The corrected perinatal mortality rate

A hospital-based study in Saudi Arabia

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ABSTRACT

الأهداف: تحديد المعدل التصحيحي لوفيات الفترة المحيطة بالولادة في مستشفى جامعة الملك عبد العزيز. واختبار أثر عدم المتابعة في عيادة الحوامل على معدل وفيات الفترة المحيطة بالولادة، بالإضافة إلى دمج الاثنين معاً ومن ثم وضع مصطلحاً جديداً يعرف باسم المعدل التصحيحي الموسع لوفيات الفترة المحيطة بالولادة.

الطريقة: أُجريت هذه الدراسة الاسترجاعية لمعدل حالات وفيات الفترة المحيطة بالولادة خلال الفترة من يناير 2000م إلى ديسمبر 2010م، وقد شملت الأمهات اللاتي ولدن في مستشفى جامعة الملك عبدالعزيز، جدة، المملكة العربية السعودية. ومن ثم تصحيحها للخداج المدقع والتشوهات الخلقية وذلك باستبعاد هذه الحالات. وفي الخطوة الثانية تم حصر جميع حالات الحوامل غير المتابعات في عيادة الحوامل ومن ثم تصحيح معدل حالات وفيات الفترة المحيطة بالولادة وذلك باستبعاد هذه الحالات. وقد قمنا باستخدام الحزمة الإحصائية للعلوم الاجتماعية من أجل التحليل الإحصائي.

النتائج: بلغ إجمالي عدد الولادات 46,677، وتم حصر 771 حالة وفيات الفترة المحيطة بالولادة بمعدل 16.5 لكل 1000 مولود. وكانت الوفيات قبل الولادة المعدلة بعد استبعاد حالات الخدج المدقع والتشوهات الخلقية 11.0 لكل 1000 مولود، ومن جهة أخرى فقد انخفضت بدرجة كبيرة إلى 6.4 لكل 1000 مولود بعد استبعاد حالات الحوامل الغير متابعات في عيادات الحمل.

خاتمة: كان معدل وفيات الفترة المحيطة بالولادة في الدراسة الحالية أعلى من تلك الموجودة في البلدان المتقدمة. ومن جهة أخرى فقد انخفض المعدل بشكل كبير بعد التصحيح لمعدل الحوامل الغير متابعات في العيادة. ويمكن استخدام المصطلح الجديد المسمى المعدل التصحيحي الموسع لوفيات الفترة المحيطة بالولادة في مقارنة المستوى النوعي للرعاية الطبية فيما بين المؤسسات المختلفة ولا سيما في البلدان النامية التي يرتفع بها عدد الحوامل الغير متابعات للحمل.

Objectives: To determine the corrected perinatal mortality rate (PMR) in a single tertiary care center, and to test the effect of unbooked pregnancies on the PMR, and amalgamate the 2 to develop a new terminology known as the extended corrected PMR.

Methods: We conducted a retrospective cohort study of all women who delivered at King Abdulaziz University Hospital, Jeddah, Kingdom of Saudi Arabia between January 2000 and December 2010. We recorded all cases of perinatal death and calculated the PMR per annum. The PMR was corrected for extreme prematurity and congenital anomalies. The unbooked cases were reported, and the PMR was further corrected for booking status. For statistical analyses, the Statistical Package for Social Sciences was used for descriptive analysis and tests of significance.

Results: The total number of births was 46,677. Seven hundred and seventy-one perinatal deaths were reported, giving a PMR of 16.5 per 1000 per year. The corrected perinatal mortality was 11.0 per 1000. The PMR decreased significantly to 6.4 per 1000 (odds ratio 2.6, 95% confidence interval 1.2-2.4, p=0.001) after correction for booking status.

Conclusion: The PMR in our study population is higher than those in developed countries, and when corrected for congenital anomalies and extreme prematurity, it is marginally higher. It was then considerably reduced after correction for booking status.

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The perinatal mortality rate (PMR) is used as an indicator of the quality of antenatal and perinatal care in different institutions and countries. It is also used to develop mechanisms that reduce avoidable fetal and neonatal deaths, and for education and training. In addition, it may reflect the socioeconomic development of a society.[1] The PMR depends on a number of factors and important determinants that have to be taken into consideration and assessed individually to reach a satisfactory conclusion on the quality of care issues. An uncritical application of this indicator in national and international comparisons can be misleading and unfair for some centers that deal with high-risk pregnancies and large numbers of unbooked deliveries. The corrected PMR is being used by some centers to overcome the above obstacles in determining the quality of care based on the PMR; however, in the developing countries some institutions with a high rate of unbooked deliveries may undervalue their medical care facilities when the perinatal mortality is reported. Numerous reports have related unbooked pregnancies to high PMR in developing countries,[2-4] with a major paucity on this issue in Saudi Arabia. In the literature, there are no available data on the corrected perinatal mortality in Saudi Arabia or any developing countries. Thus, the main objective of this study was to determine the corrected PMR at King Abdulaziz University Hospital (KAUH), Jeddah, Kingdom of Saudi Arabia, and to test whether unbooked deliveries affect the PMR. Furthermore, we aimed to develop a new terminology called the extended corrected perinatal mortality rate (ECPMR) as a fair tool to compare the quality of care at different institutions, particularly in the developing countries.

Methods. We performed a retrospective chart review of the medical records for all women who delivered at KAUH, Jeddah, Saudi Arabia, from January 2000 through December 2010. The review included the identification of all cases of perinatal death that occurred during the study period. The Biomedical Ethical Research Committee of the Faculty of Medicine of King Abdulaziz University approved the study.

The World Health Organization (WHO) defines stillbirth as a "fetal death late in pregnancy," and allows each country to define the gestational age at which a fetal death is considered a stillbirth for reporting purposes.[5] Therefore, we elected to define still birth as fetal death after 24 weeks of gestation after reviewing the threshold of survival in the neonatal unit in our institution during the study period. We included all cases of documented still birth and early neonatal deaths after 24 completed weeks of pregnancy and/or a birth weight of more than 500 g. Exclusion criteria included birth weight less than 500 grams, gestation age less than 24 complete weeks by accurate date, or early ultrasound and neonatal death beyond 7 days of life. All cases of perinatal death identified from the maternal records were cross-referenced with the labor and delivery records, neonatal intensive care unit (NICU), special baby care unit (SCBU) and the nursery to ensure that all cases of perinatal deaths were recorded. The charts of both mothers and neonates of all cases of perinatal deaths were critically reviewed, and information regarding the gestational age, neonatal birth weight, type of congenital anomalies, and the maternal booking status were extracted.

The estimated gestational age was based on an accurate last menstrual period, early ultrasound or both. Severe congenital anomalies were defined as anomalies that were not compatible with life based on perinatologist and neonatologist consensus during periodic perinatal meetings. Booking status was defined based on whether a woman had been attending antenatal visits at our hospital or not. Women who had had no prior antenatal care during pregnancy, or had had less than 2 antenatal visits at our clinics, or who had been referred to the emergency department with no antenatal record from any other medical facilities were classified as unbooked.

The crude PMR was calculated as the number of stillbirths and early neonatal deaths in the first 7 days of life per 1000 total births per year. The PMR was then corrected for congenital anomalies and reported to determine the impact of congenital anomalies on the PMR. This was followed by correction for severe prematurity and birth weight to report the standard known corrected PMR. The corrected PMR was defined as the number of still births and early neonatal deaths per 1000 total births after the exclusion of cases of severe congenital anomalies and severe prematurity. In an advanced step, the corrected PMR was further corrected for maternal booking status and reported.

Statistical analyses. The Statistical Package for Social Sciences (SPSS Inc., Chicago IL, USA) version 16 was used for descriptive analysis and tests of significance. Chi-square test was used to compare variables. Values were considered significant when $p<0.05$. Odds ratio and 95% confidence interval (CI) were calculated and reported to compare the different groups when appropriate.

Results. In the 11-year interval from January 2000 to December 2010, a total of 45,279 deliveries were recorded at KAUH; the total number of births was 46,677 when multiple pregnancies were taken into

account. Seven hundred and seventy-one perinatal deaths were reported during the study period; 523 (67.8%) were intrauterine fetal deaths, and 248 (32.2%) were early neonatal deaths.

The crude PMR in the study population was 16.5 per thousand per year. Further analysis of the data based on yearly statistics showed some difference among the years studied, ranging from 12.7 to 20.0 per 1000, with a biphasic change in the first 6 years, and a plateau pattern in the last 5 years of the decade (**Figure 1**). Among the 771 cases of perinatal deaths, 154 (20%) were related to major lethal congenital anomalies. The PMR after exclusion of congenital anomalies was 13.2 per 1000 total births (OR, 2.96 and 95% CI: 1.42-3.1). Mortalities related to severe prematurity and low birth weight were reported in 103 (13.4%) of the cases. The actual corrected PMR at KAUH after excluding cases of severe prematurity and congenital anomalies, revealed a rate of 11.0 per 1000 per year in the last decade. During the study period, the total births for unbooked mothers were 7520, and the rate of unbooked deliveries was 16%. The number of perinatal deaths among the unbooked women was 215. The calculated crude perinatal mortality in this group was 28.59 per 1000 total births. The difference between the PMR in booked (16.50 per 1000) and unbooked pregnancies (28.59 per 1000) was statistically significant (OR: 2.6; 95% CI: 1.2-2.4; p=0.001).

The amalgamation of the 3 reported factors that affect the PMR, namely, congenital anomalies, severe prematurity, and low birth weight, and unbooked deliveries resulted in a calculated PMR of 6.4 per 1000 per year, with a statistically significant reduction of the PMR (p=0.004). **Table 1** represents a stepwise description of the PMR after consideration of the stated factors and the tests for significance per year.

Discussion. It has been estimated that perinatal mortality is blamed for 7% of the total global burden of the disease.[6] Ninety-eight percent of the deaths occur in the developing countries.[7,8] Monitoring of the PMR is an essential step in the development and improvement of the quality of medical care in these countries. The WHO reports on the PMR are global estimates for certain countries and testing the health care in the country in general does not give an accurate depiction of the variable health care facilities in different parts of the country, or even sometimes within the same city.

Fair comparison of the perinatal mortality among different centers is an intricate task because of the utilization of different definitions in different centers or even in the same country. The PMR is largely affected by various factors, including the availability of timely accurate prenatal diagnosis and pregnancy termination facilities, population acceptance of termination of congenitally malformed fetuses, and the availability of NICU with qualified personnel. The corrected perinatal mortality was introduced to the clinical practice to overcome the above obstacles in determining the quality of care based on the PMR.

The current study introduces a conceptual model for a fair determination of the PMR among different institutions in developing countries with a high rate of unbooked deliveries. This model illustrates the relationship between the quality of antenatal care, perinatal care, and the major risk factors for perinatal mortality, and how these may affect the reporting of perinatal mortality rates among different institutions

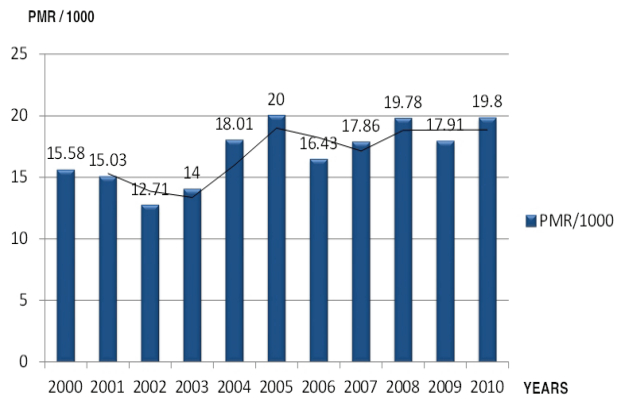

Figure 1 - The Crude Perinatal Mortality Rate (PMR) at King Abdulaziz University Hospital, Kingdom of Saudi Arabia (2000-2010).

Table 1 - The extended corrected perinatal mortality rate calculated on yearly bases.

Year	PMR	CPMR	The extended corrected PMR	*P*-value
2000	15.58	8.9	7.63	0.011
2001	15.03	11.34	8.97	0.001
2002	12.71	7.34	3.59	0.01
2003	14.0	10.35	7.3	0.03
2004	18.01	11.44	7.4	0.02
2005	20.0	14.87	8.97	0.001
2006	16.43	10.69	7.56	0.013
2007	17.86	12.5	8.42	0.002
2008	19.78	14.55	9.77	0.01
2009	17.91	11.78	6.83	0.003
2010	19.8	10.55	3.88	0.001

PMR - crude perinatal mortality rate, CPMR - corrected perinatal mortality rate, ECPMR - extended corrected perinatal mortality rate

within the same country. It also indicates how the differences in health care facilities, availability, practices and the continuity of antenatal care influence the ultimate mortality figures reported by an individual center. The available data on corrected PMR were collected from studies with different objectives and endpoint targets. Furthermore, the data collected on the corrected PMR from developed countries were also reported within the context of the perinatal mortality rates. Although the crude PMR was not one of the primary objectives of the current study, the lack of recent data on PMR in Saudi Arabia led us to report the perinatal mortality in a single tertiary care center in the Western Province of Saudi Arabia.

The crude PMR in our institution was 16.5 per 1000 per year for the study period, which is lower than reports in a small study from the Eastern Province of Saudi Arabia with a total number of births reported as 2,596, and the PMR of 26.2 per 1000.[9] The PMR in the current study was significantly lower than what was reported in some Asian and African countries. Two different studies from Pakistan showed a perinatal mortality of 97.2 and 124.0 per 1000.[10,11] Ekure et al[12] reported the PMR in Nigeria to be 84.6 per 1000, while Fawole[13] reported a figure of 78.0 per 1000 in the same country. The PMR in Burkina Faso as reported by Diallo et al[14] was 79 per 1000. Reports from developed countries showed a lower PMR. In a recent review from the Netherlands, the overall PMR was 10.1 per 1,000 total births over the period 2000-2004.[15] In Norway, the PMR was 10.7 per 1000,[16] and the Scottish Perinatal and Infant Mortality and Morbidity Report 2009 showed a PMR of 7.4 per 1000 births.[17] The Perinatal Mortality 2009 report published recently by the Centre for Maternal and Child Enquiries (CMACE) in the United Kingdom showed that in 2009 the PMR was 7.6 per 1,000 total births in 2009.[18] The above data indicate that the PMR in Saudi Arabia is better than that reported in developing countries, but further efforts are needed to match the rates in developed ones.

In developed countries, timely and accurate prenatal diagnosis followed by termination of anomalous pregnancies may have reduced the PMR by up to 50% in some settings. In a large screening prenatal ultrasound trial in Finland,[19] a 50% reduction in PMR was reported in women who were randomly selected to receive ultrasound screening between 16 and 20 weeks gestation compared to controls who received standard care (4.6 versus 9.0 percent).[19] The principle of pregnancy termination in general is not accepted in Saudi Arabia for religious and social reasons and as such the reports on perinatal mortality are significantly affected by anomalous fetuses. The corrected PMR after eliminating congenital anomalies and the global factor affecting the PMR, which is, severe prematurity may be a better reflection of the PMR in the country. The corrected PMR in the current study was 11.0 per 1000 births per year. Congenital anomalies seemed to have a stronger impact on the PMR than severe prematurity as the exclusion of cases of congenital anomalies alone reduced the rate from 16.5 to 13.2 per 1000, with a statistically significant difference. The Scottish Perinatal and Infant Mortality and Morbidity Report 2009 showed a PMR of 7.4 per 1000 births. After excluding congenital anomalies and severely premature newborns, the corrected PMR was 3.9.[17]

A major review of 176,620 non-anomalous births on trends in the perinatal mortality in Ireland by Mahony et al[20] revealed that the corrected perinatal mortality fell from 10.6 in 1984 to 7.4 per 1000 in 2007 (p<0.001).[20] When the PMR in this study is compared with the corrected PMR reported in developed countries, it is observed that there is a wide gap between the figures, which in our opinion may be narrowed if the principle of pregnancy termination for congenital anomalies was accepted. Unfortunately, in the literature there is no study that reported the corrected PMR in a developing country. The lack of antenatal care may be related to the nationwide quality of care, or to the quality of care within an established health care system; however, it may not accurately reflect the quality of care within institutions since there are many factors that may affect the number of pregnant women booked for antenatal care, including the availability of easy accessibility to health care facilities, socioeconomic status, level of education, and some social and personal beliefs.

The rate of unbooked deliveries in our institution was 16%. A substantial number of perinatal deaths occurred in this group; 215 cases representing 27.95% of all perinatal deaths. The PMR dropped to 6.4 per 1000 after further correction for unbooked status this reduction was statistically significant (OR of 2.6, 95% CI: 1.2-2.4, p=0.001) even when it was calculated on a yearly bases (**Table 1**).

Data on the influences of lack of timely and effective antenatal care on the PMR in the developing countries are persuasive. Mutihir et al reported a PMR of 260 per 1000 among unbooked deliveries in Nigeria.[4] In a prospective study conducted in Nigeria, Owolabi et al[2] found that the PMR among unbooked mothers was

significantly higher than in booked mothers (p=0.001). Similar results reported from Nepal by Pokharel et al[3] showed that the perinatal mortality was 3 times higher in unbooked mothers.

Based on the above findings, we introduce the term extended corrected perinatal mortality rate (ECPMR), which takes into account congenital anomalies, severe prematurity, and maternal booking status. The ECPMR is meant to be used as a fair comparative tool in reporting the PMR, thereby testing the quality of care among different institutions and health care facilities within the same country or in different countries with a similar socioeconomic status and health care system. It is not intended to test the health care system in different countries.

This study had some limitations. First, some patients may have had antenatal visits in different health care facilities and presented to us in active labor without antenatal records; those patients were considered as unbooked. Second, some cases diagnosed to have lethal malformations in our hospital delivered in other institutions and no data were available on those cases. Finally, cases with lethal anomalies that survived beyond the early neonatal period were not included in the analysis. The strengths of the current study lie in the fact that data for anomalous fetuses that delivered in our institution were available for analysis. In addition, we used a cross-referencing module in data collection to avoid duplication of cases and reduce the likelihood of missing cases and to define perinatal deaths, birth weight, and gestational age instead of using the data alone. The implications of the current study based on the identification of certain factors that are associated with increasing perinatal mortality rate, are that the utilization of the current findings may help in the reduction of the PMR within institutions with high rates of unbooked pregnancy through advocating perinatal care services for pregnant women. It also provides a good tool for an accurate and fair comparison of the perinatal mortality care within these institutions.

In conclusion, the corrected PMR in our study population is slightly higher than those reported in developed countries. The PMR after exclusion of cases of congenital anomalies and severe prematurity is considerably reduced after further correction for booking status. The derived term, ECPMR, may be beneficial in comparing the quality of care among different institutions particularly in developing countries with high rates of unbooked deliveries.

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