Original Articles

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Effect of the Family Health Strategy on surveillance of infant mortality

ABSTRACT

OBJECTIVE: To evaluate the effect of the Family Health Strategy on infant mortality surveillance.

METHODS: An ecologic study was performed with a multiple group design, and the unit of analysis was municipalities in Bahia state (Northeastern Brazil) in 2008. The 3,947 deaths analyzed were obtained from the Mortality Information System, and the minimum acceptable level for death investigation was 25%. Logistic regression models were used for bivariate and multivariate analysis and adjusted for sociodemographic and service organization variables.

RESULTS: In 48.9% of the municipalities at least one infant death was investigated, and 35.5% of municipalities achieved the minimum target for investigation. In the bivariate model, the investigation of at least one infant death was statistically associated with more populous municipalities, higher Human Development Indices, existence of Investigation Committee and obstetric beds in the municipality; there were no associations with Family Health Strategy coverage and existence of a designated person in the municipality. In multivariate models, the investigation of at least one infant death was statistically associated with population size (OR = 4.02) and presence of obstetric beds (OR = 2.68). Achieving the minimum target was associated only with the existence of obstetric beds in the municipality (OR = 1.76).

CONCLUSIONS: The investigation rate for deaths of children less than one year of age was less than the level agreed upon in Bahia in 2008. There was no association between coverage of the Family Health Strategy and death investigations, which suggests that Infant Mortality Surveillance is at an incipient stage, especially in regards to decentralization to local primary care teams.

DESCRIPTORS: Infant Mortality. Family Health Program. Primary Health Care. Epidemiologic Surveillance. Ecological Studies.

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INTRODUCTION

Brazil has made significant reductions in infant mortality rates over the past decades, a trend also observed in the State of Bahia (Northeastern Brazil, with 44.8 deaths/1,000 live births to 27.3 deaths/1,000 live births from 1997 to 2006).[a] Decreased fertility, improved living conditions and greater access to health care contributed to the decrease nationally. Nonetheless, national rates are still high compared to countries in similar economic circumstances.

[a] Ministério da Saúde. Rede Interagencial de Informação para a Saúde - Ripsa. Indicadores Básicos para a Saúde no Brasil: Conceitos e Aplicações. Brasília: Organização Pan-Americana da Saúde, 2008. 349 p.

Substantial differences persist between regions, states and municipalities, due to social inequities that exclude a significant contingents of the population from access to basic goods and services.[2,4,6,21]

Measures traditionally implemented through primary care, such as prenatal care, oral rehydration therapy, promotion of exclusive breastfeeding and immunization of children and pregnant women, have been emphasized as determinants for the reduction of infant mortality.[1,16,17,22,24] In addition to activities directly related to care, health service activities that can prevent avoidable deaths should be emphasized, such as interventions related to infant mortality surveillance.[12] Analysis of these deaths can provide a measure of the quality of care and identify choke points that necessitate changes to the process and organization of work to improve care. In addition, death review contributes to improved information, especially in contexts where the registration of deaths is an important public health problem, as in Brazil.

The challenge to improve information quality remains salient in the 21st century. Important segments of the global population are beyond the reach of statistics, and few countries have sufficient resources to develop reliable health information systems.[10] Epidemiologic surveillance of vital events is a principal strategy to improve the quality of data, especially in poorer countries where under-notification of births, deaths and cause of death is high.[5,9,13,14,20]

Since the 1970s when Rutstein and Berenberg (as cited by Malta et al[15]) pioneered work on the concept of avoidable death, proposals to classify avoidable events have been refined with studies throughout the word,[11] including in Brasil,[12,23] although the question remains little studied in Brazil.

One of the principal strategies to reorganize local health systems in Brazil is the Family Health Strategy (FHS). Instituted since 1994, the FHS includes multiprofessional teams responsible for accompanying a defined number of families in a delimited geographical area. It works with health promotion, prevention, recuperation and rehabilitation of more common diseases and injuries.[b]

The FHS reorients the level of primary care and has an advantageous position to implement health surveillance and infant mortality surveillance. The responsibility and obligation to the population in the coverage area should be part of the daily routine of family health teams. The death of a child is a relevant and motivating event for action to decrease the under-notification of deaths and births, improve the quality of information about the causes of death, evaluate access and quality of care and plan and organize interventions for maternal and child health.[c]

In Brazil, national incentives are implemented to stimulate activities for infant mortality surveillance in states and municipalities. In Bahia, the activities were initiated in 2005 by the Bahia State Secretary of Health (SESAB), with a model that emphasizes the educational nature of the process. This model promotes reflection upon professional practices and the importance of primary care teams in the spread and consolidation of these actions at a local level.[d]

In regards to the relative importance of these initiatives and the national reach of guidelines adopted by numerous Brazilian states for infant mortality surveillance systems, no studies were identified that evaluate the level of implementation of these initiatives in Brazil.

This study sought to analyze the effect of the FHS upon infant mortality surveillance.

METHODS

An ecologic study with a multiple group design was performed in 417 municipalities of Bahia, with 2008 as the study year. The variables studied and their respective sources were:

- investigation of at least one death among children less than one year of age (yes/no). Infant mortality surveillance was implemented in 2005 in Bahia; therefore, the variable measures the implementation of the action by municipalities, independent of population size. Data was obtained from monthly monitoring worksheets from the SESAB;

- investigation of 25% or more of deaths in children less than one year of age (yes/no): ratio between the number of deaths investigated according to the monthly monitoring worksheet and the deaths registered in the mortality information system (SIM) in 2008. The minimum goal was defined by the Ministry of Health in the 2008 Pact agreed to by Bahia State and its municipalities and was based on the operational capacity and historical series of its municipalities;

- FHS coverage: product of the number of family health teams reported by the municipality in the Primary Care Information System (*Sistema de*

Informação da Atenção Básica) in December of 2008 and the average estimated number of people accompanied per team (3,450 people) divided by the total population multiplied by 100. Coverage was classified as < 30%; ≥ 30% and < 50%; ≥ 50%;

- location of the municipality according to health microregion (MR);

- population size of the municipality based on the population estimates of the Brazilian Institute of Geography and Statistics for the year (< 50,000 residents and ≥ 50.000 residents);

- municipal Human Development Index (HDI) in 2000: simple arithmetic mean of three sub-indices: longevity (HDI – Longevity), Education (HDI – Education) and Income (HDI – Income). The closer the value of the indicator to one, the greater the human development of the country or region. The information was obtained from the Atlas of Human Development in Brazil.[e] Two municipalities (Barrocas and Luís Eduardo Magalhães) did not have an HDI, since they were emancipated after the reference year. The variable was coded in a dichotomous fashion, where the cutoff point was the HDI of Bahia (< 0.688 and ≥ 0.688);

- existence of a Committee to Prevent Infant and Fetal Deaths: municipal code or decree published in the Official Diary until 2008, creating the committee (yes/no). The municipal committee is an interinstitutional organ of a fundamentally educational character that brings together governmental institutions and organized civil society through multiprofessional participation, where the goal is to identify, increase visibility, accompany and monitor infant and fetal deaths;

- existence of a person responsible for investigation at the municipality: health professional or team responsible for the organization and management of the strategy for infant mortality surveillance at the Municipal Health Secretary (yes/no) in 2008. This data is reported annually by the Municipal Health Secretary;

- existence of obstetric beds: at least one surgical or clinical obstetric bed in the municipality reported by the National Enrollment of Health Establishments (*Cadastro Nacional de Estabelecimento de Saúde*, CNES) in 2008 (yes/no).

In the case of missing information, the variable was coded no.

A descriptive analysis was performed of municipalities that investigated at least one infant death or at least 25% of infant deaths (minimum goal) registered in the Mortality Information System (SIM) in 2008, according to population size, geographic location (macroregion), socioeconomic and demographic characteristics, FHS coverage, existence of a Committee to Prevent Infant Deaths, a designated person at the municipality and obstetric beds (clinical or surgical).

The Cuzick non-parametric test was utilized to test the trend of increased investigation of deaths with increased FHS coverage. The association between FHS coverage and the development of actions to investigate infant deaths in the municipality was investigated by bivariate and multiple logistic regression analysis, adjusting for socioeconomic, demographic and health service organization variables. The possibility of multicollinearity between the independent variables included in the model was ruled out by the variance inflation factor (VIF) test. VIF values were less than 1.7 for all variables, i.e. evidence for multicollinearity was not found (VIF>10).

The data from the various information systems was processed in one database using the statistical package Stata 10 for processing and analysis.
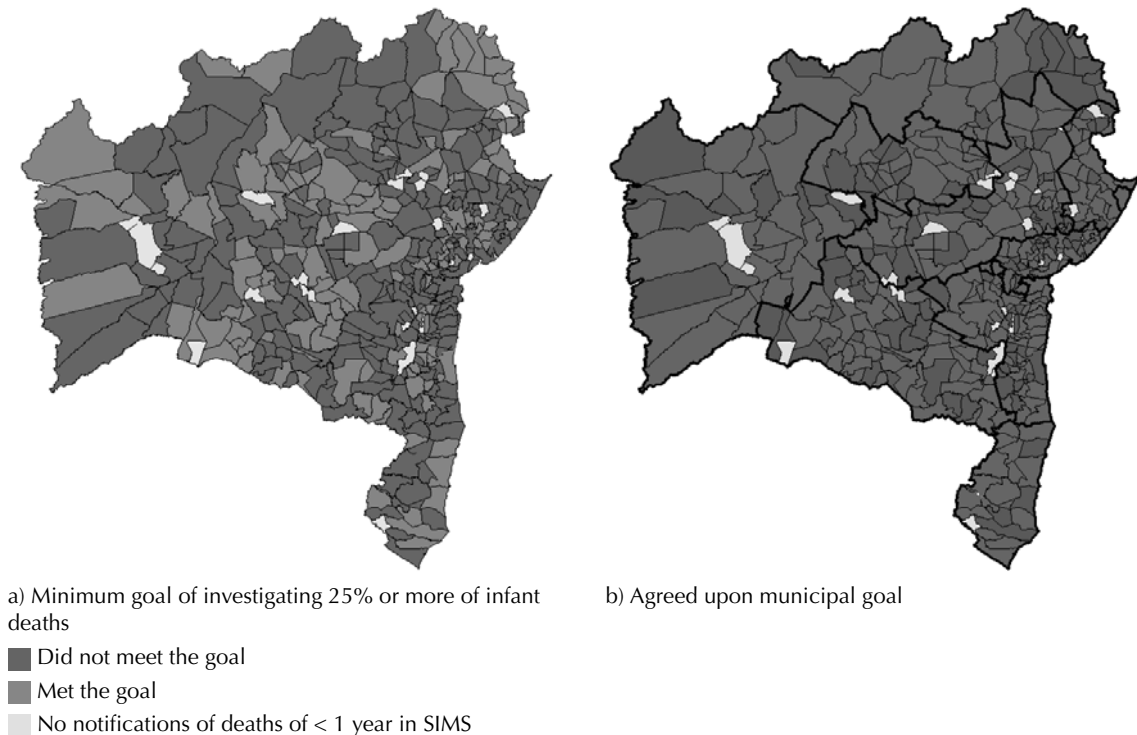
The project was approved by the Ethics Committee of the Institute of Collective Health (appearance number 045-09, of 17 Dec 2009).

RESULTS

The Figure presents the progress on goals for investigation of deaths in the municipalities of Bahia. Map "a" concerns the minimum goal for investigation of infant deaths, and map "b" concerns the minimum goal agreed to by municipalities based upon the minimum goal proposed by the Ministry of Health. Of the 3,947 deaths among children less than one year registered in SIM, 21.3% were investigated in 2008. At least one infant death was investigated in 48.9% of Bahian municipalities. The minimum goal to investigate at least 25% of deaths was reached by 35.5% and the municipal goal agreed to be managers by 26.6% of municipalities. In 26 municipalities, there were no reports of deaths of children under one year old, and in six municipalities the percentage of these deaths investigated was greater than 100%. In regards to the geographic distribution of the variables investigated, no pattern of regional distribution was identified.

In most municipalities with larger populations (88.0%) and better living conditions (83.3%), at least one infant death was investigated, while investigations occurred in less than half of municipalities with a smaller population size (45.0%) and worse living conditions (46.0%). In regards to meeting the minimum goal, no differences

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[e] Programa das Nações Unidas para o Desenvolvimento. Atlas de Desenvolvimento Humano no Brasil. [cited 2009 Sep 7]. Available from http://www.pnud.org.br/atlas/tabelas/index.php

a) Minimum goal of investigating 25% or more of infant deaths

b) Agreed upon municipal goal

■ Did not meet the goal

■ Met the goal

□ No notifications of deaths of < 1 year in SIMS

Source: Mortality Information System (SIM); Investigation Worksheet

Figure. Distribution of municipalities according to performance of the minimum goal agreed to by Bahia State to investigate at least 25% of deaths among under ones and performance of municipal goal agreed to by managers. Bahia, Northeastern Brazil, 2008.

were found between large municipalities (35.0%) and small municipalities (35.3%), and minimal differences were observed between municipalities with higher HDI (47.2%) and lower HDI values (34.0%). The North and Central-north macroregions had the highest proportion of municipalities that investigated at least one infant death (67.0% and 62.0%, respectively) and met the minimum goal (44.4% and 47.4%, respectively). The West macroregion had the lowest proportion of municipalities with death investigation (35.1%), as well as the lowest proportion of municipalities that met the minimum goal (24.3%) (Table 1).

Among municipalities with a committee, a responsible person and obstetric beds, a respective 82.0%, 54.1% and 54.0% investigated at least one death and 50.0%, 38.0% and 37.4% reached the minimum goal. A greater proportion of municipalities with at least one death investigation had an intermediate FHS coverage (64.0%) in comparison to municipalities with FHS coverage under 30% (45.0%) and greater than 50% (47.0%). According to the level of FHS coverage, the minimum goal was reached by 27.3%, 31.0% and 36.8% of municipalities; nonetheless, the increasing trend was not statistically significant (p = 0.196) (Table 1).

In bivariate analysis, investigation of at least one death was associated to larger population (OR = 8.6; 95%CI 3.3;22.5), greater HDI values (OR = 5.9; 95%CI 2.4;14.6), existence of a committee (OR = 5.1; 95%CI 1.7;15.2) and at least one obstetric bed (OR = 3.1; 95%CI 1.8;5.3). Statistically significant associations were not identified between investigation and FHS coverage and existence of an assigned person in the municipality. The magnitude of the association between reaching the minimum goal and the variables studied decreased, and the associations were not significant (Table 2).

After adjustment a statistically significant association was not found between FHS coverage and investigation of at least one infant death or performance of the minimum goal. Only large population (OR = 4.0; 95%CI 1.4;11.8) and existence of obstetric bed (OR = 2.7; 95%CI 1.5;4.6) were associated to investigation of at least one infant death. The existence of obstetric bed (OR = 1.8; 95%CI 1.0;3.1) presented a positive and statistically significant association with reaching the goal (Tables 3 and 4).

DISCUSSION

In 2008, the percentage of deaths investigated among children less than one year was less than the level agreed

Table 1. Municipalities that investigated at least one death or investigated 25% or more of deaths among under ones, according to sociodemographic and service organization characteristics. Bahia, Northeastern Brazil, 2008.

Characteristic	Municipalities (N = 417)	Investigation of at least one death (%)	Investigation of 25% or more of deaths (%)
Population size (residents)			
< 50,000	377	45.0	35.3
≥ 50,000	40	88.0	35.0
Location of the macrogreion			
Central East	73	47.0	33.0
Central North	38	63.2	47.4
Extreme South	21	62.0	38.1
East	48	46.0	29.2
Northeast	33	52.0	33.3
North	27	67.0	44.4
West	37	35.1	24.3
Southeast	73	51.0	44.0
South	67	39.0	28.4
Municipal HDI[a]			
< 0.688	379	46.0	34.0
≥ 0.688	36	83.3	47.2
Committee			
No	395	47.1	34.4
Yes	22	82.0	50.0
Responsible person			
No	234	45.0	33.3
Yes	183	54.1	38.0
Obstetric bed			
No	80	28.0	26.3
Yes	337	54.0	37.4
FHS coverage			
< 30%	33	45.0	27.3
≥ 30 and < 50%	52	64.0	31.0
≥ 50%	332	47.0	36.8

[a] Two municipalities (Barrocas and Luís Eduardo Magalhães) were excluded for missing information, since they were emancipated after the Human Development Index (HDI) was calculated.
FHS: Family Health Strategy
Source: Mortality Information System, Primary Care Information System, Brazilian Institute of Geography and Statistics, United Nations Development Program, Monitoring Worksheet of the Bahia State Secretary of Health.

upon in Bahia. There was no association between FHS coverage and this action, which suggests that surveillance of infant deaths is incipient in the state, especially in regards to the decentralization of primary care.

Population size and social conditions, as measured by the HDI, reveal different municipal realities and demonstrate specific obstacles for the consolidation of health surveillance actions and the FHS.[f] Although they have greater technical resources and better organization of services, larger and more developed municipalities also have larger numbers of deaths among under ones and present low FHS coverage in Bahia. On the other hand, the majority of small municipalities present high FHS coverage, but their lower technical and operational capacity complicates the decentralization of health surveillance actions to primary care teams.

Table 2. Bivariate logistic regression between municipalities that investigated at least 25% of infant deaths according to sociodemographic and service organization characteristics. Bahia, Northeastern Brazil, 2008.

Characteristic	Municipalities (N = 417)	Investigation of at least one death		Investigation of 25% or more of deaths	
		OR	95%CI	OR	95%CI
Population size (residents)					
< 50,000	377	1		1	
≥ 50,000	40	8.6	3.3;22.5	0.9	0.5; 2.0
Municipal HDI[a]					
< 0.688	379	1		1	
≥ 0.688	36	5.9	2.4;14.6	1.7	0.9;3.5
Committee					
No	395	1		1	
Yes	22	5.1	1.7;15.2	1.9	0.8;4.5
Assigned person					
No	234	1		1	
Yes	183	1.5	0.9;2.1	0.2	0.8; 1.8
Obstetric bed					
No	80	1		1	
Yes	337	3.1	1.8;5.3	1.7	0.9;2.9
FHP coverage					
< 30%	33	1		1	
≥ 30 e < 50%	52	2.1	0.9;5.1	1.2	0.5;3.1
≥ 50%	332	1.1	0.5;2.2	1.6	0.7; 3.4

[a] Two municipalities (Barrocas and Luís Eduardo Magalhães) were excluded for missing information, since they were emancipated after the Human Development Index (HDI) was calculated.
FHS: Family Health Strategy
Source: Mortality Information System, Primary Care Information System, Brazilian Institute of Geography and Statistics, United Nations Development Program, Monitoring Worksheet of the Bahia State Secretary of Health.

Although only 22 municipal committees exist for investigation of infant death in Bahia's municipalities, these organs are important in the implementation of investigation, as highlighted by other studies.[18,19] Considering that most large Brazilian municipalities have committees, the need for greater technical and operational support of these organs, by the State Secretariats and the Ministry of Health, appears essential, as does training of the teams involved.[g] The lack of association between the existence of an assigned person and investigation of infant deaths suggest the need for improved definition of the role of these professionals. Their roles do not necessarily relate to the performance of investigative actions, but to organizing the municipal flow of surveillance and promoting cooperation between institutions and municipal health secretaries.[h] Greater investment by municipal managers in the organization of committees and the training of assigned professionals or teams responsible for the organization of infant death surveillance are fundamental to the process of decentralizing this activity to family health teams.

The training of family health teams should be developed based on actual death investigations. Analysis of each event allows identification of the moment and level of the health system where failures occurred. Barreto et al[3] investigated infant deaths in three municipalities of Ceará State (Northeastern Brazil) using a verbal autopsy strategy included in the Manual for Investigation of Death from Ill-defined Causes by the Ministry of Health.[g] They concluded that this strategy provides valuable information for local health teams and generates an analytical consciousness, which supports reduction of infant mortality. These tools can contribute to the training of teams, while at the same time refining death surveillance actions by local health systems.

Use of secondary data in investigations is fundamental to improve the quality and coverage of health information systems. Nonetheless, study design was a limitation of this research. Although important in the evaluation of health programs, ecologic designs utilize aggregated data usually from a secondary source. This entails

[g] Manual de vigilância do óbito infantil e fetal e do Comitê de Prevenção do Óbito Infantil e Fetal. Brasília: Ministério da Saúde, 2009.
[h] Relatório do Comitê Estadual de Prevenção de Óbito Infantil e Fetal. Secretaria de Saúde do Estado da Bahia. Superintendência de Vigilância e Proteção da Saúde. Diretoria de Vigilância Epidemiológica. Secretaria de Saúde do Estado da Bahia 2009. 09 pg. (mimeo)

Table 3. Multivariate logistic regression between sociodemographic and service organization characteristics of municipalitites that investigated at least one death of children age less than one year. Bahia, Northeastern Brazil, 2008.

Variable	OR	95%CI
FHS coverage ≥30 and < 50%	2.3	0.9;6.1
FHS coverage ≥50%	1.5	0.7;3.1
Population ≥ 50,000 residents	4.0	1.3;11.8
Municipal IDH[a] ≥ 0.688	2.1	0.7;6.1
Existence of a committee	2.7	0.7;9.2
Existence of an assignde person	1.2	0.8;1.8
Existence of obstetric bed	2.6	1.5;4.6

[a] Two municipalities (Barrocas and Luís Eduardo Magalhães) were excluded for missing information, since they were emancipated after the Human Development Index (HDI) was calculated.
FHS: Family Health Strategy
Source: Mortality Information System, Primary Care Information System, Brazilian Institute of Geography and Statistics, United Nations Development Program, Monitoring Worksheet of the Bahia State Secretary of Health.

Table 4. Multivariate logistic regression between sociodemographic and service organization characteristics of municipalities that investigated 25% or more of deaths among children age less than one year. Bahia, Northeastern Brazil, 2008.

Variable	OR	95%CI
FHS coverage ≥ 30 and < 50%	1.2	0.5;3.2
FHS coverage ≥ 50%	1.6	0.7;3.7
Population ≥ 50,000 residents	0.5	0.2;1.3
Municipal IDH[a] ≥ 0.688	2.1	0.8;5.2
Existence of a committee	1.8	0.7;4.7
Existence of an assigned person	1.2	0.8;1.8
Existence of obstetric beds	1.8	1.0;3.1

[a] Two municipalities (Barrocas and Luís Eduardo Magalhães) were excluded for missing information, since they were emancipated after the Human Development Index (HDI) was calculated.
FHS: Family Health Strategy
Source: Mortality Information System, Primary Care Information System, Brazilian Institute of Geography and Statistics, United Nations Development Program, Monitoring Worksheet of the Bahia State Secretary of Health.

restrictions regarding coverage and the availability of variables to study, which are restricted to those contained in the information system.

High turnover of professionals in the family health teams, high burden of activities, low coverage by Community Health Agent Program/FHS, absence of transport for performance of investigation and lack of defined roles between primary care and epidemiologic surveillance were identified as operational difficulties in the surveillance of deaths among under ones by the professionals of the Regional Health Directorates and municipalities in 2008.[h] In the present study, it was not possible to describe organizational characteristics of local health systems that can better explain the implementation and decentralization of surveillance activities by primary care teams.

The existence of municipalities without a report of infant death, as well as municipalities with investigation percentages greater than 100% suggests the occurrence of undernotification and under-recording of deaths. This confirms the importance of active surveillance for deaths and activities to improve the quality of information systems on deaths and causes of death, in order to support decision-making by managers at all levels of government.

The problem must be faced globally, especially in poorer countries where undernotification of deaths is high. The majority of people in Africa and Asia are born and die without leaving a trace in any legal records or official statistics.[20] In Brazil, especially in the North and Northeast regions, underreporting of deaths constitutes

a serious health problem, which makes the planning and organization of specific interventions to reduce infant mortality more difficult.[c]

The present study suggests that surveillance of infant death in Bahia is incipient. The coverage reached in 2008 (21.3%) was less than the minimum goal of 25% of deaths investigated, as defined by the Ministry of Health. In addition, 48.9% of municipalities in the state investigated at least one infant death, and 26.6% of municipalities met the minimum goal agreed to by the manager. The activity is centralized, since the investigation of infant deaths is not associated with FHS coverage. Greater investments by state and municipal managers are necessary to strengthen and decentralize the actions of local teams in the expansion of the FHS to large urban centers, where a greater number of infant deaths are concentrated. In the same manner, it is necessary to train primary care teams to monitor deaths of children less than one year of age, in order to improve the quality and organization of care for pregnant women and children and to, therefore, decrease infant mortality.

This situation may not be limited to Bahia state. Despite the existence of studies about the importance of infant death surveillance to evaluate and plan programs,[3,7,8,18,19,21] we did not encounter studies that evaluate the implementation of this activity nor studies about the effect of the FHS. New investigations should be performed to analyze variables that provide insight to obstacles in decentralizing surveillance activities to health teams, as well as to identify and evaluate successful municipal experiences that support the definition of strategies to overcome problems.

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