



Original Article

## Epidemiology and risk factors associated with early onset neonatal sepsis in the south of KSA



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### المخلص

**أهداف البحث:** تهدف هذه الدراسة لوصف وبائيات وتعفن الدم المبكر وعوامل الخطورة المصاحبة له في مركز الرعاية الصحية العالية في جنوب المملكة العربية السعودية.

**طرق البحث:** قمنا بإجراء مراجعة استيعابية للسجلات الطبية لحديثي الولادة الذين تم تشخيصهم بتعفن الدم المبكر في مستشفى الملك فهد المركزي، جازان، المملكة العربية السعودية. حيث تم جمع المعلومات للإصابة، الميكروبات المسببة، وعوامل الخطورة ذات الصلة بتعفن الدم المبكر.

**النتائج:** كان معدل الإصابة بتعفن الدم المبكر في عينة الدراسة 4.44 لكل 1000 ولادة حية خلال فترة الدراسة. وكانت أكثر الكائنات الحية المعزولة من حديثي الولادة البكتيريا القولونية (29%)، والبكتيريا العقدية (17%)، والمكورات العنقودية السلبية التخثر (11%). عند مقارنة حديثي الولادة الذين توفوا خلال أسبوع بالمواليد الذين بقوا على قيد الحياة تبين أن عمر الحمل والوزن عند الولادة كانا مختلفين إحصائياً. أخيراً، تبين أن حديثي الولادة المصابين بالبكتيريا القولونية كانوا أكثر بين حديثي الولادة الذين عانوا من الوزن المنخفض إلى أبعد حد عند الولادة أو الوزن المنخفض جدا عند الولادة.

**الاستنتاجات:** أظهرت دراستنا نسبة عالية لحدوث تعفن الدم المبكر لدى المواليد في مستشفى الملك فهد المركزي بمنطقة جازان بالمقارنة بالظروف السريرية المماثلة في المملكة العربية السعودية. إن تحديد الوزن عند الولادة المبكرة وانخفاض الوزن عند الولادة كعوامل خطر محتملة للوفيات المبكرة للرضع مع تعفن الدم المبكر قد يشير إلى ضرورة إعادة تقويم خدمات رعاية ما قبل الولادة في منطقة جازان.

**الكلمات المفتاحية:** تعفن الدم؛ حديثي الولادة؛ البكتيريا القولونية؛ رعاية ما قبل الولادة؛ المملكة العربية السعودية

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### Abstract

**Objectives:** This study aims to describe the epidemiology of early onset sepsis (EOS) and its associated risk factors in a tertiary healthcare centre in the south of KSA.

**Methods:** We conducted a retrospective review of the medical records of neonates diagnosed with EOS at King Fahad Central Hospital (KFCH), Jazan, KSA. Data on the incidence, causative organisms, and related risk factors for EOS were collected.

**Results:** The incidence of EOS in our sample was 4.44 per 1,000 live births during the study period. The most frequently isolated organisms from neonates were *E. coli* (29%), *Group B streptococcus* (GBS) (17%), and *coagulase-negative Staphylococcus* (11%). The gestational age and weight at birth of neonates who died within a week compared to those who survived were statistically different ( $p$  values < 0.05). Finally, the percentage of neonates found to be infected with *E. coli* was higher among neonates with either an extremely low birth weight or very low birth weight ( $p = 0.016$ ).

**Conclusions:** Our study shows a higher incidence of EOS in KFCH in the Jazan region compared to similar clinical settings in KSA. Identifying pre-term birth weight and low birth weight as possible risk factors of early mortality of infants with EOS may necessitate the need for reassessment of antenatal care services in the region.

**Keywords:** *E. coli*, antenatal care; KSA; Neonate; Sepsis

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## Introduction

Neonates are vulnerable to morbidity because of the immaturity of their immune systems and exposure to multiple risk factors during the perinatal period. This vulnerability is likely to augment the occurrence of neonatal sepsis and mortality.<sup>1</sup> Globally, in 2018, 2.5 million children died during their first month after birth.<sup>2</sup> According to the Levels and Trends in Child Mortality Report (2019), a large variation of neonatal mortality rates exists between different regions worldwide. The highest neonatal mortality rates are reported in countries in Sub-Saharan Africa and south Asia.<sup>3</sup> In a systematic review assessing the global burden of sepsis among neonates and children, it was reported that mortality due to severe sepsis can reach 20% of affected cases.<sup>4</sup>

Neonatal early onset sepsis (EOS) is defined as a blood and/or cerebrospinal fluid culture-proven infection occurring in a newborn at less than seven days of age.<sup>5</sup> For a continuously hospitalised infant with very low birth weight, EOS is defined as a culture-proven infection occurring at less than 72 h of age.<sup>6</sup> Neonatal sepsis can be classified as EOS and late onset sepsis (LOS) depending on age of occurrence. However, the current literature indicates variability in the definition and age at onset used to classify the condition as EOS. In this regard, the cut-off points vary between two and seven days after birth.<sup>7,8</sup>

EOS is a preventable condition, and an understanding of the nature of pathogens and risk factors may assist in identifying vulnerable groups and aid in the reduction of mortality. Bizzarro et al. reported an assessment of the medical records of infants with positive blood cultures hospitalised in Yale–New Haven Hospital between 1989 and 2003. Their data were compared to pre-existing data collected since 1928 from the same hospital. Their longitudinal assessment identified 862 organisms and indicated the presence of changes in demographics, pathogens, and outcomes related to neonatal sepsis over the years. Furthermore, a reduction in the incidence of group B streptococcus and *Escherichia coli* infections was reported with a steady reduction in sepsis-related mortality from 87% in 1928 to 3% in 2003.<sup>9</sup>

Several investigations were conducted in KSA to assess the epidemiology of neonatal sepsis in different regions of the country. Two of the earliest reports published before 2000 were related to the retrospective assessment of medical records conducted in King Khalid University Hospital in Riyadh<sup>10</sup> and King Fahad University Hospital in Khobar.<sup>11</sup> Both studies reported *Staphylococcus epidermidis* as the leading cause of neonatal sepsis. Another retrospective assessment of neonatal sepsis occurrence between 1999 and 2007 in infants with birth weights varying between 500 and 1500 grams was conducted at King Khalid University Hospital in Riyadh. It reported similar findings indicating that *Staphylococcus epidermidis* was the leading isolated organism in both EOS and LOS cases.<sup>12</sup> Finally, a recent publication reporting neonatal sepsis in King Fahad Medical City in Riyadh via the retrospective assessment of medical records between 2011 and 2015 revealed that among the EOS cases, most causative organisms were Group B streptococcus and *Escherichia coli*.<sup>13</sup>

Note that the risk of developing neonatal sepsis varies depending on several factors such as time, demographics, and changes in the epidemiology of causative organisms. These variations can even be observed in different health facilities in the same country. Therefore, it is important to continuously assess factors leading to morbidity and mortality among infants affected with sepsis where this assessment may enable the effective implementation of preventive and curative strategies. The incidence, risk factors, and causative organisms of EOS in the Jazan region are currently unknown. This study aimed to retrospectively review the medical records of neonates diagnosed with EOS in King Fahad Central Hospital, Jazan, KSA to describe the incidence of EOS, causative organisms, and related risk factors.

## Materials and Methods

### Study context

This study was a retrospective review of the medical records of mothers and their neonates who were diagnosed with EOS at King Fahad Central Hospital, in Jazan, southwest of KSA. EOS was defined as the growth of a single pathogenic organism from the blood or cerebrospinal fluid of infants within 72 h of birth, with clinical and laboratory findings supporting infection. Relevant electronic medical records were retrieved for subjects covering the period between May 1, 2012 and April 31, 2019.

### Data collection

A data extraction sheet was developed to collect variables related to the demographics of the mothers and their neonates, and perinatal clinical variables such as data about gestation, delivery, and complications related to pregnancy; initial white blood cell (WBC) count, initial haemoglobin, and initial platelets; isolated organisms; the use of antibiotics; and survival of neonates within a week of delivery. Subjects were included in the study if they were born at KFCH, Jazan. Cases were excluded if they were not born at KFCH, if they were affected by major congenital anomalies, if they were infants with positive cultures for whom clinical and laboratory investigations were not consistent with infection, and did not receive antibiotics.

### Statistical analysis

Statistical analysis was performed using the IBM SPSS software version 22 (IBM Corp, Armonk, NY, USA). Proportions and frequencies were used to summarise the binary and categorical data. Means, standard deviations (SD), medians, and inter-quartile ranges (IQRs) were used to summarise the continuous variables. A Chi squared test was performed to assess differences in the proportions of neonates who died within seven days of birth and those who survived according to the sample characteristics. Similarly, differences in the proportions of neonates affected with *E. coli* and other organisms according to gender, birth weight, and gestational age were tested using a Chi squared test. To enable comparison between the study variables, continuous variables were categorised using medians and

IQRs as cut-off points. A p-value of 0.05 or less was considered a statistically significant value for the applied statistical test.

## Results

Between May 1, 2012 and April 31, 2019, 28,337 live births were recorded at KFCH. The number of neonates diagnosed with EOS was 126 after excluding 23 cases with blood cultures positive for Coagulase negative *Staphylococcus* and that were without clinical and laboratory features consistent with infection. The incidence of EOS in our sample was 4.44 per 1000 live births during the reviewed period. Table 1 describes the demographic and clinical characteristics of the neonates and their mothers. The average age of the included mothers was 27 years and the majority were Saudis. The average number of children per mother was 3.3. Only 14 mothers (11%) were hypertensive and 10 (8%) were diabetic. The genders of the neonates were similar and the majority of gestations were single.

The median number of gestational weeks was 36, and only 16 (12.7%) pregnancies were recorded to have intrauterine growth restriction. Furthermore, 65% of the deliveries of the included neonates were vaginal, and the majority of the sample underwent ventilation (76%). In a minority of cases, meconium (13.5%) or premature rupture of the membrane

(22%) were present. The average duration of the hospital stay among this sample of neonates was 18 days.

Table 2 describes the laboratory findings, use of antibiotics and bacterial sensitivity, and frequency of deaths within a week among the study sample. Initial WBC, initial haemoglobin, and initial platelets were abnormally distributed. The medians and IQRs were used for the description. The medians of initial WBC, initial haemoglobin, and initial platelets were 13 ( $\times 10^9/L$ ), 15 g/dl, and 205 ( $\times 10^9/L$ ), respectively. The most frequently isolated organisms among the included neonates with EOS were *E. coli* (29%), Group B *streptococcus* (17%), and coagulase-negative *Staphylococcus* (11%). Overall, 86% of the infants were started on Ampicillin or Gentamicin. Sensitivity of *E. coli* to Gentamicin was lower than sensitivity of Group B *Streptococcus* to Ampicillin. The cultures and sensitivity results are less likely to lead to a change in empiric antibiotic regimen since the most commonly isolated organism among our sample was *E. coli*, which had a sensitivity to Gentamicin of 78.3%. In addition, the second most frequently detected organism in our sample was Group B *Streptococcus* with a sensitivity to Ampicillin of 100%. Finally, 29 infants (23%) were recorded to have died within a week of birth.

A comparison of the demographic and clinical characteristics between infants who died within a week of delivery and those who survived is detailed in Table 3. Only gestational age and weight at birth differed statistically between the comparison groups. The proportion of infants who died within a week was higher among infants with a gestational age below 37 weeks than among those with a

**Table 1: Demographic and clinical characteristics of 126 mothers and their neonates who were diagnosed with early onset sepsis in King Fahad Central Hospital in Jazan, KSA between 2012 and 2019.**

| Mothers' characteristics:                  |               |
|--|---------------|
| Age of mothers: mean (SD)                  | 27.6 (6.3)    |
| Nationality of mothers: n (%)              |               |
| Saudi                                      | 107 (85%)     |
| Other                                      | 19 (15%)      |
| Gravity: mean (SD)                         | 3.3 (2.5)     |
| Diabetes Mellitus: n (%)                   | 10 (8%)       |
| Hypertension: n (%)                        | 14 (11%)      |
| Sickle Cell Anaemia: n (%)                 | 1 (0.8%)      |
| Urinary Tract Infection: n (%)             | 1 (0.8%)      |
| Vaginitis: n (%)                           | 1 (0.8%)      |
| Neonates' characteristics:                 |               |
| Gender:                                    |               |
| Male                                       | 65 (52%)      |
| Female                                     | 61 (48%)      |
| Gestational age in weeks: median (IQR)     | 36 (29–40)    |
| Birth weight in Kgs: median (IQR)          | 1.8 (1.1–2.9) |
| Gestation: n (%)                           |               |
| Single                                     | 121 (96%)     |
| Multiple                                   | 5 (4%)        |
| Intra Uterine Growth Restriction: n (%)    | 16 (12.7%)    |
| Mode of delivery: n (%)                    |               |
| Vaginal                                    | 82 (65%)      |
| Caesarean                                  | 44 (35%)      |
| Meconium: n (%)                            | 17 (13.5%)    |
| Umbilical Vein Catheter                    | 69 (55%)      |
| Ventilated neonates: n (%)                 | 96 (76%)      |
| Premature Rupture of Membrane: n (%)       | 28 (22%)      |
| Length of hospital stay in days: mean (SD) | 18 (0.6)      |

**Table 2: Laboratory findings, the use of Ampicillin or Gentamicin, and frequency of death within a week among 126 neonates diagnosed with early onset sepsis in King Fahad Central Hospital in Jazan, KSA between 2012 and 2019.**

| Variables  | Summary       |
|--|---------------|
| Initial WBC ( $\times 10^9/L$ )*: Median (25–75 IQR)             | 13 (6–18)     |
| Initial Haemoglobin (g/dl)*: Median (25–75 IQR)                  | 15 (13–17)    |
| Initial Platelet ( $\times 10^9/L$ )*: Median (25–75 IQR)        | 205 (133–277) |
| Isolated organisms*: n (%)                                       |               |
| <i>E. coli</i>   | 37 (29%)      |
| Group B <i>Streptococcus</i> ( <i>streptococcus</i> Agalactia)   | 21 (17%)      |
| Coagulase negative <i>Staphylococcus</i>                         | 14 (11%)      |
| <i>Staphylococcus aureus</i>                                     | 7 (5.6%)      |
| <i>Klebsiella pneumonia</i>                                      | 6 (4.8%)      |
| <i>Pseudomonas</i>   | 5 (4%)        |
| <i>Streptococcus pneumonia</i>                                   | 5 (4%)        |
| <i>Hemophilus influenza</i>                                      | 2 (1.6%)      |
| Others   | 28 (22%)      |
| Infant started Ampicillin: n (%)                                 | 108 (86%)     |
| Infant started Gentamicin: n (%)                                 | 108 (86%)     |
| Other antibiotics: n (%)   | 18 (14%)      |
| Sensitivity of Group B <i>streptococcus</i> to Ampicillin: n (%) | 21 (100%)     |
| Sensitivity of <i>E. coli</i> to Gentamicin: n (%)               | 29 (78.3%)    |
| Infants who died within a week: n (%)                            | 29 (23%)      |

IQR: Inter-quartile range.

\* Eight missing cases for white blood cell count, haemoglobin, and platelet. One missing case for isolated organisms.

**Table 3: Comparison of demographic and clinical characteristics between infants who died within a week and those who survived among 126 neonates diagnosed with early onset sepsis in King Fahad Central Hospital in Jazan, KSA between 2012 and 2019.**

| Demographic and clinical characteristics | Died within a week (n = 29) | Survived (n = 97) | P value*        |
|--|-----------------------------|-------------------|-----------------|
| Maternal age                             |                             |                   | 0.311           |
| Under 22 years                           | 8 (34.8%)                   | 15 (65.2%)        |                 |
| Between 22 and 31 years                  | 16 (21.3%)                  | 59 (78.7%)        |                 |
| Above 31 years                           | 5 (17.9%)                   | 23 (82.1%)        |                 |
| Gender of newborn                        |                             |                   | 0.684           |
| Male                                     | 14 (21.5%)                  | 51 (78.5%)        |                 |
| Female                                   | 15 (24.6%)                  | 46 (75.4%)        |                 |
| Premature rupture of membrane            |                             |                   | 0.821           |
| Yes                                      | 6 (21.4%)                   | 22 (78.6%)        |                 |
| No                                       | 23 (23.5%)                  | 75 (76.5%)        |                 |
| Gravidity                                |                             |                   | 0.618           |
| Primigravida                             | 7 (20%)                     | 28 (80%)          |                 |
| Multigravida                             | 22 (24.2%)                  | 69 (75.8%)        |                 |
| Gestational age                          |                             |                   | <b>0.00032</b>  |
| Below 37 weeks                           | 25 (38%)                    | 41 (62%)          |                 |
| Above 37 weeks                           | 4 (7%)                      | 56 (93%)          |                 |
| Birth weight                             |                             |                   | <b>0.000115</b> |
| Extremely low birth weight               | 9 (45%)                     | 11 (55%)          |                 |
| Very low birth weight                    | 11 (44%)                    | 14 (56%)          |                 |
| Low or normal birth weight               | 9 (11%)                     | 72 (89%)          |                 |
| Mode of delivery                         |                             |                   | 0.617           |
| Vaginal                                  | 20 (24.4%)                  | 62 (75.6%)        |                 |
| Caesarean                                | 9 (20.5%)                   | 35 (79.5%)        |                 |
| Initial WBC                              |                             |                   | 0.272           |
| Below 6.5                                | 9 (33.3%)                   | 18 (66.7%)        |                 |
| Between 6.5 and 18                       | 12 (18.8%)                  | 52 (81.3%)        |                 |
| Above 18                                 | 5 (18.5%)                   | 22 (81.5%)        |                 |
| Initial platelet                         |                             |                   | 0.151           |
| Severe thrombocytopenia                  | 5 (45.5%)                   | 6 (54.5%)         |                 |
| Mild to moderate thrombocytopenia        | 7 (25%)                     | 21 (75%)          |                 |
| Normal count                             | 17 (19.5%)                  | 70 (80.5%)        |                 |
| Infection with <i>E. coli</i>            |                             |                   | 0.248           |
| Yes                                      | 11 (29.7%)                  | 26 (70.3%)        |                 |
| No                                       | 18 (20.2%)                  | 71 (79.8%)        |                 |

\* Chi square test.

gestational age above 37 weeks ( $p = 0.00032$ ). Similarly, the proportion of infants who died within a week of delivery was higher among those with either extremely low birth weight or very low birth weight compared to those with low or normal birth weight ( $p = 0.000115$ ).

Table 4 describes the association between the gender of neonates, birth weight, and gestational age with infection with *E. coli* or other organisms. The gender and gestational age of neonates were not statistically associated with the frequency of *E. coli* infection. However, the proportion of infants who were found to be infected with *E. coli* was higher among neonates with either extremely low birth weights or very low birth weights, while those with low or normal birth weights were more frequently diagnosed with

**Table 4: Association between the gender of neonates, birth weight, and gestational age with infection with *E. coli* or other organisms among 126 neonates diagnosed with early onset sepsis in King Fahad Central Hospital in Jazan, KSA between 2012 and 2019.**

|                            | <i>E. coli</i> | Other organisms | P value*     |
|----------------------------|----------------|-----------------|--------------|
| <b>Gender of newborn</b>   |                |                 | 0.126        |
| Male                       | 23 (35.4%)     | 42 (64.6%)      |              |
| Female                     | 14 (23%)       | 47 (77%)        |              |
| <b>Birth weight</b>        |                |                 | <b>0.016</b> |
| Extremely low birth weight | 10 (50%)       | 10 (50%)        |              |
| Very low birth weight      | 10 (40%)       | 15 (60%)        |              |
| Low or normal birth weight | 17 (21%)       | 64 (79%)        |              |
| <b>Gestational age</b>     |                |                 | 0.07         |
| Below 37 weeks             | 24 (36%)       | 42 (64%)        |              |
| Above 37 weeks             | 13 (22%)       | 47 (78%)        |              |

\* Chi square test.

other organisms ( $p = 0.016$ ). Finally, the proportion of infants diagnosed with *E. coli* infection was higher among those with a gestational age below 37 weeks compared to those with a gestational age above 37 weeks, with marginal statistical significance ( $p = 0.07$ ).

## Discussion

This study was a retrospective review of the medical records of mothers and their neonates who were diagnosed with EOS at King Fahad Central Hospital in Jazan between May 1, 2012 and April 31, 2019. In our sample, the number of neonates diagnosed with EOS was 126, with an incidence of 4.44 per 1000 live births. The most frequently isolated organism among the neonates with EOS was *E. coli*. In total, 29 infants (23%) were recorded to have died within a week of birth. Gestational age and weight at birth were statistically different when comparing infants who died within a week to those who survived. Finally, the proportion of infants found to be infected with *E. coli* was higher among neonates with either extremely low birth weights or very low birth weights.

Although our investigation is the first to report the incidence of neonatal sepsis in the Jazan region, the findings of our investigations could be compared to several other investigations conducted in other regions in the Kingdom. Hammoud et al. reported a two-year prospective investigation of EOS in five hospitals in KSA and other Arab states in the Gulf region. The incidence of EOS in their sample varied between 0.4 per 1000 live births in King Abdul Aziz Hospital in KSA to 2.6 per 1000 live births in Al-Sabah Maternity Hospital in Kuwait, where around 60% of EOS were due to Group B *Streptococcus* infections followed by *E. coli*.<sup>14</sup> It can be clearly seen that the most frequent causative organism in the study by Hammoud et al. is different to that of the current one. Nonetheless, their report did not elaborate on factors related to the risk of infection or incidence of mortality among neonates diagnosed with EOS.

Other investigations conducted in KSA investigated both EOS and LOS in tertiary healthcare facilities in the kingdom. Al-Matary et al. conducted a retrospective study in King Fahad Medical City in Riyadh and reported a number of neonates diagnosed with neonatal sepsis. In their findings, there were 298 diagnoses of neonatal sepsis between January 2011 and December 2015, with 33 cases (11.1%) classified as EOS. The most frequently isolated organism in infants with EOS was GBS (33%) followed by *E. coli* (27%). Furthermore, Al-Matary et al. detected an association between low birth weight and preterm delivery and the risk of infection including EOS, which is similar to our findings.<sup>13</sup> Finally, a study by Abutaleb et al., which reviewed the medical records of neonates diagnosed with neonatal sepsis in 2016 in King Khalid University Hospital in Riyadh, reported that 92 neonates were diagnosed with neonatal sepsis. Of these, 68 neonates (73%) were classified as EOS. However, it must be noted that in the study by Abutaleb et al., neonates were classified with EOS if the sepsis occurred within seven days of birth, which partially explains the higher proportion of EOS compared to other studies utilising other cut-off points.<sup>15</sup>

Comparing the incidence of EOS in our sample to that reported by Hammoud et al.<sup>14</sup> shows that the incidence of EOS in KFCH in Jazan region is relatively high. This can be further elaborated via a comparison with other similar international investigations. Al-Taiar et al. reported the incidence of neonatal sepsis and causative organisms in four Asian populations: China, Malaysia, Hong Kong, and Thailand. In these Asian populations, the incidence of EOS was 0.62 per 1000 live births and the most commonly reported causative organism was GBS.<sup>16</sup> Similarly, GBS infection was reported to be the leading cause of EOS among American populations, followed by *E. coli* infections.<sup>17</sup>

This study has both strengths and weaknesses. The main strengths of our investigation are related to its ability to identify the incidence of EOS, causative organisms, and factors associated with mortality in a tertiary health care centre in the Jazan region. This may be beneficial in proposing procedures with preventive and curative implications. The frequency of mortality was higher among preterm infants and those with lower birth weights. This may indicate the importance of antenatal care in the prevention of preterm deliveries and reducing the incidence of births with low birth weights among women in Jazan. This notion is supported by a study by Gosadi et al., which investigated factors associated with the maternal care of newborns among 450 mothers in the Jazan region. Of the sample, 9.3% reported a lack of antenatal follow-up. This highlights the importance of the proper assessment of antenatal care in the region and whether the improper prescription of antibiotics during the antenatal period may explain the occurrence of EOS. Identifying *E. coli* and GBS as the most frequently isolated organisms in KFCH may assist clinicians with the early clinical assessment of EOS and choice of antibiotics. In addition, more than half the deliveries detected in our sample were preterm, which may explain the higher incidence of *E. coli* infections. The weaknesses of this investigation stem from the retrospective nature of the design utilised and presence of missing data for some patients.

## Conclusions

The incidence of EOS in KFCH in Jazan seems to be higher than that in similar clinical settings in KSA. Furthermore, detecting the most frequently isolated organism may aid clinicians in KFCH in terms of an evidence-based guided diagnosis and the use of antibiotics for infants affected with EOS.

## Recommendations

Identifying preterm birth and low birth weight as factors associated with the early mortality of infants with EOS may indicate a need to reassess antenatal care services in the region.

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## Conflict of interest

The authors have no conflict of interest to declare.

## Ethical approval

Ethical approval to conduct the study was provided by the Jazan Research Ethics Committee (approval number 076, 27-08-2018).

## Authors contributions

The study concept and design was developed by AA. MA was responsible for the development and testing of the data collection tool and was responsible for data collection supervision and data entry. IG was responsible for data analysis and prepared the final draft of the manuscript. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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