

Agreement on underlying causes of infant death between original records and after investigation: analysis of two biennia in the years 2000

Concordância sobre causas básicas de morte infantil entre registros originais e após investigação: análise de dois biênios nos anos 2000

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ABSTRACT: *Objective:* To analyze the agreement between underlying causes of infant deaths obtained from Death Certificates (DC) with those defined after investigation by the Municipal Committee for the Prevention of Maternal and Infant Mortality (CMPMMI), in Londrina, Paraná State, in the biennia 2000-2001 and 2007-2008. *Methods:* DC of infants and records of investigations were obtained from the CMPMMI. The causes of death registered in both sources were coded according to the International Classification of Diseases, tenth revision (ICD-10), and the underlying causes of deaths were selected. Agreement between underlying causes of deaths was verified by Kappa's (k) test and analyzed according to ICD-10 chapters and blocks of categories in both biennia. *Results:* In 2000/2001, according to ICD-10 chapters, high agreement rates were observed for conditions originated in the perinatal period (k = 0.85) and for external causes (k = 0.84), while, for congenital malformations, there was a substantial agreement (k = 0.71). In 2007/2008, agreement was considered poor for all analyzed chapters. For blocks of categories, high or substantial agreement rates were observed only in the first biennium for "congenital malformations of the circulatory system" (k = 0.78) and for "other external causes of accidental injury" (k = 0.91). *Conclusions:* A decrease in agreement between the sources during the study period indicates either an improvement in the process of investigation of infant death by the CMPMMI and/or a worsening in the quality of the DC information.

Keywords: Infant mortality. Underlying cause of death. Death certificates. Information systems. Reproducibility of results.

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RESUMO: *Objetivo:* Analisar a concordância entre a causa básica de morte infantil informada na Declaração de Óbito (DO) e a definida após investigação pelo Comitê Municipal de Prevenção da Mortalidade Materna e Infantil (CMPMMI), em Londrina, Paraná, nos biênios 2000/2001 e 2007/2008. *Método:* Foram obtidas as DO e as fichas de investigação do CMPMMI de óbitos infantis. As causas de morte informadas em ambos os documentos foram transcritas para um formulário, sendo posteriormente codificadas segundo a Classificação Internacional de Doenças, décima revisão (CID-10), com seleção das respectivas causas básicas. As concordâncias entre as causas básicas das DO e as do CMPMMI foram verificadas pelo teste Kappa (k), para capítulos e agrupamentos da CID-10, em ambos os períodos. *Resultados:* Em 2000/2001, observou-se ótima concordância para o capítulo das afecções do período perinatal (k = 0,85) e para o das causas externas (k = 0,84), e boa concordância para o das malformações congênicas (k = 0,71). Em 2007/2008, a concordância entre os registros da DO e os do CMPMMI foi considerada ruim ou fraca para todos os capítulos de causas. Em relação aos agrupamentos, observou-se concordância boa ou ótima apenas no primeiro biênio para “malformações do aparelho circulatório” (k = 0,78) e “outras causas externas acidentais” (k = 0,91). *Conclusão:* Observou-se diminuição da concordância entre as fontes pesquisadas no período estudado, o que indica melhora do processo de investigação dos óbitos infantis pelo CMPMMI e/ou piora na qualidade da informação original na DO.

Palavras-chave: Mortalidade infantil. Causa básica de morte. Declaração de óbito. Sistemas de informação. Reprodutibilidade dos testes.

INTRODUCTION

The underlying cause of death constitutes one of the most important information for the evaluation of health programs and for analyses of temporal tendencies and geographic differences in mortality¹. All causes that result in death should be described in the Death Certificate (DC) by the physician who assisted the deceased in deaths due to natural causes, and by the legist in accidental or violent causes. The record of these causes should follow a logical and temporal sequence of morbid events since the initial (natural or external) until the final cause, which resulted directly in death. The underlying cause of death refers to the disease or kind of accident or violence responsible for the beginning of this process (initial cause)².

Infant mortality analysis according to the underlying cause of death is essential for preventing infant death, because it allows directing actions to prevent the initial causes of the process that lead to death¹. Nevertheless, indication of diseases that directly caused the death (final cause) or acted as mediators between the initial and final causes, without mentioning the underlying cause of death, is usual in the DC.

Several studies have assessed the quality of information about underlying causes of infant death described in the DC³⁻⁹. Comparisons between the causes originally reported in statements with those defined after investigation in hospital records, in results of medical autopsies, and in interviews with relatives represent the most used kinds of evaluation.

Records of Infant Death Prevention Committees are still not very used as source of data for studies on mortality. The absence of such committees all over the national territory, the unavailability of a national information system including these records and making them electronically available, and difficulties associated with the organization of committees and with surveillance of all the infant deaths are considered possible limitations^{10,11}. However, when the committees are properly structured, they collaborate in comprehending the circumstances of infant deaths and enabling improvements in the quality of statistics on mortality^{10,12-14}.

In Londrina, Paraná, Brazil, the Municipal Committee for the Prevention of Maternal and Infant Mortality (MCPMIM) was created in 1999 and since then has been improving its actions on the investigation of infant and women of childbearing age deaths. The process of this investigation comprehends interviews with families and/or health professionals and referrals to hospital and ambulatory records from Health Basic Unities (HBU) or from the Institute of Forensic Medicine (IML, acronym in Portuguese). Londrina is the 38th most populous town in Brazil and has one of the lowest rates of infant mortality (9.54 per a thousand live births in 2011). However, in absolute numbers of deaths, it occupies the 66th position amongst more than 5 thousand Brazilian towns¹⁵.

In the end of 2001, there was an expansion of the Family Health Strategy (FHS) to the urban area of Londrina, reaching around 70% of the population inhabiting such area¹⁶. Based on the context of extending basic attention access, on the existence of an active MCPMIM, and on the importance of studies assessing the quality of information about causes of infant death, the present research had as its aim to analyze the agreement between the underlying cause of infant death reported in the DC and that established after investigation by the MCPMIM, in the biennia 2000/2001 and 2007/2008. Identifying changes in the quality standard of such information collaborates for understanding the process of information production about mortality and for adopting actions aiming its qualification.

METHODOLOGY

The study was carried out in Londrina, Paraná, Brazil, which is a town that had a population of 506,645 residents in 2010¹⁷. Two biennia from 2000 were researched: one after the creation of MCPMIM and before the FHS expansion to the urban area of the town (2000/2001), and another representing the most recent period (2007/2008), with data available about infant death at the moment of data collection.

The sources of data for the research were DC of children younger than one year old who lived in Londrina and investigation records of infant death from the MCPMIM. Initially, infant deaths of both biennia registered in the Mortality Information System (MIS) were identified and, later, by means of a manual research in MCPMIM files the DC and investigation cards of death with correction of the death causes were obtained. Causes reported in both documents were transcribed to a form with a structure that is similar to that of the DC, keeping the causal sequence informed in such documents.

The underlying causes of death were defined by an investigator qualified in Underlying Cause Selection with the support of the Underlying Cause Selection (UCS) program from

the Brazilian Ministry of Health (MH). Then they were codified based on the International Statistics Classification of Diseases and Health-Related Problems, Tenth Revision (ICD-10). Posteriorly, the causes were typed on a spreadsheet of Microsoft Excel program, and grouped by chapters and groupings of the ICD-10.

In the analysis, the profiles of underlying causes of infant death by ICD-10 chapters were compared before and after death investigation through calculation of the relative frequency and Percentage Variation (PV). PV refers to the percentage difference between the absolute number of deaths in every chapter of the ICD-10 before (x) and after investigation (y). It was calculated for each biennium through the following formula: $[(y-x) \cdot 100] / x$.

Agreement between the underlying cause of the DC and that reported by the MCPMIM was analyzed for the chapters and groupings of the ICD-10. In order to measure such agreements, Kappa's test (k) and 95% confidence intervals (95%CI) were used and calculated in the WinPepi 3.06 program. The classification suggested by Landis Jr. and Koch adapted by Pereira¹⁸ was applied to interpret Kappa's test: k-value < 0.00 (bad agreement), from 0.00 to 0.20 (weak), from 0.21 to 0.40 (poor), from 0.41 to 0.60 (regular), from 0.61 to 0.80 (good), from 0.81 to 0.99 (great), and equal to 1.00 (perfect).

The study was approved by the Research Ethics Committee of *Universidade Estadual de Londrina*.

RESULTS

A total of 198 and 148 deaths of children younger than one year old, living in Londrina, was identified at the MIS in 2000/2001 and in 2007/2008. The MCPMIM investigated 97% of the deaths from the first biennium and 100% from those in the second. The main causes, according to ICD-10 chapters, were not changed after investigation in both biennia. However, the increase of death due to infectious and parasitic diseases, congenital malformations, and external causes is more seen. On the other hand, there was a decrease of deaths due to respiratory system diseases, affections originated in the perinatal period (APP), and ill-defined causes (Table 1).

In 2000/2001 around 90% of the deaths due to APP, congenital malformations, and external causes presented the same chapter after an investigation was conducted by the MCPMIM (Table 2).

In 2007/2008, all deaths due to external causes, more than half due to congenital malformations, and around one third of those due to APP had an underlying cause changed to one of a different chapter after investigation (Table 3).

The concordance analysis by registration pairs, in the first studied biennium, showed great agreement for the chapters APP (k = 0.85) and external causes (k = 0.84), and good for congenital malformations (k = 0.71). In 2007/2008, it was observed a decrease in the agreement between DC and the MCPMIM records, the latter was considered bad or weak for all chapters about causes (Table 4).

ICD-10 grouping analysis revealed high frequency of deaths with a modified underlying cause, but still remaining in the same chapter. The chapters of the APP in the two biennia (66 changed

Table 1. Distribution of infant deaths according to underlying cause of death described in death certificate and in Municipal Committee for the Prevention of Maternal and Infant Mortality records, according to chapters of ICD-10, Londrina, Paraná State, Brazil, 2000/2001 and 2007/2008.

ICD-10 Chapters	2000/2001					2007/2008				
	DC		MCPMIM		PV*	DC		MCPMIM		PV*
	n	%	n	%		n	%	n	%	
I - Infectious and parasitic diseases	7	3.6	8	4.2	+14.3	2	1.4	6	4.1	+200.0
X- Respiratory system diseases	9	4.7	3	1.6	-66.7	5	3.4	2	1.4	-60.0
XVI- Affections originated in the perinatal period	109	56.8	107	55.7	-1.8	89	60.1	88	59.5	-1.1
XVII- Congenital malformations	37	19.3	48	25.0	+29.7	38	25.7	42	28.4	+10.5
XVIII- Ill-defined causes	9	4.7	5	2.6	-44.4	3	2.0	1	0.7	-66.7
XX- External causes	12	6.3	14	7.3	+16.7	6	4.1	7	4.7	+16.7
Others [#]	9	4.7	7	3.6	-22.2	5	3.4	2	1.4	-60.0

*Percentage variation (%) CMPMMI/DC. CMPMMI: Municipal Committee for the Prevention of Maternal and Infant Mortality; DC: death certificate.

[#]Chapters: II - Neoplasms; IV - Endocrine, nutritional, and metabolic diseases; VI - Diseases of the nervous system; IX - Diseases of the circulatory system; XI - Diseases of the digestive system; XIV - Diseases of the genitourinary system.

Table 2. Comparison between the underlying causes of death described in the death certificate and in the Municipal Committee for the Prevention of Maternal and Infant Mortality records according to chapters of ICD-10, Londrina, Paraná State, Brazil, 2000/2001.

Death Certificate [#]	Total	Reallocation in each chapter after investigation by the MCPMIM						
		Chapter I	Chapter X	Chapter XVI	Chapter XVII	Chapter XVIII	Chapter XX	Others
Chapter I	7	5	1	-	1	-	-	-
Chapter X	9	1	2	2	3	-	-	1
Chapter XVI	109	-	-	101	6	-	2	-
Chapter XVII	37	-	-	3	33	-	-	1
Chapter XVIII	9	1	-	1	1	5	1	-
Chapter XX	12	-	-	-	-	-	11	1
Others	9	1	-	-	4	-	-	4
Total	192	8	3	107	48	5	14	7

MCPMIM: Municipal Committee for the Prevention of Maternal and Infant Mortality; CD: cause of death.

[#]Chapters: I - Certain infectious and parasitic diseases; X - Diseases of the respiratory system; XVI - Certain conditions originated in the perinatal period; XVII - Congenital malformations, deformations and chromosomal abnormalities; XVIII - Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified; XX - External causes of morbidity and mortality; Others: II - Neoplasms; IV - Endocrine, nutritional, and metabolic diseases; VI - Diseases of the nervous system; IX - Diseases of the circulatory system; XI - Diseases of the digestive system; XIV - Diseases of the genitourinary system.

Table 3. Comparison between the underlying causes of death described in the death certificate and in the Municipal Committee for the Prevention of Maternal and Infant Mortality records according to chapters of ICD-10, Londrina, Paraná State, Brazil, 2007/2008.

Death Certificate [#]	Total	Reallocation in each chapter after investigation by the MCPMIM						
		Chapter I	Chapter X	Chapter XVI	Chapter XVII	Chapter XVIII	Chapter XX	Others
Chapter I	2	–	–	1	1	–	–	–
Chapter X	5	–	–	4	1	–	–	–
Chapter XVI	89	5	–	57	20	1	5	1
Chapter XVII	38	1	2	16	16	–	2	1
Chapter XVIII	3	–	–	1	2	–	–	–
Chapter XX	6	–	–	4	2	–	–	–
Others	5	–	–	5	–	–	–	–
Total	148	6	2	88	42	1	7	2

MCPMIM: Municipal Committee for the Prevention of Maternal and Infant Mortality.

[#]Chapters: 1 - Certain infectious and parasitic diseases; X - Diseases of the respiratory system; XVI - Certain conditions originated in the perinatal period; XVII - Congenital malformations, deformations and chromosomal abnormalities; XVIII - Symptoms, signs and abnormal clinical and laboratorial findings, not being elsewhere classified; XX - External causes of morbidity and mortality; Other: II - Neoplasms; IV - Endocrine, nutritional, and metabolic diseases; VI - Diseases of the nervous system; IX - Diseases of the circulatory system; XI - Diseases of the digestive system; XIV - Diseases of the genitourinary system.

Table 4. Concordance (Kappa index) between the underlying cause of infant death before and after Municipal Committee for the Prevention of Maternal and Infant Mortality investigation, according to ICD-10 chapter, Londrina, Paraná State, Brazil, 2000/2001 and 2007/2008.

ICD-10 Chapters	Biennia			
	2000/2001		2007/2008	
	Kappa	95%CI	Kappa	95%CI
I – Infectious and parasitic diseases	0.65	0.37 – 0.94	-0.02	-0.04 – 0.00
X - Respiratory system diseases	0.32	-0.03 – 0.66	-0.02	-0.04 – 0.00
XVI – Affections originated in the perinatal period	0.85	0.78 – 0.93	0.11	-0.05 – 0.28
XVII – Congenital malformations	0.71	0.60 – 0.83	0.18	0.01 – 0.35
XVIII – Ill-defined causes	0.70	0.43 – 0.98	-0.01	-0.03 – 0.01
XX – External causes	0.84	0.68 – 0.99	-0.05	-0.07 – -0.02
Others [#]	0.48	0.17 – 0.79	-0.02	-0.04 – 0.00

[#]Chapters: II - Neoplasms; VI - Endocrine, nutritional, and metabolic diseases; VI - Diseases of the nervous system; IX - Diseases of the circulatory system; XI - Diseases of the digestive system; XIV - Diseases of the genitourinary system.

underlying causes out of 101, in 2000/2001, and 35 out of 57, in 2007/2008) and of congenital malformations in the most recent period were the most emphasized. In them, all the deaths remaining in this chapter had their underlying causes changed after investigation (16 deaths).

Thus, it was possible to notice good or great concordance only in the first biennium and for the following groupings: “circulatory system malformations” (codes Q20 – Q28), $k = 0.78$ [95%CI 0.62 – 0.95], and “other accidental external causes” (codes W00 – X59), $k = 0.91$ [95%CI 0.79 – 1.00].

In 2000/2001, although agreement between the DC and MCPMIM has been great for the APP chapter, a weak concordance was seen for the “respiratory and cardiovascular disorders specific of the perinatal period” grouping (P20 – P29), $k = 0.10$, which changed from 46 to 6 causes after investigation. Also, a poor concordance for the “fetus or newborn affected by maternal factors and by complications of pregnancy, labor or delivery” grouping (P00 – P04), $k = 0.29$, which changed from 28 to 86 causes after investigation.

Since agreement by ICD-10 chapters was already bad or weak in 2007/2008, it was seen a similar tendency in the grouping analysis.

DISCUSSION

Studies on the quality of information about the underlying cause of infant death through a comparison between the original records and after a detailed investigation are still rare in Brazil. They can only be performed in local contexts, such as those carried out in Porto Alegre and Pelotas³, in metropolitan areas of Rio de Janeiro⁴ and Belo Horizonte⁵, Blumenau⁶, Montes Claros⁸ or in specific services^{7,9}. The results of the present study are in agreement with those from these investigations, because the concordance indices in general vary according to the ICD-10 chapter under analysis. In addition, more concordances have been described for the APP and congenital malformations chapters^{5,6,8,9}.

In 2000/2001, agreement indices were similar to the studies based only on the review of hospital records⁴⁻⁸, with great concordance for the APP and external causes’ chapters, and good for the congenital malformations. However, Mendonça, Goulart and Machado⁵ state that good agreement of causes by ICD-10 chapters, after investigating the process that ended up in death, happens by an internal compensation of disagreements. For example, in the APP chapter, even though there was a change of cause after the investigation, its permanence in this same chapter is still happening.

In fact, for the ICD-10 groupings, it was possible to see a weak agreement for “respiratory and cardiovascular disorders specific of the perinatal period” and for “fetus or newborn affected by maternal factors and by complications of pregnancy, of labor and of delivery”, both from the APP chapter. This happened due to a decrease in indicating the first grouping and increase to the second after investigation.

These results show that the Committee actuation enables more specificity of information about causes of infant deaths, because grouping concerning the maternal factors and pregnancy and labor complications is closer to the beginning of the chain of events that lead to death, and, therefore, to the underlying cause^{1,10} definition than to the respiratory and cardiovascular disorders of the newborn. The reduction of deaths due to mistaken causes and of those caused by diseases of the respiratory system reinforces the MCPMIM importance in classifying the underlying cause of death.

Weak or bad concordance indices were seen in 2007/2008 for all the analyzed chapters. Among the researched periods, there was an important extension of the number of teams acting in the FHS¹⁶. It is believed that such measure may have collaborated so that data survey about infant death occurrence through interviews with families and basic attention professionals, may have happened more effectively causing a positive impact in the specificity of the underlying cause of death described by the MCPMIM.

It is possible that the worsening in agreement indices in recent years happened due to the improvement in the infant death investigation process. However, one should also consider the possibility of quality worsening in the underlying cause of death reported in the DC. It is known that the quality of information recorded in the DC also depends on the access to health services, on technologies for diagnosis, and on the professional's technical capacity on recognizing the dynamic of events that participated in the causal chain of death, as well as of his/her behavior in producing reliable statistics^{8,19}.

Studies concerning quality of information about death causes point out the non-incorporation of the underlying cause idea by physicians and the valorization of legal aspects opposed to the epidemiological ones as factors that contribute for the indication of generic or terminal death causes in the DC^{4,7}. Great amount of DC fields, lack of information to establish diagnosis, and lack of instructions about completion of such document were other reasons reported by physicians of the partial and/or inconsistent fulfillment of the DC²⁰. The certificate of death causes can still be subject to fads like the frequent use of terms such as "cardiac arrest" and "failure of multiple organs"¹.

Hence, the qualification of physicians and Medicine students for the complete and coherent record of information in the DC is an essential measure to improve the quality of mortality statistics^{1,21,22}. Infant Death Investigation Committees can collaborate in this meaning because they present in their attributions the sensitization of professionals to appropriately complete such records^{10,14}.

CONCLUSIONS

Results show a decrease of agreement between the underlying cause information in the DC and that defined after investigation by the MCPMIM in the most recent biennium (2007/2008). This finding may seem to indicate improvement of the investigation

process of infant deaths by the Committee. However, worsening of the quality of the original information in the DC cannot be discarded in the researched period. Therefore, studies assessing the reasons for this greater discordance in more recent years should be performed. Regardless of the need of more studies, the importance of adopting educational measures aiming at stimulating the correct completion of this document must be more emphasized^{1,8,21,22}.

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