# Migration and Hansen's disease in Mato Grosso

## *Migração e hanseníase em Mato Grosso*

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***Abstract***

Studies on medical geography about leprosy discuss the role of the detailed report of the occupation of the territories as a basis of the permanence of leprosy focus. In Brazil, the states that present the highest rates of detection historically are in the Amazon region, which shows an uneven regional evolution of the disease. This paper analyzes the evolution of leprosy contextualizing the migratory processes that occurred in the State of Mato Grosso since the second half of the 20th century. The economic dynamism that occurred in the State in the 1970s, 1980s and 1990s caused population growth rates higher than the national average. The data analyzed permitted an association between the evolution of leprosy and the process of occupation of the mato-grossense territory. However, the permanence of leprosy in the municipalities of the Baixada Cuiabana, as well as in other municipalities that lost population, seem to point to the existence of geographic contexts of different vulnerability to the social production of the disease in the tate. The migration would explain the appearance and evolution of leprosy. However, we consider that the maintenance of the endemic can be associated to contextual factors related to environment.

**Keywords:** leprosy; migration; detection rats; special analysis; environment; geographic information systems.

## *Resumo*

Trabalhos de geografia médica sobre hanseníase discutem o papel da ocupação dos territórios como fundamento da permanência de focos leprógenos. No Brasil, os Estados que apresentam as mais altas taxas de detecção, historicamente, se localizam na região amazônica, o que evidencia uma desigual evolução regional da doença. Este trabalho analisa a evolução da hanseníase contextualizando os processos migratórios que ocorreram no Estado de Mato Grosso a partir da segunda metade do século XX. O crescimento econômico ocorrido no Estado nas décadas de 1970, 1980 e 1990 provocou taxas de crescimento populacional maiores que a média nacional. Os dados analisados permitem uma associação entre o crescimento e dispersão dos coeficientes de detecção da hanseníase com o processo de ocupação do território mato-grossense. Entretanto, a permanência da hanseníase em municípios da Baixada Cuiabana, assim como em outros municípios que sofreram perda de população, parece apontar a existência de contextos geográficos de diferentes vulnerabilidades à produção social da doença. A migração explicaria a instalação e evolução da hanseníase, entretanto consideramos que a manutenção da endemia pode estar associada a fatores contextuais relacionados com o ambiente.



**Palavras chave:** hanseníase; migração; taxa de detecção; análise espacial; ambiente; sistemas de informação geográfica.


## Introduction

Leprosy, also known as Hansen's disease, is a serious problem of public health in Brazil: the country diagnoses 90% of the cases of the Americas; worldwide, it is the second in absolute number of cases, surpassed only by India[1]. Historically, the main endemic areas in the world are in regions of tropical climate, characterized for presenting high temperature and heavy rain. Besides the natural assumptions, to the territorial distribution of leprosy, unfavorable conditions of life, nutritional deficiencies and migratory movements are added among other factors. The study of leprosy presents a vast literature that, in several ways, direct or indirectly, indicates that the distribution of leprosy is restricted to certain areas, called *foci, belts or bands*. Some works of medical geography about the disease discuss the role of history of territory occupation as a basis of the permanence of leprosy cases[2,3].

The geographic presentation in leprosy focus, without a definitive explanation, as well as a prolonged subclinical evolution of the disease, associated to the intense migratory movements of the last decades and to the concentration of the population in cities, makes the leprosy geography one of the most difficult chapters of the world, regional and local nosogeography[4].

In Brazil, the states that historically present the highest detections and the most unfavorable evolution of the endemics are located in the northern and Center-western regions, which show an uneven regional evolution and suggest the existence of geographic contexts of different vulnerabilities to the social production of leprosy. Data from 2007, of the Ministry of Health[5], show the commitment of the Legal Amazon in relation to leprosy, since this area, with 12.7% of the Brazilian population , concentrates 38.9% of the new cases detected in the country.

The concept of Legal Amazon, essentially political, replaces that of the Brazilian Amazon. This one that comprised

an area of 3.7 millions of km$^2$ occupied by the 'Tropical Dense and non-dense Rainforest', when it became Legal Amazon also increased its area in 1.3 million of km$^2$. Today, it includes a long stretch of transitional vegetation with about 700 thousand of km$^2$, bordering the center-western savanna and the northern fields in the states of Roraima, Pará and Amapá.

The Center-western region registered an abrupt inversion in the proportion of people living in the urban and rural areas, of the second half from the XX th century on. In 1940, when it had the smallest level of urbanization among the Brazilian regions, 80% of its population lived in rural areas. In 1996, 84% of the population lived in urban areas[6].

In the 1960s, 1970s and 1980s, Mato Grosso was the target of the Brazilian government programs that aimed at occupying the territory, setting up colonization programs based on settlements. There was also the opening of important highways, such as BR-163 (Cuiabá-Santarém), that led the migratory flows to the newly opened areas, directly impacting on the demographic dynamics of the state and in the process of spatial redistribution of its population. The rapid colonization led to the proliferation of new municipalities in the frontier areas that until today suffer with the absence of infrastructure and services[7]. Mato Grosso has an essentially agricultural economy, linked to a growing urbanization, but still has extended areas of forests and non-occupied forests. The existence of these areas is a strong attraction to the increase in the migratory movement, which generated a fast economic growth in the last years.

The migratory process alters the epidemiological structure of the evasion areas, as well as the migrant reception, with immediate reflexes over the individual and collective risks of diseases[8]. As the relationship between man and the environment are the action of nature on man and the human action modeling nature[9], the economic development and the migration and urbanization processes that arise from it, produces changes in the occurrence and distribution of infectious and parasite diseases .

This study aims at describing the leprosy behavior in the state of Mato Grosso, and its relationship with the migratory movements that occurred there since the second half of the 20th century.

## Methodology

It is a Nosogeography study – or Health Geography – focusing on the relationship between the territorial differentiation of leprosy and the evolution of the population in Mato Grosso, in different scales of analyses: mesorregional, micro regional and municipal. It aims at identifying both the changes occurred in the spatial organization during the period studied as well as the epidemiological situation of the disease. In this way, given the meaning that has the migratory movements of the population in the dynamics of leprosy transmission, the population growth and the evolution of leprosy cases are analyzed.

The place of study is the state of Mato Grosso, located to the west of the center-western region of Brazil, with most of its territory occupied by the Legal Amazon (Figure 1). It has an area of 906,806.9 km$^2$ and it has Cuiabá as the capital. It is divided into 141 municipalities, distributed in five mesorregions and 23 micro regions. The population is of 2,803,274 inhabitants (IBGE-2006).

### Organization and Data analyses

Historical series of detection coefficient of leprosy cases for the state were built. From 1960 to 1998, reports from the Technical Area of Sanitation Dermatology (ATDS) of the Ministry of Health (MS) were used, and, from 1999 on, the source of data was the Sistema de Informações de Agravos de Notificação - SINAN (National Disease Notification System), that is decentralized to all the municipalities. An evaluation of the NDNS database quality was carried out, taking into account completeness,

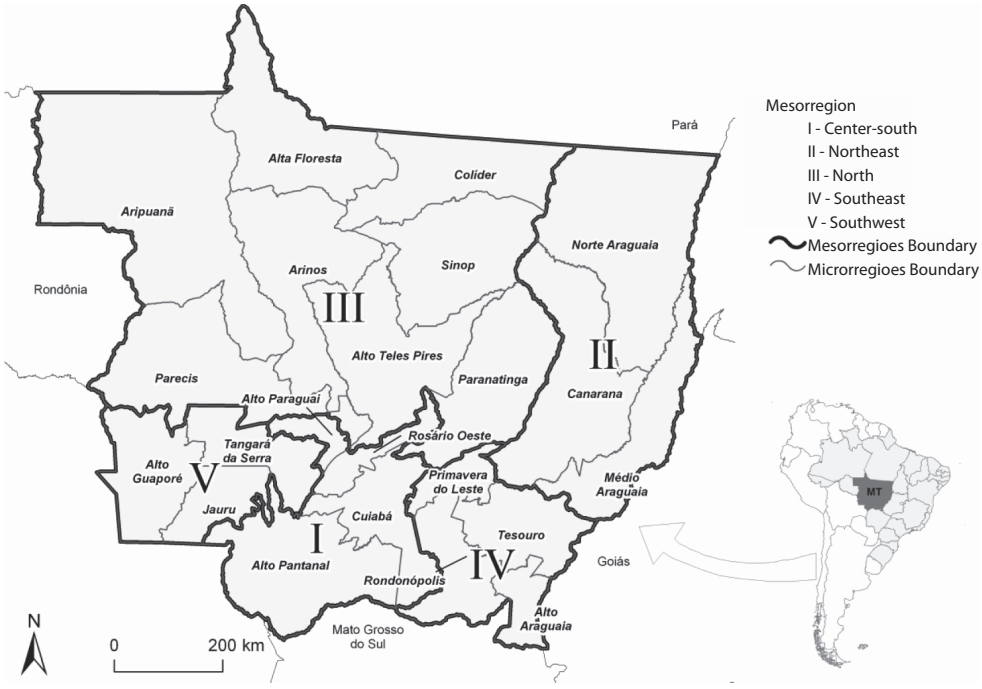



**Figure 1.** Study area: Mato Grosso State divided by meso and micro-regions
***Figura 1.*** *Área em estudo: Estado de Mato Grosso por meso e microrregiões*

consistence and duplication in the register, with those considered inconsistent being removed. For the population data, the source used was the Brazilian Institute of geography and Statistics (IBGE). For the description of the migratory movements in Mato Grosso secondary data, provided by IBGE (2000) and by the Planning Department of Mato Grosso through the *Zoneamento Sócio-Econômico Ecológico*[10] (Ecological Socio-economic Zoning) were used.

### Spatial Analysis

The historical series are presented through graphics and maps. The maps show the space-time evolution, with the distribution of cases in the state aggregated by municipalities, whose data are medium coefficients in a three-year period. It is worth highlighting that the research presented here was submitted to the analysis of the Research Ethics Committee of the State Health Department of Mato Grosso, and approved under the protocol number 331/07.

## Results

The historical series of the detection coefficient of leprosy of Mato Grosso since 1960 shows an exponential growth from 1970 to 1995, with an apparent stabilization since then, thereafter, keeping itself at a high level. The state coefficient, in 2006, is three times higher than the parameter that the Ministry of Health (MH) defines as hyperendemicity (more than 4 cases per 10,000 inhabitants), with almost all its mesorregions also above 12 cases per 10,000 inhabitants.

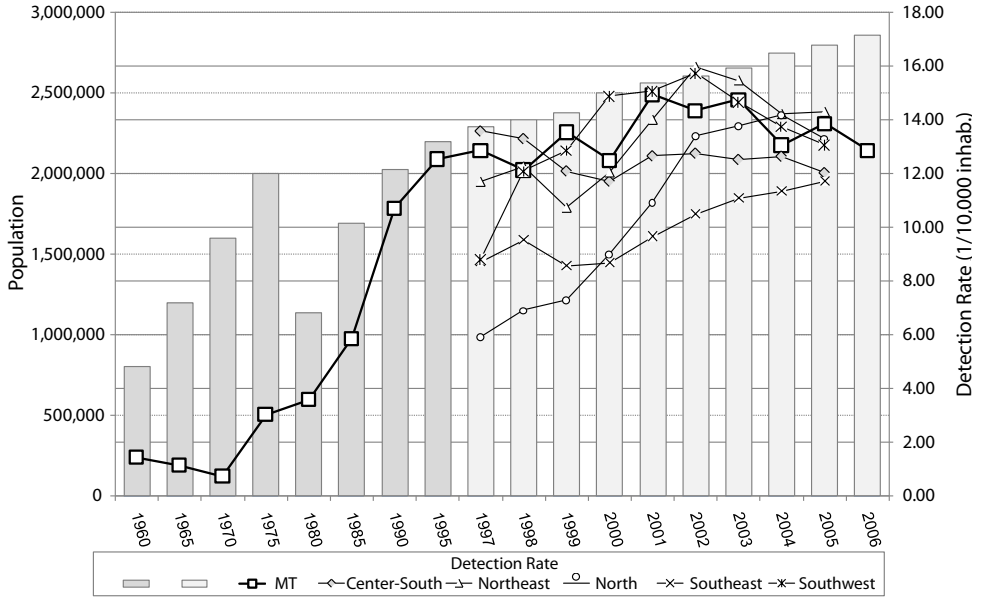
The economical growth that occurred between the 1970s and the 1990s brought a considerable increase in the state population. Its rates of population growth are higher than the national and the Center-western average (Table 1). In Figure 2 it is possible to notice the evolution of the mato-grossense population, which coincides with the increase in leprosy detection rates.

Analyzing the data per micro regions (Figure 2), we observe that the highest leprosy detection coefficients were presented by the Northern, Northeastern

**Table 1.** Population growth of Mato Grosso, Midwest and Brazil, in the 1960 and 1990's years
***Tabela 1.*** *Crescimento populacional em Mato Grosso, no Centro-Oeste e no Brasil, nas décadas de 1960 e de 1990*

| Period | 1960–1970 | 1970–1980 | 1980–1990 |
|---|---|---|---|
| Mato Grosso | 6.3% | 6.6% | 5.4% |
| Midwest | 6.2% | 4.3% | 2.7% |
| Brazil | 2.9% | 2.6% | 1.7% |

Source: ZSEE-Seplan-MT, 2002.
*Fonte: ZSEE-Seplan-MT, 2002.*




Source: Reports of ATDS, Sinan, IBGE
*Fonte: Relatórios da ATDS, Sinan, IBGE*

**Figure 2.** Population growth and rates of detection of leprosy - Mato Grosso and meso-regions, 1960–2006
***Figura 2.*** *Crescimento populacional e coeficiente de detecção de hanseníase - Mato Grosso e mesorregiões, 1960–2006*

and Southwestern mesorregions of the state, with all their micro regions presenting an increase in the detection coefficient. The southeastern region of the state also shows an increase in the coefficient in all its micro regions, while the Center-south shows a stable behavior of its micro regions, except for the Alto Pantanal, that reveals a reduction of its coefficient provoked by the municipality of Cáceres (Table 2).

Between 1996 and 1999, the incidence of the disease is higher in the municipalities with more than 50,000 inhabitants, that is, in the most populous cities of the state, as shown in Figure 3. In later periods there was a homogenization of the rates occurred, and it is possible to notice that they increase in the smaller municipalities, which represents an inter-municipal flow of the disease, possibly due to migratory movements related to the economic growth that occurred in these areas.

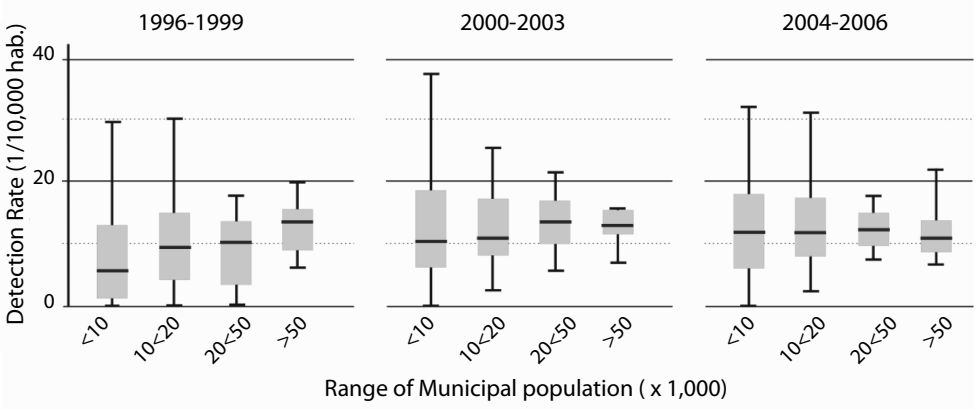
The northern mesoregion, until the late 1990s, had received a great deal of population, and except for Colíder, all the other micro regions have a positive population growth (Figure 4). The population decrease of the micro region of Colíder was caused mainly by the exit of the population of Peixoto de Azevedo, a city with a high rate of Leprosy detection that migrated mainly to Sinop and Sorriso, municipalities that belong to

**Table 2.** Rate of detection of leprosy by micro-regions - Mato Grosso, 1996/1999, 2000/2003 and 2004/2006

***Tabela 2.*** *Coeficientes de detecção por microrregião em três períodos: 1996-1999, 2000-2003, 2004-2006. (1/10.000 hab)*

| Mesoregion | Micro-region | 1996–1999 | 2000–2003 | 2004–2006 |
|---|---|---|---|---|
| Center-south | Alto Pantanal | 9.74 | 9.27 | 7.48 |
| | Alto Paraguai | 22.37 | 19.77 | 19.39 |
| | Cuiabá | 7.84 | 10.17 | 10.80 |
| | Rosário Oeste | 10.07 | 8.10 | 8.41 |
| Northeast | Canarana | 10.76 | 12.90 | 16.26 |
| | Médio Araguaia | 20.74 | 19.91 | 17.88 |
| | Norte Araguaia | 10.10 | 13.76 | 12.28 |
| North | Alta Floresta | 5.11 | 10.20 | 9.83 |
| | Alto Teles Pires | 7.10 | 12.12 | 13.50 |
| | Arinos | 3.96 | 9.60 | 13.65 |
| | Aripuanã | 4.96 | 8.26 | 12.19 |
| | Colíder | 5.79 | 11.33 | 12.15 |
| | Paranatinga | 14.50 | 19.52 | 12.70 |
| | Parecis | 8.49 | 15.13 | 19.98 |
| | Sinop | 6.07 | 13.31 | 13.67 |
| Southeast | Alto Araguaia | 3.23 | 6.52 | 7.75 |
| | Primavera do Leste | 8.36 | 8.60 | 9.02 |
| | Rondonópolis | 11.23 | 11.71 | 10.82 |
| | Tesouro | 8.33 | 9.85 | 14.53 |
| Southwest | Alto Guaporé | 4.15 | 10.55 | 8.52 |
| | Jauru | 11.31 | 13.79 | 14.97 |
| | Tangara da Serra | 14.83 | 22.14 | 13.09 |

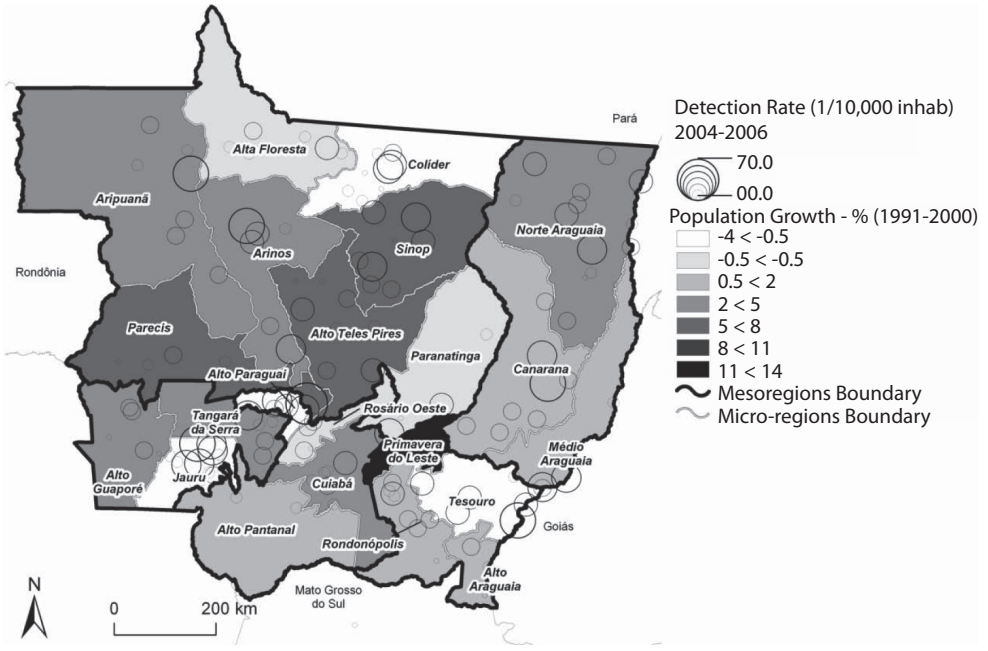
Source: Sinan/IBGE.
*Fonte: Sinan/IBGE.*




Source: Sinan/IBGE
*Fonte: Sinan/IBGE*

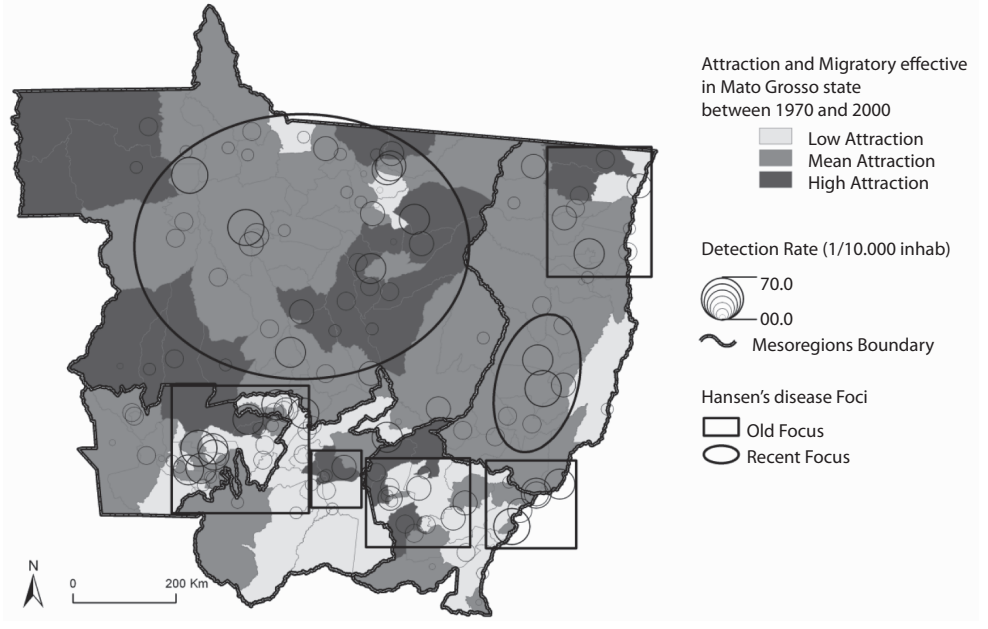
**Figure 3.** Rate of detection of leprosy by municipies and population range - Mato Grosso, 1996/1999, 2000/2003 and 2004/2006

***Figura 3.*** *Taxa de detecção de hanseníase por municípios e faixas de população - Mato Grosso, 1996/1999, 2000/2003 e 2004/2006*




Source: ZSEE-Seplan-MT 2002
*Fonte: ZSEE-Seplan-MT 2002*

**Figure 4.** Rate of population growth of the micro-regions of Mato Grosso in the 1990's years
***Figura 4.*** *Taxas de crescimento populacional das microrregiões mato-grossenses na década de 1990*




Source: ZSEE-Seplan-MT 2002
*Fonte: ZSEE-Seplan-MT 2002*

**Figure 5.** Attraction degree and effective migratory participation in Mato Grosso
***Figura 5.*** *Grau de atração e participação do efetivo migratório em Mato Grosso*

the micro regions of Sinop and Alto Teles Pires, respectively.

Continuing with the analysis of Figure 4, a decrease of the population in the micro region of Alto Paraguay is noticed. Considerable population groups migrate from the municipalities of this micro region to the municipalities of the Alto Teles Pires and Parecis micro regions.

The emergent economic growth made possible a considerable increase of the state population, superior to the national average, although this increase has occurred in an uneven way, influenced by the regional environmental specificities. The Zoneamento Sócio-Econômico Ecológico de Mato Grosso[10] classifies the municipalities of Mato Grosso according to their degree of attractiveness and effective participation of the migrants in the state (Figure 5).

In the 1990s data, the municipalities of the northern mesoregion were classified by presenting "strong" and "medium level of attractiveness". These municipalities are also those that increased the detection rates the most since the beginning of 2000. Also analyzing the evolution of the deforestation in Mato Grosso by meso and micro region, a coincidence between the increase of the leprosy detection coefficients and the growth of deforested areas is observed. The deforestation can be associated to the entrance of people in preserved natural environments and shortage of health political structures.

## Discussion

The territory that today is the state of Mato Grosso, was initially exploited by Portuguese settlers, attracted by the hunt for the Indigenous people and by the gold mining. The first settlement of Cuiabá was founded in 1719, and in the next decade it became one of the most populous nucleation of the region and, as a consequence of the great expansion of the mining activity, the surrounding areas were populated[11]. In 1723, the city of Diamantino and the nucleus of Rosário Oeste as points of support between Cuiabá and the gold and diamond mines in the interior of the region appeared. Other settlements were created, such as Alto Paraguai, Nossa Senhora do Livramento, Santo Antonio do Leverger and Barão de Melgaço. In the second half of the XVIIIth century, the settlement axis moves towards the western region, and Vila Bela da Santíssima Trindade was founded in 1752. The development of Cáceres estimulates the creation of Barra does Bugres settlement[12].

In the late 19th century and in the first decades of the 20th century, the population increase that occurred in Mato Grosso gave rise to urban centers such as Poxoréo, Guiratinga, Barra do Garças, Alto Araguaia and Tesouro, known first as "small camping grounds of diamond miners at the entrance of the diamond fields", since they had their origins in the process of exploration of diamonds. In the late 1960s of the 20th century, with the depletion of the diamond mines several of these nuclei went into decline and their inhabitants began migrating to other urban centers and rural areas. In some settlements almost all the inhabitants left.

A report of the director of Lázaros hospital, of 1927, informs that the situation of leprosy in the state is alarmingly spreading, having as the main foci: Rondonópolis, Cáceres, Ladário and Poconé. Added to this legion of patients already existent, there are others from other states, initially São Paulo, Minas Gerais and neighboring countries such as Paraguay. It is estimated that the number of patients is more than 700. Numerous foci of leprosy were identified in dwellers on the banks of the Guaporé River[13]. These foci, identified in the beginning of last century, still remain, nowadays, as leprosy hyperendemic areas in the state.

Due to the short duration, the mining cycle had little influence in the territorial planning of Mato Grosso, and the urbanization occurred due to the advance of the agricultural activity, which attracted workforce of other regions of the country. In the first moment, in the 1950s and 1960s, the migratory flow came mainly from Bahia,

Minas Gerais and Goiás. From the next decade on, the origin of the migratory flow was mainly from the south of the country. Besides the occupation of the agricultural frontier, which started in the 1940s, the construction of Brasília provided the intensive growth of the urban nuclei of varied sizes. During the 1970s the process of rural exodus in the region is initiated, more evident in the1980s[14].

The opening of federal highways, such as BR 070, 158, 163, 364, among many other state highways, facilitated the occupation of the territory. Agriculture spread quickly, giving rise to a network of cities and roads[12]. The state of Mato Grosso experiences a phase of economic expansion, based on a combined agriculture and stock raising activity that attracted a great migratory flow in the 1970s, 1980s and early 1990s. Driven by the actions of the federal programs, the economic development that expanded the combined agriculture and stock raising frontier triggered territorial, political, economic and social changes. When facing this kind of population occupation, the soybean culture appears, an agricultural activity highly capitalized and mechanized, seen as a viable option in the savannas or as a way of recovering areas with pastures[14]. However, the use of lands for this crop and for pastures, linked to the search for timber, were and still are the biggest responsible causes for the destruction of the forests[6].

The stock raising activity that is being introduced more and more in the areas previously occupied by forests made the cattle of Mato Grosso the second largest of the country[6]. Other aspects that should be considered when one intends to understand the occupation process of Mato Grosso are the disrespect to the Indigenous lands and the predatory effect of the gold mining. These elements, together, end up causing great foci of social tension in the state[6].

In 1996, the municipalities with the highest detection coefficients concentrated mainly in the Center-northern part of the state, where the micro regions of Alto Pantanal, Tangará da Serra, Rosário Oeste, Alto Paraguai and Parecis are located. The municipalities that belong to the micro-region of Alto Paraguai, along with the municipality of Diamantino, in the micro-region of Parecis, are areas of ancient occupation that began in the 19th century, when the intense gold mining activity attracted a great number of migrants and supported the economy of the region. Between 1996 and 1999, the eastern part of the state, mainly the municipalities close to Rondonópolis and Barra do Garças, stand out with high detection coefficients, however in lower intensity. The formation and growth of Rondonópolis had a direct influence of the development programs of the Federal Government. Being elevated to the category of municipality in 1953, just over ten years its population had doubled.

The rapid process of urbanization, observed since the 1980s, a consequence of the rural exodus and of the migratory movement of several regions of the country, generated severe social problems in the municipality that attracted to itself the attendance to the surrounding regions in relation to the financial, commercial and welfare activities, overloading the existing structure. Barra do Garças, a municipality founded in the 1920s by migrants from Bahia that discovered the diamond mines in the Araguaia River, became, in 1940, a local and later regional development pole, due to colonization projects and development plans of the Federal Government.

To the north of Barra do Garças, the municipalities cut by the BR-158 highway belong to an area whose occupation was intensified during the 1970s and 1980s, with the implantation of a great number of combined agriculture and stock raising projects with the support of official subsides, keeping a narrow relationship with the southeast of Pará. These municipalities, in this time and still today, present a high level of social exclusion.

In 1998, the municipalities near Rondonópolis showed an increase in case detection. Also in this year, Barra do Garças, Médio Araguaia, Arenápolis and the micro

region Alto Paraguai, presented the highest rates of the state. This area corresponds to former foci, existent since the beginning of the XXth century. Some of these municipalities were places for the spread of leprosy in Mato Grosso[13].

Since the 1990s, the endemic gradually moved towards the North, in the Center-north- northwestern direction, with the municipality of Peixoto de Azevedo presenting the highest detection coefficient. Peixoto de Azevedo had its formation linked to the discovery of gold mines in the region and to the arrival of thousands of gold miners that came from Itaituba and other regions of Pará and Maranhão that dwelt in precarious houses along the BR-163[7].

In the Center-south of the state, the population from the city Primavera do Leste presented a fast growth since the early 2000s, with the arrival of people from the south of the country and the neighboring cities, mainly of the municipalities that belong to the micro region of Tesouro, that also transferred population to the city of Rondonópolis. It is important to recognize that the municipalities near Rondonópolis are characterized as historical foci of leprosy since the time of the onset of the disease in the state.

Nowadays, we can consider that a great part of the state territory is strongly modified by the activities of the last three decades. With the advent of new combined agriculture and stock raising technologies, the development axis moved from the pantanal to the lands of plateaus and depressions. The progressive advent towards the northwest of the state was facilitated by the opening of roads, which coincides with the movement of the disease expansion in Mato Grosso. Similar associations between leprosy and migration were done in the Amazon, as stated by Penini[15], when he describes that the Amazon spaces of high historical prevalence of leprosy coincide with those of great concentration of rubber extractors, whose majority came from the northeast of the country. For the reality of Acre, Silveira et al. and Klein[16,17] defends the direct link between leprosy that installed itself in the state in the early 20th century with the migratory flows of the rubber cycle. In Rondônia, when studying the relationships between migration and leprosy, Oliveira et al.[18] observes the limited conditions of life of the migrant population, associated to the precarious physical conditions of these geographic spaces in the process of infection of the disease.

It stands out that studies on spatiality of leprosy confirm their close relationship with the socio-economic conditions[19,20]. Other studies carried out[21-25] also relate the occurrence of leprosy with environmental factors, such as regions with vegetation, climatic types, average annual rainfall, or to one real differentiation of territorial vulnerability by the presence or not of human or environmental infection sources.

Thus, an association between the migratory processes and the expansion of leprosy in Mato Grosso is observed. The municipalities with the highest detection presented high population growth, mainly in the 1970s and 1980s. The Northern mesoregion, that has grown more recently, also presented a considerable increase in its detection rates after 2000, having received a large number of people during the 1990s. Although many micro regions are losing population, being classified as of low level of migratory attraction, one does not notice that the detection rates have decreased. Instead, the coefficients maintain themselves in some municipalities and progressively increase in others, while the populations occupy and transform new spaces.

These results would indicate that the migrations in the last decades seem not to participate of the increase in the detection rates in some municipalities, what does not mean to eliminate the influence of the high increases of the previous decades, mainly in the outskirts of these cities, where the economic and social situations deteriorate during this period. Other epidemiological factors, associated to a higher environmental or even individual vulnerability of migrants or natives of these regions, must also be taken into account.

Another issue is how the performance of the health service may be influencing the Leprosy behavior in different places. Studies as those of Queiróz and Scatena[26] relate the increase of the detection of leprosy cases to operational issues of health care services, such as the number of technicians trained, coverage of control measures, among others. From 1996 to 2007, there was, in Mato Grosso, an increase of 115.5% in the coverage of the control measures carried out by the health units.

The analysis of the quality of the health services in the state suggests that the decentralization of the leprosy control measures not always have influenced the performance of the services. The detection increase seems to be related to the rise in the suspicion of cases by the family health teams (ESF), but the quality of care to the patient, as contact exams and evaluation of the level of physical incapacity, does not seem to be influenced by it. Besides, operational issues could not explain the maintenance of an epidemic for more than half a century.

## Conclusions

The data analyzed allow an association between the evolution of leprosy and the process of occupation of the mato-grossense territory. The municipalities with the highest rates of detection present high population growth, mainly in the 1970s and 1980s. The northern mesorregião that had a more recent growth, received a large number of people in the 1990s, it presented a considerable increase in the detection coefficient of the disease after 2000.

The historical permanence of leprosy in the municipalities of Baixada Cuiabana, as well as in others that suffered the process of population loss, such as Peixoto de Azevedo, Alto Paraguai and Poxoréo, seems to point to the existence of geographic contexts of different vulnerability to the social production of the disease in the state.

The migration would explain the installation and the evolution of leprosy, however the maintenance of the endemic could be associated with other factors, such as the environmental. The northern and northeastern mesorregions, predominantly covered by the Amazon Forest, present a tendency of increase of the detection rate. It is also observed that there is an association between the elevation of the detection coefficients and the increase of the deforested areas, by meso and micro regions. They are areas of combined agriculture and stock raising expansion and the people have a higher contact with the natural and still preserved spaces.

The observations about the largest increases and the highest detection coefficients would be coincident with some municipalities of higher social exclusion. However, in others that also have high coefficients, this relationship is not observed. Even if one cannot disregard the existence of other factors that would act in the disease transmission, we also consider that, even in municipalities with the lowest indexes of social exclusion, there are several peripheral areas of extreme poverty.

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