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ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Evaluation of the completeness of compulsory work-related notifications recorded by county industrial center in Brazil, 2007 – 2011

Avaliação da completitude das notificações compulsórias relacionadas ao trabalho registradas por município polo industrial no Brasil, 2007 – 2011

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ABSTRACT: ***Objective:*** To analyze the completeness of workers health problems notification fields registered in a Brazilian municipal industrial hub in the period from January 1st, 2007 to December 31st, 2011. ***Methods:*** Descriptive study based on secondary data and composed of all records related to work (n = 2,345) in the National Disease Notification System, using criteria recommended by the Guidelines for Evaluating Public Health Surveillance Systems created by the Center for Disease Control and Prevention. The completeness of the fields present in the research and report forms was assessed by the percentage of filled fields, the Spearman correlation coefficient and graphical analysis. ***Results:*** In most of the essential fields it was identified a decrease in the percentage of filling (n = 18; 64%). The degree of completeness of compulsory fields was high (> 85%); most of the non-discriminated fields were 0 – 25% filled; there were variable indexes for key fields (0 – 98%). Considerable variability was observed in the completeness of the key fields, having three variables with significant negative correlation (r_s = -0.9; p = 0.0347). Only one variable showed significant positive correlation. ***Conclusion:*** The quality of most of the stored data was classified as regular to excellent for important variables on the design of worker health and surveillance actions. However, we recommend routine quality data assessments in workers health information systems in the Unified Health System.

Keywords: Disease notification. Occupational accidents registry. Surveillance of the workers health. Epidemiological surveillance. Information systems. Computer systems.

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RESUMO: ***Objetivo:*** Analisar a completitude dos campos de notificações dos agravos à saúde do trabalhador registrados em um município polo industrial brasileiro no período de 01/01/2007 a 31/12/2011. ***Métodos:*** Pesquisa descritiva baseada em dados secundários e composta pela totalidade de registros relacionados ao trabalho (n = 2.345) no Sistema Nacional de Agravos de Notificação, utilizando critérios preconizados pelo *Guidelines for Evaluating Public Health Surveillance Systems* do *Center for Disease Control and Prevention*. Verificou-se a completitude dos campos presentes nas fichas de notificação e investigação por meio do percentual de campos preenchidos, do coeficiente de correlação de Spearman e de análise gráfica. ***Resultados:*** Foi identificado um decréscimo no percentual de preenchimento para a maioria dos campos essenciais (n = 18; 64%). O grau de completitude dos campos obrigatórios foi elevado (> 85%), constatando-se que a maior parte dos campos não discriminados teve um preenchimento entre 0 e 25% e índices variados para os campos essenciais (0 – 98%). Foi verificada importante variabilidade na completitude dos campos essenciais, observando-se três variáveis com correlação negativa e significativa (r_s= -0,9; p = 0,0347) e apenas uma com correlação positiva e também significativa. ***Conclusão:*** A qualidade da maioria dos dados armazenados foi classificada como regular a excelente para variáveis importantes quanto ao delineamento das condições de saúde do trabalhador e à deflagração de ações de vigilância. Todavia, recomenda-se o uso rotineiro de avaliações da qualidade dos dados dos sistemas de informação em saúde do trabalhador no Sistema Único de Saúde.

Palavras-chave: Notificação de doenças. Notificação de acidentes de trabalho. Vigilância em saúde do trabalhador. Vigilância epidemiológica. Sistemas de informação. Sistemas de computação.

INTRODUCTION

Work-related accidents and diseases represent a major public health problem worldwide and challenge various countries regarding the quality and comprehensiveness of official information[1].

The reliable investigation of health outcomes of workers in the world varies between countries[1]. In general, the surveying of the proportion of accidents is very low, and the basis for the calculation usually considers only insured workers, not covering all of them, especially those in the informal sector[1].

The field of occupational health in Brazil, over the years, made use of secondary data to describe the epidemiological profile[2]. With the implementation, by the Brazilian Ministry of Health (MH), of the mandatory reporting of work-related injuries in 2004, the issue of coverage and quality of information showed great advancements[3,4].

The appreciation of the role of information in the construction of health policies is directly related to the quality of health information systems (HIS) available[5,6]. Quality of

the data on HIS is in one of the attributes advocated by the Center for Disease Control and Prevention (CDC) of the United States for evaluating health surveillance systems, and it must be examined by the quantification of "ignored" or "blank answers" in fields, for data duplicity, and also for the consistency of records, that is, how much they approach the truth[7].

However, in Brazil, in spite of all technical, administrative and political developments in the use of health information in the management process, the systematic and continuous assessment of data quality does not follow a regular plan, but happens in sporadic and isolated initiatives[8,9].

In scientific production in Brazil, CDC guidelines for analyzing the quality of HIS have been used by several researchers in different public health threats, such as tuberculosis, Chagas disease, dengue and hemorrhagic fever transmitted by the Hantavirus, among others[10-14]. However, no studies were found relating to the reported parameters of workers' health hazards listed in the Information System for Notifiable Diseases (SINAN). SINAN is a HIS of national coverage, that records several cases of notifiable diseases, and among them are those who are related to work, with 11 different definitions for accidents and diseases of this nature[4]. The implementation of this system in the city of Betim, Minas Gerais, started on 2007 through the Health Surveillance records of the Municipal Health Department, and also of the Regional Reference Center for Occupational Health (CEREST).

Thus, the present study evaluated the data quality attribute of the information system that makes up the surveillance in occupational health, by analyzing the completeness of data on case report forms and investigation of work-related injuries recorded in the SINAN of the municipality of Betim, Minas Gerais, in the period 2007-2011.

METHODS

A descriptive research on the completeness of reporting forms/investigation of work-related diseases was conducted, comprising the total of 2,345 records stored in SINAN the municipality of Betim, Minas Gerais, during the period from 01/01/2007 to 31/12/2011.

POPULATION AND AREA OF STUDY

The municipality of Betim is located in the metropolitan region of Belo Horizonte and is considered a nationally prominent industrial hub, especially for its industries from automotive and petrochemical sectors. The city is also home to major companies in the logistics and services sectors[15]. In 2010, Betim had a population of 378,089 inhabitants, of whom 201,129 were economically active, and 6,313 registered companies[16]. In 1994, the local Unified Health System (SUS) began carrying out actions on Surveillance in Workers' Health (VISAT). The city hosts one CEREST that works in partnership with the three levels

of health care. Due to its political, economic, demographic and health characteristics, Betim was chosen for this research.

DATA SOURCE

The data on diseases analyzed were distributed in 9 reporting and investigation forms, contemplating 11 case definitions corresponding to the following events: fatal work accident, accident involving mutilation, accidents with children and adolescents; accident with exposure to biological material; exogenous intoxication; repetitive strain injuries or work-related musculoskeletal disorders (RSI/WMSD); occupational dermatoses; pneumoconiosis; Noise-induced hearing loss; work-related mental disorders; and work-related cancer[3]. The first three diseases make up the case definition of severe work accident and are arranged on a single reporting and investigation form. Access to data on work-related exogenous intoxications occurred after applying the selection filter by field 56 of the notification form, which identifies whether exposure/contamination was the result of work/occupation.

DEFINITION OF VARIABLES

The variables common to all notification forms were selected and then classified by type of field: key field, required field, essential field and not otherwise specified field, according to the SINAN data dictionary, which defines them as follows: the key field corresponds to the identifiers of the record in the system; the required fields are those whose lack of data prevents the inclusion of notification or investigation in SINAN; key fields register data necessary for the investigation of the case or the epidemiological or operational calculus; and the not otherwise specified field is not defined by the system's data dictionary[17-19]. Variables were organized into identification sections of the forms themselves: "Patient data"; "Residence data"; "Company data"; "Epidemiological Background"; and "Case Conclusion". The distribution of records was made by year of notification, as well as by the proportional percentage for different diseases of 2007 and 2011. Some variables were arranged in tables by field type, percentage filled (number of fields completed/total notifications x 100), percentage of empty of ignored fields (number of empty fields, with 9 or 99 codes/total notifications x 100) and quality (according to the scale of the MH).

Due to the significant variability of the percentage of completion of the key fields, the non-parametric Spearman correlation coefficient (r_s), its p-value and the graphical representation of their completeness over time (2007 – 2011) were calculated. The use of non-parametric coefficient was preceded by the verification of the data distribution using the Kolmogorov-Smirnoff test.

ANALYSIS

The quality evaluation of the data was based on the Guidelines for Evaluating Public Health Surveillance Systems created by CDC and procedures standardized by the MH for SINAN[7,17,18]. According to the CDC, the completeness of the fields of a HIS is constituted by one of the attributes that measure their quality. In this sense, it is measured by the quantification of "unknown" or "blank" fields[7]. The MH defined a performance scale for the quality of SINAN based on the percentage of completion of the fields related to the total reported cases in the system, and considers the following criteria for the classification of quality: excellent (above 90%); Regular (between 70 and 89%); poor (below 70%)[17]. For this evaluation, fields filled with "unknown", coded by numbers 9, 99, or empty, were considered as not filled[7,20]. The processing and data analyzes were performed by computer programs SPSS version 14 and Microsoft Office Excel 2007.

This investigation was approved by the Municipal Health Department of Betim and the Research Ethics Committee of Universidade Federal de Minas Gerais.

RESULTS

A total of 2,345 notifications and investigations of work-related diseases were analyzed for the period from 2007 to 2011. An increasing trend was observed in the frequency of records with growth between 2009 and 2010 of approximately 3.6 times. In 2011, the percentage of growth in the total number of notifications, compared to 2007, was approximately 1,567%, corresponding to a jump from 68 to 1,134 records (Table 1).

Health problems with the largest number of records were serious work accidents, RSI/WMSD and accidents with biological material. Lower occurrences of notifications were related to pneumoconiosis and work-related cancer (Table 1).

In the classification of the 53 common fields present in the instruments for data collection, it can be observed that the majority (53%, n = 28) belonged to the 'essential' category, 26% (n = 14) were 'required' fields, 8 % (n = 4) were considered 'key' fields and about 13% (n = 7) showed no manual categorization by the system and were identified as 'not otherwise specified' (NOS).

The completeness of the 'key' fields was classified as excellent (100% filled), ranged between 0 and 25% (bad) for most NOS fields and showed great variability for the 'essential' fields (0 – 98%) (Table 2).

Although there is the premise for the complete filling of 'required' fields, it was observed that some of them, namely 'occupation' (95%), 'date of birth' (96%), 'specific ICD' (93%); 'pregnancy' (87%) and 'issuance of work accident notice' (87%), were less than 100% filled (Table 2). In this category, the variables *patient's name, age, sex, date of accident, municipality of residence, state of residence, country, notifying unit,* and *state*

of the notifying unit showed 100% completion of the fields in all years. Note that the analyzed fields were unchanged in their ratings during the years studied.

The essential fields *neighborhood of residence* and *company neighborhood* were not filled at all, as well as the NOS fields *Unified Health System card*, *geofield1* and *geofield2* during the data time series. It is noteworthy that among the not otherwise specified fields (n = 7), only one (notification type) was 100% filled in all the years analyzed.

Regarding the quality of the essential fields, a predominance of poor completeness (57%, n = 16) was observed; 18% (n = 5) were regular and 25% (n = 7) were rated as excellent. Among the essential fields, important variables for the design of the health situation of the worker, such as education, race, and NCEA (National Classification of Economic Activities) were poorly completed, with 37, 32 and 0.5%, respectively (Table 2).

Regarding the trend of growth, 64% (n = 18) of the essential fields showed a negative completeness correlation over the years, while 21% (n = 6) increased their rates of completion and 14% (n = 4) were stationed or were not filled in the same period. Graphic study on the correlation between the completeness and the time of essential variables, in some situations, was insufficient to affirm it due to small visual variations (Figure 1). This trend of positive or negative growth was confirmed by Spearman coefficient (Table 3). Through graphical analysis, it was possible to analyze that most essential fields (n = 18, 64%) showed a decrease in the percentage of completion over time, while 34% (n = 6) showed growth over the same period.

Table 1. Distribution of the number of records of work-related health problem notifications, SINAN. Betim, 2007 – 2011.

Health Problem	2007 n	2008 n	2009 n	2010 n	2011 n	Total of records n (%)	Proportional percentage variation %
Serious accident	22	91	47	319	591	1,070 (45.6)	2,586.4
RSI/WMSD	15	10	49	237	304	615 (26.2)	1,926.7
Accident with exposure to biological material	17	29	87	108	102	343 (14.6)	500.0
Exogenous intoxication	4	12	13	50	44	123 (5.3)	1,000.0
Dermatoses	7	2	9	28	30	76 (3.2)	328.6
NIHL	1	4	5	14	38	62 (2.6)	3,700.0
Mental disorders	2	1	3	15	23	44 (1.9)	1,050.0
Pneumoconiosis	0	0	1	8	2	11 (0.5)	0.0
Cancer	0	0	0	1	0	1 (0.04)	0.0
Total	68	149	214	780	1134	2,345 (100.0)	1,567.6

Source: SINAN database provided by the Superintendence of Health Surveillance of Betim, Minas Gerais, updated on 01/24/2012.
RSI/WMSD: repetitive strain injury/work related musculoskeletal disorders; NIHL: noise-induced hearing loss.

Table 2. Classification, completion and quality of some fields records common to the workers' health problems reporting and investigation forms recorded in SINAN. Betim, Minas Gerais, 2007 – 2011.

Field/variable	Field classification	% of completion	% of "unknown" information of empty fields	Quality
Mother's name	Essential	98	2	Excellent >90%
Neighborhood of residence	Essential	98	2	
Area of residence	Essential	98	2	
Street name	Essential	97	3	
Date of birth*	Required	96	4	
Occupation**	Required	95	5	
House number	Essential	95	5	
Years of service in the occupation	Essential	95	5	
Specific ICD***	Required	93	7	
Employment situation	Essential	92	8	
Pregnancy****	Required	87	13	Regular 70 to 89%
WAN issuance****	Required	87	13	
Company name	Essential	83	17	
Patient's telephone number	Essential	81	19	
Evolution of the case	Essential	76	24	
Company State	Essential	75	25	
Company municipality	Essential	74	26	
Outsourced employer	Essential	66	34	Poor <70%
Area code of patient's telephone number	Essential	66	34	
Company neighborhood	Essential	59	61	
Type of time day/month/year	Essential	56	44	
Company address	Essential	49	51	
Company number	Essential	40	60	
Schooling	Essential	37	63	
Ethnicity	Essential	32	68	
Company's phone number	NOS	25	75	
Company's area code	NOS	20	80	
Company's Corporate Taxpayer Number or Social Security Number	Essential	12	88	
Company address complement	Essential	10	90	
Residence ZIP Code	Essential	9	91	
Reference for business location	NOS	5	95	
Date of death	Essential	1.4	98.6	
Reference for location of residence	Essential	0.6	99.4	
NCEA	Essential	0.5	99.5	

*This field did not provide 100% of completion, because there is the option for filling the age or date of birth field. **This field is not required in the exogenous intoxication form. ***This field is not required for the cancer, mental disorders and accidents with biological material forms. ****Existence of the option for unknown information.
ICD (International Classification of Diseases; WAN: work accident notice; NCEA: National Classification of Economic Activities, NOS: Not Otherwise Specified by the SINAN-net data dictionary.
Fields with 0 or 100% coverage are not presented in this table. Fields notification date, type of health problem/ICD, area code and the notification number are classified as 'key' fields and have 100% coverage. Patient's name, age, sex, date of accident, municipality of residence, State of residence, country, notifying unit and state of the notifying unit are classified as 'required' fields and had 100% of completion.

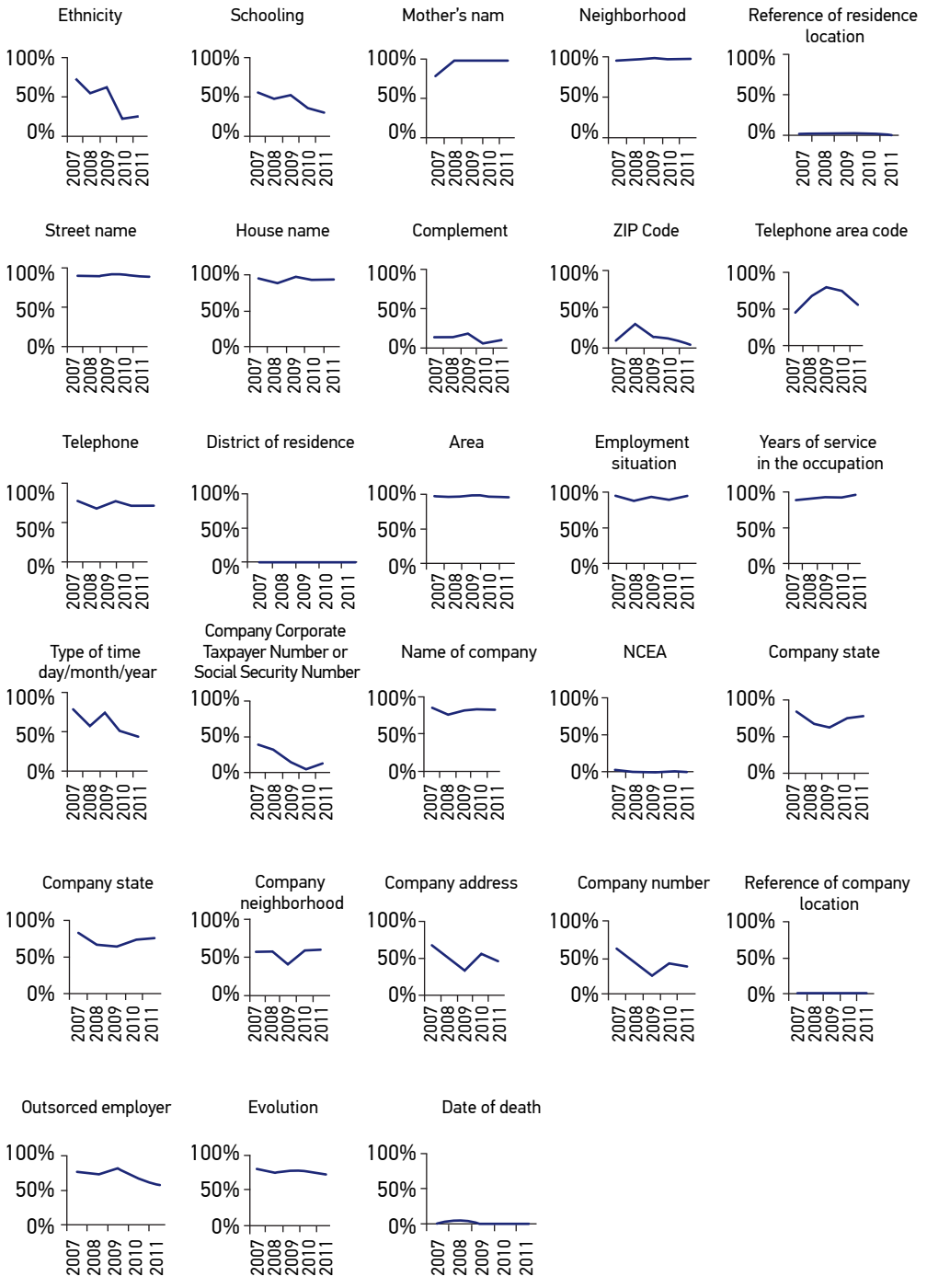

Figure 1. Trend charts of the completion rates (%) over the time (years) for all variables with essential fields.

The analysis of correlation coefficients (r_s) has shown that the variables *education*, *company Corporate Taxpayer Number* and *type of occupation time* showed a strong negative completeness and statistically significant correlation over the years (r_s = -0.9; p = 0, 0347). Among the variables that showed a tendency of increase in completeness, *mother's name*, *employment situation*, *years of service in the occupation* and the *company neighborhood*, the only one that showed significant statistical growth time was *years of service in the occupation* (r_s = 0.9; p = 0.0374) (Table 3).

Table 3. Correlation between the completion rate and the time of the essential fields common to the reporting and investigation forms expressed by the Spearman correlation coefficient and p value.

Variable/field	r_s	p-value
Patient data		
Ethnicity	-0.8	0.104
Schooling	-0.9	0.037
Mother's name	0.6	0.284
Residence data		
Neighborhood of residence	0.6	0.284
Street name	-0.2	0.747
House number	-0.1	0.872
District of residence*	-	-
Complement of home address	-0.5	0.391
Reference of residence location	0	1.000
ZIP code of residence	-0.4	0.504
Patient's telephone number area code	0.3	0.623
Patient's telephone number	-0.4	0.504
Area of residence	-0.2	0.747
Epidemiological history		
Employment situation	0.3	0.623
Years of service in the occupation	0.9	0.037
Type of time in the occupation day/month/year	-0.9	0.037
Company data		
Company's Corporate Taxpayer Number or Social Security Number	-0.9	0.037
Company Name	0	1.000
NCEA	-0.2	0.804
Company state	-0.1	0.872
Company municipality	-0.1	0.872
Company district*	-	-
Company neighborhood	0.7	0.188
Company address	-0.5	0.391
Company street number	-0.7	0.188
Outsourced employer	-0.7	0.188
Conclusion of the case		
Evolution of the case	-0.7	0.188
Date of death	-0.6	0.284

*r_s: nonparametric Spearman correlation coefficient. *Fields district of residence and the district of company were not filled during the study period.*

DISCUSSION

In the overall analysis, this study pointed at data quality ratings from regular to excellent for most of the variables analyzed, based on the completeness of the field attribute. Studies on the quality of data from several HIS, carried out in Brazil, using the CDC methodology for the evaluation, found a heterogeneous distribution of the degree of completeness of data contained in the files of SINAN, with better completion rates in the patient identification section and regular rates for case monitoring[10-14], which was also observed in the present study.

In similarity with this research, an evaluation of the surveillance system for Chagas disease found lower completeness of data of variables *Unified Health System card*, *ZIP Code*, *neighborhood and reference of the patient's residence* and, in general, identified that the reduced completeness of the SINAN investigation form prevented an epidemiological analysis of the health problem examined[12].

The composition of the SINAN data collection instrument for work-related health problems related provides important information for surveillance actions in working environments, such as the branch of economic activity of the company (NCEA), the *occupation*, the *employment situation*, the *years of service in the occupation*, *company address*, among others. The results of this study demonstrated an excellent completion rate for most of these variables, except for *NCEA* (0.5%) and *business address* (49%). In this context, the precarious completion of the NCEA variable is noteworthy, for its triggering potential for workers' health surveillance activities, by type of occupation, becomes impaired. This finding brings up reflections on the understanding of the professional services responsible for investigating and reporting health problems about the importance of this information and even on the handling of ratings tables provided by SINAN. This is also possible for the analysis of the completion of the occupation variable. It is observed that its standardization as a required field favored its high completion rate, although there are still difficulties in coding of occupational classes and families according to the list of classifications of the Brazilian classification of Occupations (CBO) and that provided by SINAN. In this sense, Vasconcellos et al.[21] believe that improvements in the quality of health records can be encouraged by structuring required fields.

These observations regarding the NCEA and occupation were also studied by Neto et al.[22], based on nationwide data from SINAN NET, in 2010. The authors found, for example, categories of occupations that are not classifiable as such, and considered that these aspects would point to certain difficulties in understanding concepts and in the use of the system tables.

For monitoring the workers' health situation, the residence identification variables *street*, *number*, *mother's name* and *neighborhood* help identify cases and provide important information for triggering territorial actions by Unified Health System's primary care health services. In many situations, the location of the residence is also the location of the individual's productive activity. These variables had excellent completion rates, ranging between 95 and 98%.

In this study, we observed a significant increase in the number of reports of work-related health problems in SINAN recorded in recent years, which was also reported by Galdino et al.[23] on severe accidents and with exposure to biological material, nationwide. According to Neto et al.[22], in the period from 2007 to 2009, increasing numbers of notifications were observed in all the federal units. This growth may be related to the initiative of the Ministry of Health to include indicators of occupational health in the *Pacto Pela Vida* (Pro-Life Pact) program, establishing progressive targets for increasing the number of notifications of these diseases throughout the Brazilian territory[24]. However, the quality of answers in the fields did not meet the progressive increase in the number of notifications in the same period. This provides some reflections on the reality of work and/or the preparation of professionals responsible for notification of health problems. Is there a real understanding and awareness of the importance of health records and their implications for health policy? Does the cycle of the information system reach the phase of consolidation and return of the data to those who collected them? Have the health services been prioritizing the apprehension of a greater number of cases/notifications, to the detriment of a more accurate and complete record? These are questions that deserve discussion and insights.

SINAN's reporting and investigation forms present a significant amount of fields. However, despite the prerogative that all fields must be filled, the system mechanisms that reinforce this obligation only affect the key and required fields[14]. Most variables are essential fields, that is, its completion, although important for calculations of epidemiological indicators, is not required for entry into the system[18,19]. This characteristic, coupled with the amount of fields and the lack of pre-defined criteria for the inclusion of variables in the forms, contributes to the failure to complete or to the option of ignoring that information by the notifiers[6].

The occurrence of variations in the completion of fields classified as required, for example, *occupation*, *date of birth*, *specific ICD*, *pregnancy and issuance of work accident notice*, was influenced by standardization factors of the data collection instrument itself, such as faults in the classification of fields in different forms and the possibility to opt for "unknown" information as a field filler.

The ability to calculate specific epidemiological indicators is threatened by the incompleteness of certain fields and mask data that measure the quality of care, failing to report recognized risk-predicting variables[25,26]. This is the cases of *race* and *education* variables, which commonly have completion rates lower than 20% in many national HIS[10,20,25]. This information is important because they configure risk factors for treatment dropout and death[25]. In this study, these variables had the somewhat higher completion rates, 32 and 37%, respectively. Still, the reality of a completion qualified as bad to very bad prevails in various regions of the country for this information[27-30].

Some relevant fields for the analysis of the workers' health situation had unsatisfactory completion, which asks for the rethinking of the most effective mechanisms for improving completeness. Changes in the standardization of the operating system, such as a reclassification of fields from "essential" to "required", could also enhance the completion rate of fields.

The correct use of SINAN in the workers' health field can define the health status of this population group in a broader level, in addition to guiding public policies, investigations, inspections, evaluations and monitoring of work environments and processes, as well as assistance to workers, such as subsidizing specific studies and research[31,32]. However, a recent study on this system identified limitations in its use, functioning only as a system for registering, information flow and data tabulations[12].

SINAN aggregates information about various factors and characteristics of work-related health problems, which are important to guide the actions of workers' health care and surveillance. However, routine assessments of their quality attributes are essential to ensuring a more efficient monitoring of the health problems in this population. The increase in quantity of information on health cannot do without attention to its quality, thus allowing the generation of qualified information that are to support decisions on health.

Although replication of the methods used in this study to evaluate the data from HIS is possible in any Brazilian city, regional characteristics that are peculiar to the health services of the municipality may have influenced the results. With regard to this observation, Muguande et al.[12] consider that the degree of completeness of data reporting in HIS are influenced by the resources and priorities of health managers, especially those responsible for public health surveillance.

Health information contained in secondary databases are valuable sources of research. However, they have biases arising from the complexity of care and utilization of health services[33]. A more complete assessment of the quality of HIS data with an already established usage requires summative assessments with further qualitative studies for verification of subjective aspects[34]. It must be recognized that the use of HIS in Brazil has improved significantly, but its improvement is in an ongoing process of assessments and adjustments[5].

CONCLUSION

Considering the completeness of fields, it was found that the quality of data stored in SINAN of Betim, Minas Gerais, was mostly rated between regular and excellent throughout 2007 to 2011. Thus, there was great possibility of using SINAN to outline the conditions of employee health and to plan surveillance actions for the workers' health status and work environments. However, the routine use of data quality assessments in the information systems that make up the area of occupational health in the Unified Health System is recommended, as well as the incentive to awareness raising and training of professionals involved in the information, reporting and investigation process of health problems as a whole.

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