Original Article

Prenatal Visits as Determinants of Maternal Hemoglobin Level and Neonatal Birth Weight in Tertiary Care Hospital

Aliya Nasim[1*], Farhan Saeed[1], Erum Saboohi[2], Farhat Ali[3], Naima Shah[4], Neelofar Ghaffar[1]

ABSTRACT

OBJECTIVE: To determine the association between the number of prenatal visits, maternal hemoglobin level, and birth weight of newborns.

METHODOLOGY: This cross-sectional study was conducted in the Department of Obstetrics & Gyneacology, Darul Sehat Hospital, Karachi, from July 2022 to January 2023. Females with any parity and full-term gestational age, regardless of mode of delivery, were included, while patients with preterm deliveries, miscarriages, and referred cases were excluded. The convenience non-probability technique is a method of sampling. A questionnaire containing demographic information, the number of antenatal visits, and the timing of the first visit to the hospital, as well as Hb level at the time of birth and fetal outcome, was introduced. The Chi-square test was used to assess the association between variables. SPSS 21 was used for data calculation.

RESULTS: 155 women were interviewed. The mean age of the respondents was 29±6.2 years, the mean parity was 2.2±1.07, and the mean number of visits was 6.3±3.2. 34% had eight or more visits. The mean gestational age at booking is 16.7±9.4 weeks, and the mean Hb level of the population is 10.1g/dl±1.2. 67% of the population is found to be anemic. A p-value of (0.04) indicates a relationship between the mother's hemoglobin level and prenatal visits. 52.3% of newborns were born with low birth weights.

CONCLUSION: Prenatal attendance is significantly associated with maternal hemoglobin level and neonatal birth weight. The number and quality of prenatal visits must be ensured at the national level to improve maternal and neonatal health.

KEYWORDS: Antenatal care, prenatal care, Low birth weight, Anemia, antenatal attendance, adverse pregnancy outcome, neonatal birth weight

INTRODUCTION

Prenatal care is a preventive healthcare system that refers to the medical attention provided by health professionals to pregnant women before birth to ensure optimal health conditions for both the mother and the neonate[1]. The WHO's goal is for every pregnant woman and newborn to have access to high-quality care during pregnancy, childbirth, and the postpartum period[2]. Despite this, an estimated 303,000 women die each year, and the majority of these deaths occur in less developed countries, and that can be avoidable[3]. Antenatal care is considered one of the fundamental requirements for reduction in maternal mortality, and its utilization has a significant impact on maternal and fetal outcomes. The World Health Organisation's (WHO) Technical Working Group (TWG) on Antenatal Care recommends that a normal pregnancy requires a minimum of 8 antenatal visits, compared to 4 trips in the past[4]. However, the quality of antenatal care depends on two key elements: the early initiation of pregnancy care and the minimum number of antenatal visits[5]. Pakistan is a country where the Maternal mortality ratio is still considered to be significantly high as compared to other subcontinent countries, which is around 186/100000 in the year 2019[6]. Unfortunately, the provision of standard antenatal care is much less in our country and is considered the leading cause behind this significantly high maternal and Perinatal mortality rate. Pakistan's 2019 demographic survey revealed that antenatal care utilization in the country is only 86%, with only 51% of women having at least four antenatal visits[7], compared to 99-100% in neighbouring countries[8].

A substantial body of literature exists regarding the socioeconomic factors that influence the utilization of maternal antenatal services worldwide. One of the surveys conducted in the province of Baluchistan revealed that ANC service utilization is very low, at around 45%, with multiple factors contributing to the non-utilization of ANC services[9]. A similar study from Punjab province demonstrated a 55.9% utilization of maternal health services, and the quality of these services was also not up to the recommended standards. Reduced antenatal visits or booking in the

[1]*Department of Obstetrics & Gynecology, Liaquat College of Medicine and Dentistry, Karachi, Sindh-Pakistan*
[2]*Sir Syed College of Medical Sciences for Girls, Karachi, Sindh-Pakistan*
[3]*Sindh Rangers Hospital, Karachi, Sindh-Pakistan*
[4]*Department of Obstetrics & Gynecology, Darul Sehat Hospital, Karachi, Sindh-Pakistan*
***Correspondence:** aliyaakhter@yahoo.com*
doi: 10.22442/jlumhs.2025.01198
Received: 08-10-2024 *Revised: 31-12-2024*
Accepted: 09-01-2025 *Published Online: 05-03-2025*

last trimester can have serious consequences for the mother and newborn, including Anemia, antepartum hemorrhage, postpartum hemorrhage, growth retardation of the fetus, low birth weight and fetal death[10]. Pakistan has the highest burden of low-birth-weight babies, ranging from 19% at term in urban areas and 32% in rural areas. Literature suggests that decreased antenatal visits below two and the first visit in the third trimester directly affect the birth weight of the fetus[11].

The study's rationale is to assess the utilization of prenatal care among our women and to investigate its association with the birth weight of newborns and maternal haemoglobin level, as both are among society's most widely used health indicators. Although the study's primary focus is prenatal care, it will also highlight the general shortcomings in Pakistan's healthcare system that need to be addressed with the right interventions. It will also assist in managing various tactics aimed at improving maternity services.

METHODOLOGY

This study was conducted in the Gynaecology and Obstetrics unit of Darul Sehat Hospital, Karachi, from July 2022 to January 2023. This is a Cross-Sectional study, and the Sample size is determined by keeping a 5% margin of error, a 95 % confidence interval and a frequency of 4 antenatal visits in Pakistan's rural population, i.e. 11.37% [12]. Based on all these assumptions, the actual sample size was determined by using the formula Sample size n = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)] The sample size is calculated using the sample size calculator Openepi version 3 software. The desired sample size is calculated to be 155.

We used the Convenience non-probability sampling technique. Written informed consent was obtained from participants after they had been told about the study's objective, and only those who felt comfortable and agreed were included. The names and other identities of the participants were kept confidential, and only principal investigators were allowed to access the data. The data collector administered a detailed structured questionnaire to females delivered in the obstetric unit of Darul Sehat Hospital. All females who delivered, whether by cesarean section or through vaginal route, with any parity and full-term gestational age are included in the study. Females with preterm deliveries, miscarriages, home deliveries and referred cases due to some complications were excluded from the study. The details were put on proforma, which consists of two parts. Part A contains demographic features such as age, parity, residence, booked or non-booked status, occupation of respondents and their husbands, and duration of pregnancy. Part B contains study variables, including mode of delivery, the total number of antenatal visits made by the patient, the timing of the first antenatal visit, tetanus vaccination, haemoglobin level at the time of birth, use of iron and folic acid supplementation, and birth weight of the newborn at the time of delivery. The respondents were divided into three groups based on the number of antenatal visits: <4, 4-8, and >8, and then the data were analyzed according to these groups.

For data analysis purposes, the software SPSS version 21 is used. Relevant descriptive statistics, including frequency and percentage, were obtained to present qualitative variables such as residence, patient and husband's occupation, females' occupation, and mode of delivery. The chi-square test was used to assess the association between dependent and independent variables like the number of antenatal visits with hemoglobin status and fetal outcome with a p-value (<0.05), considered a significance level. Quantitative variables such as age, number of children, monthly income, number of antenatal visits, and booking time, are presented as means and standard deviations.

RESULTS

A total of 155 women were selected after fulfilling the inclusion criteria. The average age of the participants was 29 ± 6.2 years, with a mean parity of 2.2 ± 1.07. The study findings indicated that the mean gravidity was 3.5±1.9, with (12.9%) primigravida and (87.1%) multigravida. (**Table I)**

Out of 155 women, only (34%) had eight or more antenatal visits, while (84) completed more than four visits. Out of the total number of women selected for this study (4.5%), women has only one antenatal visit. Additionally, those with single visits (22%) typically visited during the third trimester. Among all participants, the mean gestational age at the time of delivery was 36.6 weeks ±3.3, and the mean gestational age at booking was 16.7±9.4 weeks. Majority of the females delivered by cesarean section (57%) as compared to normal vaginal delivery (42.8%). However, the C-section rate is more observed in groups having 4-8 visits (55%). One crucial observation noted is the almost similar rate of normal and cesarean deliveries in women having less than four visits (51%) and (48%) respectively. As far as their past obstetrical history is concerned (17.5%) had one miscarriage, (5.8%) had two miscarriages, and 1.3% had a history of 3 recurrent miscarriages. Around 8.4% had previous neonatal deaths, and 7.1 % had previous intra-uterine deaths. When birth outcomes were calculated for the current pregnancy, 98.6% of the babies were delivered alive, with 41.6% being male and 54.5% being female. Approximately 1.4% gave birth to intrauterine dead babies, and 1.3% of babies expired in the neonatal period.

Table I: Demographic feature of respondents

Demographic variables	Mean (sd)	n (%)
Age (years)	29 (62)	-
Gravidity	3.5(1.9)	-
Parity	2.2(1.7)	-
Number living children	2.1(1.6)	-
No. of antenatal visits	6.3(3.2)	-
Gestational age at delivery (years)	35.4(4.7)	-
Hb level	10.1(1.2)	-
Birth weight of newborn	2.6(0.4)	-
Booked	-	133 (86.6)
Occupation: Housewives Working mothers	- 	 114 (74.2) 40 (26.1)
NVD	-	66 (42.8)
LSCS	-	88 (57.2)

Table II: Association of antenatal visits with different variables

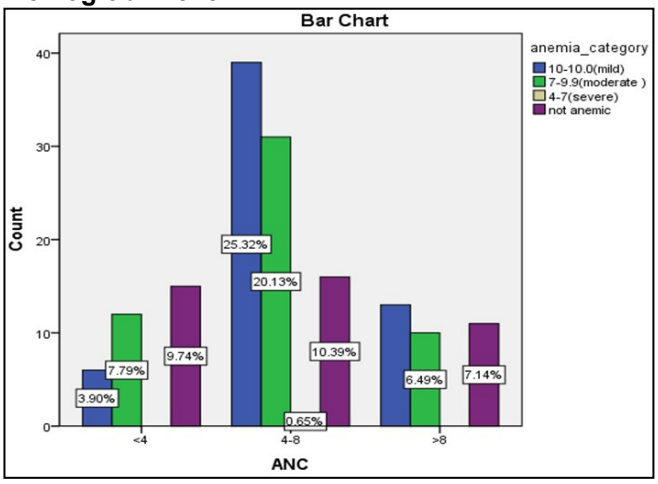
Characteristics	Antenatal visits			P-value
	<4	4-8	>8	
Female age				
<20 yrs	3	5	0	0.017*
20-30 yrs	19	34	14	
>30 yrs	11	48	20	
Female education				
Illiterate	2	16	6	0.4
Primary level	3	41	6	
Matriculation(SSC)	11	29	17	
Bachelors	11	6	5	
Professional	1	2	1	
Working status				
Working women	2	37	2	0.02*
Housewives	31	50	33	
Parity				
Primigravida	20	29	7	0.005*
2-4	11	50	26	
>5	2	8	1	
Birth weight (kg)				
<2.5	17	12	8	<0.001*
2.5-3.5	4	48	18	
>3.5	03	26	19	
Hb level (mg/dl)				
<7.9gm/dl(severe anemia)	4	3	3	<0.001**
9.9-8gm/dl(moderate anemia)	13	59	33	
10-10.9gm/dl(mild anemia)	6	24	7	
11-13gm/dl(non anemic)	1	86	2	

**p-value significant at or < 0.05, ** Fisher exact test*

Table II presents the association between antenatal visits and various parameters, including age, gravidity, booking status, occupation, educational status, fetal birth weight, and Hb level. A significant association was found between antenatal visits and the weight of newborns (p < 0.00). The mean birth weight of a newborn is 2.45 kg±0.7. More than half of the study population delivered low birth weight infants (52.3%), and only (6.5%) babies are above average weights.

The mean haemoglobin level of the population is 10.1 g/dL ± 1.2. Around (32.9%) of the study population has normal hemoglobin levels, and (67%) of the population is anemic. Mild anaemia is observed in (58%), moderate Anemia in (53%), and severe Anemia in (2%) of cases. **Figure I**. Number of Antenatal visits of patients is also associated with the hemoglobin level of a mother with a p-value of (0.04).

Figure I: Association of Antenatal visits with Hemoglobin level



DISCUSSION

ANC is an essential and integral component of the health care system. In 2016, the World Health Organization issued new guidelines recommending a minimum of eight or more prenatal visits to improve birth outcomes. Our study found that most participants (82%) have completed more than four prenatal visits, but only (34%) of women have completed eight or more prenatal visits. The same observation is evident in Pakistan's demographic health survey (PDHS 2017-18) [13], contrary to Bangladesh, where only (52%) of the population attended an antenatal clinic four or more times[14], as both the countries have lots of similarities the difference in figures might be in the healthcare system or population selection. An average number of prenatal visits is found to be (6.3) in our study. The time required for women to receive their first (ANC) check-up varied depending on their wealth level, with the wealthier women having a median wait time of 3 months, while those in the most disadvantaged groups had a median wait of 7 months[15,16]. The prevalence of timely initiation of the first ANC visit at 16 weeks is 61.7%, which aligns with

the WHO recommendations, as this reflects one study where the percentage of mothers beginning care in the first 4 months of pregnancy increased in 2020 and 2021[17].

However, the results contradict the first timely ANC visit in Ethiopia, where it was found to be around 40% in different Ethiopian districts, suggesting the socioeconomic conditions behind this[18]. Adequate and timely prenatal visits directly reflect birth outcomes, as observed in our study, where the mean gestational age of delivery is 36.3 weeks in those who completed more than four visits, compared to another group[19]. One crucial observation is the less significant difference in the mode of delivery in women having less the four visits, with (51%) normal vaginal delivery and (48%) cesarean section, which is comparable to a study conducted in China where Participants having a vaginal delivery and cesarean delivery were found in (45.1%) and (54.9%) respectively[20.]

In our study, underutilization of antennal visits (< 8) is more commonly observed in Primigravida, contrary to a study in India where underutilization of ANC, i.e., <4 visits, increased with increasing birth order[21]. The reason might be the fear of hospitals or healthcare professionals (HCPs) or the awareness and education provided to them at home or by relatives. Also, the misconception still exists in our society that multiple visits to the hospital increase the chances of a cesarean section. Similarly, booking appointments at various hospitals simultaneously is also prevalent in our community.

Additionally, this study discovered that women's economic standing was a significant predictor of compliance with ANC contact, with wealthier women being more likely to seek early medical attention. Our findings align with other research that discovered a favorable correlation between women's economic level and the frequency of ANC [22].

The mean hemoglobin level of the population in our study is 10.1 g/d. Only 32.9% of the study population has a normal haemoglobin level, and 67% of the population is anaemic. The results align with a similar study in a neighbouring country, where the prevalence is almost the same, i.e., 62.5%, and is significantly higher in subjects attending ANC in government hospitals (68.7%)[23]. One of the studies from Sindh shows an anaemia prevalence of 51% [24]. Age also appeared to affect significantly the frequency of ANC. Our study revealed that younger age <20 years are likelier to have inadequate ANC compared to > 20 years, as observed in WATCH project [25].

According to a survey across South Asian nations, children born in Pakistan had a higher likelihood of living with congenital disabilities than those born in Afghanistan[26,27]. Prenatal visits and birth weight were significantly correlated ($p < 0.00$). The mean birth weight of a newborn is 2.67 kg, as more than half of the study population delivered low-birth-weight infants (52.3%); this is similar to a study where patients who received inadequate antenatal care (ANC) had an increased prevalence of low-birth-weight infants[28,29]. Our study has certain limitations that need to be highlighted as this is cross-sectional. It couldn't establish cause-and-effect relationships; therefore, the number of prenatal visits doesn't truly reflect the quality of visits. Moreover, this study was conducted in tertiary care hospitals, where high-risk pregnancies are registered more frequently compared to low-risk populations, further affecting the validity of the findings.

CONCLUSION

Adequate prenatal care has been associated with improved maternal health, reduced complications during pregnancy, and better neonatal outcomes, including lower rates of preterm birth, low birth weight, and infant mortality. Also, there is an urgent need to address the social and economic marginalization of Pakistan's most vulnerable women. It is now imperative that technical advancements in maternal healthcare services be paired with well-informed action, especially at the primary healthcare services level.

Ethical permission: Liaquat College of Medical & Dentistry, Karachi, IRB letter No. DSH/IRB/2019/0013.

Conflict of Interest: No conflicts of interest, as stated by authors.

Financial Disclosure / Grant Approval: No Funding agency was involved in the research

Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Nasim A: Conception of work, revision and accountability
Saeed F: Critical review, approval of final version
Saboohi E: Data analysis and interpretation
Ali F: Data analysis and critical review
Shah N: Data acquisition
Ghaffar N: Revision and accountability

REFERENCES

1. Balk EM, Konnyu K, Cao W, Bhuma MR, Danilack VA, Adam GP et al. Schedule of visits and televisits for routine antenatal care: a systematic review. [Internet]. doi: 10.23970/AHRQEPCCER 257.
2. Tuncalp O, Were WM, MacLennon C, Oladapo OT, Gulmezoglu AM, Daelmans B et al. Quality of care for pregnant women and newborns - the WHO vision. BJOG. 2015; 122(8); 1045-1049. doi: 10.1111/1471-0528.13451.
3. Organization WH. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division: executive summary. World Health Organization; 2019. Available from:

https://iris.who.int/handle/10665/327596.
4. Organization WH. WHO recommendations on antenatal care for a positive pregnancy experience. World Health Organization. 2016. Available from: https://www.who.int/publications/i/item/9789241549912
5. Benova L, Tunçalp Ö, Moran AC, Campbell OM. Not just a number: examining coverage and content of antenatal care in low-income and middle-income countries. BMJ Glob Health. 2018 Apr 1; 3(2): e000779.
6. Knoema. Pakistan Maternal mortality ratio, 1960-2021. Available from: https://knoema. com/atlas/Pakistan/topics/Health/Health-Status/Maternal-mortality-ratio.
7. NIPS I. Pakistan demographic and health survey 2017-18. Islamabad, Pakistan, and Rockville, Maryland, USA: NIPS, ICF. 2019; 2.
8. Bucher S, Marete I, Tenge C, Liechty EA, Esamai F, Patel A et al. A prospective observational description of frequency and timing of antenatal care attendance and coverage of selected interventions from sites in Argentina, Guatemala, India, Kenya, Pakistan and Zambia. Reprod Health. 2015; 12: 1.
9. Arif A, Sherani A, Uzma Q, Alam B, Thom E, Abro A et al. Maternal and Perinatal Death Surveillance and Response in Balochistan, Pakistan-Causes & Contributory Factors of Maternal Deaths. J Gynecol Obsts. 2022; 10(1): 1-5.
10. Vale CC, Almeida NK, Almeida RM. Association between prenatal care adequacy indexes and low birth weight outcome. Revista Brasileira de Ginecologia e Obstetrícia. 2021; 43(04): 256-63.
11. Ahmed S. Impact of antenatal care on Birth weight in Pakistan. J Pak Med Assoc. 2022; 72(3): 537-542.
12. Khan MA. Antenatal care utilization in Pakistan. J Health Sci. 2020; 10(2): 123-132.
13. Midhet F, Hanif M, Khalid SN, Khan RS, Ahmad I, Khan SA. Factors associated with maternal health services utilization in Pakistan: Evidence from Pakistan maternal mortality survey, 2019. PloS One. 2023; 18(11): e0294225.
14. Pervin J, Venkateswaran M, Nu UT, Rahman M, O'Donnell BF, Friberg IK et al. Determinants of utilization of antenatal and delivery care at the community level in rural Bangladesh. PloS One. 2021; 16(9): e0257782.
15. Gillani S, Ahmad TI, Wang F, Shafiq MN. Antenatal Care (ANC) Coverage, Health Infrastructure, and Postnatal Care (PNC) Services Utilization: A District Level Analysis of Punjab-Pakistan. iRASD J Econ. 2021; 3(3): 318-31.
16. Agha S, Tappis H. The timing of antenatal care initiation and the content of care in Sindh, Pakistan. BMC Pragn Childbirth. 2016; 16: 1-9.
17. Martin JA, Osterman MJ. Changes in Prenatal Care Utilization: United States, 2019-2021. National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. 2023; 72(4): 1-4.
18. Fetene W, Mekonnen A, Shiferaw Z, Genet A, Haile S. Timely initiation of first antenatal care visit and associated factors among pregnant women in the Amhara Region, North-west Ethiopia: a comparative cross-sectional study. Pan Afr Med J. 2023; 44: 51. doi: 10.11604/pamj.2023.44.51.33997.
19. Abaane DN, Adokiya MN, Abiiro GA. Factors associated with anaemia in pregnancy: A retrospective cross-sectional study in the Bolgatanga Municipality, Northern Ghana. PloS One. 2023; 18(5): e0286186.
20. Fan X, Zhou Z, Dang S, Xu Y, Gao J, Zhou Z et al. Exploring status and determinants of prenatal and postnatal visits in western China: in the background of the new health system reform. BMC Public Health. 2018; 18: 39.
21. Thakkar N, Alam P, Saxena D. Factors associated with underutilization of antenatal care in India: Results from 2019–2021 National Family Health Survey. PloS One. 2023; 18(5): e0285454.20.
22. Okedo-Alex IN, Akamike IC, Ezeanosike OB, Uneke CJ. Determinants of antenatal care utilization in sub-Saharan Africa: A systematic review. BMJ Open. 2019; 9(10): e031890.
23. Azhar BS, Islam MS, Karim MR. Prevalence of Anemia and associated risk factors among pregnant women attending antenatal care in Bangladesh: a cross-sectional study. Prim Healthcare Res Develop. 2021; 22: e61.
24. Noh JW, Kim YM, Lee LJ, Akram N, Shahid F, Kwon YD et al. Factors associated with the use of antenatal care in Sindh province, Pakistan: A population-based study. PloS One. 2019; 14(4): e0213987.
25. Gardner ME, Umer A, Rudisill T, Hendricks B, Lefeber C, John C et al. Prenatal care and infant outcomes of teenage births: a Project WATCH study. BMC Pregn Childbirth. 2023; 23(1): 379.
26. Ngo N, Bhowmik J, Biswas RK. Factors Associated with Low Birthweight in Low-and-Middle Income Countries in South Asia. Int J Environ Res Public Health. 2022; 19(21): 14139.
27. Shahani Z, Shaikh AR, Gemnani VK, Abro K, Aizuddin AN, Manaf MR et al. Neonatal Morbidity Patterns and Admission Outcomes: A Cross-Sectional Study at a Tertiary Care Hospital in Pakistan. J Pharmaceut Res Int. 2022: 72-6.
28. Shah T, Khaskheli MS, Ansari S, Lakhan H, Shaikh F, Zardari AA, Warsi J, Rind NA, Rind KH, Shar AH. Gestational Anemia and its effects on neonatal outcome in the population of Hyderabad, Sindh, Pakistan. Saudi J Biol Sci. 2022; 29(1): 83-7.
29. Shaeen SK, Tharwani ZH, Bilal W, Islam Z, Essar MY. Maternal mortality in Pakistan: challenges, efforts, and recommendations. Ann Med Surg. 2022; 81.