15 Problems with Epidemiological Surveillance and Under-Reporting of Maternal Deaths in Yucatan, Mexico: An Analysis of Six Studies

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15.1 Maternal Death and Under-Reporting

Researchers in the fields of biomedicine, public health, and the social sciences have always been interested in knowing the actual magnitude of the problem of maternal deaths in various regions or countries. However, classifying the causes of death as a result of pregnancy remains an important problem for decision-making authorities and for those personnel in charge of maternal death epidemiological surveillance.

Maternal and perinatal mortality is an indicator, or proxy, of a country's development. Because of this, maternal morbidity statistics have had an impact on the health information systems—health analysts, public health authorities, and international agencies carefully evaluate it to determine the overall quality of the national health services. For example, in New Zealand, the reporting rate for serious maternal and perinatal events that reach official surveillance networks is low—fewer than 9% of local serious adverse events (SAEs) are captured and reported. This has been attributed to a low level of local review of those events eligible for analysis (Farquhar et al. 2015), with the consequence that the quality of perinatal medical care cannot be adequately monitored.

Despite the progress that has been made in some countries in the registration services of maternal mortality, a true epidemiological surveillance system of maternal deaths that guarantees reliability in terms of the actual magnitude of the problem has not been implemented. In the United Kingdom (UK), attempts to improve the registration of maternal deaths for the past 60 years have been made through the review of several data sources that allow for information triangulation. The UK recognizes that it is insufficient to base the registration of the causes of maternal death solely on the review of the death certificates, as the woman's pregnancy is not a reportable event (WHO 2004).

For many years, the reporting of cases of maternal death has been based on the identification of cases through the retrospective review of death certificates, where the major cause(s) of death are stated, together with information on the woman's condition (if she was pregnant or in the puerperium

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at the time of death). However, in some jurisdictions, there are mistakes as to the correct completion of the certificates that deviate from the actual cause(s) of death, resulting in under-reporting or under-notification of the cases of maternal death. In those instances where there are doubts about the causes of death of a pregnant woman, relatives of the deceased woman can be interviewed (termed the verbal autopsy) in order to ascertain information regarding the pregnancy and the onset of the signs and symptoms of the complication(s), up to the moment when care was sought at a hospital or death intervened (Curtis et al. 2015). Moreover, there are important social determinants that can influence the mechanisms and causes of maternal death (Lewis 2003, 2008).

A maternal death is the result of complications that arise during pregnancy, labor and delivery, or the puerperium. The causes are specified in the International Classification of Diseases, Tenth Revision (ICD-10), and the major etiologies include the hypertensive diseases of pregnancy (preeclampsia and eclampsia), postpartum hemorrhage, sepsis, and abortions (PAHO 1995; Schwartz 2015a, 2015b, 2015c). Accidental or incidental causes are not taken into account when counting the number of occurrences, but deaths derived from iatrogenic conditions, misdiagnoses, or incorrect treatments are.

One of the main problems regarding maternal mortality surveillance is that the reference documents used to report maternal deaths and their cause(s) differ between countries. Most of them utilize the ICD-10 and, based on the cause(s) reported in the death certificates, codify the major cause to be considered in the statistical calculation. In 2012, the International Classification of Diseases for Maternal Mortality (ICD-MM) was published by the World Health Organization (2016); suicide was reclassified as a direct cause of maternal death instead of an indirect one. In spite of this reclassification, the registration of pregnancy-related suicides has not been taken into account in the calculation of the maternal mortality ratio (MMR) except in some countries (i.e., United Kingdom) where it was incorporated into the statistics several years ago.

There are many publications regarding the under-reporting or under-notification of maternal deaths in the literature (Farquhar et al. 2015; McCaw-Binns et al. 2015; Simoes and Almeida 2011; Karimiam-Teherani et al. 2002; Turner et al. 2002), but such reports addressing the situation in Latin-American countries are scarce. Even though advanced information technologies have been implemented in some Latin-American countries as part of their surveillance and reporting systems, they have not yet achieved optimal quality standards to capture the total number of mother deaths. In Yucatan in the year 2002, studies were launched to analyze the under-reporting of cases of maternal death, which allowed to demonstrate their existence (Rodríguez et al. 2005, 2007, 2009; Rodríguez 2010). This paper presents the results of the analysis of the problems regarding epidemiological surveillance and the under-reporting of maternal mortality cases in the state of Yucatan.

15.2 Methodology to Analyze Under-Reporting of Maternal Deaths

The state of Yucatan is located in the southeastern region of Mexico. It has 2,097,175 inhabitants (INEGI 2015), out of which 51% are women, and out of them, 27.6% are between 15 and 49 years of age and live distributed in 106 municipalities (INEGI 2016). Between the years 2002 and 2011, six studies were carried out to analyze the under-reporting of cases of maternal death in different communities of Yucatan. Four of the studies examined the period between 1997 and 2001; another compared this period in addition to mother deaths occurring between 2002 and 2010, and one more comprised the first period and extended up to the year 2008. All of them were cross-sectional retrospective studies.

Utilizing diagnostic entities from the ICD-10 as a basis, maternal deaths were classified into two categories: (1) direct obstetric deaths and (2) indirect obstetric deaths. Direct obstetric death results from obstetric complications that occur during pregnancy, delivery, or puerperium, from interventions, omissions, incorrect treatment, or a chain of events resulting from any of the aforementioned circumstances.

Indirect obstetric deaths result from a previously existing disease or one that developed during pregnancy, which was not due to direct obstetric causes but was aggravated by the physiologic effects of pregnancy. These two categories were considered in analyzing the classification of maternal death. Other categories include late maternal death and pregnancy-related death. The former is the death of a woman from direct or indirect obstetric causes, more than 42 days but less than 1 year after the termination of pregnancy. The latter is the death of a woman during pregnancy or puerperium, regardless of the cause (ICD-10).

Following the methodology described by Laurenti (1988) based on a list of diagnoses associated with maternal death, death certificates and medical/necropsy records were reviewed, and interviews with the relatives of the deceased women (whose deaths were due to an obstetric complication with an unspecific diagnosis or those whose records showed no cause associated to pregnancy, delivery, or puerperium but the pregnant state was recorded) were carried out. The cases of death of women whose ages ranged between 9 and 50 years of age were selected. The Registry Office provided 57% of the death certificates and the Ministry of Health, 100%. Identification information of the deceased women, addresses, and death diagnoses were obtained from the case registry system at the State Ministry of Health. With this information, the domiciles of the deceased women, who resided in the different municipalities of the state of Yucatan, were located. When evidence of pregnancy or puerperium at the time of death was recorded in the death certificate or when the main cause of death corresponded to an obstetric complication, according to causes O00–O95 as codified in the ICD-10, the case was considered as probable maternal death. Once these cases were selected, the information on the obstetric history of the deceased woman, her condition of being pregnant or in puerperium at the time of death, and the circumstances and clinical characteristics involved in her death were compiled. Information was collected by means of semi-structured interviews carried out with the deceased women's relatives (mothers, mothers-in-law, sisters) who were well acquainted with the circumstances of the death and the events occurred during the journey for care of the obstetric complication (verbal autopsy). Before interviewing the relatives, their informed consent was obtained, including the request to record the interviews. When the procedure triggered the relative's tears and sadness, psychological support to achieve resilience was available. When the relative spoke in the Mayan language, a translator was necessary, and the interview was transcribed in Spanish.

When the diagnosis was non-specific, the relatives were asked if the women had been pregnant within 1 year before dying. Thus, it was possible to relate the cause of death to the pregnancy. Information obtained from certificates, records, necropsies, and relatives was cross-checked, processed, and analyzed through descriptive statistical testing. To estimate the under-reporting of maternal mortality, the number of deaths found was compared to the deaths officially reported by the National Institute of Statistics, Geography, and Informatics (*Instituto Nacional de Estadística, Geografía e Informática*) (INEGI 2016) during the period studied. The following variables related to the cases of maternal deaths were analyzed: age at the time of death, place of residence, place of death, main cause of death, and classification of obstetric death. Finally, the percentage of under-reporting corresponding to each study was estimated.

15.3 Studies on the Under-Reporting of Maternal Deaths

15.3.1 First Study of Under-Reporting

During the period between 1997 and 2001, a 19% under-reporting of maternal deaths was found in the state of Yucatan, i.e., there were only 98 deaths reported in the official records, while in reality there had actually been 121. Women had died in 51 municipalities in the state, and not in 37, as it had been reported (Fig. 15.1). Under-reporting was higher in very marginalized areas, where the magnitude of

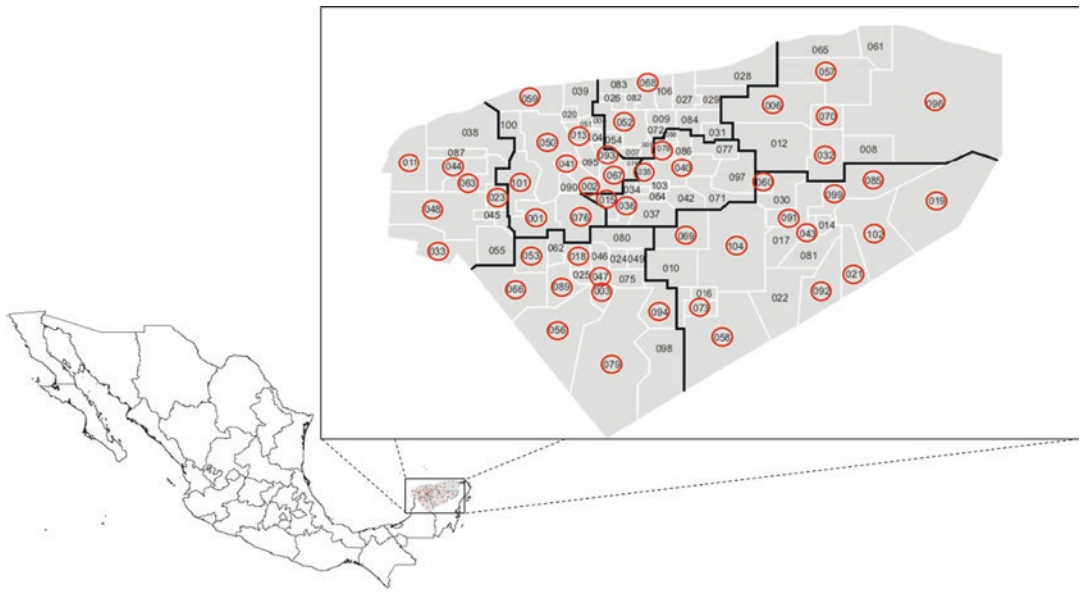

Fig. 15.1 Municipalities with maternal mortality in the state of Yucatan

underestimation of maternal deaths ranged between 50% and 100%. The main causes of under-reporting were mistakes regarding the interpretation of the clinical diagnosis, omission when codifying, and by not taking into account the pregnant condition of the woman recorded in the death certificate. The main regions with under-reporting were Merida, the state capital, 26 eastern municipalities, as well as Tizimin and Chemax.

15.3.2 Second Study of Under-Reporting

In the period between 1997 and 2001, there were 26 cases of maternal death in Merida. Five of these were late maternal deaths, which should not be included in the calculation of the MMR. Out of the 21 (81%) taken into account for the calculation, 16 were officially reported, and five corresponded to cases of under-reporting. The MMR was 0.2 per 1000 children born alive (BA). Furthermore, four (15%) were pregnancy-related deaths, and one (4%) was a case of late maternal death. The mean age of the decedents was 28 years, in a range between 19 and 38. Out of the 21 maternal deaths, 20 (95%) took place in a hospital and one (5%) at home. Seventeen (81%) of the maternal deaths occurred during puerperium and four (19%) during pregnancy. The main causes of maternal death in the cases of under-reporting were septic shock, puerperal fever, choriocarcinoma (a malignant tumor of the placental trophoblast), multiple organ failure, and pulmonary thromboembolism. Nineteen (90.5%) women died from direct obstetric causes based upon criteria according to the IDC-10. Regarding the pregnancy-related deaths, two (50.0%) were suicides (asphyxia by hanging) in women who were 20 and 24 years old. Official data had reported 16 maternal deaths in Merida during the period studied, and we identified five additional cases. The years with under-reporting of maternal deaths were 1997, 1998, and 2000, with 14%, 50%, and 75%, respectively. Twenty-four percent, or almost one quarter, of maternal deaths went under-reporting during the 5 years analyzed in the Merida municipality.

15.3.3 Third Study of Under-Reporting

In our investigation of maternal death under-reporting occurring in nine communities of eastern Yucatan during the same period of study, 757 death certificates and 1316 death certificates were reviewed. Of all the certificates, 543 (41.3%) corresponded to women, and among these, 99 (18.2%) were between 9 and 50 years of age. Twenty-one cases (21.2%) of maternal deaths were identified, six (28.6%) of which had not been reported. The years with highest under-reporting were 1998 and 1999, with 40% and 50% of deaths missed, respectively. The highest MMR was 14 deaths per 1000 children BA in the year 2000. The percentage of under-reporting made the total MMR increase to 3.1 more women dead per every 1000 children BA. Most of the maternal deaths corresponded to women between 20 and 29 years of age (47.6%), followed by women between 35 and 44 years of age (33.3%). The most frequent cause of death was hemorrhage, occurring in five (23.8%) cases.

15.3.4 Fourth Study of Under-Reporting

In another under-reporting study which we conducted in 15 municipalities in the eastern region of the state, a comparison between the deaths occurring during two periods (1997–2001 and 2002–210) was carried out. Thirty-two maternal deaths took place in each period, in 7 and 14 municipalities, respectively. During the first period, no under-reporting was found, but during the second period, one case, corresponding to a maternal death in the Valladolid municipality, was found. The MMR of the two time periods studied were compared, and the highest were recorded in the smallest municipalities, like Uayma (12 per 1000 children BA), Quintana Roo (37 per 1000 children BA), and Sucila (11 per 1000 children BA). When studying the trend in the two municipalities with the highest number of maternal deaths (Valladolid and Chemax), with 14 and 9 deaths, respectively, a decrease in the number of maternal deaths was observed. However, regarding the Valladolid municipality, there was a trend toward increased deaths starting in the year 2010. When comparing the number of deaths between four groups of maternal deaths (1997–2001 vs. 2002–2006 and 1997–2001 vs. 2007–2010), significant differences were found between both comparisons ($p = 0.049$ and $p = 0.0002$, respectively) (Table 15.1).

The leading cause of maternal death in the 1997–2001 period was obstetric hemorrhage and, in the 2002–2010 period, eclampsia. Deaths due to puerperal sepsis were reported only in the first period. Regarding the locations where the deaths occurred, it was observed that the highest number took place during transfer between the women's community and the hospital where they were treated ($p = 0.035$) (Table 15.2).

15.3.5 Fifth Study of Under-Reporting

The study was conducted in the Tizimin municipality, where death certificates from 1997 to 2008 were reviewed, and 31 were selected as probable maternal deaths. After carrying out the interviews (verbal autopsies) with the relatives, 19 cases of maternal death were confirmed, out of which two

Table 15.1 Comparison of maternal mortality according to time periods

Periods	Number of deaths	X^2	p
1997–2001 vs. 2002–2006	32 vs. 21	3.85	0.049
1997–2001 vs. 2007–2010	32 vs. 12	13.74	0.0002

Table 15.2 Location of demise for the maternal death cases in the municipalities of eastern Yucatan

	1997–2001		2002–2010		X^2	
Location of demise	Cases	Percentage	Cases	Percentage		p
Hospital with ICU*	13	40.6	5	22.5	1.88	0.17
Hospital without ICU	7	21.9	2	9.1	0.75	0.385
Transfer	2	6.3	7	31.8	4.43	0.035
Home	5	15.6	6	27.6	0.49	0.483

*Intensive care unit

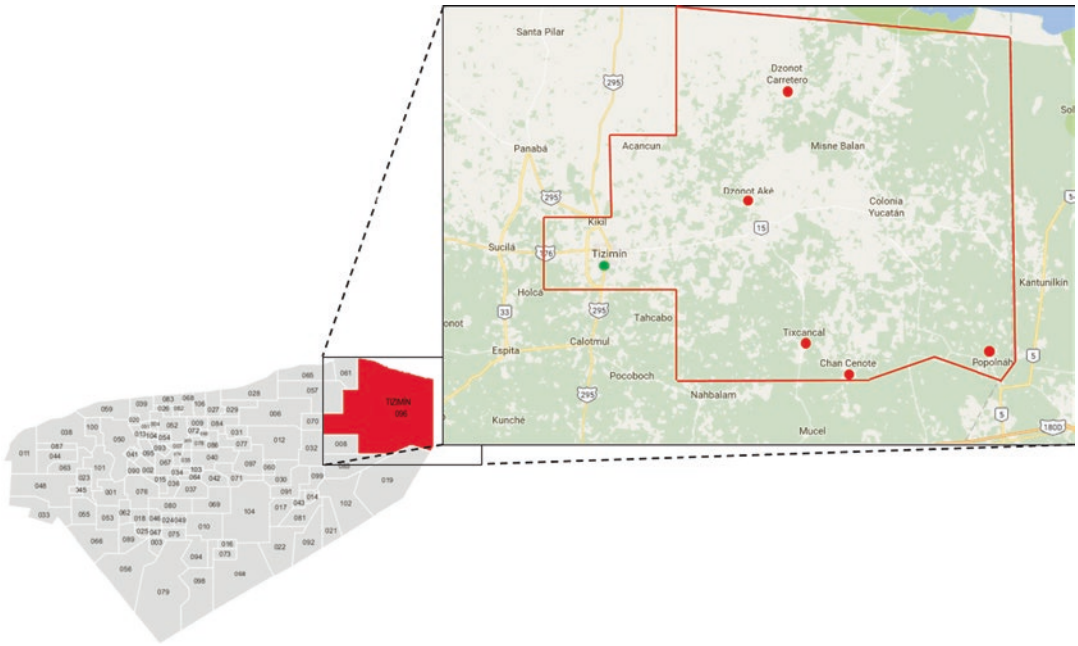

Fig. 15.2 Communities of the Tizimin municipality with maternal death under-reporting

(one from 1997 and one from 1998) had not been recognized or reported. During the 12 years analyzed, a 10.5% under-reporting was found. Two decedents who we classified as late maternal deaths and two pregnancy-related deaths were also identified. The annual MMR had a decreasing trend starting in 2002, which was the year with the highest number of deaths, with 5.4 maternal deaths per 1000 children BA. The main causes of death were hemorrhage in nine (47.4%) cases and hypertensive disorders in six (31.6%). In four (21%) cases of deaths, evidence of pregnancy, delivery, or puerperium at the time of death was recorded, and they were classified as "other causes" since the basic cause of death was not codified by the ICD-10. Out of the total maternal deaths, 15 (78.9%) were classified as direct obstetric maternal deaths and four (21%) as indirect obstetric maternal deaths. The deceased women were from five far-distant communities away from the municipal seat, where emergency services to treat obstetrical complications were not available (Fig. 15.2). Among the 19 confirmed maternal deaths, 12 (63.2%) took place in social assistance institutions, 5 (26.3%) at the deceased women's home, and 2 (10.5%) in private clinics. Underlying diseases (HIV/condylomatosis, cirrhosis, arterial hypertension, and diverticular disease) were found in four (21.1%) of the deceased women. Most deaths took place during puerperium (84.2%), two (10.5%) occurred during pregnancy, one (5.3%) took place during delivery, and six (31.6%) infants died together with their mother.

Table 15.3 Main results of the studies of under-reporting of maternal deaths in the state of Yucatan, Mexico

Region studied	Number of communities	Period	Under-reporting (%)	Maternal death diagnoses	Causes of under-reporting
State of Yucatan	51	1997–2001	19%	–	Misinterpretation of the clinical diagnosis and omission when codifying
Merida	1	1997–2001	24%	Septic shock, puerperal fever, choriocarcinoma, organic failure, pulmonary thromboembolism	
Eastern region	9	1997–2001	28.6%	Acute renal impairment, anemia, wasting syndrome, liver cancer, fulminant liver failure	Basic cause undefined and omission when codifying
Eastern region	15	2002–2010	3%	Suicide	Omission of evidence of pregnancy when codifying
Tizimin	1	1997–2008	10.5%	Hypovolemic shock, hypertensive crisis	Omission of evidence of pregnancy and puerperium when codifying
Chemax	1	1997–2001	22%	Arteriovenous malformations, left hemisphere frontoparietal aneurysm	Incorrect completion of the certificates due to a misreporting of the sequence of events that led to death

15.3.6 Sixth Study of Under-Reporting

This study was carried out in Chemax, a Mayan community considered to be highly marginalized and very deeply rooted in its indigenous cultural traditions, where the population speaks the Mayan language. Nine maternal deaths were found there for the 1997–2001 quinquennium, of which two (22%) had not been officially recognized or reported. The total number of maternal deaths in this community corresponded to 9.2% of the deaths reported in the whole state of Yucatan during that period, and the decedents were distributed equally between the two age groups of 20–24 and 35–39 years. Seven (77.7%) deaths were classified as direct obstetric deaths, and two (22.2%) were indirect. Eight (88.8%) deaths took place during puerperium and one (11.1%) during pregnancy. Four (44.4%) deaths occurred in a tertiary care hospital, and two (22.2%) occurred in a secondary care hospital. Two (22.2%) maternal deaths occurred during transfer, and one (11.1%) while at home. The estimated time between the onset of the complication, the search for medical care, and the actual care was prolonged in the cases of eclampsia (5 h). In the two cases of under-reporting, the time was 4 h for arteriovenous malformations and unknown for the case of left hemisphere aneurysm. Under-reporting was due to the incorrect completion of the death certificates, since the report of the sequence of events that led to death was incorrect, and as a result, the main cause of death was missed.

Table 15.3 summarizes the percentages of maternal death under-reporting, the municipalities where the six studies were carried out, the diagnoses recorded in the death certificates, and the main causes of under-reporting.

15.4 Discussion and Conclusions

The under-reporting of maternal death in the state of Yucatan remains a problem that requires attention, as is evidenced in the six studies discussed in this chapter. Although under-reporting was mainly observed in the 1997–2001 period, which was followed by a trend toward a decrease in the cases of

death, it cannot be asserted with certainty yet that the notification surveillance system is working under optimal conditions. The last study included results up to the year 2010, and from that time on, no new studies have been undertaken to discover whether under-reporting of maternal deaths is still occurring.

The magnitude of under-reporting identified in the six studies conducted in Yucatan varied according to the size of the locality. For example, in urban areas like Merida, the rate of under-reporting was lower (24%) in comparison with smaller communities where the phenomenon was occurring in between 50% and 100% of cases. Under-reporting in Latin America and the Caribbean was 10.1% in 2011 (PAHO-WHO 2013). However, there are significant variations between countries, such as the case of Argentina, which has declared an under-reporting level of 9.5% for maternal deaths (CEDES 2004), lower than the one found in our study. Brazil declared a 30% under-reporting (Simoes and Almeida 2011), whereas Bolivia and Haiti reached under-reporting levels of up to 50% (CEPAL 2010), similar to the rates that we found in rural Yucatan.

Even though Latin-American countries have made an effort to improve the maternal death registration system, there is still much work to be done in order for the number of deaths reported to coincide with reality. In other words, there are still lags in the information systems that prevent optimal results regarding the cases of maternal death. International organisms like the UN Maternal Mortality Estimation Interagency Group (MMEIG) and the Institute for Health Metrics and Evaluation (IHME) have created complex calculation models of the MMR based on estimations; however, they have to be taken with caution since they are built on assumptions (Family Care International 2012). Making the estimates of the MMR is difficult when death registers are few because the value per 100,000 children BA cannot be used since the results would include decimals that would hinder interpretation. This was the case of our studies, where we used the constant per 100,000 BA to derive integers. This has made it difficult to contrast our results with other countries' MMR, but it allowed us to identify the areas at higher risk of maternal death in the state (Rodríguez and Ordóñez 2006). Deaths caused by maternal hemorrhage prevailed in the first 5 years studied, in accordance with what has been reported by other authors as the characteristic cause of maternal death in marginalized communities (Islam and Yoshida 2009). However, in the following decade, the hypertensive diseases of pregnancy—preeclampsia-eclampsia—were the major etiology. These conditions can be detected during prenatal consultations through a series of alarm signs, and adequate treatment can be of potential in preventing preeclampsia from progressing (SEGOB 2016). A community intervention designed to improve awareness of the signs of alarm was tested in a Mayan locality. The intervention involved an interdisciplinary team with specialists in medical and social anthropology, public health, psychology, education, and nursing, as well as the participation of health aids from the community who served as Mayan translators. The experience was successful because there was significant progress in the recognition of the signs and symptoms of preeclampsia-eclampsia and hemorrhage by the Mayan women who participated (Rodríguez et al. 2012a). Although cases of puerperal sepsis were the second leading cause of death during the first years studied, there could have been an under-reporting of cases of death by infection, resulting from the increase of such invasive bacteria such as group A Streptococcus (GAS) to the antibiotic resistance, to the rise of cesarean sections, and to the prevalence of obesity among women, as has been reported in the United Kingdom and the Netherlands, which have experienced an increase in maternal deaths due to these causes (Acosta and Knight 2013). In Yucatan, maternal mortality committees have been created in hospitals to address serious cases of obstetrical complications. The Committee analyse the situation in cases of death and determine the medical procedures that had been attempted to treat the complication. When the information on the circumstances surrounding the death is not clear, the deceased women's relatives are interviewed (verbal autopsy) in jurisdictional areas where health information from certain number of municipalities is centralized. After the case has been analyzed at a hospital level, the State Interinstitutional Committee, made up by representatives from

the health sector, meet, and the case is presented and analyzed again, and strategies to prevent further deaths are discussed and agreed upon. However, even though this is a well-intended attempt to prevent maternal deaths from occurring, we do not know if there has been a systematic follow-up of the proposed strategies to see if they are implemented. Moreover, it is essential to have permanent surveillance systems of the sociocultural, political, and structural causes involved in the process of providing care for pregnant women with serious complications, since these aspects can result in formidable barriers that delay response to obstetrical emergencies and can ultimately lead to death (Rodríguez et al. 2012b; Rodríguez et al. 2014). Delays in providing care for an obstetrical complication have also been reported due to the difficulty for the pregnant women and her relatives to reach a hospital given the long distances they must travel to reach a hospital with an ICU, indispensable to address emergencies (Rodríguez et al. 2009). This difficulty, representing the second delay of the three delays model of maternal mortality, accounted for some of the cases of maternal death during the study on under-reporting conducted in the eastern municipalities of Yucatan.

After the occurrence of a maternal death in Yucatan, the sequence that the information must follow can delay the updating of the data on the number of cases. This in turn can impact the results when trying to determine the number of deaths occurring at any given moment. When a maternal death takes place, whether it occurs in the home, at the hospital, or elsewhere in the locality, it has to be notified to the next level of information (Sanitary Jurisdiction) within 24 h so it can be reported to the state-level agency (Yucatan State Health Services). The state-level agency reports it to the Health Ministry in Mexico City (central level), where the information from the death certificate, the verbal autopsy, and the rulings of the hospital and interinstitutional mortality committees is analyzed. In other words, at the central level, the case is analyzed once again, and it is finally ruled as a maternal death or not. Then, those cases which are definitely certified as maternal deaths are officially reported to international instances.

The perception of the procedures that are undertaken to reduce maternal deaths has created a puzzling environment among the personnel at the hospitals and the health units regarding the notification process. This is due to attention being focused on the statistics and on fulfilling numerous requests for immediate information on the individual cases, but the personnel do not perceive the changes or improvements proposed by the committees to prevent maternal mortality (oral communication).

There are studies that document that hospital information systems are not monitored for the quality of the data. In other words, the death diagnoses from the certificates are captured digitally, but the quality of the report to confirm that the correct diagnosis was captured is not analyzed (Kihuba et al. 2014).

The major causes of under-reporting which we identified in this study using several search methods and including verbal autopsies, such as the mistakes in the diagnoses stated in the death certificates, have also been reported in Los Altos de Chiapas, Mexico. In this region, 8.4% of maternal deaths were not reported in the year 2001 (Freyermuth-Enciso and Cárdenas-Elizalde 2009).

The delay in submitting forensic reports of maternal deaths has been identified as a cause of under-reporting in other countries, along with the misclassification of the diagnostic reports (McCaw-Binns et al. 2015). The second phenomenon was also identified in our studies. Hence, the importance of training personnel on the correct causes of death and how to report them on the certificates, so they are able to recognize both the diagnoses and the coding details of maternal deaths.

The risk associated with the age of the pregnant woman has always been considered an important factor for maternal mortality. However, there are limitations in asserting that maternal mortality increases in adolescent pregnancies. This can be seen from the results of a study in 144 countries, which showed lower mortality rates in this age group, compared with women older than 30 years (Nove et al. 2014). Greater attention to the study of this risk factor will have to be implemented in the future, as the number of adolescent pregnancies is increasing worldwide. Even though the impact of

this condition on human development during adolescence is well known, in Yucatan the magnitude of the risk associated to this age group remains unknown.

It will be particularly important to delve into the under-reporting of violence-related maternal deaths (a component of obstetric violence), since the studies carried out in the eastern region of the state have reported that pregnant women were physically abused by their husbands leading to miscarriages (Rodríguez et al. 2012c). In municipalities such as Chicxulub Puerto and Tahdziú, depression-related violence and low-weight newborns have been found (Oliva et al. 2016). This evidence should alert us to intensify surveillance for cases of pregnant women with emotional disorders such as untreated depression, which can culminate in suicide. Codifying these causes as direct obstetric deaths will allow us to capture those under-reported deaths resulting from maternal suicide. This will have a significant impact in the future when calculating the MMR, and they will be considered when implementing mortality prevention strategies (Knight et al. 2016).

Organizing a highly functional and effective maternal death surveillance system in Yucatan will be a challenge for the health system in the coming years. The effective training of individuals responsible for coding of obstetrical diagnoses will be a challenge to achieve.

It will also be necessary to train health personnel, consisting mostly of registered medical practitioners and those who are fulfilling their social service in different communities throughout the state, as they are the health professionals that recognize and certify the cause(s) of death of women, be it at home, during transfer, or at the hospital.

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