DOI: 10.1590/1413-81232018233.14052016

Evaluation of the adequacy of information from research on infant mortality in Recife, Pernambuco, Brazil

Conceição Maria de Oliveira [1]
Maria José Bezerra Guimarães [2]
Cristine Vieira do Bonfim [3]
Paulo Germano Frias [4]
Verônica Cristina Sposito Antonino [1]
Aline Luzia Sampaio Guimarães [3]
Zulma Maria Medeiros [5]

Abstract *This study is an evaluation of infant death research in Recife, Pernambuco (PE). It is a cross-sectional study with 120 variables grouped into six dimensions (prenatal, birth, child care, family characteristics, occurrence of death, and conclusion and recommendations), weighted by consensus technique. The research was classified as adequate, partially adequate or inadequate according to a composite indicator assessment (ICA). There was dissension on 11 variables (9 in prenatal dimension, one in labor and birth, and 1 in the conclusions and recommendations). Of the 568 deaths studied, 56.2% have adequate research. The occurrence of death was the best-evaluated dimension and prenatal the poorest. The preparation of the ICA enables professionals and managers of child health policies to identify bottlenecks in the investigation of infant deaths for better targeting of actions, and contributing to the discussion about surveillance in other cities and states.*

Key words *Infant mortality, Epidemiological surveillance, Health evaluation, Vital statistics*

[1] Secretaria Executiva de Vigilância à Saúde, Secretaria de Saúde do Recife. Av. Visconde de Suassuna 658, Santo Amaro. 50050-540 Recife PE Brasil. coliveira@recife.pe.gov.br
[2] Hospital Universitário Oswaldo Cruz, Universidade de Pernambuco. Recife PE Brasil.
[3] Diretoria de Pesquisas Sociais, Fundação Joaquim Nabuco. Recife PE Brasil.
[4] Instituto de Medicina Integral Prof. Fernando Figueira. Recife PE Brasil.
[5] Laboratório de Doenças Transmissíveis, Departamento de Parasitologia, Centro de Pesquisas Aggeu Magalhães, Fiocruz. Recife PE Brasil.

Introduction

The infant mortality surveillance (IMS) is recommended as a strategy that contributes to the prevention of avoidable deaths by health services[1,2]. In Brazil it was adopted by the Ministry of Health (*Ministério da Saúde* – MS) as a state policy in 2010, with the publication of a normative and legal basis[3], beginning with some municipalities that developed this strategy[4-8].

In spite of the scarcity of evaluations of IMS in the country, studies reiterate that this strategy represents an important administrative tool, capable of providing information for healthcare teams, generating critical awareness, and aiding the improvement of information systems[5,9,10]. It also facilitates planning interventions directed at the main healthcare problems and assistance barriers[2], awakening particular interest in reaching the target of infant mortality reduction that is a constant goal of the Sustainable Development Objectives (*Objectivos de Desenvolvivemento Sustentável*– ODS) that are to be reached by the signatory countries by 2030[11-13].

In the formulation of the IMS, the fatalitiesare identified, investigated, and discussed in specific forums, generating healthcare promotion proposals, as well as correction of vital statistics[5,9,10]. The death investigation retrospectively permits an evaluation via patient records and through interviews with family and professionals involved in maternal and child care[10,14]. In order to unravel the circumstances in which the event occurred, the investigation explores the variety of determinants in infant mortality[12], identifying failures in the chain of healthcare actions[6,15-19].

The instrument of data collection regarding infant death is not the same in all of Brazil, in spite of the Ministry of Health making a standard model available for investigation in the domestic, outpatient, and hospital environments[1,10]. For the municipalities that opted for their own instruments, collection of a group of variables that are monitored by the Ministry is obligatory[3].

The few studies on the investigation of infant fatalities do not consider the importance and adequacy of the information toward the clarification of each case's singularity[6,8,10]. The incorporation of these elements in research with an evaluative approach is indispensable for elucidating the limitations and possibilities of the investigation of infant death, with an eye towards its full implementation in various states and municipalities in the country.

In this way, this study has the objective of evaluating the adequacy of investigations into infant deaths in Recife (PE) occurring between 2011 and 2013.

Methods

This is a cross-sectional study with an evaluative framework about the IMS carried out in Recife (PE), a capital city in northeast Brazil, which has a totally urbanized area of 218.5 km^2, with 94 neighborhoods distributed in six health districts. In 2010, the population was 1,537,704 inhabitants, with 19,142 (1.24%) being children less than one year old[20].

Since 2006, all infant deaths of mothers residing in the municipality were investigated, with the exception of birth defects. The IMS is comprised of identification of infant deaths; epidemiological investigation; discussion of the deaths; recommendation of proposals for health promotion, healthcare, and correction of vital statistics; developed by a multidisciplinary team, decentralized by health districts. The investigations are conducted by different professionals: clinically by the Centers for Clinical Epidemiology, autopsy service by the core team, and outpatient and house-call services by workers in primary care.

A proprietary confidential form was used, which considers the variables recommended by the Ministry of Health[1,3] related to: identification of the child and the mother; characteristics of the family; prenatal data; childbirth and delivery; childcare; the occurrence of the death and the conclusions and recommendations. Professionals in healthcare assistance, surveillance, and administration participate in the discussion, distinguishing the process from other initiatives that occur in the context of the committees[4,5]. The recommendations are forwarded to the health administrators for the appropriate actions.

The research was carried out with records of infant deaths that occurred in the years 2011 to 2013, in order to work with recent data up to the last year with a complete database. In this period, of the 628 deaths eligible for investigation, 568 (90.4%) had confidential investigation records located and made available by the Secretary of Health of Recife, constituting the study's population.

Considering the differences in the factors that contributed to the death occurrence, independent of age range, the infant fatalities were grouped into the following categories: deaths of children that did not receive a hospital discharge after birth (Group 1), and deaths of children that received a hospital discharge to the home after

birth (Group 2). In the period studied, all of the children who died were born in a hospital environment. Group 1 included the majority of neonatal deaths and part of the post-neonatal deaths, with causes originating in the perinatal period; Group 2 included the majority of post-neonatal deaths, with causes originating in this period.

Being indispensable to the beginning of the investigation, all of the variables of the confidential investigation record of the infant fatalities were investigated, except those related to the identification of the death, as well as those variables that were repeated in other aspects. For groups 1 and 2, 106 of 120 variables were studied, distributed into five dimensions: pre-natal, pregnancy and childbirth; family characteristics; occurrence of death; and conclusions and recommendations. Childcare was added to Group 2.

The selected variables were evaluated according to their importance in the investigation of infant death by the technique of consensus[21], by a group of 25 specialists in the areas of maternal-infant health and death surveillance, working in the different levels of the Unified Health System (*Sistema Único de Saúde* – SUS). Initially, a meeting was held with the specialists for a knowledge briefing on the study's proposal and the criteria for evaluation of the variables: value of the information for the reconstruction of the history of each death; capacity to identify the level of the system and the action in the chain of healthcare in which possible failure occurred; possibility of understanding the events that contributed to the death event; and to generate recommendations for its avoidance. For each variable, a weighted value between 0 and 10 must be a given.

A classification framework for analysis was mailed electronically to each of the specialists and only one did not respond. Using the established weights, the average ($\underline{x}$)and standard deviation (σ) for each variable were calculated. The average indicated the importance of the variable from the point of view of the specialists, and the standard deviation indicated the degree of consensus. Thus, $\sigma \leq 1$ was considered consensus, $\sigma > 1$ and < 3 little consensus, and $\sigma \geq 3$ dissension. Chart 1 presents a synthesis of the stages of the technique of consensus.

All of the variables in Group 1 achieve consensus or little consensus. In Group 2, dissension in 11 variables was identified (nine related to the pre-natal dimension, one to pregnancy and childbirth, and one to conclusions and recommendations), which were discussed in person by 19 specialists for consensus according to the new weight (Table 1)

Simultaneously, the variables of the investigated death records of the period under study were evaluated by the researchers regarding their degree of completion, attributing the following weighted values: 0 (not filled out), 1 (partially filled out), and 2 (filled out). For each variable of the death investigation, the value observed (weighted value of importance x completion) and the maximum desired value (weighted value of importance x maximum completion value) were obtained.

Next, a composite indicator assessment (*indicador composto para avaliação*– ICA) for each dimension (ICA_{dim}) and for the set of dimensions (ICA_{total}) of infant death investigations was constructed. The ICA_{dim} represented a proportion of the sum of observed values of the set of variables of the respective dimension in relation to the sum of maximum desired values for each of the same variables, according to the following equation:

$$ICA_{dim} = \left(\frac{\Sigma observed\ value}{\Sigma maximum\ desired\ value} \right) x\ 100$$

To obtain the ICA_{total} of the investigation, the average of the ICA_{dim} was used. Using the values of the compound indicators, the investigation of each infant death by dimension and by its set were classified as: adequate (ICA ≥ 80%), partially adequate (ICA = 60-79%), and inadequate (ICA < 60%) (Table 1). The differences in the investigation between the health districts and the dimensions were verified by the Pearson chi-squared test (χ^2), with a significance level of 5%. When more than 20% of the cells presented a desired value < 5, this test was not applied.

The study was approved by the Research Ethics Committee of the Aggeu Magalhães Research Center of the Oswaldo Cruz Foundation - CPqAM/Fiocruz and obtained permission from the Secretary of Health of Recife.

Results

In the period studied, 843 infant deaths occurred in Recife, with an infant mortality coefficient (*coeficiente de mortalidade infantile* – CMI) of 12.4 per 1000 live births (*nascidos vivos* – NV). The largest number of infant deaths (198) was recorded in the health district VI, while the greatest CMI (14.7 for 1000 NV) was found in district I. Of the 628 deaths eligible for investigation, 96.7% (607) were investigated and discussed. In the districts, this proportion varied from 92.9% (III) to 100.0% (I and V). Of the 568 deaths studied, 467 (82.2%) belong to Group 1, and 101 (17.8%) to Group 2 (Table 2).

Chart 1. Synthesis of procedures for the creation of compost indicators for evaluation of investigation of infant deaths.

Phase	Activity developed	Actors
Grouping of infant deaths	Death records were made available in: Group 1: deaths of children that did not receive a hospital discharge after death. Group 2: deaths of children that received a hospital discharge to the home after birth.	Researchers
Selection of variables of IMS instruments	Evaluation of all variables of the investigation records of infant deaths, with exceptions for those related to the identification of death indispensable to the beginning of the investigation, and those that are repeated in other categories, totaling: Group 1 = 106 variables distributed in five categories (pre-natal, birth and delivery, family characteristics, occurrence of death, and conclusions and recommendations. Group 2 = 120 variables distributed in six categories (same as Group 1 plus childcare)	Researchers
System for agreement	study's proposal and criteria for evaluation of the variables. 2. Electronic mailing of the relevant guidelines for analysis of each variable, to be given a weight between 0 and 10. 3. Using the established weights, the average and standard deviation for each variable were calculated. 4. Identification of variables with dissension($\sigma>3$) 5. Face-to-face discussion for consensus regarding a new weight for the variables with dissension (n=11 all from Group 2)	25 specialists 24 specialists Researchers Researchers 19 specialists
Evaluation of the filling out of the record's variables	Evaluation of variables from investigated death records according to their state of completion, with the following weighted values: 0 = not filled out 1 = partially filled out 2 = filled out	Researchers
Creation of the ICA (composite indicator assessment)	1. For each variable of the death investigation, the value observed (weighted value of importance x completion) and the maximum desired value (weighted value of importance x maximum completion value) were obtained. 2. Creation of the ICA_{dim} and the ICAtotal ICA_{dim}= a proportion of the sum of observed values of the set of variables of the respective dimension in relation to the sum of maximum desired values for each of the same variables ICA_{total}= average of the ICA_{dim}	Researchers
Classification of the investigations	The investigation of each infant death by dimension and for its set was classified as: Adequate: ICA ≥ 80% Partially adequate: ICA = 60–79% Inadequate: ICA < 60%	Researchers

In Recife, 56.5% of the investigations in Group 1 were classified as adequate. Differences between the dimensions of the investigation were verified, whose adequacy varied from 56.7% (pre-natal) to 81.2% (occurrence of the death). The best evaluation of the investigation (87.8% adequate) was in health district VI, and the greatest percentage of inadequacy was in III (41.4%) (Table 3).

In Group 2, 54.5% of the investigations were adequate, with the dimensions of family char-

Table 1. Synthesis of consensus, according to opinion of the specialists, related to weight of variables of the investigation record of infant death.

Dimensions and variables		Group 1		Group 2	
		$\bar{x}$	σ	$\bar{x}$	σ
Prenatal (41 variables)					
Number of prenatal doctor visits (exact)		9,6	0,8	7,9	1,9
Where prenatal care was carried out (health unit)		8,7	2,2	7,1	2,8
Week or month of pregnancy in whichprenatal care was begun		9,7	0,9	8,0*	3,0*
Pregnancy card (visits and dates)	Date ofvisits	9,4	1,0	7,0*	3,0*
	Weeks of pregnancy (amenorrhea)	9,6	0,8	7,4	2,7
	Weight (kg)	9,4	1,1	7,0*	3,0*
	Blood pressure (mmHg)	9,9	0,3	8,0*	3,0*
	Uterineheight (cm)	9,1	1,3	6,8	2,9
	Fetal heartbeats (Batimentos cardíacos fetais - BCF)	9,6	1,0	7,0*	3,2*
Complementary exams (if done, dates, results)	Urine tests	9,7	0,8	7,5	2,7
	Urine sample in the case of urinary tract infection (UTI)	9,8	0,6	7,5	2,7
	Fasting glycaemia	9,8	0,5	7,3	2,7
	Hb/ Hematocrit	9,3	1,4	7,3	2,7
	Blood classification	9,7	0,6	7,5	2,7
	VDRL test	10,0	0,2	8,4	2,4
	Anti-HIV test	9,9	0,4	8,5	2,5
	Other serology tests	8,9	1,3	7,7	2,6
	Obstetric/fetal ultrasound	9,6	0,8	7,6	2,7
Adequate vaccine plan against tetanus at the end of pregnancy		9,3	1,2	9,0*	3,0*
Maternal complications in the pregnancy	Hypertension	9,8	0,5	8,0	2,1
	Hemorrhage	9,7	0,6	7,5	2,1
	Diabetes	9,8	0,4	7,9	2,1
	Anemia	9,4	0,9	7,5	2,1
	Heart disease	9,6	0,7	7,2	2,3
	Urinary infection	9,9	0,3	8,0	2,2
	Vulvovaginitus	9,7	0,8	7,7	2,2
	Syphilis	10,0	0,2	8,8	1,9
	Rubella	9,5	1,5	8,2	2,3
	Respiratory infection	8,6	1,8	6,6	2,8
	Threat of premature birth	9,8	0,4	7,8	2,1
	Obesity	9,0	1,5	7,2	2,5
	Alcohol use	9,3	1,0	8,1	1,8
	Smoking	9,4	1,0	8,1	1,9
	Illicit drugs	9,5	0,8	8,5	1,8
	Use of medication (what type)	9,3	1,1	8,3	1,9
Treatment of prenatal complications (which and when)		9,9	0,3	8,0	2,4
In areas covered by PSF or PACS	Received a visit from a Community Health Agent (Agente Comunitário de Saúde- ACS) during pregnancy	9,2	2,1	8,0*	3,3*
	Number of ACS visits during pregnancy	9,5	1,0	8,0*	3,0*
Pregnancy history (including the child that died)	Number of pregnancies	8,6	2,2	7,5	2,9
	Number of vaginal and cesarean births	8,6	1,6	6,0*	3,1*
	Number of live births, stillbirths, and abortions	9,5	1,2	8,0	2,7

it continues

acteristics (78.2%) and occurrence of the death (79.2%) with the best evaluation, and childcare being the most inadequate dimension (28.7%). In the health districts, the adequacy of the investigation varied from 21.1% (III) to 85.7% (VI). Between the districts there were also differences

Table 1. continuation

Dimensions and variables		Group 1		Group 2	
		$\bar{x}$	σ	$\bar{x}$	σ
Pregnancy and childbirth (23 variables)					
Where did the birth occur (health unit/name, home, other)		9,4	1,2	8,0	2,3
A partogram was used during labor		9,0	2,1	5,0*	3,1*
Labor was induced		9,2	1,3	7,1	2,6
Quick test for syphilis (VDRL) was carried out		9,9	0,4	8,6	2,2
Quick test for HIV was carried out		9,7	0,9	8,4	2,3
Gestational age (exact)		9,5	1,0	8,8	1,6
Type of pregnancy (single, double, triple, or more)		9,3	1,2	8,2	1,8
Type of birth		9,4	1,2	8,3	2,1
If cesarean, did the intervention occur before labor started?		9,3	1,7	7,3	2,8
When did the rupture of membranes occur?		9,7	0,8	7,8	2,2
Odor of amniotic fluid		9,7	0,7	7,8	2,2
Aspect of amniotic fluid		9,7	0,7	7,6	2,1
Weight at birth		9,9	0,4	9,6	1,1
Apgar score		9,7	0,8	9,6	0,6
Length of stay of the newborn in the maternity ward		9,6	0,7	9,4	1,2
In case they stayed more than 48h in maternity or in the transfer health unit	Reason	9,7	0,6	9,2	1,6
	Discharge in maternity/transfer unit before the death occurrence?	9,1	2,2	8,7	2,5
	Clinical history before the discharge/death	9,8	0,7	9,3	1,5
	Treatment	9,7	0,7	9,3	1,5
	Exams	9,7	0,6	8,9	2,0
	Procedures	9,7	0,6	8,9	1,9
	In indication of ICU/mechanical ventilation –was it given in a timely manner?	9,7	0,9	8,7	2,1
	In case of need for transferal – was one granted in a timely manner?	9,7	0,9	8,7	2,2
Childcare (11 variables)					
The child had monitoring via childcare		NA		9.8	0.5
Local where monitoring took place (health unit)		NA		8.8	1.7
Time of exclusive breastfeeding		NA		9.9	0.4
Number of visits between birth/death		NA		9.6	0.8
Received a visit from ACS (for an area covered by PSF or PACS)		NA		9.6	0.8
Child's Card	Did they have a Child's Card?	NA		9.5	0.8
	Vaccination on schedule	NA		9.8	0.6
	Weigh/age curve	NA		9.9	0.4
	Development (normal for age or evidence of delay)	NA		9.7	0.7
	History of previous illnesses	NA		9.8	0.5
	Hospital internment	NA		9.8	0.5
Family characteristics (13 variables)					
Private health insurance plan		6,5	2,5	6,5	2,6
Monthly Family income in the period of the death		8,3	2,0	9,0	1,3
Number of persons living in the home in the period of the death		7,7	1,8	8,7	1,3
Number of children less than five years old		7,5	2,4	8,3	2,2
Number of rooms used as a bedroom		7,1	2,5	8,3	2,2
Type of housing (owned, rented, donated, or occupied)		7,8	1,6	8,6	1,2
Dominant construction material of the home		7,9	2,1	8,6	1,8
Source of water supply		7,9	2,2	9,2	1,0
Type of sanitation system		8,1	2,2	9,4	0,8
Destination for garbage/domestic refuse		7,9	2,1	9,2	0,9
Distance to health services		8,1	2,5	8,3	2,9
Availability of doctor visits		8,3	2,8	9,1	1,6
Who cared for the child		NA		8,8	2,2

it continues

Table 1. continuation

Dimensions and variables		Group 1		Group 2	
		$\bar{x}$	σ	$\bar{x}$	σ
Occurrence of death (12 variables)					
Place where the death occurred (health unit/name, home, other)		9,5	1,1	9,6	1,1
Death at a health unit	Time of hospitalization in the unit where the death occurred	9,5	0,9	9,4	0,9
	Sector of the death occurrence	9,4	1,0	9,4	1,0
	The child arrived by transfer from another unit/ which?	9,0	2,3	9,5	1,1
	Diagnostic hypothesis of entry at the unit where the death occurred	9,7	0,8	9,7	0,8
	Clinical history/physical exam	9,9	0,4	9,9	0,4
	Weight during hospitalization	9,3	2,1	9,7	0,6
	Development/treatment	9,8	0,6	9,8	0,6
	Exams	9,7	0,7	9,7	0,7
	Final diagnosis	9,7	0,6	9,8	0,6
Autopsy carried out		9,5	1,1	9,6	1,1
Description of the autopsy report		9,6	0,9	9,6	0,8
Conclusions and recommendations (20 variables)					
After the investigation, the death was discussed?		9,7	0,9	9,7	0,9
The discussion occurred in and Expandedor Restricted Technical-Management?		8,8	2,3	8,8	2,3
The investigation validated or altered one or more of the filled-out variables of the DNV or the DO? If so, which?		9,3	1,4	9,3	1,4
The investigation validated/altered the sequence of causes of death?If so, describe the causes of death after the investigation		9,4	1,1	9,4	1,1
In relation to healthcare, the investigation furnished sufficient elements to identify successes and problems in: a:	Family planning	8,6	2,4	8,0	2,4
	Coverage of primary care	8,9	2,2	9,4	1,2
	Prenatal	9,7	0,9	8,2	2,1
	Assistance during birth	9,6	0,9	8,2	1,8
	Assistance to the newborn in the maternity ward	9,6	1,0	8,0	2,1
	Assistance to the child in the Health Center/UBS/ PSF/PACS	NA		9,7	0,9
	Assistance to the child in urgent care / emergency room	NA		9,2	2,3
	Assistance to the child in the hospital	9,1	2,3	9,5	1,0
	Reference and counter-reference	9,1	2,3	9,5	1,2
	Bed at ICU – high-risk pregnancy	9,2	2,2	2,0*	3,1*
	Bed at ICU Neonatal	9,7	0,9	8,3	2,6
	Center of regulation	9,0	1,8	8,6	2,2
	Pre- and inter-hospital transport	8,8	2,3	9,3	1,3
	Blood banks	9,2	1,3	9,0	1,7
The information from the investigation was sufficient for the group to classify the death as avoidable?		9,3	1,3	9,3	1,2
The discussion of the death generated specific recommendations for the inherent problems identified at the health sector		9,5	1,0	9,5	1,0

NA = not applicable. *Variables that had dissension and were re-discussed by the specialists. Group 1: deaths of children that did not receive a hospital discharge after birth. Group 2: deaths of children that received a hospital discharge for the home after birth.

observed in the six dimensions, with emphasis on childcare with 46.7% of inadequate investigations in Group II (Table 3).

For the total of infant deaths, considering the set of dimensions, 56.2% of the investigations were adequate, with occurrence of death being

Table 2. Characteristics of the study population.

Characteristics of the study population (2011-2013)	Health district of residence						Recife
	I (Center)	II (North)	III (Northwest)	IV (West)	V (Southeast)	VI (South)	
CMI of the triennium (per 1000 NV)	14.7	13.7	12.9	12.8	10.8	11.5	12.4
Infant fatalities							
Total (n)	55	136	174	155	125	198	843
Elegible for investigation (n, %)	50 (90.9)	100 (73.5)	127 (73.0)	103 (66.5)	87 (69.6)	161 (81.3)	628 (74.5)
Investigated and discussed (n, %)	50 (100.0)	95 (95.0)	118 (92.9)	99 (96.1))	87 (100.0)	158 (98.1)	607 (96.7)
Fatalities studied (n, %)	50 (100.0)	90 (94.7)	118 (100.0)	95 (96.0)	57 (65.5)	158 (100.0)	568 (93.6)
Group 1 (n, %)	*39 (78.0)*	*75 (83.3)*	*99 (83.9)*	*84 (88.4)*	*47 (82.5)*	*123 (77.8)*	*467 (82.2)*
Group 2 (n, %)	*11 (22.0)*	*15 (16.7)*	*19 (16.1)*	*11 (11.6)*	*10 (17.5)*	*35 (22.2)*	*101 (17.8)*

Table 3. Distribution of infant fatalities in Groups 1 and 2 by dimension and health district of residence according to classification of the study. Recife, 2011 and 2013.

Classification of the investigation by dimension	Group 1						
	Health district of residence						Recife (n = 467) n (%)
	I *(n = 39)*	II *(n = 75)*	III *(n = 99)*	IV *(n = 84)*	V *(n=47)*	VI *(n=123)*	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Prenatal**							
Adequate	18 (46,2)	47 (62,7)	42 (42,4)	40 (47,6)	26 (55,3)	92 (74,8)	265 (56,7)
Partially adequate	8 (20,5)	2 (2,7)	6 (6,1)	12 (14,3)	4 (8,5)	21 (17,1)	53 (11,3)
Inadequate	13 (33,3)	26 (34,7)	51 (51,5)	32 (38,1)	17 (36,2)	10 (8,1)	149 (31,9)
Pregnancy and birth*							
Adequate	35 (89,7)	54 (72,0)	45 (45,5)	37 (44,0)	28 (59,6)	111 (90,2)	310 (66,4)
Partially adequate	3 (7,7)	11 (14,7)	23 (23,2)	20 (23,8)	11 (23,4)	10 (8,1)	78 (16,7)
Inadequate	1 (2,6)	10 (13,3)	31 (31,3)	27 (32,1)	8 (17,0)	2 (1,6)	79 (16,9)
Childcare							
Adequate	-	-	-	-	-	-	-
Partially adequate	-	-	-	-	-	-	-
Inadequate	-	-	-	-	-	-	-
Family characteristics							
Adequate	0 (0,0)	51 (68,0)	59 (59,6)	57 (67,9)	35 (74,5)	95 (77,2)	297 (63,6)
Partially adequate	8 (20,5)	1 (1,3)	4 (4,0)	3 (3,6)	1 (2,1)	4 (3,3)	21 (4,5)
Inadequate	31 (79,5)	23 (30,7)	36 (36,4)	24 (28,6)	11 (23,4)	24 (19,5)	149 (31,9)
Occurrence of death*							
Adequate	38 (97,4)	69 (92,0)	74 (74,7)	51 (60,7)	28 (59,6)	119 (96,7)	379 (81,2)
Partially adequate	0 (0,0)	2 (2,7)	8 (8,1)	17 (20,2)	7 (14,9)	1 (0,8)	35 (7,5)
Inadequate	1 (2,6)	4 (5,3)	17 (17,2)	16 (19,0)	12 (25,5)	3 (2,4)	53 (11,3)
Conclusion and recommendations*							
Adequate	39 (100,0)	35 (46,7)	55 (55,6)	55 (65,5)	19 (40,4)	121 (98,4)	324 (69,4)
Partially adequate	0 (0,0)	31 (41,3)	8 (8,1)	1 (1,2)	22 (46,8)	2 (1,6)	64 (13,7)
Inadequate	0 (0,0)	9 (12,0)	36 (36,4)	28 (33,3)	6 (12,8)	0 (0,0)	79 (16,9)
Set of dimensions*							
Adequate	25 (64,1)	42 (56,0)	30 (30,3)	34 (40,5)	25 (53,2)	108 (87,8)	264 (56,5)
Partially adequate	8 (20,5)	19 (25,3)	28 (28,3)	27 (32,1)	10 (21,3)	9 (7,3)	101 (21,6)
Inadequate	6 (15,4)	14 (18,7)	41 (41,4)	23 (27,4)	12 (25,5)	6 (4,9)	102 (21,8)

it continues

Table 3. continuation

Classification of the investigation by dimension	Group 2						Recife (n = 101) n (%)
	Health district of residence						
	I (n=11)	II (n=15)	III (n=19)	IV (n=11)	V (n=10)	VI (n=35)	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Prenatal**							
Adequate	7 (63,6)	8 (53,3)	8 (42,1)	6 (54,5)	7 (70,0)	28 (80,0)	64 (63,4)
Partially adequate	2 (18,2)	2 (13,3)	2 (10,5)	0 (0,0)	2 (20,0)	4 (11,4)	12 (11,9)
Inadequate	2 (18,2)	5 (33,3)	9 (47,4)	5 (45,5)	1 (10,0)	3 (8,6)	25 (24,8)
Pregnancy and birth*							
Adequate	11 (100,0)	7 (46,7)	5 (26,3)	2 (18,2)	6 (60,0)	26 (74,3)	57 (56,4)
Partially adequate	0 (0,0)	3 (20,0)	7 (36,8)	2 (18,2)	0 (0,0)	6 (17,1)	18 (17,8)
Inadequate	0 (0,0)	5 (33,3)	7 (36,8)	7 (63,6)	4 (40,0)	3 (8,6)	26 (25,7)
Childcare							
Adequate	7 (63,6)	5 (33,3)	7 (36,8)	6 (54,5)	6 (60,0)	28 (80,0)	59 (58,4)
Partially adequate	1 (9,1)	3 (20,0)	4 (21,1)	1 (9,1)	1 (10,0)	3 (8,6)	13 (12,9)
Inadequate	3 (27,3)	7 (46,7)	8 (42,1)	4 (36,4)	3 (30,0)	4 (11,4)	29 (28,7)
Family characteristics							
Adequate	6 (54,5)	12 (80,0)	13 (68,4)	8 (72,7)	9 (90,0)	31 (88,6)	79 (78,2)
Partially adequate	0 (0,0)	0 (0,0)	1 (5,3)	1 (9,1)	0 (0,0)	0 (0,0)	2 (2,0)
Inadequate	5 (45,5)	3 (20,0)	5 (26,3)	2 (18,2)	1 (10,0)	4 (11,4)	20 (19,8)
Occurrence of death*							
Adequate	11 (100,0)	10 (66,7)	13 (68,4)	4 (36,4)	7 (70,0)	35 (100,0)	80 (79,2)
Partially adequate	0 (0,0)	1 (6,7)	4 (21,1)	2 (18,2)	0 (0,0)	0 (0,0)	7 (6,9)
Inadequate	0 (0,0)	4 (26,7)	2 (10,5)	5 (45,5)	3 (30,0)	0 (0,0)	14 (13,9)
Conclusion and recommendations*							
Adequate	11 (100,0)	6 (40,0)	6 (31,6)	7 (63,6)	4 (40,0)	33 (94,3)	67 (66,3)
Partially adequate	0 (0,0)	7 (46,7)	2 (10,5)	0 (0,0)	5 (50,0)	0 (0,0)	14 (13,9)
Inadequate	0 (0,0)	2 (13,3)	11 (57,9)	4 (36,4)	1 (10,0)	2 (5,7)	20 (19,8)
Set of dimensions*							
Adequate	8 (72,7)	5 (33,3)	4 (21,1)	3 (27,3)	5 (50,0)	30 (85,7)	55 (54,5)
Partially adequate	2 (18,2)	5 (33,3)	8 (42,1)	3 (27,3)	5 (50,0)	4 (11,4)	27 (26,7)
Inadequate	1 (9,1)	5 (33,3)	7 (36,8)	5 (45,5)	0 (0,0)	1 (2,9)	19 (18,8)

Group 1: child mortalities that did not receive hospital discharge after birth. Group 2: child mortalities that received hospital discharge to their homes after birth. Classification of investigation: adequate (ICA>80%), partially adequate (ICA = 60-79%) and inadequate (ICA < 60%). *Difference between dimension and health district, $p(\chi 2) < 0{,}001$. ** Difference between dimension and health district, $p(\chi 2) < 0{,}001$ only for Group 1.

the most adequate (80.8%) and pre-natal being the most inadequate (30.6%). Health district VI was the best evaluated, with 87.3% of investigations classified as adequate, and district III was the worst (40.7% inadequate) (Table 4).

In Groups 1 and 2 and in the total of infant deaths, a significant difference ($p < 0.001$) was observed between the health districts and the dimensions (pregnancy and birth, occurrence of death, conclusion and recommendations, and the set of dimensions) in which it was possible to calculate χ^2 (Tables 2 and 3).

Discussion

The study demonstrates that infant fatalities occurred principally in children that did not receive a hospital discharge after birth, and were investigated and discussed almost in their entirety. The investigation was adequate in slightly more than half of fatalities. In spite of more than one decade of implementation of IMS in the municipality, it is noteworthy that 1/5 of deaths presented inadequate investigation. This situation shows the difficulty that public authorities have in consolidating actions in the long term, even when they

Table 4. Distribution of infant fatalities by dimension and health district of the residence, according to the classification of the investigation. Recife, 2011 to 2013.

Classification of the investigation by dimension	Health district of residence						Recife *(n=568)*
	I *(n=50)*	**II** *(n=90)*	**III** *(n=118)*	**IV** *(n=95)*	**V** *(n=57)*	**VI** *(n=158)*	
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	
Prenatal*							
Adequate	25 (50.0)	55 (61.1)	50 (42.4)	46 (48.4)	33 (57.9)	120 (75.9)	329 (57.9)
Partially adequate	10 (20.0)	4 (4.4)	8 (6.8)	12 (12.6)	6 (10.5)	25 (15.8)	65 (11.4)
Inadequate	15 (30.0)	31 (34.4)	60 (50.8)	37 (38.9)	18 (31.6)	13 (8.2)	174 (30.6)
Pregnancy and birth*							
Adequate	46 (92.0)	61 (67.8)	50 (42.4)	39 (41.1)	34 (59.6)	137 (86.7)	367 (64.6)
Partially adequate	3 (6.0)	14 (15.6)	30 (25.4)	22 (23.2)	11 (19.3)	16 (10.1)	96 (16.9)
Inadequate	1 (2.0)	15 (16.7)	38 (32.2)	34 (35.8)	12 (21.1)	5 (3.2)	105 (18.5)
Childcare							
Adequate	7 (63.6)	5 (33.3)	7 (36.8)	6 (54.5)	6 (60.0)	28 (80.0)	59 (58.4)
Partially adequate	1 (9.1)	3 (20.0)	4 (21.1)	1 (9.1)	1 (10.0)	3 (8.6)	13 (12.9)
Inadequate	3 (27.3)	7 (46.7)	8 (42.1)	4 (36.4)	3 (30.0)	4 (11.4)	29 (28.7)
Family characteristics							
Adequate	6 (12.0)	63 (70.0)	72 (61.0)	65 (68.4)	44 (77.2)	126 (79.7)	376 (66.2)
Partially adequate	8 (16.0)	1 (1.1)	5 (4.2)	4 (4.2)	1 (1.8)	4 (2.5)	23 (4.0)
Inadequate	36 (72.0)	26 (28.9)	41 (34.7)	26 (27.4)	12 (21.1)	28 (17.7)	169 (29.8)
Occurrence of death*							
Adequate	49 (98.0)	79 (87.8)	87 (73.7)	55 (57.9)	35 (61.4)	154 (97.5)	459 (80.8)
Partially adequate	0 (0.0)	3 (3.3)	12 (10.2)	19 (20.0)	7 (12.3)	1 (0.6)	42 (7.4)
Inadequate	1 (2.0)	8 (8.9)	19 (16.1)	21 (22.1)	15 (26.3)	3 (1.9)	67 (11.8)
Conclusion and recommendations*							
Adequate	50 (100.0)	41 (45.6)	61 (51.7)	62 (65.3)	23 (40.4)	154 (97.5)	391 (68.8)
Partially adequate	0 (0.0)	38 (42.2)	10 (8.5)	1 (1.1)	27 (47.4)	2 (1.3)	78 (13.7)
Inadequate	0 (0.0)	11 (12.2)	47 (39.8)	32 (33.7)	7 (12.3)	2 (1.3)	99 (17.4)
Set of dimensions*							
Adequate	33 (66.0)	47 (52.2)	34 (28.8)	37 (38.9)	30 (52.6)	138 (87.3)	319 (56.2)
Partially adequate	10 (20.0)	24 (26.7)	36 (30.5)	30 (31.6)	15 (26.3)	13 (8.2)	128 (22.5)
Inadequate	7 (14.0)	19 (21.1)	48 (40.7)	28 (29.5)	12 (21.1)	7 (4.4)	121 (21.3)

Classification of investigation: adequate (ICA ≥ 80%), partially adequate (ICA = 60-79%) and inadequate (ICA < 60%). *Difference between dimension and health district, $p(\chi^2) < 0{,}001$.

are considered priorities and with the obligatory operationalization by decree of the Ministry of Health[3].

National and international research pertaining to the auditing and investigation of infant death mainly deals with the circumstances of the death occurrences, the quantitative aspects of the investigated fatalities, and the state of completion of the records[5,6,8,10,14,16,18,19,22]. In the present study, in addition to these approaches, we incorporate other elements that permit us to construct a composite indicator for evaluation of the infant death investigation. To evaluate the investigation records and the data pertaining to the closing of the case after discussion, a large number of variables of the instrument were used. The method utilized made possible an evaluation of the deaths' investigations with greater discrimination regarding the positive points and those that need to be improved in the operationalization of this strategy, which can be employed in other municipalities.

The weights attributed to the variables by the technique of consensus represent only one degree of provisionary consensus, considering that the epidemiological profile and the healthcare assistance network are in constant change, however it functions as a point of departure and reference for a process that can include other strategies of redefinition of the variables' weights and for the

renovation of consensus[21]. Nevertheless, it constitutes a useful tool for evaluation, and can be used in whole or in part, or modified, depending on state and municipal realities.

No variable from the investigation records, whether in deaths of Group 1 or 2, was excluded by the technique of consensus. This fact is probably related to the process of discussion of this strategy in the country, and in particular in the locale of the study, especially after the multiple institutional productions such as manuals and technical notes, in the context of the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)[1,3,11-13].

Considering the diversity of the epidemiological profile and assistance available in Brazil, the Ministry of Health suggests minimum variables that should be part of the investigation records, and recommends the addition of others that respond to local needs[1,3]. Aside from the ones proposed by the Ministry, the case under consideration adds other variables, for example some that favor a better specification of the basic cause of death by maternal affections.

The classification of infant fatalities into two groups was due to the principal activities involved in the infant death and the preferred locus of the investigation. For Group 1, the subjects of most relevance relate to prenatal care, assistance to the delivery, and the immediate care of the baby, while those in Group 2 concern the monitoring of the child. The division of fatalities into neonatal and post-natal does not entirely convey the essence of the main causes for intervention, in particular when there is use of intensive medical technologies that can delay death in newborns[17,23].

Post-neonatal fatalities in children that did not have a hospital discharge after birth became more frequent in maternity wards that have done away with intensive therapy units. On the other hand, the improvement of life conditions of the population and access to goods and services contributed to the reduction of late neonatal mortalities among those that had a discharge from a maternity ward[17,23].

Regarding the evaluation of the investigation by dimension, it can be stated that the occurrence of the death, pertaining to the assistance given to the child in the hospital[4-5,8,10], presented the most adequacy for both the Groups for the total of fatalities. Such a fact can be due to the proximity and ease of access to the medical charts by the teams of the Center of Hospital Epidemiology, which are responsible for the investigation at this level of attention, developing evaluations and institutional diagnostics[24].

The study identified the most inadequacy of the investigation in the prenatal and childcare dimensions of Groups 1 and 2, respectively. In Group1, the prenatal data is information that is essential for the prediction of risk in the mother-child binary. In Group 2, the data on childcare is fundamental for the evaluation of growth and development and background of the child[9,25]. These are important dimensions that guide the promotion of health and well-being, as well as creating an opportunity for the identification of problems and their respective treatments since the conception of the child[4].

The Family Health Strategy teams maintain a relevant role in the investigation in the prenatal and childcare dimensions, in that these professionals have broad access to the outpatient records. In this way, primary care is the privileged site for the collection of information about infant fatalities and activity in its determining factors, minimizing adverse conditions regarding family, territory, access to the healthcare system, and the quality of attention offered[1,6,9].

The inadequate investigation of the prenatal and childcare dimensions, shown in this study, with a consequent lack of evaluation of the stages of mother-child care, contributed to the inequities in the investments in the various levels of attention, perpetuating deficiencies mainly in primary care. The intensification of training of the Family Health Strategy teams regarding the investigation of infant fatalities is an indispensable condition in order for the managers to know and act on the problems related to the offered healthcare services.

The low adequacy of the investigation of infant fatalities reflects difficulties in obtaining the necessary information for each case, such as: lack of access to patient records due to bureaucratic or administrative problems, principally in supplemental and private healthcare assistance services; lack of recordkeeping in the outpatient and hospital records; and illegible annotations. Regarding household interviews, the absence of information is due to wrong addresses or families moving, as well as refusals[15,22,26].

The evaluation of the investigation of infant fatalities permitted the identification of significant differences between the health districts in their different dimensions. Evidence of deficiencies in the process of investigation makes possible the qualification and organization of the activities of the IMS in accordance with the particularities

of each territory. It is noteworthy that the district, as the unit of analysis, presents the advantage of being less heterogeneous than the whole municipality. Aside from this, these territorial units are utilized for all the areas of the municipal public administration, which facilitates an intersectoral approach, planning of actions, and operationalization of social and health programs[27].

The international experiences indicate whether the strategy is to be properly executed to understand the circumstances of the death and carry out the effective recommendations to avoid similar events[28-30]. Like what occurs in the improvement of information systems in health[31,32], for the perfecting of the investigation of infant fatalities, the following should be considered: inequalities in the training of professionals responsible for this action; the lesser importance given to specific variables during the process of data collection; and the poor completion and filling out of outpatient and hospital records[25,33,34].

For the IMS, we recommend the institution of permanent activities of training, supervision, accompaniment, and quality control of the investigations of infant fatalities for all the levels of the healthcare system involved in this strategy. The challenge of improving the investigation is a fundamental stage for the IMS to favor a critical reflexive environment concerning the care of mother and child, and contribute to the organization of thematic networks of care in the different health regions.

The development of the tool for the evaluation of IMS makes possible the identification of the bottlenecks in the investigation of infant fatalities for better targeting of actions by professionals and administrators of child healthcare policies. In addition, it contributes to reflection on this surveillance in other municipalities and states.

Collaborations

CM Oliveira MJB Guimarães and CV Bonfim worked on conception, designing, analyzing and interpreting the data, writing the article and approving the version to be published; PG Frias worked in the critical review of the article and approval of the version to be published; VCS Antonino worked in the analysis and interpretation of the data and writing of the article; ALS Guimarães worked in the analysis and interpretation of the data and ZM Medeiros worked in the critical review of the article and approval of the version to be published.

References

1. Brasil. Ministério da Saúde (MS). Secretaria de Vigilância à Saúde. *Manual de vigilância do óbito infantil e fetal e do comitê de prevenção do óbito infantil e fetal*. 2ª ed. Brasília: MS; 2009.
2. Bamber JH, Kinsella SM. MBRRACE-UK – the new home for the Confidential Enquiries into Maternal Deaths – reports for the first time. *Anaesthesia* 2015; 70(1):5-9.
3. Brasil. Ministério da Saúde (MS). 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* 2010; 11 jan.
4. Mathias TAF, Assunção NA, Silva GF. Infant deaths investigated by the Prevention Committee of Infant Mortality in region of Paraná State. *Rev. Esc. Enferm. USP* 2008; 42(3):445-453.
5. Venâncio S, Paiva R. O processo de implantação dos Comitês de Investigação do Óbito Infantil no Estado de São Paulo. *Rev Bras Saúde Matern Infant* 2010; 10(3):369-375.
6. Santana M, Aquino R, Medina MG. Effect of the Family Health Strategy on surveillance of infant mortality. *Rev Saúde Pública* 2012; 46(1):59-67.
7. Silva VLS, Santos IS, Medronha NS, Matijasevich A. Mortalidade infantil na cidade de Pelotas, estado do Rio Grande do Sul, Brasil, no período 2005-2008: uso da investigação de óbitos na análise das causas evitáveis. *Epidemiol Serv Saúde* 2012; 21(2):265-274.
8. Santos HGD, Andrade SMD, Silva AMR, Carvalho WOD, Mesas AE, González AD. Agreement on underlying causes of infant death between original records and after investigation: analysis of two biennia in the years 2000. *Rev Bras Epidemiol* 2014; 17(2):313-322.
9. Frias PG, Lira PIC, Vidal SA, Vanderlei LC. Vigilância de óbitos infantis como indicador da efetividade do sistema de saúde - estudo em um município do interior do Nordeste brasileiro. *J Pediatr* 2002; 78(6):509-516.
10. Caetano SF, Moraes Vanderlei LC, Frias PG. Avaliação da completitude dos instrumentos de investigação do óbito infantil no município de Arapiraca, Alagoas. *Cad. Saúde Colet*. 2013; 21(3):309-317.
11. AbouZahr C, Savigny D, Mikkelsen L, Setel PW, Lozano R, Nichols E, Notzon F, Lopez AD. Civil registration and vital statistics: progress in the data revolution for counting and accountability. Counting births and deaths 1. Series. *Lancet* 2015 [cited 2015 Out 02] [about 13 p.]. Available from: http://dx.doi.org/10.1016/S0140-6736(15)60173-8.
12. Grove J, Claeson M, Bryce J, Amouzou A, Boerma T, Waiswa P, Victora C. Maternal, newborn, and child health and the Sustainable Development Goals—a call for sustained and improved measurement. *Lancet* 2015; 386(10003):1511-1514.
13. United Nations. 2015 - time for global action for people and planet. New York: *United Nations* 2015 [cited 2015 Set 16]. Available from: http://www.un.org/sustainabledevelopment.
14. Jodas DA, Scochi MJ, Moura MB, Tiwata MZ. Atendimento à criança e às mães: investigação do óbito evitável em menores de cinco anos. *Rev. Gaúch. Enferm* 2011; 32(4):669-675.
15. Jorge MHPM, Laurenti R, Di Nubila HBV. O óbito e sua investigação: reflexão sobre alguns aspectos relevantes. *Rev Bras Epidemiol* 2010; 13(4):561-576.
16. Mendes ADCG, Lima MMD, Sá DAD, Oliveira LCDS, Maia LTDS. Uso da metodologia de relacionamento de bases de dados para qualificação da informação sobre mortalidade infantil nos municípios de Pernambuco. *Rev. Bras. Saúde Matern. Infant* 2012; 12(3):243-249.
17. Lansky S, Friche AAL, Silva AAM, Campos D, Bittencourt SBA, Carvalho ML, Frias PG, Cavalcante RS, Cunha AJLA. Birth in Brazil survey: neonatal mortality, pregnancy and childbirth quality of care. *Cad Saude Publica* 2014; 30(Supl. 1):S192-S207.
18. Merali HS, Lipsitz S, Hevelone N, Gawande AA, Lashoher A, Agrawal P, Spector J. Audit-identified avoidable factors in maternal and perinatal deaths in low resource settings: a systematic review. *BMC Pregnancy and Childbirth* 2014; 14(280):1-12.
19. World Health Organization (WHO). *Death reviews: maternal, perinatal and child*. WHO 2013. [cited 2016 Jan 24]. Available from: http://www.who.int/pmnch/knowledge/publications/summaries/ks27/en/
20. Instituto Brasileiro de Geografia e Estatística (IBGE). *Cidades: Censo demográfico 2010*. [acessado 2015 Jul 29]. Disponível em: http://www.cidades.ibge.gov.br/xtras/temas.php?lang=&codmun=261160&idtema=67&search=pernambuco|recife|censo-demografico-2010:-resultados-do-universo-caracteristicas-da-populacao-e-dos-domicilios.
21. Souza LEPF, Silva LMV, Hartz ZMA. Conferência de consenso sobre a imagem-objetivo da descentralização da atenção à saúde no Brasil. In: Hartz ZMA, Silva LMV. *Avaliação em saúde: dos modelos teóricos à prática na avaliação de programas e sistemas de saúde*. Rio de Janeiro: Ed. Fiocruz; 2010. p. 65-102.
22. Santana IP, Santos JMD, Costa JRD, Oliveira RRD, Orlandi MHF, Mathias TADF. Aspects of infant mortality, according to an investigation of death. *Acta Paul Enferm* 2011; 24(4):556-562.
23. Victora CG, Aquino EML, Leal MC, Monteiro CA, Barros FC, Szwarcwald CL. Maternal and child health in Brazil: progress and challenges. *Lancet* 2011; 377(9780):1863-1876.
24. Pereira PMH, Frias PG, Carvalho PI, Vidal SA, Figueiroa JN. Mortalidade neonatal hospitalar na coorte de nascidos vivos em maternidade-escola na Região Nordeste do Brasil, 2001-2003. *Epidemiol. Serv. Saúde* 2006; 15(4):19-28.
25. Costa JMBS, Frias PG. Avaliação da completitude das variáveis da declaração de óbitos de menores de um ano residentes em Pernambuco, 1997-2005. *Cien Saude Colet* 2011; 16(Supl. 1):1267-1274.
26. Mathias TAF, Uchimura TT, Assunção AN, Predebon KM. Atividades de extensão universitária em comitê de prevenção de mortalidade infantil e estatísticas de saúde. *Rev Bras Enferm* 2009; 62(2):305-311.
27. Bonfim C, Aguiar-Santos AM, Pedroza D, Costa TR, Portugal JL, Oliveira C, Medeiros Z. Social deprivation index and lymphatic filariasis: a tool for mapping urban areas at risk in northeastern Brazil. *International health* 2009; 1(1):78-84.
28. Kalter HD, Salgado R, Babille M, Koffi AK, Black RE. Social autopsy for maternal and child deaths: a comprehensive literature review to examine the concept and the development of the method. *Population Health Metrics* 2011; 9(45):1-13.

29. Stratulat P, Curteanu A, Caraus T, Petrov V, Gardosib J. The experience of the implementation of perinatal audit in Moldova. *BJOG* 2014; 121(Supl. 4):167-171.
30. United Kingdom Government. Department for Education. Child death reviews: forms for reporting child deaths. [cited 2016 Feb 09]. Available from: http://www.nrhmhp.gov.in/sites/default/files/files/Child%20death%20Review%20guidelines.pdf
31. Frias PG, Szwarcwald CL, Lira PIC. Avaliação dos sistemas de informações sobre nascidos vivos e óbitos no Brasil na década de 2000. *Cad Saude Publica* 2014; 30(10):2068-2280.
32. Figueiroa BQ, Vanderlei LCM, Frias PG. Carvalho PI, Szwarcwald CL. Análise da cobertura do Sistema de Informações sobre Mortalidade em Olinda, Pernambuco, Brasil. *Cad Saude Publica* 2013; 29(3):475-484.
33. Jorge MHPM, Laurenti R, Gotlieb SLD. Avaliação dos sistemas de informação em saúde no Brasil. *Cad Saúde Colet* 2010; 18(1):7-18.
34. Pedraza DF. Qualidade do Sistema de Informações sobre Nascidos Vivos (Sinasc):análise crítica da literatura. *Cien Saude Colet* 2012; 17(10):2729-2737.

Article submitted 17/01/2016
Approved 16/06/2016
Final version submitted 18/06/2016