Agreement between underlying cause and preventability of infant deaths before and after the investigation in Recife, Pernambuco State, Brazil, 2014*

Lays Janaina Prazeres Marques[1]
Dayane da Rocha Pimentel[2]
Conceição Maria de Oliveira[3]
Mirella Bezerra Rodrigues Vilela[4]
Paulo Germano Frias[5]
Cristine Vieira do Bonfim[1] – ⓘ orcid.org/0000-0002-4495-9673

[1]Universidade Federal de Pernambuco, Programa de Pós-Graduação em Saúde Coletiva, Recife, PE, Brasil
[2]Fundação Joaquim Nabuco, Instituto de Pesquisas Sociais, Recife, PE, Brasil
[3]Centro Universitário Maurício de Nassau, Recife, PE, Brasil
[4]Universidade Federal de Pernambuco, Departamento de Fonoaudiologia, Recife, PE, Brasil
[5]Instituto de Medicina Integral Prof. Fernando Figueira, Recife, PE, Brasil

Abstract

Objective: to assess the agreement and describe the causes and preventability of infant deaths before and after the investigation. **Methods**: investigation files and death certificates of infants under one year, of mothers living in Recife, Brazil, in 2014 were used; the Cohen kappa index was adopted for agreement analysis of the underlying causes of death; the list of preventable causes of deaths by interventions of the Brazilian National Health System was also adopted. **Results**: 183 infant deaths were analyzed, of which 117 (63.9%) had the underlying cause revised; before the investigation, 170 (92.2%) deaths were considered preventable, and after investigation, 178 (97.3%); there was reasonable agreement (0.338) regarding the underlying causes of death, and moderate (0.439) for preventability. **Conclusion**: infant mortality surveillance enabled the improvement of vital events information, contributing to the progress in the specification of underlying causes of death and in the preventability of infant death.

Keywords: Infant Mortality; Cause of Death; Epidemiological Surveillance; Vital Statistics; Health Information Systems.

Correspondence:
Cristine Vieira do Bonfim – Fundação Joaquim Nabuco, Diretoria de Pesquisas Sociais, Rua Dois Irmãos, nº 92, Ed. Renato Carneiro Campos, Apipucos, Recife-PE, Brasil. CEP: 52071-440
E-mail: cristine.bonfim@uol.com.br

Epidemiol. Serv. Saude, Brasília, 27(1):e20170557, 2018

1

Introduction

Health information systems are important sources for the continuous monitoring of vital statistics.[1] Despite the importance of access to reliable and timely information for improvement of the health of a population, in many low and middle-income countries, the statistical systems still do not meet their goals.[2] This hampers the monitoring of progress of international agendas, such as the Sustainable Development Goals.[3]

In Brazil, due to the need for standardization of mortality statistics, the Ministry of Health implemented the Mortality Information System (SIM) in 1976 and defined a unique model for a Death Certificate (DC).[4] Although the DC is a widely used resource, physicians do not always correctly identify the cause of death.[1] The adequate classification and record of the underlying cause of death favors the assignment of preventability criteria to infant deaths.[5] This classification allows the monitoring of the quality of health services, the analysis of the mortality trends and the planning of actions to reduce them.[6]

> *Surveillance of infant and fetal death is recommended to improve notification of the underlying cause and to determine preventability criteria.*

In order to improve the quality of the DC information, the Ministry of Health and the state and municipal health departments have developed a number of strategies,[7] among them the training of physicians, the strengthening of the Death Verification Services (SVO) and the Forensic Medicine Institutes (FMI). In 2010, surveillance service for infant and fetal death was implemented.[8]

Surveillance of infant and fetal death is recommended to improve notification of the underlying cause and to determine preventability criteria.[9] This strategy also contributes to the improvement of mortality records and enables the adoption of preventive and health promotion measures.[10] The Ministry of Health recommends that the investigation of deaths should be carried out by records of outpatient, hospital and household investigation, necropsy and case synthesis. The record for infant and fetal death investigation

– containing the case synthesis, conclusions and recommendations – is used to summarize the information after the discussion of each case. This method also supplies the module for the investigation of infant deaths at the federal level, the SIM-Web.[11]

With the incorporation of the normative and legal basis for the monitoring of infant and fetal deaths, the investigation and the accomplishment of case syntheses in the scope of technical groups and of Committees for the Prevention of Death have gained importance, starting to collaborate to clarify the causes of death and the circumstances of its occurrence.[9] However, few studies have evaluated the contribution of infant death investigation performed in daily services, as well as the improvement of vital information and its implications in the classification of prevention of death.

This research aimed to measure agreement, to describe the causes and the preventability of infant deaths before and after research in the city of Recife, Pernambuco State, Brazil, in 2014.

Methods

This is a cross-sectional study. The DC and summary forms of the investigation of all deaths of children under one year old born to mothers residing in Recife in 2014 investigated and discussed by the Child Death Surveillance were included.

Recife is the capital of Pernambuco State, located in the Northeast region of Brazil. In 2014, the municipality had 1,608,488 estimated inhabitants, distributed into 218 square kilometers.[12] We selected the underlying cause reported in the DC and in the summary form of the investigation of infant death. The data were grouped by component of infant mortality (early neonatal, late neonatal and post-neonatal) and organized with the aid of Tabwin version 3.6b. The agreement of the underlying cause of infant deaths before and after the investigation was analyzed by comparing the causes based on the codes of the International Statistical Classification of Diseases and Related Health Problems Tenth Revision (ICD-10), by chapters and specific groups of causes of death.[13]

For the classification of preventability of deaths, the Brazilian List of Preventability (BLP) was adopted – a list of causes of preventable deaths under the Brazilian National Health System (SUS) for children under five years. The deaths considered avoidable were classified

by groups of health actions: immunization; adequate follow-up and care for pregnant women, delivery and care for the newborn; appropriate diagnosis and treatment; and adequate health promotion actions, linked to adequate health care actions.[14]

Cohen's kappa coefficient was then calculated based on the following criteria: excellent agreement (0.80 to 1.00), substantial agreement (0.60 to 0.79), moderate agreement (0.40 to 0.59), reasonable agreement (0.20 to 0.39), poor agreement (0.00 to 0.19) and no agreement (=0.00).[15] To indicate the reliability of this estimates, the 95% confidence interval for each age group was calculated. The analysis was carried out using the Statistical Package for the Social Sciences (SPSS), version 15.0.

The research project was approved by the Research Ethics Committee of the Health Center of the Federal University of Pernambuco (CEP/CCS/UFPE) (Report No. 1,702,600) on August 30th, 2016, and there was consent of the Municipal Health Department of Recife.

Results

Of the total of 280 infant deaths recorded in SIM in 2014, 76 (27.1%) had congenital malformations, the only causes of infant death not investigated in Recife. Of the 204 (72.9%) eligible deaths, 10 (4.9%) were not investigated because the address or medical record was not found, or because the family refused to participate, and 11 (5.4%) had the record lost, representing a loss of 10.3%. The remaining 183 (89.7%) deaths were included into this study, corresponding to 94

(51.4%) early neonatal, 50 (27.3%) late neonatal and 39 (21.3%) post-neonatal (Figure 1).

Of the 183 (89.7%) deaths investigated and discussed, 117 (63.9%) had the underlying cause redefined, of which 59 (50.4%) were early neonatal death, 36 (30.8%) were late neonatal death and 22 (18.8%) were post-neonatal death. In the original DC, 148 (80.8%) were the underlying causes of death seen in Chapter XVI, corresponding to conditions originating in the perinatal period. Of these, 91 (96.8%) referred to early neonatal deaths, 42 (84.0%) late neonatal and 15 (38.5%) post-neonatal deaths. After the investigation, the causes related to this chapter increased, with 156 (85.2%) deaths, being 92 early neonatal, 45 late neonatal and 19 post-neonatal (Table 1).

Of the causes redefined, 98 (83.8%) presented equivalence in the chapters (Table 2). Agreement between infant death before and after the investigation, according to the kappa index was reasonable (0.338 - 95%CI 0.303; 0.373) for the underlying cause, and moderate (0,439; 95%IC 0,389; 0,489) for preventability. Among the components, the highest agreement was observed in the post-neonatal period, classified as moderate (0.418; 95%CI 0.399; 0.497) for the underlying cause and also for preventability (0.549; 95%CI 0.462, 0.636) (Table 3).

Before the investigation, 170 (92.9%) deaths were classified as preventable, 90 of them were included as part of the early neonatal component, 47 were part of the late neonatal period and 33 were post-neonatal. After the investigation, the proportion of preventable deaths increased to 178 (97.3%), with an increase in all components, especially in the early neonatal
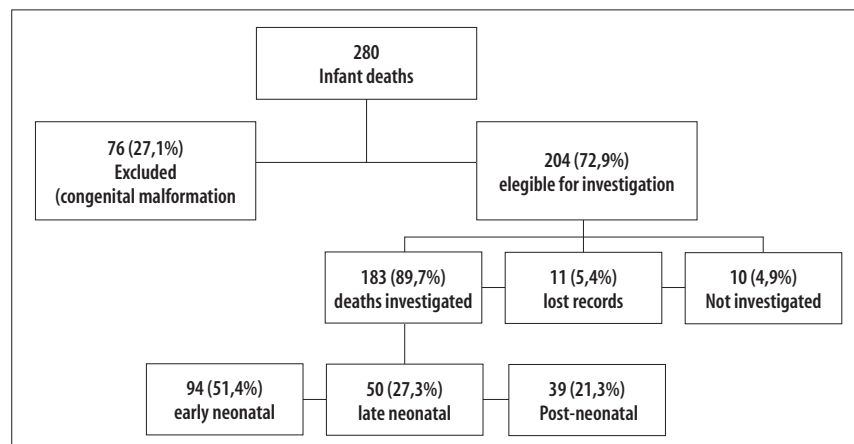

Figure 1 – Flowchart of the study about agreement between underlying cause and preventability of infant deaths before and after the investigation in Recife, Pernambuco State, Brazil, 2014

Table 1 – Agreement between the underlying causes of death informed in the Death Certificate (DC) and after investigation, per chapters of the International Statistical Classification of Diseases and Related Health Problems Tenth Revision (ICD-10), Recife, Pernambuco State, 2014

CID-10 Chapters	Early neonatal		Late neonatal		Post neonatal		Infant death	
	Before	After	Before	After	Before	After	Before	After
	n	n	n	n	n	n	n (%)	n (%)
I – Certain infectious and parasitic diseases	2	2	2	2	8	8	12 (6.6)	12 (6.6)
II - Neoplasms	–	–	–	–	–	1	–	1 (0.5)
VI - Diseases of the nervous system	–	–	–	–	–	1	–	1 (0.5)
X - Diseases of the respiratory system	–	–	1	–	5	2	6 (3.3)	2 (1.1)
XIV - Diseases of the genitourinary system	–	–	–	–	1	1	1 (0.5)	1 (0.5)
XVI – Certain conditions originating in the perinatal period	91	92	42	45	15	19	148 (80.8)	156 (85.3)
XVII – Congenital malformation, deformations and chromosomal abnormalities	1	–	1	–	2	–	4 (2.2)	–
XVIII - Symptoms, signs, and abnormal from clinical and laboratory findings, not elsewhere classified	–	–	1	–	3	1	4 (2.2)	1 (0.5)
XX – External causes of morbidity and mortality	–	–	3	3	5	6	8 (4.4)	9 (5.0)
Total	94	94	50	50	39	39	183 (100.0)	183 (100.0)

Note: for the remaining chapters of ICD-10, no deaths were identified.

Table 2 – Comparison, between chapters of the International Statistical Classification of Diseases and Related Health Problems Tenth Revision (ICD-10), of underlying causes of infant death informed in the Death Certificate (DC) and defined after investigation, Recife, Pernambuco State, 2014

ICD-10 chapters of underlying causes on the original DC	Relocation per chapter after the investigation									Total in the original DC
	I	II	VI	X	XIV	XVI	XVII	XVIII	XX	
I	6	–	–	–	–	6	–	–	–	12
II	–	–	–	–	–	–	–	–	–	–
VI	–	–	–	–	–	–	–	–	–	–
X	3	–	–	2	–	–	–	–	1	6
XIV	–	–	–	-	1	–	–	–	–	1
XVI	2	–	–	–	–	146	–	–	–	148
XVII	–	–	1	–	–	3	–	–	–	4
XVIII	1	1	-	–	–	1	–	1	–	4
XX	–	–	–	–	–	–	–	–	8	8
Total in the corrected DC	12	1	1	2	1	156	–	1	9	183

Note:
Chapters of ICD-10.
I – Certain infectious and parasitic diseases.
II - Neoplasms.
VI - Diseases of the nervous system.
X - Diseases of the respiratory system.
XIV - Diseases of the genitourinary system.
XVI – Certain conditions originating in the perinatal period.
XVII – Congenital malformation, deformations and chromosomal abnormalities.
XVIII - Symptoms, signs, and abnormal from clinical and laboratory findings, not elsewhere classified.
XX – External causes of morbidity and mortality.

period, in which all deaths were considered avoidable (Table 4).

In the early neonatal component, there was an increase from 52 to 73 in deaths classified in the group of reducible by adequate care for the pregnant woman. In the group of preventable causes by adequate care for the newborn, there was a reduction from 25 to 13 deaths. Ill-defined causes and other causes not

Table 3 – Analyis of agreement between underlying cause and preventability of infant death per mortality component before and after investigation, Recife, Pernambuco Sate, 2014

Component	Kappa index UC[a]	Classification	95%CI[b]	Kappa index BLP[c]	Classification	95%CI[b]
Early neonatal	0.343	reasonable	0.293;0.393	0.327	reasonable	0.247;0.407
Late neonatal	0.247	reasonable	0.188;0.306	0.396	reasonable	0.304;0.488
Post-neonatal	0.418	moderate	0.339;0.497	0.549	moderate	0.462;0.636
Total	0.338	reasonable	0.303;0.373	0.439	moderate	0.389;0.489

a) UC: underlying cause.
b) 95%CI: 95% confidence interval.
c) BLP: Brazilian List of Preventability.

Table 4 – Classification of preventability of infant death before and after investigation, Recife, Pernambuco State, 2014

Preventability criteria	Early Neonatal		Late Neonatal		Postneonatal		Infant death	
	Before	After	Before	After	Before	After	Before	After
	n	n	n	n	n	n	n (%)	n (%)
Preventable causes	90	94	47	49	33	35	170 (92.9)	178 (97.3)
Reducible by immunization	–	–	–	1	3	5	3 (1.6)	6 (3.3)
Reducible by adequate care for the pregnant woman	52	73	20	37	7	16	79 (43.2)	126 (68.9)
Reducible by adequate care for the woman during childbirth	13	11	4	3	2	1	19 (10.4)	12 (6.6)
Reducible by adequate care for the newborn	25	13	17	5	6	3	48 (26.2)	21 (11.5)
Reducible by adequate diagnosis and treatment	–	–	2	–	10	3	12 (6.6)	3 (1.6)
Reducible by health promotion	–	–	4	3	5	7	9 (4.9)	10 (5.5)
Ill-defined causes	1	–	1	–	3	1	5 (2.7)	1 (0.5)
Other causes (not clearly preventable)	3	–	2	1	3	3	8 (4.4)	4 (2.2)
Total	94	94	50	50	39	39	183 (100.0)	183 (100.0)

clearly avoidable were fully clarified in the investigation (Table 4).

In the late neonatal component, after the investigation, there was an increase in the number of deaths due to causes reducible by immunization and adequate care for the pregnant woman. However, there was a reduction in the causes reducible with adequate care for the newborn. The ill-defined causes were clarified, and one cause not clearly preventable remained so after the investigation (Table 4).

After the investigation of post-neonatal deaths, there was an increase from 3 to 5 in the group of deaths with causes reducible by immunization. Reducible deaths by adequate care for the pregnant woman increased from 7 to 16. Causes reducible by adequate care for the pregnant woman during childbirth reduced from two to one, and causes reducible by adequate care for the newborn decreased from 6 to 3. Only one ill-defined cause was not clarified, and three causes remained not clearly preventable (Table 4).

Discussion

The majority of deaths had a change in the underlying cause after the investigation, although deaths reclassified in their original chapter of ICD-10 predominated. When considering the underlying causes of death before and after the investigation, there was reasonable agreement for the underlying cause, and moderate agreement for the preventability classification. After investigation, there was an increase in the number of deaths preventable by SUS interventions. The great majority of deaths were considered preventable, especially those in the early neonatal period.

The redefinition of most of the underlying causes of infant death and the agreement of the causes of death and preventability identified in this study can be considered indicators of the adequacy of the actions of infant death surveillance. An assessment of the social representation of physicians on the perinatal diseases, performed in the city of São Paulo in 2012, points out

Epidemiol. Serv. Saude, Brasília, 27(1):e20170557, 2018

5

that the quality of information on mortality is related, above all, to adequate data collection and in recording processes in the health care facilities for women and infants, reflecting the consistency of the information provided.[16]

The importance of the investigations of deaths and of the action of the Centers of Hospital Epidemiology for the improvement of the information on the underlying cause of death in the DC are clear.[8,17] The conduction of the investigation facilitates the qualification of services performed by the clinical staff of health facilities, minimizing the lack of knowledge of the physicians regarding their role in the production chain of vital information.[18] Despite the investments in the training of physicians and the advances made in the adequate filling of the DC, fragilities persist.[19]

The identification of the circumstances of deaths only by cause groups is not enough to understand the conditions of their occurrence. Studies point out that changes in the cause of death and their classification regarding preventability redirect actions to achieve it, constituting a defining element of greater or lesser possibility of success in coping with and preventing infant deaths.[1,5,20]

After investigation and reclassification of deaths according to the preventability criteria, it was found that nine out of ten deaths were considered preventable by SUS interventions. Among these deaths, the early neonatal component presented the highest percentage of preventable causes when compared to the other components, both before and after the investigation. Research has shown that the information obtained near the birth is better filled, both in terms of completeness and reliability.[2,21] The availability of reliable data allows us to verify, with greater precision, the conditions of births, deaths and their determinants.[22]

After the investigation, there was an increase in deaths due to causes reducible by immunization, with a greater increase in the post-neonatal component. The correction of these causes of death potentially contributes to the knowledge of factors closely related to the mortality of newborns, and to the definition and dimensioning of health promotion and prevention measures.[23]

Approximately 70% of deaths could have been prevented if adequate attention had been paid to women during pregnancy. The causes for maternal conditions observed after the investigation represented twice as many deaths compared to those recorded in the original DC. The highest increase in these causes was observed in the late neonatal component. Adequate prenatal care and pre-childbirth follow-up and routine laboratory examinations not only can identify early complications but also reduce complications of pregnancy.[24] Thus, it is possible to control infections by vertical transmission and avoid possible maternal and infant deaths.[20]

The group of causes reducible by adequate care to the pregnant woman presented the highest percentage of preventable deaths in the original DC, and after the investigation. The inadequate registration of intermediate causes, to the detriment of specific causes, does little to clarify the mortality conditions;[9] this also compromises the identification of risk factors for the newborn, possibly related to intrauterine, maternal, placental problems or problems with the fetus.[25,26] Altering the epidemiological profile of these deaths can help achieve decisive changes in health interventions aimed at optimizing the prognosis of newborns and avoiding an unfavorable outcome.[5]

The causes of death that were not clearly preventable and ill-defined were also reduced after the investigation. This finding reinforces the idea that the investigation of deaths through the conduction of audits on mortality and verbal autopsy has contributed to the quality of information on vital events.[27-30]

Regarding the limitations of this study, we highlight the absence of assessment of the reliability of the investigation and the sample loss. This, although representing 10.3% of the deaths eligible for research, did not compromise the analysis of the results found.

The agreement of the underlying cause and preventability ranged from reasonable to moderate in infant deaths, with better agreement in the post-neonatal component. The main changes were observed in the reducible causes by adequate care to the pregnant woman. The surveillance of infant death contributed to more specific underlying causes, redirecting the intermediate causes recorded in the DC and correct classification of the preventability of infant deaths. This strategy favors the strengthening of the health system, through the systematic analysis of the events that led to the occurrence of death; it also allows the correction of vital information and the identification of failures in healthcare, with a view to prevention of similar deaths and reduction of infant mortality. For this to happen, it is necessary to continuously monitor the data produced

with the investigation of the deaths. Further studies are suggested in order to assess the reliability of information generated by infant death surveillance.

Authors' contributions

Marques LJP, Bonfim CV and Oliveira CM contributed to the conception and design of the study, and to the analysis of the data and writing of the manuscript. Pimentel DR contributed to the acquisition, analysis and interpretation of the data of this research. Vilela MBR and Frias PG contributed to the interpretation of the data and the critical review of the intellectual subject. All authors approved the final version of the manuscript and declared to be responsible for all aspects of the study, ensuring its accuracy and integrity.

References

1. Santos HG, Andrade SM, Silva AMR, Carvalho WO, Mesas AE, González AD. Concordância sobre causas básicas de morte infantil entre registros originais e após investigação: análise de dois biênios nos anos 2000. Rev Bras Epidemiol, 2014 abr-jun;17(2):313-22.

2. AbouZahr C, Savigny D, Mikkelsen L, Setel PW, Lozano R, Lopez AD. Towards universal civil registration and vital statistics systems: the time is now. Lancet. 2015 Oct;386(10001):1407-18.

3. Mikkelsen L, Phillips DE, AbouZahr C, Setel PW, Savigny D, Lozano R, et al. A global assessment of civil registration and vital statistics systems: monitoring data quality and progress. Lancet. 2015 Oct;386(1001):1395-406.

4. Mello Jorge MHP, Laurenti R, Gotlieb SLB. Avaliação dos sistemas de informação em saúde no Brasil. Cad Saúde Colet. 2010;18(1):7-18.

5. Silva CMCD, Gomes KRO, Rocha OAMS, Almeida MLM, Moita Neto JM. Validade, confiabilidade e evitabilidade da causa básica dos óbitos neonatais ocorridos em unidade de cuidados intensivos da Rede Norte-Nordeste de Saúde Perinatal. Cad Saúde Pública. 2013 mar;29(3):547-56.

6. Kassar SB, Melo AM, Coutinho SB, Lima MC, Lira PI. Determinants of neonatal death with emphasis on health care during pregnancy, childbirth and reproductive history. J Pediatr. 2013 May-Jun;89(3):269-77.

7. Azevedo BAS, Vanderlei LCM, Mello RJV, Frias PG. Avaliação da implantação dos Serviços de Verificação de Óbito em Pernambuco, 2012: estudo de casos múltiplos. Epidemiol Serv Saúde. 2016 jul-set;25(3):595-606.

8. Szwarcwald CL, Frias PG, Souza Júnior PRB, Almeida WS, Morais Neto OL. Correction of vital statistics based on a proactive search of deaths and live births: evidence from a study of the North and Northeast regions of Brazil. Popul Health Metr. 2014 Jun;12:16.

9. Oliveira CM, Bonfim CV, Guimarães MJB, Frias PG, Medeiros ZM. Mortalidade infantil: tendência temporal e contribuição da vigilância do óbito. Acta Paul Enferm. 2016 mai-jun;29(3):282-90.

10. Brasil. Ministério da Saúde, Secretaria de Vigilância à Saúde. Portaria nº 72, de 11 de janeiro de 2010. Dispõe sobre a regulamentação da Vigilância de Óbitos Infantis e Fetais. Diário Oficial da União, Brasília (DF), 2010 jan 12; Seção 1, p. 29.

11. Caetano SF, Vanderlei LCM, Frias PG. Avaliação da completitude dos instrumentos de investigação do óbito infantil no município de Arapiraca, Alagoas. Cad Saúde Colet. 2013 jul-set;21(3):309-17.

12. Instituto Brasileiro de Geografia e Estatística. IBGE Cidades. Recife [Internet]. 2014 [citado 2016 jun 10]. Disponível em: https://cidades.ibge.gov.br/xtras/perfil.php?codmun=261160

13. Organização Mundial da Saúde. Classificação estatística internacional de doenças e problemas relacionas à saúde (CID10). 10. ed. rev. 1. Reimp. São Paulo: Editora Universidade de São Paulo; 2009.

14. Malta DC, Sardinha LMV, Moura L, Lansky S, Leal MC, Szwarcwald CL, et al. Atualização da lista de causas de mortes evitáveis por intervenções do Sistema Único de Saúde do Brasil. Epidemiol Serv Saúde. 2010 abr-jun;19(2):173-6.

15. Landis JR, Koch GC. The measurement of observer agreement for categorical data. Biometrics. 1977 Mar;33(1):159-74.

16. Schoeps D, Lefevre F, Silva ZP, Novaes HMD, Raspantini PR, Almeida MF. Representações sociais de médicos obstetras e neonatologistas sobre declaração de óbito fetal e neonatal precoce no município de São Paulo. Rev Bras Epidemiol. 2014 jan-mar;17(1):105-18.

17. Pedrosa LDCO, Sarinho SW, Ordonha MR. Análise da qualidade da informação sobre causa básica de óbitos neonatais registrados no Sistema de Informações sobre Mortalidade: um estudo para Maceió, Alagoas, Brasil, 2001-2002. Cad Saúde Pública. 2007 out;23(10):2385-95.

18. Vanderlei LC, Arruda BKG, Frias PG, Arruda S. Avaliação da confiabilidade da causa básica de óbito em unidade terciária de atenção à saúde materno-infantil. Inf Epidemiol Sus. 2002 mar;11(1):15-23.

19. Oliveira CM, Bonfim CV, Guimarães MJB, Frias PG, Antonino VCS, Medeiros ZM. Vigilância do óbito infantil no Recife, Pernambuco: operacionalização, potencialidades e limites. Epidemiol Serv Saúde. 2017 abr-jun;26(2); 413-9.

20. Santos HG, Andrade SM, Silva AMR, Mathias TAF, Ferrari LL, Mesas AE. Mortes infantis evitáveis por intervenções do Sistema Único de Saúde: comparação de duas coortes de nascimentos. Ciênc Saúde Coletiva. 2014 mar;19(3):907-16.

21. Lain SJ, Hadfield RM, Raynes-Greenow CH, Ford JB, Mealing NM, Algert CS, et al. Quality of data in perinatal population health databases: a systematic review. Med Care. 2012 Apr;50(4):e7-20.

22. Marques LJP, Oliveira CM, Bonfim CV. Avaliação da completude e da concordância das variáveis dos Sistemas de Informações sobre Nascidos Vivos e sobre Mortalidade no Recife-PE, 2010-2012. Epidemiol Serv Saúde. 2016 out-dez; 25(4):849-54.

23. Willemann MCA, Goes FCS, Araujo ACM, Domingues CMAS. Adoecimento por coqueluche e número de doses administradas de vacinas Pertussis: estudo de caso-controle. Epidemiol Serv Saúde. 2014 abr-jun;23(2):207-14.

24. Paris GF, Pelloso SM, Martins PM. Qualidade da assistência pré-natal nos serviços públicos e privados. Rev Bras Ginecol Obstet. 2013 out;35(10):447-52.

25. Barbeiro FMS, Fonseca SC, Tauffer MG, Ferreira MSS, Silva FP, Ventura PM, et al. Óbitos fetais no Brasil: revisão sistemática. Rev Saude Pública. 2015;49:22.

26. Faria CS, Martins CBG, Lima FCA, Gaíva MAM. Morbidade e mortalidade entre recém-nascidos de risco: uma revisão bibliográfica. Rev Enferm Global. 2014 out; 13(36):311-22.

27. Bensaïd K, Yaroh AG, Kalter HD, Koffi AK, Amouzou A, Maina A, et al. Verbal/social autopsy in Niger 2012-2013: a new tool for a better understanding of the neonatal and child mortality situation. J Glob Health. 2016 Jun;6(1):010602.

28. França EB, Cunha CC, Vasconcelos AMN, Escalante JJC, Abreu DX, Lima RB, et al. Avaliação da implantação do programa "redução do percentual de óbitos por causas mal definidas" em um estado do Nordeste do Brasil. Rev Bras Epidemiol. 2014 jan-mar;17(1):119-34.

29. McCaw-Binns A, Mullings J, Holder Y. The Quality and completeness of 2008 perinatal and under-five mortality data from vital registration, Jamaica. West Indian Med J. 2015 Jan;64(1):3-16.

30. Stratulat P, Curteanu A, Caraus T, Petrov V, Gardosi J. The experience of the implementation of perinatal audit in Moldova. BJOG. 2014 Sep;121(Suppl 4):167-71.