Unified Social Welfare System – SUAS".

Beneficiaries are not all elderly and people with disabilities. The definition of who should be the beneficiary occurs through a means test procedure based on per-capita household income (beneficiaries must be members of families with incomes less than 1/4 of the minimum wage). BPC was implemented in the 1990s based on a biomedical model of disability identification[26,27]. However, as Costa et al.[26] emphasize: "In 2001, the proposed social paradigm for approaching disability and incapacity became effective at the international level with the dissemination by WHO of the International Classification of Functioning, Disability and Health (ICF). ICF encompasses the rehabilitation practice, the idea of social inclusion and the promotion of well-being. In Brazil, despite these advances, the criteria for granting BPC remained subject to the biomedical orientation until the end of the 2000s".

In the second half of the last decade – more specifically from Decree Nº 6.214/2007, followed by Joint Ordinance MDS/INSS No. 1, dated 29/05/2009 – the disability assessment criterion for eligibility to BPC started to be based on ICF's biopsychosocial model. While a very significant proportion of BPC beneficiaries have only been able to gain access to the program through the judicial system[26], it is clear that the normative improvements of this public policy have created a very relevant program for the social protection of one of the most vulnerable population strata: people with disabilities belonging to families living in poverty.

Thus, this study aims mainly to bring new empirical foundations based on multivariate statistical analysis to demonstrate the association between poverty and disability. More specifically, we aim to evaluate whether the low socioeconomic status and higher frequency of the disease are associated with higher prevalence of self-reported disability between the adult and elderly individuals living in an urban center. Evidence of this association reinforces the relevance of BPC as an intermediary social welfare policy based on means testing focused on protecting an extremely vulnerable segment of the population.

Methodology

Design and sample

This is a cross-sectional study, part of the "The BH Health Study" Household Survey, conducted by the Belo Horizonte Urban Health Observatory of UFMG, Minas Gerais, Brazil, in two of the nine health districts of Belo Horizonte, namely, Oeste and Barreiro, from 2008 to 2009. This is a probabilistic and stratified sampling in conglomerates in three stages: census tract, household and individual. To ensure the same proportionality of residents at all socioeconomic levels, the study area was subdivided into strata, according to the Health Vulnerability Index (HVI) and the categories of territorial vulnerability used by the Municipal Health Secretariat (SMS): low (< 2.33), average (2.33-3.32), high (3.33-4.31) and very high (> 4.31)[28]. We sampled 149 census tracts. Of these, 5,171 households were eligible with residents accessed; there were refusals (n = 628), interviews with issues (n = 35) and interviews scheduled, but not completed after three trials (n = 46). The proportion of losses was 13.7%, resulting in 4,048 households. In each household, an adult resident (≥ 18 years old) was randomly selected to answer the questionnaire to previously trained interviewers after a pilot study. More detailed information on this survey can be found in other publications[29,30].

Variable "Response"

Disability defined from the self-reported "problems in the functions or structures of the body, such as significant deviation or loss"[31], was operationalized through the question: "Do you have any limitations, difficulty or disability (either motor, visual, hearing or other)?" Responses were coded as NO (no disability) and YES (with disability).

Explanatory variables

Composition of the socioeconomic status index: latent variable estimated as a construct and operationalized by the combination of three manifest variables: family income, mother and respondent schooling. Regarding family income, we considered the midpoint of the interval of each category of income in minimum wages at the time; zero (families without income); R$ 207.50 (less than 1 minimum wage); R$ 622.50 (from 1 to less than 2 minimum wages); R$ 1,037.50 (from 2 to less than 3 minimum wages); R$ 1,660.00 (from 3 to less than 5 minimum wages); R$ 3,112.50 (from 5 to less than 10 minimum wages); R$ 6,225.00 (from 10 to less than 20 minimum wages); R$ 10,375.00 (from 20 to less than 30 minimum wages); R$ 14,525.00 (from 30 to less than 40 minimum wages); R$ 18,675.00 (from 40 to less than 50 minimum wages) and R$ 24,900.00 (50 or more minimum wages). Regarding mother and respondent schooling, categories were considered in complete years of study that ranged from zero to 16 years. In 510 missing values, the multiple imputation method was used for mother's schooling based on distribution by household income, gender and age[32].

Referred morbidity: obtained from the report of the evidence of disease through the question: "Has a doctor or other health professional ever said that you have any of these chronic diseases? The list consisted of fifteen options: hypertension, high cholesterol, diabetes, asthma, arthritis (rheumatism, osteoporosis, arthrosis), chronic kidney disease, depression, migraine, epilepsy, tuberculosis, cancer (malignant tumor), heart disease, chronic lung disease (bronchitis, emphysema), chronic digestive disease (ulcer/gastritis), mental illness (schizophrenia, psychosis, anxiety disorder, bipolar disorder, obsessive compulsive disorder, panic syndrome, anorexia, bulimia). Three categories were created for the variable from the responses according to the presence or absence of these 0-no diseases; 1-one; 2- two or more morbidities.

Demographic variables: gender (female, male) and age (years), pre-established as adjustment variables.

Data review

Score analysis: Regarding the construction of the socioeconomic status index, a data exploratory factorial analysis for the elaboration of the socioeconomic status index was initially developed. It is a multivariate factor analysis technique, through the analysis of main components, which allows identifying latent variables or factors with the same underlying structure of the original variables and explain their variance, thus summarizing most of the original information (variance) to a minimum number of factors. It also allows the investigator to work with a reduced number of variables without prejudice to information[33,34]. To assess the applicability of the method to the data set, the Bartlett's Test of Sphericity (BTS) and Kaiser-Meyer-Olkin Measurement of Sampling Adequacy (KMO) tests were applied. These tests provide the statistical probability that the correlation matrix has significant correlations between at least some of the variables. The fit of the factorial model for data review was satisfactory and expressed values of $p \leq 0.05$ for BTS and greater than 0.60 for KMO. Then, the factor extraction technique was carried out, which allowed determining the number of factors that best represented the correlation pattern among the observed variables. By the eigenvalue rule, it is suggested that only factors with eigenvalue values above 1 are extracted. The factor's eigenvalue is such that it contributes to explain variance in the original variables. This single factor represented the socioeconomic status indicator with a mean -0.23 ($\pm$ 0.91), minimum -1.742; maximum of 4.029, used in this study. Next, the variable of the socioeconomic status indicator was transformed into a standardized variable that ranged from zero (0) to one hundred (100), with zero (0) indicating the worst economic status and one hundred (100) the best socioeconomic status.

Descriptive analyses were then performed through frequency distributions, means and standard deviation. The magnitude of the association between the explanatory variables and the response variable was measured by the odds ratio (OR) and its confidence interval (CI 95%) by the univariate and multivariate logistic regression model and the Hosmer-Lemeshow fit test. STATA 12.0 software was used for the statistical analysis, considering the sampling design and significance level of 5%. The Research Ethics Committee of the Medical School of UFMG approved this study.

Results

Of the 4,048 study participants, the prevalence of self-reported disability was 10.43% (95% CI: 9.1-11.7%); 53.11% were women, with a general mean age of 40.94 ($\pm$ 16,14). Most of the respondents reported having one or more diseases (56.95%).

With the KMO of 0.6723 and BTS <0.001, factor extraction was allowed through factor analysis. A single factor (socioeconomic status index) with an eigenvalue of 1.95 was identified, resulting in a socioeconomic status index with a mean of 26.13 (SD $\pm$ 15.85). The index of socioeconomic status explained 67.2% of the variance of the manifest variables, mother's schooling, individual's education and income, with factorial weight of 0.82 for mother's schooling and 0.77 and 0.82, for individual's income and schooling, respectively.

The median socioeconomic status index, mother and respondent schooling was lower among individuals with disability when compared to those without disability, as shown in Figure 1.

In the univariate analysis, all sociodemographic and health variables were significantly associated ($p \leq 0.05$) with self-reported disability (Table 2). The prevalence of self-reported disability was higher in females (11.93%, 95% CI: 10.2-13.6) when compared to males (8.72%, 95% CI: 6.8-10.5). The mean age of participants with disability was higher (51.13 years) compared to those without disability (39.76 years). The prevalence of self-reporting two or more diseases among individuals with disability was significantly higher (19.67%) compared to individuals without disease (4.38%). The socioeconomic status index was lower, with a mean of 21.44 ($\pm$ 16.22) among participants with disability compared to those without disability, with a mean of 31.21 ($\pm$ 17.11).

In the multivariate model (Table 3), the associations between the explanatory variables and self-reported disability remained significant, except for the gender category that was maintained in the model as adjustment. Each one-year age increase increased the odds of self-reported disability by 2% (OR = 1.02, 95% CI: 1.01-1.03). The presence of one (OR = 1.6, 95% CI: 1.09-2.34), two or more (OR = 3.24, 95% CI: 2.16-4.86) reported diseases increased, respectively, by 1.60 and 3.24 times the likelihood of individuals reporting disability. The socioeconomic status index had a protective effect for self-reported
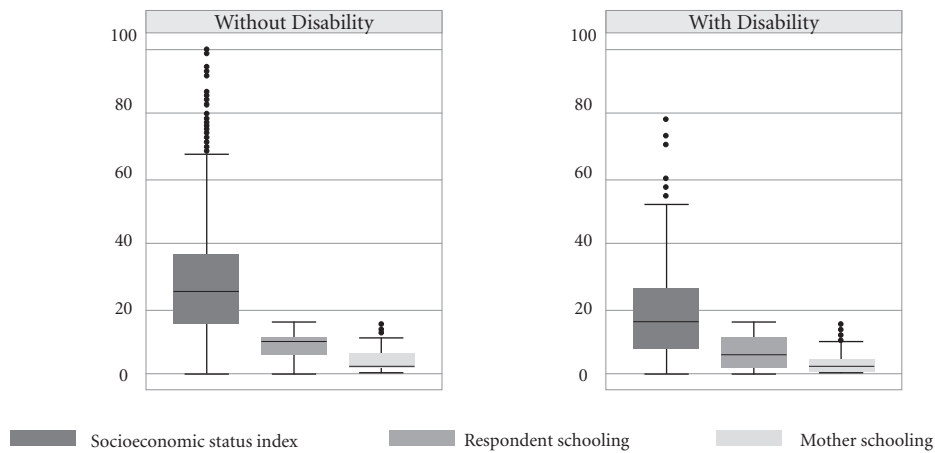
Figure 1. Relationship between socioeconomic status index, mother schooling and respondent schooling, without and with disability.

Table 2. Prevalence and association of sociodemographic and health variables in the univariate analysis according to self-reported physical disability: 2008-2009 Belo Horizonte Health Study (n = 4,048).

Variable	Total	With disability Prevalence (%) (CI95%)	Without disability Prevalence* (%) (CI95%)	OR (CI95%)
Gender (%)				
Female	53.11	11.93 (10.24-13.63)	88.07 (86.37-89.76)	1
Male	46.88	8.72 (6.87-10.56)	91.27 (89.43-93.12)	0.70 (0.53- 0.93)&&
Age (years) (mean ± SD)	40.94 (±16.14)	51.13 (17.50)	39.76 (15.55)	1.04 (1.03; 1.05)&
Number of referred diseases (%)				
None	43.03	4.38 (3.24-5.53)	95.6 (94.47-96.76)	1
One	23.56	8.35 (6.39-10.32)	91.6 (89.68-93.60)	1.98 (1.37-2.88)&
Two or more	33.39	19.67 (16.53-22.81)	80.3 (77.18-83.46)	5.34 (3.84; 7.44)&
Status index Socioeconomic (mean ± SD; median, P25-P75)#	26.13 (±15.85) (14.27-34.69)	21.44 (16.22)	31.21 (17.11)	0.96 (0.95; 0.97)&

Title: (*) Weighted prevalence; (#) 152 missing; (&) P-value < 0,001; (&&) P-value: 0,011.

disability (OR = 0.97, 95% CI: 0.96-0.98). Each one-point increase in the socioeconomic status index decreased by 3% the odds of the individual having a disability. The model showed a good fit according to the Hosmer and Lemeshow test (p = 0.8591).

Discussion

This study showed that the low socioeconomic status showed represented by household income, mother and respondent schooling and the high frequency of diseases are associated with a higher prevalence of disability. These associations persisted in the multivariate model.

The prevalence of disability estimated by the World Health Organization (WHO)[3] at 10%, was similar to that found in this study. However, the National Health Survey, in 2015[1], estimated prevalence of disability at 6%, while the 2010 census evidenced 24%[2]. As mentioned previously, disparities found among prevalence of disability can be attributed to several factors such as definitions adopted for the theme and variations in the tools used for collection[5].

From the association viewpoint, however, a relative agreement with previous studies was found. Age remained associated with disability even when adjusted for gender, self-reported disease, and socioeconomic status, corroborating the well-established effect in the literature of age on the occurrence of disability[12,15,17,19]. With the aging of the population, the odds of reporting disability increase, as well as the high frequency of diseases, especially among those over 60 years of age[14,15]. It should be noted, however, that in this study, the occurrence of disability was observed in people with a mean age of 51 years, possibly revealing an early decline of human body functions and structures.

Literature shows that women have a high prevalence of disability when compared to men[11,14,35]. However, in this study, gender was not associated with disability in the multivariate analysis.

Table 3. Association of sociodemographic and health variables according to self-reported physical disability in the multivariate analysis: 2008-2009 Belo Horizonte Health Study (n = 4,048).

Variable	OR (CI 95%)	P-value
Gender (%)[*]		
Female	1	0.791
Male	0.96 (0.7 -1.3)	
Age (years)[*]	1.02 (1.01 - 1.03)	<0.001
Number of referred diseases (%)		
None	1	
One	1.6 (1.09 - 2.34)	0.017
Two or more	3.24 (2.16 - 4.86)	<0.001
Socioeconomic status index[#]	0.97 (0.96- 0.98)	<0.001

Title: [*]Adjustment variable; [#]152 missing; Model fit test: Hosmer-Lemeshow.

The dose-response gradient observed by the increased number of morbidities referred to as prevalence of disability also increases has been previously described[11-13,36], supporting the results of this study. The relationship between the aging process and the self-reported disability with chronic diseases also assumes a dose-response gradient: increasing age raises the frequency of referred morbidities and increases the prevalence of disability[12,15,37]. The association between aging and self-reported disability is often accompanied by a high prevalence of chronic diseases, especially in females, due to the greater survival and chronic non-fatal conditions among them, as well as the scarce access to health and rehabilitation services[37].

In this study, the effect of socioeconomic status on increased prevalence of disability, even after adjusting for gender, age and evidence of comorbidities, remained similar to that found in previous international[14,17,35,38] and national studies[12,13]. While most studies verified use income and schooling separately, our results showed the same direction of the association.

In the study by Zitko and Melo[17], individuals belonging to the poorest income quintile reported more often disability in all age groups. However, Gjonça and Breeze[38] found that the effect of lower wealth was associated with increase in its prevalence among adults (50-74 years), even after adjusting for age. The magnitude of this association between the poorer income and health condition was lower for individuals over 75 years of age.

In the study by Abellán et al.[19], both high schooling and income reduced the likelihood of disability by 43%, while low schooling with high income reduced the odds of disability by only 21%. One of the explanations that elucidates the effect of schooling on the health condition is that people with high schooling tend to adopt healthy behaviors, are more socially participative and seek more health services, mainly with a preventive approach[6,39].

Kingston et al.[40] confirmed the theory of the accumulation of disadvantages or risks during the course of life, stating that the worst level of schooling contributes to worsened health condition among the elderly in the 85-90 age group with functional disability. The high level of schooling is a protective factor for the early onset of diseases and disability, as found in this study. The socioeconomic status throughout life, in part, determines health in adult life[8]. Individuals whose parents have low levels of education

during childhood are at increased risk of developing disability when adults[9]. In this study, the socioeconomic status index of individuals with disability was lower than those without disability, as well as mother and respondent schooling (Figure 1). This finding evidenced by previous studies adds evidence in the current hypothesis that, among adults and the elderly, the effect of low mother's schooling is in the causal chain of manifest health issues such as comorbidities, evidence of disabilities and incapacity in life activities[9,17].

The socioeconomic status indicator measures different aspects of social stratification, and each of the components of this indicator, education and/or income are more or less relevant because they affect health, depending on the event investigated and the stages of the course of life[6]. This finding was corroborated by Herd et al.[7], whose schooling indicator was more relevant since it predicted the onset of the chronic diseases process and whose income indicator predicted the progression of chronic disease and functional limitation. An important aspect should be considered. This study advances by using a robust, multidimensional socioeconomic status indicator, which aggregates three measures – respondent's schooling and income and mother's schooling. The latter reflects the cumulative effect of socioeconomic status in adult life, which is considered a proxy of the socioeconomic status of the household context in which the child developed influencing the health process in adult life[8]. While some studies cite as a limitation the retrospective measurement of parents' schooling, even leading to an underestimation of the associations found, there is evidence for the replicability of results of these measurements[41,42].

Some limitations should be discussed. The classic impossibility of establishing a causal relationship, because this is a cross-sectional study; the possible existence of the reverse causality effect of the income variable and the variable of the respondent's schooling. This effect cannot be totally excluded, since individuals with the lowest income and education are exposed to worse health conditions, since their financial resources are reduced for the maintenance of their health.

In addition, the comparison of the results is hampered by the question used in the survey, by the varying definitions of the term disability available in the literature for which, in many studies, was directed to functional incapacity outcomes. Measuring disability through self-report can generate errors in disability estimates. Despite comparability issues found, prevalence similar to national and international studies suggest the external validity of this study.

The poor socioeconomic status and the high frequency of self-reported diseases seem to contribute to increased self-reported disability and to favor health inequities in this population group. Focused on reducing these inequities, our data point to the incentive of public policies and programs that stimulate health and disease prevention practices. Our results indicate the enormous relevance of income transfer policy targeted through the application of a means testing based on household income per capita and geared to a population with a high level of vulnerability, which is the case of people with disabilities.

Collaborations

MF Felicíssimo, AAL Friche, JAB Neves and WT Caiaffa worked on the design and outline of the paper, data analysis and interpretation, final writing and critical review; CC Xavier and FA Proietti worked on data interpretation, paper writing and critical review. All authors approved the final version to be published.

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