

Maternal Preconception and Antenatal Care as a Predictor of Birth Outcome in Akure South Local Government Area of Ondo State

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ABSTRACT

Background: Preconception and antenatal care have emerged as a pivotal strategy for enhancing birth outcomes and reducing maternal and childhood mortality and morbidity across both high and low-income countries.

Objective: This study explores the influence of maternal preconception care (PCC) and antenatal care (ANC) on birth outcomes.

Methodology: The study adopted a descriptive cross-sectional design. Simple random sampling was used to select 302 participants from registers of 12 Primary health care facilities. Data were collected, with a semi-structured, interviewer-administered questionnaire on socio-demographics, preconception care, antenatal care, ANC barriers, and birth weight (primary outcome). Data were analyzed using SPSS version 23 and presented with descriptive statistics and Pearson's correlation ($p < 0.05$).

Results: The results revealed that, most participants were aged 20-30 (67.6%), married (84.1%), and tertiary-educated (75.9%), with 89.9% delivering babies of normal birth weight (2.5-4.0 kg). Of the mothers, 65.2% has average PCC score, though dietary modifications in PCC were limited, with only 32.5% adjusting diets to lose weight and 26.2% to gain weight. ANC utilization was high (93%), yet like risky behaviours like self-medication (62.9%) persists. Barriers to ANC access included transportation costs (14.6%), financial limitations (18.9%), and negative attitude of caregiver's attitudes (24.8%). PCC and ANC significantly affect birth weight with correlations of $r = 0.20$ ($p < 0.05$) and $r = 0.30$ ($p < 0.05$) respectively.

Conclusion: The Study revealed obvious gaps in nutritional practices, patient education, and care quality Addressing these deficiencies through targeted interventions could optimize maternal and neonatal health in Nigeria.

Keywords: Preconception care, Antenatal care, Maternal health, Birth outcome, Utilization.

Doi: <https://dx.doi.org/10.4314/njns.v47i1.6>

INTRODUCTION

Preconception care (PCC) and antenatal care (ANC) are integral public health strategies aimed at improving maternal and child health outcomes by promoting the well-being of women, adolescents, and men before and during pregnancy [1,2]. PCC involves screening and managing risk factors, addressing chronic health

conditions, and educating individuals on healthy behaviours to optimize pregnancy outcomes, regardless of reproductive intentions [3,4]. Preconception care is critical for enhancing birth outcomes and reducing maternal and childhood mortality and morbidity [2,37]. By empowering women to make informed decisions about their fertility and health, it fosters healthier pregnancies

and contributes to the social and economic advancement of families and communities [2,37]. ANC complements this by providing regular medical check-ups during pregnancy to monitor maternal and fetal health, manage complications, and educate women on healthy practices [1,5]. Together, these approaches form a continuum of care that reduces environmental and behavioural risks, fostering healthier pregnancies and better birth outcomes [6,7].

PCC and ANC are critical for reducing maternal and childhood mortality and morbidity, empowering women to make informed decisions about their fertility and health, and contributing to the social and economic advancement of families and communities [1,2]. In high-income countries, PCC promotes general health and risk awareness, while ANC ensures ongoing monitoring and support, particularly for socially marginalized and economically disadvantaged groups [8,9]. In low-income settings, both strategies address pervasive health disparities, bolstering maternal and child health [10]. By targeting risk behaviours, chronic conditions, and environmental factors, PCC and ANC align with the life-course perspective, emphasizing disease prevention and health promotion from infancy through adulthood [1,2,17].

Despite their proven benefits, maternal and child health remain a global challenge, particularly in developing regions [11]. The World Health Organization reported approximately 295,000 maternal deaths worldwide in 2017, with developing countries accounting for 94% of these deaths [11]. Sub-Saharan Africa bears the heaviest burden, with a maternal mortality ratio of 542 per 100,000 live births in 2017, far exceeding the global average of 211 [11]. This region faces significant barriers to accessing PCC and ANC services [12]. Thus, Maternal health service utilization remains a major challenge in many low- and middle-income countries [13].

In 2024, antenatal and prenatal care in Sub-Saharan Africa have shown modest improvements but still lag behind global standards. Approximately 57–65% of pregnant women receive at least four antenatal care (ANC) visits, an increase from 52% in 2019, though uptake of the WHO-recommended eight-contact model remains below 25% in most countries [38].

In Nigeria, the 2023 Nigeria Demographic and Health Survey (NDHS) highlights maternal healthcare utilization trends. Approximately 70% of women aged 15–49 who had a live birth in the

five years preceding the survey had at least one ANC visit with a skilled provider (doctor, nurse, or midwife), up from 67% in 2018. About 60% completed at least four ANC visits, a slight increase from 57% in 2018, but only 20% achieved the WHO-recommended eight or more ANC visits, indicating a gap in meeting global standards. Additionally, 39% delivered with a skilled birth attendant, and 43% received postnatal care within two days of delivery [15]. PCC utilization remains low, constrained by limited awareness and access [16,17]. These gaps are driven by low socioeconomic status, limited healthcare providers, illiteracy, and poor awareness of maternal health services, including PCC and ANC [16,17].

PCC and ANC are essential for reducing risk behaviours and exposures that impair fetal development and birth outcomes [3,4]. However, knowledge and utilization of PCC remain low in many developing countries, particularly in Sub-Saharan Africa [18]. A systematic review highlighted that education, socioeconomic status, and access to healthcare services significantly influence PCC and ANC practices [19]. Studies from Sri Lanka, Nigeria, and Sudan consistently report low PCC awareness among women, with similar challenges noted for ANC uptake [20,16,21]. These findings expose the need to evaluate the combined impact of PCC and ANC on birth outcomes to inform targeted interventions, as Postnatal care utilization remains low in many settings [22,23].

METHODOLOGY

Study design

This study utilized a cross-sectional design to evaluate the influence of maternal preconception care (PCC) and antenatal care (ANC) on birth outcomes among women in Akure South Local Government Area, Ondo State, Nigeria. Data were collected using a semi-structured, interviewer-administered questionnaire to gather both quantitative and qualitative information from participants.

Study area

The study was conducted in Akure South Local Government Area, Ondo State, Nigeria. Akure, the state capital, is located in Southwestern Nigeria at approximately 7°25' N latitude and 5°19' E longitude. According to the 2006 census, the city had a population of 484,798, making it a significant urban center in the region.

The area is a commercial hub, hosting major markets like Araromi and Isikan, and institutions such as the Federal University of Technology, Akure (FUTA). Its road networks connect it to major cities, enhancing trade and accessibility.

Culturally, Akure South is grounded in Yoruba traditions, led by the Deji of Akure, a prominent traditional ruler. Economically, agriculture thrives in its semi-urban and rural zones, with crops like cocoa, yams, and cassava, supported by a tropical climate. Urban expansion continues due to population growth and infrastructure development, making Akure South a vital economic and cultural center in Ondo State.

Study population, sample size, and technique

The study population comprises mothers, specifically lactating mothers, and women who had delivered a child within the two years prior to the survey. Inclusion criteria are age (15-49), residency in Akure during the current or last pregnancy, and ability to give written informed consent. Mothers who are non-residents, those unable to communicate effectively, or those with records of cognitive impairments were excluded from the study.

Using Cochran's formula for prevalence studies, a sample size of 302 was estimated, assuming a 50% prevalence, 5% margin of error, 95% confidence level. Twelve primary health care centers were purposively selected based on high antenatal and postnatal clinic attendance (>50 visits/month). Stratified random sampling was used to allocate participants proportionally to clinic attendance at each facility. From each center, a list of eligible women (aged 18-45, attending antenatal or postnatal clinics) was compiled, and participants were randomly selected using a computer-generated random number table to ensure unbiased representation within each facility.

Data collection

Data was collected via interviews conducted by trained research assistants fluent in Yoruba (the local language) and English. Interviews lasted approximately 30-45 minutes per participant. To ensure data quality, interviewers underwent a two-day training session on questionnaire administration, ethical conduct, and data recording. Birth weight, the primary outcome, was obtained through maternal recall and, where possible, cross-checked with health facility records

to reduce recall bias. Data collection occurred over a two-month period.

Ethical approval

Ethical approval was obtained from the Center for Research and Development (CERARD) Bamidele Olumilua university Education Science and Technology, Ikere Ekiti, with the approval ID CERAD-25-0073

Research instrument

A semi-structured questionnaire was developed to collect data, adapted from the Nigeria Demographic and Health Survey (NDHS, 2018) [24] and adapted with items from validated studies on maternal health in Nigeria [16,17]. The questionnaire was pre-tested on 20 women in a neighboring community to ensure clarity, cultural appropriateness, and reliability. Feedback from the pilot test led to minor revisions, such as simplifying wording for better comprehension.

Questions on Preconception Care (PCC)

The PCC section included a set of 10 questions, each with a "Yes" (1) or "No" (0) response option: These questions were adapted from the NDHS 2018 (24) and studies (16, 17) which assessed maternal health practices in similar Nigerian contexts.

Questions on Antenatal Care (ANC) during pregnancy

The ANC section included a set of 14 questions with "Yes" (1) or "No" (0) responses: These questions were similarly derived from the NDHS 2018 (24) and validated studies (16, 17), ensuring relevance to maternal care practices in Nigeria.

Measurement of variables

Preconception Care (PCC) was assessed using 10 items listed above. Each "Yes" response was scored 1, and "No" was scored 0. Total scores ranged from 0 to 10 and were categorized based on tertiles: Poor (0-3), Average (4-6), Good (7-10). Antenatal Care (ANC) was measured using 14 items listed above. Positive care practices (e.g., seeking medical care) were scored 1, and negative practices (e.g., alcohol consumption) were scored 0 where applicable. Total scores ranged from 0 to 14 and were categorized as: Poor (0-4), Average (5-9), Good (10-14). The primary outcome was birth weight, categorized as low (<2.5 kg), normal (2.5-4.0 kg), or high (>4.0 kg).

Data analysis

Data was analyzed using SPSS version 23. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize demographic characteristics, PCC, ANC, and birth outcomes. Pearson's correlation coefficient was employed to test the hypotheses examining relationships between PCC, ANC, and birth outcome. Statistical significance was set at $p < 0.05$. Assumptions of normality were checked using histograms and Shapiro-Wilk tests to ensure the appropriateness of the parametric.

RESULTS

Socio-demographic characteristics of mothers

Table 1 shows the socio-demographic characteristics of the respondents. The majority of mothers were between 20 and 30 years old (67.6%) with a mean age of 30.1 ± 6.1 years, married (84.1%), and had 1-4 children (98.4%). Educational attainment was high, with 75.9% holding tertiary degrees. Birth outcomes were largely normal, with 89.9% of babies weighing 2.5-4.0 kg. Additionally, 94.7% attended fewer than 14 antenatal visits, and only 51% took maternity leave.

Table 1: Socio-demographic characteristics of mothers

Characteristics	Frequency (302)	Percentage (%)
Age (years)		
<20	1	0.3
20-30	204	67.6
31-40	76	25.3
41-50	21	6.8
Mean \pm SD = 30.1 ± 6.1		
Marital status		
Single	33	10.9
Married	254	84.1
Divorced	8	2.6
Separated	4	1.4
Widowed	3	1
Level of education		
Primary	1	0.3
Secondary	72	23.8
Tertiary	229	75.9
Religion		
Christianity	221	73.2
Islamic	77	25.5
Traditional	2	0.7
Others	2	0.6
Occupation		
Not working	7	2.3
Civil servant	110	36.4
Business	139	46
Artisans	17	5.6
Retired	1	0.4
Student	25	8.3
Others	3	1
Income (₦)		
<10,000	16	5.3
10,001-30,000	179	59.3
>30,000	107	35.4
Number of children		
1-4	297	98.4
5-8	5	1.6
Mean \pm SD = 2.2 ± 1.1		

Table 1 contd

Characteristics	Frequency (302)	Percentage (%)
Birthweight of last child		
<2.5	21	6.9
2.5-4.0	271	89.9
>4.0	10	3.2
Mean \pm SD=2.9 \pm 0.52		
Age of last child in months		
0-12	187	61.9
13-24	115	38.1
Mean \pm SD=17.9 \pm 10.9		
Number of antenatal care visits		
<8	286	94.7
8	3	1
>8	13	4.3
Mean \pm SD=7.5 \pm 3.4		
Maternity leave		
Yes	154	51
No	148	49

Preconception care of Mothers

Table 2 shows the prenatal care of mothers. It reveals that 71.9% of the mothers took prescription medicine regularly, 66.6% exercised for 3 or more days of the week, 65.9% were treated for anxiety or depression, and 63.2%

talked to a health care worker about their medical history. More than half (60.9%) took vitamins with folic acid, 32.5% changed their eating habit to lose weight, while 26.2% changed their eating habit to gain weight.

Table 2: Preconception care of Mothers (N=302)

Care before conception	Yes n (%)	No n (%)
Regular intake of prescription medicine	217 (71.9)	85 (28.1)
Exercise for 3 or more days of the week	201 (66.6)	101 (33.4)
Got treatment for anxiety or depression	199 (65.9)	103 (34.1)
Consulted health care personnel about their medical history	191 (63.2)	111 (36.8)
Intake of vitamin with folic acid	184 (60.9)	118 (39.1)
Anti-tetanus injection	153 (50.7)	149 (49.3)
Counselled on genetic diseases	150 (49.7)	152 (50.3)
Counselled on importance of weight gain	122 (40.4)	180 (59.6)
Changed eating habit to lose weight	98 (32.5)	204 (67.5)
Changed eating habit to gain weight	79 (26.2)	223 (73.8)

Antenatal care of mothers

Table 3 shows mothers' care during pregnancy. Most of the mothers (93.0%) sought medical care during pregnancy, 92.7% drank enough water to stay hydrated during pregnancy, while 88.7% took adequate rest. The table also showed that 81.5% were treated for malaria, 64.9% received vaccination, and 62.9% did self-medication during pregnancy, 58.9% took herbal medicine, 39.1% changed their eating habits, and 3.6% took alcohol during pregnancy.

Factors affecting antenatal care utilization

Figure 1 reveals that ignorance affected 12.0% of the mothers from utilizing antenatal care service, long waiting time of antenatal care service affected 23.0%, attitude of care givers also affected 17.0% of the mothers, 10.0% couldn't take time off from work, while 18.0% is affected by insufficient funds.

Table 3: Antenatal care of mothers (N=302)

Care during pregnancy	Yes n (%)	No n (%)
Seek medical care during pregnancy	281 (93.0)	21 (7.0)
Intake of plenty of water	280 (92.7)	22 (7.3)
Ensured adequate rest	268 (88.7)	34 (11.3)
Treatment for malaria	246 (81.5)	56 (18.5)
Took over-the-counter medication	204 (67.5)	98 (32.5)
Reduced junk food	201 (66.6)	101 (33.4)
Got vaccination	196 (64.9)	106 (35.1)
Did self-medication	190 (62.9)	112 (37.1)
Intake of coffee	179 (59.3)	123 (40.7)
Intake of herbal medicine	178 (58.9)	124 (41.1)
Intake of sweets	153 (50.7)	149 (49.3)
Changed eating habits	118 (39.1)	184 (60.9)
Intake of sugar beverages	91 (30.1)	211 (69.9)
Intake of alcohol	11 (3.6)	291 (96.4)

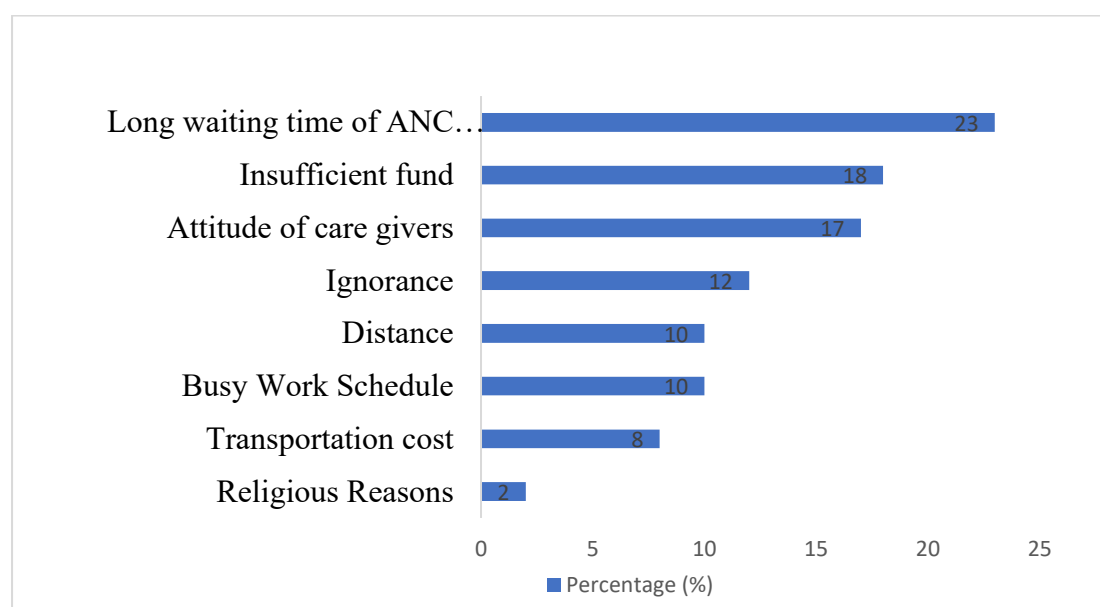


Figure 1: Factors affecting the utilization of antenatal care services

Preconception care, ANC care, and birth outcome

Table 4 reveals significant relationships between preconception care and pregnancy care, and between pregnancy care and birth outcome, at r

= 0.20 (p < 0.05) and r = 0.30 (p < 0.05), respectively. Correlation analysis reveals that birth outcome is dependent on both preconception and antenatal care.

Table 4: Correlation analysis showing the relationship between preconception care, ANC care, and birth outcome

Variables	Birth outcome		
	Correlation coefficient (r)	Coefficient of determination (r ²)	% determination
Preconception care	0.20	0.04	4%
Care during pregnancy	0.30	0.09	9%

Significant at the level of p ≤ 0.05.

DISCUSSION

This study assessed the role of maternal preconception care (PCC) and antenatal care (ANC) on birthweight, a critical neonatal health indicator. The findings suggest that PCC and ANC are positively associated with improved birth weight. These associations are supported by similar studies which reported a 10–15% reduction in low birth weight through integrated PCC in Nigeria, indicating that more comprehensive PCC implementation could amplify outcomes (25). Similarly, enhanced ANC supervision in Kaduna and Kano states improved birth outcomes by up to 20%, highlighting the value of quality ANC delivery (26). PCC with robust nutritional interventions improved birth weight by 25% across sub-Saharan Africa, emphasizing the pivotal role of nutrition (27).

A significant proportion of mothers engaged in PCC practices, such as folic acid supplementation and genetic counselling, which are essential for pre-pregnancy health. However, dietary adjustments for weight management were less common, revealing gaps in nutritional education. This finding aligns with the observation in South-Eastern Nigeria, where inadequate nutritional practices during pregnancy were linked to suboptimal fetal development (28). In Belgium, women with planned pregnancies made preconception lifestyle changes, such as improved nutrition, but adherence varied, emphasizing the need for targeted education even in high-income settings (36).

The preference for junk food among over half of the mothers during pregnancy further diminishes ANC's effectiveness, as poor dietary choices can impair fetal growth. This pattern is consistent with a study where only 38% of women used folic acid correctly, reflecting broader challenges in nutritional awareness (29).

ANC utilization in Akure South was notably high, with widespread adoption of practices like hydration maintenance (92.7%) and malaria treatment (81.5%), both vital in Nigeria's malaria-endemic context. However, risky behaviours, including self-medication and herbal medicine use, compromised ANC quality, potentially offsetting professional care's benefits. These findings reflect reports of inconsistent adherence to ANC recommendations (29). The high ANC uptake exceeds the 70% of women with at least one ANC visit reported in the 2023 Nigeria Demographic and Health Survey, likely attributed

to urban advantages such as improved healthcare access (15).

Barriers to ANC access, including transportation costs, financial constraints, and negative caregiver attitudes, were more significant than previously reported in urban Nigeria, suggesting context-specific challenges (30). These barriers align with findings in Guinea, where 42% of women delayed ANC due to poverty, and with observations on rural-urban disparities in Nigeria (31, 32). Systemic issues, such as long waiting times and work conflicts, further impede effective ANC delivery (33). Supervised ANC has been linked to a 37.15% first-trimester contact rate and improved outcomes across Africa, suggesting enhanced oversight could address these barriers (34). In addition, 88.46% of unaware women in Sokoto were receptive to PCC education, indicating that awareness campaigns could reduce harmful practices (35).

The findings affirm the importance of PCC and ANC in improving birth weight, but their impact is constrained by nutritional deficiencies, risky behaviours, and access barriers. High ANC coverage (93%) and moderate PCC utilization (65.2%) are strengths, yet targeted interventions are essential to bridge gaps. Integrating PCC into routine healthcare services and adopting group ANC models could enhance service delivery (26,33).

Community-based education campaigns, alongside caregiver training and increased staffing to reduce waiting times, could address nutritional gaps, risky behaviours, and access challenges (35,30,32). The influence of access to health facilities and on service utilization is consistent with finding reported in earlier studies (30,32). These strategies could align Akure South's maternal and neonatal health outcomes with global benchmarks.

ACKNOWLEDGEMENTS

We appreciate the staff and leadership of the primary health care facilities that were used in this study for their participation and cooperation.

Conflict Of Interest

The authors declare no conflict of interest.

REFERENCES

1. World Health Organization. (2013). *Meeting to develop a global consensus on preconception care to reduce maternal and childhood mortality and morbidity*. <https://www.who.int/publications/i/item/9789241507622>
2. Hill, B., Skouteris, H., Teede, H. J., Bailey, C., Watson, S., & Field, M. (2021). Preconception care: A review of the evidence. *Journal of Clinical Medicine*, 10(12), Article 2634. <https://doi.org/10.3390/jcm10122634>
3. Hood, J. R., Parker, C., & Atrash, H. (2007). Preconception care: A means to improve pregnancy outcomes. *Journal of Midwifery & Women's Health*, 52(6), 546–554. <https://doi.org/10.1016/j.jmwh.2007.06.008>
4. Temel, S., Birnie, E., Sonneveld, H. M., Steegers, E. A., & Denktas, S. (2019). Preconception care: An overview of the evidence. *European Journal of Public Health*, 29(4), 782–789. <https://doi.org/10.1093/eurpub/ckz048>
5. Mason, E., McDougall, L., Lawn, J. E., Gupta, A., Claeson, M., Pillay, Y., ... Starrs, A. M. (2014). From evidence to action to deliver a healthy start for the next generation. *The Lancet*, 384(9941), 455–467. [https://doi.org/10.1016/S0140-6736\(14\)60750-9](https://doi.org/10.1016/S0140-6736(14)60750-9)
6. Singh, P. K. (2010). Preconception care: An essential component of maternal and child health. *Journal of Health Management*, 12(4), 435–444. <https://doi.org/10.1177/097206341001200403>
7. Barker, M., Dombrowski, S. U., Colbourn, T., Fall, C. H. D., Kriznik, N. M., Lawrence, W. T., ... Sniehotta, F. F. (2021). Intervention strategies to improve nutrition and health behaviours before conception. *Journal of Developmental Origins of Health and Disease*, 12(2), 145–156. <https://doi.org/10.1017/S2040174420000482>
8. Atrash, H. (2008). Preconception care for improving perinatal outcomes: The time to act. *Maternal and Child Health Journal*, 12(Suppl 1), 3–11. <https://doi.org/10.1007/s10995-008-0343-0>
9. Stephenson, J., Vogel, C., Hall, J., Hutchinson, J., Mann, S., Duncan, H., ... Barker, M. (2020). Preconception health in England: A proposal for annual reporting with core metrics. *The Lancet*, 395(10235), 1368–1374. [https://doi.org/10.1016/S0140-6736\(20\)30914-8](https://doi.org/10.1016/S0140-6736(20)30914-8)
10. Dean, S. V., Lassi, Z. S., Imam, A. M., & Bhutta, Z. A. (2018). Preconception care: Identifying and addressing the needs of women in low- and middle-income countries. *BMC Pregnancy and Childbirth*, 18(1), Article 349. <https://doi.org/10.1186/s12884-018-1980-8>
11. World Health Organization. (2019). *Trends in maternal mortality 2000 to 2017: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division*. <https://www.who.int/publications/i/item/9789241516488>
12. Banke-Thomas, A., Avoka, C. K., Gwacham-Anisiobi, U., & Omololu, O. (2020). Barriers to maternal healthcare access in Nigeria: A systematic review. *BMC Health Services Research*, 20(1), Article 1024. <https://doi.org/10.1186/s12913-020-05874-0>
13. World Health Organization. (2020). *World health statistics 2020: Monitoring health for the SDGs, sustainable development goals*. <https://www.who.int/publications/i/item/9789240005105>
14. UNICEF. (2020). Delivery care. UNICEF Data. <https://data.unicef.org/topic/maternal-health/delivery-care/>
15. National Population Commission (NPC) [Nigeria] & ICF. (2023). *Nigeria Demographic and Health Survey 2023*. NPC and ICF.
16. Idris, S. H., Sambo, M. N., & Ibrahim, M. S. (2013). Barriers to utilization of maternal health service in a semi-urban community in Northern Nigeria. *Nigerian Medical Journal*, 54(1), 6–10. <https://doi.org/10.4103/0300-1652.108884>
17. Okonofua, F., Ntoimo, L., Ogungbangbe, J., & Yaya, S. (2020). Factors influencing maternal healthcare utilization in Nigeria: A multilevel analysis. *Reproductive Health*, 17(1), Article 159. <https://doi.org/10.1186/s12978-020-01004-3>
18. Ghanbari, S., Majlessi, F., Ghaffari, M., & Mahmoodi Majdabadi, M. (2021). Preconception care in low- and middle-income countries: A review of the literature. *BMC Public Health*, 21(1), Article 1919. <https://doi.org/10.1186/s12889-021-11968-3>
19. Tekalign, T., Getachew, T., & Assefa, N. (2020). Preconception care practices and its determinants among women of reproductive age group in Ethiopia: A systematic review and meta-analysis. *BMC Pregnancy and Childbirth*, 20(1), Article 692. <https://doi.org/10.1186/s12884-020-03389-0>
20. Patabendige, M., & Goonewardene, I. M. (2013). Preconception care received by women attending antenatal clinics at a

- teaching hospital in Southern Sri Lanka. *Sri Lanka Journal of Obstetrics and Gynaecology*, 35(1), 3–9. <https://doi.org/10.4038/sljog.v35i1.5937>
21. Ahmed, K. Y., Elhadi, M., & Eltayeb, D. (2015). Knowledge and practice of preconception care among women attending antenatal care at a tertiary hospital in Sudan. *Sudanese Journal of Paediatrics*, 15(2), 47–54.
 22. Wahabi, H. A., Fayed, A. A., Esmail, S. A., & Bahkali, K. H. (2020). The effectiveness of preconception care in improving pregnancy outcomes: A systematic review and meta-analysis. *BMC Pregnancy and Childbirth*, 20(1), Article 694. <https://doi.org/10.1186/s12884-020-03397-0>
 23. Singh, K., Bloom, S., & Brodish, P. (2018). Postnatal care utilization in low- and middle-income countries: A systematic review. *PLOS ONE*, 13(11), Article e0207894. <https://doi.org/10.1371/journal.pone.0207894>
 24. National Population Commission (NPC) [Nigeria] & ICF. (2019). *Nigeria Demographic and Health Survey 2018*. NPC and ICF.
 25. Oyedele, O. K. (2023). Multilevel and subnational analysis of the predictors of maternity continuum of care completion in Nigeria. *Scientific Reports*, 13(1), Article 20863. <https://doi.org/10.1038/s41598-023-48002-4>
 26. Evans, W. D., Ochu, C. L., Bingenheimer, J. B., Adebayo, S. B., David, F. A., Gar, S. A., & Abdulkarim, M. (2024). Implementation and baseline evaluation of an evidence-based group antenatal care program in two Nigerian states. *International Journal of Environmental Research and Public Health*, 21(11), 1461. <https://doi.org/10.3390/ijerph21111461>
 27. Woldeyohannes, D., Jemal, K., & Sisay, M. (2023). Preconception care in sub-Saharan Africa: A systematic review and meta-analysis. *SAGE Open Medicine*, 11, 1–13. <https://doi.org/10.1177/20503121231153511>
 28. Ezegwui, H. U., Onah, H. E., & Ikeako, L. C. (2019). Nutritional practices during pregnancy in South-Eastern Nigeria. *Journal of Obstetrics and Gynaecology*, 39(2), 123–129. <https://doi.org/10.1080/01443615.2018.1479517>
 29. Nwolisa, C. E., Anene-Okeke, C. G., & Ofojebe, C. P. (2021). Folic acid use among pregnant women in South East Nigeria: A cross-sectional study. *Nigerian Journal of Clinical Practice*, 24(6), 874–879. https://doi.org/10.4103/njcp.njcp_10_20
 30. Ilesanmi, B. N., Adebayo, A. M., & Afolabi, A. A. (2023). To what extent is antenatal care in public health facilities associated with delivery in public health facilities? Findings from a cross-sectional study in Nigeria. *BMC Public Health*, 23(1), Article 1568. <https://doi.org/10.1186/s12889-023-16492-4>
 31. Sidibe, C. S., Toure, M., & Coulibaly, A. (2023). Delays in antenatal care initiation in Guinea: A cross-sectional study. *BMC Pregnancy and Childbirth*, 23(1), Article 123. <https://doi.org/10.1186/s12884-023-05436-2>
 32. Lateef, O. J., Adeyemi, A. S., & Afolabi, O. T. (2024). Rural-urban disparities in maternal healthcare access in Nigeria. *African Journal of Reproductive Health*, 28(3), 45–53. <https://doi.org/10.29063/ajrh2024/v28i3.5>
 33. Ojifinni, O. O., & Ibisomi, L. (2020). Preconception care in Nigeria: Exploring opportunities for integration into routine maternal health services. *African Journal of Primary Health Care & Family Medicine*, 12(1), Article a2450. <https://doi.org/10.4102/phcfm.v12i1.2450>
 34. Abdo, R. A., Halil, H. M., Kebede, A. A., & Wolde, H. F. (2023). Supervised antenatal care and maternal health outcomes in Africa: A systematic review. *PLOS ONE*, 18(4), Article e0284287. <https://doi.org/10.1371/journal.pone.0284287>
 35. Umar, N. J., Afolayan, E. A., & Musa, M. B. (2019). Awareness and acceptability of preconception care among women in Sokoto, Nigeria. *Journal of Community Medicine and Primary Health Care*, 31(2), 54–62.
 36. Goossens, J., De Roose, M., Van Hecke, A., Goemaes, R., Verhaeghe, S., & Beeckman, D. (2018). Preconception lifestyle changes in women with planned pregnancies. *Midwifery*, 56, 112–120. <https://doi.org/10.1016/j.midw.2017.10.004>
 37. Lassi, Z. S., Dean, S. V., Mallampati, D., Bhutta, Z. A., & Salam, R. A. (2023). Investigating the pathways from preconception care to preventing maternal, perinatal, and child mortality: A scoping review and causal loop diagram. *Global Health: Science and Practice*, 11(4), e2200400. <https://doi.org/10.9745/GHSP-D-22-00400>
 38. Federal Ministry of Health and Social Welfare of Nigeria, National Population Commission [Nigeria], & ICF. (2024). *Nigeria Demographic and Health Survey 2023-24: Key indicators report*. ICF. <https://dhsprogram.com/pubs/pdf/PR157/PR157.pdf>