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Complete List of Authors:	Agho, Kingsley; Western Sydney University, School of Science and Health Ezeh, Osita; The University of Western, Sydney, Australia, School of Medicine Issaka, Abukari; Western Sydney University, School of Social Sciences and Psychology Enoma, Anthony ; Ambrose Alli University, Economics Baines, Surinder; University of Newcastle, School of Health Sciences Renzaho, Andre; Western Sydney University, School of Social Sciences and Psychology
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Factors associated with non-utilisation of postnatal care services among women in Nigeria: a population-based study

Agho, KE [1], Ezeh, OK[1], Issaka, AI[3], Enoma, AI[2], Baines, S[4] & Renzaho, AMN[3]

[1]School of Science and Health, Western Sydney University, Locked Bag 1797, Penrith NSW 2571, Australia

[2]Economics Department, Ambrose Alli University, Ekpoma, Nigeria

[3]School of Social Sciences and Psychology, Western Sydney University, Locked Bag 1797, Penrith 2751, NSW, Australia

[4]School of Health Sciences, University of Newcastle, Newcastle, NSW 2308, Australia

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Abstract

Objectives: To determine factors associated with non-use of postnatal care in Nigeria.

Design, setting and participants: The most recent Nigeria Demographic and Health Survey (NDHS, 2013) was examined. The study consisted of 20,467 mothers aged 15-49 years. Non-use of postnatal care services was examined against a set of demographic, health knowledge and social structure factors using multilevel regression analysis.

Main outcome: Postnatal care (PNC) services

Results: Of the 20,467 mothers, 58% reported not attending any postnatal clinics. Our analysis indicated that out of the total population at risk, 70% of mothers delivered at home, 60% delivered with the help of non-health professionals and 38% of those who lacked knowledge of obstetric complications could be attributed to non-use of PNC services. Non-use of postnatal care services among mothers was significantly associated with living in rural areas, poor households, mothers with no formal education, mothers who perceived their neonate's body size to be smaller than average; poor knowledge of delivery-related complications, and limited or no access to the mass media.

Conclusions: More than half of mothers did not utilise postnatal care services in Nigeria. Increasing awareness of these services through community-based interventions, especially among the uneducated, rural and poor mothers could improve patronage of the services and thereby reduce the rates of neonatal and maternal deaths.

Strengths and limitations of this study.

- Our analysis was restricted to births that occurred within the previous five years to the survey in order to reduce statistical bias.
- Data was from a population based national respective survey with a response rate of about 98%
- This study was a cross-sectional design, meaning that inferences on causes and effects could not be substantiated.
- This study did not assess the quality of postnatal care offered to mothers.

Introduction

There is evidence that most maternal deaths occur during labour, delivery or the first 24 hours postpartum [1, 2]. Although the neonatal period is only 28 days, it accounts for as much as 38% of all deaths in children younger than 5 years [3]. There could be a drastic reduction in these maternal and neonatal problems if women received the requisite medical attention immediately after delivering a baby and up to six weeks after delivery. This first attention given to a woman is referred to as postnatal care [4], and the first six weeks is known as postnatal period. The postnatal period is thus critical for the health and survival of both mother and newborn alike. It is against this background that the World Health Organization (WHO) has strongly advocated improvements of maternal health services as part of its Safe Motherhood Initiative (SMI) [5]. The WHO recommends that women should be given postnatal care within the first 24 hours, followed by check-ups on the second or third day, and then on the seventh day after giving birth [4].

Globally, postnatal care has been recognized to be crucial to the maintenance and promotion of the health and survival of a mother and her newborn baby. It also provides health professionals the opportunity of identifying, monitoring and managing the health conditions of both the mother and her baby during the postnatal period. Furthermore, health professionals use postnatal care to undertake health promotional programs to encourage exclusive breastfeeding, personal hygiene, appropriate infant feeding practices as well as family planning counselling and services [4].

The government of Nigeria has made tremendous efforts to meet the Millennium Development Goals (MDGs) relating to the survival of children under five years of age and that of mothers. However, the estimated maternal mortality ratio in 2013 (576) is almost the same as in 2008 (545) [6], indicating a stagnation of maternal mortality ratios. Neonatal mortality rates during this period decreased by 20%, from 46 deaths per 1,000 live births to

37 deaths per 1,000 live births [6]. Despite the benefits and effectiveness of Post natal care (PNC), the 2013 Nigeria DHS reported that 58% of Nigerian women had no postnatal check-ups [6].

In the past, utilization and timing of PNC services have been investigated by researchers from various countries, including Bangladesh [7, 8] and Indonesia [9]. However, the literature on PNC in Nigeria is limited. Some of the studies are small-scale research, focussing on small size rural communities [10-12], while others investigated a combination of antenatal and postnatal care services [13]. Even the population-based study on PNC services [14] investigated factors associated with utilization of PNC services and not non-utilization of PNC services.

Results of investigation using nationally-representative data could provide policy makers with information to implement interventions that will encourage the patronage of PNC services among women, thereby improving maternal and newborn survival rates. Consequently, given the accessibility of the most recent national data of the 2013 NDHS, and the existing gaps in the literature from Nigeria, this current study aimed to explore the individual-, household- and community-level factors that posed risk to the non-utilization PNC services among women in Nigeria.

Methods

Data from the 2013 NDHS dataset were used for this study. The 2013 NDHS household survey was conducted by the National Population Commission (NPC) in conjunction with ICF International. The household survey information on demographic and health issues such as maternal and child health, childhood mortality, and education were gathered by interviewing eligible reproductive age women and men, aged 15-49 and 15-59 years. Three questionnaires (household, women's and men's questionnaires) were used to record all

information gathered. Sampling procedures utilised in the NDHS have earlier been published in detail elsewhere [15].

A total of 38,948 women were successfully interviewed, yielding a response rate of 97.6%. More than 50% (20,467) of these women had the most recent birth within five years prior to the survey interview, and were used for our study analyses. The analysis was restricted to births that occurred within the previous five years because only those births had detailed information on the use of perinatal health services, and to limit the potential for differential recall of events from mothers who had delivered at very different durations prior to the survey date.

Study variables

Dependent variable

The outcome variable for this current study was non-utilisation of PNC services. This takes a binary form, such that postnatal care will be regarded as a 'case' (1 = if healthcare service was not received during the specified period) or a 'non-case' (0 = if healthcare service was received during the specified period). The outcome variable was examined against all potential confounding variables (Figure 1).

Independent variables

A behavioural conceptual framework of maternal health care services developed by Anderson [16] is frequently referenced in other studies on perinatal care services [17-19]. As a result, our study used the Anderson [16] framework as the basis for identifying key risk factors associated with non-use of PNC services in Nigeria. Figure 1 presents all potential confounding variables based on information available in the 2013 NDHS. These variables were classified into five distinct groups: community level factors, enabling factors, need factors, previous used health services, and predisposing level factors consisting of demographic, health knowledge and social structure factors.

[Figure 1 about here]

Statistical analysis

The prevalence of non-utilization of PNC services was described by conducting a frequency tabulation of all potential risk factors included in the study. Logistic regression generalized linear latent and mixed models (GLLAM) [20] were then used for multivariable analyses that independently examined the effect of each factor, after adjusting for confounding variables.

A hierarchical modelling technique [21] was used in the multivariable logistic regression to allow more distal factors to be appropriately examined without interference from more proximate factors. A five stage modelling was used by following a similar conceptual framework to that described by Anderson [16] (Figure 1). First, *community level factors* were entered into the baseline model to assess their relationship with the study outcome. A manually processed stepwise backwards elimination was performed and variables that were significant at 5% significance level were retained in the model. Second, *predisposing level factors* were examined with the community level factors that were significantly associated with the non-utilisation of PNC, and those variables with p-values < 0.05 were retained.

In the third stage, *enabling level factors* were investigated with the community and predisposing level factors that were significantly related with the study outcome. As before, those variables with p-values < 0.05 were retained. A similar procedure was used for *need* and *previous use of health services level factors* in the fourth and fifth stages, respectively. In our final model, we double–check for colinearity in order to reduce any statistical bias. All analyses were conducted using "SVY" commands in STATA version 13.1 (STATA Corporation, College Station, TX, USA) to adjust for the cluster sampling survey design, and weights.

The population attributable risk percentage (PAR%) was calculated for the significant risk factors to estimate contribution of each risk factor to the total risk for non-use of PNC services between 2009 and 2013. We obtained PAR% by using the following formula [ ]:

$$PAR\% = \frac{pr\ (aOR - 1)}{1 + (pr(aOR - 1))}\ X\ 100\%$$

where *pr* is the proportion of the population exposed to risk factor, and a*OR* was the adjusted odds ratio for non-use of PNC.

Results

Of the weighted total of 20,467 mothers' eligible for postnatal care (PNC) services for their most recent live-born infants within five years preceding the 2013 NDHS survey interview date, approximately 58% of the eligible mothers did not utilise PNC services during the first 41 days of infant life. The prevalence of mothers who were assisted by non-health professionals during delivery was approximately 85% (95%CI: 83.2 to 86.2). Greater than three-quarters (81.9%; 95%CI 80.3 to 83.3) of mothers delivered their infants at non-health facilities and 81% (95%CI: 79.2 to 82.7) of mothers were from poor households

The multivariable analysis showed that community, predisposing, enabling, need and previous use of health services level factors were significantly associated with non-utilisation of PNC services in Nigeria (Table 1). Infants whose mothers resided in rural areas (OR= 1.69; CI: 1.40 to 2.06) had higher odds of not patronising PNC services compared to those living in urban areas. The odds of non-use of PNC services increased significantly among infants born to mothers from poor households (OR= 1.66; CI: 1.35 to 2.05) and those whose mothers had no formal education. A higher likelihood of non-use of PNC services was associated with infants whose mothers had no knowledge of delivery-related complications and lack of exposure to mass media, particularly watching television. It was also observed that attitude of health workers had a significant effect on non-use of PNC services among nursing mothers.

An increased odds of not utilising PNC services was observed among infants whose birth size was perceived as small at birth compared to large-sized infants (OR= 1.41; CI: 1.22 to 1.64). The mothers whose infants were delivered by non-health professionals had a 3.5 times greater odds of not using PNC services than those infants who were delivered by health professionals. Other significant factors that were associated with the non-use of PNC services included mothers whose infants were delivered at non health facilities (OR= 4.51; CI: 3.75 to 5.43), and those whose deliveries occurred by caesarean section (OR= 2.29; CI: 1.61 to 3.27).

Out of the total population risk for non-use of PNC services, nearly 0.70% (PAR: 0.69; CI: 0.59 to 0.73) was attributable to infants who were delivered at non-health facilities (Table 2). Our findings also showed that non-use of PNC was associated with infants whose mothers lacked knowledge of obstetric complications (PAR: 0.38; CI: 0.34 to 0.45) and those delivered by non-health professionals (PAR: 0.60; CI: 0.54 to 0.66).

Table 1 Distribution of characteristics and adjusted odds ratio (OR) for factors associated with underutilisation of postnatal care services in Nigeria, 2013 NDHS.

		Prevalence	Adjusted
Variable	**N**	**%* (95% CI)**	**OR (95% CI)**
Environmental factor			
Residence type			
Urban	7278	36.8 (33.4—40.3)	*Ref*
Rural	13189	69.4 (67.1—71.5)	1.69(1.40—2.06)
Geopolitical zone			
North Central	2890	50.2 (45.4—55.1)	
North East	3434	67.7 (63.7—71.5)	
North West	7445	80.6 (77.1—83.6)	
South East	1719	38.7 (34.9—42.7)	
South west	2002	35.3 (31.4—39.4)	
South South	2977	22.6 (18.6—27.2)	
Socio-demographic factor			
Household wealth index			
Rich	3604	20.4 (17.8—23.2)	*Ref*

Middle	7576	47.1 (44.6—49.6)	1.15(0.98—1.34)
Poor	9287	81.0 (79.2—82.7)	1.66(1.35—2.05)
Mother's education			
Secondary or higher	6758	29.0 (27.0—31.1)	*Ref*
Primary	3915	51.2 (48.7—53.7)	0.98(0.85—1.12)
No education	9794	80.3 (78.4—82.0)	1.37(1.17—1.61)
Mother's working status			
working	13190	53.1 (50.9—55.2)	
Not-working	7258	66.4 (63.6—69.0)	
Mother's age			
< 20	2813	66.5 (63.7—69.2)	
20—29	10079	56.8 (54.5—59.0)	
30—39	6329	54.6 (52.3—56.8)	
40—49	1246	62.2 (58.7—65.6)	
Marital status			
Currently married	19397	58.5 (56.5—60.4)	
Formerly/ never married	1070	45.3 (41.1—49.6)	
Father's education			
Secondary or higher	8372	36.5 (34.3—38.8)	
Primary	3661	56.4 (53.6—59.1)	
No education	7785	82.2 (80.3—84.0)	
Birth rank and birth interval			
2 or 3 child, interval > 2	7053	53.8 (51.3—56.2)	
First child	3670	48.0 (45.3—50.7)	
2 or 3 child, interval <= 2	2094	54.9 (51.5—58.2)	
4 or more child, interval > 2	6020	66.2 (64.2—68.2)	
4 or more child, interval <= 2	1630	69.5 (66.5—72.3)	
Child sex			
Male	10282	57.3 (55.2—59.4)	
Female	10185	58.2 (56.1—60.3)	
Health knowledge			
Frequency of reading newspaper or magazine			
At least once a week	1228	22.0 (19.0—25.2)	
Less than once a week	1716	24.2 (21.2—27.5)	
Never	17393	63.5 (61.6—65.4)	
Frequency of listening to radio			
At least once a week	7317	43.7 (41.3—46.1)	
Less than once a week	5131	54.9 (51.8—58.0)	
Never	7951	72.6 (70.6—74.5)	
Frequency of watching television			
At least once a week	6027	31.0 (28.7—33.4)	Ref
Less than once a week	3517	45.6 (42.2—48.9)	1.23(1.07—1.41)
Never	10833	76.7 (74.8—78.5)	1.63(1.41—1.88)
Knowledge of delivery complications			
Yes	9032	33.8 (31.8—35.9)	Ref
None	11283	76.9 (75.0—78.6)	2.05(1.83—2.29)

Enabling factor			
Seek permission to visit health services			
Not a big problem	17865	55.1 (53.1—57.1)	
Big problem	2502	76.7 (72.5—80.4)	
Getting money to pay health services			
Not a big problem	11410	52.5 (50.1—54.8)	
Big problem	8956	64.5 (62.1—66.8)	
Distance to health facility			
Not a big problem	13907	51.0 (48.9—53.0)	
Big problem	6472	72.3 (69.7—74.9)	
Want to be accompany to health facility (19830)			
Not a big problem	17437	54.6 (52.7—55.6)	
Big problem	2934	76.4 (73.4—79.1)	
Behaviour of health workers			
Not a big problem	16928	55.4 (53.3—57.4)	Ref
Big problem	3434	69.4 (66.4—72.1)	1.18(1.03—1.36)
Need factor			
Contraceptive use			
Yes	3260	26.8 (24.3—29.4)	
No	17207	63.6 (61.8—65.5)	
Wanted pregnancy at the time			
Wanted then	18368	59.5 (57.4—61.4)	
Wanted later	1554	41.5 (38.2—44.8)	
Unwanted	444	40.0 (34.7—45.5)	
Mother's perceived birth size			
Large	8996	54.6 (52.3—56.8)	Ref
Average	8307	56.7 (54.2—59.2)	1.03(0.97—1.15)
Small	3026	69.4 (66.4—72.2)	1.41(1.22—1.64)
Previous use of health services			
Delivery assistance			
Health professional	8582	20.5 (18.9—22.2)	Ref
Non-health professional	11793	84.8 (83.2—86.2)	3.50(2.88—4.27)
Mode of delivery			
Non-caesarean	19981	59.0 (57.0—60.9)	Ref
Caesarean section	486	8.6 (6.2 — 11.7)	2.29(1.61—3.27)
Place of delivery			
Health facility	7649	17.3 (15.7—19.0)	*Ref*
Home	12780	81.9 (80.3—83.3)	4.51(3.75—5.43)

* Prevalence of non-use of postnatal care as reported by mothers interviewed during the NDHS, 2015.

Table 2 Population Attributable Risk (PAR) for adjusted significant factors

Variable	Adjusted		
	%~	OR	PAR (95%CI)
Environmental factor			
Residence type			
Urban	0.23	1.00	-
Rural	0.77	1.69	0.32(0.19—0.37)
Socio-demographic factor			
Household wealth index			
Rich	0.06	1.00	-
Middle	0.30	1.15	0.04(-0.13—0.26)
Poor	0.64	1.66	0.25(0.20—0.43)
Mother's education			
Secondary or higher	0.17	1.00	-
Primary	0.17	0.98	n/a
No education	0.66	1.37	0.18(0.11—0.31)
Health knowledge			
Frequency of watching television			
At least once a week	0.16	1.00	-
Less than once a week	0.14	1.23	0.03(-0.03—0.23)
Never	0.70	1.63	0.27(0.22—0.37)
Knowledge of delivery complications			
Yes	0.26	1.00	-
None	0.73	2.05	0.38(0.34—0.45)
Enabling factor			
Behaviour of health workers			
Not a big problem	0.79	1.00	-
Big problem	0.20	1.18	0.03(-0.02—0.19)
Need factor			
Mother's perceived birth size			
Large	0.42	1.00	-
Average	0.40	1.03	0.01(-0.02—0.08)
Small	0.18	1.41	0.05(-0.12—0.28)
Previous use of health services			
Delivery assistance			
Health professional	0.15	1.00	-
Non-health professional	0.85	3.5	0.60(0.54—0.66)
Place of delivery			
Health facility	0.11	1.00	-
Home	0.88	4.51	0.59(0.19—0.73)

~ Proportion of mothers who did not use postnatal care services

Discussion

Non-use of PNC services was used as the main outcome variable in this current study. The main factors that posed risk to patronage of PNC services included the type of residence (rural or urban), household wealth, maternal education, mothers' knowledge of delivery-related complications, mothers' access to the mass media, and perceived size of the baby at birth.

The current study has several strengths that included the use of nationally-representative data, with a relatively large sample size that yielded a high response rate (97.6%) [6]. The current findings are generalizable to the entire country since the demographic and health surveys are internationally validated and nationally adapted. Furthermore, to the best of our knowledge, this is the first study to use nationally representative data to study the determinants of non-use of PNC services in Nigeria. There are however, a number of limitations that are worthy of note when interpreting results of the current study. Firstly, being a cross-sectional study, causal associations of the observed findings could not be clearly established. Secondly, variables available to measure the demographic, health knowledge and social structure factors were limited. Finally, the survey relied on retrospective information, which may have suffered a recall bias. However, such bias might not be problematic, as the study involved only mothers who gave birth within five years preceding the survey.

Living in a rural area was found in the current study to be negatively associated with utilization of PNC services in Nigeria. This finding implied that utilization of PNC was associated with infants whose mothers lived in urban areas, which is consistent with a past study from Nepal [22]. Generally, cultural practices are more prevalent in rural areas than in urban areas. PNC patronage is limited by the cultural tradition of keeping a newborn indoors, especially among mothers who give birth at home. Several other studies have reported this tradition of seclusion [23, 24]. The finding can also be explained by the fact that in rural areas, there is inadequate access to public services such as transportation, roads and health services, meaning that urban dwellers are more likely to have access to adequate transportation and health services [25]. Adequate physical accessibility has been found to increase maternal health utilization as reported by past studies from Ghana [26] and Nepal [27]. Our finding suggests the need to provide PNC services through alternative means, such as home visits by

health professionals. The utilization of PNC services during the seclusion period when mother and baby are confined to their room could be increased in communities by involving community leaders including religious leaders in health programmes [24]. It may also be worthwhile to implement community-based newborn programmes to focus on providing home-based PNC services to mothers [28].

One key finding of the current study was that non-use of PNC services was significantly associated with infants from poor households. Using household wealth index as a proxy indicator for the socio-economic status of the household, mothers of low socio-economic status were significantly less likely to utilise PNC services. This implied that mothers from rich households or of high socio-economic status were significantly more likely to patronise PNC services. This finding is consistent with other past studies from India, Nepal and Nigeria [14, 29-33], and can be explained by the availability of money to be able to pay for such healthcare services. The government of Nigeria and other stakeholders should make these maternal health care services affordable to mothers from low-income families.

There is evidence in the extant literature that mothers with higher levels of education are better informed about health risks and are more likely to demand and gain access to healthcare [14, 31].. Several past studies have highlighted the fact that utilization of PNC services was significantly associated with mothers with higher levels of education, implying that the risk of non-utilization of PNC services was higher among mothers with no schooling [27, 34, 35]. This is similar to a finding in our study where mothers with no formal education were more likely not to access PNC services in Nigeria.

In this current study, non-utilization of PNC services was found to be significantly higher among mothers who had limited or no access to the mass media. This is consistent with results from studies in Bangladesh [36] and Indonesia [9]. Limited or non-access to the mass media implies lack of exposure to information and health knowledge about pregnancy and PNC. Apart from entertainment, the mass media are generally meant to educate. Education enhances women's knowledge of the

significance of health. It also increases women's confidence and improves their ability to seek appropriate healthcare services [37].

Conclusions

The current study reveals that the majority of Nigerian women did not utilise PNC services. Factors associated with this lack of patronage included household poverty, Rural dwelling, poor maternal educational attainment and limited access to the mass media. The government of Nigeria and other non-governmental organisations should provide focused financial support to mothers from economically disadvantaged households in order to minimise the inequitable access to pregnancy and delivery healthcare services with trained healthcare personnel in Nigeria. Such an intervention could be complemented with community-based promotion programmes that would enhance awareness of the benefits of both pregnancy and delivery healthcare services. Devices such as television sets and radios should be made affordable to women, especially those who reside in rural areas. Furthermore, the use of home visits by health professionals should also be implemented to ensure that those mothers living in remote areas are not disadvantaged.

Contributors:

KEA and OKE were involved in the conception and design of this study. KEA conducted the literature review, carried out the analysis and drafted the manuscript. OKE, AII, AIE, SB and AMNR provided advice on interpretation, and revised and edited the manuscript. All authors read and approved the manuscript.

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Competing interests: None.

- **Ethics approval:** This study was based on an analysis of existing public domain survey data sets that is freely available online with all identifier information removed. The first author communicated with MEASURE DHS/ICF International, Rockville, MD, USA and permission was granted to download and use the data.
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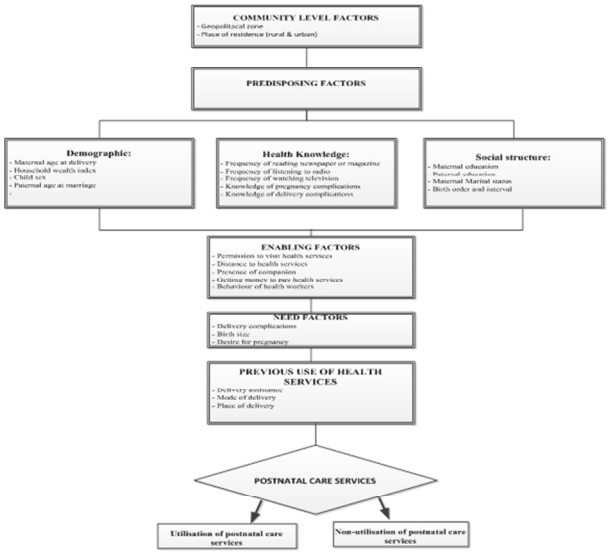

Figure 1 Conceptual frame work adapted from Anderson behavioural model.

Figure 1 Conceptual frame work adapted from Anderson behavioural model.
254x190mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	7-8

	Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy
	(*e*) Describe any sensitivity analyses

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-12
		(*b*) Report category boundaries when continuous variables were categorized	9-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Non

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Population-attributable risk estimates for factors associated with non-use of postnatal care services among women in Nigeria

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Population-attributable risk estimates for factors associated with non-use of postnatal care services among women in Nigeria

Agho, KE [1*], Ezeh, OK[1], Issaka, AI[3], Enoma, AI[2], Baines, S[4] & Renzaho, AMN[3]

[1]School of Science and Health, Western Sydney University, Locked Bag 1797, Penrith NSW 2571, Australia

[2]Economics Department, Ambrose Alli University, Ekpoma, Nigeria

[3]School of Social Sciences and Psychology, Western Sydney University, Locked Bag 1797, Penrith 2751, NSW, Australia

[4]School of Health Sciences, University of Newcastle, Newcastle, NSW 2308, Australia

*Correspondence

Kingsley E Agho
Senior Lecturer
School of Science and Health
Western Sydney University
Building 24, level 4, Room 57
Campbelltown Campus
Locked Bag 1797, Penrith NSW 2571
Australia
Ph: +612 4620 3635
Fax: +612 4620 3792
Email: k.agho@uws.edu.au

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Abstract

Objectives: To determine Population-Attributable risk (PARs) estimates for factors associated with the non-use of postnatal care in Nigeria.

Design, setting and participants: The most recent Nigeria Demographic and Health Survey (NDHS, 2013) was examined. The study consisted of 20,467 mothers aged 15-49 years. Non-use of postnatal care (PNC) services was examined against a set of demographic, health knowledge and social structure factors, using multilevel regression analysis. PARs estimates were obtained for each factor associated with non-use of PNC in the final multivariate logistic regression model.

Main outcome: Postnatal care (PNC) services

Results: Non-use of PNC services was attributed to 68% (95%CI: 56%-76%) of mothers who delivered at home, 61% (95%CI: 55%-75%) of those who delivered with the help of non-health professionals and 37% (95% CI- 31%-45%) of who lacked knowledge of delivery complications in the study population. Multiple variable analyses revealed that non-use of PNC services among mothers was significantly associated with rural residence, household poverty, no or low levels of mothers' formal education, small perceived size of neonate, poor knowledge of delivery-related complications, and limited or no access to the mass media.

Conclusions: PAR estimates for factors associated with the non-use of postnatal care in Nigeria highlight the need for community-based interventions regarding maternal education and services that focus on mothers who delivered their babies at home. Our study also recommends financial support from the Nigerian government for mothers from low socioeconomic settings, so as to minimise the inequitable access to pregnancy and delivery healthcare services with trained healthcare personnel.

Strengths and limitations of this study.

- Our analysis was restricted to mothers who received PNC services within five years prior to the survey; in order to minimise recall bias.
- Data was from a population based national respective survey with a response rate of about 98%
- This study was a cross-sectional design and therefore inferences on causes and effects could not be substantiated.
- This study did not assess the quality of postnatal care offered to mothers.

Introduction

There is evidence that most maternal deaths occur during labour, delivery or the first 24 hours postpartum [1, 2]. Although the neonatal period is only 28 days, it accounts for as much as 38% of all deaths in children younger than 5 years [3]. There could be a drastic reduction in these maternal and neonatal problems if women received the requisite medical attention and postnatal care during the postnatal period (i.e. health care services received in the first six weeks after delivery) [4]. The postnatal period is thus critical for the health and survival of both mother and newborn alike. It is against this background that the World Health Organization (WHO) has strongly advocated improvements of maternal health services as part of its Safe Motherhood Initiative (SMI) [5]. The WHO recommends that women should be given postnatal care within the first 24 hours, followed by check-ups on the second or third day, and then on the seventh day after giving birth [4].

Globally, postnatal care has been recognized to be crucial to the maintenance and promotion of the health and survival of a mother and her newborn baby. It also provides health professionals the opportunity of identifying, monitoring and managing the health conditions of both the mother and her baby during the postnatal period. Furthermore, health professionals use postnatal care to undertake health promotional programs to encourage exclusive breastfeeding, personal hygiene, appropriate infant feeding practices as well as family planning counselling and services [4].

The government of Nigeria has made tremendous efforts to meet the Millennium Development Goals (MDGs) relating to the survival of children under five years of age and that of mothers. However, the most recently estimated maternal mortality ratio indicated a slight rise of approximately 6% - from 545 maternal deaths per 100,000 live births in 2008 to

576 per 100,000 live births in 2013[6], indicating poor maternal health care services. Neonatal mortality rates during this period decreased by 8% - from 40 deaths per 1,000 live births to 37 deaths per 1,000 live births [6]. Despite the benefits and effectiveness of postnatal care (PNC), the 2013 Nigeria Demographic and Health Survey (NDHS) reported that 58% of Nigerian women had no postnatal check-ups despite the recommendations [6].

Several population-based studies have been carried out on both use and non-use of PNC services, particularly in low and middle income countries, including Bangladesh [7, 8], Indonesia[9], and Timor-Leste [10] . However, in Nigeria the literature is limited. A majority of past studies were community based studies that focused on small-scale research [11-13] . Recently, a population-based study on determinants of PNC non-utilization among women in Nigeria was conducted [14]. However, this study did not examine the attributable risks of factors associated with non-use of PNC. Hence, this current study aimed to extrapolate PAR proportions to provide estimates of the total magnitude of each of the factors associated with non-use of PNC in Nigeria. Results of our investigation using nationally-representative data could provide policy makers with information to implement interventions that will encourage the patronage of PNC services among women, thereby improving maternal and newborn survival rates.

Methods

Data from the 2013 NDHS dataset were used for this study. The 2013 NDHS household survey was conducted by the National Population Commission (NPC) in conjunction with ICF International. The household survey information on demographic and health issues such as maternal and child health, childhood mortality, and education were gathered by interviewing eligible reproductive age women and men, aged 15-49 and 15-59 years

respectively. Three questionnaires (household, women's and men's questionnaires) were used to record all information gathered. Sampling procedures utilised in the NDHS have earlier been published in detail elsewhere [15].

A total of 38,948 women were successfully interviewed, yielding a response rate of 97.6%. More than 50% (20,467) of these women had the most recent birth within five years prior to the survey interview, and were used for our study analyses. The analysis was restricted to births that occurred within the previous five years because only those births had detailed information on the use of perinatal health services, and to limit the potential for differential recall of events from mothers who had delivered at very different durations prior to the survey date.

Study variables

Dependent variable

The outcome variable for this current study was non-use of PNC services. This takes a binary form, such that postnatal care will be regarded as a 'case' (1 = if healthcare service was not received during the first six weeks after delivery) or a 'non-case' (0 = if healthcare service was received during the first six weeks of infant life"). The outcome variable was examined against all potential confounding variables (Figure 1).

Independent variables

A behavioural conceptual framework of maternal health care services developed by Anderson [16] is frequently referenced in other studies on perinatal care services [17-19]. As a result, our study used the Anderson [16] framework as the basis for identifying key risk factors associated with non-use of PNC services in Nigeria. Figure 1 presents all potential confounding variables based on information available in the 2013 NDHS. These variables were classified into five distinct groups: community level factors (geopolitical zone and place of residence); predisposing level factors (demographic, health knowledge and social structure

factors); demographic and social structure factors (household wealth index, level of mother's education, mother's age at delivery, level of father's education, mother's marital status, child's sex and a combination of birth order and birth interval); health knowledge characteristics (frequency of reading newspaper or magazine, frequency of watching television, frequency of listening to radio and knowledge of delivery complication); enabling factors (permission to visit health services, distance to health services, presence of companion, ability to pay for health services and behaviour of health workers); need factors (delivery complications, birth size and desire for pregnancy); and previous use of health services (delivery assistance, mode of delivery and place of delivery).

[Figure 1 about here]

Statistical analysis

The prevalence of non-use of PNC services was described by conducting a frequency tabulation of all potential risk factors included in the study. Logistic regression generalized linear latent and mixed models (GLLAM) with the logit link and binomial family [20] were then used for multivariable analyses that independently examined the effect of each factor, after adjusting for confounding variables.

A hierarchical modelling technique [21] was used in the multivariable logistic regression to allow more distal factors to be appropriately examined without interference from more proximate factors. A five stage modelling was used by following a similar conceptual framework to that described by Anderson [16] (Figure 1). First, *community level factors* were entered into the baseline model to assess their relationship with the study outcome. A manually processed stepwise backwards elimination was performed and variables with *p*-values < 0.05 were retained in the model. Second, *predisposing level factors* were examined

with the community level factors that were significantly associated with the non-use of PNC, and those variables with *p*-values < 0.05 were retained.

In the third stage, *enabling level factors* were investigated with the community and predisposing level factors that were significantly related with the study outcome. As before, those variables with *p*-values < 0.05 were retained. A similar procedure was used for *need* and *previous use of health services level factors* in the fourth and fifth stages, respectively. In our final model, we double–check for colinearity in order to reduce any statistical bias. All analyses were conducted using "SVY" commands in STATA version 13.1 (STATA Corporation, College Station, TX, USA) to adjust for the cluster sampling survey design, and weights.

The population attributable risk (PAR) was calculated for the significant risk factors to estimate contribution of each risk factor to the total risk for non-use of PNC services between 2009 and 2013. We obtained PAR and 95% confidence Intervals (CI) by using the following similar method employed by Stafford et al [22].

$$PAR = \frac{pr\ (aOR - 1)}{(aOR)}$$

where *pr* is the proportion of the population exposed to risk factor, and a*OR* was the adjusted odds ratio for non-use of PNC.

Results

Of the weighted total of 20,467 mothers' eligible for PNC services for their most recent live-born infants within five years preceding the 2013 NDHS survey interview date, approximately 58% of the eligible mothers did not use PNC services during the first six weeks of an infant's life. The prevalence of mothers who were assisted by non-health professionals during delivery was approximately 85% (95%CI: 83.2 to 86.2). Greater than three-quarters (81.9%; 95%CI 80.3 to 83.3) of mothers delivered their infants at non-health facilities and 81% (95%CI: 79.2 to 82.7) of mothers were from poor households

The multivariable analysis showed that community, predisposing, enabling, need and previous use of health services level factors were significantly associated with non-use of PNC services in Nigeria (Table 1). Infants whose mothers resided in rural areas (OR= 1.69; CI: 1.40 to 2.06) had higher odds of not patronising PNC services compared to those living in urban areas. The odds of non-use of PNC services increased significantly among infants born to mothers from poor households (OR= 1.66; CI: 1.35 to 2.05) and those whose mothers had no formal education. A higher likelihood of non-use of PNC services was associated with infants whose mothers had no knowledge of delivery-related complications and lack of exposure to mass media, particularly watching television. It was also observed that attitude of health workers had a significant effect on non-use of PNC services among nursing mothers.

An increased odds of non-use of PNC services was observed among infants whose birth size was perceived as small at birth compared to large-sized infants (OR= 1.41; CI: 1.22 to 1.64). The mothers whose infants were delivered by non-health professionals had a 3.5 times greater odds of not using PNC services than those infants who were delivered by health professionals. Other significant factors that were associated with the non-use of PNC services included mothers whose infants were delivered at non health facilities (OR= 4.51; CI: 3.75 to 5.43), and those whose deliveries occurred by caesarean section (OR= 2.29; CI: 1.61 to 3.27).

Out of the total population attributable risk for non-use of PNC services, nearly 0.70 (PAR: 0.68; CI: 0.56 to 0.76) was attributable to infants who were delivered at non-health facilities (Table 2). Our findings also showed that non-use of PNC was associated with infants whose mothers lacked knowledge of obstetric complications (PAR: 0.37; CI: 0.31 to 0.45) and those delivered by non-health professionals (PAR: 0.61; CI: 0.55 to 0.75).

Table 1 Distribution of characteristics, unadjusted and adjusted odds ratio (OR) for factors associated with non-use of postnatal care services in Nigeria, 2013 NDHS.

Variable	N	%* (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Environmental factor				
Residence type				
Urban	7278	36.8 (33.4—40.3)	*Ref*	*Ref*
Rural	13189	69.4 (67.1—71.5)	3.89 (3.20—4.73)	1.69(1.40—2.06)
Geopolitical zone				
North Central	2890	50.2 (45.4—55.1)	*Ref*	
North East	3434	67.7 (63.7—71.5)	2.08 (1.59—2.71)	
North West	7445	80.6 (77.1—83.6)	4.11 (3.09—5.47)	
South East	1719	38.7 (34.9—42.7)	0.63 (0.48—0.81)	
South west	2002	35.3 (31.4—39.4)	0.54 (0.42—0.70)	
South South	2977	22.6 (18.6—27.2)	0.29 (0.21—0.40)	
Socio-demographic factor				
Household wealth index				
Rich	3604	20.4 (17.8—23.2)	*Ref*	*Ref*
Middle	7576	47.1 (44.6—49.6)	3.48 (2.90—4.17)	1.15(0.98—1.34)
Poor	9287	81.0 (79.2—82.7)	16.7 (13.6—20.5)	1.66(1.35—2.05)
Mother's education				
Secondary or higher	6758	29.0 (27.0—31.1)	*Ref*	*Ref*
Primary	3915	51.2 (48.7—53.7)	2.57 (2.29—2.89)	0.98(0.85—1.12)
No education	9794	80.3 (78.4—82.0)	9.97 (8.55—11.6)	1.37(1.17—1.61)
Mother's working status				
working	13190	53.1 (50.9—55.2)	*Ref*	*Ref*
Not-working	7258	66.4 (63.6—69.0)	1.75 (1.54—1.97)	0.84(0.76—0.92)
Mother's age				
< 20	2813	66.5 (63.7—69.2)	Ref	
20—29	10079	56.8 (54.5—59.0)	0.66 (0.59—0.74)	
30—39	6329	54.6 (52.3—56.8)	0.61 (0.53—0.69)	
40—49	1246	62.2 (58.7—65.6)	0.83 (0.70—0.99)	
Marital status				
Currently married	19397	58.5 (56.5—60.4)	*Ref*	
Formerly/ never married	1070	45.3 (41.1—49.6)	0.59 (0.49—0.70)	
Father's education				
Secondary or higher	8372	36.5 (34.3—38.8)	*Ref*	
Primary	3661	56.4 (53.6—59.1)	2.25 (1.99—2.54)	
No education	7785	82.2 (80.3—84.0)	8.04 (6.87—9.42)	
Birth rank and birth interval (years)				
2 or 3 child, interval > 2	7053	53.8 (51.3—56.2)	Ref	
First child	3670	48.0 (45.3—50.7)	0.79 (0.72—0.87)	
2 or 3 child, interval <= 2	2094	54.9 (51.5—58.2)	1.05 (0.93—1.18)	
4 or more child, interval > 2	6020	66.2 (64.2—68.2)	1.69 (1.54—1.85)	
4 or more child, interval <= 2	1630	69.5 (66.5—72.3)	1.95 (1.70—2.25)	
Child sex				

Male	10282	57.3 (55.2—59.4)	Ref	
Female	10185	58.2 (56.1—60.3)	1.04 (0.97—1.11)	
Health knowledge				
Frequency of reading newspaper or magazine				
At least once a week	1228	22.0 (19.0—25.2)	Ref	Ref
Less than once a week	1716	24.2 (21.2—27.5)	1.14 (0.92—1.41)	1.08(0.81—1.45)
Never	17393	63.5 (61.6—65.4)	6.19 (5.11—7.51)	1.40(1.09—1.79)
Frequency of listening to radio				
At least once a week	7317	43.7 (41.3—46.1)	Ref	
Less than once a week	5131	54.9 (51.8—58.0)	1.57 (1.37—1.79)	
Never	7951	72.6 (70.6—74.5)	3.41 (3.02—3.85)	
Frequency of watching television				
At least once a week	6027	31.0 (28.7—33.4)	Ref	Ref
Less than once a week	3517	45.6 (42.2—48.9)	1.87 (1.61—2.17)	1.23(1.07—1.41)
Never	10833	76.7 (74.8—78.5)	7.35 (6.30—8.57)	1.63(1.41—1.88)
Knowledge of delivery complications				
Yes	9032	33.8 (31.8—35.9)	Ref	Ref
None	11283	76.9 (75.0—78.6)	6.50 (5.71—7.40)	2.05(1.83—2.29)
Enabling factor				
Seek permission to visit health services				
Not a big problem	17865	55.1 (53.1—57.1)	Ref	Ref
Big problem	2502	76.7 (72.5—80.4)	2.68 (2.13—3.36)	1.27(1.09—1.47)
Getting money to pay health services				
Not a big problem	11410	52.5 (50.1—54.8)	Ref	Ref
Big problem	8956	64.5 (62.1—66.8)	1.65 (1.47—1.85)	1.26(1.14—1.39)
Distance to health facility				
Not a big problem	13907	51.0 (48.9—53.0)	Ref	Ref
Big problem	6472	72.3 (69.7—74.9)	2.52 (2.18—2.91)	1.25(1.12—1.40)
Want to be accompany to health facility				
Not a big problem	17437	54.6 (52.7—55.6)	Ref	
Big problem	2934	76.4 (73.4—79.1)	2.69 (2.30—3.15)	
Behaviour of health workers				
Not a big problem	16928	55.4 (53.3—57.4)	Ref	Ref
Big problem	3434	69.4 (66.4—72.1)	1.82 (1.60—2.09)	1.18(1.03—1.36)
Need factor				
Contraceptive use				
Yes	3260	26.8 (24.3—29.4)	Ref	Ref
No	17207	63.6 (61.8—65.5)	4.78 (4.16—5.49)	1.12(0.98—1.28)
Wanted pregnancy at the time				
Wanted then	18368	59.5 (57.4—61.4)	Ref	
Wanted later	1554	41.5 (38.2—44.8)	0.48 (0.42—0.56)	
Unwanted	444	40.0 (34.7—45.5)	0.45 (0.36—0.57)	
Mother's perceived baby size at birth				
Large	8996	54.6 (52.3—56.8)	Ref	Ref
Average	8307	56.7 (54.2—59.2)	1.09 (0.98—1.21)	1.03(0.97—1.15)
Small	3026	69.4 (66.4—72.2)	1.88 (1.64—2.16)	1.41(1.22—1.64)

Previous use of health services				
Delivery assistance				
Health professional	8582	20.5 (18.9—22.2)	Ref	Ref
Non-health professional	11793	84.8 (83.2—86.2)	21.1 (17.8—25.0)	3.50(2.88—4.27)
Mode of delivery				
Non-caesarean	19981	59.0 (57.0—60.9)	Ref	Ref
Caesarean section	486	8.6 (6.2 — 11.7)	1.44 (1.33—1.56)	2.29(1.61—3.27)
Place of delivery				
Health facility	7649	17.3 (15.7—19.0)	Ref	*Ref*
Home	12780	81.9 (80.3—83.3)	21.6 (18.6—25.1)	4.51(3.75—5.43)

*Prevalence of non-use of postnatal care as reported by mothers interviewed during the NDHS, 2013.

Table 2 Population Attributable Risk (PAR) for adjusted significant factors

Variable	Adjusted %~	Adjusted OR	Adjusted PAR (95%CI)
Environmental factor			
Residence type			
Urban	0.23	1.00	-
Rural	0.77	1.69	0.31(0.21—0.39)
Socio-demographic factor			
Household wealth index			
Rich	0.06	1.00	-
Middle	0.30	1.15	0.04(0.02—0.24)
Poor	0.64	1.66	0.26(0.21—0.45)
Mother's education			
Secondary or higher	0.17	1.00	-
Primary	0.17	0.98	n/a
No education	0.66	1.37	0.18(0.10—0.33)
Health knowledge			
Frequency of watching television			
At least once a week	0.16	1.00	-
Less than once a week	0.14	1.23	0.03(0.02—0.27)
Never	0.70	1.63	0.27(0.21—0.38)
Knowledge of delivery complications			
Yes	0.26	1.00	-
None	0.73	2.05	0.37(0.31—0.45)
Enabling factor			
Behaviour of health workers			
Not a big problem	0.79	1.00	-
Big problem	0.20	1.18	0.03(0.02—0.25)
Need factor			
Mother's perceived birth size			
Large	0.42	1.00	-
Average	0.40	1.03	0.01(0.009—0.12)
Small	0.18	1.41	0.05(0.03—0.25)
Previous use of health services			
Delivery assistance			
Health professional	0.15	1.00	-
Non-health professional	0.85	3.5	0.61(0.55—0.75)
Place of delivery			
Health facility	0.11	1.00	-
Home	0.88	4.51	0.68(0.56—0.76)

~ Proportion of mothers who did not use postnatal care services

Discussion

The non-use of PNC services was used as the main outcome variable in this current study. The main factors that posed risk to patronage of PNC services included the type of residence (rural or urban), household wealth, maternal education, mothers' knowledge of delivery-related complications, mothers' access to the mass media, and perceived size of the baby at birth.

The current study has several strengths that included the use of nationally-representative data, with a relatively large sample size that yielded a high response rate (97.6%) [6]. The current findings are generalizable to the entire country since the demographic and health surveys are internationally validated and nationally adapted. Furthermore, to the best of our knowledge, this is the first study to use nationally representative data to study the determinants of non-use of PNC services in Nigeria. There are however, a number of limitations that are worthy of note when interpreting results of the current study. Firstly, being a cross-sectional study, causal associations of the observed findings could not be clearly established. Secondly, variables available to measure the demographic, health knowledge and social structure factors were limited. Finally, the survey relied on retrospective information, which may have suffered a recall bias. However, such bias might not be problematic, as the study involved only mothers who gave birth within five years preceding the survey.

Living in a rural area was found in the current study to be negatively associated with use of PNC services in Nigeria. This finding implied that use of PNC was associated with infants whose mothers lived in urban areas, which is consistent with a past study from Nepal [23]. Generally, cultural practices are more prevalent in rural areas than in urban areas. PNC patronage is limited by the cultural tradition of keeping a newborn indoors, especially among mothers who give birth at home. Several other studies have reported this tradition of seclusion during the postnatal period [24, 25]. The finding can also be explained by the fact that in rural areas, there is inadequate access to public services such as transportation, roads and health services, whereasurban dwellers are more likely to have access to adequate transportation and health services [26]. Adequate physical accessibility to health care services has been found to increase maternal health utilization as reported by past studies from Ghana [27] and Nepal [28]. Our findings support the need to provide PNC services, especially in

rural areas, through alternative means, such as home visits by health professionals. The use of PNC services during the seclusion period when mother and baby are confined to their room could be increased in communities by involving community leaders including religious leaders in health programmes [25]. It may also be worthwhile to implement community-based newborn programmes to focus on providing home-based PNC services to mothers [29].

One key finding of the current study was that non-use of PNC services was significantly associated with infants from poor households. Using household wealth index as a proxy indicator for the socio-economic status of the household, mothers of low socio-economic status were significantly less likely to use PNC services. This implied that mothers from rich households or of high socio-economic status were significantly more likely to patronise PNC services. This finding is consistent with other past studies from India, Nepal and Nigeria [30-35], and can be explained by the availability of money to be able to pay for such healthcare services. The government of Nigeria and other stakeholders should look to make these maternal health care services affordable to mothers from low-income families.

There is evidence in the extant literature that mothers with higher levels of education are better informed about health risks and are more likely to demand and gain access to healthcare [32, 35].. Several past studies have highlighted the fact that use of PNC services was significantly associated with mothers with higher levels of education, implying that the risk of non-use of PNC services was higher among mothers with no schooling [28, 36, 37]. This is similar to a finding in our study where mothers with no formal education were more likely not to access PNC services in Nigeria.

In this current study, non-use of PNC services was found to be significantly higher among mothers who had limited or no access to the mass media. This is consistent with results from studies in Bangladesh [38] and Indonesia [9]. Limited or non-access to the mass media implies lack of exposure to information and health knowledge about pregnancy and PNC. Apart from entertainment, the mass media also inform and educate. Education and availability of information can help to enhance women's knowledge of the significance of health and increase women's confidence and improve their ability to seek appropriate healthcare services [39].

Conclusions

The current study reveals that the majority of Nigerian women did not use PNC services. Factors associated with this lack of patronage included household poverty, rural dwelling, poor maternal educational attainment and limited access to the mass media. The government of Nigeria and other non-governmental organisations should provide focused financial support to mothers from economically disadvantaged households in order to minimise the inequitable access to pregnancy and delivery healthcare services with trained healthcare personnel. Such an intervention could be complemented with community-based promotion programmes that would enhance awareness of the benefits of both pregnancy and postnatal care health services. Devices such as television sets and radios should be made affordable to women, especially those who reside in rural areas. Furthermore, the use of home visits by health professionals should also be implemented to ensure that those mothers living in remote areas are not further disadvantaged.

Contributors:

KEA and OKE were involved in the conception and design of this study. KEA carried out the analysis. KEA and AII drafted the manuscript. OKE, AII, AIE, SB and AMNR provided advice on interpretation, and revised and edited the manuscript. All authors read and approved the manuscript.

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Competing interests: None.

Ethics approval: This study was based on an analysis of existing public domain survey data sets that is freely available online with all identifier information removed. The first author communicated with MEASURE DHS/ICF International, Rockville, MD, USA and permission was granted to download and use the data.

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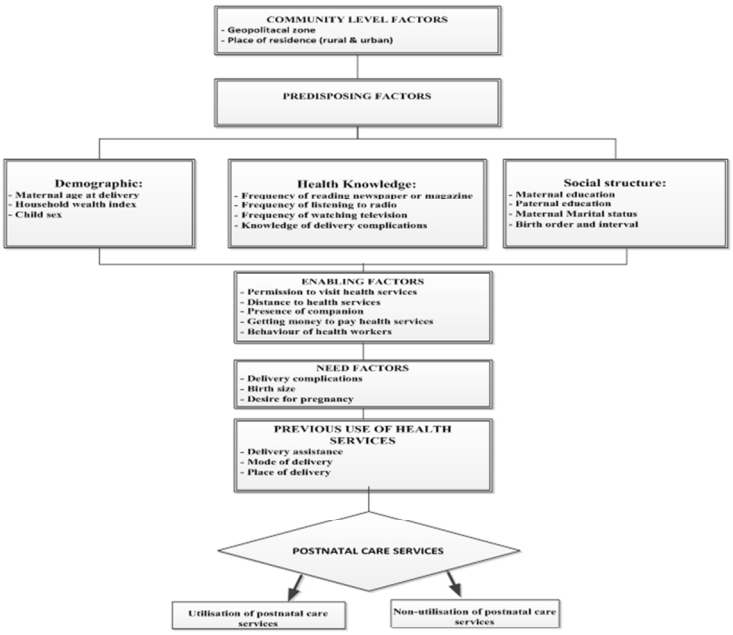

Figure 1 Conceptual frame work adapted from Anderson behavioural model.

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254x190mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	7-8

	Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy
	(*e*) Describe any sensitivity analyses

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-12
		(*b*) Report category boundaries when continuous variables were categorized	9-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Non

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.