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Quality of information registered on fetal deaths certificates in São Paulo, Southeastern Brazil

ABSTRACT

OBJECTIVE: To evaluate the quality of information registered on fetal death certificates.

METHODS: Records were reviewed from 710 fetal deaths registered in the consolidated database of deaths from the State System for Data Analysis and the São Paulo State Secretary of Health, for deaths in São Paulo municipality (Southeastern Brazil) during the first semester of 2008. Completeness was analyzed for variables on fetal death certificates issued by hospitals and autopsy service. The death certificates from a sub-sample of 212 fetal deaths in hospitals of the National Unified Health System (public) were compared to medical records and to the records from Coroner's Office.

RESULTS: Among death certificates, 75% were issues by Coroner's Office, with Coroner's greater frequency in public hospitals (78%). Completeness of variables on death certificates issued by hospitals was higher among non-public hospitals. There was greater completeness, agreement and sensitivity in death certificates issued by hospitals. There was low agreement and high specificity for variables related to maternal characteristics. Increased reporting of gender, birth weight and gestational age was observed in certificates issued by Coroner's Office. Autopsies did not result in improved ascertainment of cause of death, with 65.7% identified as unspecified fetal death as 24.3% as intrauterine hypoxia, while death certificates by hospitals reported 18.1% as unspecified and 41.7% as intrauterine hypoxia.

CONCLUSIONS: Completeness and the ascertainment of cause of fetal death need to be improved. The high proportion of autopsies did not improve information and ascertainment of cause of death. The quality of information generated by autopsies depends on access to hospital records.

DESCRIPTORS: Fetal Death. Death Certificates. Cause of Death. Autopsy. Mortality Information System. Information quality.

INTRODUCTION

Although fetal deaths account for the majority of perinatal deaths, they are not well understood and studied,^{7,8,16,17} and remain almost invisible throughout the world. Systematic and reliable records of these events are essential to understand the problem. Nonetheless, quantification of fetal deaths remains insufficient; detailed information is necessary to support interventions to prevent fetal mortality.⁸ Information from mortality information systems are an important

tool to identify potential risk factors. Based on mortality data, studies have identified the role of twins,⁸ maternal age^{5,13,17} and gestational age^{5,13} on fetal mortality.

The Euro Perinatal Statistics project of the European Union defined specific indicators for monitoring perinatal mortality, like birth weight, gestational age, time of death (antenatal/intrapartum), maternal age and parity.²⁵ The indicators are obtained from vital statistics databases.

Causes of death are also important for understanding and preventing fetal deaths. Performance of autopsies can improve data quality. Some countries such as the United Kingdom propose that 100% of fetal deaths should be autopsied, although a study in Wales found an autopsy rate of 60.5% for fetal deaths between 1994 and 2003.¹ Comparison of vital statistics with hospital records is a method to evaluate information quality and should be used in quality improvement.^{10,12,20,21}

There have been few studies about fetal mortality in Brazil,^{3,7,18,22} and this indicator is not included among the basic Brazilian health indicators. Eight Brazilian federative units have perinatal mortality data considered as good quality. Under-notification of fetal deaths and low completeness of information on death certificates contribute to this problem.^{2,4} Nonetheless, perinatal and fetal mortality merits increased attention in national health research, given their growing importance.

In São Paulo, São Paulo state, 99.4% of deliveries occur in hospital wards, mainly in high complexity hospitals.²³ Fetal mortality was 7.2 per one thousand births and accounted for 56% of perinatal deaths in 2008. It has been the principal component of perinatal mortality since 1996.^a Fetal deaths were 14.6 times more frequent than maternal deaths and constituted 60% of infant deaths in 2008.^a

Vital statistics in São Paulo have good coverage of events. Data from 2006^a show that the majority of fetal death certificates (70%) were autopsied, a similar proportion as in developed countries, which may suggest good quality information.

The study objective was to evaluate the quality of information from fetal death certificates in São Paulo municipality, in southeast Brazil.

METHODS

The study analyzed 710 fetal deaths among resident mothers delivering in hospitals of São Paulo municipality, during the first semester of 2008. Data were

obtained from the unified database of deaths from the *Fundação Sistema Estadual de Análise de Dados* (SEADE, State System Foundation of Data Analysis) and the São Paulo State Health Secretary. Deaths that occurred at home were excluded. Deaths from deliveries in hospitals with less than 100/births per year were also excluded due to infrequent fulfilling of fetal death certificates.

Identification of the institution responsible for fulfilling of the death certificate was performed using field 52 of the death certificate (Did signing physician attended the death? 1- Yes; 2-Substitute; 3-Medical Legal Institute; 4-Coroner's Office [CO] and 5-Others). Responses 1, 2 and 5 were considered as death certificates by hospitals. Events identified as Medical Legal Institute and with those not filled in were excluded.

The hospital where death occurred was identified on the death certificate and subsequently classified as part of the *Sistema Único de Saúde* (SUS, National Unified Health System) or non-SUS, according to information from the *Cadastro Nacional de Estabelecimentos de Saúde* (CNES, National Registration of Health Establishments). Death certificates without hospital name and code were excluded.

Completeness of data on certificates was classified as excellent (above 95%); good (from 90% to 95%); moderate (from 70% to 90%); poor (from 50% to 70%); and very poor (less than 50%).⁶ The variables analyzed were maternal characteristics (age; education; number of previous children alive and deceased); pregnancy/delivery (gestational age, type of pregnancy and delivery mode) and fetal (sex and birth weight).

In a second step of the study, fetal deaths from a sample of SUS hospitals in São Paulo municipality were analyzed. The 11 SUS hospitals studied (ten high complexity and one medium complexity)²³ are representative of the SUS network. Fetal deaths occurring in four municipal owned hospitals, two state hospitals, three university hospitals (two public and one philanthropic) and two from the Social Organizations of Health were studied. Education (medical residency) take place in the university hospitals and in three other public institutions.

Data completeness (percentage filled in) and the primary cause of death on death certificates fulfilled by hospitals and CO were compared. Causes of death were classified based on the International Statistical Classification of Diseases and Related Health Problems (ICD-10). The cause of death coding was performed by SEADE Foundation. A specific protocol was used to

^a Fundação Seade. Nascidos vivos, nascidos mortos, óbitos neonatais precoces e perinatais e taxas de mortalidade segundo distritos do Município de São Paulo. São Paulo; 2008 [cited 2011 Jun 12]. Available from: http://www.seade.gov.br/produtos/mortinf/tabelas/2008/pdf/tabela06_2008_distritos.pdf

extract information from the obstetric medical records at hospitals. A specific protocol was applied to obtain data from the records of the CO.

Agreement was calculated for each variable based on data registered in hospital records and death certificates. Sensitivity and specificity were estimated for the information recorded, with the gold standard being hospital records.¹⁵ Sensitivity was defined as the proportion of information present in medical records and death certificates in relation to the total hospital records with information. Specificity was defined as the proportion of information missing in the two data sources, among events that were not included in hospital records.

The project was approved by the Research Ethics Committee of the Faculdade de Saúde Pública da Universidade de São Paulo (Process nº 049/07) on 20 of April of 2007.

Table 1. Institutions responsible for issuance of fetal death certificates, by type of hospital at delivery. São Paulo, Southeastern Brazil, 2008.

Type of hospital at delivery	Issuance of fetal death certificates					
	CO		Hospital		Total	
	n	%	n	%	n	%
SUS	421	78.1	118	21.9	539	100.0
Non-SUS	112	65.5	59	34.5	171	100.0
Total	533	75.1	177	24.9	710	100.0

SUS: Brazilian Unified Health System
CO: Coroner's Office

RESULTS

Among the 710 deaths, 75.1% of death certificates were issued by the CO and 24.9% by hospitals that provided delivery care (Table 1). Death certificates were issued by the CO 19% more frequently for deaths in SUS hospitals compared to non-SUS hospitals ($p < 0.001$; 95%CI 1.06;1.34).

Completeness for fetal sex and birth weight was excellent for fetal death certificates issued by CO and were respectively excellent and good in death certificates emitted by hospitals. The variables related to maternal characteristics (age, education and previous children) had poor completeness, and hospitals performed better than the CO, especially non-SUS hospitals which had completeness between moderate and good. Completeness was good and excellent for variables related to pregnancy and delivery in non-SUS hospitals and moderate in the SUS network. Death certificates issued by CO showed large variability in data completeness: good (gestational age and birth weight), moderate (type of pregnancy) and very poor (delivery mode). Death certificates from hospitals, especially non-SUS hospitals, presented greater completeness than those filled in by the CO (Table 2).

Fetal deaths in the 11 SUS hospitals represented 39% of the total deaths in SUS hospitals during the study period. Of the sample, 66% of death certificates were emitted by CO and 34% by hospitals (Table 3).

For referral of fetal deaths to CO, a police report must be made, authorizing removal of the corpse from the

Table 2. Completeness of variables on fetal death certificates, by type of hospital and institution responsible for issuance. São Paulo, Southeastern Brazil, 2008.

Variável	SUS				Non-SUS				Total				Total Overall	
	CO (n = 421)		Hospital (n = 118)		CO (n = 112)		Hospital (n = 59)		CO (n = 533)		Hospital (n = 177)		Overall (n = 710)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Maternal														
Age	165	39.2	90	76.3	30	26.8	55	93.2	195	36.6	145	81.9	340	47.9
Education	12	2.9	63	53.4	1	0.9	46	78.0	13	2.4	109	61.6	122	17.2
Previous live births	153	36.3	84	71.2	18	16.1	51	86.4	171	32.1	135	76.3	306	43.1
Previous deaths	99	23.5	65	55.1	17	15.2	43	72.9	116	21.8	108	61.0	224	31.5
Gestation/delivery														
Gestational age	394	93.6	106	89.8	96	85.7	57	96.6	490	91.9	163	92.1	653	92.0
Type of pregnancy	319	75.8	102	86.4	83	74.1	57	96.6	402	75.4	159	89.8	561	79.0
Delivery mode	17	4.0	92	78.0	4	3.6	54	91.5	21	3.9	146	82.5	167	23.5
Fetal														
Sex	421	100.0	117	99.2	111	99.1	58	98.3	532	99.8	175	98.9	707	99.6
Birth weight	415	98.6	108	91.5	110	98.2	53	89.8	525	98.5	161	91.0	686	96.6

SUS: Brazilian Unified Health System
CO: Coroner's Office

hospital. In 88.6% of deaths, the police report was solicited by family members, and in the remaining cases, by other people, including hospital staff made the request. The Municipal Health Secretary introduced Cadaver Referral Guidelines, in order to improve hospital information sent to the CO; nonetheless, the guidelines were present in only 21.4% of records at the CO.

The analysis according to source of death certificate (hospital or CO) did not show significant differences in completeness of records. Differences were observed when comparing the proportion of variables recorded on medical records and death certificates, although there was no consistent trend. Maternal characteristics had lower completeness in death certificates issued by CO compared to hospital records. Recording of maternal education was minimal (3.6%). Gestational age was complete in 97.8% of death certificates and 66.4% of

medical records, and type of pregnancy was complete in 80.4% and 86.4%, respectively. Type of delivery was practically not registered on death certificates (1.4%), although it was present in 98.6% of hospital records. In regards to the fetal characteristics, completeness was high in medical records and death certificates, especially in the later (Table 3).

Among death certificates issued by hospitals, all variables with the exception of maternal age present greater completeness in death certificates than medical records, even though completeness is unsatisfactory in both sources. The variables related to gestation/birth, type of pregnancy and type of delivery presented higher completeness in medical records. Sex and birth weight had excellent completeness and were slightly better in death certificates (Table 3).

Table 3. Completeness, agreement, sensitivity and specificity of variables in fetal death certificates from deliveries in hospitals of the Brazilian Unified Health System, according to the institution responsible for issuance. São Paulo, Southeastern Brazil, 2008.

Variables	Completeness						Sp
	Medical Record		DC		A	Se	
	n	%	n	%			
DC issued by CO (n=140)							
Maternal							
Age	138	98.6	55	39.9	40.7	39.9	100.0
Education	24	17.1	5	3.6	80.7	0.0	97.4
Previous live births	103	73.6	77	55.8	55.0	43.7	86.5
Previous child deaths	100	71.4	50	36.2	45.7	29.0	87.5
Gestation/delivery							
Gestational age	93	66.4	135	97.8	64.3	95.7	2.1
Type of pregnancy	121	86.4	111	80.4	71.4	79.3	21.1
Delivery mode	138	98.6	2	1.4	2.9	1.4	100.0
Fetal							
Sex	133	95.0	140	100	95.0	100.0	0.0
Birth weight	127	90.7	137	99.3	88.6	97.6	0.0
DC issued by hospitals (n = 72)							
Maternal							
Age	72	100	57	79.2	81.9	81.9	-
Education	9	12.5	44	61.1	37.5	44.4	36.5
Previous live births	45	62.5	63	87.5	56.9	84.4	11.1
Previous child deaths	38	52.8	39	54.2	34.7	39.5	29.4
Gestation/delivery							
Gestational age	54	75	62	86.1	63.9	83.3	5.6
Type of pregnancy	60	83.3	59	81.9	81.9	88.3	50.0
Delivery mode	70	97.2	53	73.6	70.8	72.9	0.0
Fetal							
Sex	70	97.2	71	98.6	97.2	98.6	0.0
Birth weight	69	95.8	62	98.6	87.5	88.4	66.7

A: agreement; Se: sensitivity; Sp: specificity

DC: fetal death certificate

CO: Coroner's Office

Table 4. Primary cause of fetal death listed on death certificates for hospitals of the Brazilian Unified Health System, according to the institution responsible for issuance. São Paulo, Southeastern Brazil, 2008.

Primary Cause of Death (ICD-10)	CO		Hospital		Total	
	n	%	n	%	n	%
Fetal death of unspecified cause (P95)	92	65.7	13	18.1	105	49.5
Intra-uterine hypoxia, unspecified (P209)	34	24.3	30	41.7	64	30.2
Maternal complications (P000;P002;P011;P015;P371)	7	5.0	14	19.4	21	9.9
Placental complications (P021;P022;P023)	0	0.0	6	8.3	6	2.8
Umbilical cord complications (P024-P025)	0	0.0	3	4.2	3	1.4
Malformations (Q000;Q240;Q249;Q602;Q913)	4	2.9	4	5.6	8	3.8
Other perinatal causes (P072;P832;P964;P969)	3	2.1	2	2.8	5	2.4
Total	140	100.0	72	100.0	212	100

ICD-10: International Statistical Classification of Diseases and Related Health Problems, 10th Revision.

CO: Coroner's Office

The agreement between medical records and death certificates issued by the CO was obtained. Data from medical records were considered the gold standard, since they are a primary information source and easily recovered (Table 3). In death certificates emitted by CO, there was high agreement for the variables birth weight and sex and low agreement for the other variables. Birth weight and sex presented high sensitivity, and the other variables had low sensitivity.

In death certificated fulfilled by hospitals, there was good agreement between the variables sex, birth weight, type of pregnancy and maternal age. High sensitivity (above 80%) was found for birth weight, sex and type of pregnancy, indicating good recording of these variables in the two data sources. Nonetheless, the high agreement for maternal age was due to the absence of information in the two sources.

Fetal deaths sent to the CO were predominantly pre-term (96.4%), with high concentration during the period of 32 to 36 weeks (35.7%). There were differences in the cause of death between the hospital death certificates and those from CO (Table 4). Unspecified fetal death was the principal cause of death on death certificates issues by CO, and more frequent than those fulfilled by hospitals (OR=8.6, 95%CI 4.37;17.78; $p < 0.001$); intrauterine hypoxia was more common on hospital death certificates (OR=0.45; 95%CI 0.24;0.83; $p < 0.001$) and the main cause of death for this group. These two causes of deaths were responsible for almost 80% of total deaths.

Among death certificates emitted by hospitals there was more diversity of primary cause of death, and placenta and umbilical cord complications were present, but these causes were absent in the group sent to the CO. Congenital malformations did not present a statistically

significant difference (OR=0.50; 95%CI 0.11;2.29; $p=0.179$) between death certificates emitted by CO and hospitals, nor did other perinatal causes (OR=0.77; 95%CI: 0.11-6.58; $p=0.770$).

DISCUSSION

Completeness of fetal death certificates in São Paulo municipality was good or excellent when considering gestational age, sex and birth weight. Type of pregnancy had moderate completeness, and the other variables presented very poor completeness. Therefore, specific mortality indicators cannot be calculated according to maternal characteristics, such as age, education and parity.

SUS and non-SUS hospitals presented differences in completeness for variables based on information routinely collected in hospital care, demonstrating greater care in the transcription of data from hospital records to death certificates.

Performance of fetal autopsies is supposed to produce more detailed and higher quality information. Two-thirds of fetal deaths were referred to the CO for autopsy, a level that approximated developed countries.^{1,14} Nonetheless, recording of data on death certificates from CO was less consistent than in hospitals.

In death certificates from CO, the variables obtained either directly or indirectly by autopsy (sex, birth weight and gestational age) presented similar, and sometimes higher, completeness than death certificates emitted by hospitals. CO do not have access to hospital records and instead only have access to data registered on the police reports emitted by the police precinct. The use of the Cadaver Referral Guide^b was unable to resolve the

^b Secretaria Municipal da Saúde de São Paulo; Sistema Único de Saúde. Guia de encaminhamento de cadáver. São Paulo; 2006 [cited 2011 Jun 12]. Available from: http://ww2.prefeitura.sp.gov.br/arquivos/secretarias/saude/legislacao/0077/Guia_Encaminhamento_Cadaver.pdf

problem, since it was present in CO records for 21.4% of reviewed deaths (SUS hospitals), which explains the low completeness of variables that depend on information unobtainable by fetal autopsy.

High completeness for birth weight was observed for death certificates emitted by CO, although the measurement was performed at autopsy and did not represent true birth weight. Gestational age, which had good completeness overall, is provided by family members and is written in months in CO records. The calculation for weeks is performed when death certificates are filled out, which can involve measurement errors in data transcription.

The high proportion of fetal death certificates emitted by CO can be related to the combination of four factors: a) performance of fetal autopsies is thought to improve the identification of cause of death by obstetricians; b) the high proportion of antepartum fetal deaths (approximately 90%)³ combined with the lack of integration between prenatal care and delivery, results in the woman's health records not being sent to the delivery hospital; c) the relative proximity of CO in the capital; d) the reluctance of health professionals to report unfavorable outcomes.⁸ These factors can incentivize obstetricians to judge antepartum fetal deaths as undefined deaths and to refer them to autopsy. The situation was more frequent in SUS hospitals, probably due to the need of family authorization.

Recording of data in hospital records was more complete than information in death certificates, except for the variables birth weight, sex and gestational age. For almost all the other variables there was a loss of data during transcription from medical records to death certificates, especially those emitted by the CO. This results in a low degree of agreement for the majority of variables.

The type of pregnancy had lower agreement for death certificates emitted by SUS hospitals and CO, when compared to a study in Washington in the USA.¹⁵ The variable for previous live births had even lower agreement than in the Washington study.¹⁵ These results suggest a lower preoccupation in the recording of information on death certificates emitted in São Paulo. The study in the United States compared the values recorded in death certificates and medical records, and in the current study, agreement refers to the presence of information and not their values in death certificates and medical records.

The presence of birth weight and gestational age had a high sensitivity in the death certificates emitted by hospitals, indicating simultaneous recording of both documents. With the exception of age, there was low recording of maternal characteristics in medical records and therefore low completeness of death certificates.

Although the objective of performing autopsies is to improve information on cause of death, the majority of death certificates emitted by CO attributed the primary cause of death as unspecified. The most frequent cause of death indicated by CO was unspecified fetal death, followed by intra-uterine hypoxia. These positions were reversed in death certificates emitted by hospitals. A similar result was obtained in Massachusetts in the USA,¹³ where a comparison of the cause of death on death certificates with autopsy results demonstrated that a portion of deaths indicated as asphyxia on death certificates, were subsequently considered as unknown following autopsy. Perinatal autopsies performed in a referral hospital in Curitiba¹⁹ found 15.7% of fetal deaths as unspecified.

The variety in the classification of fetal deaths⁹ makes the comparison of results complex. The proportion of deaths due to unknown or unexplained causes depends on the classification used by various studies. A study performed in West Midlands⁹ in England found 66% of deaths were considered as unexplained fetal deaths using the Wigglesworth classification,²⁴ and when employing the Classification System according to the Relevant Mortality Code,⁹ 15.1% were classified as unknown. A study involving the classification system adopted by Australia and New Zealand found that the cause of death reported by hospitals was undetermined in 26.7% of antepartum fetal deaths, although this proportion increased to 38.4% when reviewed by the Perinatal Mortality Committee.¹¹

In death certificates emitted by hospitals, besides the aforementioned causes of death, there was a high proportion of deaths due to gestational complications, as well as placenta and umbilical cord complications, which were absent from death certificates emitted by CO. This finding may be due to the absence of clinical information concerning the pregnancy and delivery, during autopsy. In addition, the placentas do not accompany the fetuses for autopsy which complicates the identification of cause of death.

Some authors indicate that there are problems in the use of ICD-10 for the study of fetal deaths,⁸ specifying that the codes referring to placental conditions are incomplete and include few pathologies. There is also overlap between obstetric and perinatal conditions which could contribute to the high proportion of undefined or unexplained deaths, demonstrating the need to introduce modifications in the next ICD revision.⁸ Information about fetal deaths can be improved with the introduction of a specific fetal death certificate, which could include more detailed information about gestational complications.¹⁴

In 2005, fetal deaths of 2,500 or more grams were included in investigations that should be performed by

the Infant and Fetal Death Surveillance Committees^c to improve information and obtain a better understanding for prevention programs. It is possible that compulsory surveillance of infant and fetal deaths by the SUS health services (public and private)^d will improve information quality.

The removal of the fetuses from the hospital to the CO occurs after a police report is submitted by the police station responsible for the area where the hospital is located. In the sample of SUS hospitals, the police reports for almost 90% of deaths referred to CO were requested by family members. Instead of family members receiving counseling and support from health services, they are referred to police stations to obtain the document. Families in São Paulo state that use SUS and experience a fetal loss, appear to receive a different level of care than offered in the United States, United

Kingdom, Canada and Australia, where support and counseling activities are provided to families.^e

In conclusion, it is necessary to improve completeness and reporting for the cause of death in fetal deaths. The high proportion of autopsies did not improve information quality. Improvement of information quality on CO death certificates depends on access to hospital information. Good quality vital statistics are a critical first step for the research, monitoring and prevention of fetal mortality. Sensitization of managers and health professionals is fundamental to improve the information available about fetal deaths. It is possible to develop routines to facilitate the adequate flow of information between prenatal care services and hospitals and subsequently to CO. In addition, it is necessary to improve support for families that experience a fetal death.

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