Perinatal mortality statistics provide important information on maternal health, characteristics of the obstetric population and outcome of pregnancy.\textsuperscript{1} Thus national data on perinatal mortality rate are an index of quality of maternal health and perinatal care in the community. Such data can be used as basis for improving perinatal health or care in order to reduce perinatal mortality rate (PNMR).\textsuperscript{2}

The association between PNMR and maternal characteristics as well as the quality of perinatal care is well documented.\textsuperscript{1-4} Similarly the impact of pregnancy-related disorders and prematurity on pregnancy outcome has been highlighted in national\textsuperscript{2} as well as regional surveys.\textsuperscript{3,4} National surveys are essential in the formulation of perinatal health plans for the whole country because regional variation may exist in the various risk factors.\textsuperscript{2} Finally, a review of the causes of death should be an important aspect of such data because it may provide information on preventable causes of death.\textsuperscript{2,5} Recent perinatal mortality
statistics from some Western countries\textsuperscript{6,7,8} have shown a decline in the perinatal mortality rate and changes in the pattern of causes of perinatal death. The studies highlighted the areas of perinatal care that should be addressed to reduce perinatal mortality as well as the need for continuous monitoring.

Previous reviews of perinatal mortality statistics in Saudi Arabia were based on data from individual institutions.\textsuperscript{9,10} The PNMR in Saudi Arabia, based on hospital reports varied from 15 to 40 per 1000 total births. A review of the data collection and analysis process of the published studies revealed differences in the definition of PNMR.\textsuperscript{10} Thus the figures could not be representative of any region or of the whole Kingdom. Further, the lack of standardization of data collection made inter-institutional comparison invalid.

A previous attempt to evaluate perinatal mortality in different hospitals during the study\textsuperscript{11,12} of the neonatal care facilities and resources in the Kingdom was unsuccessful for reasons given above. This study was therefore undertaken to provide a national baseline data on perinatal population characteristics and the outcome of pregnancy among the hospital deliveries in Saudi Arabia using a standard format. It was hoped that the results would highlight the role of some risk factors affecting the outcome of pregnancy as well as focus attention on areas of perinatal health and care that need more detailed study and/or improvement in order to reduce PNMR. This is important since several establishments provide variable levels of medical care to various sectors of the community in Saudi Arabia.\textsuperscript{11}

Materials and Methods

In order to obtain uniform perinatal data, a standardized record book was produced. The following variables for each delivery were recorded in this book: medical record number, date, time and mode of delivery, infant’s weight, length, sex and gestational age, single or multiple birth, mother’s age, nationality and parity, discharge date of the infant and in cases of deaths, the date and time of death as well as the cause of death. The final cause of death in the individual case was determined by the investigators based on the data recorded by the hospital and classified according to a modification of the causes of perinatal death as suggested by Wiglesworth.\textsuperscript{5} All the hospitals providing perinatal care in the Kingdom were provided with enough copies of the booklet to be filled for the selected period of the study. A contact person usually a physician or a charge nurse responsible for entering the information into the books during the study period in each hospital was identified. Research assistants who had been trained in data collection were responsible for delivering the perinatal record book to the various hospitals and for arranging for a commitment and cooperation from the contact persons who were to record the required data on a daily basis.

The original plan was to collect perinatal data for a 4-month period to account for variations in the response patterns; then select one month during which entries were complete for all hospitals and computerize only that section of the data collected. However, taking the size and the quality of data into consideration the team decided to process all available data, thus improving the validity and the accuracy of the results. The completed record books covered a total period of 4 months, from beginning of October 1988 to the end of January 1989. This period was taken as the duration of data entry of the study.

However, since the starting dates for all participating hospitals did not match, a part of the data had to be excluded from the analysis to obtain a period in which the majority of the hospitals were represented. The processed data, thus covered a period of 82 days between 11 October and 31 December 1988 both inclusive.

Initially, all hospitals with perinatal care activities were contacted. There were 177 such hospitals distributed over 93 towns and villages. Finally, 147 hospitals provided complete data for the period of analysis.

Results

The final analysis thus covered data from 147 hospitals representing 83\% of the Kingdom’s 177 hospitals providing perinatal care activities. There were 49 863 births during the period of 82 days.

Maternal characteristics

Nationality

About three-quarters (73.3\%) of the 49 863 total births were Saudis. The remainder (26.7\%) consisted of non-Saudis belonging to a wide range of nationalities.

Age of the mother

The study showed that 12.3\% of the births were to mothers below 20 years of age. The majority 26.6\% and 29.6\% of the mothers were of the age groups
0–24 years and 25–29 years respectively. The mean maternal age for the whole sample was 26.7 years. The comparison between the Saudi and non-Saudi mother showed a significant increase in the proportion of non-Saudi mothers in the age groups 25–29 years and 30–34 years, whereas the proportion of Saudi mothers was significantly higher in the age groups above 35 years.

Parity
The parity figures in the sample ranged from 0 to 20 with a mean of 3.5. Primigravidae constituted 20.9% followed by 14.8% for 1-para, 13.8% for 2-para, 12% for 3-para, 9.9% for 4-para, 8.0% for 5-para and 6.6% for 6-para mothers. The figure of 14% for the >6-para group of mothers was relatively high.

Mode of delivery
The analysis of 49,696 births with available information on the mode of delivery is shown in Table 1.

Infants’ characteristics

Multiple births
Multiple births recorded in the survey represented 9/1000 deliveries.

Sex distribution of the babies
Sex distribution analysis showed that 25,545 babies (51.2%) were male, and 24,334 (48.8%) were female.

Birth weight and length
The mean birth weight for the whole data set was 3.16 kg (± SD 0.56). For Saudi newborns only, the mean birth weight was 3.15 kg. Boys were heavier than girls with a mean birth weight of 3.22 kg for boys and 3.11 kg for girls. The incidence of low birth weight infants (LBW) (less than 2500 g) was 8.2%. The very low birth weight infants (less than 1500 g) constituted 1% of the total births.

The mean birth length for the whole data set was 50.1 cm ± SD 3.11. For Saudi newborns, the figure was 49.9 cm. There was a significant difference between males and females with a mean length of 50.2 cm for boys and 49.8 cm for girls.

Gestation
The mean gestational age observed in the study was 39.4 weeks with a standard deviation of 1.9. The incidence of preterm babies (less than 37 weeks) was 8.6%.

Perinatal mortality
There were 49,863 births and 572 perinatal deaths in the institutions included in the final analysis (Table 2). A further analysis of the overall perinatal deaths and perinatal mortality rates is shown in Table 3. Birth weight specific mortality rates and gestational age specific mortality rates are summarized in Tables 4 and 5 respectively. About 60% of the perinatal deaths were born preterm before completion of 37 weeks of gestation. The maternal age, parity and mode of delivery were significantly related to perinatal mortality. The mean maternal age (± SD) in mothers with and without perinatal death was 26.7 ± 5.9 years versus 27.2 ± 6.7 (p < 0.0001). The mean parity (± SD) for mothers who had perinatal death was
3.8 ± 3.3 compared with 3.5 ± 2.8 among those with normal outcome (p < 0.0001). Similarly, while vaginal breech delivery constituted 1.9% of births, it accounted for 12.1% of the perinatal deaths.

Regional distribution of perinatal mortality rates (PNMR)

Considering the importance of the regional variance in the perinatal mortality figures, the rates were calculated separately for each region. Table 6 summarized the distribution of the PNMR showing a considerable variation from 6.3 to 22.7 per 1000 live births between the regions.

Causes of perinatal deaths

Using a modification of the classification suggested by Wigglesworth, the causes of perinatal deaths were divided into six groups including asphyxia, immaturity, infection, congenital malformations, stillbirths and others. As shown in Table 7 the most common single factor was immaturity accounting for 32.5% and closely followed by stillbirth which represented 32.0% of the perinatal deaths. Thus, analysis of the causes of death revealed that immaturity antepartum or intrapartum, fetal death and congenital malformation were the three most common factors.

Discussion

This survey provides a national baseline data on hospital perinatal population distribution and outcome of pregnancy using standardized guidelines and uniform data collection methods. The majority (83%) of the Kingdom’s perinatal centres responded and thus the results can be regarded as representative of the current perinatal care status in Saudi Arabia. The hospitals that failed to respond gave various reasons which included factors such as the magnitude of the extra effort, lack of personnel and hospital policy reasons. A mandatory policy for health establishments to record such perinatal data in a standardized format on a regular basis could improve compliance in future studies.

The study identified a relatively high proportion of non-Saudis (26.7%) among the hospital perinatal population. This could be due to the high utilization of hospital facilities by non-Saudis who might constitute 30% of the population.

The survey revealed a mean birth weight of 3.15 kg and birth length of 49.9 cm for the Saudi newborns. The results also confirm the known general observation of preponderance (51.2% vs 48.8) of male over female newborns. The figure for the multiple births of 9 per 1000 births was similar to the 8.5 per 1000 births from Al-Khobar Teaching Hospital but less than 10.7/1000 reported from Riyadh Armed Forces Hospital.

The incidence of low birth weight (LBW) (<2500 g) of 8.2% in this national survey was similar to the other published figures from the Kingdom while the incidence of very LBW (<1500 g) of 1% was comparable to reports from Western countries. Preterm births (<37 weeks gestation) occurred in 8.6% of the births. This incidence is higher than the published figures of 5.9% from Riyadh. Among the group of 4141 LBW infants in this study 1974 (47.6%) were born preterm. This indicates a higher proportion (52%) of small-for-gestational age infants when compared with the expected figure of 33%. Further studies are required to determine the reason for this finding.

The overall national PNMR of 11.5 per 1000 live births (LB) was significantly less than the 1985 figure of 30.4 per 1000 LB calculated for the whole Kingdom based on the various figures given by a smaller number of individual hospitals. The regional figures showed a higher mortality in Makkah and Hail regions while most (62%) of the regions had PNMR of 10 per 1000 LB or less. It is possible that the figures could be partly

<table>
<thead>
<tr>
<th>Region</th>
<th>PNMR</th>
<th>Riyadh</th>
<th>Makkah</th>
<th>Al-Baha</th>
<th>Madina</th>
<th>Eastern</th>
<th>Asir</th>
<th>Najran</th>
<th>Gizen</th>
<th>Gasim</th>
<th>North</th>
<th>Hail</th>
<th>National</th>
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<td>19.2</td>
<td>10.0</td>
<td>6.8</td>
<td>13.0</td>
<td>6.5</td>
<td>6.3</td>
<td>10.3</td>
<td>9.9</td>
<td>13.4</td>
<td>22.7</td>
<td>11.5</td>
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Table 6
Regional distribution of PNMR

Table 7
Causes of perinatal deaths

<table>
<thead>
<tr>
<th>Classification</th>
<th>No. males</th>
<th>No. females</th>
<th>No. total</th>
<th>%</th>
<th>Rank order</th>
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</thead>
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<tr>
<td>Immaturity</td>
<td>104</td>
<td>82</td>
<td>186</td>
<td>32.52</td>
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<tr>
<td>Stillbirth</td>
<td>97</td>
<td>86</td>
<td>183</td>
<td>31.99</td>
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<tr>
<td>Congenital</td>
<td>35</td>
<td>24</td>
<td>59</td>
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<td>3</td>
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<tr>
<td>malformations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>30</td>
<td>24</td>
<td>54</td>
<td>9.44</td>
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<tr>
<td>Asphyxia</td>
<td>32</td>
<td>21</td>
<td>53</td>
<td>9.27</td>
<td>5</td>
</tr>
<tr>
<td>Infection</td>
<td>15</td>
<td>22</td>
<td>37</td>
<td>6.47</td>
<td>6</td>
</tr>
</tbody>
</table>
affected by the lack of response from a few hospitals in some of the regions. However, the lower national mortality figures probably reflected the general improvement of health care in the Kingdom over the last few years. The results also highlight the need for improved perinatal care in regions with high PNMR.

Among the factors contributing to perinatal death, immaturity and antepartum or intrapartum deaths due to asphyxia accounted for about two-thirds of the cases. This finding is similar to the findings from a maternity study in Riyadh15 except that the proportion of deaths due to asphyxia in labour was much less in this national study. The birth weight specific mortality confirmed the association between LBW and high PNMR with 60% of the perinatal deaths being LBW infants. Thus further improvement in prenatal and obstetric care levels I and II hospitals as well as provision of more neonatal intensive care would significantly reduce mortality associated with these factors. In general, more emphasis on health education programmes to encourage pregnant mothers to utilize the prenatal services provided at various health centres is urgently required.

In conclusion, since perinatal mortality rate is a good indicator of the quality of perinatal health care, a continuing evaluation of this parameter on a regular basis would be necessary to monitor the effect of any intervention. A centre or unit at the Ministry of Health for monitoring perinatal and neonatal mortality statistics as well as infant mortality is recommended. This centre or unit should provide standardized and uniform national policies for data collection in all the hospitals with perinatal care activities.

In view of the possible significant proportion of births outside hospital16 computerized birth and death certificates are essential if community-based annual statistics of neonatal deaths and infant mortality are to be available in the future.

Acknowledgement

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References