



ISSN: 2230-9926

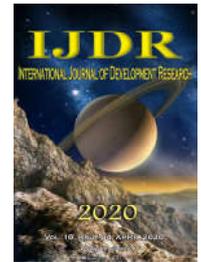
Available online at <http://www.journalijdr.com>

# IJDR

International Journal of Development Research

Vol. 10, Issue, 04, pp. 35467-35473, April, 2020

<https://doi.org/10.37118/ijdr.18742.04.2020>



RESEARCH ARTICLE

OPEN ACCESS

## DETECTION OF VIRAL HEPATITIS B AND C IN A METROPOLITAN REGION IN NORTHERN BRAZIL

\*<sup>1</sup>Maria Helena Cunha Oliveira; <sup>2</sup>Lena Lillian Canto de Sá Moraes; <sup>3</sup>Fernanda Rafaela de Souza Rebelo da Costa; <sup>4</sup>Lidineusa Machado Araújo; <sup>5</sup>Andréa de Melo Valente; <sup>6</sup>Michelle da Silva Pereira; <sup>7</sup>Antônio Marcos Mota Miranda; <sup>8</sup>Ricardo José de Paula Souza e Guimarães <sup>9</sup>Tássio Ricardo Martins da Costa and <sup>10</sup>Maria de Nazaré Rodrigues Pereira Martins

<sup>1</sup>PhD from the Evandro Chagas Institute (IEC). Master in Epidemiology by Fio Cruz. Public servant of the Executive Secretariat of Public Health of the Department of Epidemiology and of the Coordination of Viral Hepatitis (SESPA/DEPI). Professor at the Federal Institute of Education Science and Technology of Pará (IFPA). Belém, Pará, Brazil. <sup>2</sup>PhD in Biology of Infectious and Parasitic Agents, Federal University of Pará (UFPA). Master in Biology of Infectious and Parasitic Agents. Public servant at the Evandro Chagas Institute / Ananindeua Environment Department, Pará, Brazil. <sup>3</sup>Health manager at the Federal Institute of Science and Technology Education of Pará (IFPA). Specialist in Education and health, Federal University of Rio Grande do Sul. Health services auditor, Faculty Porto União (FAVENI). Belém, Pará, Brazil. <sup>4</sup>Master in Virology from Instituto Evandro Chagas (IEC). Public health specialist. Professor at the Federal Institute of Education Science and Technology of Pará (IFPA). Belém, Pará, Brazil. <sup>5</sup>Forest Engineer, Federal Rural University of the Amazon (UFRA). Remote Sensing Specialist - IG. Master in Natural Resource Management and Local Development in the Amazon from the Federal University of Pará (UFPA). Professor at the Federal Institute of Education Science and Technology of Pará (IFPA). Belém, Pará, Brazil. <sup>6</sup>Technologist in public health management. Master in Health, Society and Endemics in the Amazon by the Federal University of Amazonas (UFAM). Specialization in Health and Socio-environmental Sciences. Professor at the Federal Institute of Science and Technology Education of Pará. Belém, Pará, Brazil. <sup>7</sup>PhD in Public Health by the Federal University of Rio de Janeiro (UFRJ). Master in Tropical Medicine. Specialist in Epidemiology from the State University of Pará (UEPA). Professor at the Federal Institute of Scientific and Technological Education of Pará. Belém, Pará, Brazil. <sup>8</sup>PhD in Biomedicine by the Institute of Teaching and Research of Santa Casa de Belo Horizonte. Master in Remote Sensing by the National Institute for Special Research. Member of the Department of Geoprocessing of Pará, at the Evandro Chagas Institute (IEC). Belém, Pará, Brazil. <sup>9</sup>Nurse. State University of Pará (UEPA). Editor-in-chief, Publisher *Neurus*. Belém, Pará, Brazil; <sup>10</sup>Nutritionist. Master in Education, University of Brasília (UnB). Specialist in Public Health. Professor at the Federal Institute of Education, Science and Technology of Pará (IFPA). Belém, Pará, Brazil

### ARTICLE INFO

#### Article History:

Received 11<sup>th</sup> January, 2020

Received in revised form

03<sup>rd</sup> February, 2020

Accepted 06<sup>th</sup> March, 2020

Published online 30<sup>th</sup> April, 2020

#### Key Words:

Hepatitis, Viral, Human;  
Health Services Research;  
Uses of Epidemiology.

\*Corresponding author: *Maria Helena Cunha Oliveira*

### ABSTRACT

**Objective:** Analyze the SINAN epidemiological database for cases of viral hepatitis B and C, using the Linkage tools between the databases of the Laboratory Environment Manager (GAL) and the data from the Foundation of Hemotherapy and Hematology Center of Pará (HEMOPA). **Method:** Cross-sectional and descriptive epidemiological study, based on information on HBV and HCV collected in the SINAN databases, Environment Manager of the Laboratory of the Evandro Chagas Institute (GAL-IEC), Central Laboratory of the State of Pará (GAL-Lacen) and blood donation screening sheets of the Foundation Center for Hemotherapy and Hematology of Pará (HEMOPA), with reagent results for hepatitis C anti-HCV serological markers and hepatitis B HBsAg serological markers. **Results:** The statistical test applied in this study proved the distance between the averages of the detection rates calculated with information from all complementary bases in relation to the information from SINAN, analyzed in all the municipalities of the Metropolitan Region I. Therefore, the rates calculated between all bases during the period 2010 to 2015 reflected an increasing trend for HBV and HCV in all municipalities. In the years 2014 and 2015, the rates were higher in all the municipalities analyzed. The data demonstrated that the detection rates of HBV and HCV were above the rate for Brazil and the state of Pará, confirming the existence of underreporting of cases. **Conclusion:** The cases captured in the complementary databases allowed to improve the sensitivity of the notification system of HBV and HCV in the SINAN base, of the municipalities of the Metropolitan Region I, in the state of Pará.

Copyright © 2020, *Maria Helena Cunha Oliveira et al.* This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**Citation:** *Maria Helena Cunha Oliveira; Lena Lillian Canto de Sá Moraes; Fernanda Rafaela de Souza Rebelo da Costa et al.* "Detection of viral hepatitis b and c in a metropolitan region in Northern Brazil", *International Journal of Development Research*, 10, (04), 35467-35473.

### INTRODUCTION

Viral hepatitis is a health problem with high magnitudes and severities in public health. According to data from the 2015 global report, these diseases are responsible for 1.34 million

deaths related to chronic forms that can lead to the appearance of serious complications, such as cirrhosis which represents 720 thousand deaths, and hepatocellular carcinoma which represents 470 thousand deaths (WHO, 2017). However, in cases where the diagnosis is made in the early stages and the

intervention occurs in a timely manner, hepatocellular carcinoma is potentially curable (Chedid *et al.*, 2017). The geographical distribution of viral hepatitis, in Brazil and worldwide, is wide and uneven, whose epidemiological behavior has undergone major changes in recent years. In addition, the relationship between the virus, the disease and the geographic space needs clearer explanations to understand its evolution, from the moment the disease is identified, until its last stages of evolution, such as cure, chronicity or death (Brasil, 2018). In addition, data from the 2018 epidemiological bulletin show, from 1999 to 2017 by region of Brazil, that the detection rate of the hepatitis B virus (HBV) occurred at 14.3 per 100,000 inhabitants in the northern region and was the third highest rate from the country. This bulletin also expresses that the hepatitis C virus (HCV) had a rate of 3.7 per 100,000 inhabitants and represented the last in the ranking by regions, both compared to the national rate of 11.9 per 100,000 inhabitants. As for the state of Pará, the incidence rate of HBV was higher than that of the capital Belém, in relation to HCV the pattern was reversed, since the incidence of Belém was higher than that of the state. However, in the state, the rates of the two viruses were below national averages, which are 6.5% for HBV and 11.9% for HCV (Brasil, 2018).

In 1996, viral hepatitis was included in the List of Diseases of Compulsory Notification (LDNC) in Brazil, after four years of implantation of the Information System for Notifiable Diseases (SINAN), a health information system used to store information about diseases in the LDNC (Almeida and Alencar, 2000; Laguardia *et al.*, 2004). In continuity, in 2003, the Health Surveillance Secretariat of the Ministry of Health (SVS / MS) became the administrator of this system (Brazil, 2015) and standardized the instruments for collecting information on the diseases of compulsory notification (DNC) by through the Notification Form and Individual Investigation Form, composed of mandatory and essential variables, important to better describe the natural history of the disease (Mascarenhas and Gomes, 2011). The database generated by SINAN is identified as a valid source for the construction of morbidity statistics at the municipal, state and federal levels, which shows the importance of studies that analyze and discuss the quality of this source of information for public health, even that some point out the poor quality of this system in terms of completeness and consistency (Almeida and Alencar, 2000; Laguardia *et al.*, 2004). In the State of Pará, assistance services are offered to the population with the potential to suspect, report and diagnose cases of viral hepatitis in the laboratory. However, it is difficult to identify whether the cases present in some of these sources have been officially reported to surveillance and included in SINAN. Therefore, it is emphasized that the relationship between the databases of information systems is a strategy used by health surveillance services to assess the sensitivity of the system in the identification of underreported cases. In addition, an effective and widely used alternative in epidemiology is the joint use of the Linkage tool and the Capture-Recapture information method (Wolter, 1991). These alternatives allow the monitoring of diseases in the population, which generates correct estimates of health indicators, even if the data provided by a given source are incomplete (Pinheiro; Andrade and Oliveira, 2012).

**Objective:** Analyze the SINAN epidemiological database for cases of viral hepatitis B and C, using the Linkage tools between the databases of the Laboratory Environment

Manager (GAL) and the data from the Foundation of Hemotherapy and Hematology Center of Pará (HEMOPA).

## MATERIALS AND METHODS

**Type of Study:** Cross-sectional and descriptive epidemiological study, based on information on HBV and HCV collected in the SINAN databases, Environment Manager of the Laboratory of the Evandro Chagas Institute (GAL-IEC), Central Laboratory of the State of Pará (GAL-Lacen) and blood donation screening sheets of the Foundation Center for Hemotherapy and Hematology of Pará (HEMOPA), with reagent results for hepatitis C anti-HCV serological markers and hepatitis B HBsAg serological markers. Notifications of viral hepatitis were obtained from secondary sources through the Directorate of Health Surveillance/Coordination of Viral Hepatitis of the Secretariat of Health of Pará (SESPA), of the Central Laboratory of the State of Pará (LACEN/PA), of the Evandro Chagas Institute (IEC) and the Center for Hemotherapy and Hematology of Pará (HEMOPA).

**Study location:** This research was carried out in Metropolitan Region I, which comprises one of the 13 Health Regions of the State of Pará, northern Brazil. In 2015, this region had a population coverage area of 2,039,298 inhabitants and five municipalities: Ananindeua, Belém, Benevides, Marituba and Santa Bárbara do Pará. The municipalities of Belém and Ananindeua are the most populous in the state, with 1,439,561 and 505,404 inhabitants in 2015, respectively, these numbers correspond to 23.63% of the population. The municipality of Santa Bárbara do Pará is the least populous, with 19,645 inhabitants (Instituto Brasileiro de Geografia e Estatística, 2015).

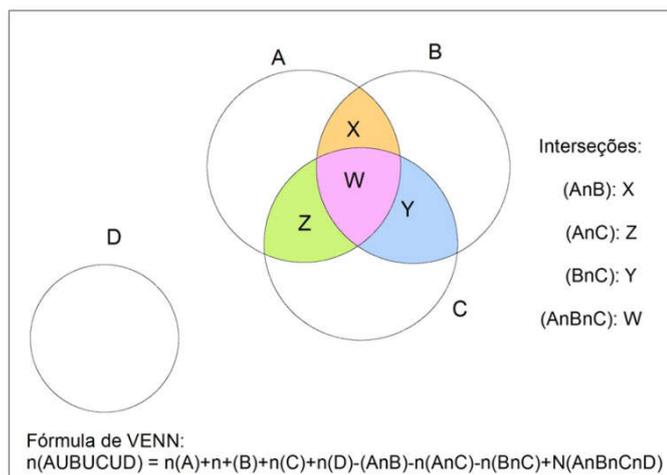
### Methodological procedures

**Data source:** In the period from January 2010 to June 2016, information was extracted from the SINAN and GAL databases, however, data from January 2010 to December 2015 were used to carry out this research. The Tabwin program, version 3.6 (Brasil, 2020), was used to generate the SINAN bank and, later, these data were transcribed in Microsoft office Excel 2007 software. GAL information and HEMOPA files were digitized using the same software.

**Collection and organization of data:** The deterministic technique of Linkage was adopted with the use of some identification variables common among the banks of SINAN, GAL-Lacen, GAL-IEC and HEMOPA, and the Capture-Recapture method to promote estimates of the detection rates of HBV and HCV and to identify the underestimation percentages of these rates with data constructed from SINAN.

The variables selected in Linkage were: i) name; ii) sex; iii) age, were grouped to allow the identification of duplicates. The contents were standardized and formatted with the creation of phonetic codes, sequentially the search was performed only once in each database. Thus, clean and standardized bases were used in the data connection stage. For this, one of the searches and reference available in the Microsoft Office Excel 2007 software was used. Indexing or blocking was used to reduce the number of registration links sent for comparison and classification. The process consists of dividing, in parts, the files related to the values of one or more

fields, constituting the indexing key, such as: (sex + phonetic code of the first name + phonetic code of the last name). Comparisons of records were restricted to records that agree with the value of this key. To demonstrate the Capture-Recapture method, the "VENN Diagram" was adopted, which mathematically illustrates the set theory. The method is used in epidemiology to make estimates of incidence and prevalence, even if data from incomplete sources are used and the exact number of cases is not known (Robles *et al.*, 1988). Therefore, the secondary data obtained from the databases represented the sets of the VENN diagram, as defined, SINAN (set A), GAL-IEC (set B), GAL-LACEN (set C) and information from HEMOPA (set D), as shown in figure 01 below.



Source: Research authors

**Figure 1. Representation of the VENN diagram on the databases with the number of cases of HBV and HCV that occurred in the cities of Metropolitan Region I, in the State of Pará, between the years 2010 to 2015, in Brazil**

To demonstrate the dependency relationship between the databases, SINAN (database A) was considered in this study as a positively dependent base of GAL (database B) and HEMOPA (database C), since a case found in database A is more likely to be captured by databases B and C. From then on, to reinforce this hypothesis of dependence, GAL-Lacen, GAL-IEC and HEMOPA, although they are independent databases, were considered complementary and notified to the epidemiological surveillance system that holds laboratory information responsible for confirming or discarding notified cases. In addition, a formula from the VENN diagram (figure 01) was used to find the total number of virus cases in the selected databases. The calculation basis occurred from the total number of cases registered in each base and was repeated (n) among them. The information in the databases was compared and adjusted to that of SINAN for the assembly of a second database. A cartographic base from the Brazilian Institute of Geography and Statistics (IBGE) was used to establish detection rates for HBV and HCV viruses and geographical maps of these rates in the municipalities in the region. As the detection rates were calculated in two moments, only data from SINAN and data from all databases (available in the second bank). Subsequently, the calculation of the underestimation of fees per year and for the municipalities of the region was performed, being used in the denominator of rates or data from IBGE. For the geospatial analysis, the ArcGis 10.5 geoprocessing program and the cartographic base of the municipalities of the state of Pará were used, which formed the shapefile 2015, available for download on the

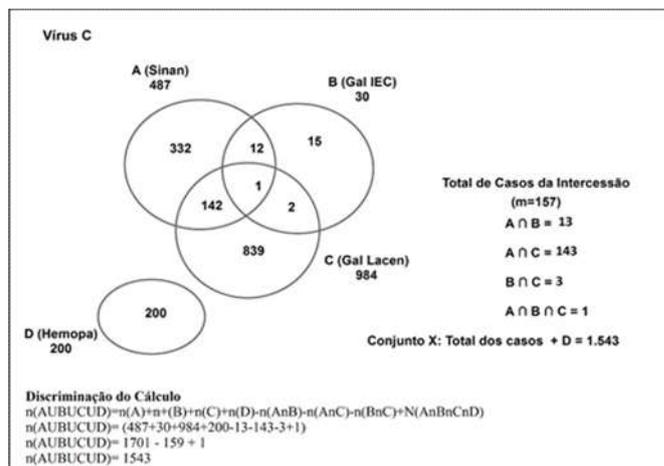
IBGE website, and on the hepatitis B and C database. The process of building the maps started with a section of the Metropolitan Region of Health I, which generated a new shapefile file just for that region. Information about the HBV and HCV viruses, available in the SINAN database, were spatially distributed in the municipalities of this new file and classified according to the detection rate, resulting in four maps, two with the data from the SINAN database and two with data from all databases, for each type of virus. The detection rate averages were analyzed using thematic maps of Metropolitan Region I, according to the following analysis parameters adopted: detection rate from 0 to 3.5 per 100,000 inhabitants (low); from 3.51 to 7.0 per 100,000 inhabitants (average) and above 7.0 per 100,000 inhabitants (high). The parameters were created by the authors, considering the values of the detection rates of the HBV and HCV viruses, respectively, namely: i) Brazil 7.6 per 100,000 inhabitants and 12.6 per 100,000 inhabitants; ii) Northern Region 16.7 per 100,000 inhabitants and 8.3 per 100,000 inhabitants; iii) State of Pará 3.6 per 100,000 inhabitants and 2.8 per 100,000 inhabitants. These estimates are from the Ministry of Health and are available in the 2017 Epidemiological Bulletin (Brasil, 2017).

To assess whether there is equivalence between the average detection rates of HBV and HCV viruses in the municipalities, calculated before and after capturing information from other databases, a two-sample equivalence test was performed, considering that these samples are independent. The test determined the existence of a difference (or ratio) between the average rates with a 95% significance level. In this equivalence test, intervals that were close were used to be considered equivalent to the reference average. This equivalence interval was based on the values of the detection rates of the HBV and HCV viruses in Brazil, North Region and Pará, defined by the Ministry of Health, in the Epidemiological Bulletin 2017 (Brasil, 2017). This study was prepared in accordance with the rules of Resolution 466/2012 of the National Health Council and approved by CONEP and authorized by the State Secretariat of Public Health (SESPA) and HEMOPA.

## RESULTS

The VENN formula was applied to identify repeated cases of HBV. The results showed 1,319 cases, on the following bases: 420 cases at SINAN, 281 cases at GAL-IEC, 523 cases at GAL-Lacen and 95 cases at HEMOPA. The cases identified in only one of the bases were 169 cases in SINAN, 166 in GAL-IEC, 333 in GAL-Lacen and 95 in HEMOPA, data corresponding to 763 cases, that is, 57.84% of the total. Regarding repeated cases, simultaneously, in more than one database, there are: 73 cases found in SINAN and GAL-IEC, 148 cases found in SINAN and GAL-Lacen, 12 cases found in GAL-IEC and GAL-Lacen and 30 cases found in all databases, these data represent 263 cases, that is, 19.93% of the total cases identified by the VENN formula for an HBV. In relation to the notified cases of HCV, 1,701 of the VENN formula were captured, of which 487 were identified based on SINAN, 30 based on GAL-IEC, 984 based on GAL-Lacen, 200 based on GAL-Lacen and 200 based on that of HEMOPA. After excluding the cases included in the crossing, 1,386 HCV cases were identified, of which 332 in SINAN, 15 in GAL-IEC, 839 in GAL-Lacen and 200 in HEMOPA. In addition, when these data were compared to verify repetition cases, 157 cases

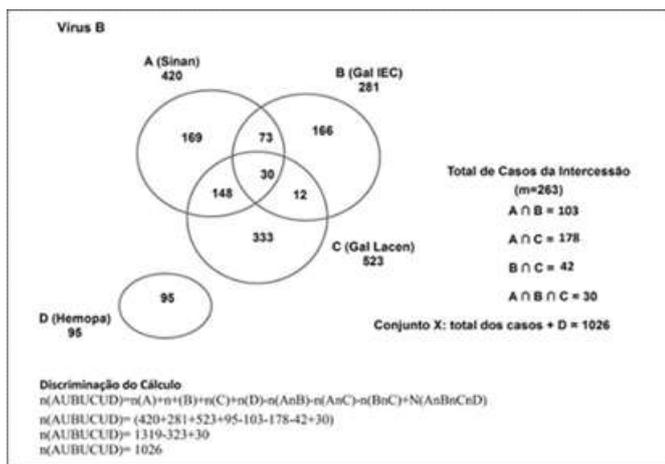
(9.22%) were observed, 12 between SINAN and GAL-IEC, 142 between SINAN and GAL-Lacen, two cases between GAL-IEC and GAL - Lacen and one case were observed in all databases. In addition, the cases registered in the HEMOPA database were not repeated among the other databases, therefore, on that basis the intersection was null. After removing the intersections, 2,569 cases of HBV and HCV were identified, of which 1,026 were of HBV, representing 39.9% of the cases and 1,543 of HCV, that is, 60.1% of the total cases. Of the total number of HBV cases, 606 (59.06%) were underestimated for SINAN. Regarding the total number of HCV cases, an underestimation of 1,055 cases (68.43%) was observed, that is, these data of underestimations allowed to identify 18.13% and 36.87% of the cases that were not registered with based on the SINAN of HBV and HCV, respectively, as expressed in figures 02 and 03.



Source: Research authors

Figure 3. Diagram of VENN with distribution of cases of HCV in the bases of SINAN, GAL-LACEN, GAL-IEC and HEMOPA, from the Municipalities of Metropolitan Region I, Pará, in Brazil

The equivalence test was used to verify whether the average of a population is equivalent to the average of a reference population, in this case, the two samples were considered independent. As reference data, the limits of the detection rates of HBV and HCV were calculated from the values specified for Brazil, for the North Region and for Pará, in the years 2010 and 2015. The results of this test demonstrated that there is no equivalence between the averages of the detection rates of HBV and HCV when calculated with the information from SINAN and recalculated with the information from other databases, that is, the values of the rates are not completely within the equivalence range for all municipalities. Throughout the analyzed period, rates for the two viruses in the municipalities were detected when recalculated with data from all databases, therefore, it was possible to underestimate the rates calculated with the information from SINAN.



Source: Research authors

Figure 02. Diagram of VENN with distribution of cases of HBV in the bases of SINAN, GAL-LACEN, GAL-IEC and HEMOPA, from the Municipalities of Metropolitan Region I, Pará, in Brazil

Table 1. Detection rate / 100 thousand inhabitants and percentage of underestimation of HBV, distributed by the municipality of residence of metropolitan region I, Pará, 2010 to 2015, in Brazil

| Year | Ananindeua       |       |       | Belém            |       |       | Benevides        |       |       | Marituba         |      |       | Santa Bárbara    |       |       |
|------|------------------|-------|-------|------------------|-------|-------|------------------|-------|-------|------------------|------|-------|------------------|-------|-------|
|      | Detection rate S | AB    | %US   | Detection rate S | AB    | %US   | Detection rate S | AB    | %US   | Detection rate S | AB   | %US   | Detection rate S | AB    | %US   |
| 2010 | 1,48             | 1,48  | 0,0   | 3,84             | 4,21  | 8,93  | 5,81             | 5,81  | 0,0   | 2,77             | 2,77 | 0,0   | 11,66            | 11,66 | 0,0   |
| 2011 | 2,09             | 5,02  | 58,33 | 1,78             | 5,21  | 65,75 | 1,89             | 5,67  | 100,0 | 1,80             | 3,61 | 50,0  | 0,0              | 0,00  | 0,0   |
| 2012 | 0,83             | 3,72  | 77,78 | 1,99             | 7,09  | 72,00 | 5,55             | 5,55  | 33,33 | 1,76             | 4,41 | 60,0  | 5,55             | 5,55  | 0,0   |
| 2013 | 4,05             | 6,28  | 35,48 | 3,09             | 6,66  | 53,68 | 1,78             | 5,35  | 66,67 | 3,40             | 5,10 | 33,33 | 0,0              | 5,34  | 100,0 |
| 2014 | 9,4              | 14,21 | 33,8  | 3,7              | 9,0   | 58,91 | 6,97             | 12,20 | 57,14 | 7,48             | 9,14 | 18,18 | 0,0              | 15,63 | 100,0 |
| 2015 | 6,33             | 23,74 | 73,33 | 3,82             | 12,43 | 69,27 | 6,97             | 20,46 | 100,0 | 3,25             | 12,2 | 73,33 | 5,09             | 5,09  | 0,0   |

Source: SINAN, GAL-LACEN, GAL-IEC, HEMOPA

Subtitle: S= SINAN; AB=All Bases; % US= Percentage of Underestimation.

Table 2. Detection rate / 100 thousand inhabitants and percentage of underestimation of HCV, distributed by the municipality of residence of metropolitan region I, Pará, 2010 to 2015, in Brazil

| Ano  | Ananindeua       |       |       | Belém            |       |       | Benevides        |       |       | Marituba         |      |       | Santa Bárbara    |       |      |
|------|------------------|-------|-------|------------------|-------|-------|------------------|-------|-------|------------------|------|-------|------------------|-------|------|
|      | Detection rate S | AB    | %US   | Detection rate S | AB    | %US   | Detection rate S | AB    | %US   | Detection rate S | AB   | %US   | Detection rate S | AB    | %US  |
| 2010 | 1,48             | 1,91  | 22,22 | 10,8             | 11,51 | 5,88  | 5,81             | 5,81  | 0,0   | 1,85             | 1,85 | 0,0   | 0,0              | 0,0   | 0,0  |
| 2011 | 1,05             | 3,14  | 66,67 | 1,93             | 6,63  | 70,97 | 0,0              | 1,89  | 100,0 | 0,9              | 0,90 | 0,0   | 0,0              | 0,0   | 0,0  |
| 2012 | 1,65             | 8,06  | 79,49 | 3,05             | 12,62 | 75,84 | 3,7              | 5,55  | 33,33 | 0,0              | 3,53 | 100,0 | 5,55             | 5,55  | 0,0  |
| 2013 | 3,64             | 10,93 | 66,67 | 4,07             | 19,08 | 78,68 | 1,78             | 5,35  | 66,67 | 0,85             | 3,40 | 75,00 | 5,34             | 21,23 | 75,0 |
| 2014 | 2,8              | 9,20  | 69,57 | 2,37             | 11,72 | 79,76 | 5,23             | 12,2  | 57,14 | 0,83             | 6,65 | 87,50 | 0,0              | 0,0   | 0,0  |
| 2015 | 3,56             | 15,24 | 76,62 | 6,32             | 25,08 | 74,79 | 0,0              | 13,64 | 0,0   | 1,63             | 6,51 | 75,0  | 10,18            | 10,18 | 0,0  |

Source: SINAN, GAL-LACEN, GAL-IEC, HEMOPA

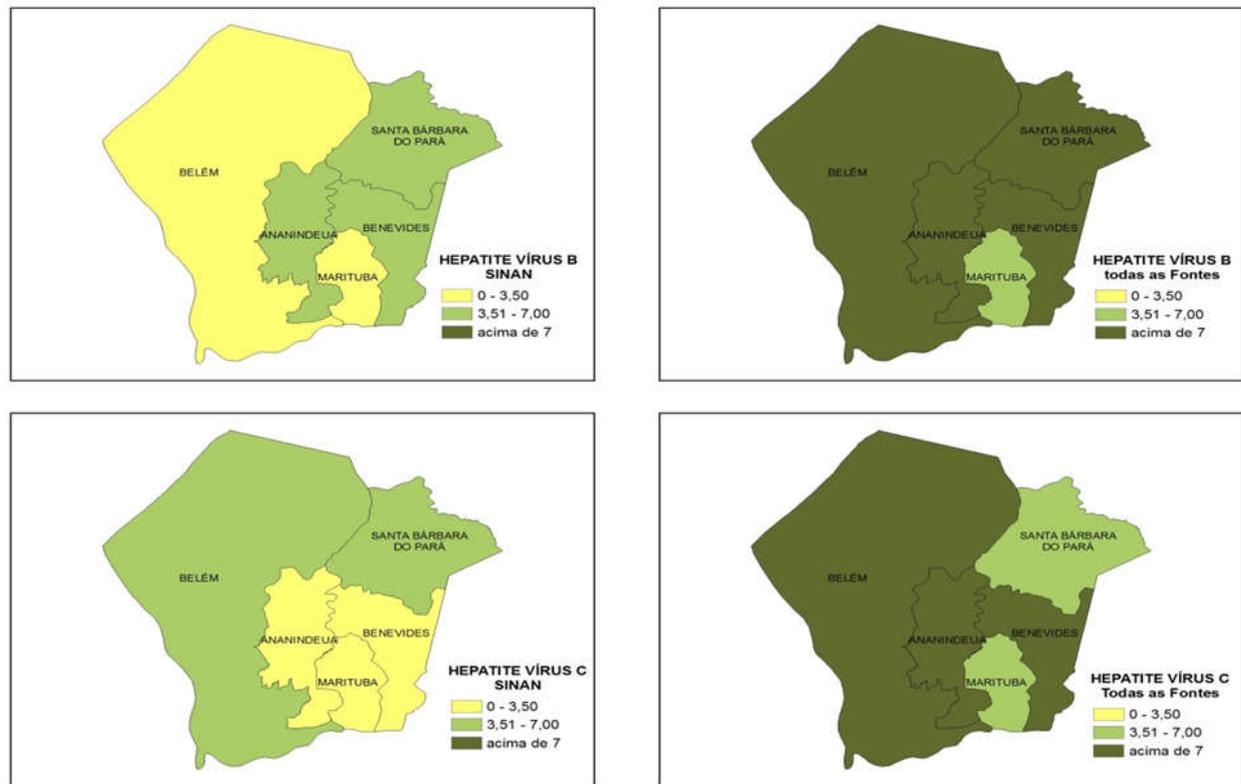
Subtitle: S= SINAN; AB=All Bases; % US= Percentage of Underestimation.

The highest detection rates per municipality for HBV and HCV, respectively, were in Ananindeua: (23.7 per 100,000 inhabitants and 15.2 per 100,000 inhabitants); followed by Benevides: (20.5 per 100,000 inhabitants and 13.6 per 100,000 inhabitants); then Belém: (12.4 per 100,000 inhabitants and 25.1 per 100,000 inhabitants); Marituba: (12.2 per 100,000 inhabitants and 6.5 per 100,000 inhabitants); and Santa Bárbara: (5.1 per 100,000 inhabitants and 10.2 per 100,000 inhabitants).

were classified as High and the municipality of Marituba was classified as Medium, as shown in figure 04.

## DISCUSSION

The surveillance of viral hepatitis is based on a universal system of notification and epidemiological investigation of all suspected cases and outbreaks of the disease, which makes the



Source: SINAN, GAL-LACEN, GAL-IEC, HEMOPA

**Figure 4. Thematic maps with comparison of the parameters of detection rates / 100 thousand inhabitants of HBV and HCV, between the SINAN base and other databases, in the cities of Metropolitan Region I, Pará, 2010 to 2015, in Brazil**

All detection rates per municipality are above the rate for the state of Pará, which represents an estimate of 3.6 per 100,000 inhabitants, according to tables 01 and 02. According to the parameters High, Medium and Low, established in this study for the detection rates of HBV and HCV in the municipalities, it was found that of the cases identified in all databases and compared with the indexes constructed with the SINAN data, the parameters have been modified. For HBV, the rates built with SINAN data, which were Low for Belém and Marituba, changed to High and Medium, respectively, from the inclusion of data from all databases. Regarding the municipalities of Ananindeua, Benevides and Santa Bárbara, all went from Medium to High, therefore, in this region for HBV, only the municipality of Marituba had the parameter Medium in all bases, the other municipalities changed to High. As for HCV data, the rates built with SINAN data show Medium parameters in Belém and Santa Bárbara, however, in the municipality of Belém there was a change to the High parameter and in Santa Bárbara there were no changes. On the other hand, in the municipalities of Ananindeua, Benevides and Marituba, the parameters, according to SINAN, were considered Low, however, when the other bases were evaluated, the municipalities of Ananindeua and Benevides

notification of these occurrences by all information bases mandatory (Rede Interagencial de Informações para a Saúde, 2020). In this context, there is SINAN, a tool used to represent the morbidity indicators of capturing the exact number of cases of worsening of a given disease (Maia-Elkhoury *et al.*, 2007). Therefore, it was decided to use SINAN as the main base and the bases of HEMOPA, GAL-Lacen and GAL-IEC as complementary bases due to the potential and reliability of these bases, to detect and notify viral hepatitis. Underreporting of health problems is a worrying sign for health authorities. Based on this, in relation to viral hepatitis in the state of Pará, the findings of this research demonstrate that many cases were not registered at SINAN, which impairs the diagnosis of the health situation and the adoption of intervention measures to reduce health risks of the population. However, scientific studies highlight that filling in the variables of etiological classifications based on SINAN depends on notifications from laboratories and other bases, in this case, the bases of HEMOPA, GAL-Lacen and GAL-IEC, as this process guarantees the effectiveness of the epidemiological surveillance work processes and complements the SINAN base. Therefore, the result of this action, in part, is the improvement of the internal consistency of the system, which is one of the dimensions of the analysis of information quality

(Guimarães; Lourenço and Cosac, 2001). The cases of HBV and HCV registered in different bases and that do not repeat themselves between them, identify the low effectiveness of the information flow of the disease in a region, therefore, the local health services do not recognize the potential of the reporting bases for the surveillance services (Brasil, 2007). From this, it was observed that the findings identified during this research proved that there is a significant gap between the hepatitis data reported in the SINAN of the state of Pará and its municipalities in relation to the other local bases, that is, there is no homogeneity between the record base cases.

To minimize cases of underreporting, this research used the Linkage method between databases and the Capture-Recapture information method to accurately identify the epidemiological profile of diseases. The use of these methods, among the research bases, made it possible to identify repeated and underreported cases. In addition, this step made it possible to reduce the underestimation of the indicators and point out the bases that contribute to the notification of the disease. Therefore, this study demonstrated that the GAL-Lacen database was effective in identifying SINAN underreported cases. The GAL-IEC and HEMOPA databases contributed, however, with smaller proportions for the identification of underreported cases. Therefore, it is observed that these findings provoke reflections on the role of laboratories in the state of Pará, in view of the responsibility to feed back the SINAN database, since national studies report that local databases should not exceed the cases reported in SINAN and, yes, present equivalent data (Brasil, 2005; Vieira *et al.*, 2010). Public and private laboratories, hemotherapy services and other databases with information about certain diseases are considered notification units, therefore, the information generated in these services must necessarily be reflected in SINAN (Rede Interagencial de Informações para a Saúde, 2020). In addition, serological samples of suspected cases of HBV and HCV, sent by the services of the Testing and Counseling Center (CTA) and by the Specialized Assistance Service (SAE) or by the services of the laboratories' health units, must be accompanied by their respective complaint notification / investigation forms that must be entered in SINAN, therefore, underreporting is an unexpected condition.

The cases of HBV and HCV identified in the complementary databases and which are not repeated in SINAN reinforce the condition of underreporting. In addition, it is worth mentioning that the cases identified in HEMOPA and underreported in SINAN, in the GAL-Lacen and GAL-IEC bases corroborate other studies that identify underreporting. In view of this reality, underreporting leads to mistaken investigations, facts that compromise the development of public policies, as the real magnitude of the disease is unknown (Vieira *et al.*, 2010; Ferreira and Silveira, 2004). The high rate of underreported cases in SINAN, found in the complementary databases, shows that in the cities of Metropolitan Region I it is not possible to identify the real number of cases of HBV and HCV just by searching the SINAN database, since the underestimation of cases present on the basis of HEMOPA and absent in the other databases represent 62.36% of cases of HBV and 68.49% of HCV, thus, the distortion of rates for both viruses is observed. The statistical test applied in this study proved the distance between the averages of the detection rates calculated with information from all complementary bases in relation to the information from SINAN, analyzed in all the municipalities of the Metropolitan Region I. Therefore, the rates calculated

between all bases during the period 2010 to 2015 reflected an increasing trend for HBV and HCV in all municipalities. In the years 2014 and 2015, the rates were higher in all the municipalities analyzed. The data demonstrated that the detection rates of HBV and HCV were above the rate for Brazil and the state of Pará, confirming the existence of underreporting of cases. Finally, based on the identification of high rates of underreported cases, it is up to SESPA to develop strategies to improve the practice of feedback routines for the epidemiological surveillance of DNC. It is also suggested that the municipalities be monitored and supervised periodically, mainly the municipalities of Belém and Ananindeua, as they have the highest number of cases of underreporting.

## Conclusion

The cases captured in the complementary databases allowed to improve the sensitivity of the notification system of HBV and HCV in the SINAN base, of the municipalities of the Metropolitan Region I, in the state of Pará. The findings contributed positively to increase virus detection rates, therefore, it was possible to adjust these rates to the Medium and High parameters in all municipalities, above the detection rates for Brazil and Pará, reinforcing the condition of underreporting of these rates in municipalities in that region. The studies that use Linkage to identify underreported cases are essential, as they allow to evaluate, at the same time, different aspects such as the quality of the information generated, the effectiveness of the information flow and the epidemiology of certain diseases.

## REFERENCES

- Almeida, M.FandAlencar, G.P., 2000. Informações em Saúde: Necessidade de Introdução de Mecanismos de Gerenciamento dos Sistemas. Informe Epidemiológico do SUS. 9(4):241 -249. Available:<https://doi.org/10.5123/S0104-1673200000400003>.
- Brasil, Ministério da Saúde, 2017. Boletim Epidemiológico – Hepatites Virais. Secretaria de Vigilância em Saúde – Departamento de Vigilância, Prevenção e Controle das IST, do HIV/Aids e das Hepatites Virais. Ano V – nº 01.
- Brasil, Ministério da Saúde, 2018. Secretaria de Vigilância em Saúde – Departamento de Vigilância, Prevenção e Controle das IST, do HIV/Aids e das Hepatites. Virais Boletim Epidemiológico – Hepatites Virais. Ano VI – nº 01.
- Brasil. Ministério da Saúde, 2005. Agência Nacional de Vigilância Sanitária - ANVISA Este texto não substitui o(s) publicado(s) em Diário Oficial da União. Resolução de Diretoria Colegiada – RDC nº 302, de 13 de outubro de 2005 (Publicada em DOU nº 198, de 14 de outubro de 2005). “Dispõe sobre Regulamento Técnico para funcionamento de Laboratórios Clínicos”.
- Brasil. Ministério da Saúde, 2007. Secretaria de Vigilância em Saúde. Departamento de Vigilância Epidemiológica. Sistema de Informação de Agravos de Notificação – SINAN: normas e rotinas / Ministério da Saúde, Secretaria de Vigilância em Saúde, Departamento de Vigilância Epidemiológica. – 2. ed.
- Brasil. Ministério da Saúde, 2009. Portal saúde. DATASUS. Tabwin, Versão 3.6.
- Chedid, M. F., Krueel, C.R.P., Pinto, M.A., Grezzana-Filho, T.J.M., Leipnitz, I., Krueel, C.D.P., *et al*, 2017. Carcinoma hepatocelular: diagnóstico e manejo cirúrgico. ABCD.

- Rev. Arq. Bras. Cir. 30(4):272-278. Available: <https://doi.org/10.1590/0102-6720201700040011>.
- Ferreira, C. TandSilveira, T. R., 2004. Hepatites virais: aspectos da epidemiologia e da prevenção. Rev. bras. epidemiol. [Internet]. 7 (4): 473-487. Available: <http://dx.doi.org/10.1590/S1415-790X2004000400010>.
- Guimaraes, R., Lourenco, R and Cosac, S, 2001. A pesquisa em epidemiologia no Brasil. Rev. Saúde Pública [online]. 35(4):321-340. Available: <https://doi.org/10.1590/S0034-89102001000400001>.
- Instituto Brasileiro de Geografia e Estatística (IBGE), 2015. Estimativas de população para 1º de julho de 2015. Available: [https://ww2.ibge.gov.br/home/estatistica/populacao/estimativa2015/estimativa\\_tcu.shtm](https://ww2.ibge.gov.br/home/estatistica/populacao/estimativa2015/estimativa_tcu.shtm).
- Laguardia J, Domingues, C.M.A., Carvalho, C., Lauerman, CR, Macárioand E, Glatt, R, 2004. Sistema de Informação de Agravos de Notificação (SINAN): desafios no desenvolvimento de um sistema de informação em saúde. Epidemiologia e Serviços de Saúde. 13(3):135-147. Available: <http://dx.doi.org/10.5123/S1679-49742004000300002>.
- Maia-Elkhoury A.N.S., Carmo, E.H., Sousa-Gomes, M.LandMota, E., 2007. Analysis of records of leishmaniose visceral pelo método de captura-recaptura. Rev. Saúde Pública [Internet]. 41(6):931-937. Available: <http://dx.doi.org/10.1590/S0034-89102007000600007>.
- Mascarenhas, M.D.Mand Gomes, K.R.O, 2011. Confiabilidade dos dados do sistema de informações sobre nascidos vivos em Teresina, Estado do Piauí, Brasil-2002. Ciência & Saúde Coletiva. 16 (Supl.1): 1233-1239. Available: <http://dx.doi.org/10.1590/S1413-81232011000700055>.
- Pinheiro R.S., Andrade, VLand Oliveira, G.P, 2012. Subnotificação da tuberculose no Sistema de Informação de Agravos de Letras (SINAN): abandono primário de bacilíferos e captação de casos em outras fontes de informação usando link probabilístico. Cad. Saúde Pública. 28(8):1559-1568. Available: <http://dx.doi.org/10.1590/S0102-311X2012000800014>.
- Rede Interagencial de Informações para a Saúde, 2020. Indicadores de Dados Básicos RIPSAS/SC. Available: <http://www.sc.ripsa.org.br/php/level.php?lang=pt&component=91>.
- Robles, S., Marrett, L.D., Clarke, E.A andRisch, H.A, 1988. An application of capture-recapture methods to the estimating of completeness of cancer registration. J Clin Epidemiol. 41(5):495-501. Available: [http://dx.doi.org/10.1016/0895-4356\(88\)90052-2](http://dx.doi.org/10.1016/0895-4356(88)90052-2).
- Vieira, M.R.M., Gomes, L.M.X., Nascimento, W.D.M., Pereira, G.V.N., Dias, O.V and Leite, M.T.S, 2010. Aspectos epidemiológicos das hepatites virais no norte de Minas Gerais. Rev BaianaSaúdePública. 34(2): 348-358.
- WHO. World Health Organization, 2017. Global hepatitis report 2017.

\*\*\*\*\*