Leprosy in Brazilian counties bordering Paraguay: Mato Grosso do Sul State, 2001–2011

MARIA ELIZABETH ARAÚJO AJALLA*, SONIA MARIA OLIVEIRA DE ANDRADE*, EDSON MAMORU TAMAKI*, WILLIAM WAISSMANN**, SANDRA HELENA CORREIA DEITTRICH* & VALTER ARAGÃO DO NASCIMENTO*
*Universidade Federal de Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil
**Fundação Oswaldo Cruz, Av. Brazil, 4365 - Manguinhos, Rio de Janeiro - CEP:21040-900, Brazil

Accepted for publication 3 November 2015

Summary

Background: In Mato Grosso do Sul state, Brazil, the dry border shared with Paraguay is a territory marked by facilities in the flow of goods, services and people, bringing difficulties for surveillance of communicable diseases.

Purpose: The purpose of this study is to characterise leprosy epidemiologically in dry border municipalities of Mato Grosso do Sul in Brazil with contiguous urban areas with neighbouring Paraguayan counties, in the period 2001–2011.

Methods: This is an exploratory descriptive investigation that includes the four dry border municipalities of Mato Grosso do Sul (Coronel Sapucaia, Paranhos, Ponta Porã, and Sete Quedas) in Brazil whose urban areas are contiguous with Paraguay. Data comprised the period 2001–2011.

Results: The rates of leprosy detection and prevalence oscillated along the study period, increasing in the last 2 years investigated. The detection rate was 3·3/10 000 in 2011, up from 1·7/10 000 in 2009. Prevalence was 5·3/10 000 in 2011, up from 2·5/10 000 in 2009. The Virchowian disease form was predominant in 8 of the 11 years investigated. Most patients were male, with limited formal education (44·2% with less than 4 years of study).

Conclusion: In the border of Brazil, most (greater than 70%) of the cases detected were classified as multibacillary. The higher coefficient found in Brazilian municipalities was the Virchowian clinical form, which can influence the operational classification in multibacillary. The predominance of the Virchowian clinical form,
larger number of patients in rural areas and children under 15 years of age provides
new information on the manifestations of the disease in the border territories.
The study revealed that municipalities with contiguous cross-border urban areas with
Paraguay have unique epidemiological features that need to be addressed by policies
focusing leprosy as a public health priority.

Introduction

Leprosy is a complex disease, in which the manifestations of Mycobacterium leprae are
strongly related to immune responses and living conditions of patients. Treatment, introduced
in the 1980s, is available from the World Health Organization (WHO) in the form of
multidrug therapy (MDT), administered according to clinical status. Despite the effectiveness
of healthcare services in controlling the disease, in some countries like Brazil it is not
eradicated, being treated as a neglected tropical disease.1,2

According to WHO, Brazil accounted for 16% of new cases worldwide, which, in
conjunction with India (58%) and Indonesia (9%), constitute 83% of new cases detected in
2011. This numbers shows that the disease is active in Brazil.3

Overall, new cases have fallen 41·5% nationwide from 2003 to 2012, yet detection rates
remain high in the North and Mid-west regions, maintaining the chain of transmission.7 In the
Mid-west region, in the state of Mato Grosso do Sul, the detection rate was 29·5 per 100,000
in 2011, rated very high (20–39/100,000 range) according to parameters of health ministry
of Brazil.4,5

In Mato Grosso do Sul, 11 counties share a border with Paraguay and one with Bolivia.
Six of these municipalities have contiguous cross-border urban areas and four (Ponta Porã,
Sete Quedas, Paranhos, and Coronel Sapucaia) have dry-border urban areas contiguous with
Paraguayan municipalities (Pedro Juan Caballero, Corpus Cristi, Ypejhu, and Capitán Bado,
respectively - Figure 1).6

In Paraguay, the official documents of data on population health conditions are reported
by 17 departments (in Brazil, Departments are called states). Capitán Bado and Pedro Juan
Caballero are municipalities located in Amambay Department. Ypejú and Corpus Christi are
municipalities that belong to the Department of Canindeyú.7,8

The municipalities of the borders, with contiguous urban area are small, in 2010
the estimated population was 115,073 inhabitants, with primary care coverage above
50% (Table 1).

According to the characterisation of Amambay Department with respect to population
and coverage of primary health care (PHC), it has a population of 125,611, and 21 units of
PHC, with an estimated 58% coverage, and Canindeyú Department has a population of
191,447 inhabitants, 38 PHC units for a 69·5% coverage.7,8

According to the report of the Pan American Health Organization (PAHO) - Health in the
Americas-2012, Paraguay would have reached the goal of elimination of leprosy as a public
health problem in 2006, but three departments (Amambay, Neembucu and Concepcion) not
reached the elimination target in 2010.7,8

In 2010, Paraguay has detected 392 cases of leprosy, of these 79% were multibacillary,
16% had Grade II of incapacity at the time of diagnosis and 3·3% were in children
under 15 years. The country had PHC in 2010, and expects the comprehensive care offered in
this type of health care facility will contribute to achieving the elimination in all departments.\textsuperscript{10}

The integration between the border cities with contiguous urban areas creates a unique space, with cultural features, ethnic and own language, which facilitate population mobility, the movement of animals and goods. The demand for various health services, gains complexity when considering the residence of Brazilians in the neighbouring country and the Brazilian health system.\textsuperscript{11} The Healthcare in Brazil is a constitutional right, so the Single Health System (Sistema Único de Saúde - SUS) guarantees attention to every Brazilian citizen creating a disequilibrium between demand and supply of services which are calculated based on the resident population. The Brazilian notification of patients diagnosed with leprosy is based on place of residence and municipalities. This fact difficult the registration of Brazilian patients living in Paraguay, making it impossible to monitor effectively these cases.\textsuperscript{12,13}

\textbf{Table 1.} Characteristics of municipalities of dry border in Mato Grosso do Sul-Brazil, with contiguous urban areas, population in 2010, and primary care coverage in health care (PHC)

<table>
<thead>
<tr>
<th>Municipalities (Brazil)</th>
<th>Population 2010</th>
<th>2001%</th>
<th>2011%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronel Sapucaia</td>
<td>14,064</td>
<td>0</td>
<td>73,6</td>
</tr>
<tr>
<td>Paranhos</td>
<td>12,350</td>
<td>67,1</td>
<td>83,9</td>
</tr>
<tr>
<td>Ponta Porã</td>
<td>77,879</td>
<td>11,7</td>
<td>53,2</td>
</tr>
<tr>
<td>Sete Quedas</td>
<td>10,780</td>
<td>0</td>
<td>96,0</td>
</tr>
</tbody>
</table>
To eliminate leprosy as a public health problem, WHO stated the necessity to reach a prevalence of less than one case of leprosy per 10,000 population. This requires changes in various local factors, and the correct information on the distribution and dynamics of transmission of leprosy in a region with unique characteristics in the state. In order to provide information needed for health personnel and researchers who wish to know more about monitoring and elimination leprosy, the intention of this paper is to epidemiologically characterise leprosy in the dry border counties of Mato Grosso do Sul state in Brazil, whose contiguous urban areas are neighbouring Paraguay, in the period 2001–2011.

Method

This exploratory descriptive investigation included the four dry-border counties (FDB) of Mato Grosso do Sul state (Coronel Sapucaia, Paranhos, Ponta Porã, and Sete Quedas) with cross-border urban areas contiguous with Paraguayan counterparts. Data comprised the period 2001–2011.

FDB are small municipalities with a joint population of 115,073 in 2010. Located further than 300km from Campo Grande, the state capital, each of them experienced improved human development index (HDI) in the period 1991–2010 — from very low to low in Coronel Sapucaia and Paranhos, very low to high in Ponta Porã, and low to medium in Sete Quedas. PHC increased significantly from 2001 to 2011, reaching almost all population in Paranhos and Sete Quedas.¹⁴

Data were obtained from the notification records of the State Epidemiological Surveillance Coordination of the Mato Grosso do Sul, Department of Health. Demographic data were based on census, conducted by the Brazilian Institute of Geography and Statistics (IBGE).⁹

Percentages of mode of entry into the healthcare system (new cases, transfers, recurrence, etc.) and type of discharge were calculated. Calculations of annual detection rates for each county were based on the number of new diagnosed cases per 10,000 residents. Detection rates were also calculated for children under 15 years. Calculation of prevalence rates per 10,000 residents included all patients who were under treatment on December 31 each year.

The dates of treatment onset and discharge, as well as type of discharge, were taken into account to estimate whether a patient was under treatment on December 31 each year. For records without date or type of discharge, the discharge date was estimated considering the operational classification and type of multidrug therapy.

Socio demographic analysis employed variables available from notification records (gender, age, and years of formal education).

Epi-Info 7·0 (Centers for Disease Control and Prevention, Atlanta, GA, USA) and Excel (Microsoft, USA) software were used for data analysis.

Data were expressed as absolute and relative frequencies.

The study was approved by the Universidade Federal de Mato Grosso do Sul (UFMS) Ethics Committee for Research on Humans (permit 0249-0-049-00-11, of Sept. 30, 2011).

Results

In the study period, 8216 cases of leprosy were reported in the state of Mato Grosso do Sul. From these, 279 were from dry-border counties with cross-national contiguous urban areas with Paraguayan counterparts (233 are new cases, six recurrences, 20 transfer cases from
other origins, 20 unknown). Among these 279 cases, the reasons for treatment cessation were cure (202), referral (to other county, state, country, or unspecified location) (20), treatment dropout (29), death (three), misdiagnosis (two), and unspecified reason (23).

Table 2 shows the detection coefficients and prevalence of leprosy per 10 000 inhabitants in the counties of boundary line between Brazil and Paraguay, with contiguous urban area in the period from 2001 to 2011, Mato Grosso do Sul. The detection coefficients (DC) indicate 1·2–2·4 cases during the years from 2001 to 2010. There was a relevant increase in 2011 to 3·3. From 1996 to 1998, the DC of children under 15 years-old showed values from 0·0 to 2·0, however, there was a rise in 2011 to 6·3. At the same time, the prevalence coefficients for the respective periods of 2001–2010 was 2·1–4·0, and for 2011 rose to 5·3.

Information on the clinical form and the degree of physical disability are shown in Figures 2 and 3. The study conducted between 2001 and 2011 reported that the coefficient of Virchowian form (clinical form sensitive to the bacillus, resulting in multiplication and spread of the disease) was higher in nine years in the study period. In 2008 was surpassed by

![Figure 2. Detection coefficient per 10 000 population of the clinical form in the counties of the boundary line with contiguous urban area Brazil - Paraguay, from 2001 to 2011, Mato Grosso do Sul, Brazil.](image-url)
indeterminate form (0·8/10 000), in 2009, also by tuberculoid clinical form (clinical form of containment of bacterial multiplication), and dimorphous disease (unstable form of the disease interspersed between tuberculoid and Virchowian form), both with equal values ratio (0·6/10 000). Grade zero of disability at diagnosis is by far the most common, except for the years 2003 and 2007 (surpassed by Grade I) (Figures 2–3).

Analysis of the results shows that in the four municipalities with contiguous urban area with Paraguayan counties, male patients are the most affected, especially with higher coefficient (Coronel Sapucaia (4·1/10 000) and Ponta Porã (2·2/10 000)). Unlike other municipalities, in Ponta Porã the coefficient of cases in the rural population (2·2/10 000) is higher than that of urban residents (1·3/10 000). Adults ages 40–69 are most affected in the municipalities of Ponta Porã and Sete Quedas. In Coronel Sapucaia and Paranhos the highest detection coefficient was found in patients above 70 years. The municipality of Sete Quedas has a higher detection coefficient for aged 0 to 14 years (1·6/10 000).

Most cases occurred in patients with low education (44·2%), illiterate or with less than 4 years of study. In the municipality of Sete Quedas this group accounted for 66·6% of new cases, the highest proportion among the four municipalities investigated.

**Discussion**

The analysis of the data (Table 2) showed fluctuations in coefficient of detection. These fluctuations can be explained by operational factors in healthcare services, such as improvements in reporting mechanisms, diagnosis, active search of new cases, and examination of household contacts.\(^\text{15,16}\) The increase in new cases, however, also reflects an increased demand for healthcare services, owing to the dissemination of information on the availability of treatment and cure of leprosy.\(^\text{15}\)

The mean coefficient of detection of 2·0/10 000, according to the parameters of the Ministry of Health in Brazil (Ordinance 3125 of 2010)\(^\text{17}\) is considered very high. Penna in the
period from 2009 to 2011 found the coefficient of 1·9 new cases per 10 000 population.\textsuperscript{16} On the other hand, in Paraguay the mean coefficient of detection reported in Amambay and Canindeyú departments in 2010, were 1/10,000 and 0·7/10 000 respectively.

The period 2001-2011 showed differences in the tendency of growth of the detection rate between Mato Grosso do Sul counties. Contiguous urban border areas (Coronel Sapucaia, Paranhos, Ponta Porã, and Sete Quedas counties) presented a growing tendency while other borderline counties (with no contiguous urban border areas) showed a negative trend, and the other counties of Mato Grosso do Sul presented a detection rate stabilised. The operational classification of the research showed that in the four municipalities of contiguous urban areas 78·5\% of detected cases were classified as multibacillary, in the other municipalities of the boundary line this percentage was 51·5\% and 53·8\% at the rest of the state.

In the present study, mean prevalence rate in the period investigated was 3·2/10 000, with an upward trend at the end of period (4·0/10 000 and 5·3/10 000, high rates in 2010 and 2011). Point prevalence is influenced by operational aspects of the program for control and elimination of leprosy, paucibacillary patients beginning treatment in the first 5 months of a given year are not included in the calculation of prevalence for the same year. This can produce a hidden prevalence, which is added to point prevalence would increase the values found. Higher prevalence rates reflect an increase in new multibacillary cases and relapses.\textsuperscript{17,18,19}

In eight of the 11 years comprised in the present study, the Virchowian clinical form predominated in the municipalities investigated. Because of its potential transmission became worrisome it could explain the high percentage multibacillary in the four municipalities surveyed. The main prevalence in municipalities of the boundary line without contiguous urban area was the dimorphous clinical form.

Studies of Cazola \textit{et al.} from 2011 to 2014, about Brazilians living in Paraguay, who receive health care in Brazil, showed that the greatest demand services is PHC.\textsuperscript{11,20} However, outside the Brazil territory, the monitoring and control of Brazilian patients diagnosed with leprosy residents in the neighbouring country can be hampered. The reduction or increase in the number of new cases border depends on the measures to increase and improve information about patients through tracking and surveillance, quality control and assurance follow-up of cases.

Grade of disability at diagnosis was one of the indicators selected for monitoring the global strategy for further reducing the burden of leprosy in 2011–2015. No parameters have been defined for this indicator, but a target has been set to reduce by 35\% the degree of disability at diagnosis by 2015, relative to 2010. In Brazil, the rate of new cases with Grade II disability ranged from 6\% in 2001 to 1\% in 2011.\textsuperscript{21,22}

In the present study, the rate of Grade II disability at diagnosis increased in the last year of the period investigated, in contrast with a reduction over the period 2000–2011 observed by Panna \textit{et al.}\textsuperscript{16} in a country-wide investigation. However, gradual increases in grade II cases were found by Ignotti and Paula for Mato Grosso do Sul in 2008, 2009, and 2010 (1·71, 1·31, and 2·74/100 000 respectively).\textsuperscript{21}

Grade II disability rates reflect late diagnosis and expose weaknesses of healthcare services in diagnosing leprosy in a timely manner. Nonetheless, primary health care coverage in Ponta Porã increased from 11·7\% in 2001 to 53·2\% in 2011, and in Sete Quedas from 0\% to 95\% in the same period. Expanding the primary healthcare network in the counties investigated meant materialising access to diagnosis and treatment for patients with developed disease living in peripheral regions.\textsuperscript{21,22,23}
Indeed, in epidemiological terms, aspects related to the affected population are as crucial as those related to the disease itself. In all four counties investigated, males were the population segment most affected by leprosy. Similar results were found by Scheelbeek et al. for endemic areas in Cebu, Philippines, with 3288 cases in 2000–2010, 69.4% of them in males. Males also predominated (63.7%) in a study conducted by Guerrero in Colombia over the same period. An earlier investigation by Figueiredo and Silva in São Luís, Maranhão, Brazil, also showed a similar gender distribution.

In the present study, the detection rate for rural residents in Ponta Porã (a high rate, according to standards of the Brazilian Ministry of Health) was higher than for urban residents, in contrast with findings by Mohite et al. and Kuruwa et al., in which urban cases predominated. According to data of Brazilian Institute of Geography and Statistics Foundation (IBGE Instituto Brasileiro de Geography e Estatistica) in Ponta Porã, 48% of the rural population live in recently established settlements in 2010. Those who now live in the country’s largest rural settlement have a history of living in temporary camps precariously set up on the edges of roads or in encroachments, while waiting for land reform to be regulated. In these camps, housing is precarious, cluttered, built with makeshift materials (plastic sheeting, scrap lumber, tarp, cardboard), facilitating contagion and spread of leprosy among family members and neighbours.

Among children younger than 15 years, mean detection rate was 0.3/10,000, categorised as low by the Brazilian Ministry of Health. However, the increase in 2011 to 6.3/10,000, shows that the disease is in activity in the study area. These results draw attention to the urgency of monitoring cases in this age group, since detection rates serve as an indicator of the strength of recent transmission. Detection rates for this age group were low in Coronel Sapucaia, Paranhos, and Ponta Porã, but moderate in Sete Quedas and highest for patients aged 40–69 years old and those aged 70 and older. In a study conducted in the northern state of Pará, Melo et al. found cases of relapse in the age range of 29–42 years.

Overall, a low educational level was found in the present study: 44.2% of patients was illiterate or having less than 4 full years of schooling, in contrast with 34.9% with 4 to 7 years of schooling in an investigation conducted by Maranzi et al.

Leprosy affects the poor people more strongly. Furthermore, poor education translates to unfavourable working conditions and lower income, rendering the population investigated more vulnerable to disease and increasing the demand for healthcare services.

Conclusion

The findings of this study showed that 78.5% of leprosy detected cases were classified as multibacillary. For the other municipalities in the Brazilian boundary line, it was 51.5% for the same period. The highest rate found in the municipalities of the study was the Virchowian clinical form, which can influence in the operational classification in multibacillary.

The evidences of the peculiarities of study of border in the Brazil, as the predominance of the Virchowian clinical form, larger number of patients in rural areas of Ponta Porã, children under 15 years of age in the city of Sete Quedas and a level of detection worse than other municipalities of state and a worrying growth of this indicator over the last 2 years of this study.

To reduce the prevalence of leprosy in the dry border municipalities with contiguous urban area, the health services should consider the particularities of this regions, the cultural influence, the social patterns and epidemiology of leprosy, that demand higher qualification
of health teams, particularly the PHC, besides the clinical aspects of the disease. Priority and joint actions could be carried out between the two neighbouring countries, increasing the effectiveness in the diagnosis, treatment and monitoring of patients. Together, it is possible to reduce the disease burden due to leprosy and ensure that the physical and social consequences of the disease continue to decline in worldwide.

References

26 Mohite RV, Mohite VR, Durgawale PM. Differential trend of leprosy in rural and urban area of Western Maharashtra. Indian J Lepr, 2013; 85: 11–18.