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ABSTRACT

The aim is to analyse how specific socio- demographic and health factors influence healthcare demand, considering the socio-economicsocio-economic diferences in Brazil's adult population. The study focused on "expressed demand", i.e., an individual's need for healthcare services and their ability to seek care. Overall, the Brazilian adult population had a 22.1% probability of requiring medical care within two weeks before the survey. An increasing gradient was observed from the poorest to the wealthiest deciles, with the wealthiest group having a 40% higher healthcare demand than the poorest. The main predisposing, enabling and need factors analysed were relevant in determining healthcare demand; however, they are strongly influenced by income disparities.

Keywords: adult people, healthcare demand, income inequalities, propensity score, health policy.

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ABSTRACT

The aim is to analyse how specific socio-demographic and health factors influence healthcare demand, considering the socio-economicsocio-economic diferences in Brazil's adult population. The study focused on "expressed demand", i.e., an individual's need for healthcare services and their ability to seek care. Overall, the Brazilian adult population had a 22.1% probability of requiring medical care within two weeks before the survey. An increasing gradient was observed from the poorest to the wealthiest deciles, with the wealthiest group having a 40% higher healthcare demand than the poorest. The main predisposing, enabling and need factors analysed were relevant in determining healthcare demand; however, they are strongly influenced by income disparities. In the Brazilian context of a universal and free access healthcare system, a significant gap remains in healthcare demand due to income distribution, which disproportionately affects there is still a significant gap in healthcare demand through income distribution to the detriment of the poorest groups. Future research should focus on the impact of private health insurance on healthcare demand and spending. Monitoring the impact of private health insurance on healthcare utilisation is essential to ensure that provider profits do not influence healthcare demand.

Keywords: adult people, healthcare demand, income inequalities, propensity score, health policy.

I. INTRODUCTION

Healthcare demand analysis has various applications, including identifying factors that affect access to healthcare services, healthcare utilisation, utilization, and patient perceptions of healthcare quality. It can also reveal which social groups are excluded or delayed in receiving essential healthcare services due to poverty or other factors. This evidence can help policy makers address issues of efficiency and equity in healthcare systems (Mwabu, 2008; Rodriguez Santana et al., 2023).

Healthcare demand refers to the individual's decision to seek and pay for healthcare, influenced by their perception of health, socioeconomic status, cultural factors, and beliefs (Ghorbani, 2022; Levesque et al., 2013). Factors such as financial resources, education level, risk attitude, time costs, availability, accessibility, and quality of healthcare services affect healthcare demand (Mwabu, 2008).

Access to and utilisation of healthcare are two Critical factors related to healthcare demand. However, access is a complex concept that involves both supply and demand factors, while utilisation reflects the satisfaction of supply and demand factors, while utilisation utilization reflects satisfied and observed demand (Adhikari, 2011; Levesque et al., 2013). Simply measuring utilisation to define access overlooks other crucial factors such as care quality and cultural and financial barriers that contribute to inequalities (Allin et al., 2007). The demand for healthcare is influenced by both the needs of patients and the availability of healthcare services. Healthcare services encompass goods and services that maintain, improve, or restore health, possessing specific characteristics and unique qualities (Ghorbani, 2022).

From an economic perspective, the demand for healthcare is determined by the perceived benefits and the cost of accessing care (Rodriguez Santana et al., 2023). Individuals aim to maximise healthcare benefits within their budget constraints, but limited information about healthcare affects their ability to optimise benefits (Mwabu, 2008). This study examines expressed demand, which refers to an individual's need for health services and their ability to access care.

The Brazilian Unified Health System, a taxpayer-funded public health care system, offers free services to all residents (Costa, 2017). However, around 22% of the population holds private health insurance, allowing access to private healthcare providers (OECD, 2021). On the other hand, Brazil is experiencing a demographic transition with a rapidly ageing population (Demográfica, 2018a; OECD, 2019; Veras & Oliveira, 2018), which is also occurring with an epidemiological transition and significant socioeconomic and territorial inequalities (Lima-Costa et al., 2018; Programme, 2022). By 2043, 25% of Brazil's population is estimated to be over 60 years old (Demográfica, 2018b). Growth in non-communicable diseases, disability, rising obesity rates, physical inactivity, and other unhealthy lifestyles affects people of all ages but is more frequently associated with older and socially disadvantaged groups (OECD, 2021)

The study aims to analyze how sociodemographic and health factors affect healthcare demand in Brazil's adult population while accounting for socioeconomic differences. Understanding the impact of socioeconomic disadvantage on healthcare demand among vulnerable populations helps promote a comprehensive discussion on health inequalities.

II. MATERIALS AND METHODS

A cross-sectional study was conducted using data from the 2019 Brazilian National Health Survey (PNS 2019), which surveyed 275,323 individuals aged 15 years 2019-PNS), which surveyed 275,323 individuals aged 15 years or older. The survey was conducted using smartphones between August 2019 and March 2020, achieving a household response rate of 93.6% (Pesquisa Nacional de Saúde 2019, 2020).

The study included data from 62,454 people aged 18 or older who were considered competent to respond and answered the healthcare utilisation module.

The outcome variable was self-reported healthcare demand, obtained through the question: "In the last two weeks, did you require a place, service, or health professional for care related to your health?" For the analyses, a binary variable was arranged; those who answered “yes” were considered the interest group, and those who answered “no” were considered the reference group.

The 2019-PNS survey collected detailed information on geographic, sociodemographic and health factors. Covariates were selected based on their association with the treatment variable. Because previous research had found that sleep disturbance patterns experienced by socioeconomically disadvantaged groups are associated with adverse health outcomes and increased healthcare utilisation n and expenditures (Grandner et al., 2016; Huyett & Bhattacharyya, 2021), sleep disturbances were included in the analysis.

The study included several dichotomous variables, such as sex(1=woman), marital status (1=married), residence area (1=urban), working (1=yes), health insurance (1=yes) dental insurance (1=yes), social participation (1= participation more than twice time a month), alternative medicine use (1=yes), and tobacco smoking (1=yes).

The covariates,; including sex, marital status, residence area, employment status, health insurance, dental insurance, social participation, alternative medicine, and tobacco smoking, were included as dichotomous variables. The following covariates were included as categorical variables: age, region of residence, education level, self-rated health status (SRH), chronic diseases, sleep disturbances, physical activity, sedentary behaviour, and frequency of drinking alcohol. For details about categories and reference groups of these covariates, see Table 1.

The income deciles were included in the model as a discrete covariate. The availability of doctors obtained from the Federal Council of Medicine and the University of São Paulo data, was considered to adjust for the supply side (Scheffer, 2020). The distribution of doctors was assigned according to the capital areas or municipalities of each State, and the rate of doctors,was calculated per 1,000 inhabitants. The final regression model employed the product of sampling weight and propensity score weight to enhance both internal and external validity, thereby facilitating inferences about the population (Dugoff et al., 2014; Guo et al., 2020). The sample weight was calculated for the selected residents and calibrated for sex and age based on population projections.

A multistep approach was used to predict healthcare demand probabilities. Firstly, a multicollinearity diagnostic was conducted on the variables. Secondly, logistic regression was used to estimate a propensity score model for covariate adjustment. Thirdly, the propensity score balance was assessed across the treated and comparison groups by computing standardised differences using *the pbalchk* command (Garrido et al., 2014; Granger et al., 2020). Fourthly, individuals' propensity scores were weighted using inverse probability treatment weighting to ensure confounder similarity in the treatment and comparison groups (Olmos & Priyalatha, 2019). Fifthly, a logistic regression model including the product of the sampling and propensity score weights was run for healthcare demand, and the outcome probability was estimated using the logit post-estimation command "pr." Finally, the average probabilities for healthcare demand were calculated across income deciles for relevant covariates.

The statistical analysis was conducted using Stata version 14.0, with a significance level of 5%accepted. Monetary values were expressed in nominal 2019 reais.

III. RESULTS

Of 207,845 people aged 18 and older in the 2019-PNS registry, 30% were competent and remained in the analysis. Of this group, 22.7% required healthcare in the last two weeks. Fifty per cent of the demand was for public services, while 32% was for private services.

The main reasons for healthcare demand were illness or disease control (46%), medical check-ups (17%), diagnostic exams (13%), dental problems (6%), and other health-related services (6%). Only 3.7% of those who sought healthcare were not attended to.

During the two weeks preceding the completion of the questionnaire, 14,181 adults required healthcare services. This group had an average age of 51.4 and primarily consisted of women living in urban areas. The monthly household income for individuals in the first and tenth deciles was R$521 and R$ 18,355, respectively. Those in the wealthiest 10% had 35 times more income than those in the poorest 10%. There was a clear correlation between income and the likelihood of having private health or dental insurance.

Table 1 presents the geographic, socio-demographics, and health characteristics of the sample. Of those requiring healthcare services, 48% rated their health as “good/very good”, while 13% reported “bad/very bad” health”. Chronic diseases were present in 76% of patients, and sleep disturbance was reported by 52%. A significant portion of patients were moderate or excessive drinkers (33%), current smokers (11%), physically inactive (13%), had sedentary behaviour (12%), and used alternative medicine (11%). Additionally, 68% of patients participated in social activities in the last year. [Table 1 near here].

3.1 Propensity Score Model Performance

The multicollinearity diagnostic indicated no issues with multicollinearity. The propensity score was utilised for covariate adjustment to match participants seeking healthcare services with comparison groups that had similar background characteristics. The Hosmer-Lemeshow test showed a good fit for the propensity score model, and including the weighted propensity score in the propensity score

diagnostic model improved the balance of some baseline covariates. Table 2 presents the adjusted odds ratios for the final model of healthcare demand, which includes the product of the sampling weight and the propensity score weight. [Table 2 near here].

3.2 *Predicted Healthcare Demand Probabilities and Socioeconomic Inequalities.*

According to the final model, the probability that the adult Brazilian population would require healthcare within two weeks before the survey was 22.1%. An increasing gradient was observed from the poorest to the wealthiest deciles, with the wealthiest group having a 40% higher demand than the poorest. Those who sought healthcare services were three times more likely to demand them compared to those who did not.

Table 3 presents healthcare demand probabilities for relevant covariates related to health inequalities in the Brazilian adult population. Women have a significantly higher demand for healthcare than men across all income deciles, with the difference being more significant in the first five deciles. Wealthy individuals and those with higher incomes show significantly higher healthcare demand than the poorest, with this disparity being more pronounced in the most extreme deciles. Healthcare demand increases with age, with persons aged 60 or older demanding significantly more healthcare than their younger counterparts. Except for the older age group, the wealthiest tended to demand significantly more healthcare than their poorer counterparts in the remaining age groups. [Table 3 near here].

Higher levels of education lead to an increased demand for healthcare, with Brazilian adult graduates showing the highest demand. Wealthy individuals across all education levels are more likely to demand healthcare than the poor. These differences are statistically significant throughout all deciles.

Individuals with health insurance require significantly more healthcare than those without across all income deciles. In the poorer five deciles, those with health insurance have a declining higher probability of requiring healthcare than the general population, while individuals without health insurance follow a similar demand pattern to the general population.

The wealthier Wealthier five deciles have a slightly steady increase and decrease in healthcare demand with and without health insurance. No significant difference in demand probability exists between the poorest and wealthiest individuals without health insurance.

In the sample, doctors' rates were higher in capital areas than in interior municipalities, resulting in higher healthcare demand. However, when doctors' rates were below the median, capital areas showed lower healthcare demand than interior municipalities. Conversely, except for the first two deciles, when doctors' rates were above the median, interior municipalities had higher healthcare demand than capital areas. Wealthier individuals were significantly more likely to demand healthcare in both areas when doctors' rates were above the median, but only in interior municipalities when below the median.

Healthcare demand increases inversely with self-rated health. Individuals with “bad/very bad” SRH have significantly higher healthcare demand than those with fair and “good/very good’ SRH. However, those with “good/very good” SRH have a lower likelihood of healthcare demand than the average population, particularly in the lower income deciles. Wealthier individuals are significantly more likely to seek healthcare across all categories of self-rated health (SRH).

Individuals with three or more chronic diseases required significantly more healthcare than those with 1 or -2, or no chronic diseases. Wealthier individuals, regardless of the number of chronic diseases, have a higher demand for healthcare than poorer individuals. While the number of chronic diseases is higher, the gap in healthcare demand between the most affluent and poorer individuals is less pronounced.

Individuals with sleep disturbances, regardless of their income level, tend to require more healthcare. Those experiencing severe sleep disturbances demand significantly more

healthcare than those with moderate or no disturbances.

Wealthier individuals with severe sleep disturbances have a significantly higher demand for healthcare than the poorest, but this difference decreases as the severity of the disturbance increases.

IV. DISCUSSION

Over the last few decades, numerous studies have analysed the correlation between income inequality and healthcare access and utilisation from a supply-side perspective. However, it is still Critical to comprehend the connection between income inequality and healthcare from a demand-side perspective.

The paper analyses healthcare demand probability in Brazil's adult population based on sociodemographic and health factors, with a focus on household income differences. The study uses a propensity score to adjust for confounding variables and a balanced sample to build a healthcare demand model. Validity is enhanced by incorporating sampling weights and a weighted propensity score, resulting in more precise and generalisable outcomes (Dugoff et al., 2014; Guo et al., 2020).

Our findings indicate a clear trend in healthcare demand, showing that the probability of seeking healthcare increases significantly from the poorest to the wealthiest income deciles. the wealthiest adult Brazilians had a 40% higher likelihood of seeking healthcare compared to those in the poorest income bracket. This result is surprising, as one might expect that lower income would correlate with higher health needs and consequently greater demand for healthcare services.

According to the Aday-Andersen behavioural framework, our findings suggest that income inequalities are strongly associated with the predisposing, enabling, and need factors in determining an individual's likelihood of healthcare demand. The probability of healthcare demand increases from the poorest to the wealthiest deciles, as observed in predisposing factors such as sex, age, and education level. Furthermore, wealthier individuals consistently experience more favourable healthcare outcomes than the poorest ones.

For the enabling factors, the poorest individuals without health insurance were slightly more likely to demand healthcare than the wealthiest; however, this difference was not statistically significant. Conversely, we found that the poorest individuals with health insurance displayed significantly higher probabilities of seeking healthcare than the most affluent individuals, suggesting that the moral hazard associated with having private health insurance may lead to increased demand from private healthcare who had health insurance displayed significantly higher probabilities of seeking healthcare than the most affluent individuals, suggesting that the moral hazard associated with having private health insurance may lead to increased demand from private healthcare providers.

Additionally, our findings align with numerous empirical studies that highlight a close association between healthcare demand and the density of doctors in a specific area (Dzampe & Takahashi, 2022; Sekimoto & Ii, 2015; Tsai et al., 2004; Xirasagar & Lin, 2006). Even when the doctor's rate was highly concentrated in capital areas, individuals in interior municipalities still had a higher demand for healthcare, suggesting that other factors, such as income and health insurance, equalise the doctor's rate effect on healthcare demand.

Regarding the need factors, we found that self-rated health, the number of chronic diseases, and sleep disturbances are strong predictors of the probability of healthcare demand. Furthermore, in all categories of these factors, an increasing healthcare demand gradient across income deciles suggests that income distribution has a significant influence on healthcare demand.

In our study, healthcare demand corresponds to an event preceding access or utilisation of health services, making it challenging to compare our findings with empirical evidence on income disparities associated with healthcare access or

utilisation. However, it is possible to compare factors associated with income and sociodemographic disparities. Our findings suggest that even when predisposing, enabling and need factors are relevant in determining healthcare demand, income disparities strongly equalise this relationship. These findings differ from studies that have shown a negative relationship between low-income and vulnerable groups and healthcare access (Malta et al., 2021; Ogundipe & Adesola, 2022; Tzogiou et al., 2021; Zhang et al., 2015).

A significant strength of this study is its large, representative sample, which accounts for various significant economic and sociodemo- graphic factors. A propensity score- weighted approach was employed to minimise potential selection bias, enhancing both internal and external validity and allowing the results to be more generalisable. However, the study has several limitations: 1) the data relied on self-reported information, which could lead to subjective biased perception about their health conditions, affecting their decision to require healthcare, 2) the data was collected based on a two-week recall, which may not account for seasonal variation in acute diseases, 3) the analysis was based on cross-sectional data, which means causal relationships cannot be inferred. 4) The analysis did not account for other factors that influence healthcare demand, such as health literacy, self-care practices, distance to healthcare facilities, and waiting times. Therefore, caution is advised when interpreting the study findings.

These unobserved factors could introduce endogeneity and potential confounding effects.

The Brazilian healthcare system provides free and equal healthcare access, but there is still a gap in healthcare demand. Regardless of the enabling, predisposing, and need factors, wealthier socioeconomic groups are more likely to seek healthcare than vulnerable populations. Understanding healthcare demand in Brazil can help inform the development of effective policies and allocate resources to address healthcare inequalities.

Future research should focus on personality traits and individual behaviour, and consider the impact of private health insurance on healthcare demand and expenditures. Monitoring the effect of private health insurance is Critical to ensure supplier interests do not influence healthcare services.

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Table 1: Participants'Participants Characteristics According to Healthcare Demand Categories

Characteristics	Healthcare demand procure healthcare (n:14,181)	 no procure healthcare (n:48,273)
Avg. Age , years (Std.) **	51.4 (16.50)	47.7 (16.65)
**Age groups **		
18-39 (ref.)	3,891 (27.4%)	17,697 (36.7%)
40-59	5,432 (38.3%)	17,699 (36.7%)
60 or over	4,858 (34.3%)	12,877 (26.7%)
sex (n, women) **	9,601 (67.7%)	26,880 (55.7%)
marital status (n, married) **(n.s.)**	5,555 (39.2%)	18,592 (38.5%)
urban residence (n) **	11,645 (82.1%)	36,136 (74.9%)
working (n) **n.s.**	7,238 (51.0%)	28,535 (59.1)%
health insurance (n) **	4,318 (30.4%)	9,993 (20.7%)
dental health insurance (n) **	2,110 (14.9%)	5,284 (10.9%)
**education level **		
Elementary School	6,786 (47.9%)	23,637 (49.0%)
High School	4,048 (28.5%)	15,470 (32.0%)
Graduate school (ref.)	3,347 (23.6%)	9,166 (19.0%)
household income decils (n) **		
1st decile	1,369 (9.7%)	5,626 (11.7%)
2nd decile	2,201 (15.5%)	7,661 (15.9%)
3rd decile	1,253 (8.8%)	4,690 (9.7%)
4th decile	1,728 (12.2%)	6,208 (12.9%)
5th decile	1,246 (8.8%)	4,400 (9.1%)
6th decile	1,167 (8.2%)	4,060 (8.4%)
7th decile	1,169 (8.2%)	4,114 (8.5%)
8th decile	1,259 (8.9%)	3,985 (8.3%)
9th decile	1,308 (9.2%)	3,736 (7.7%)
10th decile	1,481 (10.4%)	3,793 (7.9%)
**region **		
north	2,209 (15.6%)	9,620 (19.9%)
northeast	4,662 (32.9%)	16,831 (34.9%)
central west	1,590 (11.2%)	5,627 (11.7%)
southeast	3,640 (25.7%)	10,040 (20.8%)
south (ref.)	2,080 (14.7%)	6,155 (12.8%)
**self-rated health status **		
bad(bad/very bad)	1,886 (13.3%)	2,620 (5.4%)
fair	5,521 (38.9%)	14,289 (29.6%)
good(good/very good)(ref.)	6,774 (47.8%)	31,364 (65.0%)
**number chronic diseases **		
none (ref.)	3,369 (23.8%)	22,592 (46.8%)
1-2	6,566 (46.3%)	19,380 (40.1%)
3+	4,276 (30.2%)	6,301 (13.1%)
smoking (n) **	1,533 (10.8%)	6,442 (13.3%)
**drinking alcohol **		
never drink(ref.)	9,420 (66.4%)	29,405 (60.9%)
moderate	1,576 (11.1%)	5,952 (12.3%)
excessive	3,185 (22.5%)	12,916 (26.8%)

Table 2: Estimated Odds Ratio, Standard Error and 95% ConfidenceConfidences Intervals for Healthcare Demand Logistic Regression Model (n: 16,284)

	Odds Ratio	Std. Err.	95% Conf. Interval	p-value
Age groups				
40-59 y-old	1.203	0.0607	(1.090 - 1.328)	0.000
60+ y-old	1.536	0.1259	(1.309 - 1.804)	0.000
Women	1.601	0.0768	(1.458 - 1.759)	0.000
Married	0.775	0.0384	(0.703 - 0.854)	0.000
Working	1.136	0.1098	(0.941 - 1.374)	0.185
Urban residence	0.713	0.0549	(0.613 - 0.829)	0.000
Education level				
high School	0.704	0.0411	(0.628 - 0.789)	0.000
elementary School	0.645	0.0481	(0.557 - 0.747)	0.000
Household income deciles	0.946	0.0098	(0.927 - 0.966)	0.000
Region				
north	2.435	0.2135	(2.050 - 2.892)	0.000
northeast	1.650	0.1250	(1.423 - 1.915)	0.000
central west	1.728	0.1449	(1.466 - 2.037)	0.000
southeast	0.482	0.0379	(0.413 - 0.562)	0.000
Health insurance	1.645	0.1021	(1.457 - 1.859)	0.000
Dental health insurance	1.264	0.0760	(1.124 - 1.422)	0.000
Self-rated health status				
fair	1.800	0.1024	(1.610 - 2.012)	0.000
bad	2.910	0.3862	(2.244 - 3.775)	0.000
Number chronic diseases				
'1-2	2.174	0.1121	(1.965 - 2.405)	0.000
3+	2.964	0.2264	(2.552 - 3.443)	0.000
Drinking alcohol				
moderate	0.930	0.0620	(0.816 - 1.060)	0.278
excessive	0.917	0.0485	(0.827 - 1.017)	0.101
Smoking	0.975	0.0780	(0.834 - 1.140)	0.756
Physical activity				
recommended	0.870	0.0498	(0.778 - 0.974)	0.015
inactive	0.920	0.5640	(0.816 - 1.037)	0.173
Sedentary lifestyle				
moderate time	0.947	0.0666	(0.825 - 1.087)	0.438
many time	0.911	0.0866	(0.756 - 1.098)	0.327
Sleep disturbances				
moderate	1.420	0.0747	(1.281 - 1.574)	0.000
severe	1.980	0.1355	(1.730 - 2.263)	0.000
Alternative medicine	1.394	0.0940	(1.221 - 1.591)	0.000
Doctors rate	1.175	0.0108	(1.154 - 1.196)	0.000
Social participation	1.228	0.0812	1.078 - 1.398)	0.002
Sample weigth*P. Score weig	1.461	0.0148	(1.432 - 1.490)	0.000

Table 3: Predicted Healthcare Demand Probabilities by Socio-Demographics, and Health Factors, and Income Disparities

(deciles)	I	II	III	IV	V	VI
Population	0,197	0,175	0,201	0,192	0,201	0,210
Sex						
Men	0,127	0,129	0,140	0,141	0,132	0,153
Women	0,258	0,228	0,260	0,247	0,275	0,272
Age groups						
18-39 y-old	0,156	0,154	0,168	0,159	0,175	0,185
40-59 y-old	0,246	0,203	0,236	0,226	0,223	0,235
60 or more years	0,262	0,220	0,295	0,274	0,262	0,239
Education level						
elementary	0,194	0,171	0,200	0,202	0,214	0,218
high	0,184	0,165	0,188	0,177	0,183	0,177
graduate	0,281	0,221	0,246	0,213	0,223	0,260
Health insurance						
without	0,193	0,166	0,195	0,181	0,195	0,184
with	0,347	0,276	0,253	0,254	0,230	0,285
State areas doctors' rate						
IM States-under	0,176	0,156	0,187	0,181	0,190	0,191
IM States-upper	0,213	0,177	0,248	0,216	0,226	0,273
CS States-under	0,185	0,143	0,132	0,157	0,167	0,144
CS States-upper	0,270	0,211	0,223	0,204	0,211	0,217
Self-rated health status						
very good/good	0,141	0,129	0,151	0,150	0,159	0,178
fair	0,260	0,265	0,295	0,289	0,296	0,305
bad/very bad	0,456	0,399	0,427	0,474	0,466	0,456
Number of chronic diseases						
none	0,117	0,111	0,115	0,117	0,131	0,136
1-2	0,256	0,239	0,264	0,258	0,255	0,268
3+	0,388	0,393	0,411	0,376	0,411	0,404
Sleep Disturbances						
no day	0,144	0,137	0,153	0,148	0,161	0,172
moderate	0,256	0,235	0,270	0,240	0,245	0,248
severe	0,358	0,280	0,365	0,361	0,358	0,366

IM: Interior Municipalities of the States; **CS**: Capital of the States; **Under**: under the median (2.03): **Upper:**