

Obstetric and Neonatal Outcomes of Pregnant Indian Pilgrims

A three-year experience at the Indian Hajj Medical Mission

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نتائج التوليد والولادة عند الحجاج الحوامل من الهند خبرة ثلاث سنوات في بعثة الحج الهندية الطبية

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ABSTRACT: Objectives: The Hajj, an annual mass gathering of Muslim pilgrims, is known for its high morbidity and mortality rates. However, pregnant women sometimes participate in this pilgrimage, despite guidelines that discourage such an undertaking due to potential fetomaternal complications. This study aimed to evaluate fetomaternal outcomes among pregnant Indian Hajj pilgrims. **Methods:** This prospective cross-sectional study was conducted at two Indian Hajj Medical Mission (IHMM)-affiliated secondary care hospitals in Saudi Arabia during the Hajj periods of August–October 2015 and 2016 and July–September 2017. All female Indian pilgrims of reproductive age who underwent pregnancy screening at secondary care IHMM hospitals during this period were included in the study. Definitive obstetric care was provided at the Makkah Maternity & Child Hospital. Data regarding the pilgrims' obstetric characteristics, antenatal complications, management and fetomaternal outcomes were evaluated. **Results:** A total of 114 pregnant Indian pilgrims were identified during the study period. The most common antenatal complications were respiratory tract infections (51.75%), followed by iron deficiency anaemia (17.54%), hyperemesis gravidarum (14.04%), hypothyroidism (9.65%) and gestational diabetes mellitus (5.26%). There were 20 vaginal deliveries (17.54%), two Caesarean sections (1.75%) and 32 abortions (28.07%). The cumulative three-year birth rate was 24.60 per 1,000 females. **Conclusion:** During Hajj, pregnant pilgrims have a high risk of abortion, respiratory tract infections and various antenatal, perinatal and neonatal complications which may go unreported or untreated. Women should therefore be educated regarding the risk of adverse fetomaternal outcomes which may occur while undertaking a Hajj pilgrimage during pregnancy.

Keywords: Travel Medicine; Muslims; Pregnancy Outcomes; Miscarriage; Respiratory Infections; Saudi Arabia.

المخلص: الهدف: الحج، وهو تجمع جماعي سنوي للحجاج المسلمين، ومعروف بمعدلات مرضية ووفيات عالية. ومع ذلك، تشارك النساء الحوامل أحياناً في هذا الموسم على الرغم من المبادئ التوجيهية التي تثبط مثل هذه المشاركات بسبب المضاعفات الأمومية الجنينية. تهدف هذه الدراسة إلى تقييم النتائج الأمومية الجنينية بين الحجاج الحوامل من الهند. الطريقة: أجريت هذه الدراسة الإستباقية المستعرضة في اثنين من مستشفيات رعاية ثانوية للحج الطبي في المملكة العربية السعودية خلال فترات الحج من أغسطس–أكتوبر 2015 و 2016 ويوليو–سبتمبر 2017. شملت هذه الدراسة جميع الحجاج النساء من الهند في سن الأنجاب واللاتي خضعن لفحص الحمل في مستشفيات الرعاية الثانوية التابعة لبعثة الحج الهندية. تم توفير الرعاية التوليدية النهائية في مستشفى مكة للولادة والأطفال. تم تقييم المعطيات المتعلقة بخصائص الحجاج التوليدية والمضاعفات السابقة للولادة والإدارة والنتائج الأمومية الجنينية. النتائج: تم تحديد 114 من الحجاج الهنود الحوامل خلال فترة الدراسة. كانت أكثر مضاعفات ما قبل الولادة شيوعاً هي التهابات الجهاز التنفسي (51.75%) يليها فقر الدم بسبب نقص الحديد (17.54%)، تقيء الحمل المفرط (14.04%)، قصور الغدة الدرقية (9.65%) وسكري الحمل (5.26%). كان هناك 20 حالة ولادة مهبلية (17.54%)، وحالتان لولادة قيصرية (1.75%) و 32 حالة إجهاض (28.07%). وبلغ معدل الولادة التراكمي لمدة ثلاث سنوات 24.60 لكل 1,000 امرأة. الخلاصة: أثناء الحج، يكون الحجاج الحوامل أكثر عرضة للإجهاض، والتهابات الجهاز التنفسي ومضاعفات ما قبل الولادة والفترة المحيطة بالولادة ومضاعفات التوليد والتي قد لا يتم الإبلاغ عنها أو عدم علاجها. لذلك يجب أن يتم تعليم النساء فيما يتعلق بخطر النتائج المعاكسة الأمومية الجنينية والتي قد تحدث للحوامل أثناء أداء فريضة الحج.

الكلمات المفتاحية: طب السفر: المسلمين: نتائج الحمل: إجهاض: التهابات الجهاز التنفسي: المملكة العربية السعودية.

ADVANCES IN KNOWLEDGE

- This prospective study is the first of its kind to evaluate fetomaternal outcomes among pregnant Indian Hajj pilgrims.
- The cumulative three-year birth rate was 24.60 per 1,000 women.
- The most common antenatal complications were respiratory infections, followed by iron deficiency anaemia. There was also a high incidence of abortions and other adverse pregnancy and neonatal outcomes.

APPLICATION TO PATIENT CARE

- Mass gatherings increase the transmissibility of respiratory pathogens. In addition, local healthcare systems may not be able to detect antenatal complications during Hajj or may experience transport difficulties due to crowded conditions, potentially leading to neonatal morbidity and mortality. Pregnant women considering undertaking Hajj pilgrimage should be educated regarding such risks.

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THE *Hajj* IS AN ANNUAL MUSLIM PILGRIMAGE of more than 2.3 million people from all over the world.¹ *Hajj* forms one of the five pillars of Islam and is obligatory for all able-bodied men and women of requisite means.² Muslims consider *Hajj* to be the most important pilgrimage for spiritual enlightenment during their lifetime. However, the pilgrimage involves physically demanding rituals which take place over approximately 45 days in the desert climate of Saudi Arabia, sometimes without adequate nourishment, hydration or sufficient rest.² Furthermore, *Hajj* is associated with high rates of morbidity and mortality due to various factors, including old age, chronic diseases, infectious disease outbreaks, accidents and disasters, all of which require appropriate surveillance and emergency response systems.^{3–5}

Mass gathering medicine is challenging due to the increased transmission of communicable diseases, limited healthcare accessibility, the often overwhelming number of patients and difficulties in evacuating patients during emergencies. Healthcare during *Hajj* is also affected by pilgrim diversity and vulnerability, despite yearly efforts to augment resources and enhance preparedness.^{6–8} While the *Holy Quran* does not prohibit performing *Hajj* during pregnancy and air travel during this time is considered safe, the governments of several countries actively discourage women from undertaking *Hajj* while pregnant.^{9–12} Nevertheless, pregnant women regularly undertake this arduous journey, sometimes in the belief that giving birth in the holy cities of Makkah or Medina will confer spiritual benefit. Such pregnancies are often not declared and remain largely undetected prior to departure for *Hajj*.¹⁰

The Indian Hajj Medical Mission (IHMM) caters to pregnant Indian women during their pilgrimage before transferring them to Saudi Arabian state-sponsored hospitals for appropriate fetomaternal care.^{7,8} The IHMM comprises a multi-tier network of medical outreach teams, mobile medical task forces, primary care clinics, tent clinics and two secondary care hospitals with 30–40 beds each. In addition, the IHMM has referral and evacuation capabilities in Makkah, Medina and Jeddah.^{7,8} To the best of the authors' knowledge, no data have yet been reported in the literature regarding pregnancy and neonatal outcomes during *Hajj* or in comparable mass gathering settings. This study therefore aimed to evaluate the obstetric and neonatal outcomes of pregnant Indian *Hajj* pilgrims over a three-year period from 2015–2017.

Methods

This prospective cross-sectional study was conducted at two IHMM-affiliated secondary care hospitals in Saudi Arabia during the *Hajj* seasons of August–October

2015 and 2016 and July–September 2017. All female Indian pilgrims between 15–45 years old with amenorrhoea who were seen at secondary care IHMM hospitals during the study period underwent pregnancy screening under the supervision of obstetricians and gynaecologists. All pregnant patients identified during *Hajj* as well as those who had registered their pregnancies in Indian hospitals prior to their arrival in Saudi Arabia were included in the study as part of a convenience inclusive sampling strategy. Patients who attended the hospitals for follow-up appointments for pre- and post-pregnancy events or those who had conditions unrelated to pregnancy were excluded.

All pregnant patients either presented to the secondary care hospitals directly or after referral from IHMM-affiliated clinics or mobile task forces. Subsequently, a prenatal nursing assessment was performed to determine gravidity, parity and the number of previous abortions or living offspring. At their first visit to the secondary care hospital, the pregnancy was registered under the supervision of an IHMM-affiliated obstetrician and gynaecologist. A basic work-up was performed to confirm the pregnancy, including height, weight and blood pressure measurements, a complete blood count and random blood glucose and urine pregnancy tests. All results were processed in the secondary care hospital laboratory under the supervision of a pathologist or microbiologist.

For high-risk pregnancies, patients were referred to the Makkah Maternity & Children Hospital for an antenatal work-up that included blood grouping, Rhesus typing, a coagulation profile and screening for HIV, hepatitis B and C, syphilis, toxoplasmosis, rubella, cytomegalovirus and herpes simplex virus (i.e. TORCH screening), followed by ultrasonography and routine follow-up. Potential exposure to pilgrims from developing or underprivileged countries mandates detailed screening for infectious diseases, including TORCH screening, which would otherwise not be routinely recommended.¹³ In addition, patients requiring fetal monitoring, perinatal care and neonatal intensive care, those in labour and obstetric emergency cases were also transferred to the Makkah Maternity & Children Hospital. However, all patients were followed up by IHMM-affiliated doctors throughout their entire stay in Saudi Arabia and, when necessary, were transferred to India under medical supervision.

Data were analysed using Microsoft Excel, Version 2010 (Microsoft Inc., Redmond, Washington, USA). Various clinicodemographic characteristics, including diagnosis, management, the presence of antenatal complications and fetomaternal outcomes, were compiled and compared with previous years for analysis. The results were expressed as descriptive statistics, including frequencies, percentages and 95% confidence intervals.

Ethical approval for this study was provided by the IHMM. Written informed consent was obtained from all participants prior to their inclusion in the study.

Results

Overall, there were 450,000 Indian pilgrims seen at IHMM-affiliated secondary care hospitals between 2015–2017, including 89,400 female pilgrims of reproductive age (19.87%). Of these, 114 (0.13%) were pregnant. The pregnancy was identified by urine test for the first time in 22 women (19.3%). A total of 101 women (88.6%) had planned pregnancies, although these were not declared to the *Hajj* medical authorities prior to beginning the pilgrimage. Of these, nine women (8.91%) were unaware of their pregnancy prior to their arrival in Saudi Arabia. A total of 39 women (38.61%) had received routine antenatal care in India. Among 23 women (20.18%) who were in the early stages of pregnancy, nine (39.13%) had had an antenatal appointment in India after conception and 14 (60.87%) were unaware of the date

of their last menstrual period. There were four patients (3.51%) with twin pregnancies. The cumulative three-year birth rate was 24.60 per 1,000 women [Table 1]. All of the women had received oral poliomyelitis, combined seasonal influenza and influenza A subtype H1N1 and meningococcal (serogroups A, C, Y and W-135) vaccines prior to their arrival in Saudi Arabia.

Respiratory tract infections were the most common antenatal complication (51.75%), followed by iron deficiency anaemia (17.54%), hyperemesis *gravidarum* (14.04%), hypothyroidism (9.65%) and gestational diabetes mellitus (GDM; 5.26%) [Table 2]. There were no reported cases of calf pain or deep vein thrombosis. All respiratory infections were treated empirically with antimicrobials as specific bacterial, fungal and viral cultures and immunological and molecular diagnostic procedures were unavailable. In addition, affected women were regularly monitored to avoid the transmission of suspected cases of H1N1 or Middle East respiratory syndrome (MERS). None of the women with respiratory infections required intensive care

Table 1: Obstetric characteristics of pregnant Indian pilgrims undertaking *Hajj* pilgrimage between 2015–2017 (N = 114)

Characteristic	n (%)			Total	95% CI*
	2015 (n = 38)	2016 (n = 32)	2017 (n = 44)		
Gravidity					
<i>Primigravidae</i>	10 (26.32)	9 (28.13)	11 (25)	30 (26.32)	18.72–35.55
<i>Multigravidae</i>	28 (73.68)	23 (71.88)	33 (75)	84 (73.68)	64.45–81.28
Type of pregnancy					
Single	37 (97.37)	31 (96.88)	42 (95.45)	110 (96.49)	90.73–98.87
Twin	1 (2.63)	1 (3.13)	2 (4.55)	4 (3.51)	1.13–9.27
Birth rate per 1,000 females	42.85	13.60	18.75	24.60	-

CI = confidence interval. *Of the cumulative percentage.

Table 2: Antenatal complications of pregnant Indian pilgrims undertaking *Hajj* pilgrimage between 2015–2017 (N = 114)

Complication*	n (%)			Total	95% CI†
	2015 (n = 38)	2016 (n = 32)	2017 (n = 44)		
RTIs	19 (50)	18 (56.25)	22 (50)	59 (51.75)	42.24–61.14
Iron deficiency anaemia‡	6 (15.79)	8 (25)	6 (13.64)	20 (17.54)	11.29–26.03
Hyperemesis <i>gravidarum</i>	4 (10.53)	5 (15.63)	7 (15.91)	16 (14.04)	8.49–22.09
Hypothyroidism	2 (5.26)	5 (15.63)	4 (9.09)	11 (9.65)	5.15–16.98
GDM	2 (5.26)	3 (9.38)	1 (2.27)	6 (5.26)	2.16–11.57
Oligohydramnios	1 (2.63)	0 (0)	1 (2.27)	2 (1.75)	0.30–6.81
Severe PE	0 (0)	0 (0)	1 (2.27)	1 (0.88)	0.05–5.51

CI = confidence interval; RTIs = respiratory tract infections; GDM = gestational diabetes mellitus; PE = pre-eclampsia.

*Percentages do not add up to 100% as some women may have had more than one complication. †Of the cumulative percentage. ‡Defined as a haemoglobin level of < 10.5 g/dL.

Table 3: Pregnancy outcomes of pregnant Indian pilgrims undertaking *Hajj* pilgrimage between 2015–2017 (N = 114)

Outcome*	n (%)			Total	95% CI†
	2015 (n = 38)	2016 (n = 32)	2017 (n = 44)		
Early pregnancy					
Missed abortion	9 (23.68)	6 (18.75)	12 (27.27)	27 (23.68)	16.44–32.73
Threatened abortion	4 (10.53)	2 (6.25)	4 (9.09)	10 (8.77)	4.52–15.93
Inevitable abortion	2 (5.26)	0 (0)	3 (6.82)	5 (4.39)	1.63–10.44
Ectopic pregnancy	0 (0)	0 (0)	1 (2.27)	1 (0.88)	0.05–5.51
Single fetal demise	0 (0)	0 (0)	1 (2.27)	1 (0.88)	0.05–5.51
Term pregnancy					
Vaginal delivery	11 (28.95)	4 (12.5)	5 (11.36)	20 (17.54)	11.29–26.03
Caesarean delivery	1 (2.63)	0 (0)	1 (2.27)	2 (1.75)	0.3–6.81
Preterm birth	1 (2.63)	0 (0)	1 (2.27)	2 (1.75)	0.3–6.81
Premature labour	1 (2.63)	0 (0)	1 (2.27)	2 (1.75)	0.3–6.81
IUFD/stillbirth	0 (0)	0 (0)	1 (2.27)	1 (0.88)	0.05–5.51

CI = confidence interval; IUFD = intrauterine fetal demise. *Percentages do not add up to 100% as some women may have fallen into more than one category. †Of the cumulative percentage.

Table 4: Neonatal outcomes of births among pregnant Indian pilgrims undertaking *Hajj* pilgrimage between 2015–2017 (N = 22)

Outcome*	n (%)			Total	95% CI†
	2015 (n = 12)	2016 (n = 4)	2017 (n = 6)		
Alive and well	10 (83.33)	4 (100)	5 (83.33)	19 (86.36)	0.64–0.96
Low birth weight‡	2 (16.67)	0 (0)	2 (33.33)	4 (18.18)	0.06–0.41
Low Apgar score§	2 (16.67)	0 (0)	1 (16.67)	3 (13.64)	0.03–0.36
Neonatal resuscitation	2 (16.67)	0 (0)	1 (16.67)	3 (13.64)	0.03–0.36
Admission to NICU	2 (16.67)	0 (0)	1 (16.67)	3 (13.64)	0.03–0.36
Preterm¶	2 (16.67)	0 (0)	1 (16.67)	3 (13.64)	0.03–0.36
Fetal distress/birth asphyxia	2 (16.67)	0 (0)	1 (16.67)	3 (13.64)	0.03–0.36
RDS	1 (8.33)	0 (0)	0 (0)	1 (4.55)	0.24–0.25
Jaundice	1 (8.33)	0 (0)	0 (0)	1 (4.55)	0.24–0.25
Stillborn	0 (0)	0 (0)	1 (16.67)	1 (4.55)	0.24–0.25

CI = confidence interval; NICU = neonatal intensive care unit; RDS = respiratory distress syndrome.

*Percentages do not add up to 100% as some neonates may have fallen into more than one category. †Of the cumulative percentage. ‡Defined as <2,500 g. §Defined as <5 at 10 minutes. ¶Defined as <37 gestational weeks. ||Two preterm babies were born as a result of preterm labour occurring in a twin pregnancy.

or mechanical ventilation. Cases of iron deficiency anaemia received haematinic supplements, while those with hyperemesis *gravidarum* were admitted to hospital for supportive care and received intravenous (IV) fluids and antiemetics. Patients with GDM were prescribed 500 mg of metformin three times daily to ensure good glycaemic control and those with hypothyroidism were treated with thyroxine.

The most common adverse early pregnancy outcomes were missed (23.68%) or threatened (8.77%) abortions. There were 20 vaginal deliveries (17.54%) and two Caesarean deliveries (1.75%) [Table 3]. There were no instrumental deliveries. Four of the women with threatened abortions were admitted for progesterone support and bed rest, while the remaining six patients were managed conservatively. Of the 32 missed and

inevitable abortions, the spontaneous expulsion of products of conception was confirmed by ultrasonography in 28 cases (87.5%), whereas the remaining four patients (12.5%) underwent outpatient dilation and evacuation procedures.

One patient with an ectopic pregnancy underwent a laparoscopic salpingectomy at the Makkah Maternity & Child Hospital. Among the four patients with twin pregnancies, one experienced the demise of a single fetus at 29 gestational weeks, although an examination four weeks earlier had indicated that both fetuses were viable. This patient was closely monitored for coagulopathy disorders until she returned to India. Another pregnancy ended in intrauterine fetal demise at 29 gestational weeks due to ultrasonography-confirmed oligohydramnios, intrauterine growth restriction and skeletal and skull defects. This patient went into spontaneous premature labour and subsequently required postnatal inpatient care.

There were a total of 22 births (19.3%) during the study period. The male-to-female ratio was 1.4:1. Neonatal outcomes were good in 19 cases (86.36%). However, there were three cases (13.64%) of birth asphyxia [Table 4]. In one of these cases, the mother was *multigravida* and presented with imminent eclampsia, high blood pressure (190/160 mmHg), albuminuria, headache, visual disturbances and epigastric discomfort. A magnesium sulphate infusion was administered, along with steroids. Subsequently, the patient was transferred to the Makkah Maternity & Child Hospital for an immediate Caesarean section at 34 gestational weeks. The preterm neonate had perinatal *asphyxia* and seizures, requiring a six-day stay in the neonatal intensive care unit and phenobarbital and ventilator support. He was later readmitted with neonatal sepsis and administered IV antimicrobials.

Discussion

The Saudi Arabian Ministry of Health has published succinct guidelines for pregnant pilgrims recommending that such women postpone pilgrimage due to the risk of infection, heat stroke and dehydration.^{14,15} The Hajj Committee of India has similarly prohibited *Hajj* pilgrimages for pregnant women over four gestational months, cautioning that pregnant pilgrims may potentially be deboarded from *Hajj* flights.¹¹ However, many pregnant women are likely to covertly attempt *Hajj* pilgrimage, perhaps for religious or financial reasons. In Saudi Arabia, maternal and child healthcare is sponsored for foreign *Hajj* pilgrims, which may tempt those who reside in countries where adequate obstetric and neonatal care is not accessible or affordable.

The overcrowding of people from diverse geographical backgrounds in mass gathering settings—in which population density may reach up to 9 individuals/m²—can increase the transmissibility of certain respiratory pathogens, such as Ebola virus, MERS, H1N1, multidrug-resistant tuberculosis and polymicrobial infections, against which many people do not have pre-existing immunity.¹⁶ Moreover, if an outbreak occurs during *Hajj*, there is high risk of the global spread of pathogens and continuing risk once affected individuals return to their countries of residence. Although most viral pathogens cause limited morbidity in healthy adults, they can pose significant risks to both mother and fetus during pregnancy.^{17,18} Cardio-respiratory compromise can adversely affect maternal haemodynamic stability, thereby affecting fetal nourishment.¹⁹ In addition, viruses which are transmitted transplacentally can cause fetal viraemia, leading to multi-organ infections.²⁰ This is particularly worrying as the detection of such infections is limited in mass gathering settings.²¹

Furthermore, the clinical presentation of certain respiratory infections may be non-specific, especially in cases of seasonal influenza and H1N1, thus increasing the burden of laboratory testing. During *Hajj*, the Saudi Arabian healthcare system has limited resources at its disposal, particularly when it comes to the sophisticated molecular tests required for the diagnosis and identification of novel respiratory pathogens.^{21–23} While there are operational stringencies in place for the isolation of suspected cases of infection, there are no approved antiviral drugs for treating novel respiratory pathogens—the teratogenic effects of which would need to be assessed in any case—nor available guidelines for their specific monitoring, prognosis or follow-up.²¹ Moreover, hospitalisation can further increase the transmission of respiratory pathogens.²⁴ Unfortunately, sociolinguistic and ethnocultural differences are barriers to proposed measures aiming to help prevent the transmission of respiratory infections among *Hajj* pilgrims.

It is possible that the adverse outcomes observed in the present study are attributable to the strenuous physical demands of *Hajj*. Pilgrims routinely perform physically demanding religious rituals including *tawaf* (circumambulating the *Kaaba*) and *sa'i* (a religious ritual involving walking for long distances) along with trips to Mina, Muzdalifah and Arafat, often without eating or drinking properly or getting sufficient rest. Pregnancy can negatively affect the physiological status of the mother due to the increasing demands of the growing fetus. Physical exhaustion can lead to contractions of the lower abdomen, backaches, physical injuries and physiological compromise.²⁵ However, there is an incr-

easing body of evidence that women who participate in sustained and vigorous physical activity in the first and second trimester, such as high-performance sports and endurance training, have successful fetomaternal outcomes.^{25–27}

Nevertheless, pregnant pilgrims run the risk of the spontaneous onset of labour during *Hajj* rituals, resulting in unattended delivery. Furthermore, other complications like anaemia, pre-eclampsia, GDM and hypothyroidism can have adverse fetomaternal outcomes. Such complications require on-site antenatal management which may not be readily accessible; moreover, transportation to other facilities may not be possible due to overcrowding.^{7,8} Generally, pregnant women who travel for extended periods of time are likely to miss out on opportunities for breast feeding counselling, family planning, neonatal care and antenatal surveillance to detect gynaecological comorbidities.

It is recommended that women with high-risk pregnancies, a history of preterm labour, recurrent pregnancy losses, GDM, chronic hypertension, pre-eclampsia, heart disease and those in the third trimester postpone *Hajj* pilgrimage. If determined to proceed, pregnant women should consult an obstetrician prior to embarking on *Hajj* and travel with sufficient medications for the entire pilgrimage. In addition, they should do their best to avoid crowds, wear comfortable clothes and shoes and maintain proper nutrition, hydration, rest and exercise.²⁸ Adverse symptoms like bleeding, abdominal contractions, headaches and watery vaginal discharge should be immediately reported. Moreover, pregnant women should avoid excessive physical effort during *Hajj* rituals and take advantage of allowances, such as using a wheelchair during *tawaf* and *sa'i*. Patients should also declare known pregnancies or their intention to conceive during *Hajj* to the Saudi Arabian medical authorities, thereby enabling the adequate provision of antenatal care. Such efforts should be further promulgated by medical missions in various countries.

Conclusion

Women who perform *Hajj* pilgrimages while pregnant have a high risk of abortion, respiratory infections and various antenatal and neonatal complications which may go untreated. Practitioners should therefore educate patients of these risks and advise them to postpone the pilgrimage until after the pregnancy.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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