

# BMJ Open Neonatal morbidity among African refugee women in Israel: a case-control study

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## ABSTRACT

**Objectives** Reports on neonatal morbidity (NM) among refugees in developed countries remain inconsistent. We aimed to compare NM among infants of African refugees in Israel to the native population based on a large population sample.

**Design** A case-control study.

**Setting** A tertiary hospital in Israel.

**Participants** Data on hospital-based live births of refugee women and their newborns who were born in 2014 and 2017 were retrieved from medical records. Perinatal and neonatal data were compared between the refugee group and the native residents matched for gestational age and year of birth as well as within the refugee group.

**Primary outcome** Prevalence of NM among African refugees in Israel.

**Results** Newborns delivered by 357 refugee women (mean age 30.2 years) and 357 controls (mean age 32.2 years) were analysed. Both groups were similar for the newborns' weight and gestational age. There were no significant differences in NM between the groups. A within-refugee comparison conducted between 2014 and 2017 yielded significant differences in birth weight (3051.4 vs 3373.6 gr,  $p < 0.001$ , 95% CI (198.3 to 446.2),  $d = 0.56$ ), the number of twin deliveries (10 vs 4,  $p = 0.002$ ,  $\Phi = 0.173$ ), the number of neonates evaluated as small for gestational age (15 vs 10,  $p = 0.003$ ,  $\Phi = 0.167$ ) and the use of human milk (71% vs 93%,  $p < 0.001$ ,  $\Phi = -0.298$ ).

**Conclusions** We conclude that NM among neonates born to refugee mothers was not higher than that of neonates born to native Israeli mothers. We suggest that successful implementation of health policies for refugees has improved their accessibility to mother-child health services.

## INTRODUCTION

Refugees are generally defined as individuals who involuntarily flee their country of origin because of persecution, conflict or generalised violence and who are unable or afraid to return home.<sup>1</sup> In 2014, the UN estimated that there were 19.5 million refugees worldwide.<sup>2</sup>

The published findings on neonatal morbidity (NM) among refugees in developed countries are inconsistent.<sup>3</sup> Refugee status is typically associated with considerable

## Strengths and limitations of this study

- One of the strengths of this study is its heightened outcome reliability due to the relatively large sample of neonates born to refugee women.
- The single tertiary neonatal unit received the vast majority of the refugee deliveries in Israel.
- The key limitation of the study is the lack of details on migration date, length of stay in our country, access to perinatal care and maternal psychological and socioeconomic status of the refugees.

social disadvantage, and the factors, such as malnutrition,<sup>4</sup> sexual violence<sup>5</sup> and psychological stress,<sup>6</sup> which prevail among refugee populations, are all linked to adverse perinatal outcomes. In contrast, a phenomenon termed 'healthy migrant effect', whereby foreign-born infants are stronger and healthier compared with the native-born ones, has also been reported.<sup>7</sup> Those authors, however, noted that the strength of this effect is related to country of origin, health outcome, healthcare and integration policies of receiving countries as well as immigration class.

From 2006 to 2012, a large influx of African asylum seekers arrived to Israel, with many having been trafficked through the Sinai Peninsula. According to the Israeli Administration of Border Crossings, Population and Immigration, 35 659 refugees lived in Israel as of July 2018 and 92% of them originated from Sudan or Eritrea. An alarming number of these asylum seekers are also survivors of violence and torture.

Evidence-based reports on neonatal outcome and morbidity in infants of refugees living in Israel are scarce.

NM has been examined in a number of studies,<sup>7-11</sup> which compared refugee women to non-refugee immigrants and native residents, and the findings have not been consistent.

The current retrospective study aimed to assess the prevalence of NM among neonates born to African refugee women in Israel based on a large data set. We also evaluated the trends in NM over time.

## METHODS

### Population and study design

This retrospective case–control study was conducted at the Tel Aviv Medical Center in the years 2014 and 2017. We included all refugee women from Eritrea, Ethiopia, Ghana, Sudan, Guinea, Zimbabwe, Cote d'Ivoire, Senegal, Congo, Rwanda, Nigeria, Mali and Cameroon who gave birth during those years. A gestational age (GA)-matched control group was comprised of neonates born in the same medical centre to consecutively selected native residents during the same time period.

### Data management

Data were extracted from medical records by the study investigators who used a standardised Excel spreadsheet. The collected data were anonymised and none was missing. Included were maternal data on age, steroid treatment (celestone) prior to preterm delivery, twin delivery, chorioamnionitis and premature rupture of membrane and neonatal data on GA dated by last menstrual period and confirmed by early first trimester ultrasonographic dating, weight at birth, Apgar score at 1 min and 5 min, transfer to neonatal intensive care unit (NICU), hospitalisation days, the need for ventilation or assisted ventilation, neonate weight evaluation (eg, small for GA (SGA)), phototherapy treatment, patent ductus arteriosus, congenital defects, necrotising enterocolitis, intraventricular haemorrhage, periventricular leukomalacia, bronchopulmonary dysplasia, asphyxia and applied cooling. The infant feeding regimen was classified into exclusive breastfeeding, solely milk formula, solely hydrolysed formula or mixed use of human milk and milk formula. The status of the feeding regimen applied to the entire infant hospital stay from birth to discharge. For the purpose of analyses, the data were organised per infant, country of origin and year of birth.

### Statistical analyses

Continuous data were expressed as means±SD. Categorical parameters were expressed as percentages. Normality was evaluated for all variables by several methods, such as the Kolmogorov-Smirnov test, skewness, kurtosis or histogram. Comparisons (between the refugee and control groups and within the refugee group between 2014 and 2017) were performed with a two-tailed independent t test or two-sided Mann-Whitney U test as appropriate. Fisher's exact test or the  $\chi^2$  test for contingency table was applied for categorical variables such as NM and infant feeding as appropriate. Effect size was measured with Cohen's d ( $\delta$ ) for t test-independent test, eta-squared ( $\eta^2$ ) for the Mann-Whitney U test or phi ( $\Phi$ ) coefficient for the  $\chi^2$  test.

IBM SPSS Statistics for Windows, V.25, was used for statistical data analyses, and a p value <0.05 was considered significant.

### Patient and public involvement

No patients or the public were involved in the design, or conduct, or reporting of this research. Patient consent for publication was not required.

## RESULTS

The data on the collected parameters are presented in [table 1](#). A total of 714 women were included. Perinatal and neonatal data of newborns delivered by 357 refugee women and 357 native Israeli controls in 2014 and 2017 were analysed. Mothers in the refugee group were significantly younger than those in the control group (30.2±5.3 vs 32.2±5.2 years, respectively,  $p<0.001$ , 95% CI (1.183 to 2.727), with a moderate effect  $\delta=0.38$ ). Birth weight and GA (as per study design) of the newborns in both groups were similar (3271.6±573.1 gr vs 3274.6±578.3,  $p=0.94$  and 39.6±2.1 vs 39.5±2.1 weeks,  $p=0.86$ , for the refugee and control groups, respectively). There were no differences in the occurrence of complications or morbidities between the groups, and the number of NICU admissions was similar although, in 2014, the rate of NICU admissions in the refugee group was significantly lower than in the control group (0.9% vs 6.3%,  $p=0.035$ ,  $\Phi=-0.145$ ).

A Mann-Whitney U test revealed that the length of hospital stay of the neonates in the refugee group (4.9±7.7 days) was significantly higher compared with the control group (4.2±8.7 days), ( $z=-7.232$ ,  $p<0.001$ , with a medium effect size  $\eta^2=0.073$ ).

Neonate feeding preferences were significantly different between the groups. A  $\chi^2$  analysis indicated that refugee mothers were less likely to exclusively breastfeed their neonates than the Israeli mothers (9.8% vs 25%, respectively,  $p<0.001$ , with a small effect  $\Phi=-0.205$ ). The majority of the refugees (68%) were medically insured.

We further compared data from the refugee groups between 2014 and 2017 ([table 2](#)). In 2017, the birth weight ( $p<0.001$ , 95% CI (198.27 to 446.168), with a medium effect  $d=0.582$ ), GA ( $p=0.009$ ,  $\eta^2=0.019$ ), maternal age ( $p=0.001$ ,  $\eta^2=0.029$ ), length of infant hospital stay ( $p<0.001$ ,  $\eta^2=0.092$ ) and NICU admission ( $p=0.044$ ,  $\Phi=-0.113$ ) increased, while the number of twin deliveries ( $p=0.002$ ,  $\Phi=0.173$ ) and number of SGA infants ( $p=0.003$ ,  $\Phi=0.167$ ) decreased. Furthermore, more neonates (93%) were fed with any amount of human milk in 2017 compared with 2014 (71%) ( $p<0.001$ , moderate effect  $\Phi=-0.298$ ).

## DISCUSSION

We found no differences in NM between neonates born to refugee women and neonates born to Israeli women. However, we found significant differences in minor NM within the refugee group between 2014 and 2017.

**Table 1** Perinatal and neonatal morbidity analyses in refugee and control groups

	Refugees n=357	Control n=357	P value
Birth weight (g)	3271.6±573.1 (950–4775)	3274.6±578.3 (730–4640)	NS
Gestational age (weeks)	39.6±2.1 (28–44.2)	39.5±2.1(28–44)	NS
Age of mother (years)	30.2±5.3 (21–50)	32.2±5.2(19–47)	<0.001
Length of infant hospitalisation stay (days)	4.9±7.7(1–94)	4.2±8.7(1–100)	<0.001
Number of infants who needed ventilation	4	6	NS
Number of infant who needed assisted ventilation*	7	10	NS
Apgar score at 1 min	8.6±1.2(1–9)	8.8±0.8(2–9)	NS
Apgar score at 5 min	9.7±0.6(6–10)	9.8±0.5(7–10)	NS
Neonatal intensive care unit admission	15 (4)	18 (5)	NS
2014	1 (0.9)	7 (6.3)	0.035
2017	14 (5.7)	11 (4.5)	NS
Celeston treatment	8 (2.2)	5 (1.4)	NS
Twin delivery	14 (3.9)	11 (1.4)	NS
Chorioamnionitis	0	0	–
Small for gestational age	25 (7)	17 (4.7)	NS
Premature rupture of membranes	31 (8.7)	27 (7.5)	NS
Phototherapy treatment	20 (5.6)	21 (5.9)	NS
Patent ductus arteriosus	6 (1.7)	4 (1.1)	NS
Congenital defects	22 (6.2)	30 (8.4)	NS
Necrotising enterocolitis	1 (0.3)	1 (0.3)	NS
Intraventricular haemorrhage	4 (1.1)	2 (0.5)	NS
Periventricular leukomalacia	1 (1.1)	0	NS
Asphyxia	2 (0.5)	0	NS
Bronchopulmonary dysplasia	0	1 (0.3)	NS
Cooling	1 (0.3)	0	NS
Infant feeding:			<0.001
Exclusive human milk	35 (9.8)	91 (25)	
Formula	47 (13)	46 (12.9)	
Mixed	271 (75)	219 (61)	
Hydrolysed	3 (0.8)	1 (0.3)	
Health maintenance organisation	242 (68)	100 (100)	<0.001

Data are expressed as mean±standard deviation (range) or n (%). NS—non-significant; Celeston—mother received steroid treatment prior to preterm delivery; Mixed—combined human milk and formula feeding.

\*Assisted ventilation—nasal Continuous Positive Airway Pressure (CPAP), high-flow nasal cannula, nasal intermittent positive pressure ventilation.

Our findings are contrary to our initial hypothesis that was based on a study, which suggested that refugees were susceptible to adverse perinatal outcomes compared with their Israeli counterparts.<sup>12</sup> In Michaan *et al*'s paper, there was high incidence of premature deliveries, admissions to the NICU, meconium aspiration cases and low Apgar score at 5 min in the refugee group compared with the Israeli control group between 2010 and 2011. Several methodological issues in their study may explain the differences with ours. First, we matched the control group to the study group by GA, and second, we selected a different period of residency (ie, further away from the refugees'

arrival time to Israel). According to local authorities, refugees from East Africa (Sudan, Eritrea, Somalia and Ethiopia) were arrived in Israel between 2006 and 2012. Two additional studies reported significantly higher NM rates among refugee populations.<sup>8,13</sup> Celik *et al* reported higher rates of perinatal asphyxia, SGA, large for GA and jaundice in the Syrian refugee population in Turkey during 2013–2016<sup>8</sup>. Guðmundsdóttir *et al*'s large study conducted in Iceland between 1997 and 2018 revealed increased odds of several maternal and perinatal complications in refugee women compared with Icelandic women.<sup>13</sup> Although perinatal healthcare is advanced and

**Table 2** Perinatal and neonatal morbidity analyses in infants of refugee mothers per birth year

	Year 2014 n=113	Year 2017 n=244	P value
Birth weight (g)	3051.4±626.6 (950–4150)	3373.6±516.9 (1470–4775)	<0.001
Gestational age* (weeks)	39.4±2.5 (28–42.3)	40.1±1.9 (28.3–44.2)	0.009
Age of mother* (years)	28±6.5 (21–50)	30±4.6 (21–50)	0.001
Length of infant hospital stay* (days)	2±7.8 (1–52)	3±7.6 (2–94)	<0.001
Twin delivery	10 (8.8)	4 (1.6)	0.002
Neonatal intensive care admission	1 (0.9)	14 (5.7)	0.044
Small for gestational age	15 (13.3)	10 (4)	0.003
Infant feeding:			<0.001
Exclusive human milk	17 (15)	18 (7.4)	
Formula	30 (26.5)	17 (7)	
Mixed	63 (55.7)	208 (85.2)	
Hydrolysed	3	0	
Missing	0	1	
Any amount of human milk feeding	80 (71)	226 (93)	<0.001

Data are expressed as mean±standard deviation (range) or NS—non-significant; Mixed—combined human milk and formula feeding.

\*Median ±standard deviation (range) or n (%).

its services are free in those countries, the authors argued that a large proportion of the refugee women still did not have access to these healthcare services. A recent review by Sturrock *et al* concluded that despite better healthcare services in high-income countries, refugee mothers still had worse outcomes that may be explained by their late or lack of attendance to antenatal care.<sup>14</sup> On the other hand, a large Canadian retrospective population-based database study between 2002 and 2014 showed that the refugee status was associated with a few adverse maternal and perinatal health outcomes but the associations were not strong except for HIV.<sup>11</sup> Similarly, Bulut *et al* found that the incidence rates of neonatal mortality and morbidity did not differ between infants born to Syrian and those born to Turkish mothers between 2015 and 2019.<sup>15</sup>

The mothers in our refugee group were significantly younger than those in the native Israeli group, as was also described in other studies,<sup>12 16</sup> a finding we consider most likely due to a cultural difference rather than to a medical reason. Length of hospital stay in the study group was significantly longer than in the control group. Specifically, discharge was not delayed because of adverse conditions of these neonates but rather because of concern regarding their medical insurance coverage and access to neonatal care services post-discharge. During the first years of arrival, the health network support that included community midwifery support, family health centres and HMO were less accessible to the refugees. Only 68% of the refugee women in our study cohort were medically insured.

The rate of exclusive breastfeeding was higher in the Israeli control group than in the refugee group, similar to the reports in other studies.<sup>17 18</sup> This finding may be

attributed to the facts that refugee women witnessed war, experienced traumatic events and faced immense challenges that contributed to increased maternal anxiety and insecurity that further interfered with the mother's "let down" reflex and lactation and additionally to insufficient prenatal or postnatal care, as suggested by Bayram Değer *et al*.<sup>18</sup>

Within the refugee group, we found significant improvement in NM between 2014 and 2017. Birth weight, GA and rate of breastfeeding increased while twin deliveries decreased by 2017. We speculate that having lived in Israel for at least 2 years since their arrival, the general health of our refugee cohort improved over time. Interestingly, the refugee mothers were significantly older in 2017 than in 2014, as if the local social and cultural practices had been of some influence. Furthermore, we observed an increase in the rate of breastfeeding among refugee mothers from 2014 to 2017, indicating that the time spent living in the host country probably increased their awareness of the importance of breastfeeding for newborns, as also described in Woldeghebriel *et al*'s study.<sup>19</sup>

The low rate of NICU admission for the refugee group in 2014 was surprising, but we do not have an explanation for it.

The length of time in the host country had a positive effect in decreasing NM, as previously described in other studies.<sup>20 21</sup> The national healthcare system provides universal coverage for hospital care and free medical service for refugees (such as emergencies, maternal and child ambulatory clinics, prenatal care (including guidance in nutrition), mandatory vaccinations, hospital and ambulatory care). It is probably inevitable that the length of stay of refugee women in the host country would



have an impact on their health and the health of their newborns.

### Study limitations

A limitation of our study is that data were extracted from a single tertiary centre, even though our centre received the vast majority of refugee deliveries in central Israel. Moreover, our study could have benefited from details on migration date, exposure to perinatal care and socioeconomic status.

### CONCLUSIONS

In conclusion, we suggest that refugee status alone is not an independent risk factor for developing NM in this tertiary NICU in Israel. We suggest that it is possible that the length of stay in the host country and the health policy that provides free comprehensive medical services have a positive effect on curbing the development of neonatal disease.

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**Competing interests** None declared.

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**Patient consent for publication** Not applicable.

**Ethics approval** The study was approved by the Tel Aviv Sourasky Medical Center institutional ethical committee (0202–19-TLV) and a waiver of consent was granted.

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**Data availability statement** Data are available upon reasonable request.

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