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Quality of hospital databases in Brazil: some elements

Qualidade das bases de dados hospitalares no Brasil: alguns elementos

Juliana Pires Machado[I], Mônica Martins[II], Iuri da Costa Leite[III]

ABSTRACT: *Introduction:* The use of secondary data for health service research has been increasingly common, having the advantage of acquiring information faster and cheaper, in addition to its larger population, temporal and geographical amplitude. *Objectives:* The aim of this study was to describe problems in the quality of information about hospitals characteristics and hospitalizations in Brazil. *Methods:* The National Database on Health Units (CNES), the Public Hospital Information System (SIH), and the Private Hospital Information System (CIH) were analyzed. We explored "coverage," "completeness," "consistency," and "validity" as quality dimensions. *Results:* There are complete and consistent basic registration data for hospitals, and most of them sent some information about the production of hospitalization. CIH covered 55% of admissions, and SIH exceeded 100%. The inadequate filling of the "procedure," "main," and "secondary diagnosis" fields is higher than expected, especially for CIH. *Conclusion:* Improvements in databases are required to qualify the analysis and increase its potential use, contributing with strategic studies that support decision-making in the planning of hospitals and health care networks.

Keywords: Database. Hospital information systems. Hospitalization. Evaluation. Health care quality. Access and evaluation. Information dissemination.

[I]Board of Sectoral Development, National Agency of Supplementary Health.

[II]Department of Administration and Health Planning, National School of Public Health, Fundação Oswaldo Cruz.

[III]Department of Epidemiology and Quantitative Methods in Health, National School of Public Health, Fundação Oswaldo Cruz.

Corresponding author: Juliana Machado. Agência Nacional de Saúde Suplementar. Diretoria de Desenvolvimento Setorial. Avenida Augusto Severo, 84, 8º andar, Glória, CEP: 20021-040, Rio de Janeiro, RJ, Brasil. E-mail: juliana.pm@gmail.com

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RESUMO: *Introdução:* O uso de bases de dados secundárias para o desenvolvimento de pesquisas sobre serviços de saúde tem sido cada vez mais frequente, tendo como vantagem a obtenção mais rápida e menos custosa das informações, além da maior amplitude populacional, temporal e geográfica. *Objetivo:* O objetivo deste estudo foi descrever problemas na qualidade das informações sobre a rede e a produção hospitalar no Brasil. *Métodos:* Foram analisados o Cadastro Nacional de Estabelecimentos de Saúde (CNES), o Sistema de Informações Hospitalares do SUS (SIH) e a Comunicação de Internação Hospitalar (CIH). Exploraram-se as dimensões "cobertura", "completitude", "consistência" e "validade". *Resultados:* Há preenchimento completo e consistente dos dados cadastrais básicos de hospitais, e a maioria deles enviou alguma informação sobre produção via CIH e SIH. Enquanto a CIH alcançou cobertura de 55% das internações, o SIH ultrapassou 100%. O preenchimento inadequado dos campos "procedimento realizado", "diagnóstico principal" e "secundário" é maior que o desejável, especialmente na CIH. *Conclusão:* As melhorias em bases de dados são necessárias para qualificar as análises e aumentar seu potencial uso, contribuindo para estudos estratégicos que subsidiem a tomada de decisões no planejamento de hospitais e redes de atenção à saúde.

Palavras-chave: Base de dados. Sistemas de informação hospitalar. Hospitalização. Avaliação. Qualidade. Acesso e avaliação da assistência à saúde. Disseminação de informação.

INTRODUCTION

The use of secondary databases for the development of studies about health services has been more frequent, especially when it comes to studies that assess the quality of hospital care[1,2]. The main advantages of these databases are the fast and less expensive acquirement of information and the possibility to conduct a temporal follow-up, besides the large volume of information with population and geographic amplitude. On the other hand, the main limitation is related to purposes, especially those originally created for payment, often limited in terms of availability of clinical information, besides issues with reliability and validity.

There are different interests associated with the filling out of data in information systems, but all of them can cause quality problems that require adaptation, so that it can be used in scientific studies or surveillance programs[3,4]. In a study conducted in the Netherlands, Anema et al.[5] mentioned the fact that the main issues in hospital databases are related to the manipulation of information to get better results in the performance surveillance applied by local authorities and to the nonstandardization of procedures and terminological specifications. Regarding research, the disadvantage of these databases is the lack of control from the researcher about data collection[4,6].

However, it is unrealistic to assume there is any database completely free of error, even after strict auditing procedures[2]. Besides, the use of these databases in studies can be useful to improve the quality of care and information systems[7].

The definition of quality and of the dimensions composing the quality of databases, especially those of health, is usually ambiguous or unspecific, making the internal evaluation of a database and its comparison with similar or related ones complex. To deal with this problem, Arts et al.[2] suggest that its dimensions be clearly predefined, as well as the way of measuring them and the reference patterns of quality.

Considering the advantages and the limited use of secondary databases, it is essential to approach the aspects related to the quality of this information, which potentially influences the results of the studies[2,5]. In this sense, considering that the credibility of data affects the practical use of information by administrators and by the society itself, the objective of this study is to describe problems regarding the quality of information about the service network and hospital production in Brazil.

METHODS

STUDY SCOPE AND UNIVERSE

This is a descriptive and exploratory study about the quality of Brazilian hospital information systems. National Database on Health Units (CNES), Public Hospital Information System (SIH), and Private Hospital Information System (CIH) databases were analyzed. The study universe includes all of the hospitalizations registered in the locations considered to be active in at least one year, from 2008 to 2010.

The Records of Health Insurance Plans (RPS/ANS 2008–2010) were used, as well as the National Household Sample Survey (PNAD 2008), the Study on Sanitary Medical Care (AMS 2009), the System of Mortality Information (SIM 2009), and the Live Birth Information System (SINASC 2009), in order to compare with the information about hospitals and hospitalizations.

All data were accessed in the first semester of 2013, through files made publically available in Datasus websites (Department of Informatics at SUS), except for RPS, obtained after a formal request was sent to the Supplementary National Health Agency (ANS)

The study is part of the research "The public–private arrangement and the quality of hospital care in Brazil," approved by the Ethics Committee of the National School of Public Health, CAAE no. 02234312.3.0000.5240. There are no conflicts of interests related to this study.

DESCRIPTION OF THE BRAZILIAN HOSPITAL INFORMATION SYSTEM

CNES is a database managed by the Ministry of Health which stores information about the public and private institutions in the country, characterizing them according to their physical and functional structure. In 2003, it became the official information system used by SUS to pay for the services. Since then, ANS also started demanding the use of the CNES number in contracts and in the RPS database[8].

SIH records information about the hospitalizations that were financed by SUS in either public or private contracted hospitals. Data are sent through a virtual Hospitalization Authorization (AIH) form, whose main goal is reimbursement. The system has been through a lot of changes toward its improvement; however, its content and purpose have been basically the same since 1991[9].

The Private Hospital and Outpatient Clinic Information System (CIHA) is the official and mandatory instrument to register the hospitalizations in the country that were not financed by SUS; therefore, it is not in the scope of the data that have to be sent to SIH.

Established as the Private Hospital Information System (CIH) in 1999, its name was altered to CIHA in 2011, aggregating outpatient clinics as well. It is mandatory to send information via CIHA, since it provides concession and renovation of the Certificate of Charitable Organization for Social Assistance (CEBAS); renovation of the Sanitary Surveillance permit; and processing of any request to the Ministry of Health regarding arrangements, records, and exemption of importation taxes. For units integrating the SUS network, sending the CIHA is a requirement to process and pay the hospitalizations covered by SIH, as well as to the transfer of monthly financial resources from the Ministry of Health[10].

APPROACH AND ANALYSIS OF THE QUALITY OF THE INFORMATION SYSTEM

The conceptual alignments presented in the studies by Sorensen et al.[6] and Lima et al.[3] were used to delimit the quality analyses of the CNES, SIH, and CIH databases.

Lima et al.[3] listed nine quality dimensions in the health information systems: accessibility (availability and facility to understand), methodological clarity (good documentation, contributing with the understanding and use of data), coverage (level of coverage of the events), completeness (level of noninvalid values), reliability (level of agreement in different analyses), consistency (coherence between related variables), absence of duplicity (single representation of each event), opportunity (availability in place and time), and validity (level that measures what is supposed to be measured).

On the other hand, the model of evaluation of secondary databases proposed by Sorensen et al.[6] stands out seven aspects that influence the value and credibility of these databases; some of the factors are in common with those related by Lima et al.[3], but there are also some others such as size of the databases, period of data records, data formatting, and the possibility of linkage with other databases.

Regarding the methods applied to assess these dimensions, the authors mentioned as main strategies: panel of experts, active search of records, comparison with criteria accepted by the scientific community, comparative analysis with other databases, evaluation of consistency between measures of the database and the completeness of these data, and temporal series evaluating the coherence of the observed tendency[3,6].

Considering the analyzed approaches, in this study we especially observed the dimension "coverage of databases," applying the following strategies: description of available data, comparison with the expected result according to the obligation to send it, and comparison with other databases providing similar information.

For the comparison of information about the hospital network, AMS was used as a reference. Considering AMS as a gold standard, the estimated coverage of CNES was calculated as the product between the number of hospitals and beds in this system, divided by the number of hospitals and beds in AMS.

To analyze the validity of information regarding the connection with health insurance plans or SUS registered in CNES, the categorization according to the field "contract" in CNES was compared to:

1. Database of RPS, which registers hospitals that work with private insurance health plans;
2. Hospitalizations reported in SIH and CIH, indicating, respectively, a connection with SUS and the plans.

About the sending of data regarding hospitalizations, the number of hospitals that should inform the SIH and the CIH was estimated based on the contracts registered in CNES and RPS, comparing it to the number of hospitals that, in fact, sent data to the systems. Regarding hospitalizations, the total number of hospitalizations in SIH and in CIH was compared, in 2008, with the total number of hospitalizations SUS and not-SUS estimated based on the information of PNAD 2008. The total of hospital deaths, deliveries, and births recorded in SIH and CIH was compared, respectively, with the information from SIM and SINASC for 2009.

To complement the coverage analysis in the databases about hospitalizations, completeness, consistence, and validity were analyzed based on the description and evaluation of the level of fulfillment of the variables. The fields "procedure concluded" and "main diagnosis" were analyzed; in the first case, the validity deficit was considered when the filled out data consisted of procedure codes without specification, that is, those with only the first 6 digits filled out from a total of 10; in this case, it is not possible to identify the procedure effectively. In the second case, the proportion of poorly defined diagnoses was assessed, belonging to chapter XVIII of ICD-10 "Abnormal symptoms, signals and findings of clinical and laboratory tests, not classified elsewhere."

RESULTS

The total number of hospitals with hospitalizations registered in CNES and active in 2009, in all regions of the country, was compatible with that accounted by AMS (100.3%; Table 1). In most regions, it was also possible to observe similarities regarding the distribution of the number of public or private hospitals and connection with SUS. However, the differences observed between the federation units (FU) and the

Table 1. Coverage of information about hospitals and beds per region and state, according to juridical nature and work with SUS. Brazil, 2009.

Region/State	Hospitals*				Beds**	
	Total	Public	Private	Private working with SUS	Existing	SUS
Brazil	100.3	98.8	101.4	105.3	112.2	110.1
North region	95.5	95.6	95.2	105.3	114.7	105.8
Rondônia	97.9	105.7	88.4	114.3	112.4	124.5
Acre	90.9	100.0	57.1	50.0	112.1	113.0
Amazonas	103.6	93.4	152.6	162.5	125.9	112.5
Roraima	73.7	76.5	50.0	100.0	107.4	113.9
Pará	95.2	96.9	93.7	102.2	116.0	99.9
Amapá	109.5	94.1	175.0	100.0	113.5	108.6
Tocantins	83.8	90.7	57.1	100.0	92.1	93.6
Northeast region	105.3	103.0	108.6	113.1	114.0	111.7
Maranhão	98.5	93.5	114.5	109.8	116.5	114.4
Piauí	105.6	102.2	113.6	118.2	108.9	107.5
Ceará	111.7	98.8	131.0	128.6	124.7	115.1
Rio Grande do Norte	112.1	109.7	116.4	118.9	114.7	118.4
Paraíba	127.7	127.9	127.5	143.1	130.4	128.2
Pernambuco	102.4	106.6	96.2	115.3	118.4	114.6
Alagoas	94.2	93.0	95.7	100.0	109.4	108.7
Sergipe	123.9	137.5	116.7	136.4	116.9	117.4
Bahia	99.1	100.3	97.8	96.0	101.6	101.7
Southeast region	98.2	94.1	99.6	102.5	111.2	109.3
Minas Gerais	94.2	83.4	97.9	104.0	105.6	105.4
Espírito Santo	95.8	103.4	93.4	93.3	109.0	118.0
Rio de Janeiro	108.7	94.6	115.9	103.3	115.5	114.9
São Paulo	95.9	100.9	94.5	102.2	108.4	108.0
South region	97.1	101.9	95.6	100.6	107.3	109.1
Paraná	103.7	103.7	103.7	106.6	112.4	115.3
Santa Catarina	92.1	92.9	92.0	98.7	103.5	104.5
Rio Grande do Sul	91.8	103.5	89.8	96.1	104.7	106.0
Center-West region	101.5	91.8	108.4	110.7	120.8	114.4
Mato Grosso do Sul	94.0	87.2	97.7	98.3	106.8	100.1
Mato Grosso	102.5	81.1	120.2	122.8	126.8	116.2
Goiás	104.0	98.3	108.6	106.1	118.7	110.9
Distrito Federal	98.4	85.7	104.7	214.3	135.2	139.1

Source: CNES, RPS, AMS.
*Ratio of the number of hospitals in CNES/RPS and number of hospitals in AMS; **Ratio of the number of beds in CNES and number of beds in AMS.

number of hospitals are many; coverage regarding AMS ranges from 73.7% (Roraima) to 127.7% (Paraíba). Besides Roraima, Tocantins also presented percentage lower than 90%. The comparison between information from both sources indicated 12.2% more beds in CNES than in AMS. In all regions, it was possible to observe more existing and available beds in SUS registered in CNES (Table 1). The states of Pará, Mato Grosso do Sul, Bahia, Santa Catarina, Rio Grande do Sul, Minas Gerais, São Paulo, Alagoas, Piauí, and Amapá presented less than 10% of difference between the number of beds in both sources of information.

Among the problems of incompleteness or inconsistence in CNES, the absence of CNPJ (29.7%) and the error in the information about payment sources stand out: 4.2% of the SUS hospitals, in CNES, were in the health insurance networks of RPS, and 1.3% of the hospitals that informed exclusive private services in CNES had hospitalizations by SUS in SIH (Table 2).

Table 2. Quality of filled out information in CNES, SIH, and CIH. Brazil, 2008 – 2010.

Main problems identified	n	%
CNES (hospitals)		
CNPJ not filled out in CNES	2,134	29.7
Working only with SUS in CNES X Present in RPS as a plan network	304	4.2
Inactive in CNES X Has hospitalization informed by SIH or CIH (2008)	162	2.3
Inactive in CNES X Has hospitalization informed by SIH or CIH (2009)	97	1.3
Only private services in CNES X Has hospitalization informed by SIH	94	1.3
Inactive in CNES X Has hospitalization informed by SIH or CIH (2010)	68	0.9
Working only with SUS in CNES X Has hospitalization informed by CIH	15	0.2
SIH		
Non filling out of the hospital's CNPJ	7,397,056	22.3
Non filling out of the secondary diagnosis	29,354,013	88.4
Invalid CNES for vinculation with the CNES database	446,023	1.3
Invalid CNPJ for vinculation with the CNES database	2,095,428	6.3
Hospitalizations with poorly defined causes	423,754	1.3
CIH		
Non filling out of the hospital's CNPJ	312,734	5.0
Non filling out of the secondary diagnosis	5,181,953	82.7
Non filling out of ICU days	256,340	4.1
Invalid CNES for vinculation with the CNES database	65,699	1.1
Invalid CNPJ for vinculation with the CNES database	151,185	2.4
Hospitalizations with poorly defined causes	418,523	6.7
Hospitalizations with unspecific procedure	550,834	8.8

Source: CNES, RPS, SIH, CIH.

Regarding the filling out of the fields of each hospitalization in SIH and CIH (Table 2), most presented good completeness in both systems, except for the CNPJ number, with partial presence, and the secondary diagnosis, with high proportion of absence. With relation to the fields of hospitalization regarding each hospitalization in SIH and CIH, despite the complete filling out of the field "main diagnosis" in both databases, in 6.7% of non-SUS hospitalizations and 1.3% of the SUS hospitalizations the codes were unspecific, that is, codes regarding chapter XVIII in ICD-10 were used ("Abnormal symptoms, signals and findings of clinical and laboratory tests, not classified elsewhere"). In 8.8% of the hospitalizations informed in CIH, the field referring to the procedure only indicated the procedure group; only the first two digits, of a total of 10, were filled out (Table 2).

Of the 7,161 hospitals, more than 5.6 thousand informed at least one hospitalization from 2008 to 2010, representing 78.8% of the total of hospitals analyzed (Table 3). The legal analysis showed that, among public hospitals, 90.1% informed hospitalizations in the period. The higher proportion of data about hospitalizations came from private and nonprofit hospitals (94.4%); among the private and for-profit hospitals, this percentage was 54.5%. General hospitals were more prevalent and presented the highest proportion of information among the analyzed hospitals. The sending of information

Table 3. Number and structure of hospitals and sending of information about hospitalizations. Brazil, 2008 – 2010.

Characteristics of structure	Hospital		
	Existing	Informed hospitalization	
	n	n	(%)
Total	7,161	5,643	78.8
Juridical nature			
Public	2,905	2,617	90.1
Private and nonprofit	1,773	1,673	94.4
Private and for–profit	2,483	1,353	54.5
Type			
General hospital	5,199	4,305	82.8
Specialized hospital	1,072	682	63.6
Mixed unit	764	582	76.2
General emergency room	70	45	64.3
Specialized emergency room	56	29	51.8
Size (beds)			
Up to 49	4,198	3,050	72.7
50 to 149	2,140	1,828	85.4
150 to 299	635	588	92.6
300 or more	188	177	94.1

Source: CNES, SIH, CIH.

about hospitalizations seems to be directly proportional to the size of the hospital; 94.1% of the information came from hospitals with 300 beds or more (Table 3).

Out of the 5,778 hospitals that worked with SUS, 92.1% informed hospitalizations via SIH; at the same time, of the 4,719 hospitals working with insurance plans, only 39.0% informed hospitalizations via CIH (Table 4). The Northeast region presented lower percentage of information of hospitalizations via SIH, and the North region had the lowest percentage of information of hospitalizations via CIH (Table 4). States with largest CIH coverage were Santa Catarina (75%), São Paulo (71%), Rio Grande do Sul (71%), and Minas Gerais (51%). Hospitals from Amazonas, Roraima, Amapá, Tocantins, and Alagoas did not inform any hospitalization outside of SUS between 2008 and 2010.

The total number of hospitalizations obtained by the addition of SIH and CIH, when compared to PNAD 2008, indicates coverage of 93.2% in the information about hospitalizations in the country (Table 4). By comparing the SIH and CIH coverages with the number of hospitalizations collected from PNAD, when the patient referred using SUS, the coverage of SIH would reach 116.4% (SIH – 10.7 million and PNAD – 9.2 million). Regarding the non-SUS hospitalizations, CIH would represent 43.3% of the cases estimated by PNAD (CIH – 1.8 million and PNAD – 4.3 million; Table 4). Four states presented coverage of SUS hospitalizations lower than 90%: Roraima (86.1%), Tocantins (82.3%), Maranhão (83.0%), and Rio Grande do Norte (88.3%). As to non-SUS hospitalizations, only three states presented coverage higher than 50%: São Paulo (96.6%), Santa Catarina (53.1%), and Rio Grande do Sul (50.7%). In the Southeast region, the low coverage of non-SUS hospitalizations in Rio de Janeiro (5.5%) stands out (Table 4).

When comparing the hospital deaths informed in SIM with those informed as a result of SUS and non-SUS hospitalizations, respectively registered in SIH and CIH, the coverage in Brazil was 56.8% in 2009 (Table 5). For non-SUS hospitalizations, considering the estimation of mortality among users of health plans made available by ANS (ANS

Table 4. Coverage of information about hospitalization, per great region and state, 2008 – 2010.

Region/State	Sending of information about hospitalizations from the hospitals*			Volume of hospitalizations informed**		
	Total	SIH	CIH	Total	SIH	CIH
Brazil	78.8	92.1	39.0	93.2	116.4	43.3
North region	77.8	94.0	10.1	80.2	100.0	6.0
Rondônia	64.4	89.7	16.0	64.7	96.2	4.6
Acre	87.1	96.4	13.3	116.4	155.9	17.2
Amazonas	80.3	94.9	-	79.1	95.0	1.0
Roraima	88.2	100.0	-	75.0	86.1	1.3
Pará	81.4	95.3	14.2	80.5	100.4	7.3
Amapá	45.8	64.7	-	183.2	238.5	1.4
Tocantins	83.9	98.1	-	70.9	82.3	3.3

Table 4. Continuation.

Region/State	Sending of information about hospitalizations from the hospitals*			Volume of hospitalizations informed**		
	Total	SIH	CIH	Total	SIH	CIH
Northeast region	78.9	87.9	11.9	85.4	100.5	16.1
Maranhão	84.3	92.9	5.1	72.1	83.0	4.6
Piauí	79	84.6	6.2	81.8	91.9	21.7
Ceará	81.2	92.1	21.9	84.2	98.8	24.5
Rio Grande do Norte	80.5	83.8	3.1	74.4	88.3	13.2
Paraíba	70.9	75.8	14.1	88.4	99.6	35.1
Pernambuco	77.8	90.7	1.9	88.0	110.4	0.6
Alagoas	84.7	92.2	-	116.7	136.2	1.0
Sergipe	61.7	69.8	46.2	80.8	96.0	33.6
Bahia	78.7	89.8	15.1	89.6	105.2	17.5
Southeast region	76.4	94.3	50.0	101.9	130.7	61.2
Minas Gerais	84.5	95.9	51.4	83.5	109.1	26.4
Espírito Santo	76.2	95.6	36.4	74.6	98.7	29.7
Rio de Janeiro	52.4	90.9	11.5	72.3	134.5	5.5
São Paulo	84.9	94.4	71.4	125.0	148.8	96.6
South region	87.8	95.4	62.4	102.4	133.8	44.0
Paraná	86.8	94.0	48.4	96.2	129.7	33.2
Santa Catarina	86.3	99.0	75.0	104.3	130.9	53.1
Rio Grande do Sul	90.2	95.3	70.8	108.2	140.0	50.7
Center-West region	74.0	93.1	24.9	75.9	109.8	12.8
Mato Grosso do Sul	78.9	95.9	42.9	72.7	98.8	12.9
Mato Grosso	77.1	93.2	35.2	76.2	92.9	34.4
Goiás	73.8	93.3	14.2	63.4	100.4	2.5
Distrito Federal	58.0	82.9	21.7	123.6	196.2	22.0

Source: CNES, RPS, SIH, CIH, PNAD.
*Ratio between hospitals that informed SIH and/or CIH and hospitals that should inform them according to the contracts registered in CNES and RPS; **Ratio between hospitalizations informed via SIH and/or CIH and hospitalizations estimated by PNAD.

Table 5. Coverage of information about hospital deaths and births. Brazil, 2009.

Region	Deaths*			Births**		
	Total	Non-SUS (CIH)	SUS (SIH)	Total	Non-SUS (CIH)	SUS (SIH)
Brazil	56.8	50.4	57.8	76.1	32.0	87.5
North region	45.5	8.4	47.6	79.8	4.8	86.5
Northeast region	49.5	25.5	51.2	82.5	7.6	90.3
Southeast region	58.8	54.3	59.8	72.6	39.6	88.8
South region	66.8	66.9	66.8	72.4	35.9	83.0
Center-West region	49.6	20.4	52.3	70.1	13.9	78.3

Source: SIH, CIH, SIM, SINASC.
*Deaths outside of SUS estimated based on the number of deaths of beneficiaries, publicized by ANS in the Internet, and deaths inside SUS estimated by the difference with SIM; **Births outside of SUS estimated based on the number of beneficiaries of up to 1 year old publicized by ANS in the Internet, and births inside SUS estimated by the difference with SINASC.

TabNet), the coverage of information about hospital mortality in CIH was of 50.4%. Based on the difference between the total of hospital deaths registered in SIM and those informed by ANS, the coverage of SIH was estimated in 57.8%. Being a part of SUS or not, the South and Southeast regions presented the largest coverages of mortality information, and the North region, the lowest coverage (Table 5).

The comparison between births in hospitals, informed by CIH and SIH, and those registered by SINASC, indicated coverage of 76.1% in Brazil (Table 5). Specifically for information about not SUS, considering the number of beneficiaries younger than 1 year old, used to estimate the total number of births (ANS 2009), approximately 584 thousand births would have occurred in 2009, indicating coverage of 32.0% of CIH. Based on the difference between the total of births informed in SINASC and the estimation among beneficiaries, the coverage estimated in SIH for Brazil was 87.5% (Table 5).

DISCUSSION

Despite the relatively short time since the implantation of CNES, approximately 13 years, and the lack of scientific papers using it as a data source about the Brazilian care network, the analysis in this study indicated the complete and consistent fulfillment of records in hospitals with hospitalization. The coverage of CNES can be considered as satisfactory, based on the information of AMS, study with great scientific acknowledgment[11-13].

The importance of this national record for the investigation and auditing of services, physical structures, and human resources had been mentioned by Nascimento[14]. Before that, Carvalho[15], reporting to the implantation of CNES, had already indicated its pertinence, viability, and advantages. These qualities, together with the results in this study — which indicate good coverage, completeness, and consistence of CNES for information about hospitalization units —, increase the legitimacy of its use, even if it is necessary to invest in improvements. Therefore, CNES is a relevant source of information about the infrastructure of the National Health Service, especially because its information is not limited to the network that provides services to SUS.

Despite its flaws, SIH has been used in different studies of collective health[4]; its use is common in hospital performance analyses[16]. Even if the information available is limited for the risk adjustment of the indicators, SIH constitutes a single source with national comprehension, so it can be valuable in the management process.

The analysis of the quality of CIH conducted in this study showed important flaws in its coverage, thus making it impossible to use it in a national level. On the other hand, CIH presented consistency in some states, with higher coverages that were compatible with other sources of data, especially in São Paulo, Santa Catarina, and Rio Grande do Sul. These results corroborate those presented by Moreira and Novaes[17], pointing out to the need for efforts to improve this source of information, since Brazil still does not have a database that describes its entire hospital production.

Regarding the flow of data on hospitalizations, most hospitals have sent some information via SIH and CIH. However, hospitals in the SUS network presented higher coverage, especially because of the payment system, besides the need to fulfill the demands required to obtain the philanthropy certificate, since most private hospitals working with SUS (about 58%) are nonprofit[18]. Regarding the differences in the CIH coverage among private hospitals, the for-profit ones were less representative than the nonprofit ones. These differences can also be related to the interest in filling out the form, because of the connection between the hospital and SUS.

By assessing the coverage of CIH, based on the comparison of information about deliveries, Pinheiro et al.[19] found rates that were even lower than those observed in the analyses of this study, even though the regional differences had been similar. About SUS and non-SUS hospitalizations, Moreira and Novaes[17] identified problems as to the validity in the field "main diagnosis," even more than those found in this study. Considering that the authors analyzed it before we did, it is possible to infer that there has been slight qualification in the diagnostic information.

With regard to the reasons for the low coverage of the death records informed in CIH and SIH in relation to SIM, it is possible to assume the high occurrence of deaths in emergency that did not result in hospitalization, so no records were found in those databases[20]. This finding stands out, since these cases are commonly registered in some services, aiming at the importance of the record. Besides, it is worth to mention the absence of an information system that can register, individually, the type of emergency service in the country. It is also possible that not all deaths are notified, especially because the outcome of the hospitalization does not affect the payment of the procedures conducted. Inconsistencies of data referring to procedures carried out in non-SUS hospitalizations can be associated with the use of the SUS table of procedures in CIH. Until 2009, there were several existing tables of medical procedures, with variations in codes and prices. From that year on, the Single Table of Procedures in Supplementary Health (TUSS)[21] was validated. Then, there was a unified terminology for all of the services addressed to patients with health insurance plans. Still, considering the inexistence of a mechanism to convert the tables in the CIH system, the problem of the quality of this information continues.

Some limitations of the strategies used to analyze the quality in this study should be taken into account. The study privileged the evaluation of the coverage of databases in comparison to alternate sources of information. In fact, the analyses conducted in the ecological scope help to provide an approximate description of the quality of information, but do not allow identifying the magnitude of the gaps precisely. Besides, it is important to mention that accessibility, opportunity, and methodological clarity were not assessed. However, the possibility of the free acquisition of data and their registration via Internet indicates that these dimensions do not seem to have been neglected. The reliability and validity of the data could not be assessed, since its analysis would require a comparison with the files of the hospitals, in the case of CNES, and with patients records, for SIH and CIH; then, another study design would be necessary.

Finally, the nonduplicity was not the focus of this study, but instead, in the analyses conducted, the idea was to control its effect by using identification keys with the numbers of CNES and CNPJ, besides the exclusion of hospitalization notifications by continuity. It is important to mention that, on a daily basis, before the dissemination of data files, a treatment to reduce duplicities is conducted. Specifically regarding CNES, this analysis focused on registers of hospitals with hospitalization, thus limiting any conclusions beyond this universe, such as the ones referring to the outpatient clinics or other data about the service supplier, like services or human resources.

CONCLUSION

Considering that the complete dimensioning of the issues found in the quality of information recorded in secondary data sources about hospitals and hospitalizations in Brazil can be, alone, a research line, the analyses conducted here represent an approximation of their effect on studies using these databases.

It is possible to conclude there are basic registration data with good coverage, completeness, and consistence for hospitals with hospitalization registered in CNES, increasing the legitimacy of its use as a source of information about hospitals in Brazil. Regarding the information about hospitalizations in the country, there is much to be done when it comes to improving the quality of the existing systems, especially concerning CIH.

In this sense, it is very important that the databases be used to show the main flaws to be corrected. It is even more important that the results of these studies be incorporated by managers of the information systems. This does not seem to have happened on a regular basis, and one example is the filling out of information about secondary diagnosis in SIH. Twenty years after the publication of the first evidence of subnotification[5], this percentage is still high.

Even though the lack of diagnostic and clinical information is inherent to the secondary databases originally created with the purpose of payment, this information was improved in other countries, being very relevant for risk adjustments and validity of indicators of care, as well as for the description of the morbidity profile of the population, currently aging, and with multiple chronic diseases. In Brazil, ordinance no. 1,324 was published only in November 2014, and increased the number of fields to register this information; still, initiatives to encourage the registration are essential.

In this sense, the first recommendation about the information systems concerns the need to encourage the correct filling out and sending of data with the proper periodicity. Incompleteness, inconsistencies, lack of information, or intermittent sending of data should be continuously monitored, with concrete consequences for hospitals, even for those who do not work with SUS patients, once the information is interesting to the public. The improvements in the filling out of secondary databases are desirable not only to qualify the analyses that are currently conducted, but also to increase their potential of use, especially regarding the scope of research and the construction

of strategic analyses. Such improvements are essential to get to know the morbidity profile of the population, enabling to understand health needs better, therefore subsidizing the decision-making in the planning of hospitals and health care networks.

The second recommendation concerns the creation of fields to fill out clinical data, especially "secondary diagnosis, which, ideally, should allow the record of all existing comorbidities and their presence at the time of hospital admission. It is a known fact that this action depends on financial investments, hiring, and training of human resources. However, it seems to be inevitable to invest in the quality of the databases and in the qualification of services and professionals working with the record of information, in a context management innovation including, among other strategies, systems of payment by performance which demand more accurate information.

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