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## Original article

# Evaluation of emerging infectious disease and the importance of SINAN for epidemiological surveillance of Venezuelans immigrants in Brazil



Mário Maciel de Lima Junior <sup>a,\*</sup>, Gabrielle Almeida Rodrigues <sup>b</sup>, Maysa Ruiz de Lima <sup>c</sup>

<sup>a</sup> Universidade Estadual de Roraima, Departamento de Medicina Interna, Boa Vista, RR, Brazil

<sup>b</sup> Universidade Federal de Roraima, Boa Vista, RR, Brazil

<sup>c</sup> Prefeitura de Pacaraima, Boa Vista, RR, Brazil

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## ABSTRACT

**Background:** Following socio-economic turmoil in Venezuela, millions of the Venezuelan people are migrating to the neighboring Latin American countries including Brazil. Besides the social and economic burden of these migrants, Brazil must manage the health-related issues arising as consequence of these Venezuelan migrants.

Poor health services in Venezuela along with unhygienic travelling conditions, lack of food (malnutrition) and potable water, unhealthy and overcrowded refugee camps or shelters, poor availability of medical services have made the migrant Venezuelan population susceptible to various diseases, especially infectious diseases.

SINAN system is a health-related system in Brazil that keeps track of different health occurrences in the society and allows health care workers and policymakers free access to these data.

**Objectives:** To evaluate the emergence of infectious diseases as a consequence of the arrival of Venezuelans immigrants in Brazil and to assess the importance of SINAN for epidemiological surveillance.

**Methods:** Observational retrospective study. Data were collected from the SINAN system between 2015 and 2017 and was analyzed using descriptive statistics, and Mann-Whitney test (using SPSS tool version 12). Evaluated infectious diseases in this study were tuberculosis, sexually transmitted infections (STIs), HIV/AIDS, syphilis, viral hepatitis, leishmaniasis, and malaria.

**Results:** STIs were the most commonly reported diseases. Compared to Brazilians, Venezuelan migrants reported significantly higher number of HIV/Aids ( $p < 0.046$ ) and leishmaniasis cases ( $p < 0.049$ ), while Brazilians reported significantly higher number of hepatitis cases ( $p < 0.046$ ). Malaria was also more prevalent among Venezuelan migrants than native Brazilians.

\* Corresponding author at: Rua Levindo, Inácio de Oliveira, 1547, Paraviana, Boa Vista, RR CEP: 69307-272, Brazil.

E-mail addresses: [mmljr@uol.com.br](mailto:mmljr@uol.com.br) (M.M. de Lima Junior), [gabrielle.enf@hotmail.com](mailto:gabrielle.enf@hotmail.com) (G.A. Rodrigues), [maysaruiz@hotmail.com](mailto:maysaruiz@hotmail.com) (M.R. Lima).

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Conclusion: Increased incidence of infectious diseases among the migrant population should be considered seriously as lack of adequate control of these diseases might lead to outbreaks.

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## Introduction

Reliable information is of paramount importance towards adequate monitoring and delivery of health care services.<sup>1</sup> It is already established that the backbone of a successful disease control program is a strong disease information system as it not only provides the information essential to run the program satisfactorily but also lends support to different decision-making including allocation and rational use of resources.<sup>2</sup>

Failure of disease control programs has been mainly attributed to lack of credible and evidence-based decision making in health sectors.<sup>2,3</sup> Other obstacles were outdated, incomplete and incomprehensible health related data.

To overcome all these hindrances, in 1994 the Brazilian Government introduced a nationwide disease information system for notifiable diseases, the SINAN (“Sistema Nacional de Agravos de Notificação”).<sup>2,4</sup>

In the year 2004, the Brazilian Ministry of Health stated the objectives of SINAN as to diagnose any health-related occurrences in a population, to assess the associated risk factors, and to provide information to identify specific epidemiological situations in a given geographic area.<sup>2,5</sup> The systematic information provided by SINAN is stated to be decentralized so that all health professionals and the community may have access to it. Thus, it plays a pivotal role in not only planning, and prioritizing of objectives but also in successfully implement, monitor and evaluate health related interventions.<sup>2,5</sup>

According to a 2008 WHO report, in developing countries of all diseases infectious diseases such as HIV/Aids (5.2%), malaria (4%) and tuberculosis (2.7%) were are the prevailing ones.<sup>2,6</sup> The report also mentioned that the so-called neglected tropical diseases (NTDs) were also quite common.<sup>7,8</sup>

According to a report published by the International Organization for Migration in 2009, around 3% of the global population are migrants of which 200 million people are documented as international migrants and around 26 million people are estimated to be internally displaced in 52 countries.<sup>9</sup> Especially in the past 50 years, huge number of people have been forced to migrate from their own countries to other countries due to various causes (especially due to socio-economic unrest, war, etc.).<sup>10–12</sup>

In 2004 Saker et al. published in their report that population mobility might lead to several health-related negative consequences affecting the migrant population, the host population, or both.<sup>13</sup> The most significant impact of migration is the spread of infectious diseases. Most of the epidemics in human history occurred due to population migration either as consequence of war or of a complete change in the whole society.<sup>14</sup> Thus, the spread of infectious disease from one country to other countries remains the most important

concern for international organizations.<sup>15</sup> The black death (bubonic plague) in Europe most likely occurred due to conflict with Asia minor and then it spread rapidly through trade routes.

The close association between migration and emergence of diseases, both in the host and the migrant population, can be explained by several factors. Firstly, the unfavourable environmental or social conditions which led to migration of the population in the first place like poverty, overcrowded settlements, poor economic infrastructure, and collapse of health care, scarcity facilities, lack of sanitation, safe and potable water, and education, etc. Secondly, the entire process of migration from one country to another might make the migrating population susceptible to diseases, as the risk of emergence of infectious diseases care increases because of lack of proper sanitation, availability of safe drinking water, scarcity of food leading to malnutrition, overcrowding, etc. Even after reaching the host countries, the migrant population might remain susceptible to various infectious diseases especially due to overcrowded shelters or refugee camps, and poor availability of food, potable, water, and health care facilities.

According to a 1994 report of the US Centers for Disease Control and Prevention around 50,000 people died due to cholera when leaving Rwanda migrating to Zaire. Similarly, incidences of malaria outbreaks in the refugee camps of Afghanistan and Pakistan are well documented.<sup>16</sup> In 1999 Rowland et al. described the occurrence of cutaneous leishmaniasis among one third of the Afghan refugees in Pakistan.<sup>17</sup>

Sometimes contact with newer populations (host), newer microbes, vectors, cultural changes, behavioural and lifestyle changes might again increase the risk of infection in the already vulnerable migrant population. Several atypical vector-borne infections especially louse-borne diseases like epidemic typhus and relapsing fever are commonly prevalent in refugee camps and are associated with high fatality rate. Moreover, overcrowding in poor sanitary conditions might lead to emergence of atypical infections and multidrug resistant strains of common microbes.

Currently, the poor socioeconomic status of Venezuela has driven thousands of its citizens to migrate to different countries including Brazil. Incessant entry of Venezuelan migrants to Brazil has led to several socio-economic issues including health related issues. Thus, regular epidemiological surveillance, especially for infectious diseases, of the migrant Venezuelan and the local host population is essential to prevent outbreaks.

The objective of this study was to evaluate the emerging infectious diseases among Venezuelans immigrants in Brazil and to assess the importance of SINAN for epidemiological surveillance in the same population.

**Table 1 – Demand for health related interventions by Brazilians and Venezuelan migrants in the municipality of Pacaraima, Roraima state, Brazil, 2015–2017.**

	Brazilians and foreigners seeking medical attention from 2015–2017		Brazilians and foreigners seeking dental appointments in 2017		Brazilians and foreigners seeking appointments for dressing in 2017		Brazilians and foreigners requiring nebulization in 2017		Brazilians and foreigners requiring injectable drugs in 2017	
	Brazilians	Foreigners	Brazilians	Foreigners	Brazilians	Foreigners	Brazilians	Foreigners	Brazilians	Foreigners
January	315	128	80	20	315	128	0	0	0	0
February	297	122	127	23	297	122	1	0	1	0
March	364	179	158	58	364	179	0	0	0	0
April	226	130	100	92	226	130	1	1	1	1
May	369	284	136	80	369	284	2	0	2	0
June	321	262	182	70	321	262	0	0	0	0
July	242	262	130	80	242	262	5	17	5	17
August	291	344	151	59	291	344	3	63	3	63
September	256	268	45	20	256	268	2	42	2	42
October	349	306	114	47	349	306	2	86	2	86
November	269	240	186	52	269	240	4	106	4	106
December	254	174	116	45	254	174	3	63	3	63

## Materials and methods

The study was a three-year retrospective observational study covering all infectious diseases reports between 2015 and 2017.

### Study site

#### Place of study

The study analyzes data available from the municipality of Pacaraima, Brazil during the study period (2015–2017). The municipality of Pacaraima is located in the North of the State of Roraima, in the North mesoregion, Boa Vista microregion, located at the geographical coordinates 61°09′15″ West longitude and 04° 29′33″ North latitude. It is limited to the North by the Bolivarian Republic of Venezuela, to the South by Municipalities of Boa Vista and Amajari, to the East by Municipalities of Normandy and Uiramutã, and to the West by Municipality of Amajari (Ministry of Defense, 2004). It has a territorial area of 8,028,483 km<sup>2</sup> which corresponds to 3.58% of the territory of Roraima (SEPLAN, 2014). According to data from the IBGE/Demographic Census, in 2017 the municipality had a population of 12,375 people (IBGE, 2017). In relation to basic health care, the municipality has five teams of family health strategy (ESF), four oral health teams and 28 community health agents (ACS). Of these five ESF teams, three are serving in the municipality headquarters and two in indigenous communities (São Marcos and Raposa Serra do Sol). In addition to the ESF teams, the municipality has implemented the Family Health Support Nucleus (NASF), modality 1, which are multiprofessional teams that has an integrated work with the Family Health teams (eSF), the Primary Care teams for specific populations (Offices in the Street - eCR) and with the Health Academy Program.

### Data collection

Data collection was carried out through consultation with SINAN and through the software DATASUS.

All the data available in the SINAN system regarding infectious diseases reported between 2015 and 2017 for the municipality of Pacaraima were abstracted and analyzed. For the purpose of analysis the infectious diseases tuberculosis, sexually transmitted infections, HIV/Aids, syphilis, viral hepatitis, leishmaniasis, and malaria were considered. In addition, data available on medical consultation, dental consultation, nursing services, and other health related services were also taken into account.

Country of origin (Brazil or Venezuela) of study subjects was also considered to assess the specific health conditions (infectious diseases) among the different groups of people.

### Statistical analysis

Data of all the three years (2015, 2016, and 2017) were compiled and analyzed. Descriptive statistics were used to analyze the data initially. Specific infectious diseases rates reported among Brazilians and Venezuelans were compared with the nonparametric Mann-Whitney test. Any p-value <0.05 was considered to be statistically significant. All analyses were conducted using the software STATA v12.

## Results

Total number of medical appointments in the three years (2015–17) was 6252, of which 3553 (56.8%) were sought by Brazilians and remaining by Venezuelans (Table 1 and Fig. 1). No prominent pattern was observed for Brazilian residents; however, the number of Venezuelans seeking medical care increased over the time from January to August followed by small drop during the later months of the year.

In 2017, out of those who sought dental care 1525 (70.24%) were Brazilians and the remaining were Venezuelan migrants (n = 646) (Table 1). Still in 2017, the number of dressings provided was higher for Venezuelans (n = 518) than for Brazilians (n = 60) (Table 1). In addition, 378 Venezuelans required nebulization and 384 required injectable drugs, numbers much higher than the 23 and 62 Brazilians, respectively (Table 1).

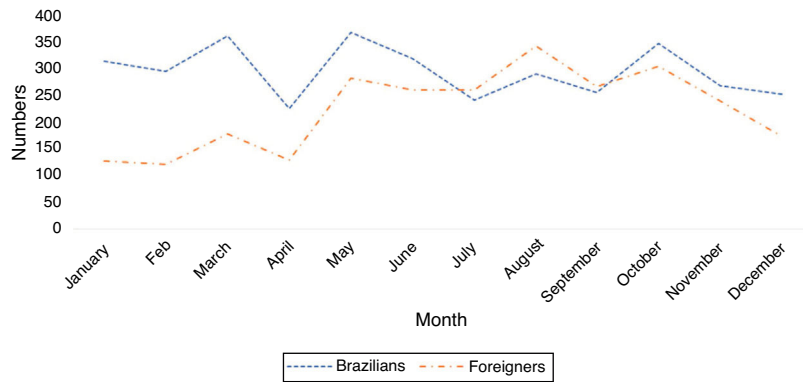


Fig. 1 – Number of medical appointments sought each month from 2015 to 2017.

Table 2 – Reported infectious diseases among Brazilians and Venezuelan migrants in the municipality of Pacaraima, Roraima state, Brazil, 2015–2017.

Disease	Brazil (number)	Venezuela (number)	Total (number)	p-value
Tuberculosis	7	9	16	0.658
Sexually transmitted disease	396	333	729	0.275
HIV/AIDS	08	25	33	0.046*
Syphilis	4	4	8	1.00
Hepatitis	39	1	40	0.046*
Leishmaniasis	65	207	267	0.049*

\* p-value <0.05 (Mann-Whitney test).

Both Brazilians and Venezuelan migrants reported all the evaluated infectious diseases namely tuberculosis, STIs, HIV/Aids, syphilis, hepatitis, and leishmaniasis. Majority of the reports were for STIs and of the 729 STI cases 396 were reported by Brazilians and 333 by Venezuelan migrants in Brazil. However, the numbers of reporting for each disease varied between the two groups (Table 2). There were more cases of tuberculosis, HIV/Aids, and leishmaniasis among Venezuelan migrants (tuberculosis = 9; HIV/Aids = 25; leishmaniasis = 207) than among Brazilians (tuberculosis = 7; HIV/Aids = 8; for leishmaniasis = 65) (Table 2). Nonetheless, there were reports of STIs and hepatitis (STIs = 396; hepatitis = 39) among Brazilians than among Venezuelan migrants in Brazil (STIs = 333; hepatitis = 1) (Table 2). Despite the differences in the numbers of reporting between the two groups for each infection (except for syphilis; four in both groups), only for hepatitis and HIV/Aids the differences were significant ( $p = 0.046$  for both infections).

Malaria screening for residents was usually done during the period of March–June, but there was an increase in the number of screening in August 2016 (Fig. 2). In 2016, a higher proportion of screened people for malaria was positive during first half of the year, whereas in 2017 there were more malaria cases reported at the end of the year (October–December) (Fig. 3).

## Discussion

Venezuela was once considered among the leading countries of the Latin America regarding vector borne diseases and strong and efficient public health related policies.<sup>18,19</sup> It was

considered the first country to eradicate malaria following a very successful insecticide spraying campaign.<sup>19</sup> However, there has been a rise of vector borne diseases in Venezuela. Among the many attributing factors for this crisis, shortage/poor supply of insecticides, antiparasitic drugs, and fuel are the major factors along with widespread malnutrition, collapse of the existing health system, poor epidemiological surveillance and almost no reporting of infectious diseases cases.<sup>20,21</sup> Besides vector borne diseases, viral infections especially arboviral diseases like dengue, chikungunya, and Zika are on the rise.<sup>22</sup> One of the most important reemerging parasitic diseases in Venezuela is malaria; there is almost three-fold increase in the incidence of malaria cases since 2014.<sup>18,23</sup> Besides malaria, Chagas disease and leishmaniasis are the other two vector borne diseases which are posing severe threat to Venezuela.<sup>24,25</sup>

Currently, with political unrest and collapse of once thriving economic system, the health care system of this country has also collapsed. Lack of jobs, economic stagnation, high inflation, high rate of crime, poor availability of day amenities have led millions of Venezuelan citizens to migrate from their own land to other Latin American countries including Brazil.<sup>18</sup>

Migrant populations as such usually suffer from different health related problems due to travelling in unhygienic conditions, lack of food, potable water, overcrowding, poor medical care, etc. In addition, settlement in the new country might prove very difficult especially if the number of migrants exceeds the capacity of the hosting country. The number of Venezuelan migrants to Brazil had a striking increase each passing day and Brazil has started to take humanitarian steps

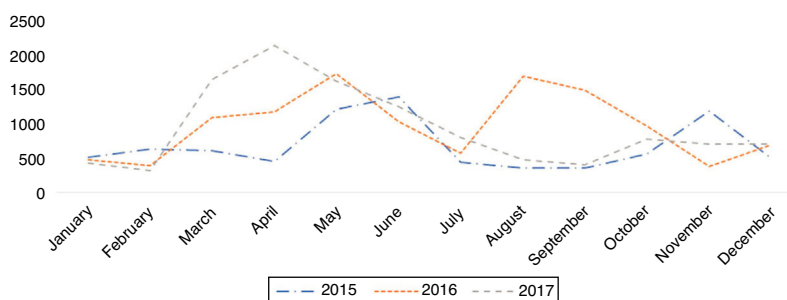


Fig. 2 – Number of people tested for malaria each month from 2015 to 2017.

for the Venezuelan migrants. Among all the other issues, health related issues are of immense importance as there are possibilities that many of the infectious diseases might spread from these Venezuelan migrants to the locals.

In this retrospective observational study we have assessed the importance of the Brazilian health-related information system (SINAN) regarding surveillance of certain infectious diseases in the municipality of Pacaraima between 2015 and 2017 where huge numbers of Venezuelan migrants have taken shelter by collecting data.

Data analysis revealed that about equal number of Brazilians and Venezuelan migrants were seeking medical attention, but Venezuelan migrants seeking treatment (both medical and dental) seemed to be on the rise (Table 1). Reporting of HIV/Aids cases were significantly higher among Venezuelan migrants in Brazil ( $p=0.046$ ) and those of hepatitis was significantly higher among Brazilians ( $p=0.046$ ) (Table 2).

The number of malaria positive cases were far greater among the Venezuelan migrants in Brazil ( $n=340, 1262,$  and  $943$  in 2015, 2016, and 2017, respectively) compared to Brazilians ( $n=170, 169,$  and  $285$  in 2015, 2016, and 2017, respectively) (Table 3).

Thus, it is evident that the incidence of infectious diseases especially malaria is significantly higher in Venezuelan migrants.

In line with the present study, Tuite et al. have also shown the implication of Venezuelan migrants on emergence and re-emergence of previously controlled infectious diseases like

Table 3 – Number of cases positive for malaria among Brazilians and Venezuelan migrants in the municipality of Pacaraima, Roraima state, Brazil, 2015–2017.

Year	Local dwellers	From other states	Venezuelans	Total
2015	170	10	340	520
2016	169	13	1262	1444
2017	285	22	943	1250
Total	624	966	2545	3214

tuberculosis, malaria, diphtheria, measles, etc. and on subsequent outbreaks of these diseases in host as well as migrant populations.<sup>26</sup>

Pavli et al. published a systematic review including all the published articles (using PubMed search and published between 2003 and 2016) on health problems (both communicable and noncommunicable) in migrants and refugees coming to Europe. Like our study, they also noted that the burden of diseases due to population migration cannot be ignored and underscored the need for a multidisciplinary integrated approach would be best for both the migrant and the host population.<sup>27</sup>

Another interesting finding of this study is the number of live births reported among Brazilians and Venezuelan migrants in Brazil (Table 4). The number of live births among Brazilians (80, 91, and 77, in 2015, 2016, and 2017, respectively) were quite high compared to those among the Venezuelan migrants to Brazil (17, 32, and 45, in 2015, 2016, and 2017, respectively) (Table 4). This suggests probable lack of proper

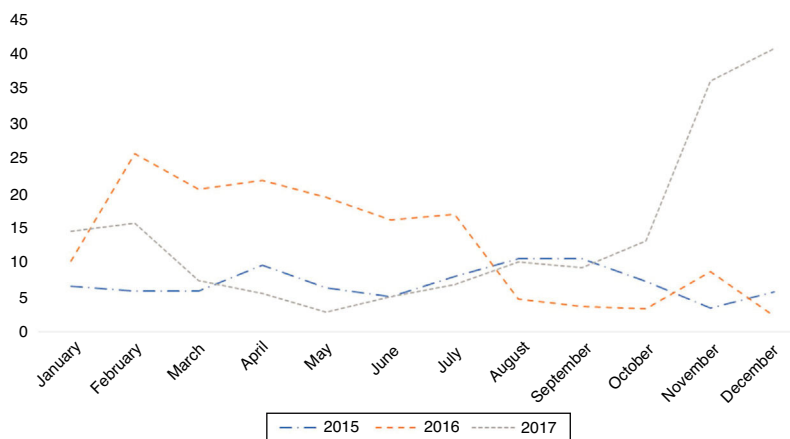


Fig. 3 – Percentage of malaria positive case each month from 2015 to 2017.

**Table 4 – Number of live births among Brazilians and Venezuelan migrants in the municipality of Pacaraima, Roraima state, Brazil, 2015–2017.**

Year	Brazilians	Venezuelans	Total
2015	80	17	97
2016	91	32	123
2017	77	45	122

antenatal medical care among the migrant population compared to local people. However, as the number of live births is increasing among Venezuelan migrants in Brazil it suggests that pregnant migrant women are benefiting from better health care they are receiving in Brazil.

## Conclusion

Evaluation of emergence of infectious diseases among Venezuelan migrants in Brazil, the incidence of several infectious diseases like malaria are significantly higher in the Venezuelan population compared to local Brazilian people. Also, the importance of the SINAN system for epidemiological surveillance in both migrant and host populations cannot be underestimated.

## Conflict of Interest

The authors declare no conflicts of interest.

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