Original article

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

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Introduction

Reliable information is of paramount importance towards adequate monitoring and delivery of health care services. 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.

Failure of disease control programs has been mainly attributed to lack of credible and evidence-based decision making in health sectors. 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”).

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. 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.

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 the prevailing ones. The report also mentioned that the so-called neglected tropical diseases (NTDs) were also quite common.

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. 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.).

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. 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. Thus, the spread of infectious disease from one country to other countries remains the most important concern for international organizations. 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 unfavorable 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. In 1999 Rowland et al. described the occurrence of cutaneous leishmaniasis among one third of the Afghan refugees in Pakistan.

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.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brazilians</td>
<td>Foreigners</td>
<td>Brazilians</td>
<td>Foreigners</td>
<td>Brazilians</td>
</tr>
<tr>
<td><strong>January</strong></td>
<td>315</td>
<td>128</td>
<td>80</td>
<td>20</td>
<td>315</td>
</tr>
<tr>
<td><strong>February</strong></td>
<td>297</td>
<td>122</td>
<td>127</td>
<td>23</td>
<td>297</td>
</tr>
<tr>
<td><strong>March</strong></td>
<td>364</td>
<td>179</td>
<td>158</td>
<td>58</td>
<td>364</td>
</tr>
<tr>
<td><strong>April</strong></td>
<td>226</td>
<td>130</td>
<td>100</td>
<td>92</td>
<td>226</td>
</tr>
<tr>
<td><strong>May</strong></td>
<td>369</td>
<td>284</td>
<td>136</td>
<td>80</td>
<td>369</td>
</tr>
<tr>
<td><strong>June</strong></td>
<td>321</td>
<td>262</td>
<td>182</td>
<td>70</td>
<td>321</td>
</tr>
<tr>
<td><strong>July</strong></td>
<td>242</td>
<td>262</td>
<td>130</td>
<td>80</td>
<td>242</td>
</tr>
<tr>
<td><strong>August</strong></td>
<td>291</td>
<td>344</td>
<td>151</td>
<td>59</td>
<td>291</td>
</tr>
<tr>
<td><strong>September</strong></td>
<td>256</td>
<td>268</td>
<td>45</td>
<td>20</td>
<td>256</td>
</tr>
<tr>
<td><strong>October</strong></td>
<td>349</td>
<td>306</td>
<td>114</td>
<td>47</td>
<td>349</td>
</tr>
<tr>
<td><strong>November</strong></td>
<td>269</td>
<td>240</td>
<td>186</td>
<td>52</td>
<td>269</td>
</tr>
<tr>
<td><strong>December</strong></td>
<td>254</td>
<td>174</td>
<td>116</td>
<td>45</td>
<td>254</td>
</tr>
</tbody>
</table>

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.

**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 km² 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 have 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.

**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).
Besides

in

HIV/Aids

ease

HIV/Aids,

of

cases

V enezuela

310

in

the

tis

there

more

cases

were

reported

in

Brazil.

p-value

for

screening

numbers

was

considered

the

country

to

eradicate

malaria

following

a

very

successful

insecticide

spraying

campaign.19

However,

there

has

been

a

rise

of

vector

borne

diseases

in

V enezuela.

Majority

of

the

reporting

for

each

disease

varied

among

the

two

groups

(Table

2).

There

were

more

cases

of

tuberculosis,

HIV/Aids,

and

leishmaniasis

among

V enezuelan

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

V enezuelan

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

signif-

icant

(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.14,25

It

was

considered

the

first

country

to

eradicate

malaria

following

a

very

successful

insecticide

spraying

campaign.19

However,

there

has

been

a

rise

of

vector

borne

diseases

in

V enezuela.

Among

the

many

attributing

factors

for

this

crisis,

short-

age/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.

Besides

vector

borne

diseases,

viral

infections

es-

pecially

arboviral

diseases

like
dengue,

chikungunya,

and

Zika

are

on

the

rise.22

One

of

the

most

important

reemerging

parasitic

diseases

in

V enezuela

is

malaria;

there

is

almost

three-fold

increase

in

the

incidence

of

malaria

cases

since

2014.18,23

Besides

malaria,

Chagas
disease

and

leishmaniasis

are

the

other

two

vector

borne

diseases

which

are

posing

severe

threat

to

V enezuela.24,25

Currently,

with

political

unrest

and

collapse

of

once

thrive-

ing

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

V enezuelan

citizens

to

migrate

from

their

own

land

to

other

Latin

American

countries

including

Brazil.18

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

V enezuelan

migrants

to

Brazil

had

a

striking

increase

each

passing

day

and

Brazil

has

started

to

take

humanitarian

steps.
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 \( (n = 340, 1262, \text{and } 943 \text{ in } 2015, 2016, \text{and } 2017, \text{respectively}) \) compared to Brazilians \( (n = 170, 169, \text{and } 285 \text{ in } 2015, 2016, \text{and } 2017, \text{respectively}) \) (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 tuberculosis, malaria, diphtheria, measles, etc. and on subsequent outbreaks of these diseases in host as well as migrant populations.²⁶

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.²⁷

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 \( (80, 91, \text{and } 77 \text{ in } 2015, 2016, \text{and } 2017, \text{respectively}) \) were quite high compared to those among the Venezuelan migrants to Brazil \( (17, 32, \text{and } 45 \text{ in } 2015, 2016, \text{and } 2017, \text{respectively}) \) (Table 4). This suggests probable lack of proper

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Local dwellers</th>
<th>From other states</th>
<th>Venezuelans</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>170</td>
<td>10</td>
<td>340</td>
<td>520</td>
</tr>
<tr>
<td>2016</td>
<td>169</td>
<td>13</td>
<td>1262</td>
<td>1444</td>
</tr>
<tr>
<td>2017</td>
<td>285</td>
<td>22</td>
<td>943</td>
<td>1250</td>
</tr>
<tr>
<td>Total</td>
<td>624</td>
<td>966</td>
<td>2545</td>
<td>3214</td>
</tr>
</tbody>
</table>

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

**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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Brazilians</th>
<th>Venezuelan</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>80</td>
<td>17</td>
<td>97</td>
</tr>
<tr>
<td>2016</td>
<td>91</td>
<td>32</td>
<td>123</td>
</tr>
<tr>
<td>2017</td>
<td>77</td>
<td>45</td>
<td>122</td>
</tr>
</tbody>
</table>

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.

REFERENCES