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ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Data quality of the reporting of viral hepatitis caused by work-related accidents, Brazil

Qualidade dos dados das notificações de hepatites virais por acidentes de trabalho, Brasil

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ABSTRACT: ***Objective:*** To assess the completeness and consistency of reports describing viral hepatitis caused by work-related accidents in Brazil between 2007 and 2014. ***Methods:*** This is an analytical, epidemiological study evaluating the quality of data from the Information System for Notifiable Diseases (*Sistema de Informação de Agravos de Notificação*). Data were analyzed using absolute and relative frequencies, proportional percentage variation, and a linear χ^2 test. ***Results:*** The majority of mandatory and essential variables were classified with good completeness, despite growth during the study period. The occupation and clinical form variables were classified as normal when they had less than 25.1% incomplete data. Inconsistency was considered high among different variables above 15.0%, including, for example, serologic markers with the types of viral hepatitis and age with occupation and date of birth. ***Conclusions:*** We need to evaluate data quality periodically, in addition to train health professionals on the adequate way to completely fill out reports, because this contributes to the establishment of an efficient surveillance of communicable diseases and improves the population's quality of life.

Keywords: Communicable diseases. Data accuracy. Disease notification. Hepatitis. Work-related accidents.

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RESUMO: ***Objetivo:*** Avaliar a completitude e a consistência das notificações de hepatites virais por acidentes de trabalho no Brasil entre 2007 e 2014. ***Métodos:*** Trata-se de um estudo epidemiológico analítico de avaliação da qualidade dos dados do Sistema de Informação de Agravos de Notificação. Os dados foram analisados pelas frequências absoluta e relativa, variação percentual proporcional e pelo teste do χ^2 linear. ***Resultados:*** A maior parte das variáveis obrigatórias e essenciais foi classificada em boa completitude, apesar de crescimento no período em estudo. A ocupação e a forma clínica foram classificadas como regular, com mais de 25,1% dos dados incompletos. A inconsistência foi considerada alta entre diferentes variáveis, superior a 15,0%, como por exemplo os marcadores sorológicos com os tipos de hepatites virais; e a idade com a ocupação e data de nascimento. ***Conclusões:*** Conclui-se que se faz necessária a avaliação da qualidade dos dados periodicamente, assim como a capacitação dos profissionais de saúde quanto ao preenchimento adequado e completo das notificações, o que contribui para atuação eficiente da vigilância das doenças transmissíveis e melhoria da qualidade de vida da população.

Palavras-chave: Doenças transmissíveis. Confiabilidade dos dados. Notificação de doenças. Hepatite. Acidentes de trabalho.

INTRODUCTION

The different types of viral hepatitis must be reported, as instituted by the Brazilian Ministry of Health, and these records are required be fed into the Information System for Notifiable Diseases (*Sistema de Informação de Agravos de Notificação - SINAN*). All suspected and confirmed cases, in addition to cases of outbreak, must be reported. Because it is a transmissible disease, viral hepatitis can be spread due to work-related accidents, which is another event that is mandatory to report[1].

As such, reports of viral hepatitis due to occupational accidents must be performed after establishing an epidemiological technical link between the two public health events. This link can occur in different work environments, which compromises the health conditions and quality of life of workers, and can generate economic and social damages to labor organizations.

Considering this context, the surveillance of communicable diseases is an efficient strategy for disease prevention and control, as it requires the compulsory reporting of suspected and confirmed cases, and a commitment on the part of health professionals to follow through with this public health strategy[2]. Health professionals' commitment refers to early diagnosing and compulsory reporting, as well as to health education that aims to prevent diseases and promote health.

In order for surveillance to work efficiently, disease records need to be of high quality with regard to the information contained in the report form. Data quality can be verified from inconsistency between two variables that complement each other, and from the completeness of each variable, considering fields that are ignored or left blank[3,4].

A review of the quality of the databases that are part of the health information system reveal the scarcity of studies on this subject in Brazil, mainly in the northeast region, where

very few articles were found on the completeness of SINAN data, and where none were found on data consistency[5]. The studies that are performed are limited to municipalities or states, and those with larger coverage in Brazil refer to other communicable diseases and only evaluate completeness[6].

As such, the need for investment in the analysis of SINAN data is evident in order to improve the quality of its information and, consequently, efficient practices of communicable disease surveillance, which improves the quality of life of the population. Therefore, this study aimed to evaluate the completeness and consistency of reports of viral hepatitis that were due to work accidents in Brazil between 2007 and 2014.

METHODS

This is an analytical, epidemiological study, which evaluated the data quality of reports of viral hepatitis due to work-related accidents in SINAN. All cases of viral hepatitis were verified by laboratorial, clinical-epidemiological, and serological scar confirmation — closed cases — reported in Brazil from 2007 to 2014, and they had a source of infection from workplace accidents.

The variables analyzed were those contained in the report form for viral hepatitis, of which some are mandatory to include in the SINAN database and some are just essential for investigating the case. There were a total of 36 variables, of which 28 were mandatory and 8 were essential. In order to analyze the SINAN data quality, the completeness of the variables (incomplete, ignored, or blank fields) and inconsistency (the relationship between two selected variables) were evaluated. For completeness, the variables were dichotomized into complete and incomplete fields. For inconsistency, the same categories as used in the report form were utilized in the analysis.

The completeness of the data was evaluated in the reports according to the calendar year of the report under study, considering the criteria recommended and adapted from SINAN's manual of operations[4], which categorizes completeness as: good (presents ≤ 25.0% incomplete fields); normal (between 25.1 and 50.0%); poor (between 50.1 and 75.0%); and very poor (those with ≥ 75.1% incomplete fields).

The consistency between two related variables was evaluated according to the script for using SinanNET, an analysis of the quality of the database, and a calculation of the epidemiological and operational indicators — viral hepatitis[3]. The variables selected for this analysis were: final classification and etiological classification, final classification and clinical form, clinical form and etiological classification, serological results and etiological classification, age and etiological classification, age (<18 years) and occupation, age (<18 years) and exposure to an "accident with biological material", age (<18 years) and date of birth; and age (<18 years) without date of birth and date of the accident. The age <18 years variable was selected upon considering Brazilian labor laws. And, when evaluating the relationship between other variables and this age group, the analyses were made case by case.

In order to perform the data analysis, the absolute and relative frequencies of completeness and consistency between the variables were calculated. For completeness, proportional percentage variation (PPV) - PPV = [(final year - initial year] / initial year]*100 was calculated, and the linear χ^2 test of the incomplete data was used in order to verify the trend of the time series, considering a statistical significance of $p < 0.05$. The temporal trend was classified as decreasing when PPV was negative, increasing when PPV was positive, and stationary when there was no linear statistical significance. The variables that had ≥ 25.1% incomplete fields (normal, poor and very poor) were evaluated by region and by year.

This study complied with all ethical principles according to Resolution number 466/2012, when the database was authorized by the Department of Health Surveillance (*Secretaria de Vigilância em Saúde*) and approved by the Research Ethics Committee of the Bahia School of Medicine.

RESULTS

A total of 1,493 cases of viral hepatitis were reported due to work-related accidents in Brazil between 2007 and 2014. The Southeast (40.6%), South (28.1%) and Northeast (11.9%) reported the majority of cases in this period.

An analysis of the completeness of these data revealed that the variables that are considered mandatory when completing the reports were classified as having good completeness, that is, <25.0% incomplete fields. However, the majority presented a growth in incomplete data between 2007 and 2014, except for the institutionalized variables and HIV/AIDS-related diseases, which presented a reduction of 28.0 and 5.9%, respectively. The variables of exposure to: injectable drugs (PPV = 266.7%), hemodialysis (PPV = 233.4%), surgical treatment (PPV = 200.0%), injectable drugs (PPV = 175.0%), inhalable drugs (PPV = 175.0%) and transfusion (PPV = 140.0%) presented more than 100% growth in incomplete data. Despite the decreasing and increasing variation in the incomplete data, no obligatory variable presented statistical significance, remaining in a steady trend (Table 1).

Most of the essential variables for follow-up of reported cases were classified as good completeness, except for occupation and clinical form, which were classified as normal (> 25.1% of incomplete data). Of these, the etiological classification ($p = 0.002$) and clinical form ($p = 0.006$) variables revealed a statistically significant growth in incomplete data during the study period. The occupation (PPV = -16.7%, $p = 0.006$), patient referral (PPV = -28.3%, $p = 0.028$) and genotype for hepatitis C virus (PPV = -41.8%; = 0.001) variables had a reduction in incomplete data with statistical significance, that is, a decreasing trend during the period (Table 1).

For the occupancy and clinical form variables, completeness was also analyzed by region in Brazil. Occupation was classified as normal with regard to completeness in all of the regions and had a growth in incomplete data between 2007 and 2014 in the northeast region (PPV = 4.1%), but with a steady trend. Only the Midwest (PPV = -43.7%, $p = 0.042$)

Table 1. Incomplete report data of viral hepatitis from work-related accidents, Brazil, 2007–2014.

Variable	2007 Initial year		2014 Final year		PPV	Total (2007–2014)		CC	p-value
	n	%	n	%		n	%		
Pregnant patient	5	3.4	10	5.7	100.0	70	4.7	G	0.908
Race/skin color	9	6.1	14	8.0	55.6	125	8.4	G	0.573
Schooling	33	22.4	37	21.0	12.1	321	21.5	G	0.761
Zone of residence	2	1.4	9	5.1	350.0	42	2.8	G	0.161*
Occupation	60	40.8	50	28.4	-16.7	550	36.8	N	0.006#
Vaccine against hepatitis A	20	13.6	28	15.9	40.0	283	19.0	G	0.660
Vaccine against hepatitis B	21	14.3	23	13.1	9.5	212	14.2	G	0.600
Institutionalized	25	17.0	18	10.2	-28.0	168	11.3	G	0.186
Injuries associated with HIV/AIDS	17	11.6	16	9.1	-5.9	145	9.7	G	0.678
Injuries associated with STDs	21	14.3	25	14.2	19.0	189	12.7	G	0.872
Patient contact HBV/HCV + (sexual)	37	25.2	45	25.6	21.6	369	24.7	G	0.893
Patient contact HBV/HCV + (household)	34	23.1	38	21.6	11.8	322	21.6	G	0.568
Patient contact HBV/HCV + (occupational)	37	25.2	38	21.6	2.7	370	24.8	G	0.225
Exposure – injectable medicine	3	2.0	11	6.3	266.7	113	7.6	G	0.638
Exposure – tattoo or *piercing*	6	4.1	12	6.8	100.0	109	7.3	G	0.884
Exposure – accident with biological material	10	6.8	13	7.4	30.0	96	6.4	G	0.695
Exposure – inhalable drugs	4	2.7	11	6.3	175.0	97	6.5	G	0.881
Exposure – acupuncture	7	4.8	13	7.4	85.7	118	7.9	G	0.907
Exposure – transfusion	5	3.4	12	6.8	140.0	104	7.0	G	0.873
Exposure – injectable drugs	4	2.7	11	6.3	175.0	91	6.1	G	0.919
Exposure – surgery	4	2.7	12	6.8	200.0	106	7.1	G	0.674
Exposure – contaminated food and water	26	17.7	28	15.9	7.7	281	18.8	G	0.609

Continue...

Table 1. Continuation.

Variable	2007 Initial year		2014 Final year		PPV	Total (2007–2014)		CC	p-value
	n	%	n	%		n	%		
Exposure – dental treatment	6	4.1	12	6.8	100.0	132	8.8	G	0.970
Exposure – 3 or more sexual partners	11	7.5	15	8.5	33.4	140	9.4	G	0.866
Exposure – hemodialysis	3	2.0	10	5.7	233.4	93	6.2	G	0.706
Exposure – transplant	6	4.1	10	5.7	66.7	94	6.3	G	0.927
Exposure – other factors	16	10.9	24	13.6	50.0	231	15.5	G	0.823
Referral	46	31.3	33	18.8	-28.3	322	21.6	G	0.028#
Genotype for HCV	55	37.4	32	18.2	-41.8	371	24.8	G	0.001#
Clinical form	27	18.4	44	25.0	63.0	396	26.5	N	0.006&
Etiological classification	4	2.7	13	7.4	225.0	66	4.4	G	0.002&

PPV: proportional percentage variation; CC: completeness classification; HIV: human immunodeficiency virus; STD: sexually transmitted diseases; HBV: Hepatitis B virus; HCV: Hepatitis C virus; G: good; N: normal; *variable was verified by the χ^2 test per biennium due to expected values < 5; #decreasing time trend; &increasing time trend.

and Southeast (PPV = -19.5%; p = 0.033) showed a decreasing trend of incomplete data. A reduction of incomplete data was verified in the North (PPV = -62.5%) and Northeast (PPV = -28.7%), although it was not statistically significant. A growing trend was observed in the Southeast (p = 0.006), South (p = 0.020) and Midwest (p = 0.020) (Table 2).

With regard to the consistency analysis, in the relationship between final classification and etiological classification, an inconsistency of 6.0% was verified, whereas in the final classification and clinical form, an inconsistency of 26.5% was observed. Between clinical form and etiological classification, there was an inconsistency of 26.0%, which was greater than the hepatitis B virus (19.2%). The serological results and the serological classification presented divergent data for all types of hepatitis virus, with an inconsistency of more than 15.0%. Age and etiological classification were inconsistent mostly among children under 14 years old (50.0%) (Table 3).

Consistency between age <18 years and other variables was verified on a case-by-case basis, individually (n = 21). Among cases of patients <14 years old, there was an inconsistency of 100.0% in relation to occupation and 42.9% in relation to exposure to an accident with biological material. For those patients between 14 and 17 years old, the inconsistencies were 50.0 and 57.1%, respectively. The age <18 years old variable presented an inconsistency of 31.6% in relation to date of birth and 100.0% in relation to age (<18 years old), without date of birth and with the date of the accident (Table 3).

DISCUSSION

The results point to the relevance of reporting work-related viral hepatitis for the field of occupational health, as it provides consistent data that allows for the construction of epidemiological indicators that are able to portray Brazilian workers' health situations and show how these two associated diseases are preventable in the arena of public health. The analyses presented proportional differences between reporting by Brazilian region. The largest proportion of mandatory and essential fields showed a growth in incomplete data and an inconsistency of greater than 15%.

In the case of mandatory variables in the report form, other studies in Brazil[7] and in the United States[8] also indicated good and excellent completeness. While with the essential

Table 2. Incomplete data from reports of viral hepatitis caused by work-related accidents for the variables "occupancy" and "clinical form" according to year and region, Brazil, 2007–2014.

Variable	Northern Region		Northeastern Region		Southeastern Region		Southern Region		Midwestern Region	
	n	%	n	%	n	%	n	%	n	%
Occupation										
2007–2008*	15	46.9	11	31.4	58	41.1	29	34.1	14	58.3
2013–2014	13	41.9	16	32.7	41	33.1	21	20.0	22	32.8
PPV	-10.7		4.1		-19.5		-41.3		-43.7	
Total (2007–2014)	65	47.8	75	42.4	223	36.8	126	30.1	61	39.4
CC	N		N		N		N		N	
p-value	0.932		0.902		0.033		0.159		0.042	
TT	S		S		D		S		D	
Clinical Form										
2007–2008	11	34.4	6	17.1	40	28.4	8	9.4	5	20.8
2013–2014	4	12.9	6	12.2	54	43.5	19	18.1	25	37.3
VPP	-62.5		-28.7		53.2		92.6		79.3	
Total (2007–2014)	52	38.2	28	15.8	201	33.2	66	15.8	49	31.6
CC	N		G		N		G		N	
p-value	0.182		0.587		0.006		0.020		0.020	
TT	S		S		I		I		I	

PPV: proportional percentage variation; CC: completeness classification; TT: time tendency; N: normal; S: stationary; D: decreasing; G: good; I: increasing; *in this analysis, biennia were used due to the variables with expected values <5 which prevented the calculation of the linear χ^2 test.

Table 3. Inconsistency between related variables in reports of work-related viral hepatitis, Brazil, 2007–2014.

Relationship between variables	n	%
Final classification *versus* etiological classification (n = 1.493)	89	6.0
Final classification *versus* clinical form (n = 1.493)	396	26.5
Information regarding serological scar ignored or left blank	356	23.8
Information regarding laboratory and clinical-epidemiological confirmation ignored or left blank	40	2.7
Clinical form *versus* etiological classification (n = 1.405)*	365	26.0
Virus A	5	0.4
Virus B	270	19.2
Virus C	66	5.0
Virus E	1	0.1
Virus B and C	11	0.8
Virus A and B	2	0.2
Serological results *versus* etiological classification (n = 1.116)**		
Virus A (n = 15)	9	60.0
Virus B (n = 415)	69	16.6
Virus C (n = 619)	35	5.7
Virus E (n = 1)	1	100.0
Virus B and D (n = 1)	–	–
Virus B and C (n = 18)	11	61.1
Virus A and B (n = 3)	2	66.7
Virus A and C (n = 2)	1	50.0
Age *versus* etiological classification		
< 14 years old (n = 14)	7	50.0
14 to 17 years old (n = 7)	–	–
18 to 65 years old (n = 1.431)	80	5.6
> 65 years old (n = 41)	1	2.4
Age (< 18 years old) *versus* occupation***		
< 14 years old (n = 7)	7	100.0
14 to 17 years old (n = 6)	3	50.0
Age (< 18 years old) *versus* exposure to an accident with biological material		
< 14 years old (n = 14)	6	42.9
14 to 17 years old (n = 7)	4	57.1
Age (< 18 years old) *versus* date of birth (n = 19)#	6	31.6
Age (< 18 years old) no birth date *versus* date of the accident (n = 2)	2	100.0

*Except for cases that did not have the etiological classification field filled out; **confirmed laboratory cases; ***occupation field filled out; #2 cases not filled out.

variables, where filling out of the fields is necessary but not mandatory, such as in work-related reporting, incompleteness has varied between 0 and 98%[9].

Exposure factors presented a growth in incompleteness during the study period, but authors[10] have considered that at least one risk factor that is filled out completely is adequate, thus obtaining 81%. As such, this variable could be re-developed according to type of viral hepatitis, or even designed in such a way that allows for one or more risk factor to be chosen, without the obligation of filling out all of the variables related to exposure.

Occupation was one of the essential variables that presented regular completeness. The low quality of variables related to occupation was also found in reports of communicable diseases in Cuba.[2] In various locations in Brazil, poor quality was observed in malaria records[11] and mortality due to occupational accidents[12].

Even in reports of work-related injuries, in which filling out an occupation is mandatory, there was not 100% completeness[9]. The occupation variable presents a number of methodological problems in reporting, such as consistency, completeness, definition and coding, considering that the instructions for filling out the field is vague in relation to the time of the activity, and does not specify that the Brazilian Occupation Classification (*Classificação Brasileira de Ocupação*) should be used in the updated version[13].

The clinical form showed normal completeness, and the proportion of incomplete data in the southeastern, mid-western and southern regions of the country increased. The state of Pernambuco[7], which is located in the northeast region, presented an incompleteness of 6.9% of the reports of viral hepatitis, confirming the results of the present study. It was noticed that because the variables are classified as essential, professionals have stopped filling them out, thus compromising the system of disease surveillance.

In addition to incompleteness, there were several inconsistencies between reporting variables, such as clinical aspects that did not match the characteristics of a particular case of viral hepatitis. Reactive and non-reactive serological markers were also found to be incompatible with hepatitis types, mainly for type B hepatitis. Similar data was also reported in another study[7] with an inconsistency of 32.6%.

A problem of inconsistency was found in the variable clinical form with regard to filling out the final classification, in order to confirm the nature of the case. The form states that, when filling out the final classification field under the category "serological scar", the system will automatically fill out the clinical form under the category "inconclusive". However, this did not occur in most of the reports, and the field on the clinical form was left blank or ignored.

Another relevant fact refers to the source of infection, a variable used to select the cases caused by an occupational accident in the present study. The category "other" appeared in innumerous reports. However, in the space provided to specify the source, some of the categories present were the same as in the variables, only written using different words.

Age was a variable that presented the greatest inconsistency with different variables, including occupation and accidents with biological material, both of which required a high level of schooling to perform the activity, which did not correspond to people under

14 years of age. In addition, work performed by children under 14 years of age is prohibited under Brazilian law. Legislation allows for people over 14 years old to participate in a young apprentice program. Teenagers between the ages of 16 and 18 are allowed to work, except at night and in hazardous or unhealthy places[14].

This result was also demonstrated in reports of work-related mortality, with records of 0.9% among children under 14 years of age and 7.7% among children aged 15 to 19 years old[12]. In addition, date of birth also appeared inconsistent with age in the same report. In another study, we found inconsistency in 465 records of people older than 120 years old, which was considered improbable.

Consistency between diagnostic suspicion and etiological classification was not evaluated because these are fields for which a strict consistency is not expected, because there is no way to change the field referring to the diagnostic suspicion after the report. This is due to the fact that it is possible to change the fields "laboratory data" and "case completion after an epidemiological investigation" in the SINAN database, as all reports of suspected or confirmed cases should be completed within 180 days of the report date.

Data quality involves many factors, such as the number of questions and the number of pages to be filled out, which can contribute to whether the report is filled out or not. In Massachusetts, USA, modifications were made to the surveillance system for hepatitis C virus infection, reducing the form to one page on a computer system, which contributed to the increase of reports and a reduction in incomplete fields[10].

Most of the report systems perform data cleaning procedures and verify the duplication of records, which is good for data quality. However, data consistency is not verified by most systems. Therefore, greater care is required in the records and in the investigation of each reported case[8]. One strategy for improving this information and data quality is an annual evaluation of the performance indicators of the information system[2], which should be carried out by each administrator or by partnerships with universities.

It is worth noting the possible limitations of this study. For one, an analysis of duplicate data, which was prevented when the patient and mother's names were not present. Second, we were unable to establish a causal link between viral hepatitis and work-related accidents of people with different professions. Third, it was not possible to analyze data consistency by region and calendar year due to the number of values below five, even considering the two-year periods. Finally, because there is a lack of studies testing similar variables, it was impossible to compare results. However, this study presents crucial points for health professional interventions with regard to the appropriate and careful filling out of disease reports, and the improvement of the information system, the reporting form, and the form instructions.

CONCLUSION

The data quality of SINAN's reports should be evaluated frequently in order to ensure the best possible analysis of the distribution of cases of viral hepatitis due to occupational accidents and, consequently, the effective monitoring of communicable diseases.

Essential variables in some cases should be mandatory. Furthermore, it is necessary to review the compatibility of the system with instructions for completing the reports. A more careful evaluation is necessary in cases with children under 18 years of age, because if there is no inconsistency, it means that child labor is being exploited illegally. Finally, in order for SINAN to operate with quality and contribute to improve the population's quality of life, health professionals should be trained periodically to fill out the report form (with correct and consistent knowledge of the concepts in each variable and category) and to understand the ethical commitment they must establish with regard to public health.

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