

# BMJ Open Knowledge, attitude and current practices of pregnant women towards group B streptococcus screening: cross-sectional study, Al-Madinah, Saudi Arabia

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## ABSTRACT

**Aims** Group B streptococcus (GBS) is one of the most frequent bacterial pathogens causing invasive infections in neonates. It can be transmitted from colonised mother to neonates around delivery. Screening strategies for GBS during pregnancy include either universal culture-based or risk-based screening. The present study aimed to assess the knowledge, attitude and current practices of pregnant women towards GBS screening in Al-Madinah City, Saudi Arabia.

**Methods** A hospital-based cross-sectional study was conducted at Madinah Maternity and Children Hospital, Al-Madinah, Saudi Arabia, from May to July 2018. Participants were recruited from postnatal wards. Participants were interviewed using a previously published validated survey that was divided into the following domains: demographic data, knowledge, experience and attitude towards different GBS screening strategies.

**Results** A total of 377 out of 450 women (response rate 83.7%) were enrolled. The results showed that the overall mean knowledge score of the pregnant women towards GBS screening was 59.8%. Majority of the women (66.8%) were not aware of the GBS bacterium, while 86.5% of them had never been informed of GBS risk assessment during their pregnancies. The mean knowledge score among women who were aware of GBS (62.8%) was significantly higher than that among women who were not (58.4%) ( $p=0.015$ ). However, majority of the pregnant women (61.8%) showed preference for universal culture-based GBS screening strategy over risk-based strategy.

**Conclusion** The study results have concluded that the level of awareness and knowledge about GBS among pregnant women were relatively poor; however, majority of the pregnant women prefer universal culture-based screening.

## INTRODUCTION

Group B streptococcus (GBS) (also known as *Streptococcus agalactiae*) is a Gram-positive bacterium that colonises the human gastrointestinal and genital tracts. GBS is the most common bacterial pathogen causing invasive

## Strengths and limitations of this study

- In Saudi Arabia, there are no national guidelines on GBS screening strategy during pregnancy (ie, universal culture-based vs risk-based).
- To our knowledge, this study is the first study conducted in Saudi Arabia to assess pregnant women's knowledge, attitude and current practices regarding GBS screening in Saudi Arabia.
- The study results are limited because it was conducted in a postnatal department in only one hospital of Al-Madinah, Saudi Arabia.
- A larger sample size and more hospitals are recommended for future studies.

infections in newborn infants during the first week of life.<sup>1</sup> Maternal colonisation has been found to be a major risk factor for invasive GBS disease in neonates.<sup>2</sup> Approximately 20%–30% of pregnant women are colonised with GBS in the vagina, rectum or both.<sup>3</sup> Invasive neonatal GBS infection can be described as either early-onset sepsis (EOGBS) (ie, occurs in the first week of life) or late-onset sepsis (ie, occurs after the first week of life).<sup>4</sup> The rate of peripartum transmission of GBS to newborns of colonised women is approximately 50%, and about 1%–2% of the neonates born to these mothers develop EOGBS.<sup>5</sup>

The case fatality rate for EOGBS is approximately 22% among Africans, 11% among Americans and 7% among the European population.<sup>6</sup> EOGBS commonly presents with sepsis without focus in 80%–85% and pneumonia without sepsis in 10% or both in 35%–50%, while late-onset GBS infection is more likely to present with meningitis and septicaemia.<sup>6</sup>



The risk of EOGBS reduces with the use of intrapartum antibiotic prophylaxis (IAP).<sup>7</sup> There are two approaches for GBS screening and IAP: risk-based screening strategy and universal culture-based screening strategy.<sup>8</sup> Universal culture-based screening strategy is defined as screening of all pregnant women for GBS infection by culture testing at 35–37 weeks' gestation, and decisions to administer IAP are based on a positive GBS culture. On the other hand, in risk-based screening strategy, IAP is administered based on risk factors that increase likelihood of early-onset GBS infection (ie, premature delivery at <37 weeks gestation, maternal fever at >38°C and rupture of membranes for >18 hours). Under both strategies, IAP is recommended for women with GBS bacteriuria at any time during their current pregnancy or for women who had given birth previously to an infant with invasive EOGBS.<sup>8</sup>

The incidence of EOGBS in USA decreases from 1.7 cases per 1000 live births to 0.5 case per 1000 live births with the risk-based approach.<sup>8</sup> However, the incidence decreased further to 0.3–0.4 case per 1000 live births after the implementation of universal culture-based screening.<sup>8</sup> For these reasons, the Centers for Disease Control and Prevention (CDC) and other professional bodies in the United States (American Congress of Obstetricians and Gynaecologists, and the American Academy of Paediatrics) recommend the universal culture-based screening approach since 2002.<sup>9–11</sup> A recent study published in 2019, from US, showed further decrease in the incidence of EOGBS to 0.23 per 1000 live births in 2015.<sup>12</sup>

On the other hand, the Royal College of Obstetrician and Gynaecology in UK and other professional bodies outside North America recommends risk-based GBS screening strategy.<sup>13</sup>

In Saudi Arabia, there are no national guidelines on GBS screening strategy during pregnancy (ie, universal culture-based vs risk-based). So, the screening practices are variable among institutions.<sup>14</sup> In Saudi Arabia, antenatal care takes place at different healthcare settings (ie, primary healthcare centres, private sectors or governmental hospitals). Pregnant women have the right to choose where to follow up during pregnancy. It is done by physicians, including general practitioners and specialised obstetric and gynaecologists.

There is little known about Saudi women's attitude, knowledge and acceptance of GBS screening. Therefore, the present study aimed to determine the current knowledge, practices and attitude of pregnant women towards GBS screening during pregnancy in Al-Madinah City, Saudi Arabia.

## METHODS

### Study design

This is a cross-sectional study conducted at Madinah Maternity and Children Hospital (MMCH), Al-Madinah, Saudi Arabia, from 1 May to 31 July 2018.

### Study participants

A total of 450 pregnant women who were in the post-natal department at MMCH during the study period were invited to participate in the study. Women who did not speak Arabic or English were excluded. The agreement to complete the interview was considered as consent after verbal explanation of the nature and purpose of the study.

### Patient and public involvement statement

No patients or public agency were involved in the research team. However, the study aimed to measure public awareness regarding GBS infections during pregnancy. Results of this study may influence public health stakeholders to take further actions to address issues related to GBS screening during pregnancy in Saudi Arabia.

### Study questionnaire

Each participant was interviewed by one member of the research team using a validated survey from a previously published study.<sup>15</sup> The questionnaire was divided into four sections: demographic data and obstetric history, knowledge assessment questions, awareness and previous experience with GBS screening, and attitude towards different GBS screening strategies (ie, universal culture-based strategy vs risk-based strategy).

Women's knowledge was assessed using six (true/false) questions and two multiple choice questions that measure their knowledge on the risk, transmission mode, consequences and treatment of GBS infections. Participants' answers were rewarded with three points for each correctly answered question and zero for the incorrectly answered ones. The sum of these scores ranges from 0 to 24, which was converted into percentage. Knowledge score means, along with 25th, 50th and 75th percentiles, were used to describe knowledge outcome. As knowledge scores were normally distributed (online supplementary appendix table 1 and figure 1) and to analyse knowledge outcome using the binary logistic regression analysis, the 75% score was considered as the passing score based on the 75th percentile. Participants' awareness was assessed by a single (yes/no) question.

Participants' experience was assessed on the basis of following six items (yes/no questions):

- ▶ Previous or current GBS colonisation.
- ▶ Receiving information about GBS risk assessment during current pregnancy.
- ▶ Receiving information about GBS risk assessment during delivery.
- ▶ Request by caring healthcare worker to undergo GBS testing.
- ▶ Being tested for GBS after being requested.
- ▶ Receiving the test result after being done.

To simplify the multivariate binary logistic regression, the non-linear categorical principal components analysis was conducted on these six items using statistical data analysis software (SPSS V.21). Each item was considered as one exposure to GBS. Then, the exposure score was transformed into a scale range between 1 and 100 (structural

equation modelling confirmatory factor analysis is shown in the online supplementary appendix, p2).

### Study procedure

The questionnaire was filled during the interview by interviewers. The interviewers were three of the authors. After completing the first three sections of the questionnaire (ie, demographic data and obstetric history, knowledge assessment questions, awareness and previous experience with GBS screening), information about GBS and GBS screening strategies (ie, risk-based and universal culture-based GBS screening) were explained to the participants, including advantages and disadvantages of both strategies. Women's attitude towards different GBS screening strategies was assessed by direct question about which strategy they would prefer.

### Statistical analysis

IBM statistical data analysis software, SPSS V.21, was used for analysis. Means and SDs were used to describe metric continuous variables (ie, knowledge scores) and percentages for categorical and binary variables (ie, demographic variables, obstetric variables, awareness and questions about previous experience with GBS screening).

Univariate chi-square test ( $\chi^2$ ) goodness-of-fit non-parametric test was employed to assess the distribution of the women's answers for statistically significant difference from equal (50% correct answer: 50% incorrect answer chances). Pearson's products moments tests were used to assess the correlations between continuous variables.

The chi-square test ( $\chi^2$ ) test of independence was used to assess the association between categorical variables. One-way analysis of variance test was used to assess the multilevel categorical variables for mean differences on continuously measured variables.

Binary multivariate logistic regression analysis was employed to explore the individual and combined associations between the independent variables (women's demographics, obstetric history and past experiences score) and the dependent variables (participants' awareness of GBS and the odds of scoring more than the 75th percentile in GBS knowledge questions).

### RESULTS

During the study period, a total of 377 out of 450 women (response rate 83.7%) were enrolled and completed the interview. The demographic data and obstetric history of the women are shown in [table 1](#).

The overall mean knowledge score for women was 59.8% (SD=16.3). The 25th, 50th and 75th percentiles for scores were 50 %, 63% and 75%, respectively (online supplementary appendix table 1). Thirty-five participants (9.3%) scored more than the 75th percentile. [Table 2](#) shows univariate  $\chi^2$  analysis of knowledge questions. Majority of women (62%) had incorrect answers regarding meningitis as a complication of GBS infection in neonates ( $p<0.001$ ). Of the women, 60.5% incorrectly believed that GBS is a sexually transmitted diseases

**Table 1** Demographic and obstetric characteristics of the participants (N=377)

Item	Measure	Frequency	Percentage
Age (years)	18–24	87	23.1
	25–34	167	44.3
	35–44	106	28.1
	45 or older	17	4.5
Employment	No	325	86.2
	Yes	52	13.8
Educational level	Less than high school	48	12.7
	Completed high school	101	26.8
	Postsecondary and still studying	91	24.1
	Completed postsecondary	125	33.2
	Advanced degree	12	3.2
Prenatal care provider	No definite follow-up clinic	16	4.2
	Government hospital clinics	112	29.7
	Primary healthcare centres	56	14.9
	Private hospitals	193	51.2
Specialty of the caring physicians	None	19	5
	General and family doctor	36	9.5
	Gynaecologist	322	85.4
Reason for referral	Not referred/visiting	310	82.2
	Referred for further management from other centres	66	17.6

**Table 2** Univariate analysis of the women's answers to the knowledge questions on GBS screening (N=377)

	Incorrectly answered	Correctly answered	P value
GBS is a leading cause of serious blood infections?	151 (40.1%)	226 (59.9%)	<0.001
GBS is a leading cause of meningitis?	234 (62.1%)	143 (37.9%)	<0.001
It is a sexually transmitted infection?	228 (60.5%)	149 (39.5%)	<0.001
It can be transmitted to a newborn during delivery?	63 (16.7%)	314 (83.3%)	<0.001
GBS carrier mother cannot give birth through normal vaginal delivery?	133 (35.3%)	244 (64.7%)	<0.001
GBS carrier mother cannot breast feed?	58 (15.4%)	319 (84.6%)	<0.001
The risk of GBS being passed from mother to baby is highest (during, before or after) delivery?	112 (29.7%)	265 (70.3%)	<0.001
If a woman carries GBS during pregnancy, when she must get antibiotics?	232 (61.5%)	145 (38.5%)	<0.001

GBS, group B streptococcus.

( $p < 0.001$ ). Also, about 60% of the participants did not know when antibiotic prophylaxis should be given for colonized or at risk pregnant mothers.

Multivariate binary logistic regression explaining the association between women's characteristics and their odds of passing a GBS knowledge score above the 75th percentile is shown in [table 3](#). Women with higher past exposure scores have significantly higher odds (OR 1.025, 95% CI 1.009 to 1.039) of scoring above the 75th percentile in the knowledge score. For each additional point on the exposure to GBS screening score, the odds of women being informed on the GBS rises by 2.4% ( $p = 0.001$ ). Women's age converged significantly and negatively on scoring above the 75th percentile in the knowledge score (OR 0.28, 95% CI 0.139 to 0.603) (online supplementary appendix figure B). Moreover, women's parity numbers correlate significantly with higher odds of scoring above the 75th percentile on knowledge score. The odds of scoring above the 75% score are predicted to rise by 13.71%, on average, as the number of pregnancies increases by one ( $p = 0.008$ ). Pregnant women who were

followed up by gynaecologists had higher odds of scoring more than the 75th percentile. However, it was not statistically significant ( $p = 0.421$ ).

The descriptive analysis of GBS awareness and exposure to GBS screening percentages is shown in [table 4](#).

Results of the  $\chi^2$  test of association between the awareness of GBS screening and demographic and obstetric variables are shown in online supplementary appendix table 2. Multivariate logistic regression analysis of GBS awareness (Q8 in the questionnaire) and demographic and obstetric variables is shown [table 5](#). There was a statistically significant association between women's awareness of GBS screening and specialty of the healthcare professionals providing antenatal care. Women followed up by gynaecologists were significantly more aware of the GBS screening as compared with those cared for by other specialties ( $p = 0.018$ ).

Majority of the women (61.8%) believed that the universal culture-based GBS screening strategy is better than risk-based strategy to prevent GBS infection in neonates. However, there was no statistically significant

**Table 3** Multivariate binary logistic regression explaining the association between women's characteristics and their odds of passing the GBS knowledge score above (75th percentile)

	Adjusted OR	95% CI for OR		P value
		Lower	Upper	
Past exposure to GBS score (1–100 points)	1.02	1.00	1.03	0.001
Age group	0.28	0.13	0.60	0.001
Educational level	1.39	0.91	2.13	0.122
Employment: yes	2.08	0.58	7.40	0.254
Number of pregnancies	1.37	1.08	1.73	0.008
Type of follow-up clinic	1.22	0.79	1.87	0.360
Caring physician's specialty	1.53	0.54	4.32	0.421
Referral reason: further management	1.59	0.64	3.95	0.317
Acceptance of universal culture-based GBS screening	0.61	0.28	1.30	0.202

GBS, group B streptococcus.

**Table 4** Women's awareness and past experiences with GBS screening (N=377)

Item	Measure	Frequency	Percentage
Are you aware of GBS?	No	252	66.8
	Yes	125	33.2
Have you ever had GBS?	No	361	95.8
	Yes	16	4.2
During current pregnancy, were you informed of GBS risk assesment?	No	329	87.3
	Yes	48	12.7
Who informed you of GBS risk for pregnant women?	Never been informed	329	87.3
	General practitioner/family doc	6	1.6
	Gynaecologist	37	9.8
	Nurses and other sources	5	1.3
Are you aware of the available risk screening for GBS during labour?	No	326	86.5
	Yes	51	13.5
Have you ever been requested to undergo GBS testing?	No	329	87.3
	Yes	48	12.7
Who requested you to undergo GBS testing? (n=48)	General practitioner/family doc	5	10.4
	Gynaecologist	43	89.6
Did you undergo the requested GBS testing? (n=48)	No	14	29.1
	Yes	34	70.9
When were you tested/requested to undergo GBS testing during your pregnancy? (n=48)	Below or during first 30 weeks of pregnancy	19	39.5
	After 30 weeks of pregnancy	23	48
	Cannot remember	6	12.5
Were you informed of the GBS testing result? (n=34)	No	6	17.6
	Yes	28	82.4

GBS, group B streptococcus.

**Table 5** Multivariate logistic regression analysis of women's demographic and obstetric variables with their odds of being aware of GBS screening (Q8)

	Adjusted OR	95% CI for OR		P value
		Lower	Upper	
Age (years)	0.89	0.58	1.35	0.599
Educational level	1.28	0.99	1.65	0.057
Employment: yes	1.76	0.80	3.87	0.156
Number of previous pregnancies	0.50	0.29	0.87	0.014
Number of previous delivered babies	2.05	1.14	3.67	0.016
Type of follow-up clinic	0.94	0.71	1.23	0.670
Caring physician specialty: gynaecologist	2.16	1.13	4.10	0.018
Past exposure to GBS score (1–100 points)	2.12	1.50	3.00	0.000
GBS knowledge score (1–100 points)	1.01	0.99	1.02	0.116
Sources of information	1.33	0.96	1.84	0.082
Perceived best way of GBS prevention: universal screening, all women	0.68	0.41	1.13	0.141
Constant	0.15			0.129

GBS, group B streptococcus.

difference across demographic and obstetric variables regarding preference for the universal culture-based approach (online supplementary appendix table 3).

## DISCUSSION

The present study has shown that majority (66%) of the pregnant women were not aware of antenatal GBS screening strategies with vaginal and rectal swabs. Lower awareness regarding GBS compared with pertussis and influenza has been reported by McQuaid *et al* among women in a UK study. About 30% of women in that study never heard about GBS.<sup>16</sup> However, higher awareness rate among women in the UK compared with women in the current study could be explained by the presence of national guidelines in the UK. Another study conducted in Hong Kong showed that only 36% of the participants had ever heard about GBS.<sup>17</sup> In this study, only 12.7% of women were asked to do the GBS screening test, which was mainly requested by the gynaecologists.

Majority of pregnant women have poor knowledge about GBS infection and screening strategies, as 69.5% of them scored below 65% in the knowledge score. This result was consistent with previous studies conducted by Chow *et al* and Youden *et al*.<sup>15 17</sup> The knowledge deficit about GBS infection and its outcomes may be due to lack of national guidelines on antenatal screening, which might result in variability in screening practices among physicians.<sup>14</sup> Women with good knowledge about GBS were more likely to be cared for obstetric and gynaecologist physicians and were exposed to GBS. This might be explained by the lower rate of GBS testing requests among non-obstetric/gynaecologist healthcare professionals.

Knowledge deficit was more significant in terms of acknowledging the consequences of GBS infection among newborns, as most women did not know that GBS might cause meningitis. However, the Hong Kong study showed that the majority of the participants (89%) overestimated the risk of EOGBS infection on newborns delivered by GBS colonised mothers.<sup>17</sup> A previous qualitative study has assessed knowledge, perceptions and experiences of women regarding GBS and its screening.<sup>18</sup> The results were in agreement with the present study as majority of the women had little knowledge about GBS screening strategies. It seemed that women were struggling to understand the meaning and implications of GBS infection for their babies as well as for themselves.<sup>18</sup>

Around 61.8% of the pregnant women in our study believed that the universal culture-based screening method would be the best way to prevent GBS infection in newborns, after they were informed about the different approaches to GBS screening. This finding was close to the Hong Kong study, where 81% of participants were willing to have universal culture-based GBS screening during pregnancy and 66% agreed that universal culture-based GBS screening should be implemented.<sup>17</sup> Participants who had heard about GBS had higher scores on knowledge of GBS and better acceptance to its screening.<sup>17</sup>

A previous study conducted in Saudi Arabia found that the GBS colonisation rate in pregnant women in the third trimester ranges from 9.2% to 27.6%.<sup>19</sup> Moreover, a recently published prospective study from three hospitals in Arabian Gulf countries, including Saudi Arabia, showed that the overall incidence of EOGBS was 0.9 per 1000 live births, which is higher than current incidence in high-income countries.<sup>20</sup> However, there are no nationwide surveillance data about rates of EOGBS, and these data are crucial to choose the GBS screening strategy (ie, risk-based vs universal culture-based).

This study has limitations. It is a cross-sectional survey study, which might have recall bias among participants regarding previous GBS screening strategies. Also, we did not interview the healthcare workers to explore the cause of low request rate for GBS screening. Another limitation is that the interviews were conducted in the postnatal department of only one hospital in Al-Madinah. As a consequence, this may not represent the whole Al-Madinah region, where about 200 000 women are of childbearing age. However, MMCH is the largest women hospital in Al-Madinah region with 14 000 deliveries per year. Future studies need to consider more hospitals and a larger sample size for obtaining generalisable results.

The present study is the first study conducted in Saudi Arabia to assess public awareness about GBS screening. It might influence public health stakeholders to conduct further studies about GBS screening and might help in establishing national guidelines regarding GBS screening.

## CONCLUSION

The present study has assessed the knowledge, attitude and current practices of pregnant women towards GBS screening in Al-Madinah, Saudi Arabia. It was concluded that the level of awareness and knowledge about GBS among the pregnant women was relatively poor; however, majority of the pregnant women prefer universal culture-based screening. The results have depicted the need for nationwide research to ascertain the cost-effectiveness of either GBS screening strategies (ie, universal culture-based vs risk-based) based on the prevalence of maternal GBS colonisation, vertical transmission to neonates and rate of early-onset neonatal disease in different provinces of Saudi Arabia. The study results would be helpful in future development of a national guideline regarding GBS screening strategy and reinforcing women education about different GBS screening strategies during pregnancy.

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#### REFERENCES

- Borghesi A, Stronati M, Fellay J. Neonatal group B streptococcal disease in otherwise healthy infants: failure of specific neonatal immune responses. *Front Immunol* 2017;8:215.
- Shane AL, Stoll BJ. Neonatal sepsis: progress towards improved outcomes. *J Infect* 2014;68 Suppl 1:S24–32.
- Heath PT. Status of vaccine research and development of vaccines for GBS. *Vaccine* 2016;34:2876–9.
- Creti R, Imperi M, Berardi A, et al. Neonatal group B Streptococcus infections. *Pediatr Infect Dis J* 2017;36:256–62.
- Kowalska B, Niemiec KT, Drejewicz H, et al. [Prevalence of group B streptococcal colonization in pregnant women and their newborns based on the results of examination of patients in the Obstetric and Gynecology Department of the National Research Institute of Mother and Child—a pilot study]. *Ginekol Pol* 2003;74:1223–7.
- Madrid L, Seale AC, Kohli-Lynch M, et al. Infant group B streptococcal disease incidence and serotypes worldwide: systematic review and meta-analyses. *Clin Infect Dis* 2017;65:S160–72.
- Santhanam S, Arun S, Rebekah G, et al. Perinatal risk factors for neonatal early-onset group B streptococcal sepsis after initiation of Risk-based maternal intrapartum antibiotic Prophylaxis-A case control study. *J Trop Pediatr* 2018;64:312–6.
- Verani JR, McGee L, Schrag SJ, et al. Prevention of perinatal group B streptococcal disease—revised guidelines from CDC, 2010. *MMWR Recomm Rep* 2010;59:1–36.
- Centers for Disease Control and Prevention. *Prevention of perinatal group B streptococcal disease revised guidelines from CDC, 2010 continuing education*, 2010.
- American College of Obstetricians and Gynecologists Committee on Obstetric Practice. ACOG Committee opinion no. 485: prevention of early-onset group B streptococcal disease in newborns. *Obstet Gynecol* 2011;117:1019–27.
- Baker CJ, Byington CL, Polin RA, et al. Policy statement—Recommendations for the prevention of perinatal group B streptococcal (GBS) disease. *Pediatrics* 2011;128:611–6.
- Nanduri SA, Petit S, Smelser C, et al. Epidemiology of invasive early-onset and late-onset group B streptococcal disease in the United States, 2006 to 2015: multistate laboratory and population-based surveillance. *JAMA Pediatr* 2019;173:224–33.
- Royal College of Obstetrician and Gynecology. *Prevention of early onset neonatal group B streptococcal disease*. London, UK: Royal College of Obstetricians and Gynaecologists (RCOG), Green-top guideline, 2012: 36. 1–13.
- Musleh J, Al Qahtani N. Group B Streptococcus colonization among Saudi women during labor. *Saudi J Med Med Sci* 2018;6:18–22.
- Youden L, Downing M, Halperin B, et al. Group B streptococcal testing during pregnancy: survey of postpartum women and audit of current prenatal screening practices. *J Obstet Gynaecol Can* 2005;27:1006–12.
- McQuaid F, Jones C, Stevens Z, et al. Factors influencing women's attitudes towards antenatal vaccines, group B Streptococcus and clinical trial participation in pregnancy: an online survey. *BMJ Open* 2016;6:e010790.
- Chow TY, William WK, Daniel TO. *Knowledge and attitudes of Hong Kong pregnant women on group B Streptococcus screening*. Department of Obstetrics and Gynaecology, United Christian Hospital, 2013.
- Darbyshire P, Collins C, McDonald HM, et al. Taking antenatal group B Streptococcus seriously: women's experiences of screening and perceptions of risk. *Birth* 2003;30:116–23.
- Al-Suleiman SA, Farrag I, Kingsley T-D, et al. Third trimester colonisation and treatment of group B β-haemolytic Streptococcus among obstetric patients in the eastern Province of Saudi Arabia. *J Obstet Gynaecol* 1991;11:409–13.
- Hammoud MS, Al-Ta'iar A, Al-Abdi SY, et al. Culture-Proven early-onset neonatal sepsis in Arab states in the Gulf region: two-year prospective study. *Int J Infect Dis* 2017;55:11–15.