Effect of Antenatal Care On Fetal, Neonatal And Maternal Outcomes: A Retrospective Cohort Study

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Abstract

Purpose:

The aim of this study is to evaluate the effect of antenatal care (ANC) on pregnant women in regards to maternal and perinatal outcomes, with attention being made to the difference between high and low risk mothers. Furthermore, the study aims to assess rate of complications in regards to number of ANC visits

Patients and methods:

This retrospective cohort study was conducted in the department of Obstetrics and Gynecology at King Abdulaziz Medical City, Saudi Arabia, between 2011 and 2013. Four hundred mothers were divided into two groups, whereas Group 1 had antenatal booking and group 2 didn't. Participants were classified based on their antenatal risks into high, intermediate or low risk. The chi-squared test or Fisher exact test was used to compare differences in categorical variables.

Results:

Antepartum complications were significantly higher for booked compared to un-booked mothers ($p < 0.001$). Booked mothers were less likely to be anemic ($p = 0.02$). There was higher number of babies diagnosed with congenital anomalies in the booked group ($p = 0.015$). No significant difference was found in antepartum, fetal and neonatal complications between the booked mothers with four or less ANC visits and those with more than four. No significant difference was found between the number of ANC visits for mothers with low risk and those with intermediate/high risk ($p = 0.240$).

Conclusion:

Antepartum and congenital anomalies were higher in booked mothers. No difference was found in antepartum, fetal and neonatal complications with four or less or more than four ANC visits.

INTRODUCTION

Antenatal Care (ANC) is an opportunity for clinicians to educate, counsel, screen and treat pregnant mothers. The recommended number, content and outcomes of ANC visits has persisted to be a challenge and controversy in the published literature.[1-4]

ANC is vital to some mothers and their fetuses as life-threatening complications may be prevented and a number of interventions can be offered to positively influence the well being of both mother and baby.[5] ANC visits were shown to reduce maternal mortality and morbidity and rates of pre-term labor (PTL).[4] Un-booked mothers or those who did not have any ANC visit during pregnancy are at higher risk of antepartum hemorrhage (APH), postpartum hemorrhage (PPH), anemia, preeclampsia, eclampsia, ruptured uterus, sepsis and surgical delivery when compared to booked mothers.[4, 6, 7]

Babies of un-booked mothers are at higher risk to develop asphyxia and infection.[8] They are also at higher risk to develop intrauterine fetal death (IUFD), early neonatal death (NND), intrauterine growth restriction (IUGR) and low birth weight (LBW).[9] Furthermore, early initiation of prenatal care may reduce the risk of congenital anomalies, the exposure to

unnecessary irradiation, drugs and early pregnancy infections.[10]

All pregnant mothers, irrespective of their risk classification, are advised to attend antenatal clinics regularly at minimum recommended intervals.[4] Socio-demographic and reproductive factors may influence the utilization of ANC including social status, family income, availability and distance of medical services, maternal age, age at marriage, parity, traditional beliefs and customs, level of education and health awareness of the couple and their occupations.[11] In under-resourced settings, the number of mothers who need ANC is far greater than the capacity of the provided health-care services.[4, 12] In such situations, health-care workers are less likely to provide sufficient chances and time to each pregnant mother, and hence the quality and frequency of ANC is compromised.[4, 12]

A world health organization (WHO) study has recommended a reduced ANC scheme based on four goal-oriented visits.[3] This conservative method of ANC was found to be as effective as other schemes that were based on a higher number of visits. Since the WHO work that has recommended four ANC visits for low risk pregnancies, there was a debate regarding the optimal number, content and timing of ANC visits for all pregnancies in general and for high-risk pregnancies specifically. A recent Cochrane review has compared the effects of antenatal care programs with reduced visits for low-risk women with standard care.[1] The authors have concluded that in settings with limited resources where the number of visits is already low, reduced visits antenatal programs are associated with an increase in perinatal mortality.[1] Moreover, it was noted that women prefer the standard visits schedule. However, the previous result is applied to low risk pregnant mothers only. Some of the ANC models implement high number of visits reaching sixteen where the models don't differentiate between high and low risk mothers and don't consider the cost effectiveness and efficiency of the practiced care.[13, 14]

In Saudi Arabia (SA) ANC is provided to the mothers during their pregnancies but the majority of them have either suboptimal number of visits or variable content of care.[15] On the other hand, a large number of Saudi pregnant mothers are considered at high risk due to high prevalence of grand-multiparity, obesity, diabetes mellitus, repeated cesarean section and others.[16,17] Therefore, there is a need for Saudi women antenatal risk stratification and enforcement of properly tailored goal oriented ANC.

The aim of this study was to estimate the rate of maternal and neonatal complications in correlation to the woman's booking status. Furthermore, the study aims to assess rate of complications in regards to number of ANC visits. This study also aims to assess the safety of implementing the recommended four ANC visits by the WHO; four visits throughout pregnancy versus a visit every 4 weeks for low risk pregnant mothers.

MATERIALS AND METHODS

We conducted a retrospective cohort study at the department of Obstetrics and Gynecology; National Guard health affairs (NGHA), King Abdulaziz medical city (KAMC), Riyadh, SA. KAMC is a 1000 bed tertiary health care center were about 8000 women deliver annually. The center is attached to primary and secondary care clinics where mothers can receive their ANC visit and are referred to the tertiary center clinics when needed. KAMC has approved risk classification for all pregnant women (appendix 1). Women with low risk (LR) usually continue follow up in the primary/secondary centers and are referred to the tertiary center for delivery at term. Intermediate risk (IR) women are referred at booking to the tertiary care center for opinion and based on the consultant obstetrician judgment; they either continue the follow up in the tertiary center or are referred back with recommendation to the referring physicians. Finally, women with high risk (HR) are immediately referred for follow up in the tertiary care center. All women following in the primary and secondary clinics are referred to the tertiary center at tem.

ANC program content: At KAMC, pregnant women usually have their first ANC visits at the primary/secondary care clinics once they request it. Their medical and obstetric histories are taken in details, a full physical examination, and booking investigations are sent for them. Investigation includes, complete blood count, type and screening, hepatitis screening, rubella antibodies, and fasting blood sugar. All low risk pregnant mothers have USS at 22-24 weeks for anomaly screening and fetal size and they have a 2 hours post 75 grams glucose blood sugar test at 24-28 weeks. Based on the results of the investigations, pregnant mothers are stratified according to the scoring system into LR, IR or HR. LR pregnant women continue to have their visits in the primary care clinics, unless any complication develop during follow up. They are usually seen once in their first trimester, followed by monthly visits till 32 weeks then every 2 weeks till 38 weeks, after that they are usually seen weekly till delivery. IR/HR Pregnant mothers' visits frequency and

investigations are individualized according to their risk factors.

A medical record search for all women delivered at KAMC between "January 2011 and December 2013" was done. The total number of delivered women during this period was about 24,000 mothers. Every woman delivering in KAMC is recorded in the delivery book located in the Labor and Delivery ward. Information recorded includes the woman's name, medical record number, age, parity, any high-risk factors, the medical record number of her newborn, newborn's weight, Apgar score, arterial and venous pH, and where the newborn was admitted. We calculated the sample size for this study based on single population proportion equation. By assuming 5% significance, 80% power, confidence level of 95%, and incidence of preterm labor of 7%, the minimum sample size is 311. A sample size of 400 mother/participants who delivered at KAMC within study period of time were selected to account for incomplete records. Assigned participants were divided into two main research groups, booked mother (N=200), and un-booked mothers (N=200). Almost all mothers were booked and we had to extend our study to 3 years to include our number of 200 un-booked mothers. We defined booked mother as those who have attended KAMC, ANC clinics for at least one time during the concerned pregnancy. The selected participants were also classified into high risk (HR), intermediate risk (IR) and low risk (LR) based on the approved classification. Booked women's data was reviewed and the number of ANC visits they attended was registered. Participants' medical records paper and electronic files were screened for all relevant fetal, neonatal and maternal outcomes.

Antenatal collected data included; mothers age, booking status, gestational age at booking, any concurrent medical illnesses, number of previous cesarean section (CS) if any, antenatal ultrasound scanning (USS) for dating, gestational age, and abnormalities. Data on antenatal complication such as gestational diabetes mellitus (GDM) defined as "new onset or diagnosis of carbohydrate intolerance during pregnancy"; Gestational hypertension (GHTN) defined as "new-onset elevations of blood pressure after 20 weeks of gestation, often near term, in the absence of proteinuria"; Pre-eclampsia (PET); antepartum hemorrhage (APH) defined as "bleeding from or in to the genital tract, occurring from 24+0 weeks of pregnancy and prior to the birth of the baby"; anemia defined as "hemoglobin concentration (Hb) < 110 g/L" and others were collected.

Women data at time of delivery included their gestational age at presentation, reason for presentation, presence of labor pain, leaking membranes, decreased fetal movements, etc. Information on their cardio-toco-graphy (CTG) at presentation, being normal or abnormal, type of abnormality, hemoglobin at presentation and discharge, blood transfusing, admission, reasons for admission, and length of hospital stay were recorded.

Moreover, we collected intra-partum data concerning womens' progress of labor, mode of delivery and indications for interventions (if any). Immediate, short- and long-term postpartum complications data were gathered.

Fetal data included: birth weight, sex, Apgar score, cord pH at birth, presence of congenital abnormality, need for resuscitation, place of admission, length of hospital stay, perinatal morbidity, and perinatal mortality.

Data were analyzed using the IBM SPSS Statistics for Windows version 22.0 (IBMCorp, Armonk, NY, USA). Descriptive statistics are presented as the means ± standard deviations for numerical variables and as frequencies with percentages for categorical variables. The chi-squared test or Fisher exact test was used to compare differences in categorical variables between the groups. An independent samples t-test was used to compare continuous data. Odds ratios (OR) with 95% confidence intervals (CI), adjusted for age and medical illnesses were calculated using multivariate logistic regression. A p-value < 0.05 was considered to be statistically significant. This study was approved by the Institutional Review Board of the King Abdullah International Medical Research Centre.

RESULTS

The demographic characteristics of the study participants are shown in Table 1. Older mothers were more likely to attend ANC clinics with a mean age of 27.77 ± 6.1 years compared to 25.95 ± 6.7 years for un-booked mothers (p =0.005). Booked mothers had also significantly more medical illnesses compared to those un-booked including diabetes, hypertension, hypothyroidism, asthma and others (18% vs 9%, p =0.008). There was no significant difference between booked and un-booked mothers in terms of other studied parameters, such as their parity, body mass index (BMI), nationality, risk classification, and previous CS deliveries.

Table 2 presents a comparison between booked and un-booked mothers ante-partum, intra-partum and post-partum complications. The results showed that antepartum complications were significantly higher in booked mothers

compared to un-booked mothers (31.5% vs 15.5%, p <0.001). Booked mothers were less likely to be anemic at presentation to the labor unit; with 16.5% of booked mothers had hemoglobin level below 11 g/dl compared to 83.5% with hemoglobin concentration above 11 g/dl (p =0.02).

Un-booked mothers were more likely to deliver via a spontaneous vaginal delivery compared to booked mothers (78.5% vs 67.5%, p =0.013). Booked mothers had also more short-term postpartum complications. Their length of hospital stay was longer and they had more elective hospital admissions (2.6 ± 2.3 days vs 2.1 ± 1.5 days, p= 0.001).

Table 3 shows fetal and neonatal complications. No statistically significant differences were found between booked and un-booked mothers in terms of mean birth weight, low birth weight, preterm deliveries, Apgar scores at 1 and 5 minutes, cord pH at birth, need for resuscitation, place of admission, and length of hospital stay. There was no significant difference in neonatal complications; including respiratory distress syndrome, jaundice, asphyxia, intra-ventricular hemorrhage, necrotizing enterocolitis, stillbirth, sepsis, early neonatal death, and others. Babies born to booked mothers were more likely to be diagnosed with congenital anomalies than those born to un-booked mothers (18.5% vs 10%, p= 0.015).

We further subdivided booked mothers into those with four antenatal visits or less and to those with more than four antenatal visits, as this was the proposed number of visits from the WHO antenatal care randomized controlled trial (6). We found no statistically significant difference between antepartum complications between the two groups. In addition, there were no significant differences between the two groups in regards to gestational age at presentation, reason for presentation, cardio-toco-gram abnormalities, hemoglobin at presentation, place of admission, mode of delivery, indication of surgical delivery, postpartum complications, estimated blood loss, and length of hospital stay.

Comparison was also made between booked mothers who had four antenatal visits or less and to those with more than four antenatal visits in regards to perinatal complications. No significant differences were found between the two groups in mean birth weight, low birth weight, Apgar score at 1 and at 5 minutes, cord pH at birth, congenital anomalies, need for resuscitation, place of admission, perinatal complications, and length of hospital stay.

To compare maternal complications based on risk factors classifications, we subdivided the study booked participants into two groups (LR and IR-HR). We utilized the risk classification form approved by the institution (Table 4). Antepartum complications occurred more in IR/HR mothers (47.7% vs 14.2%, p <0.001). However, there was no significant postpartum difference between the two groups.

LR and IR/HR mothers were also compared for fetal and neonatal complications (Table 5). Low birth weight was significantly different between the two groups. IR/HR mothers had 33.3% low birth weights compared to 9.7% in the LR group (OR 4.7; 95% CI 2.7–8.1, p <0.001). Preterm delivery was also significantly higher in the IR/HR group compared to the LR group (34.2% vs 5.5%, p <0.001). Higher risk of neonatal complications was noted in the IR/HR group (41.4% vs 28.4%, p= 0.012); these included jaundice, respiratory distress syndrome, stillbirth, early neonatal death and others.

Table 1

Characteristics of study participants classified into booked and un-booked mothers.

Variable	Un-booked (N=200)	Booked (N=200)	P value
Age (mean±SD)	25.95±6.7	27.77±6.1	.005
Age N(%)			
<35 y	178(89)	167(83.5)	.110
≥35 y	22(11)	33(16.5)	
Parity N(%)			
Para 0	101(50.5)	100(50)	.814
Para 1-4	78(39)	75(37.5)	
Para ≥5	21(10.5)	25(12.5)	
BMI (mean±SD) kg/m2	31.9±11.1	31.7±10.6	.811
Nationality N(%)			
Saudi	194(97)	194(97)	.651
Non-Saudi	6(3)	6(3)	
Risk classification N(%)			
Low	141(70.5)	148(74)	.554
Moderate	38(19)	37(18.5)	
High	21(10.5)	15(7.5)	
Medical illnesses N (%)	18(9)	36(18)	.008
Diabetes	0	3(1.5)	
Hypertension	0	1(.5)	
Hypothyroid	2(1)	6(3)	
Asthma	9(4.5)	12(6)	
Others	7(3.5)	14(7)	
Previous CS N(%)	17(8.5)	19(9.5)	.727

Abbreviations: BMI; body mass index, CS; cesarean section, N; number, Y; years, SD; Standard deviation.

Table 2a

Comparison between booked and un-booked mothers concerning ante-partum, intra-partum and post-partum complications.

Variable	Un-Booked (N=200)	Booked (N=200)	OR	95% CI	P value
Ante partum complications, N (%)	31(15.5)	63(31.5)	.4	.3-.7	<.001*
Anemia	0	10(5)			
Gestational diabetes mellitus	1(.5)	15(7.5)			
Gestational hypertension	0	7(3.5)			
Antepartum hemorrhage	0	1(.5)			
Mild Preeclampsia	0	1(.5)			
Severe Preeclampsia	1(.5)	4(2)			
Pre-term labor	30(15)	24(12)			
Intrauterine growth restriction	0	3(1.5)			
Chorioamionitis	0	1(.5)			
Others	0	13(6.5)			
GA at presentation, mean±SD	38.0±3.9	38.4±2.9			.258
GA at presentation, N (%)					
<37 wks.	30(15)	24(12)			.380
≥37 wks.	170(85)	176(88)			
Reason for presentation, N (%)					
Per vaginal leaking	44(22)	35(17.5)			.258
Decreased fetal movement	6(3)	7(3.5)			.778
Labor	161(80.5)	156(78)			.538
Other	18(9)	35(17.5)			.212
CTG at presentation, N (%)					
Normal	189(94.5)	194(97)			.215
Abnormal	11(5.5)	6(3)			

Table 2b

Comparison between booked and un-booked mothers concerning ante-partum, intra-partum and post-partum complications. (Cont'd)

Hb at presentation, mean±SD g/dl	11.9±1.5	12.3±1.4			.008*
Hb at presentation					
<11 g/dl	52(26)	33(16.5)	1.8	1.1-2.9	.020*
≥11 g/dl	148(74)	167(83.5)			
Place of admission, N (%)					
Labor and delivery unit	178(89)	146(73)	2.9	1.7-5.1	<.001*
Ward	22(11)	54(27)			
Mode of delivery, N (%)					
Spontaneous vaginal delivery	157(78.5)	135(67.5)	1.8	1.1-2.8	.013*
Operative and caesarean section	43(21.5)	65(32.5)			
EBL, mean±SD mls	319.8±230.5	319.0±187.8			.972
Postpartum complications, N (%)	25(12.5)	20(10)			.429
Immediate	24(96)	15(75)			.074
Short	1(4)	6(30)			.057
Long term	2(8)	2(10)			.909
Length of hospital stay, mean±SD	2.1±1.5	2.6±2.3			.001*
Length of hospital stay, N (%)					
≤2 days	152(76)	128(64)	1.8	1.2-2.8	.009*
>2 days	48(24)	72(36)			

Abbreviations: GA; gestational age, CTG; cardiotocograph, Hb; hemoglobin, EBL; estimated blood loss, PPH; postpartum hemorrhage, SD; standard deviation, OR; odds ratio, CI; confidence interval.

Table 3

Comparison between booked and un-booked mothers concerning perinatal complications

Variable	Un-Booked (N=200)	Booked (N=200)	OR	95% CI	P-value
Birth weight, mean±SD (g)	2997.1±664.3	2991.4±626.1			.493
Low birth weight	36(18)	29(14.5)			.343
Apgar score					
At 1 min <7	20(10)	17(8.5)			.605
At 5 min <7	5(2.5)	4(2)			.736
Cord pH at birth, N (%)					
<7	37(18.5)	42(21)			.530
≥7	163(81.5)	158(79)			
Congenital anomaly, N (%)	20(10)	37(18.5)	.5	.2-.8	.015*
Need for resuscitation, N (%)	17(8.5)	16(8)			.856
Place of admission, N (%)					
Regular nursery	179(89.5)	179(89.5)			.823
ICN	10(5)	8(4)			
NICU	11(5.5)	13(6.5)			
Perinatal complication, N (%)					
No	137(68.5)	135(67.5)			.830
Yes	63(31.5)	65(32.5)			
Length of hospital stay, N (%)					
≤2 days	122(61)	114(57)			.416
>2 days	78(39)	86(43)			

Abbreviations: ICN; intermediate care unit, NICU; neonatal intensive care unit, SD; standard deviation, OR; odds ratio, CI; confidence interval

Table 4

Maternal outcome between booked LR mothers and those with IR/HR

Variable	IR/HR (N=111)	LR (N=289)	OR	95%CI	P-value
Antepartum complications, N (%)	53(47.7)	41(14.2)	5.5	3.4-9.1	<.001*
Anemia	6(5.4)	4(1.4)			
GDM	6(5.4)	10(3.5)			
GHTN	5(4.5)	2(.7)			
APH	1(.9)	0			
Mild PET	0	1(.3)			
Severe PET	3(2.7)	2(.7)			
PTL	38(34.2)	16(5.5)			
IUGR	1(.9)	2(.7)			
Chorioamnionitis	0	1(.3)			
Others	6(5.4)	7(2.4)			
Hb at presentation (g/dl), N (%)					
<11 g/dl	27(24.3)	58(20.1)			.358
≥11 g/dl	84(75.7)	231(79.9)			
Postpartum complications, N (%)					
No	96(86.5)	259(89.6)			.375
Yes	15(13.5)	30(10.4)			
Immediate	15(13.5)	24(8.3)			.561
Short	3(2.7)	4(1.4)			.063
Long term	1(.9)	3(1)			.711

Abbreviations: Hb; hemoglobin, OR; odds ratio, CI; confidence interval, LR; low risk, IR; intermediate risk, HR; high risk

Table 5

Neonatal complications in low and intermediate/high risk pregnant women

Variable	IR/HR (N=111)	LR (N=289)	OR	95%CI	P-value
Low birth weight, N (%)	37(33.3)	28(9.7)	4.7	2.7-8.1	<.001*
Preterm delivery, N (%)	38(34.2)	16(5.5)	8.9	4.7-16.8	<.001*
Apgar score, N (%)					
At 1 min.<7	15(13.5)	22(7.6)			.068
At 5 min. <7	4(3.6)	5(1.7)			.270
Cord pH at birth, N (%)					
<7	91(82)	230(79)			.590
≥7	20(18)	59(20.4)			
Congenital anomaly, N (%)	14(12.6)	43(14.9)			.562
Perinatal complication, N (%)	46(41.4)	82(28.4)	1.8	1.1-2.8	.012*

Abbreviations: OR, odds ratio; CI, confidence interval; LR, low risk; IR, intermediate risk; HR, high risk

DISCUSSION

It is difficult to argue the importance of ANC, however the number of visits and the quality of care provided have been areas of research and controversy.[1-4] Until today a clear antenatal program has yet to be evolved in Saudi Arabia; to improve maternal and fetal outcomes and to better use recourses. The aim of this study is to estimate the rate of various maternal, fetal and neonatal morbidities and mortalities that are occurring for both high and low risk pregnant mothers in relation to their booking status. It also aims to assess the safety of implementing the recommended four ANC visits by the WHO; 4 visits throughout pregnancy for low risk pregnant mothers.

We found that booked mothers were more likely to have medical illnesses including diabetes, hypertension, hypothyroidism and asthma (p =0.008). They are also at higher risk to develop antepartum complications (p <0.001). This is probably because mothers with chronic disease were more conscious about the effect of the diseases on their pregnancies. Despite the known effect of ANC in reducing pregnancy complications, these women had higher risk for complications.[18] This is in contrast to what Owolabi et al[19] have found for Nigerian un-booked mothers who developed antepartum hemorrhage 6 times more (OR 5.96; 95% CI 2.53–14.29, p < 0.001), and preeclampsia/eclampsia almost two times more than the booked mothers (OR 1.71; 95% CI 1.15–2.55, p < 0.001). It appears for our studied participants that the presence of tertiary care services and advanced medical care did not assist in reducing the feto-maternal and neonatal complications.[20] This is except for anemia where booked mothers are less likely to be anemic with hemoglobin less than 11 g/dl.[19] The identification of HR mothers, preferably by preconception care programs, may lead to better care for these mothers, with a multidisciplinary approach if needed.[21] The quality of ANC is a valuable preventive intervention that needs to be widely available, accessible and affordable to all pregnant women.[22] On the other hand, standard ANC model has limited efficacy in reducing most maternal and perinatal complications. A more practical and effective ANC model for women at high-risk is needed.[23]

The number of attended ANC visits did not prove to be the most important factor affecting pregnancy outcomes; rather it is the woman's' risk factors and the presence of pre-pregnancy chronic diseases. The WHO has released a report aiming to improve practiced ANC in 2009. In this report, a recommendation to divide pregnant mothers receiving ANC

into three main categories; those who enjoy routine care, additional care or specialized ANC based on their risk factors. Additional care was suggested for pregnant mothers with urinary tract infection, vaginal infection, mild to moderate anemia, mothers required treatment for syphilis and pregnant mothers who needed support such as adolescents and women exposed to violence. Additional care is also required for women with HIV, uncomplicated malaria and women with mild to moderate opportunistic infections. Pregnant mothers are in need for specialized obstetrical if they have serious pregnancy complications including severe pre-eclampsia, eclampsia, anemia, infection with severe HIV, bleeding, complicated malaria and other severe medical complications.[24] However, the utilization of such classifications is not common across centers providing ANC services.[25] Moreover, the availability of the quality medical staff and venues needed for additional and specialized care categories of pregnant women is not usually available.[4,12] Moreover, a Cochrane review that compared the effects of antenatal care programs with reduced visits for low-risk women with standard care1 has contradicted the results of the WHO randomized controlled trial on reduced ANC visits for low risk pregnant mothers. Apart from women preference, perinatal mortality has increased significantly when reduced visit was implemented.[3] Therefore, risk classification and goal-oriented ANC service with adequate medical resources and women education should be the ultimate goal that we achieve to reduce fetal, neonatal and maternal morbidity and mortality.

Study limitations: This study was done on one population attending tertiary health care facility. The applicability of the results on other population may not be totally appropriate. However, the results shed light on possibilities of enhancing ANC services. Moreover, this is a retrospective study that may carry this type of studies problems. The authors tried to be as meticulous as possible in the data collection and reporting to reduce any observed error. Further research is needed to explore this management option.

CONCLUSION

ANC is a valuable method to screen pregnant mothers and identify pre-pregnancy and pregnancy complications. Despite the effort in identifying these risks, pregnancy complications are not always timely prevented or treated. Goal oriented ANC services with tailored program for each risk category could be the ultimate solution. Further research in this line of ANC services is needed.

ABBREVIATIONS:

ANC, antenatal care; PTL, preterm labor; APH, ante partum hemorrhage; PPH, postpartum hemorrhage; IUFD, intrauterine fetal death; NND, neonatal death; IUGR, intrauterine growth restriction; LBW, low birth weight; WHO, World Health Organization; SA, Saudi Arabia; NGHA, National Guard Hospital Affairs; KAMC, King Abdulaziz medical city; LR, low risk; IR, intermediate risk; HR, high risk; CS, cesarean section; USS, ultrasound scanning; GDM, gestational diabetes mellitus; GHTM, gestational hypertension; PET, Pre-eclampsia; Hb, hemoglobin; CTG, cardio-toco-graphy; OR, odds ratio; CI, confidence interval; BMI, body mass index.

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