STUDIES ON STATISTICAL HOUSING CONDITIONS FOR DISABILITIES PERSONS

Paulo Oliveira*
IME-USP, São Paulo, Brazil – poliver@usp.br

Abstract

According to the World Health Organization (WHO), it is estimated that more than one billion people live with some type of disability, which represents about 15% of the world population (based on 2010 estimates). This is lower than estimates from the IBGE, which also date from 2010, suggest that approximately 23.9% of the Brazil´s population, represented by 45,600,00 are people with at least one disability, with approximately 6.9% considered as cases more serious, which represent 13.1 million. The term disability means a physical, intellectual or sensory disability, of a permanent or temporary nature, which limits the ability to exercise one or more activities. Disabled person refers to anyone who has a disability and who are under the protection of a law. It is believed that disabilities people find themselves in inequality conditions, violations of their dignity and loss of autonomy. In 1991, according to WHO, it was established that adequate housing is one that provides shelter against climate change, health conditions, safety and a minimum size to be considered habitable. The necessary sanitary facilities, served by essential public services, including water, sewage, electricity, public lighting, garbage collection, sidewalks, public transportation and access to social facilities should be provided. Public inclusion policies are being implemented in the various social movements linked to disabilities people as part of their mobilization for the pursuit of their basic rights, an action that urges the authorities to think and develop projects that deal with this population. In this paper, we intend to show how to find the accessibility conditions for people with different disabilities in relation to those who are not disabled, considering the data obtained from interviewees who composed the sample of the IBGE, and for each of the different types of disability, we will investigate the life conditions considering the variables that have the most influence and best partitions using techniques such as homogeneity test, AID, stereotype ordinal logistic regression analysis, Model selection and variables selection. In housing, including the Brazilian Constitution, accessibility for residence and rehabilitation of disabilities people and promoting their integration into community life.
Keywords: disabilities people, variables selection, models selection, housing conditions, regression models.

1. Introduction

According to the Disabilities Persons Rights Convention, disabilities persons are those who have a long-term physical, intellectual (mental) or sensory disability, which, in interaction with various barriers, may obstruct their full and effective participation in society in equality with non-disabled persons, and can be characterized as a citizen with the same rights, that is, self-determination and enjoyment of the opportunities available in society; not be considered the same as disease and, therefore, one can not have his life harmed because of his disability; disabled person has limitation or inability to perform the activities, and finally; May have one or more deficiencies, perceived at birth or acquired over a lifetime.

Disability is an attribute of man, such as being tall, short, fat or thin, and disabilities people are part of this diversity, with the same rights and duties as other citizens.

Disabilities people are known to have greater difficulties in accessing education, inadequate infrastructure, prejudice and accessibility lack that these people have had lower schooling levels, which limits their entry into the formal labor market and take advantage of other human rights, such as leisure, health and full citizenship (Oliveira, 2013).

Note today a great concern for the dwellings, not only with commercial and public spaces, are accessible to all people. Including in this case: wheelchairs, the elderly, children, temporary limitations people and according to universal design (Garcia, 2011).

We have, however, to consider that successive measures taken in this area have not produced significant changes in the existing scenario with a large percentage of buildings, spaces and facilities that do not meet the minimum conditions of accessibility in Brazil and which impose limitations on a large part of Citizens who claims throughout this set of building, better accessibility conditions.

In this regard, the main steps were taken by ABNT (Technical Norms Brazilian Association) 9050 and its updates in 2004, which establishes the definition of accessibility conditions in projects and construction of public spaces, collective equipmen, and buildings and dwellings legally counting on the Support of the LBI (Brazilian Inclusion Law), approved by the National Congress and promulgated by President Dilma Rousseff in 2015.

Due to this scenario, accessibility is a prerequisite for the full exercise of the citizenship rights enshrined in the Brazilian Constitution, such as the right to life quality, freedom of expression, information, social

dignity and legal capacity, as well as Equal opportunities in access to education, health, housing, leisure, free time and work. (Furlanetto et al., 2012).
In statistical terms, we intend to evaluate the accessibility conditions for the housing of people with disabilities, using data obtained from the respondents to the complete questionnaire selected from all the respondents of the 2010 Census prepared by the IBGE (Statistics and Geography Brazilian Institute) and a critical evaluation there.
Then using the exhaustive AID decision tree technique groups were formed for the study population according to the incidence of each one of the deficiencies studied and amount of deficiencies. In each case, for each deficiency they formed groups for the Brazil´s data.
The exhaustive AID algorithm investigates all variables, the groups formed were evaluated and select the one with the highest association with the dependent variable. This is done for all independent variables and can be used in situations where the objective is to divide the population into different segments by a certain criterion. In this case, the criterion chosen was the effect of the different deficiencies studied.
The objective of this study is to study the relationship between the different disabilities studied in the population and their different forms of housing conditions.
In this article, we consider data on different types of disability, housing conditions and a critical evaluation of the 2010 IBGE Census questionnaire.
In Section 2 we present a motivation for the problem, define and characterize the variables to be used, AID algorithm and ordinal logistic regression stereotype (RLOE), variables selection through the Wald test, models selection using AIC, BIC and DIC criteria and severity degrees: 'can not in any way', 'can, but with great difficulty' and 'may with a little difficulty' for visual, hearing and physics disabilities, and, in the intellectual disability case, we consider the 'have' or 'not have'. In section 3 we present the results and discussions, and in section 4 we present our conclusions and suggestions for futures works.

2. Materials and Methods

2.1 Motivation

In order to be able to include desabled people, it is necessary first of all to estimate more precisely the number of people living in these conditions for each of the different types of disability, how they live and where they live, and an alternative in this case, it is to consider the database obtained from the 2010 census for the sample questionnaire, and, according to this same census estimates, it is believed that there are 45,606,048 people in Brazil are at least one disability Permanent, representing approximately 23.9% of all of the country's population, in the same census, equivalent to 190,755,799 inhabitants.
In order to include disabilities people, it is interesting, firstly, to know what are the factors that most influence the existence of disabilities people in the population and their housing conditions. In this work, we propose comparative studies on selection of variables and models in adjustment by ordinal logistic regression stepwise stereotype and exhaustive AID, for, verify which are the most significant variables and which best adjusts and which would be other variables that could be of interest.

2.2. Variables descriptions

In this study we consider variables attributed to the following themes: disability, housing conditions and other assets as described in Oliveira (2014b).
Finally, on the topic deficiencies: deficiencies (number of deficiencies that each individual has, and ranges from 0 to 4); rent in minimum salary categorized (1 for values between 0 and 0.5sm, 2 between 0.5 and 1sm, 3 between 1 and 2sm, 4 between 2 and 4sm, and finally 5, that 4sm); number of rooms categorized (1, if the house has a bedroom, 2 if the house has 2, 3 if the residence has 3, 4 if 4 bedrooms or more); density dwellers by room (1 if the density is between 0 and 1 occupant by room, 2 if it is between 1 and 2 residents by room, and finally 3 if the house has a density of more than 2 inhabitants per room) ; and, resident by room categorized (1, if the residence is between 0 and 1 residents by dormitory, 2, if it has between 1 and 2; 3, if it has between 2 and 3, 4 if it has between 3 and 4; 5, if you have between 4 and 5, and finally, 6 if you have five or more).

2.3. Exaustive AID Technique

It is a technique used in situations where the goal is to divide the population into differentiated segments in relation to a certain criterion, as described in Oliveira (2014a).

2.4. Stereotype Logistic Ordinal Regression

Many of the study variables in the social and human sciences are ordinal. Frequently, the dependent variable takes discrete values, or orderable categories, but whose distance between them is not known, nor is it so constant (Abreu, 2007). For example, in epidemiological studies and disability severity to see, hear or move

as established in the Sample Questionnaire in the IBGE Demographic 2010 Census that can be classified in "can not at all"; "It does, but with great difficulty"; "It does, but with a little difficulty"; and, finally, he has no problem hearing, seeing or moving. In the case of intellectual disability is divided into ¨have¨ or ¨not have¨.
For this work, we have as variable response: deficiencies, visual, hearing, locomotor and intellectual that are about ordinal variables that are not continuous variable versions, in view of this, we adopt in this work the stereotype model as described in Oliveira (2014c).

2.4.1. Variables selection

Selecting variables means choosing a subset that holds the most important predictor variables excluding the others, so that it seeks to avoid problems such as multicollinearity and that this subset fits as well as the model described in Oliveira (2014a).

2.4.2. Models selection

Selecting a model means, after formulating and adjusting different plausible models, to select the model that "best" is adjusted to the data of a certain experiment according to a certain criterion adopted and proposed in Oliveira (2013).
In this work, we used the AIC, BIC and DIC criteria, choosing the lowest value model for each of these criteria.

3. Results and Discussions

For this study, we used the following techniques:
First) Descriptive analysis by crossing between the different studied variables related to deficiencies and to housing conditions and homogeneity tests.
Second) application of the exhaustive AID algorithm
Third) adjustment by RLOE.
• Deficiencies, which represents the number of deficiencies that each person possesses can assume a value among 0 and 4 deficiencies;
• Deficiencies to see, hear and move considering categories: 0, "for those who can not at all", 1, "for who can, but with great difficulty", 2, "for who can, but with a little difficulty", and, 3, "for those who do not have a problem"; and finally;
• Intellectual deficiency considering the categories "have" or "not have".
For the variables linked to housing conditions for each of the different deficiencies studied and for the model formed by all the significant variables:
a) Selection methods by stepwise backward variables and excluding the variables that were not considered significant by the Wald test in each step;
b) Repetition of the analysis until there are no more variables to be excluded;
c) For each of these adjustments, the selection criteria of AIC, BIC and DIC models we calculated, and, finally ;
d) Selection of the best model among the different final models for each of the different deficiencies and number of deficiencies for each of the following criteria: AIC, BIC and DIC.
For the calculation of AIC, BIC and DIC in this work, the following expressions were used:

$$AIC = -2LN(LR) - 2p$$
$$BIC = -2LN(LR) - 2pLN(n)$$
$$AIC = -2LN(LR) + 2p,$$

where p represents the number of parameters; LR the likelihood ratio and, finally; n is the sample size of this study.
From the results of the crosses between different disabilities and variables of the different housing conditions considered in the 2010 IBGE Census, we obtained the following results: people who answered the complete questionnaire (with or without disability) were more concentrated in permanently occuped house, particular unit type, owned by one of the residents; rent between 0 and 0.5sm; masonry coating; three bedrooms; density between 0 and 1 resident per room; bathroom or toilet; general sewage or rainwater for the way of water supply; at least one room with water supply; garbage collected directly by the cleaning service; electricity distribution company; with meter or watch; radio; tv; no washing machine; refrigerator, mobile phone; landline; Microcomputer with internet access; not have a motorcycle; and, car for private use.
In order to make a comparative study between the groups formed by disabilities people and who do not present deficiency, homogeneity tests were performed and in all cases a significance level of 0.000 was obtained for this test, which concludes that there is no homogeneity among the different levels of the

different deficiencies tested, which means that there is inequality between different levels of severity of the same disability and between different disabilities.
Next, we made decision tree diagrams using an exhaustive AID algorithm considering as dependent variables:
• Blind disability (BD) that was partitioned into the number of residents per categorized room, followed by a computer with internet access, car for private use and fixed telephone;
• Hearing disability (HD) partitioned in number of dwellers by categorized room followed by the variables cell phone, computer connected to the internet and occupation condition;
• Physical disability (PD) partitioned by the variables number of residents by room, cellular, computed with Internet access and occupation conditions;
• Intellectual disability (ID) in mobile, computer with internet access and number of residents by room, and, finally;
• Multiple disabilities (MD) partitioned by number of residents by categorized room followed by computer with internet access and occupation condition.
When analyzing these decision tree diagrams can see that the variables most partitioned by the different deficiencies studied are number of inhabitants per room categorized, computer with internet access, car for private use and cell phone.
For each case studied, Table 1 shows the number of cases formed and which variables are partitioned.
Table 1 shows that the variables that were partitioned in all cases were number of inhabitants by categorized room, computer with internet access, car for private use and fixed telephone; four cases were cell phone and home occupation condition; three of the cases studied water supply and residents by room; two cases rent in categorized minimum salaries and sewage type; and finally; washing machine, motorcycle for private use, garbage collection and number of rooms classified with only one case each.
The next step was to evaluate the groups formed in the decision tree graph, and the groups that presented the least probability of occurrence of people with the different deficiencies considered in the study were:
For BD and MD are the following variables with the categories represented in brackets: number of residents by categorized dormitory (1.0); computer with internet access (yes) and car for private use (yes); For HD and PD we have number of residents by categorized dormitory (1.0); cell phone (sim) and computer with internet access (yes), and finally; ID cell (yes); computer with internet access (yes) and car for private use (yes).

Table 1. Partitioned variables for each disability

Disability	GROUPS	PARTICIONED VARIABLES									
BD	17	number of residents by bedroom categorized	computer with internet access	car for private use	home occupancy condition	landline					
HD	18	number of residents by bedroom categorized	cell phone	computer with internet access	home occupancy condition	water supply	car for private use	landline	washing machine	residents by room	sewage type
PD	17	number of residents by bedroom categorized	cell phone	computer with internet access	home occupancy condition	water supply	car for private use	landline	rent in minimum wages categorized	sewage type	
ID	13	cell phone	computer with internet access	number of residents by bedroom categorized	car for private use	landline	residents by room	water supply	Motorcycle for private use	garbage disposal	
MD	20	number of residents by bedroom categorized	computer with internet access	home occupancy condition	car for private use	cell phone	landline	rent in minimum wages categorized	residents by room	number of rooms categorized	

On the other hand, the groups formed that are most likely to be carriers of the studied deficiencies are formed by:
For BD number of residents by categorized dormitory (3.0), fixed telephone (no) and occupation condition (rented; assigned by the employer);
HD number of residents per categorized dormitory (3.0), occupancy condition (rented; assigned by the employer) and washing machine (no);
PD number of residents by categorized dormitory (3.0); occupancy condition (rented, assigned by the employer) and rent in minimum salaries categorized (2.0, 3.0 and 5.0);
Cell ID (no); Number of residents by categorized dormitory (3.0) and waste destination (burned on the property, placed in the cleaning bucket, buried in the property, in an empty lot or for the street, has another destination, thrown into the river, lake or sea); and finally;

MD number of residents by categorized dormitory (3.0); occupancy condition (rented, assigned by the employer) and rent in minimum salaries categorized (2.0, 4.0 and 5.0).
We then adjusted the stereotype ordinal logistic regression models for all the different deficiencies under study and obtained the following significant variables:
For BD dependent variables, the variables sanitary for ejections, motorcycle for private use, unit visited type and occupancy condition were selected.
On the other hand, for HD, we selected the independent variables sanitary or hole for ejections, electricity, radio, cell phone, landline, microcomputer, motorcycle for private use, categorized dormitories, residents by room, unit visited type and occupancy condition.
For PD, we selected the independent variables: water supply, plumbing, TV, washing machine, cell phone, landline, microcomputer, microcomputer with internet access, motorcycle for private use, private car, dormitory residents, residents by room, rent in categorized minimum wage, type of unit visited, house type and occupancy condition.
Now, for ID were selected the independent variables sanitary or hole for ejections, sanitation, waste, destination, electricity, existence meter or watch, electricity, distribution company, refrigerator, landline, microcomputer, motorcycle for private use, residents by room, residents by room and unit visited type.
Finally, for MD, the following variables were selected as independent variables: sanitary or faecal hole, water supply form, plumbing, electricity, rent in minimum wages, cell phone, landline, microcomputer, motorcycle for private use, residents by dormitory, residents by room, unit visited type and occupancy condition.
Analyzing joint analyzes, the variables motorcycle for private use, unit type, and in four of the adjustments were the resident variables by room, computer and fixed telephone.
From the comparative study between the different deficiencies and explanatory variables using exhaustive AID and stepwise RLOE analysis we have:
BD did not obtain an independent variable in both analyzes that were made;
For HD the independent variables that appeared simultaneously in both analyzes were number of dwellers by categorized dormitory, cell phone, occupancy condition of the dwelling, telephone and number of dwellers by room;
Regarding PD, the independent variables that were present in both analyzes were cell phone, computer with internet access, housing occupancy conditions, water supply, car for private use, telephone, rent in categorized minimum salaries;
Now, for ID, in both analyzes the following independent variables were detected: number of dwellers by dormitory categorized, resident by room and motorcycle for private use, and finally;
For MD, the independent variables were the number of inhabitants by categorized dormitory, computer with Internet access, mobile phone, occupancy conditions and residents by dormitory.
These results mean that these variables were the best partitioned after the use of AID and considered significant in the stereotype ordinal logistic regression adjustment.
Table 2 shows the results obtained by LR (Likelihood Ratio), p (number of parameters), Sig (level of significance), AIC (Akaike Information Criterion), BIC (Bayesian Information Criterion) and DIC (Deviation Information Criterion).

Table 2. Values of the AIC, BIC and DIC information criteria adjusted

Model	LR	P	Sig.	AIC	BIC	DIC
BD	**980.118**	7	0.000	-27.7753	-249.682	0.224653
HD	**31669.61**	17	0.000	-54.7262	-593.643	13.27377
FD	**4744.764**	20	0.000	-56.9296	-690.95	23.07041
ID	1501.061	21	0.000	-56.6279	-722.349	27.37214
MD	78692.168	27	0.000	-76.5466	-932.474	31.4534

The situation with the highest number of variables detected simultaneously for both situations was for PD with seven variables, and they had less was for BD with no variable detected in both methods simultaneously.
Examining the results of Table 2 and considering as the criterion of better fit models with lower values for AIC, BIC and DIC, we found that MD was considered the best fit for AIC and BIC values and BD was considered the best fit for DIC.

4. Conclusions

The higher the number of disabilities the worse the living conditions levcl and life quality of these people tend to be.

The model adjusted by ordinal logistic regression stereotype was required a smaller number of explanatory variables was BD (7), while the most needed was MD (13).
The variables considered significant for all adjusted models were unit visited type and motorcycle for private use.
Different types of disability were considered homogeneous for the different variables of housing condition.
Using the exhaustive AID technique, fewer intellectual disability groups were formed with 13, and the largest number of groups was for multiple disabilities with 20 groups.
The variable that best discriminated the different deficiencies studied was classified by the number of residents by dormitory, this may have been motivated by the fact that the smaller the number of people occupy the same space, the better in terms of privacy and life quality. The exception in this case, it was only for intellectual disability that the variable that discriminated the best was cellular, this may be due to the fact that among all the different types of disability is one that generally has the worse schooling level and work of all types of disability studied and, worse autonomy to communicate, greater need for help from other people to the daily tasks, therefore, worse housing conditions and life quality.
Application of decision tree technique allows the formation of different profiles, for example, formed by variables and levels that show smaller and more likely to present disabilities people.
The better the income level (Oliveira, 2014a), the better the conditions tend to be obtained by the household accessibility family.
The results of this study also show the need for more research and analysis when it comes to risk; we note that there are several methods to determine this risk, either using the regression coefficients, the risk factor of weighting factor of disability, considering the risk weight for each of the different explanatory variables.
In statistical terms: improve national disability statistics by employing an efficient and more reliable approach to data collection, a more comprehensive approach, and add disability questions in the population census; existence of connection between different data sets, longitudinal data collection, including disability issues, so that it can be better monitored, making the data better comparable; develop appropriate tools and fill gaps among different types of research; strengthen and support the different investigations, considering the creation of instruments that can measure and monitor the life quality and well-being of these people on an ongoing basis; consider also include issues related to health, accessibility and leisure, and finally; repeat the analysis by region, state and municipalities.
Proposing better studies and surveys on the evaluation of housing conditions taking into account other topics such as:
Improve accessibility conditions in flooring, lighting, furniture, electricity, telephony and others.
The result of this work can benefit public managers in better support in the care of disabilities people to have knowledge of who they are, where they are and how.
So in order to have a better analysis quality for the accessibility conditions in housing, in the data of the 2010 census it is noted the data lack in relation to internal areas such as heights of outlets, emergency light switches to avoid the movement In dark environment lamps and electrical installations for any layout of furniture in electrical installations.
Finally, I suggest the IBGE to the questionnaire answered by those selected to compose the sample, which includes a question about having bicycles for private use as it is considered easier to use, cheaper and accessible to a greater number of people, and also, it is interesting that he responds at what age he was acquired, since according to the literature (Garcia, 2010), it is known that the older he becomes a person with a disability, the greater the difficulties that person has to adapt,

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