

Poverty Understood as Social Deprivation: A Multi-criteria Model Applied to the City of Uberlândia, Minas Gerais, Brazil

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Keywords

Urban Poverty
Multidimensional Deprivation
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Abstract

Urban poverty can be understood as the deprivation of the freedom to access goods and values considered important within a given society. It is a complex phenomenon to evaluate, as it requires multidimensional measures adapted to local realities. This study aims to develop and apply a multi-criteria model to assess urban poverty in Uberlândia, the second-largest city in the state of Minas Gerais, Brazil. The methodology was based on the selection and prioritization of indicators derived from the 2022 Demographic Census of IBGE. Fifteen indicators were selected, covering the dimensions of income, education, demographics, neighborhood surroundings, and housing conditions. These indicators were standardized through linear normalization, weighted using the Analytic Hierarchy Process (AHP), and aggregated via weighted linear combination. The outcome was the construction of the Social Deprivation Index of Uberlândia (IPSUDI), ranging from 0 to 1 and expressed in five classes defined using the natural breaks method. The analyses employed exploratory spatial data techniques and dependency assessment using Global and Local Moran's I statistics. The results revealed clusters of high social deprivation throughout the peripheral zones of Uberlândia, contrasting with low-deprivation areas in the central, southern, and parts of the eastern regions. High-deprivation areas were found to concentrate younger populations and higher proportions of Black and Brown residents, whereas low-deprivation areas tended to be older and predominantly White. The study concludes that poverty in Uberlândia is a spatially structured and socially determined phenomenon, reproducing racial and generational inequalities. The multi-criteria model proved to be an effective tool for evaluating intraurban poverty, reinforcing the need for integrated public policies that address the multiple dimensions of deprivation and the structural mechanisms that perpetuate inequality.

INTRODUCTION

The assessment of poverty is a complex decision-making process, as it involves the selection and categorization of variables according to the characteristics of each social formation. Historically, income-based poverty measures have predominated, emphasizing the minimum nutritional requirements for subsistence. This is the case of the pioneering studies by Booth (1889) and Rowntree (1901) in England. It was later observed that income alone does not allow for an adequate assessment of poverty, and that the problem cannot be associated solely with the subsistence threshold. For this reason, the approach was expanded to assess poverty based on basic needs, including variables beyond income and nutritional condition, such as access to education, housing, and transportation, among others. In this sense, it is possible to mention the poverty index proposed by Orshansky (1965) in the United States in the 1960s.

Both approaches (subsistence and basic needs), however, are based on absolute measures of poverty, which do not vary over time and space. For this reason, they proved to be limited in guiding social protection policies, since a series of processes can render poverty measures relative. To overcome this, Peter Townsend (1979) introduced the notion of relative deprivation, shifting the focus from absolute needs to an approach centered on the conditions that shape how those needs vary across each society. Townsend's work was fundamental to almost all proposals for assessing poverty in capitalist societies in the late twentieth century. Among these, the capability approach by Amartya Sen (2010) stands out, understood as the set of substantive freedoms that allow people to achieve functionings and objectives they consider valuable in their society. In this respect, poverty is defined as the deprivation of basic capabilities, that is, the limitation of substantive freedoms necessary to lead the life one values. This perspective inspired the creation of the Human Development Index (UNDP, 1990), widely recognized as a benchmark measure for assessing human development and complementing traditional income-based analyses of poverty.

Multidimensional methodologies for poverty assessment were developed based on Townsend's and Sen's contributions. One example is the method developed by Alkire and Foster (2011), which gave rise to the Multidimensional Poverty Index (UNDP; OPHI,

2024). which has been applied in several countries around the world. In Brazil, these approaches have inspired the Human Development Atlas (PNUD *et al.*, 2020) and many other multi-criteria models applied at different scales and for different purposes (Barrozo *et al.*, 2020; Marcelino; Cunha, 2024; Stankiewicz *et al.*, 2021; Tavares; Betti, 2024). However, there are still few studies applied at the intra-urban scale, due to database fragmentation, especially in medium and large non-metropolitan cities.

The perspective of social deprivation enables significant advances in the assessment of urban poverty. First, it must be understood that models, no matter how robust they are, can only assess certain dimensions of poverty, not the phenomenon as a whole. This is important to avoid associating the mathematical model – which is a representation of reality – with the lived reality of poverty. Deprivation measures, therefore, are indicators that summarize the assessment of certain dimensions of urban poverty. Second, deprivation measures enable the assessment of varying levels of access to goods and services in a society. Although it is necessary to establish a poverty threshold for social protection and income transfer policies, it is important to recognize that not all individuals above this threshold are free from every type of deprivation. In practice, a zero deprivation score does not exist, or is very rare, as it would mean complete access to all the goods, services, and values of a society. There is no situation of absolute absence of the natural constraints of life (such as illness, environmental crisis, or anything else).

This study aims to assess some dimensions of social deprivation associated with poverty in the municipality of Uberlândia, state of Minas Gerais (MG), Brazil. The objective is to develop and apply a multi-criteria assessment model based on data from the Demographic Census of the Brazilian Institute of Geography and Statistics - IBGE (IBGE, 2022). Subsequently, the model will be contextualized in terms of age and race/color. The results may contribute to understanding the intra-urban structuring of poverty in a non-metropolitan urban context, which tends toward growth and the production of problems already known in Brazilian capital cities.

METHODOLOGICAL PROCEDURES

Study Area

The study was conducted in the urban area of Uberlândia (MG). It is a large non-metropolitan city located between 450 and 550 km from the cities of São Paulo, Brasília, and Belo Horizonte. According to data from IBGE (IBGE, 2022), the municipality has 713,224 inhabitants, and 98.6% of the population lives in the urban area. At the time of the most recent census survey, the main urban area consisted of 1,915 census tracts, representing the smallest geographic unit used for census purposes in Brazil, grouped into 85 neighborhoods. Of these urban sectors, 86 had no recorded data because they were located in areas classified as urban voids, industrial zones, and parks, among others. As a result, 1,829 census tracts remained and were included in the assessment.

Dimensions and indicators assessed

The first challenge in developing a multi-criteria evaluation model is defining the dimensions and indicators that will be evaluated. This decision is always shaped by the question that guides the construction of the model itself. In our case, the question was formulated as follows: what are the most appropriate indicators of urban poverty available at the scale of the IBGE census tracts? Therefore, our challenge was to scrutinize the IBGE database, specifically the 2022 Census – the most recent one conducted in the country at the scale of the census tracts (IBGE, 2022). In that database, it is possible to find data on the following dimensions: i) housing units; ii) people (divided into demographics, race/color, kinship, literacy), iii) mortality; iv) surrounding environment; and v) income.

In this first phase, an exploratory study was conducted with all available dimensions and variables. This decision-making process was guided by works that assess social deprivation in small areas (Allik *et al.*, 2020; Carstairs; Morris, 1990), as well as by Brazilian experiences in assessing deprivation at the scale of census tracts (Ichihara *et al.*, 2018; Spode; Faria, 2025). The next step was to develop

indicators for these variables in order to verify the distribution and variability of the indicator. It was observed that not all variables were relevant to the study because of their limited relevance to the context of Uberlândia or the fragmentation of the data. It was not possible, for example, to use any variable from the mortality dimension. Although it represents a positive innovation of the latest census, the survey of self-reported deaths in households in the period from 2019 to 2022 is marked by substantial imprecision. For example, in Uberlândia, only 258 deaths of people under 60 years of age were recorded between January 2019 and July 2022 (IBGE, 2022). This is an unrealistic number, given that, according to data from the Mortality Information System (SIM), approximately 1,200 people die annually in this age group in that city.

It was observed, in this exploratory process, that the urban poverty variables to be included in the model depend directly on the reality being evaluated. Some indicators that are important in some cities or that were important in previous censuses are not currently important for Uberlândia. For example, the indicator referring to “proportion of private housing units without a bathroom or toilet” was not included in the model, given that only six households in Uberlândia were classified in this category. The dimension of race/color was not included in the evaluation either, due to its strong correlation with urban poverty. Therefore, race/color was assessed separately as a dependent variable rather than a dimension of the multi-criteria model.

The scrutiny of the IBGE census tract database, considering the literature and the relevance of the indicator for Uberlândia, led to the selection of 15 indicators related to income, education, demographics, the surrounding environment, and housing units (Chart 1). Unfortunately, the 2022 Demographic Census has not yet released disaggregated variables for income (income classes) or education (school levels), and the variables related to the conditions of housing units remain the most widely available. For this reason, housing-related variables - particularly those concerning dwelling conditions and access to basic sanitation - are the most strongly represented in the model.

Chart 1 - List of dimensions and indicators selected for inclusion in the multi-criteria urban poverty assessment model for Uberlândia, MG

Dimension	Variables	Acronym	Weight (w)
		RNMRD	
Income	Average monthly nominal income of household heads		0.20
Education	Literacy rate of the resident population aged 60 years or older	TAP60+	0.09
Education	Literacy rate of the resident population aged 15 to 59 years	TAP15-59	0.11
Demographics	Average number of children aged 0 to 14 years per occupied private housing unit	MCADPP	0.08
Demographics	Proportion of occupied private housing units with six or more residents	PDP6M+	0.08
Demographics	Proportion of spouses or partners aged 10 to 19 years	PCC10-19	0.03
Surrounding environment	Proportion of occupied private housing units located on paved roads	PDPRP	0.01
Surrounding environment	Proportion of occupied private housing units located on streets with public lighting	PDPRI	0.02
Housing unit	Proportion of occupied private housing units supplied by alternative water sources (shallow wells, groundwater, springs, etc.)	PDPOFAA	0.04
Housing unit	Proportion of occupied and improvised housing units with deteriorated conditions	PDPIED	0.04
Housing unit	Proportion of occupied permanent private housing units with rudimentary sewage disposal from bathrooms or toilets	PDPDREB	0.03
Housing unit	Proportion of occupied permanent private housing units using alternative forms of waste disposal (burning, vacant lot, buried on the property, etc.)	PDPOFDL	0.02
Housing unit	Proportion of occupied permanent private housing units not connected to the general water distribution network.	PDPNCRG	0.03
Housing unit	Proportion of occupied private housing units with three or more exclusively used bathrooms equipped with both a shower and a flush toilet	PDP3MB	0.17
Housing unit	Proportion of occupied private housing units served by the public water supply system	PDPURG	0.04

Source: The authors (2025).

Modeling and indicator normalization

The selected indicators (Chart 1) were developed, in percentages, considering the relationship between the numerator and denominator of the selected variable. For example, the literacy rate of the population aged 15 to 59 was calculated as the ratio of the literate population and to the total resident population of that same age group. Exceptions were made for monthly nominal income – whose value is already calculated in the IBGE database –, and the average ratio of children and adolescents aged 0 to 14 per private housing unit – whose calculation was performed by the ratio between the number of resident children

and adolescents and the number of private housing units in that census tract.

The next step was the standardization of the indicators on the same measurement scale. Linear normalization was applied in this study, rescaling the values of variable X_{ij} to a standardized range between 0 and 1, using the minimum and maximum values of the variable (Equation 1).

$$P_{i,j} = \left(\frac{X_{ij} - X_{i,min}}{X_{i,max} - X_{i,min}} \right)$$

Where:

$P_{i,j}$ = standardized value of indicator i for unit j ;

X_{ij} = original value of indicator i for unit j ;

$X_{i,min}$ = minimum value of indicator i (minimum reference value);
 $X_{i,max}$ = maximum value of indicator i (maximum reference value).

This formula was applied to benefit-type indicators, meaning that the higher the benefit, the better the situation in that census tract (in the case of literacy, for example). In the opposite case, the formula was reversed. This is a widely known and applied technique, for example, in the development of the Human Development Index.

Weighting and Combination of Indicators

Standardization establishes a single measure for all indicators in the model, but it is necessary to evaluate the relevance (weighting) of each one in the final calculation of the proposed index. In this study, indicators were weighted using the Analytic Hierarchy Process (AHP), which is a technique used in multi-criteria decision-making processes (Saaty, 1990). In AHP, relative weights can be assigned to indicators by quantifying their pairwise importance relationships. This is achieved using a conceptual judgment scale, translated into a numerical scale, and structured in a pairwise comparison matrix, where all indicators are systematically compared against one another (Saaty, 1990).

The comparison matrix was constructed based on the conceptual scale by Saaty (1990), considering the exploratory analysis of individual indicators conducted in previous stages, the literature on urban poverty assessment, and the researchers' expertise in studies on the city of Uberlândia. Income, literacy, and the number of bathrooms per housing unit were assigned higher weights, whereas variables related to the surrounding environment (paved and illuminated streets) and waste disposal received lower weights (Chart 1). It should be noted, however, that all indicators contribute to the final index, and weighting only establishes a hierarchy of relative importance.

To validate the pairwise comparison matrix and, consequently, the weights of the indicators, the Consistency Index (CI) was calculated, as per Equation 2.

$$IC = \frac{\lambda_{max} - n}{n - 1}$$

Where:

IC = Consistency Index

λ_{max} = largest eigenvalue of matrix A

n = number of categories evaluated

The value of λ_{max} was obtained according to Equation 3:

$$\lambda_{max} = \frac{1}{n} \sum_{i=1}^n \frac{(Aw)_i}{wi}$$

Where:

A = is the pairwise comparison matrix $a_{i,j}$;

w = is the normalized weight vector ($\sum wi = 1$);

Aw = is the i-th element of the vector resulting from the multiplication of A by w;

n = is the number of criteria (the order of the matrix).

However, according to Saaty (1990), CI alone is not sufficient, as it needs to be compared to the Random Index (RI), which is a reference value that allows measuring how much inconsistency would be expected in a completely random comparison matrix. In turn, RI depends on the number of criteria n evaluated. In our case, for $n = 15$, Saaty defined $RI = 1.59$. This value was then used for comparison with the Consistency Index (CI), from which the Consistency Ratio (CR) was calculated, as presented in Equation 4:

$$CR = \frac{IC}{RI}$$

The Consistency Ratio (CR) obtained for the weights assigned to the indicators in our model was 0.0394, a value that falls within Saaty's acceptable consistency threshold ($CR \leq 0.10$), indicating that the model is coherent.

The final step in deriving the proposed index involved combining the standardized indicators with their respective weights. In this study, the weighted linear combination technique was used according to Equation 5:

$$IPSUDI = \sum_{i=1}^n wi \cdot xi$$

IPSUDI = final value of the composite index (result);

n = number of indicators;

wi = weight of indicator i (obtained using AHP);

xi = standardized value of indicator i .

The Social Deprivation Index of Uberlândia (IPSUDI) is expressed as a score ranging from 0 to 1, where values closer to 1 indicate higher levels of deprivation in a census tract, and lower values indicate less deprivation.

Spatial Analyses

The analyses were performed using exploratory and descriptive techniques. The choropleth map was constructed using five classes defined by the natural breaks (Jenks) classification method. This method was chosen because it defines class boundaries based on the identification of discontinuity points in the data distribution, aiming to minimize within-class variance and maximize between-class variance. In other words, this method ensures the boundaries between categories will reflect effective groupings of similar values, enhancing statistical robustness and interpretative coherence of the spatial representation of the index. Therefore, the classes were categorized according to levels of deprivation as “very low,” “low,” “medium,” “high,” and “very high.”

Based on this categorization, it was possible to assess the relationship between IPSUDI and the demographic profile (evaluated in relation to the population of children and adolescents aged 0 to 14 years; the active population aged 15 to 59 years, and the population aged 60 years or over) and IPSUDI and the racial profile (white, black, mixed-race, Asian and Indigenous). These two variables (age and race/color) are, unfortunately, key markers of urban poverty in Brazil and tend to be spatially segregated as a result of differences in birth and death rates (which shape the demographic composition) and structural racism present in the country.

To identify spatial patterns of urban poverty concentration, global and local indicators of spatial autocorrelation were used. In this study, the spatial relationship was evaluated using the Inverse Distance approach, in which nearer neighboring units exert a stronger influence on the calculations of a target feature than those located farther away. Considering the spatial extent of Uberlândia’s urban area, an optimal distance threshold of 2,138.3 meters was computed to define the spatial relationship, with the analysis conducted using 10 distance bands. This procedure was implemented using the “Incremental Spatial Autocorrelation” tool in ArcGIS Pro. With the average radius defined, the Global and Local Moran’s I indices were computed. To assess statistical significance, a

pseudo-significance test (p-value) was performed using 499 random permutations, following the recommendation of Anselin (1995).

Descriptive statistical techniques – such as mean, standard deviation, and coefficient of variation – were also applied to analyze the tendency towards dispersion or homogeneity of the indicator.

The cartographic elaboration and exploratory analyses were performed using ArcGIS Pro 3.5 (ESRI, 2025), licensed by the Federal University of Uberlândia.

RESULTS AND DISCUSSION

Urban poverty expressed through the Social Deprivation Index

Uberlândia presents favorable indicators in terms of income, education, housing conditions, and the surrounding environment (Table 1). High levels of literacy are observed, along with broad access to sanitation services (treated water supply, sewage network, and waste collection) and surrounding infrastructure (public lighting and paved streets). On the other hand, demographic indicators associated with household density are relatively low, such as the average number of children and adolescents per private housing units and the proportion of housing units with six or more residents, as well as the share of spouses or partners aged 10 to 19 years. The average monthly income of the household head is relatively high, exceeding the national average of R\$ 1,810.1 reported in the same census (IBGE, 2022). These findings are consistent with Uberlândia’s Human Development Index (HDI) of 0.789, ranking it third among the municipality of Minas Gerais (IPEA, 2010). Nevertheless, high coefficients of variation (CV) are observed (Table 1), particularly for housing-related indicators and the proportion of spouses or partners aged 10 to 19 years. These results indicate significant intra-urban heterogeneity, reflecting underlying socio-spatial inequalities even in variables whose overall city averages suggest favorable conditions.

Table 1 – Global results of the selected indicators for assessing urban poverty in Uberlândia, MG, Brazil

Dimensions	Acronyms	Mean	SD*	CV**
Income	RNMRD	3914.2	3193.1	81.58
Education	TAP60+	87.0	16.2	18.62
Education	TAP15-59	98.3	3.1	3.19
Demographics	MCADPP	0.4	0.2	44.65
Demographics	PDP6M+	1.3	1.9	146.63
Demographics	PCC10-19	0.4	1.5	411.38
Surrounding environment	PDP RP	95.8	18.9	19.69
Surrounding environment	PDP RI	97.5	14.5	14.83
Housing unit	PDPOFAA	0.7	7.6	1044.70
Housing unit	PDPPIED	0.1	1.5	2924.08
Housing unit	PDPDREB	2.9	15.2	523.01
Housing unit	PDPOFDL	0.1	1.9	1761.17
Housing unit	PDPNCRG	0.8	8.4	986.38
Housing unit	PDP3MB	12.0	17.2	143.15
Housing unit	PDPURG	98.9	9.1	9.16

*Standard deviation

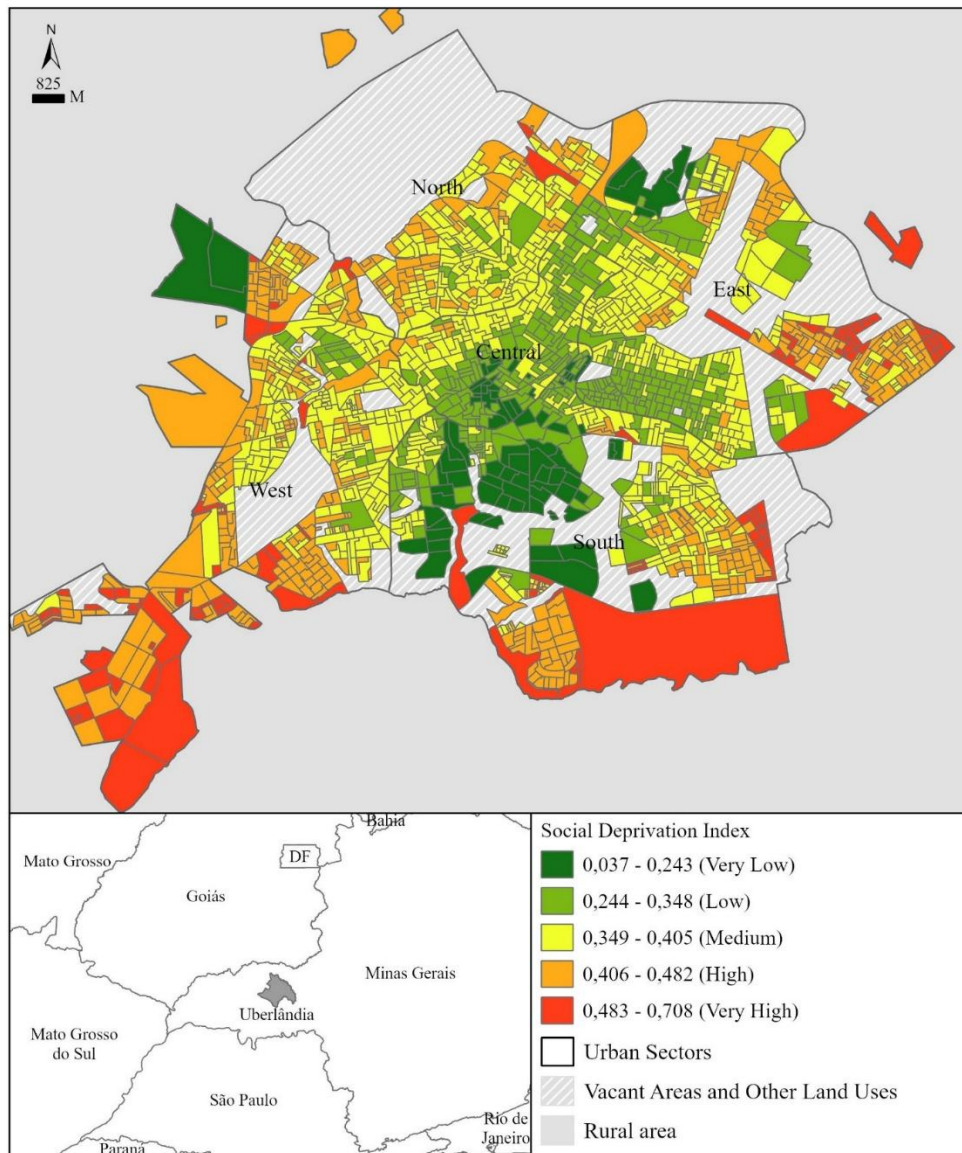
** Coefficient of variation

Source: The authors (2025).

Disaggregated indicators at the intra-urban scale are essential for challenging the perception of cities as uniformly characterized by favorable socioeconomic conditions. The spatial distribution of IPSUDI presented in Figure 1. The urban mean was 0.379, ranging from 0.037 to 0.708. Areas of lower deprivation (low and very low indices) predominate in the Central and Southern regions, as well as in parts of the Eastern region. In contrast, areas of higher deprivation (high and very high indices) are found across different peripheral zones of the city, with the exception of the Central area. This pattern reveals a clear center-periphery

spatial structure in the distribution of the index, consistent with the configuration observed in Brazilian cities, particularly non-metropolitan inland urban areas (Sposito, 2011). This pattern is not uniform, however, as areas of high deprivation are also found near the city center, while areas of low deprivation occur in peripheral zones to the East and West. A distinctive feature of Uberlândia is the presence of numerous vacant urban lots, which fragment the urban fabric and, with the exception of parks, public squares, and public facilities, reflect strategies of real estate speculation and profitability (Bessa; Soares, 1996).

Figure 1 – Social Deprivation Index by census tracts in the city of Uberlândia, MG, Brazil

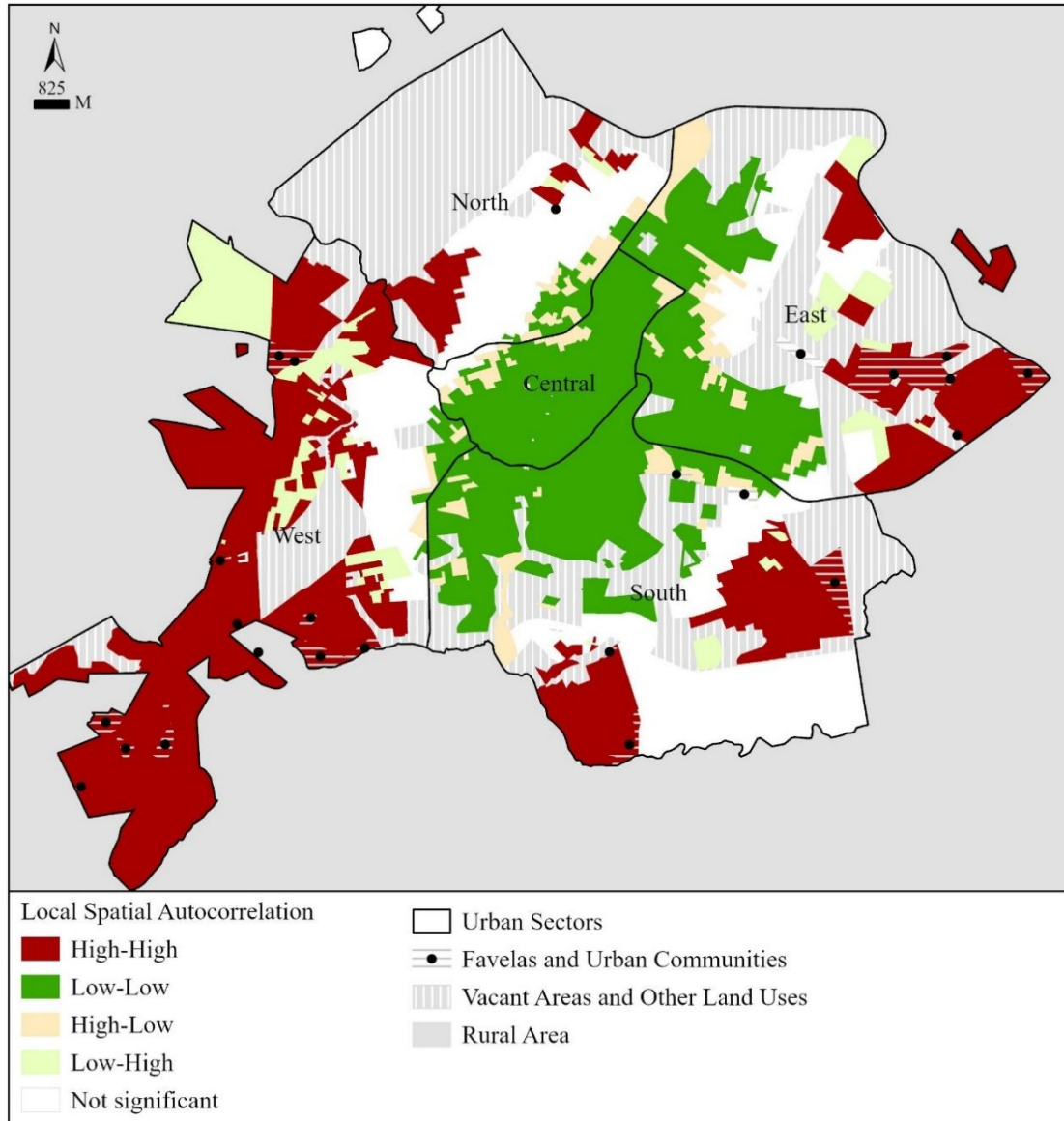


Source: The authors (2025).

The Global Moran’s I index applied to the Social Deprivation Index of Uberlândia showed a value of 0.51 ($z = 120.3$; $p < 0.001$), indicating a statistically significant positive spatial autocorrelation. Therefore, the index exhibits spatial dependence. Figure 2 shows the clusters generated from the Local Moran’s I index. The spatial patterns observed in Figure 1 were

confirmed by the Local Moran’s I analysis shown in Figure 2, revealing a spatial concentration of low deprivation indices in the Central, South, and East regions, and clusters of high deprivation values across nearly the entire peripheral arc of Uberlândia, especially in the West and East regions.

Figure 2 – Local spatial autocorrelation applied to the Social Deprivation Index of the city of Uberlândia, MG, Brazil



Source: The authors (2025).

As expected, the favelas and urban communities of Uberlândia are predominantly concentrated in areas characterized by high levels of social deprivation (Figure 2). Due to its size and role as a regional center, Uberlândia has increasingly experienced – albeit on a smaller scale – urban dynamics commonly associated with large metropolitan areas, and the presence of favelas reflects persistent barriers to adequate access to housing within the municipality (Souza, 2024).

Atypical situations (spatial outliers) were identified in the vicinity of both high- and low-deprivation clusters. These patterns may be associated with, on the one hand, the presence of medium- and high-income gated communities adjacent to highly deprived areas and, on the other hand, low-income working-class

neighborhoods located near areas of lower deprivation, particularly in the Central and Southern regions. Overall, however, relatively few outliers were observed, which is consistent with the strong spatial dependence indicated by the Global Moran’s I value. Therefore, these are two extremes that denote both pronounced urban poverty and better living conditions.

Demographic and Racial Dimensions of Urban Poverty in Uberlândia, MG

Urban poverty is directly related to the Brazilian demographic and racial structure. Most of Uberlândia’s population lives in areas of medium and high social deprivation, which together account for approximately three-quarters of the city’s residents (Table 2). The

areas characterized by very low and very high social deprivation have the smallest resident populations. In areas of very low deprivation, high land values and income concentration restrict access for most of the population to areas with better infrastructure. By contrast, areas of very high deprivation are characterized by extensive peripheral zones composed of low-

income housing developments, many of which were built under programs such as Minha Casa Minha Vida – and informal settlements, which are often located in peri-urban areas with low population density. Therefore, these represent two contrasting conditions that are both associated with the smallest shares of the resident population.

Table 2 – Distribution of the population by age groups, sex ratio, and dependency ratio by levels of social deprivation in the urban area of Uberlândia, MG, Brazil (in %)

Social Deprivation Index	Relative population	Sex ratio (M/F)	Population aged 0–14 years	Population aged 60 years and over	Dependency ratio
Very low	3.73.7	91.3	18.2	20.8	64.0
Low	16.9	88.5	13.8	20.3	51.9
Medium	44.0	92.3	17.0	16.1	49.4
High	30.3	94.4	21.2	11.3	48.1
Very high	5.1	100.1	27.5	7.2	53.1

Source: The authors (2025).

The distribution of the population by age groups is also consistent with the relationship between poverty and demographics (Barros *et al.*, 2015; Ribas, 2007). Areas with high and very high deprivation levels recorded the highest proportions of children and adolescents aged 0 to 14 years relative to the total population, with these shares progressively decreasing in areas with low and very low deprivation levels. The opposite pattern is observed for the population aged 60 years or older, with higher proportions in areas with low and very low deprivation levels and lower proportions in areas with high and very high deprivation levels. This pattern is directly related to differences in birth and mortality rates, with higher birth rates and lower life expectancy observed in poorer areas (Boing *et al.*, 2020; Chiavegatto Filho; Kawachi, 2015). In contrast, the larger proportion of older adults in areas with lower levels of social deprivation reflects better living conditions and higher life expectancy (Guimarães; Andrade, 2020).

Indicators related to the dependency ratio and sex ratio (M/F) are directly linked to the demographic composition of the different strata of social deprivation. For example, a higher dependency ratio is observed in areas with low deprivation levels, resulting from a greater degree of population aging. In areas with higher deprivation levels, this dependency ratio is lower, as population aging is at a less advanced stage. It is also observed that, in the low and very low social deprivation classes, the proportion of men is lower than that of women. This pattern once again reflects population aging in these areas, as well as the higher life expectancy of women. As levels of deprivation increase, this gender gap tends to narrow, which may be associated with a higher concentration of young, economically active populations – particularly men – in more vulnerable areas. This distribution highlights the relationship between socioeconomic conditions, age structure, and gender composition, characteristics that reinforce the unequal nature of the urban socio-spatial organization of Uberlândia.

Table 3 – Distribution of the population by race/color and levels of social deprivation in the urban area of Uberlândia, MG

Social Deprivation Index	White	Black	Mixed-race	Asian	Indigenous
Very low	82.9	1.8	14.7	0.6	0.0
Low	67.2	5.8	26.4	0.5	0.0
Medium	49.7	10.5	39.6	0.1	0.0
High	37.6	14.4	47.9	0.0	0.1
Very high	27.0	18.0	54.9	0.0	0.1

Source: The authors (2025).

The distribution by race/color is, unfortunately, consistent with patterns of racial segregation in Brazil (Guimarães *et al.*, 2022,) (Table 3). Lower deprivation levels are associated with a higher proportion of white residents, whereas areas with higher deprivation levels are increasingly composed of black and mixed-race populations. Black and mixed-race residents account for 50.8% of the total population of Uberlândia, although they represent more than 72.9% in the areas with the highest deprivation levels. In contrast, they constitute only 15.5% of the population in the areas with the lowest deprivation levels. By contrast, white residents account for 48.9% of the total population of Uberlândia, although they represent more than 82.9% in the areas with the highest deprivation levels. On the other hand, they constitute only 27.0% of the population in the areas with the lowest deprivation levels. The Indigenous population residing in Uberlândia's urban area totaled just 307 individuals in 2022, and their proportional distribution is also concentrated in areas with high and very high deprivation levels. The Asian population, in turn, comprised 1,305 individuals, with a higher concentration in areas with low and very low deprivation levels.

Overall, the city's racial and demographic composition can be seen as a reflection of urban poverty in Uberlândia and, more broadly, of Brazilian social inequalities. It should be noted that the higher proportion of black, mixed-race, and Indigenous populations in more deprived areas is not solely the result of individual income differences, but also of historical processes of racial exclusion and discrimination that have shaped urban space. This spatial structure, in turn, contributes to the reproduction of poverty, insofar as it conditions unequal access to goods and services (Maricato, 2015). At the same time, the higher proportion of older and predominantly white populations in areas with low deprivation levels reflects the cumulative advantages of generations with greater access to education, healthcare, and formal employment opportunities. Thus,

Uberlândia reproduces, at an intra-urban scale, the same structural inequality that characterizes Brazilian society as a whole: a socially fragmented territory in which race, age, and poverty intersect to define the position of different groups within the city.

FINAL CONSIDERATIONS

This study applied a multi-criteria methodology to assess urban poverty using data from the 2022 Demographic Census. This is a well-established and accessible approach that seeks to evaluate selected dimensions of urban social deprivation. These dimensions allowed poverty to be mapped in the city of Uberlândia, providing a partial but meaningful representation of the social conditions of this territory.

Urban poverty is a complex phenomenon, and mathematical models can only partially capture its full complexity. Nonetheless, such models remain essential tools for understanding social reality. Policies aimed at reducing poverty and hunger, such as those implemented in Brazil, are typically based on income strata. While income is undoubtedly an important variable in assessing poverty in capitalist societies, it alone is insufficient to capture the complexity of urban poverty in Brazil. For this reason, it is necessary to develop models capable of jointly assessing multiple dimensions of living conditions.

The results show that urban poverty in Uberlândia is a spatially structured and socially determined phenomenon. The center-periphery pattern identified in the distribution of IPSUDI confirms analyses of socio-spatial segregation in Brazilian cities (Maricato, 2015; Villaça, 2017), while also revealing specific characteristics associated with its role as a regional economic center. One such characteristic is the extent of the urban periphery affected by poverty, as well as the continued importance of its traditional city center in urban functioning and in the

concentration of better living conditions. The city center still acts as an interchange node from which areas with lower social deprivation levels extend toward the East and South regions of the city. It should be noted that, unlike in metropolitan areas – where traditional city centers have increasingly been occupied by lower-income groups – in Uberlândia this central area still concentrates middle- and upper-income populations. In contrast, the peripheries accumulate multiple forms of deprivation, with pockets of poverty expanding along urban edges and at the fringes of public housing developments, forming a mosaic of inequalities intensified by real estate speculation and the creation of urban vacant land. The study by Motta (2019), for instance, identified these socially segregated peripheral urban fragments, whose reproduction processes have intensified in the early twenty-first century.

Beyond the spatial dimension, the results also highlight the interdependence between demographic and racial aspects of poverty. The overrepresentation of black and mixed-race populations in areas with high deprivation levels shows that racial inequalities continue to shape urban living conditions, a phenomenon widely documented in metropolitan areas and also present in medium-sized inland cities (Peres; Saboya, 2024). This finding reinforces the interpretation of authors such as Almeida (2019) and Souza (2024), who consider structural racism a fundamental dimension of social inequality and not a mere byproduct of it. Similarly, age differences – namely the higher presence of young people in poorer areas and older populations in wealthier areas – indicate that urban poverty is also reproduced across generations, perpetuating vulnerabilities across both time and space.

From a methodological perspective, the adopted multi-criteria model demonstrated strong potential to capture intra-urban nuances of poverty that are not revealed by traditional income-based indicators. By integrating dimensions related to education, demographics, infrastructure, and housing conditions, the index synthesizes multiple aspects of urban life and allows for the identification of priority areas for public policies. This multidimensional approach is consistent with the theoretical advances proposed by Alkire and Foster (2011) and Sen (2010), which emphasize that poverty is not limited to income deprivation but also involves the lack of capabilities and opportunities. Therefore, applying this model to the case of Uberlândia reinforces its relevance for analyzing medium-sized cities, whose

inequalities have grown rapidly in recent decades.

Finally, the results suggest the need for more integrated urban policies, aimed not only at alleviating poverty but also at transforming the structures that reproduce it. Coordination among housing, transportation, education, healthcare, and racial inclusion policies is essential to break the cycle of deprivation that characterizes urban peripheries. Moreover, recognizing the spatial dimension of poverty should guide territorial planning strategies that prioritize public investment in the most vulnerable areas. In this sense, understanding urban poverty as a multidimensional and spatially uneven phenomenon is a key step toward formulating more just, effective, and locally responsive policies.

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REFERENCES

- ALKIRE, S.; FOSTER, J. Counting and multidimensional poverty measurement. **Journal of Public Economics**, v. 95, n. 7–8, p. 476–487, 2011. <https://doi.org/10.1016/j.jpubeco.2010.11.006>
- ALLIK, M.; LEYLAND, A.; ICHIAHARA, M. Y. Y.; DUNDAS, R. Creating small-area deprivation indices: a guide for stages and options. **Journal of Epidemiology and Community Health**, v. 74, n. 1, p. 20–25, 2020. <https://doi.org/10.1136/jech-2019-213255>
- ALMEIDA, S. **Racismo estrutural**. São Paulo: Pólen, 2019.

- ANSELIN, L. Local Indicators of Spatial Association—LISA. **Geographical Analysis**, v. 27, n. 2, p. 93–115, 3 abr. 1995. <https://doi.org/10.1111/j.1538-4632.1995.tb00338>.
- BARROS, R. P.; FIRPO, S. P.; GUEDES, R.; LEITE, P. G. **Demographic changes and poverty in Brazil**. 1. ed. Brasília: Instituto de Pesquisas Econômicas Aplicadas, 2015.
- BARROZO, L. V.; FORNACIALI, M.; ANDRÉ, C. D. S.; MORAIS, G. A. Z.; MANSUR, G.; CABRAL-MIRANDA, W.; MIRANDA, M. J.; SATO, J. R.; AMARO JÚNIOR, E. GeoSES: A socioeconomic index for health and social research in Brazil. **PLOS ONE**, v. 15, n. 4, p. e0232074, 2020. <https://doi.org/10.1371/journal.pone.0232074>
- BESSA, K. C.; SOARES, B. R. Vazios urbanos e especulação imobiliária em Uberlândia-MG. **Sociedade e Natureza**, v. 3, n. 16, p. 163–168, 1996.
- BOING, A. F.; BOING, A. C.; WAGNER, K. J. P.; SUBRAMANIAN, S. V. Narrowing geographic inequality in life expectancy in Brazil: a multilevel analysis between 1991 and 2010. **Public Health**, v. 180, p. 102–108, 2020. <https://doi.org/10.1016/j.puhe.2019.11.015>
- BOOTH, C. **Life and Labour of the People in London**. London: Macmillan and Co., 1889.
- CARSTAIRS, V.; MORRIS, R. Deprivation and health in Scotland. **Health Bull (Edinb)**, v. 48, n. 4, p. 162–175, 1990.
- CHIAVEGATTO FILHO, A. D.; KAWACHI, I. Income inequality is associated with adolescent fertility in Brazil: a longitudinal multilevel analysis of 5,565 municipalities. **BMC Public Health**, v. 15, n. 1, p. 103, 2015. <https://doi.org/10.1186/s12889-015-1369-2>
- ESRI - Environmental Systems Research Institute. **ArcGIS Pro** (Versão 3.5) [Software de computador]. 2025. Available: <https://www.esri.com/pt-br/arcgis/products/arcgis-pro/overview>. Accessed on: jun. 12, 2026.
- GUIMARÃES, J. M. N.; YAMADA, G.; BARBER, S.; CAIAFFA, W. T.; FRICHE, A. A. L.; MENEZES, M. C.; SANTOS, G.; SANTOS, I.; CARDOSO, L. O.; DIEZ ROUX, A. V. Racial Inequities in Self-Rated Health Across Brazilian Cities: Does Residential Segregation Play a Role? **American Journal of Epidemiology**, v. 191, n. 6, p. 1071–1080, 2022. <https://doi.org/10.1093/aje/kwac001>
- GUIMARÃES, R. M.; ANDRADE, F. C. D. Healthy life-expectancy and multimorbidity among older adults: Do inequality and poverty matter? **Archives of Gerontology and Geriatrics**, v. 90, p. 104157, 2020. [10.1016/j.archger.2020.104157](https://doi.org/10.1016/j.archger.2020.104157)
- IBGE - Instituto Brasileiro de Geografia e Estatística. **Censo Demográfico 2022**: características gerais da população e dos domicílios: resultados do universo. Available: <https://censo2022.ibge.gov.br/panorama>. Accessed on: may 05, 2025.
- ICHIHARA, M. Y. T.; RAMOS, D.; REBOUÇAS, P.; OLIVEIRA, F. J.; FERREIRA, A. J. F.; TEIXEIRA, C.; ALLIK, M.; KATIKIREDDI, S. V.; BARRETO, M. L.; LEYLAND, A. H.; DUNDAS, R. Area deprivation measures used in Brazil. **Revista de Saúde Pública**, v. 52, p. 83, 30 ago. 2018. [10.11606/S1518-8787.2018052000933](https://doi.org/10.11606/S1518-8787.2018052000933)
- IPEA - Instituto de Pesquisa Econômica Aplicada. **Atlas do desenvolvimento humano no Brasil**. Brasília, DF: IPEA, 2020. Available: <https://www.undp.org/pt/brazil/desenvolviment-to-humano/atlas-do-desenvolvimento-humano-no-brasil>. Accessed on: feb. 24, 2026.
- MARCELINO, G. C.; CUNHA, M. S. da. Multidimensional poverty in Brazil: evidences for rural and urban areas. **Revista de Economia e Sociologia Rural**, v. 62, n. 1, 2024. <http://dx.doi.org/10.1590/1806-9479.2022.266430pt>
- MARICATO, E. **Para entender a crise urbana**. São Paulo: Expressão Popular, 2015.
- MOTTA, G. A. S. **Fragmentos urbanos**: segregação socioespacial em Uberlândia - MG. São Paulo: Universidade Presbiteriana Mackenzie, 2019. <https://doi.org/10.22533/at.ed.1571905096>
- ORSHANSKY, M. Counting the Poor: Another Look at the Poverty Profile. **Social Security Bulletin**, v. 28, n. 1, p. 3–29, 1965.
- PERES, O. M.; SABOYA, R. Segregação socioespacial, morfologia da expansão e fragmentação socioeconômica em cidades brasileiras de porte médio. **urbe. Revista Brasileira de Gestão Urbana**, v. 16, 2024. <https://doi.org/10.1590/2175-3369.016.e20230192>
- PNUD - Programa das Nações Unidas para o Desenvolvimento; IPEA, Instituto de Pesquisa Econômica Aplicada; FJP, Fundação João Pinheiro. **Atlas do Desenvolvimento Humano no Brasil**. 2020. Available: <http://www.atlasbrasil.org.br/>. Accessed on: sep. 27, 2025.
- RIBAS, R. P. A caracterização da pobreza urbana ao longo do tempo: aplicação do modelo idade-período-coorte na estimação das tendências de privações crônica e transitória no Brasil. **Revista Brasileira de Estudos de**

- População**, v. 24, n. 1, p. 139–161, 2007. <https://doi.org/10.1590/S0102-30982007000100009>
- ROWNTREE, B. S. **Poverty: A Study of Town Life**. London: Macmillan and Co., 1901.
- SAATY, T. L. How to make a decision: The analytic hierarchy process. **European Journal of Operational Research**, v. 48, n. 1, p. 9–26, 1990. [https://doi.org/10.1016/0377-2217\(90\)90057-1](https://doi.org/10.1016/0377-2217(90)90057-1)
- SEN, A. **Desenvolvimento como liberdade**. São Paulo: Companhia das Letras, 2010.
- SOUZA, J. **A ralé brasileira: quem é e como vive**. 2. ed. Rio de Janeiro: Civilização Brasileira, 2024a.
- SOUZA, T. S. **Urbanização informal e reprodução do espaço: Uberlândia – MG e as irregularidades socioespaciais no campo e na cidade**. 2024b. 251 f. Tese (doutorado em Geografia) – Universidade Federal de Uberlândia, Uberlândia, 2024b.
- SPODE, P. L. C.; FARIA, R. Privação Social e Pobreza na Cidade de Santa Maria, Rio Grande do Sul: Análise a partir das Periferias Populares de Alta Privação Social. **Sociedade & Natureza**, v. 37, n. 1, 2025. <https://doi.org/10.14393/SN-v37-2025-75531>
- SPOSITO, M. E. B. A produção do espaço urbano: escalas, diferenças e desigualdades socioespaciais. In: CARLOS, A. F.; SOUZA, M. L.; SPOSITO, M. E. B. (Org.). **A produção do espaço urbano: agentes e processos, escalas e desafios**. 1. ed. São Paulo: Contexto, p. 123–145, 2011.
- STANKIEWICZ, A. S.; YALONETZKY, G. I.; MAIA, A. G. Multidimensional Poverty in Brazil in the Early 21st Century: Evidence from the Demographic Census. **Social Indicators Research**, v. 154, n. 1, p. 79–114, 2021. <https://doi.org/10.1007/s11205-020-02568-5>
- TAVARES, F. F.; BETTI, G. Gender Differences in Multidimensional Poverty in Brazil: A Fuzzy Approach. **Social Indicators Research**, v. 175, n. 2, p. 385–422, 2024. <https://doi.org/10.1007/s11205-024-03312-z>
- TOWNSEND, P. **Poverty in the United Kingdom: A Survey of Household Resources and Standards of Living**. London: Penguin Books, 1979. <https://doi.org/10.1525/9780520325760>
- UNDP - United Nations Development Programme. **Human Development Report 1990: Concept and Measurement of Human Development**. New York: Oxford University Press, 1990.
- UNDP - United Nations Development Programme; OPHI, Oxford Poverty and Human Development Initiative. **Multidimensional poverty index 2024**. New York: UNDP, 2024.
- VILLAÇA, F. **Espaço intra-urbano no Brasil**. 2. ed. Rio de Janeiro: Studio Nobel, 2017.

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DATA AVAILABILITY: The data that underpin the results of this study may be made available by the corresponding author, upon duly justified request. [Rivaldo Faria].



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