Public healthcare and urban planning: A GIS approach

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Abstract

The rapid changes that are in the metropolis today justify the adoption of elements of analysis and prediction of changes over the life of the inhabitants caused by installing of enterprises and modifying actions over the surrounding landscape. Among the tools adopted in Brazil, stands out for being a federal institution the Neighborhood Impact Study - EIV. The enterprises are analyzed by an EIV, by legal definition, are those who have a central character in relation to the environment where they lay. In metropolitan spaces where high social contrasts are evident, enterprises installed in the outskirts or in socially fragile areas have a clear influence on parts of the territory or even over the whole of established communities. This paper compares two cases of modifying actions installed in socially fragile areas on the outskirts of Belo Horizonte, analyzed using GIS techniques. Both enterprises are aimed at public hospitals and care to low-income populations living in consolidated informal settlements (slums). The justification of its location in terms of urban planning was to serve the healthcare through a structured network of health coverage, with the installation of specific services in areas of high demand. The paper concludes that under the strictly technical point of view the analysis through GIS techniques presented in this case, the advantage of the recognition of a territory over which lack knowledge on the part of the government (and even of the residents themselves) with the establishment of scenarios and predictions that will guide the decision to intervene in the political aspect of population health and other aspects of the neighbourhood. From a social standpoint, the installation represents the response to a poor service, especially in health, living in a highly dense areas with a history of social deprivation that began with the irregular occupation and remains irregular even as a consolidated settlement until the current days.

Keywords:Urban planning, public health, GIS, impact assestment, neighborhood..

1. INTRODUCTION

The urban changes, the social function of urban spaces and reflections on the interactions present in these spaces are subjects of analysis of planners and urban designers in Brazil. One of the tools provided by the City Statute in 2001, the Neighborhood Impact Study (EIV), has great potential as a tool for analysis of impacts resulting from the implementation and operation of urban developments. The statute establishes guidelines for urban policy and sets the EIV as the previous study of the impacts on the urban aspects required to obtain licenses or authorizations for the construction, expansion or operation in charge of the municipal government of enterprises and activities in private or public area urban that may cause positive and negative effects of the enterprise or activity on the quality of life of the resident population in the area and its vicinity. The statute also seeks to increase public participation in the processes involving collective decisions of great interest in the enterprise implementation and to understand structural changes or major extension in the urban environment.

The law allows each municipality to establish the types of businesses that are subject to the preparation of the study. In several locations in Brazil hospitals fall between these types, due to its characteristics of centrality in relation to the environment in which it installs. This centrality in

relation to a neighborhood is determined not only by nature broad scope of care provided by hospitals, but also the high potential traffic generation associated with its operation. The installation of hospitals also presents a potential, unquantified, of transforming its surroundings or its immediate vicinity, either by the alteration of uses, of the attractiveness of services and other elements of infrastructure. This potential is evidenced when the surrounding neighborhood or presents economic and social characteristics of imbalance and deficiency.

The process of urban growth observed in Brazil in the last decades of the twentieth century led to the proliferation of irregular occupations in areas neglected by the housing market, or those with patches of fragile ecosystems by anthropogenic pressures surrounding, or those determined by law as permanent preservation in which the occupation is prohibited. The consequence of this process is visible in the largest and even in medium Brazilian cities. There is a proliferation of extremely dense areas, disordered and dysfunctional, which in most cases have disrepair or nonexistent sanitation, with direct consequences on the health of populations causing high mortality and morbidity. Add to this the absence of the State with the lack of urban facilities such as schools, nurseries or health clinics, and lack of recreational areas and cultural integration. The result is people who survive on environmental conditions limits in areas that are naturally vulnerable to erosion, depletion of soil, water contamination, natural disasters and climate variations.

This paper examines two enterprises in vulnerable areas of the metropolitan region of Belo Horizonte. One, the Hospital Odilon Behrens, is running as a general public hospital for nearly twenty years. The other case, the Hospital Teresopolis, is designed and has the beginning of construction for its installation planned for the year 2014. The comparative analysis is facilitated by the similar nature of the service, both for the existing unit as designed. Both hospitals are intended to serve primarily as service centers to emergency care, and pediatric intensive care, and care to pregnant women and newborns. Will be analyzed and compared aspects of their areas of influence, chosen using the same assumptions.

Case 1 – Hospital Municipal Odilon Behrens

The Hospital Odilon Behnrens was initially designed and sized to meet a specific group, the municipal employees and their dependents. One of its features was the time your entries and accesses facing IAPI set, in which they resided most of these employees. With the 1988 Constitution and the universalization of health services, the hospital began to receive the entire population receiving general reforms to its expansion. Currently, Odilon Behrens Hospital is a general hospital with an emergency room, ambulatory, day hospital and endowed with broad sectors of admission to the Intensive Care Centers (CTI), pediatrics, gynecology and obstetrics, surgical blocks, support services diagnosis and treatment, pharmacy, nutrition and dietetics service, blood bank, laundry, sterilization and physiotherapy. The maternity unit is a benchmark in high-risk pregnancies and accounts for 23% of births of this kind conducted in Belo Horizonte. The high-risk nursery offers 40 beds and health unit also has 20 beds for neonatal and pediatric ICU. Additionally, the Hospital is recognized as a Center for Teaching, Research and Teaching Hospital, providing internships in physical therapy, nutrition, nursing, medicine, computing, administrative services, psychology, speech therapy, occupational therapy and medical residency in several areas. All these changes required the hospital to adapt to its surroundings, expanding its potential constructive to the extreme limits prescribed by the laws. Symptomatic of this transformation is the creation of three new accesses, facing the entry of poor communities surrounding, as seen in the image below.

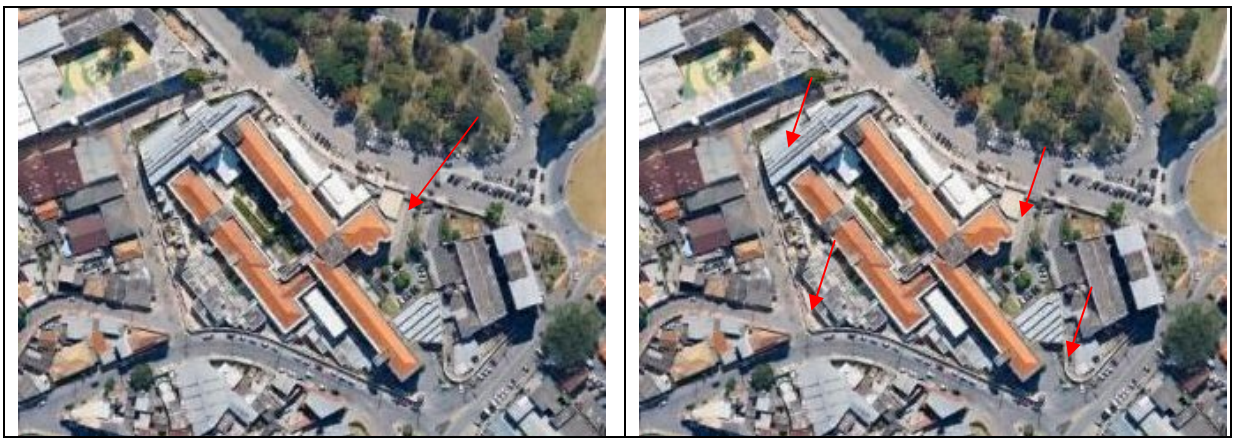

Fig. 1. Acessos do Hospital Odilon Behrens; Antes e depois de 1988

Case 2 – Hospital Teresopolis, Betim

The Hospital Teresopolis has the forecast a total area of 28,194.45 m2, which requires prior environmental licensing, as established by law. The hospital will be built in the midst of an informal settlement in the consolidated city of Betim, in the Metropolitan Region of Belo Horizonte. Its proposed location can be viewed in the following figure.

Fig. 2. Location of Hospital Teresópolis, Betim, MG

The overall purpose of the Hospital Teresopolis is the provision of care and health care under the immediate care, hospitalization, support the diagnosis and therapy, and technical support. The enterprise will also serve the training and development of human resources and research services to support management and administrative implementation and provision of logistical support.

As stated, the area of the new Hospital Teresopolis is installed in the urban area of Betim, already being quite disturbed, and the site suffered several changes as a result of the activities

developed. Much of the land is currently occupied by the community´s football field indeed deactivated, and residence of about 45 families. Natural resources are already quite changed, confirming the presence of changes in the ground surface in the area of implementation of the enterprise as a result of the construction and demolition of buildings, paving of roads and drainage and regularization of the football field. There is still a lack of native vegetation or any kind of water resources and the degradation of the surrounding terrain, with irregular releases of sewage drainage networks.

The design was conceived to seek the best solutions of the locational, technological and environmental views for the enterprise, seeking to ensure the best conditions of safety and orderly land use in the area. However, the development certainly cause effects on the neighborhood.

2. MATERIALS AND METHODS

The models of zoning advocate the mixing of uses in order to maintain the dynamism of urban areas, and is therefore essential to assess the greater or lesser interaction incompatibility between different uses, keeping in view the guidelines of territorial management and social development. The parameters and conditions of use and land cover have effects on ventilation and lighting, population density, traffic generation and demand for public transport, urban and community equipment, the urban landscape, the natural and cultural heritage and real estate valuation of surrounding properties.

Cowen (1988, p. 1551) highlights the fact that these are GIS decision support processes: "It is a system (...) which involves the integration of georeferenced data in an environment geared towards problem solving ". Urban planning can dispose of GIS as information systems at the same time as the decision support tool, through the systematic construction of alternative scenarios using modeling a phenomenon or set of phenomena.

For the construction of these scenarios, we performed mapping features in the vicinity of two areas selected homogeneously and adopting acceptable criteria for the development of a EIV. Thus, in determining the area of influence of the two buildings, we adopted a distance of 300 meters from the main accesses of each of the buildings. In terms of methodology, the creation of a buffer allows the spatial analysis of a particular area and the changes in their conditions at defined time intervals. In this case study, it is proposed that the analysis of the elements associated with anthropogenic be used as a tool for urban and landscape planning.

2.1 Criteria of analisys

The temporal analysis and comparison of research presented is part of greater range and scope, connected to municipal environmental licensing of each hospital units and is based on three sets of factors described below.

Income usually received after monthly work

IBGE (2010) defines as monthly income usually earned from work the one a person usually earns in a full month on the job. Where the cash remuneration be fixed, it is the monthly income that the person usually wins for the month in which falls the reference week. Where the cash remuneration is variable, it is the monthly income that a person earns on average for the month in which falls the reference week. Where remuneration varies according to the period or season, it is the monthly income that a person earns the usual seasonal period in which it inserts the reference week. In the case of compensation for products or goods production seasonal, is the monthly average value, actual or estimated (market value) that a person usually earns, calculated considering

the time devoted to production that generates revenue. For a person licensed by the labor welfare institute, it is the gross monthly income that usually wins as cash benefit (sickness; aid for accidents at work, et cetera) for the month in which falls the reference week. For the employee, the monthly income usually earned excludes all parcels that do not have an ongoing and does not consider the occasional discounts (faults, possible damage caused to the enterprise et cetera).

Education level

IBGE (2010) deals with the education as years of schooling, and defines how the classification obtained depending on the number and level or degree that the person was attending or had attended, considering the last grade-completed approval. The matching is done so that to each series of approval corresponds to one year of completed study. Counting the years of study commencing in one year, from the first series and successfully completed the course of elementary school, elementary or first grade; In five years of study, from the first series concluded with approval of course mean first cycle; in 9 years of study, from the first series and successfully completed the course of middle school, high school or middle second cycle; And finally on 12 years of study, from the first series concluded with approval of course higher graduation. Enrolment rates, as mentioned, represents the percentage of students from one age group to the total of people of the same age group.

Síntese da infra-estrutura de serviços urbanos

The criterion seeks to assess the sanitary conditions of the home, using the following settings for this (IBGE, 2010);

Household with treated water - permanent household served by piped water from the water supply system with internal distribution to one or more rooms. (PNAD 1992, 1993, 1995, 1996).

With household sewage collection network connected to (or septic tank) - permanent household in the bathroom or sanitary sewer usage of its residents are connected to the collection system or septic tank;

Collection network - when the channeling of wastewater or manure is connected to a collection system that leads to the overall drainage area, region or municipality, even though the system has no treatment plant matter exhausted;

Septic tanks - when wastewater and waste products are exhausted into a pit, where they undergo treatment or decanting, and the liquid part absovida on the spot or piped to a drain general area, region or municipality. (PNAD 1992, 1993, 1995, 1996).

As it turns out, this analysis does not include any criteria related to health, since the improvement brought by the presence of the people attending to emergencies, emergency and pregnant women is evident; interested here the possible effects of radiation caused by the operation of the enterprise on their surroundings.

So we adopted these elements of analysis of spatial data from the municipalities of Belo Horizonte and Betim, Minas Gerais, Brazil and census data from 2000 and 2010, provided by IBGE.

2.1 Thematic Maps

The following figures show the thematic maps constructed for the census sectors surrounding the two buildings. IBGE (2010) defines a census sector as a territorial unity collection of census operations, with physical limits identified in continuous areas and respecting the political and administrative division of Brazil. The census sector is the smallest territorial unit, with identifiable physical boundaries in the field with a size suitable for operation and research which together exhaust the entire national territory, allowing ensure full coverage of the country. Generally, the sectors are defined according to the number of households. In urban areas, each census sector consists mostly of 250 to 350 households. In rural areas the census tract is composed, mostly, from 150 to 250 households. The territorial basis of the 2010 Population Census was designed to integrate the spatial representation of urban and rural areas of the national territory in an environment of geospatial database.

Sectors receive two classifications: type and situation. The situation may be urban or rural. In urban situation are considered urbanized areas or not, corresponding to cities (municipal headquarters), the villages (district headquarters) or isolated to urban areas. The situation covers the entire rural area outside the city limits, including the rural settlements of urban sprawl, the villages and the cores. The type of industry can be: common sector or non-special and special sector. The sector is one that has special features that make it necessary to collect differential treatment in relation to joint sectors or non-specific, such as barracks, asylums, prisons, etc.

In areas planned for analysis, the sectors have urban situation and are of the common type.

The following figures show the comparison of the situation of each attribute in the vicinity of buildings.

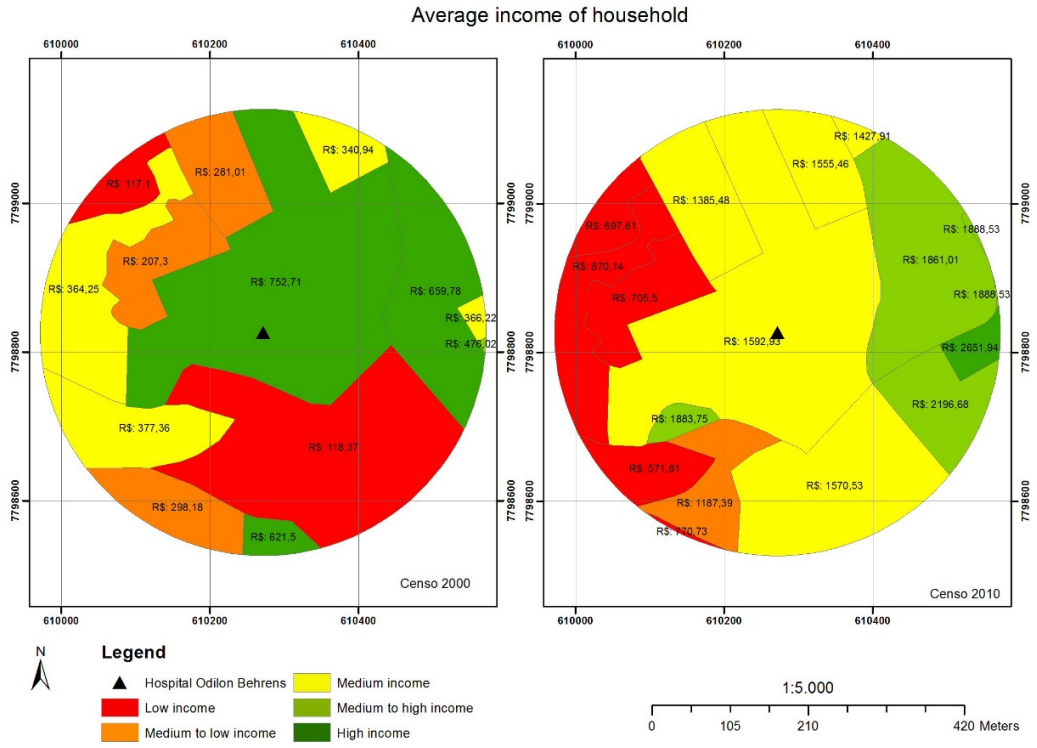

Fig. 3. Hospital Odilon Behrens – Income (a) year 2000; (b) year 2010

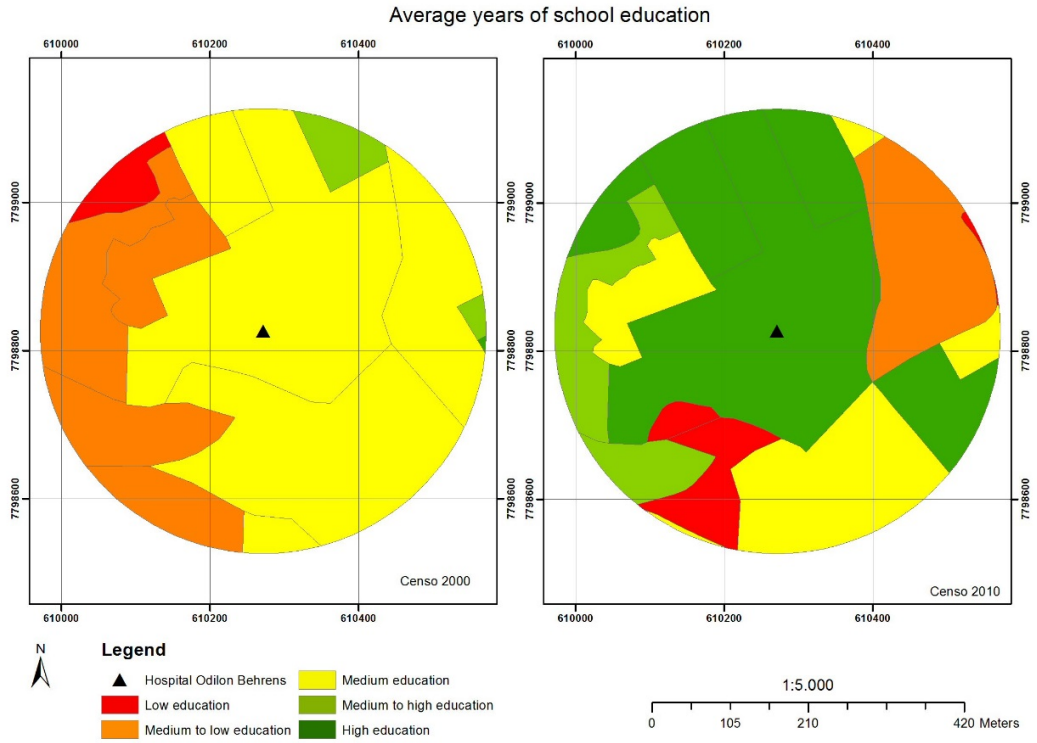

Fig. 4. Hospital Odilon Behrens – Education level (a) year 2000; (b) year 2010

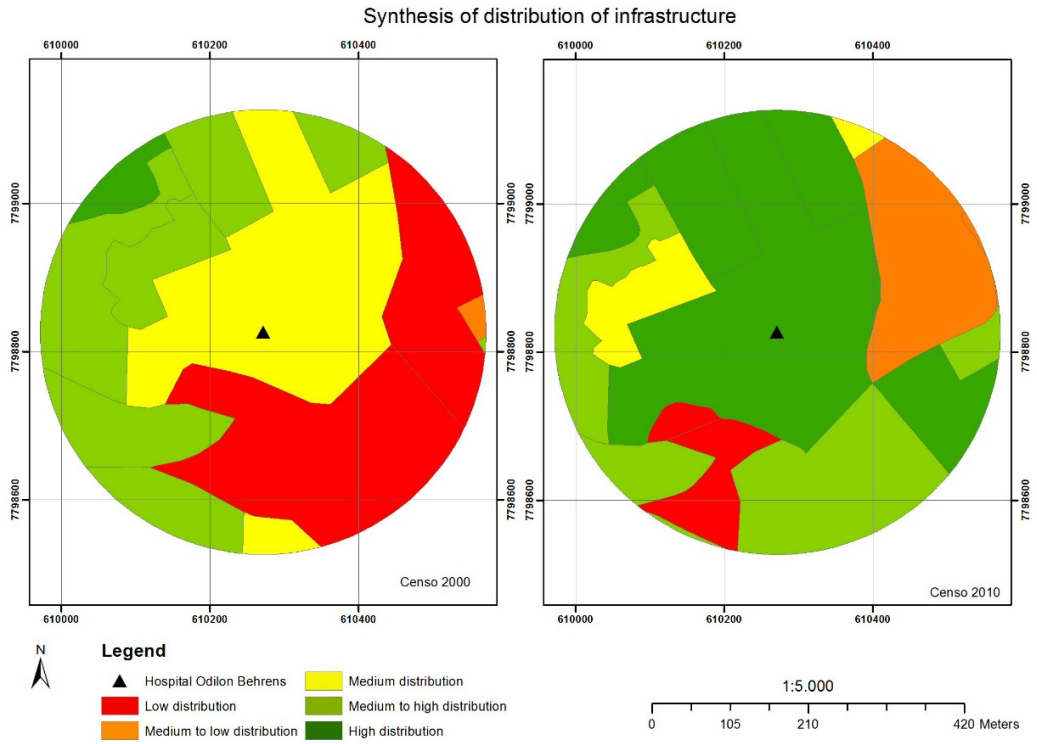

Fig. 5. Hospital Odilon Behrens – Synthesis of distribution of infrastructure (a) year 2000; (b) year 2010

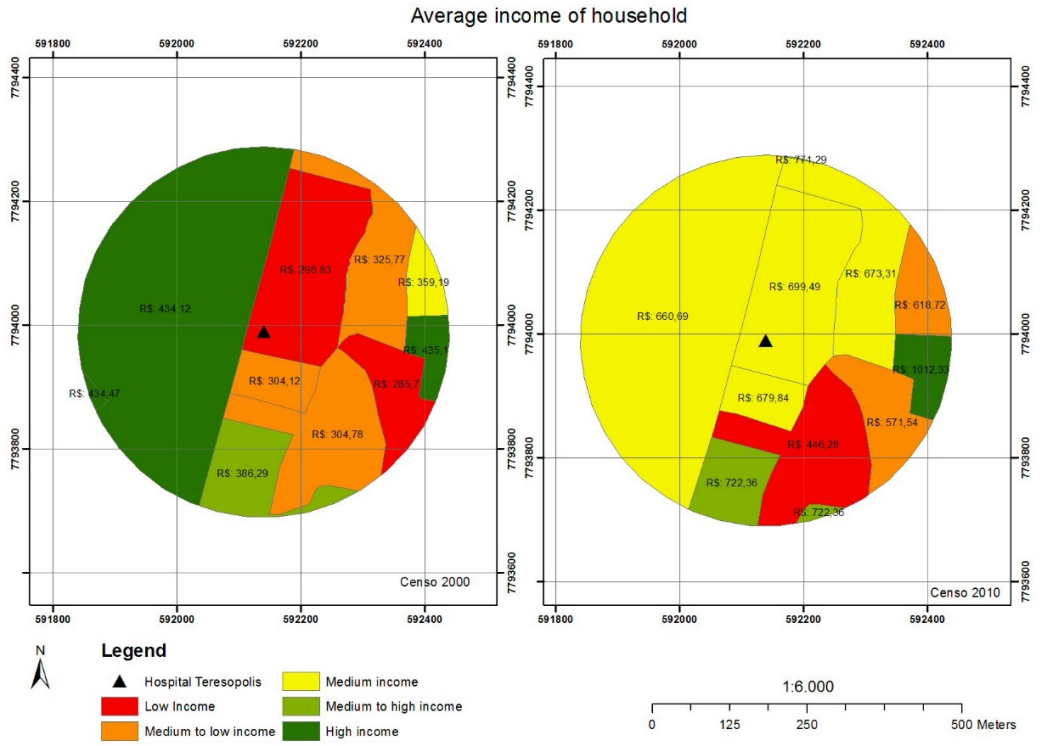

Fig. 6. Hospital Teresópolis – Income (a) year 2000; (b) year 2010

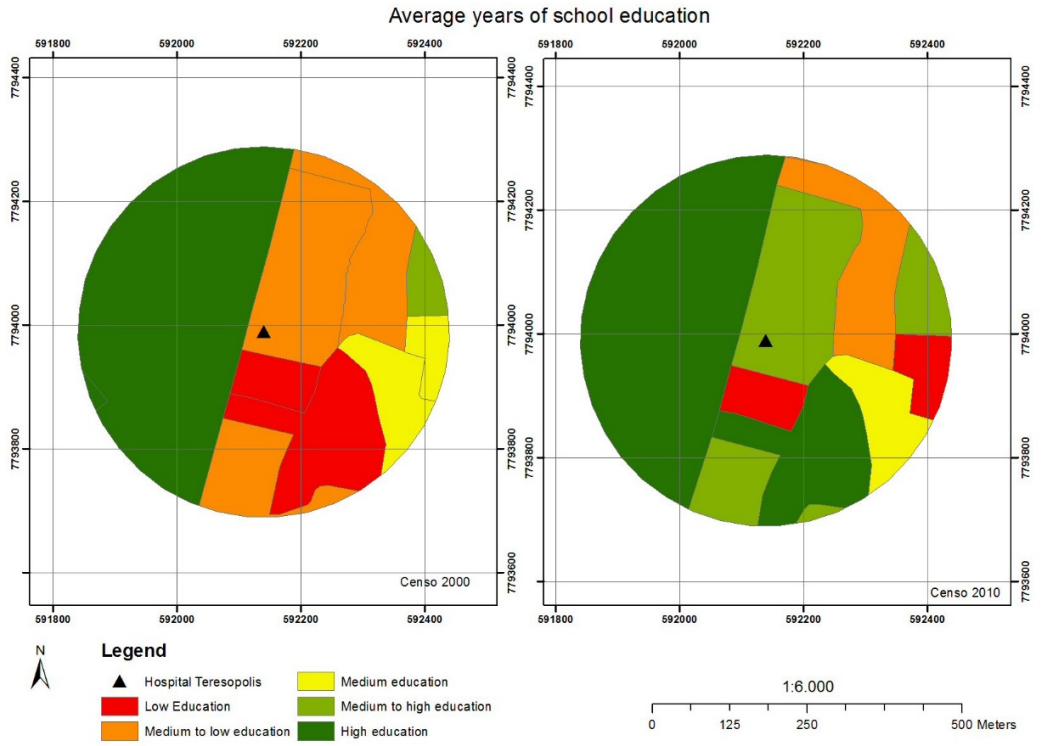

Fig. 7. Hospital Teresópolis– Education level (a) year 2000; (b) year 2010

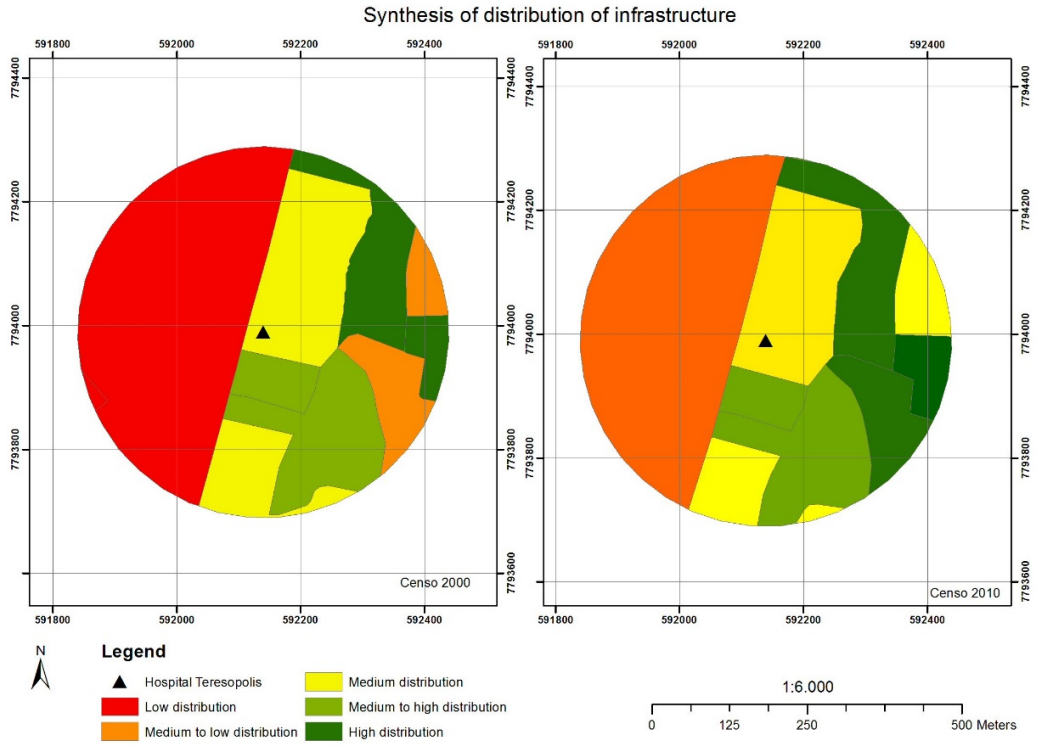

Fig. 8. Hospital Teresópolis– Synthesis of distribution of infrastructure (a) year 2000; (b) year 2010

3. RESULTS AND DISCUSSION

Income in the vicinity of buildings

The analysis of the income variable is hampered by the advance made in this regard in Brazil in the past ten years, especially with regard to underserved populations. Recent economic policies of income distribution and financial aid introduced improvement in these indicators. It is found in the immediate surroundings of the hospital Odilon Behrens rising incomes, especially in census tract on the slum. However a similar increase is seen in Garden Teresopolis, even in the absence of the hospital building. This increase can be reported as cyclical and thus can not be credited to the installation or not the respective projects.

Education Level in the vicinity of buildings

The analysis shows an overall improvement in the surroundings of the Hospital Odilon Behrens, especially in areas related to surrounding slums. The census tract closest to Hospital showed significant improvement. Meanwhile, the situation surrounding the future Hospital Teresopolis shows small variations, with most sectors around the display presented stagnation. The improvement of a sector south of the development is justified, since its population already had income levels higher than the surrounding slums is visible and the use of resources by the population in improving their education.

Urban infrastructure in the vicinity of buildings

The analysis shows that no significant changes occurred in the vicinity of the future hospital Teresopolis, with a small improvement in the area corresponding to the slum. The other sectors, which showed significant improvement should this improvement also to improve the general income. Surrounding the hospital Odilon Behrens, however, the improvement of the overall

condition of each sector can be easily verified. There is a significant indicator of developments in the neighboring slum, reflecting public and private investments for sanitation in the surroundings.

4. CONCLUSIONS

The variable that best represents both the developments surrounding the hospital as the stagnation existing in this area of the future hospital Teresopolis is the synthesis of urban services. A simple analysis of thematic maps allowed gauge what occurs in practice, namely the improvement of the territory reached by the attraction of venture. At the same time one can predict that, after installing Hospital Teresopolis, the general conditions of the surroundings should provide significant improvement.

The elements generated in the form of thematic maps consisted of specific elements of communication that will enable the integration of understandings between environments technical, administrative and community, with emphasis on production and space planning by urban planner / scheduler. Another benefit is that the spatial distribution of elements becomes more refined the result of the communication process, which reflects greater refinement in the process of decision making, reducing error and dubious interpretation processes.

It is concluded that the installation of the activity is on a pole aggregator of quality in a region known degraded and unimportant landscape, bringing chances of rescue and recovery space for urban residents, generating employment and income for a portion of the population resident. From a social standpoint, the installation represents the response to a poor service, especially in health, living in a highly dense and with a history of social deprivation that began with the occupation remains irregular and consolidated until the days. However, it should be emphasized that the nature of the enterprise is that achieves these results. We must remember that there are businesses that do not bring direct benefit to the neighborhood. Instead, determine the deterioration of real estate values in their neighborhood, like sewage treatment or disposal of waste and wastewater, cemeteries or some types of industrial enterprises. For cases of depreciation must be provided by the scheduler / planner ways of mitigating measures include the implementation of those specific to the containment of this valuation, such as offering jobs or other services or activities that attract new inhabitants.

5- ACKNOWLEDGEMENTS

The authors would like to thank CAPES – Ministério da Educação – Brasil and the NPGAU – Programa de Pós-Graduação em Arquitetura e Urbanismo da Universidade Federal de Minas Gerais for the support that made this participation possible.

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