Differentials in vital information in the state of Pernambuco, Brazil, 2006-2008

Diferenciais na adequação das informações de eventos vitais nos municípios de Pernambuco, 2006-2008

Mirella Rodrigues[I,V]
Cristine Bonfim[II]
Paulo Germano de Frias[III,IV]
Cynthia Braga[III,V]
Idê Gomes Dantas Gurgel[VI]
Zulma Medeiros[V,VII]

[I] Secretaria de Saúde do Estado de Pernambuco. Recife, PE, Brasil

[II] Diretoria de Pesquisas Sociais da Fundação Joaquim Nabuco. Recife, PE, Brasil

[III] Instituto de Medicina Integral Prof. Fernando Figueira. Recife, PE, Brasil

[IV] Secretaria de Saúde do Recife. Recife, PE, Brasil

[V] Departamento de Parasitologia do Centro de Pesquisas Aggeu Magalhães. Recife, PE, Brasil.

[VI] Departamento de Saúde Coletiva do Centro de Pesquisas Aggeu Magalhães. Recife, PE, Brasil.

[VII] Instituto de Ciências Biológicas. Universidade de Pernambuco. Recife, PE, Brasil.

Correspondence: Mirella Rodrigues. Centro de Pesquisas Aggeu Magalhães, Departamento de Parasitologia, Laboratório de Doenças Transmissíveis. Av. Moraes Rego, s.n. Recife, PE, Brasil, CEP 50670-420. E-mail: mirellarod@hotmail.com

Abstract

Objective: To assess differentials in official birth and death data for estimating infant mortality. **Methods:** An ecological study was conducted based on data obtained from birth and death information systems in the state of Pernambuco, northeastern Brazil, between 2006 and 2008. The following indicators were used: age-standardized mortality rate, relative mean deviation of mortality rate, ratio of reported to estimated live births, relative mean deviation of birth rate and proportion of deaths of unknown cause. These indicators were grouped into three dimensions: mortality, fertility and ill-defined causes. Based on predetermined criteria, municipalities were classified as follows: consolidated vital data; vital data in the consolidation phase; and non-consolidated data. The data were analyzed using EpiInfo and Terraview for map preparation. **Results:** Of the 185 municipalities in the state of Pernambuco, 141 (76.2%) were classified as having consolidated vital data, accounting for about 85% of the state population, and 17 (9.2%) were classified as having non-consolidated data, accounting for only 4.9% of the population. Larger municipalities (50,000 inhabitants or more) showed better data quality. **Conclusion:** The approach studied proved itself valuable to assess the quality of vital information and identify inequalities in Pernambuco. Reduction of inequalities is a challenge in this state in the sense of enabling vital information to be analyzed directly from data systems at the local level. It will also allow assessing the effectiveness of initiatives to reduce infant mortality in Pernambuco.

Keywords: Information Systems. Death. Live Birth. Infant Mortality. Vital Statistics.

Resumo

Objetivo: Avaliar os diferenciais da adequação das informações de nascimentos e óbitos do Ministério da Saúde para o cálculo da mortalidade infantil nos municípios do Estado de Pernambuco, 2006-2008. **Métodos:** Estudo ecológico, cujas fontes de dados foram os sistemas de informação sobre nascidos vivos e mortalidade. Foram utilizados os indicadores: coeficiente de mortalidade geral padronizado por idade, desvio médio relativo do coeficiente de mortalidade geral, razão entre nascidos vivos informados e estimados, desvio médio relativo da taxa de natalidade e proporção de óbitos sem definição de causa básica. Estes indicadores foram agregados em três dimensões: mortalidade, natalidade e mal definidos. Utilizando critérios pré-estabelecidos, os municípios foram classificados como: informações vitais consolidadas, em fase de consolidação e não consolidadas. Os dados foram analisados através do programa Epiinfo e do Terraview para elaboração dos mapas. **Resultados:** Dos 185 municípios do Estado, 141 (76,2%) foram classificados como informações vitais consolidadas, agregando aproximadamente 85% da população residente e 17 (9,2%) como não consolidadas, categoria na qual reside apenas 4,9% da população. Os municípios com 50.000 habitantes ou mais têm informações de melhor qualidade. **Conclusão:** O método utilizado mostrou-se potencial para classificar a qualidade das informações vitais em Pernambuco, identificando as desigualdades, que se constituem em desafios para o Estado, no sentido de possibilitar a análise destas informações a partir de dados diretos dos sistemas no âmbito municipal. Apenas dessa forma torna-se possível avaliar os investimentos realizados para a redução da mortalidade infantil em Pernambuco de forma realística.

Palavras-chave: Sistemas de Informação. Óbito. Nascido Vivo. Mortalidade Infantil. Estatísticas Vitais.

Introduction

The adequacy of health information has been considered a challenge to the health sector, regarding the need to assess the fulfillment of the millennium goals, such as the reduction of infant mortality (IM) in the Americas.[1] It is well known that precise and safe monitoring of the event is performed only by calculating the coefficients by the direct method.[2]

Since the implementation of the Information Systems on Mortality and Live Births, an increasing coverage of the national territorry[3,4,5] has been observed, having reached approximately 90% in 2006.[6] However, large variations occur when these coverage percentages are analyzed in the Unit of the Federation (UF), particularly in the states of the North and Northeast regions of Brazil[3]

Delayed civil registration and underreporting of births and deaths are viewed as the major factors that hamper the attainment of the IM estimates and their components.[4,7] When it is not possible to measure the IM coefficients by the direct method, indirect demographic techniques are used, and the coefficients are calculated based on data from the census of population and from the National Household Sample Survey (*Pesquisas Nacionais por Amostra de Domicílios* - PNADs), conducted by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* - IBGE)[2].

In order to assess the adequacy of vital information of the municipalities, a methodology was developed, which used five indicators of mortality and natality[2]. This proposal, refined in 2007[3], allows the identification of weaknesses in the information systems at a local level[8] and the development of specific actions to improve adequacy, in order to obtain reliable measures of the IM using the direct method.

The state of Pernambuco has experienced considerable progress in coverage and quality of information of these systems.[5] Based on estimates of the Interagency

Health Information Network (Ripsa), it is estimated that in 2006, the Sinasc recorded 93.7% of births and the SIM, 80% of the expected deaths in the population[6]. Pernambuco is considered the state with best quality of vital statistics records in the Northeast.[4] However, it is possible that some variation in the adequacy of the system still persist because of peculiarities in the local network of health services regarding registration and processing of vital information.

The knowledge of the adequacy of information on births and deaths in the municipalities of the state of Pernambuco will enable the identification of the localities most in need of investments aimed at improving the adequacy of vital statistics and will obtain more precise IM indicators, calculated by the direct method, which provides subsidies for the formulation of specific public health policies[1]. The goal of this paper is to assess the adequacy of information on births and deaths in order to calculate the IM in the municipalities of the state of Pernambuco.

Methods

Between 2006 and 2008 we conducted an ecological study in the municipalities of Pernambuco, a state in Northeastern Brazil, with an area of 98,311,616 Km² and a population of 8,485,386, predominantly urban (76.5%). Pernambuco has 185 municipalities distributed in five mesoregions: Metropolitana do Recife, Mata, Agreste, Sertão and São Francisco.[9] We chose this reference period because of the availability of data and because studies had already been conducted on the previous 2 trienniums[5]. We used data from SIM and Sinasc, made available by the Health Departament of Pernambuco (*Secretaria de Saúde de Pernambuco* (SES-PE)).

To assess the adequacy of information, we used the method proposed by Andrade e Szwarcwald[3], which consists of five indicators, calculated per municipality (Table 1). All the municipalities were classified as: satisfactory, non-satisfactory or deficient, for each indicator studied. For classification purposes, the municipalities were categorised into two groups, according to population size: size I (municipalities with less than 50,000 inhabitants) and size II (municipalities with 50,000 or more inhabitants).[3]

The parameters used to classify the municipalities according to the indicators of adequacy of information were calculated based on the confidence limits of the average of the indicators of the 8 Ufs, with information deemed appropriate by Ripsa's criteria[5]. The classification parameters for the satisfactory, non-satisfactory and deficient categories were measured by the 10th and 1st percentiles by the indicators *total mortality coefficient standardised by age* and *ratio between reported and estimated live births*, and the 90th and 99th percentiles by the other indicators[5] (Table 1). The classification of municipalities according to each indicator permitted the analysis of three dimensions – mortality, natality and ill-defined causes – and the overall adequacy of vital information.[3]

To assess the dimensions we made use of three categories[5]:

- Consolidated: when the indicators of the dimension are satisfactory.
- Consolidating: when at least one of the dimension indicators is not satisfactory and none is deficient.
- Non-consolidated: when at least one of the dimension indicators is deficient.

Similarly, the municipalities were classified according to the overall adequacy of vital information[5]:

- Consolidated vital information: when all the indicators are satisfactory.
- Consolidating vital information: when at least one of the indicators is not satisfactory and none is deficient.
- Non-consolidated vital information: when at least one of the indicators is deficient.

We carried out the mapping of the municipalities according to the three dimensions and the overall adequacy of vital information. The software used was *TerraView*, version 3.5.0. The extension of the base map

Chart 1 - Criteria for classification of municipalities according to the appropriateness of vital information at the local level.

Quadro 1 *- Critérios para classificação dos municípios segundo a adequação das informações vitais.*

Dimension	Indicators	< 50.000 inhabitants			≥ 50.000 inhabitants		
		Satisfactory	Non-satisfactory	Deficient	Satisfactory	Non-satisfactory	Deficient
Mortality	Coeficiente geral de mortalidade padronizado por idade	≥ 4.39	≥ 3.42 e < 4.39	< 3.42	≥ 5.29	≥ 4.72 e < 5.29	< 4.72
	Desvio médio relativo do coeficiente geral de mortalidade	≤ 21.92	> 21.92 e ≤ 36.37	> 36.37	≤ 6.98	> 6.98 e < 9.98	> 9.98
Natality	Razão entre nascidos vivos informados e estimados	≥ 0.64	≥ 0.47 e < 0.64	< 0.47	≥ 0.76	≥ 0.65 e < 0.76	< 0.65
	Desvio médio relativo da taxa de natalidade	≤ 16.27	> 16.27 e ≤ 29.58	> 29.58	≤ 5.14	> 5.14 e ≤ 8.80	> 8.80
Ill-defined causes	Proporção de óbitos sem definição da causa básica	≤ 17.35	> 17.35 e ≤ 29.37	> 29.37	≤ 16.33	> 16.33 e ≤ 22.02	> 22.02

Fonte/*Source*: Frias et al., 2010.[5]

was shapefile *(*.shp)*, an extension required to read the georeferencing program. The other data was analysed by Epi Info for Windows, version 3.5.1.

This study was approved by the Research Ethics Commitee of the *Centro de Pesquisas Aggeu Magalhães* (CPqAM/FIOCRUZ), under registration CAAE No. 0079.0.095.000-10, and we declare that there are no conflicts of interests.

Results

Of the total number of municipalities, 152 (82.1%) have less than 50,000 inhabitants (size I). All municipalities in the state were classified as satisfactory by the *relative average deviation indicator in the total mortality coefficient (CGM)*. Also all those categorized as size II were rated as satisfactory by the *CGM Standardized Indicators* and in the *Ratio between reported and estimated live births*. The *relative average deviation of birth rate* was considered satisfactory in 93.4% of municipalities of size I, and in 81.8% of municipalities of size II. By the indicator *percentage of deaths with ill-defined causes*, 93.9% of municipalities of size II were rated satisfactory (Table 1).

In the mortality dimension, all municipalities of size II and 93.4% of those of size I were classified as consolidated. In the natality dimension, 91.4% of municipalities of size I and 81.8% of size II were also classified as consolidated (Table 2).

In assessing the overall adequacy, 141

municipalities (76.2%) were classified as consolidated vital information. These municipalities have 85% of the state population. 17 municipalities (9.2%) were classified as non-consolidated vital information and there resides 4.9% of the population of Pernambuco.

Stratifying the overall adequacy of information according to size, we concluded that both sizes belong to the category *consolidated* vital information: 75.7% of the municipalities with less than 50,000 inhabitants and 78.8% of municipalities of size II. The percentage of municipalities with non-consolidated vital information was similar in both population strata, 9.2% and 9.1%, respectively (Table 2).

Figure 1 shows the spatial distribution of the adequacy of information in the municipalities of Pernambuco. It shows that only two municipalities are non-consolidated in the dimension mortality (Figure 1A). In contrast, in the dimension natality, we notice that among the non-consolidated municipalities, 4 (50%) are located in the Sertão mesoregion (Figure 1B). In the dimension ill-defined causes, 100% of the municipalities of the Metropolitana do Recife and Mata mesoregions were classified

Table 1 - Classification of the appropriateness of vital information according to selected indicators. Pernambuco, northeastern Brazil, 2006–2008.
Tabela 1 *- Classificação da adequação da informação segundo indicadores utilizados. Pernambuco, 2006-2008.*

Classification	Indicators											
	Total mortality coefficient standardised by age		Relative average deviation indicator in the total mortality coefficient		Ratio between reported and estimated live births		Relative average deviation of birth rate		% of deaths with ill-defined causes		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Municipalities with less than 50,000 inhabitants												
Satisfactory	142	93.4	152	100	149	98	142	93.4	127	83.6	115	75.7
Non- satisfactory	8	5.3	-	-	2	1.3	6	3.9	15	9.9	23	15.1
Deficient	2	1.3	-	-	1	0.7	4	2.6	10	6.6	14	9.2
Total	152	100	152	100	152	100	152	100	152	100	152	100
Municipalities with 50,000 or more inhabitants												
Satisfactory	33	100	33	100.0	33	100	27	81.8	31	93.9	26	78.8
Non- satisfactory	-	-	-	-	-	-	3	9.1	1	3.0	4	12.1
Deficient	-	-	-	-	-	-	3	9.1	1	3.0	3	9.1
Total	33	100	33	100.0	33	100	33	100	33	100	33	100
All the Municipalities												
Satisfactory	175	94.6	185	100	182	98.4	169	91.4	158	85.4	141	76.2
Non- satisfactory	8	4.3	-	-	2	1.1	9	4.9	16	8.6	27	14.6
Deficient	2	1.1	-	-	1	0.5	7	3.8	11	5.9	17	9.2
Total	185	100	185	100.0	185	100	185	100	185	100	185	100

Table 2 - Classification of the appropriateness of vital information according to the three dimensions assessed. Pernambuco, northeastern Brazil, 2006–2008.
Tabela 2 *- Classificação da adequação da informação segundo as três dimensões avaliadas. Pernambuco, 2006-2008.*

Classification	Dimensions							
	Mortality		Natality		Ill-defined causes		Overall adequacy	
	N	%	N	%	N	%	N	%
Municipalities with less than 50,000 inhabitants								
Consolidated	142	93.4	139	91.4	127	83.6	115	75.7
Consolidating	8	5.3	8	5.3	15	9.9	23	15.1
Non-consolidated	2	1.3	5	3.3	10	6.6	14	9.2
Total	152	100	152	100	152	100	152	100
Municipalities with 50,000 or more inhabitants								
Consolidated	33	100	27	81.8	31	93.9	26	78.8
Consolidating	-	-	3	9.1	1	3.0	4	12.1
Non-consolidated	-	-	3	9.1	1	3.0	3	9.1
Total	33	100	33	100	33	100	33	100
All the Municipalities								
Consolidated	175	94.6	166	89.7	158	85.4	141	76.2
Consolidating	8	4.3	11	5.9	16	8.6	27	14.6
Non-consolidated	2	1.1	8	4.3	11	5.9	17	9.2
Total	185	100.0	185	100.0	185	100	185	100

as consolidated, whereas in the Agreste, 41% of municipalities were classified as non-consolidated (Figure 1C).

The analysis of the overall adequacy of information reveals that in the Metropolitana do Recife and Mata mesoregions almost all municipalities have consolidated vital information, while of the 15 municipalities of São Francisco mesoregion, 8 (53%) were classified as belonging to the consolidating or non-consolidated catagories (Figure 1D).

Discussion

Considering the method we used, it can be stated that the majority of the population of Pernambuco lives in municipalities with consolidated vital information, whereas less 5% lives in localities with non-consolidated information. The municipalities with 50,000 or more inhabitants have higher quality information when compared to municipalities with less than 50,000.

This evidence[5,10,11,12] is confirmed by other studies, which acknowledge that in Pernambuco there was improvement on coverage and regularity of information[5,10], as well as advance in quality, both in the percentage of filled in variables in a declaration of birth[11,12] and in a declaration of death[13,14] and in the percentage of deaths with ill-defined causes.[10] Such improvements were

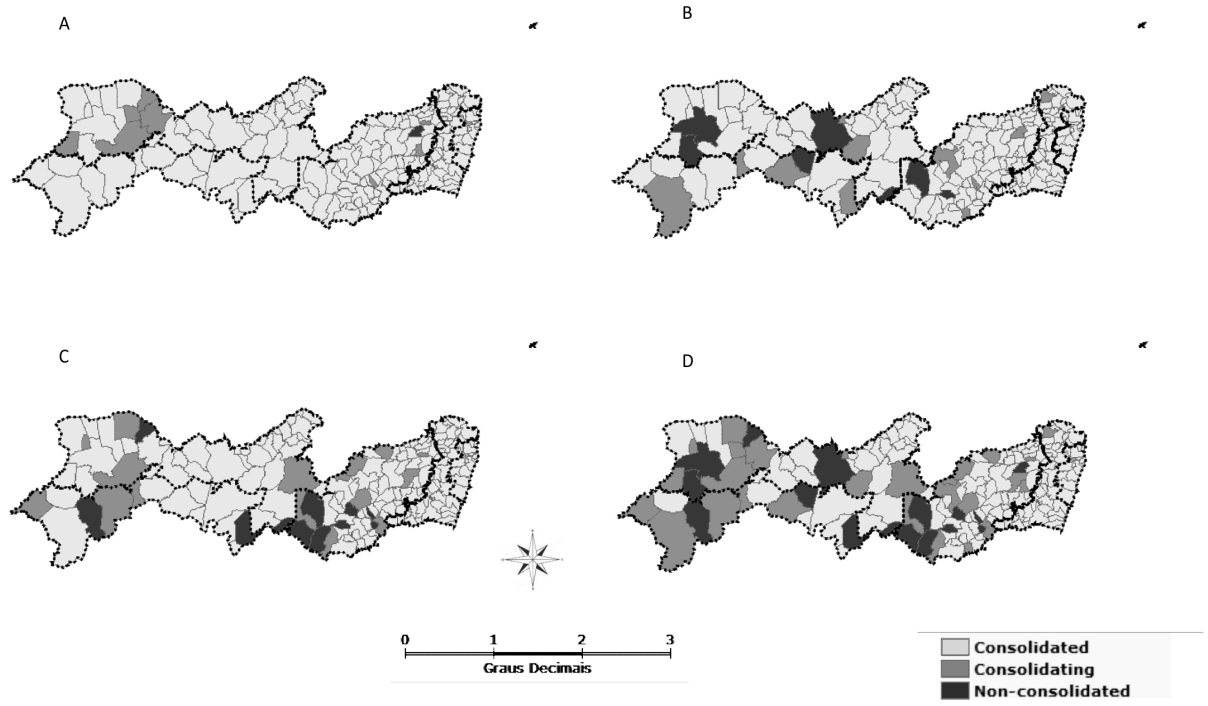

Figure 1 – Spatial distribution of the criteria for appropriateness of vital information by municipality. A) Magnitude of mortality, B) Magnitude of birth rates, C) Ill-defined causes and D) Overall appropriateness of vital information. 1 – Mesoregion of Greater Recife (capital city); 2 – Mesoregion of Mata; 3 – Mesoregion of Agreste Pernambucano; 4 – Mesoregion of Sertão Pernambucano; 5 – Mesoregion of São Francisco.

Figura 1 *– Distribuição espacial dos critérios de adequação da informação segundo municípios. A) Dimensão da Mortalidade, B) Dimensão da Natalidade, C) Mal definidas e D) Adequação Global das informações vitais. 1- Mesorregião Metropolitana do Recife; 2- Mesorregião da Mata; 3- Mesorregião do Agreste; 4- Mesorregião do Sertão; 5- Mesorregião do São Francisco.*

superior to those attained in the Northeast and in Brasil.[5]

In the spatial distribution of the adequacy of information, we observed that, of the three dimensions, mortality is the most homogeneous in Pernambuco and natality is disparate.

In regard to the latter, the number of municipalities classified as non-consolidated increases as we move away from the capital. The Sertão mesoregion concentrates most of these municipalities.

The percentage of municipalities classified as consolidating or non-consolidated in the mortality dimension is greater than or equal to the percentage of municipalities, with the same classification as above, in the natality dimension.

This fact is noted both in small and large towns but other studies have found that the natality rate is greater than the mortality rate.[6,15] However, Sinac's coverage has come down, even in areas where there are states considered by Ripsa as possessing adequate vital information.

Between the years 1997 and 2002, the South, Southeast and Mid-West witnessed a decrease in coverage. This fact may be associated with fertility decline and the resulting birth rate.[16]

Death with ill-defined causes refers to cases where the person did not receive any medical assistance, cases where the cause of death was not established, or cases where the physician only described a sign or a sympton[17]. This indicator can elucidate aspects that go beyond adequacy of information, providing elements to make us reflect on the living conditions and the inadequacy of access to health services.[18,19,20]

In this study, we found that municipalities with fewer than 50,000 inhabitants have difficulties in determining the causes of death of their residents. Approximately 17% of the municipalities were classified as belonging to consolidating or non-consolidated dimensions, which compromise specific analysis of the main causes of death.

Although between 2000 and 2005 some improvements were made to identify underlying causes of death, some municipalities in Pernambuco still have a high percentage of deaths with ill-defined causes[5]. It is well known that as the health care and the access to it improves, particularly in a hospital environment, where diagnostic resources are readily available, ill-defined causes of death decrease[21,22].

In Brazil, of the overall number of ill-defined causes of death in 2002, 53% happened without medical assistence[17], and in 2003, in Pernambuco, 81.7%, which reflects the difficulty of access to health care.[23] As for the overall adequacy of information, it is clear that it is heterogeneous. Almost all municipalities in the mesoregions Metropolitana do Recife and Mata have consolidated vital information. But as we move away from the capital, more municipalities are classified as consolidating and non-consolidated vital information. In the mesoregion São Francisco, most municipalities were classified in the latter two categories. This heterogeneity may be related to social inequality and the availability of goods and health services, which are reflected in the continuation of the existence of municipalities with inadequate information. Overall, there is a direct relationship between the distance from the capital, insufficient health services and skilled professionals that can promote appropriate care in a timely manner and the need for adjustments to consolidate vital information.[3]

With respect to the method used to evaluate the adequacy of information, there are limitations previously described.[3,2,5] Here are some of the limitations that resulted from the application of this method in Pernambuco. The first refers to the *CGM Standardised* indicators and *Ratio between reported and estimated live births*, covered by SIM and Sinasc, respectively. These indicators are more useful to classify than quantify, as they identify the municipalities that have problems gathering information on death and birth, but do not accurately measure the coverage of the above-mentioned systems. The need to use population estimates, based on the 2000 census, creates limitations for the calculation of the indicators. As an example, we can cite the population estimate for the less than one year-olds, which is affected by the undercount of this age group in the census demographics and by the steady decline of fertility and birth rate.

Another limitation is the use of criteria to classify the adequacy of information, based on the results of a previous triennium. However, since these criteria were calculated based on vital information of the 8 Ufs classified by Ripsa as adequate, and these showed no major changes in a short period, we believe that the use of previous information does not compromise the analysis nor the classification of the municipalities of Pernambuco.

The last limitation is that the death *with ill-defined causes* indicator is not linked to the dimension that assesses mortality. Even though it is an indicator that belongs to SIM, in this method it is used to assess the quality of information of death, as it is admittedly a potential assessment parameter.

The use of indicators proved to be a potential method for classifying the quality of information in Pernambuco, insofar as it enabled assessment of the state's vital information systems, identification of inequalities, thus leading to the proposal of specific actions to improve the SIM and Sinasc at a local level, such as active research.[24,25,26]

These inequalities are challenges for Pernambuco, insofar as they allow analysis of vital information at a municipal level. Only with analysis that makes use of direct data from the systems can one evaluate accurately and realistically the investments made to reduce infant mortality.

References

1. Torres C, Mujica OJ. Health, equity, and the millennium development goals. *Rev Panam Salud Pública* 2004; 15: 430-9.

2. Szwarcwald CL, Leal MC, Andrade CLT, Souza Jr. PRB. Estimação da mortalidade infantil no Brasil: o que dizem as informações de óbitos e nascimentos do Ministério da Saúde? *Cad Saúde Pública* 2002; 18: 1725-36.

3. Andrade CLT, Szwarcwald CL. Desigualdades sócio-espaciais da adequação das informações de nascimentos e óbitos do Ministério da Saúde, Brasil, 2000-2002. *Cad Saúde Pública* 2007; 23: 1207-16.

4. Schramm J M A, Szwarcwald C L. Sistema hospitalar como fonte de informações para estimar a mortalidade neonatal e a natimortalidade. *Rev Saúde Pública* 2000; 34: 272-9.

5. Frias PG, Pereira PMH, Andrade CLT, Lira PIC, Szwarcwald CL. Avaliação da adequação das informações de mortalidade e nascidos vivos no Estado de Pernambuco, Brasil. *Cad Saúde Pública* 2010;26: 671-81.

6. Rede Interagencial de Informações para a Saúde. *Indicadores básicos para saúde no Brasil: conceitos e aplicações* (2ª ed.). Brasília: Organização Pan-Americana da Saúde; 2008.

7. Almeida MF, Alencar GP, Novaes HMD, Ortiz, LP. Sistemas de informação e mortalidade perinatal: conceitos e condições de uso em estudos epidemiológicos. *Rev Bras Epidemiol* 2006; 9: 56-68.

8. Whitman S, Silva A, Shah A, Ansell D. Diversity and disparity: GIS and small-area analysis in six Chicago neighborhoods. *J Med Syst* 2004; 28: 397-411.

9. IBGE (Instituto Brasileiro de Geografia e Estatística), 2009. *Estados@ - Tema – Síntese de Indicadores Sociais 2009*. Disponível em http://www.ibge.gov.br. [Acessado em 27 de dezembro de 2010]

10. Paes N. Avaliação da cobertura dos registros de óbitos dos estados brasileiros em 2000. *Rev Saúde Pública* 2005; 39: 882-90.

11. Frias PG, Pereira PMH, Vidal AS, Lira PIC. Avaliação da cobertura do Sistema de Informações sobre Nascidos Vivos e a contribuição das fontes potenciais de notificação do nascimento em dois municípios de Pernambuco, Brasil. *Epidemiol Serv Saúde* 2007; 16: 93-101.

12. Costa JMBS, Frias PG. Avaliação da completitude das variáveis da Declaração de Nascido Vivo de residentes em Pernambuco, Brasil, 1996 a 2005. *Cad Saúde Pública* 2009, 25: 613-24.

13. Costa JMBS, Frias PG. Avaliação da completitude das variáveis da declaração de óbitos de menores de um ano residentes em Pernambuco, Brasil, 1997-2005. *Ciência e Saúde Coletiva* 2011, 16: 1267-1274

14. Romero DE, Cunha CB. Avaliação da qualidade das variáveis sócio-econômicas e demográficas dos óbitos de crianças menores de um ano registrados no Sistema de Informações sobre Mortalidade do Brasil (1996/2001). *Cad Saúde Pública* 2006; 22: 673-84.

15. Schramm JMA, Szwarcwald CL. Sistema hospitalar como fonte de informações para estimar a mortalidade neonatal e a natimortalidade. *Rev Saúde Pública* 2000; 34: 272-9.

16. Almeida MF, Alencar GP, Schoeps D. Sistema de Informações sobre Nascidos Vivos – Sinasc: Uma Avaliação de sua Trajetória. In: *A Experiência Brasileira em Sistemas de Informação em Saúde – Produção e Disseminação de Informações sobre Saúde no Brasil* (Vol I). Brasília; Ministério da Saúde; 2009. 148p. Ilust.

17. Mello Jorge MHP, Laurenti R, Gotlieb SLD. Análise da qualidade das estatísticas vitais brasileiras: a experiência de implantação do SIM e do SINASC. *Ciência & Saúde Coletiva* 2007; 12: 643-54.

18. Mathers CD, Fat DM, Inoue M, Rao C, Lopez AD. Counting the dead and what they did from: an assessment of the global status of cause of death data. *Bull World Health Organ* 2005; 83: 171-7.

19. Setel PW, Sankoh O, Rao C, Velkoff VA, Mathers C,Gonghuan Y, et al. Sample registration of vital events with verbal autopsy: a renewed commitment to measuring and monitoring vital statistics. *Bull World Health Organ* 2005; 83: 611-7.

20. Teixeira CLS, Klein CH, Bloch KV, Coeli CM. Reclassificação dos grupos de causas prováveis dos óbitos de causa mal definida, com base nas Autorizações de Internação Hospitalar no Sistema Único de Saúde, Estado do Rio de Janeiro, Brasil. *Cad Saúde Pública* 2006; 22: 1315-24.

21. Costa MR, Marcopito LF.Mortalidade por causas mal definidas, Brasil, 1979-2002, e um modelo preditivo para idade. *Cad Saúde Pública* 2008; 24: 1001-12.

22. Rozman MA, Eluf Neto J. Necropsia e mortalidade por causa mal definida no Estado de São Paulo. *Rev Panam Salud Publica 2006*; 20: 307-13.

23. Santo AH. Causas mal definidas de morte e óbitos sem assistência. *Rev Assoc Med Bras* 2008; 54: 23-8.

24. Frias PG, Pereira PMH, Andrade CLT, Szwarcwald CL. Sistema de Informações sobre Mortalidade: estudo de caso em municípios com precariedade dos dados. *Cad Saúde Pública* 2008; 24: 2257-66.

25. Viacava, F. Informações em saúde: a importância dos inquéritos populacionais. *Ciência & Saúde Coletiva* 2002; 7: 607-21.

26. Frias PG, Vidal SA, Pereira PMH, Lira PIC, Vanderley LC. Avaliação da notificação de óbitos infantis ao Sistema de Informações sobre Mortalidade: um estudo de caso. *Rev Bras Saúde MaternInfant* 2005; 5(1): 43-52.

Received: 02/14/2011
Final version: 11/04/2011
Approved: 01/31/2012