

Prevalence and outcomes of different antenatal care status in the Maternity and Children Hospital in Jeddah, Saudi Arabia: a prospective study

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Abstract

Background: Antenatal care (ANC) is beneficial for preserving the health of mothers and babies. This study aimed to investigate the prevalence and outcomes of deliveries among women with different ANC statuses.

Methods: This prospective study included 1,349 deliveries, classified into 3 groups: A, no ANC; B, full or partial ANC at another hospital without any documentation; and C, full ANC at our institute. Data were collected prospectively using a standardized data collection sheet. The primary outcomes were maternal and neonatal all-cause mortality. Secondary outcomes included maternal and neonatal morbidity indicators.

Results: Of the 1,349 deliveries, 274 (20.3%) were among women with no ANC, who also had the highest mean patient age (30.1 ± 6.2 years; $p < 0.001$). Mothers without ANC were more likely to be non-citizens and to have higher parity. Deliveries in this group were associated with significantly higher odds of maternal Intensive Care Unit (ICU) admission, neonatal ICU (NICU) admission, low birth weight, early neonatal death, and intrauterine fetal death compared with mothers who received adequate ANC. Outcomes for women with undocumented or partial ANC were comparable to those with adequate ANC, without statistically significant differences.

Conclusion: Targeted initiatives should focus on high-risk populations to promote the importance of planned delivery and consistent ANC throughout pregnancy.

Keywords

Antenatal care, deliveries, maternal, neonatal, mortality, morbidity, partial.

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How to cite

Safdar H, Al-Hindi M, Almalki F, Alattas A, Fatani R, AlQurashi M. Prevalence and outcomes of different antenatal care status in the Maternity and Children Hospital in Jeddah, Saudi Arabia: a prospective study. *J Pediatr Neonat Individual Med.* 2026;15(1):e150103. doi: 10.7363/150103.

Background

The World Health Organization (WHO) envisions a world where “every pregnant woman and newborn receives quality care throughout the pregnancy, childbirth, and postnatal period.” In 2016, the WHO released updated antenatal care (ANC) recommendations aimed at ensuring a positive pregnancy experience [1]. ANC is defined as care provided by skilled healthcare professionals to ensure the best possible health outcomes for mother and baby [2]. ANC is designed to monitor and manage pregnancy by facilitating the timely diagnosis and treatment of pregnancy-related complications and identifying women at higher risk of adverse outcomes. Although ANC plays a critical role in this process, it does not directly reduce maternal and neonatal morbidity and mortality. Rather, the reduction in these risks stems from the effective actions that follow ANC, including accurate diagnosis of complications and the implementation of appropriate therapeutic interventions. Through early detection and targeted management, ANC serves as a vital framework for improving maternal and neonatal health outcomes [3].

The WHO recommends a minimum of 8 ANC visits for a risk-free pregnancy, including 1 ultrasound scan before 24 weeks of gestation (early ultrasound). The directed strategy involves routine care for all pregnant women and additional advanced care for women who are moderately and highly at risk of developing complications [4]. Pregnant women in low- and middle-income

countries suffer a 1 in 160 lifetime chances of maternal death, compared with 1 in 3,700 in high-income countries [5]. Although some complications such as preeclampsia, eclampsia, infections, and hemorrhage, which account for 75% of maternal deaths, may not be preventable due to underlying health conditions or unpredictable medical emergencies, many can be prevented through adequate ANC, timely medical interventions, and access to quality healthcare services [6]. ANC for women with hypertensive disorders, anemia, gestational diabetes, and preterm delivery is effective in reducing perinatal mortality [7]. Unfortunately, despite the WHO recommendation, many pregnant women worldwide do not receive or undergo ANC [8].

A study published in 2018 in Saudi Arabia reported a neonatal mortality rate of 3.6 per 1,000 live births and a maternal mortality rate of 11.9 per 100,000 live births [9]. An important aspect of underutilized ANC is unbooked deliveries, a well-known risk factor for adverse outcomes for mothers and babies [2, 10]. Following a unit audit, a unique group of pregnant mothers was observed in our center. These mothers received ANC in a healthcare facility and delivered at the Ministry of Health at Mesadiah Maternal and Children Hospital (MMCH) without any documentation. Most of this group were either illegal immigrants or had financial constraints. This group of mothers will be referred to have “inadequate ANC” [11]. Only a few published studies have addressed maternal and neonatal mortality and morbidity related to mothers without ANC (“unbooked”) as a primary outcome, mainly in underdeveloped countries [12]. In addition, only 1 study focused on maternal demographics and reasons for not receiving ANC in Saudi Arabia > 2 decades ago [11]. Furthermore, to the best of the authors’ knowledge, mothers with inadequate ANC had never been examined and studied in Saudi Arabia. Hence, this study aimed to compare maternal and neonatal mortality and morbidity outcomes between mothers who received adequate ANC, those who did not receive ANC at all, and the new group of mothers who received inadequate ANC.

Methods

Study design, area, and settings

This prospective cohort study used data collected through a data collection sheet using information

from files and a questionnaire filled using face-to-face interviews with mothers. The study was conducted in a tertiary care center (MMCH) in Jeddah, Saudi Arabia, from February 1 to May 31, 2017. MMCH accepts all types of deliveries, irrespective of nationality, insurance coverage, eligibility status, military affiliation, or booking status.

Study population

All patients who were admitted for delivery were included, regardless of their ANC status. We compared 3 groups of delivering mothers: (1) those without ANC, defined as unbooked deliveries or those with < 4 ANC visits; (2) those with inadequate ANC, defined as mothers who reported ANC follow-up at another facility but presented to the Emergency Department (ED) without documentation; and (3) those with adequate ANC, defined as mothers who had been followed from early pregnancy either in a primary healthcare center (and referred to MMCH) or at another facility, and presented with proper documentation in the ED during labor. At the time of the study, the WHO had not yet recommended the current standard of a minimum of 8 ANC visits. Therefore, the older guidelines of a minimum of 4 visits was used to categorize mothers as having an adequate ANC.

The sample size was calculated as follows: based on previous studies in Saudi Arabia, the proportion of women without ANC was estimated at 20%. Assuming a margin of error (α) of 0.05 and a power ($1 - \beta$) of 80%, a minimum of 246 participants was required in this group. The incidence of mothers with inadequate ANC was approximately at 50% based on the internal unit audit. Hence, an additional sample of 380 was required. A 40% refusal of consent was anticipated; therefore, a sample of 877 patients was recruited. Based on internal unit audit, the sample size would be recruited over 4 months. All eligible women who delivered in the Obstetrics and Gynecology Ward or presented to the ED during the study period were approached. Deliveries occurring at home or in vehicles but later admitted to MMCH were also included. Women who did not provide informed consent were excluded.

Primary and secondary outcomes

The primary outcome was maternal and neonatal all-cause mortality. Secondary maternal morbidity outcomes included antepartum hemorrhage, Inten-

sive Care Unit (ICU) admission, and emergency cesarean delivery. Secondary neonatal outcomes included prematurity, low birth weight (LBW), Neonatal ICU (NICU) admission, length of stay in the NICU in days, incidence of respiratory distress syndrome, transit tachypnea, pneumonia, air leak, meconium aspiration syndrome, need for mechanical ventilation, sepsis, hypoxic-ischemic encephalopathy, and birth trauma. Differences in the incidence of these outcomes between mothers without ANC, mothers with inadequate ANC, and mothers with adequate ANC were evaluated. Furthermore, factors associated with different ANC statuses were analyzed.

Clinical data

The data collection sheet included 2 parts.

Part A included mothers' demographic data such as nationality, age, parity, and ANC status, as well as chronic maternal disease, gestation-induced diseases, serology, antepartum hemorrhage, mode of delivery, site of delivery, and ICU admission. Moreover, the collection of family socioeconomic status such as mother's employment, father's employment, family income in Saudi Arabian Riyal, current marital status, and educational level was included. In addition, if maternal death occurred, the cause of death was also included.

Part B included demographic data of neonates including date of birth, sex, singleton/multiple, gestational age, birth weight, and Apgar score, as well as early neonatal complications such as NICU admission, length of stay in the NICU in days, and presence of congenital anomalies. Some neonatal morbidities were also collected, such as respiratory distress syndrome, transit tachypnea, pneumonia, air leak, meconium aspiration syndrome, need for mechanical ventilation, sepsis, hypoxic-ischemic encephalopathy, prematurity, intrauterine fetal death (IUFD), and birth trauma. Furthermore, if neonatal death occurred, the cause of death was included.

Data collection methods and measurements

The authors collected data in 2 steps; first, by interviewing patients and inquiring if they were following their ANC visits pre-delivery and if they had any evidence of their visits if conducted outside the hospital. Other data related to patients' demographics and socioeconomics, gravidity, parity, and chronic diseases were also collected

by interviewing patients. All data collected during patients' interviews were filled in an electronic data collection sheet. Second, post-delivery data were collected by authors and data collectors from personal health records and entered the electronic data collection sheet. Data were then exported to the Statistical Package for Social Sciences (SPSS®) version 25.0 (SPSS Inc., Chicago, IL, USA) for analysis.

Statistical analysis

Data were examined to look for distribution and outliers. Categorical variables were represented using proportions and bar charts. Mean \pm standard deviation were used for numerical variables to represent normally distributed data. Median and a 50% interquartile range were used to describe skewed data. In univariate analysis, variables were compared using chi-square or Fisher's exact test for categorical data. For measured data, the one-way analysis of variance test was used for normally distributed data, and the Kruskal-Wallis test for skewed data. Then, 3 models were created, and multivariate logistic regression analysis was used. Model A constituted risk factor analysis for mothers without ANC versus adequate ANC, and maternal age, parity, educational status, employment, husband employment, and family income were included as covariates. Educational status was recategorized into 2 groups. Mothers who were not educated, primary school educated, and intermediate school educated were combined as 1 group, and mothers who were secondary school educated and higher were used as the reference group. Model B was similar to model A but compared mothers with inadequate ANC to mothers with adequate ANC. In model C, selected outcomes of mothers without ANC and mothers with inadequate ANC were compared to mothers with adequate ANC as a control group. Unadjusted and adjusted odds ratios (ORs) were used as a measure of association. ORs were adjusted for maternal disease, age, parity, and premature births. SPSS® version 25.0 (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses.

Results

The total number of admissions to MMCH during the 4-month study period was 1,497, excluding 148 patients due to refusal or missing data. Eventually, 1,349 patients were included in the study. Of the 1,349 patients, 274 (20.3%) had no ANC, 635

(47.1%) had inadequate ANC, and 440 (32.6%) had adequate ANC.

All-group comparison

In the inadequate ANC group, the mean age of patients was 28.9 ± 5.6 years, in contrast to 30 ± 5.7 years for those in the adequate ANC group and 30.1 ± 6.2 years for those without ANC group. Citizens (Saudi nationality) were lowest among the group without ANC (177 [64.6%]), whereas the adequate and inadequate ANC groups were 373 (84.7%) and 498 (78.4%), respectively (**Tab. 1**).

For neonatal outcomes, mothers without ANC, had lower birth weight babies, $2,712 \text{ g} \pm 803$, compared with mothers with adequate and inadequate ANC ($2,922 \text{ g} \pm 585$ and $2,923 \text{ g} \pm 630$, respectively). Moreover, mothers without ANC had more premature babies, LBW babies, small-for-gestational-age babies, and more babies who had respiratory distress syndrome (**Tab. 2**).

In multiple regression analysis, model A (that compared the risk factors associated with different ANC statuses between mothers without ANC to mothers with adequate ANC) revealed that mothers without ANC were associated with significant odds of being non-citizens, having a higher parity, and were in the group with the lowest income (OR: 2.4, 95% confidence interval [CI]: 1.51-3.81, OR: 1.15, 95% CI: 1.02-1.31, and OR: 2.71, 95% CI: 1.35-5.45, respectively) (**Tab. 3**).

Model B of the analysis (that compared mothers with inadequate ANC to mothers with adequate ANC) demonstrated no significant difference in demographics or socioeconomic risk factors between the 2 groups.

In model C, deliveries without ANC were associated with higher odds of maternal ICU admissions, compared with mothers with adequate ANC (adjusted OR [aOR]: 5.3, 95% CI: 1.2-23). Moreover, deliveries without ANC were associated with more NICU admission and having an LBW baby compared with mothers with adequate ANC (aOR: 2, 95% CI: 1.3-3.2, and aOR: 2, 95% CI: 1.2-3.3, respectively). Also, deliveries without ANC were associated with more odds of having an IUFD and neonatal deaths compared with mothers with adequate ANC (aOR: 7, 95% CI: 1.5-32, and aOR: 3.6, 95% CI: 1.3-10, respectively). However, no significant differences in those outcomes were observed when mothers with inadequate ANC were compared to mothers with adequate ANC (**Tab. 4**).

Table 1. Characteristics of mothers and deliveries among individuals of different antenatal care (ANC) status.

Variable		Mothers with no ANC (n = 274)	Mothers with inadequate ANC (n = 635)	Mothers with adequate ANC (n = 440)	p-value	
Demographics	Age (years), mean ± SD	30.1 ± 6.2	28.9 ± 5.6	30 ± 5.7	< 0.001	
	Saudi nationality	177 (64.6)	498 (78.4)	373 (84.7)	< 0.001	
	Parity, median (IQR)	3 (2-4)	2 (1-4)	2 (2-4)	0.93	
	History of abortion	91 (34)	168 (26.6)	131 (30.2)	0.57	
Comorbidities	Maternal diseases	29 (10.9)	87 (13.7)	94 (21.6)	< 0.001	
	Hypertension/preeclampsia	8 (2.9)	13 (2)	5 (1.1)	0.19	
	Diabetes	12 (4.5)	30 (4.7)	51 (11.7)	< 0.001	
	Thyroid disease	1 (0.4)	24 (3.8)	20 (4.6)	< 0.001	
Socioeconomic status	Maternal employment	23 (8.4)	59 (9.3)	70 (15.9)	< 0.001	
	Family income	< 5,000 SAR	97 (35.4)	209 (32.9)	101 (23)	< 0.001
		5,000-10,000 SAR	67 (24.5)	288 (45.4)	215 (48.9)	
		> 10,000 SAR	17 (6.2)	92 (14.5)	74 (16.8)	
	Education	Not educated	16 (5.8)	36 (5.7)	11 (2.5)	< 0.001
		Primary school educated	28 (10.2)	39 (6.1)	23 (5.2)	
		Intermediate school educated	27 (9.9)	60 (9.4)	31 (7)	
		Secondary school educated	50 (18.2)	212 (33.4)	136 (30.9)	
		Bachelor graduate	36 (13.1)	114 (18)	85 (19.3)	
		Postgraduate	26 (9.5)	127 (20)	103 (23.4)	
Husband employment	150 (54.7)	546 (86)	362 (82.3)	< 0.001		
Perinatal outcomes	SVD	200 (74.1)	510 (80.3)	256 (58.6)	< 0.001	
	Emergency C/S	65 (24.1)	103 (16.2)	77 (17.6)		
	Elective C/S	5 (1.9)	22 (3.5)	104 (32.8)		
	Car delivery	5 (1.9)	2 (0.3)	0	0.002	
	Antepartum haemorrhage	4 (1.6)	15 (2.4)	5 (1.1)	0.321	
	Maternal ICU admission	11 (4.3)	11 (4.3)	3 (0.7)	< 0.004	
	Home delivery	2 (0.8)	2 (0.3)	1 (0.2)	0.49	

Data are presented as n (%) unless otherwise specified.

ANC: antenatal care; C/S: cesarean section; ICU: Intensive Care Unit; IQR: interquartile range; SAR: Saudi Arabian Riyal; SD: standard deviation; SVD: spontaneous vaginal deliveries.

Table 2. Neonatal outcomes among patients with different antenatal care (ANC) status.

Variable	Mothers with no ANC (n = 274)	Mothers with inadequate ANC (n = 635)	Mothers with adequate ANC (n = 440)	p-value
Sex (male)	134 (49.1)	333 (52.6)	241 (54.9)	NS
Birth weight (g), mean ± SD	2,712 ± 803	2,923 ± 630	2,992 ± 585	< 0.001
Gestational age (weeks), mean ± SD	37.4 ± 3.8	38.3 ± 2.8	38.6 ± 2.2	< 0.001
Prematurity (< 37 weeks)	65 (23.7)	88 (13.8)	44 (10)	< 0.001
LBW	82 (30.3)	112 (17.7)	70 (16)	< 0.001
SGA < 10 th percentile	14 (5.1)	6 (0.9)	6 (1.4)	< 0.001
RDS	40 (14.6)	40 (6.3)	13 (3)	< 0.001
Need for mechanical ventilation	29 (10.6)	26 (4.1)	16 (3.6)	< 0.001

Data are presented as n (%) unless otherwise specified.

ANC: antenatal care; LBW: low birth weight; NS: not significant; RDS: respiratory distress syndrome; SGA: small for gestational age; SD: standard deviation.

Table 3. Regression analysis for risk factors associated with deliveries with no antenatal care (ANC) compared to deliveries with adequate ANC (model A of the analysis).

Variables	OR and 95% CI	p-value
Age	0.99 (0.95-1.03)	0.55
Nationality (non-citizen)	2.4 (1.51-3.81)	< 0.001
Parity	1.15 (1.02-1.31)	0.023
Mother employment	0.89 (0.49-1.61)	0.70
Husband employment	1.41 (0.76-2.62)	0.28
Educational status	1.58 (0.99-2.53)	0.06
Family income less than 5,000 SAR	2.71 (1.35-5.45)	0.005

CI: confidence interval; OR: odds ratio; SAR: Saudi Arabian Riyal.

Table 4. Odd ratios (ORs) of selected outcomes among mothers with different antenatal care (ANC) status (model C of the analysis).

Variables	Adequate ANC, n (%)	Inadequate ANC, n (%)	No ANC, n (%)	No ANC vs. adequate ANC		Inadequate ANC vs. adequate ANC	
				OR	aOR ^a	OR	aOR ^a
Maternal ICU admission	3 (0.7)	11 (1.7)	11 (4.3)	6.4 (1.8-23)	5.3 (1.2-23)	2.5 (0.7-9.2)	2.6 (0.7-10.3)
Congenital anomalies	17 (3.9)	9 (1.4)	18 (6.6)	1.7 (0.9-3.6)	1.3 (0.6-2.7)	1.7 (0.3-9.0)	1.5 (0.3-8.0)
LBW	70 (16)	112 (17.7)	82 (30.3)	2.3 (1.6-3.3)	2.0 (1.2-3.3)	1.1 (0.8-1.6)	1.0 (0.7-1.5)
NICU	75 (17)	92 (14.5)	89 (32.5)	2.3 (1.6-3.3)	2.0 (1.3-3.2)	0.9 (0.6-1.1)	0.9 (0.6-1.3)
Neonatal death	5 (1.1)	12 (1.9)	17 (6.2)	5.8 (2-15.8)	3.6 (1.3-10)	1.7 (0.6-4.8)	1.45 (0.5-4.3)
IUFD	2 (0.5)	5 (0.8)	11 (4)	9 (2.0-41)	7 (1.5-32)	1.7 (0.3-9.0)	1.5 (0.3-8.0)

Data are presented as n (%).

ANC: antenatal care; aOR: adjusted odds ratio; ICU: Intensive Care Unit; IUFD: intrauterine fetal death; LBW: low birth weight; NICU: Neonatal Intensive Care Unit; OR: odds ratio.

^aAdjusted for maternal disease, age, parity, premature birth.

Discussion

The significantly poorer fetomaternal outcomes associated with unbooked deliveries were clearly evident in this study. This study aimed to compare maternal and neonatal morbidity and mortality across 3 groups: those with adequate, inadequate, and no ANC. Moreover, we explored factors contributing to the likelihood of unbooked deliveries.

Our findings revealed that unbooked deliveries were associated with higher rates of neonatal death and adverse outcomes. Risk factors significantly associated with the absence of ANC included low family income, non-citizenship, and high parity. The association between non-citizen status and lack of ANC suggests systemic barriers faced by migrant populations in accessing healthcare services. Additionally, a higher parity risk factor suggests that women who have had multiple pregnancies are less likely to seek out prenatal care. Moreover, economic factors also played a role, as mothers with family incomes below 5,000

Saudi Arabian Riyal (SAR) were significantly more likely to lack access to ANC.

Similar to our study, research conducted in Riyadh reported a 30% adequate ANC rate [13]. Nonetheless, in our study, mothers without ANC had a higher tendency to be older, which contradicts the findings of 2 studies conducted in Nigeria and the United Kingdom, in which mothers with adequate ANC had a higher tendency to be older, and mothers with no ANC had a higher tendency to be younger [10, 14]. However, our findings aligned with the Nigerian study regarding higher rates of preterm births in mothers without ANC. Other studies have also reported associations between lack of ANC and factors such as low family income, low educational attainment, and mother unemployment [14-16]. Neonatal outcomes were worse among those with unbooked deliveries as compared with booked deliveries [17-21].

Our findings reinforce the importance of attending ANC visits throughout pregnancy and highlight the benefits of planned deliveries under the supervision of health care providers. The

maternal and neonatal morbidity outcomes were notably, as evident in previous studies, in favor of having ANC. Based on our study findings, the non-significant difference in outcomes between mothers with adequate and inadequate ANC suggest that even minimal ANC visit improves maternal and neonatal health. However, the WHO recommends at least 8 ANC visits to optimize maternal and child health, aligning with broader evidence supporting comprehensive prenatal care.

To our knowledge, our results regarding factors associated with receiving no ANC and the fetomaternal outcomes are comparable with findings in the literature; thus, our response to the research question is satisfactory.

We could not find any related literature about the group of mothers who were labeled as having inadequate ANC, and we could not tell if they were booked or not. We believe that some of them did receive ANC, but because the pregnancy was thought to be complicated, they chose to go to the ED when labor began and deliver in the hospital. Moreover, their outcomes were better than those with no ANC and unbooked deliveries and similar to those with adequate ANC.

A limitation of our study is that the study area was single-centered; therefore, the findings are limited to our center. Future studies are recommended including multicenter national level to identify correctable factors and use more validated tools to assess the role of antenatal risk scores and multidomain socioeconomic scores [22, 23]. Moreover, long-term follow-up is recommended for affected newborns to assess neurodevelopmental outcomes and healthcare resource utilization, particularly in the post-COVID-19 era [24-26].

Conclusion

Deliveries among mothers without ANC were associated with significantly higher maternal morbidities including more ICU admissions, associated with some risk factors including non-citizenships, higher parity, and lower socio-demographic status. Those deliveries had a higher neonatal morbidity rate, including more NICU admissions, more LBW babies, more neonatal deaths, and more IUFDs. and the need for mechanical ventilation. However, the demographics and morbidities of the other 2 groups with adequate and inadequate ANC were similar to some extent. These results demonstrate the significance of ANC, at least according to WHO criteria. We emphasize

the importance of ANC and recommend that it be improved in government hospitals and used in quality improvement for policy makers. Future initiatives to raise awareness among pregnant women should be encouraged to ensure proper guidance and management for mothers and babies.

Acknowledgments

We want to acknowledge Dr. Ahmed Abdulmajeed Abed, Dr. Sayeda Nilofer Jahan, and Dr. Amal Mosaed Alrefaie for their outstanding effort in data collection and data entry.

Ethics approval and consent to participate

The study was approved by the Ministry of Health IRB committee (A00448) for research (00782). All participants on whom the research has been carried out have given their voluntary and informed written consent, and when participants were unable to give such consent, surrogate consent was obtained.

Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration of interest

The Authors declare that they have no competing interests. The Authors report no funding to declare.

References

1. Tunçalp Ö, Were WM, MacLennan C, Oladapo OT, Gülmezoglu AM, Bahl R, Daelmans B, Mathai M, Say L, Kristensen F, Temmerman M. Quality of care for pregnant women and newborns – the WHO vision. *BJOG*. 2015;122(8): 1045-9.
2. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. Available at: <https://www.who.int/publications/i/item/9789241549912>, date of publication: November 2016, last access: May 2025.
3. Carroli G, Rooney C, Villar J. How effective is antenatal care in preventing maternal mortality and serious morbidity? An overview of the evidence. *Paediatr Perinat Epidemiol*. 2001;15(s1): 1-42.
4. World Health Organization. WHO recommended interventions for improving maternal and newborn health: integrated management of pregnancy and childbirth. Available at: https://www.who.int/publications/i/item/WHO_MPS_07.05, date of publication: May 2007, last access: May 2025.
5. Watterson JL, Walsh J, Madeka I. Using mHealth to improve usage of antenatal care, postnatal care, and immunization: a

- systematic review of the literature. *Biomed Res Int.* 2015;2015(1):153402.
6. World Health Organization. World health statistics 2012. Available at: <https://apps.who.int/iris/handle/10665/44844>, last access: January 2022.
 7. Ghimire PR, Agho KE, Akombi BJ, Wali N, Dibley M, Raynes-Greenow C, Renzaho AM. Perinatal mortality in South Asia: systematic review of observational studies. *Int J Environ Res Public Health.* 2018;15(7):1428.
 8. Fagbamigbe AF, Idemudia ES. Assessment of quality of antenatal care services in Nigeria: evidence from a population-based survey. *Reprod Health.* 2015;12:1-9.
 9. Ministry Of Health, Kingdom of Saudi Arabia. Statistical Yearbook. Available at: <https://www.moh.gov.sa/en/Ministry/Statistics/book/Pages/default.aspx>, last access: January 2022.
 10. Owolabi AT, Fatusi AO, Kuti O, Adeyemi A, Faturoti SO, Obiajuwa PO. Maternal complications and perinatal outcomes in booked and unbooked Nigerian mothers. *Singapore Med J.* 2008;49(7):526-31.
 11. Adelusi B, Al-Nuaim LA, Chowdhury N, Abotalib Z, Moghraby S, Kangave D. Socio-demographic characteristics of the “unbooked mother”. *West Afr J Med.* 1999;18(3):191-5.
 12. Sinha M, Goel JK, Sah S, Goel R, Chaurasia R. Severe acute maternal morbidity: study of epidemiology and risk factors. *Int J Reprod Contracept Obstet Gynecol.* 2016;5(7):2141-6.
 13. Al-Mouqdad M, Abdelrahim A, Alodhaidan NA, Sumaily HH, Khalil TM, Asfour Y, Asfour SS. Antenatal care of mothers and morbidity and mortality disparities among preterm Saudi and non-Saudi infants less than or equal to 32 weeks’ gestation. *Ann Saudi Med.* 2020;40(4):290-7.
 14. Tucker A, Ogutu D, Yoong W, Nauta M, Fakokunde A. The unbooked mother: a cohort study of maternal and foetal outcomes in a North London Hospital. *Arch Gynecol Obstet.* 2010;281:613-6.
 15. Adhikary A, Begum A, Joty FS, Sarker NR, Akhter T. Pregnancy outcome between booked and unbooked cases in a tertiary level hospital. *J Shaheed Suhrawardy Med Coll.* 2017;9(2):43-8.
 16. Hamilton RA, Perlmann T, de Souza JJ. The unbooked patient. Part I. Reasons for failure to attend antenatal clinics. *S Afr Med J.* 1987;71(1):28-31.
 17. Briggs ND. Maternal death in the booked and unbooked patients: University of Port Harcourt Teaching Hospital experience. *Trop J Obstet Gynaecol.* 1988;1(1):26-9.
 18. Owolabi AT, Fatusi AO, Kuti O, Adeyemi A, Faturoti SO, Obiajuwa PO. Maternal complications and perinatal outcomes in booked and unbooked Nigerian mothers. *Singapore Med J.* 2008;49(7):526.
 19. John CO, Alegbeleye JO. Pregnancy outcome in unbooked mothers at a tertiary health institution, South-South, Nigeria. *Niger J Med.* 2016;25(3):294-300.
 20. Sharma S, Sidhu H, Kaur S. Analytical study of intrauterine fetal death cases and associated maternal conditions. *Int J Appl Basic Med Res.* 2016;6(1):11-3.
 21. Manape M, Saleu G, Valley L. Outcome of infants born to unbooked mothers: a short report from Goroka General Hospital, Eastern Highlands province, Papua New Guinea. *P N G Med J.* 2011;54(3/4):185-8.
 22. Al-Hindi MY, Aljuhani H, Alnajjar AR, Alessa S, Alqurashi M, Faden YA. Examining the association between parental socioeconomic status and preterm birth using multidomain social determinants scale in a tertiary care center in Saudi Arabia. *Cureus.* 2020;12(9):e10506.
 23. Al-Hindi MY, Al Sayari TA, Al Solami R, Al Baiti AK, Alnemri JA, Mirza IM, Alattas A, Faden YA. Association of antenatal risk score with maternal and neonatal mortality and morbidity. *Cureus.* 2020;12(12):e12230.
 24. Alharbi AS, Alzahrani M, Alodayani AN, Alhindi MY, Alharbi S, Alnemri A. Saudi experts’ recommendation for RSV prophylaxis in the era of COVID-19: Consensus from the Saudi Pediatric Pulmonology Association. *Saudi Med J.* 2021;42(4):355-62.
 25. Al-Hindi MY, Almahdi BH, Alasmari DA, Alwagdani RK, Hunjur WM, Khalel AF, AlQurashi MA, Almahdi B, Alasmari D. Screening for neurodevelopmental delay for preterm very low birth weight infants at tertiary care center in Saudi Arabia. *Cureus.* 2021;13(12):e20092.
 26. Al-Hindi MY, Alshamrani ZM, Alkhotani WA, Albassam AB, Tashkandi AM, AlQurashi MA. Utilization of health-care resources of preterm infants during their first 2 years of life after discharge from neonatal intensive care unit. *J Clin Neonatol.* 2021;10(1):37-44.