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## Factors associated with non-utilisation of postnatal care services among women in Nigeria: a population-based study

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1 **Factors associated with non-utilisation of postnatal care services among women in**  
2 **Nigeria: a population-based study**

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13 **Keywords:** Postnatal care, Mortality, Nigeria

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3 16 **Abstract**

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5 17 **Objectives:** To determine factors associated with non-use of postnatal care in Nigeria.

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7 18 **Design, setting and participants:** The most recent Nigeria Demographic and Health Survey  
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10 19 (NDHS, 2013) was examined. The study consisted of 20,467 mothers aged 15-49 years. Non-  
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12 20 use of postnatal care services was examined against a set of demographic, health knowledge  
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14 21 and social structure factors using multilevel regression analysis.

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17 22  
18 23 **Main outcome:** Postnatal care (PNC) services

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20 24  
21 25 **Results:** Of the 20,467 mothers, 58% reported not attending any postnatal clinics. Our  
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23 26 analysis indicated that out of the total population at risk, 70% of mothers delivered at home,  
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25 27 60% delivered with the help of non-health professionals and 38% of those who lacked  
26  
27 28 knowledge of obstetric complications could be attributed to non-use of PNC services. Non-  
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29 29 use of postnatal care services among mothers was significantly associated with living in rural  
30  
31 30 areas, poor households, mothers with no formal education, mothers who perceived their  
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33 31 neonate's body size to be smaller than average; poor knowledge of delivery-related  
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35 32 complications, and limited or no access to the mass media.

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37 33  
38 34 **Conclusions:** More than half of mothers did not utilise postnatal care services in Nigeria.  
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40 35 Increasing awareness of these services through community-based interventions, especially  
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42 36 among the uneducated, rural and poor mothers could improve patronage of the services and  
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44 37 thereby reduce the rates of neonatal and maternal deaths.

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3 41 **Strengths and limitations of this study.**  
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- 5 42 • Our analysis was restricted to births that occurred within the previous five years to the survey in  
6  
7 43 order to reduce statistical bias.  
8  
9 44 • Data was from a population based national representative survey with a response rate of about 98%  
10  
11 45 • This study was a cross-sectional design, meaning that inferences on causes and effects  
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13  
14 46 could not be substantiated.  
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16 47 • This study did not assess the quality of postnatal care offered to mothers.  
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## 49 Introduction

50 There is evidence that most maternal deaths occur during labour, delivery or the first 24 hours  
51 postpartum [1, 2]. Although the neonatal period is only 28 days, it accounts for as much as  
52 38% of all deaths in children younger than 5 years [3]. There could be a drastic reduction in  
53 these maternal and neonatal problems if women received the requisite medical attention  
54 immediately after delivering a baby and up to six weeks after delivery. This first attention  
55 given to a woman is referred to as postnatal care [4], and the first six weeks is known as  
56 postnatal period. The postnatal period is thus critical for the health and survival of both  
57 mother and newborn alike. It is against this background that the World Health Organization  
58 (WHO) has strongly advocated improvements of maternal health services as part of its Safe  
59 Motherhood Initiative (SMI) [5]. The WHO recommends that women should be given  
60 postnatal care within the first 24 hours, followed by check-ups on the second or third day, and  
61 then on the seventh day after giving birth [4].

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

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

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3 74 37 deaths per 1,000 live births [6]. Despite the benefits and effectiveness of Post natal care  
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5 75 (PNC), the 2013 Nigeria DHS reported that 58% of Nigerian women had no postnatal check-  
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7 76 ups [6].  
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10 77 In the past, utilization and timing of PNC services have been investigated by researchers from  
11  
12 78 various countries, including Bangladesh [7, 8] and Indonesia [9]. However, the literature on  
13  
14 79 PNC in Nigeria is limited. Some of the studies are small-scale research, focussing on small  
15  
16 80 size rural communities [10-12], while others investigated a combination of antenatal and  
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18 81 postnatal care services [13]. Even the population-based study on PNC services [14]  
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20 82 investigated factors associated with utilization of PNC services and not non-utilization of  
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22 83 PNC services.  
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25 84 Results of investigation using nationally-representative data could provide policy makers  
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27 85 with information to implement interventions that will encourage the patronage of PNC  
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29 86 services among women, thereby improving maternal and newborn survival rates.  
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31 87 Consequently, given the accessibility of the most recent national data of the 2013 NDHS, and  
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33 88 the existing gaps in the literature from Nigeria, this current study aimed to explore the  
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35 89 individual-, household- and community-level factors that posed risk to the non-utilization  
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37 90 PNC services among women in Nigeria.  
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## 40 91 **Methods**

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43 92 Data from the 2013 NDHS dataset were used for this study. The 2013 NDHS household  
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45 93 survey was conducted by the National Population Commission (NPC) in conjunction with  
46  
47 94 ICF International. The household survey information on demographic and health issues such  
48  
49 95 as maternal and child health, childhood mortality, and education were gathered by  
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51 96 interviewing eligible reproductive age women and men, aged 15-49 and 15-59 years. Three  
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53 97 questionnaires (household, women's and men's questionnaires) were used to record all  
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3 98 information gathered. Sampling procedures utilised in the NDHS have earlier been published  
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5 99 in detail elsewhere [15].  
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7  
8 100 A total of 38,948 women were successfully interviewed, yielding a response rate of 97.6%.  
9  
10 101 More than 50% (20,467) of these women had the most recent birth within five years prior to  
11  
12 102 the survey interview, and were used for our study analyses. The analysis was restricted to  
13  
14 103 births that occurred within the previous five years because only those births had detailed  
15  
16 104 information on the use of perinatal health services, and to limit the potential for differential  
17  
18 105 recall of events from mothers who had delivered at very different durations prior to the  
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20 106 survey date.  
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## 22 23 107 **Study variables**

### 24 25 108 *Dependent variable*

26  
27 109 The outcome variable for this current study was non-utilisation of PNC services. This takes a  
28  
29 110 binary form, such that postnatal care will be regarded as a 'case' (1 = if healthcare service  
30  
31 111 was not received during the specified period) or a 'non-case' (0 = if healthcare service was  
32  
33 112 received during the specified period). The outcome variable was examined against all  
34  
35 113 potential confounding variables (Figure 1).  
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### 38 39 114 *Independent variables*

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41 115 A behavioural conceptual framework of maternal health care services developed by Anderson  
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43 116 [16] is frequently referenced in other studies on perinatal care services [17-19]. As a result,  
44  
45 117 our study used the Anderson [16] framework as the basis for identifying key risk factors  
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47 118 associated with non-use of PNC services in Nigeria. Figure 1 presents all potential  
48  
49 119 confounding variables based on information available in the 2013 NDHS. These variables  
50  
51 120 were classified into five distinct groups: community level factors, enabling factors, need  
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53 121 factors, previous used health services, and predisposing level factors consisting of  
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55 122 demographic, health knowledge and social structure factors.  
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3 123 [Figure 1 about here]  
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8 125 **Statistical analysis**

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10 126 The prevalence of non-utilization of PNC services was described by conducting a frequency  
11 127 tabulation of all potential risk factors included in the study. Logistic regression generalized  
12 128 linear latent and mixed models (GLLAM) [20] were then used for multivariable analyses that  
13 129 independently examined the effect of each factor, after adjusting for confounding variables.

14 130 A hierarchical modelling technique [21] was used in the multivariable logistic regression to  
15 131 allow more distal factors to be appropriately examined without interference from more  
16 132 proximate factors. A five stage modelling was used by following a similar conceptual  
17 133 framework to that described by Anderson [16] (Figure 1). First, *community level factors* were  
18 134 entered into the baseline model to assess their relationship with the study outcome. A  
19 135 manually processed stepwise backwards elimination was performed and variables that were  
20 136 significant at 5% significance level were retained in the model. Second, *predisposing level*  
21 137 *factors* were examined with the community level factors that were significantly associated  
22 138 with the non-utilisation of PNC, and those variables with  $p$ -values  $< 0.05$  were retained.

23 139 In the third stage, *enabling level factors* were investigated with the community and  
24 140 predisposing level factors that were significantly related with the study outcome. As before,  
25 141 those variables with  $p$ -values  $< 0.05$  were retained. A similar procedure was used for *need*  
26 142 and *previous use of health services level factors* in the fourth and fifth stages, respectively. In  
27 143 our final model, we double-check for collinearity in order to reduce any statistical bias. All  
28 144 analyses were conducted using “SVY” commands in STATA version 13.1 (STATA  
29 145 Corporation, College Station, TX, USA) to adjust for the cluster sampling survey design, and  
30 146 weights.



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3 147 The population attributable risk percentage (PAR%) was calculated for the significant risk  
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5 148 factors to estimate contribution of each risk factor to the total risk for non-use of PNC  
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7 149 services between 2009 and 2013. We obtained PAR% by using the following formula [ ]:  
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9

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

10  
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13 150 where *pr* is the proportion of the population exposed to risk factor, and *aOR* was the adjusted  
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15 151 odds ratio for non-use of PNC.  
16

## 17 152 **Results**

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20 153 Of the weighted total of 20,467 mothers' eligible for postnatal care (PNC) services for their  
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22 154 most recent live-born infants within five years preceding the 2013 NDHS survey interview  
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24 155 date, approximately 58% of the eligible mothers did not utilise PNC services during the first  
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26 156 41 days of infant life. The prevalence of mothers who were assisted by non-health  
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28 157 professionals during delivery was approximately 85% (95%CI: 83.2 to 86.2). Greater than  
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30 158 three-quarters (81.9%; 95%CI 80.3 to 83.3) of mothers delivered their infants at non-health  
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32 159 facilities and 81% (95%CI: 79.2 to 82.7) of mothers were from poor households  
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35 160 The multivariable analysis showed that community, predisposing, enabling, need and  
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37 161 previous use of health services level factors were significantly associated with non-utilisation  
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39 162 of PNC services in Nigeria (Table 1). Infants whose mothers resided in rural areas (OR=  
40  
41 163 1.69; CI: 1.40 to 2.06) had higher odds of not patronising PNC services compared to those  
42  
43 164 living in urban areas. The odds of non-use of PNC services increased significantly among  
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45 165 infants born to mothers from poor households (OR= 1.66; CI: 1.35 to 2.05) and those whose  
46  
47 166 mothers had no formal education. A higher likelihood of non-use of PNC services was  
48  
49 167 associated with infants whose mothers had no knowledge of delivery-related complications  
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51 168 and lack of exposure to mass media, particularly watching television. It was also observed  
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53 169 that attitude of health workers had a significant effect on non-use of PNC services among  
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55 170 nursing mothers.  
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171 An increased odds of not utilising PNC services was observed among infants whose birth size  
 172 was perceived as small at birth compared to large-sized infants (OR= 1.41; CI: 1.22 to 1.64).  
 173 The mothers whose infants were delivered by non-health professionals had a 3.5 times greater  
 174 odds of not using PNC services than those infants who were delivered by health  
 175 professionals. Other significant factors that were associated with the non-use of PNC  
 176 services included mothers whose infants were delivered at non health facilities (OR= 4.51;  
 177 CI: 3.75 to 5.43), and those whose deliveries occurred by caesarean section (OR= 2.29; CI:  
 178 1.61 to 3.27).  
 179 Out of the total population risk for non-use of PNC services, nearly 0.70% (PAR: 0.69; CI:  
 180 0.59 to 0.73) was attributable to infants who were delivered at non-health facilities (Table 2).  
 181 Our findings also showed that non-use of PNC was associated with infants whose mothers  
 182 lacked knowledge of obstetric complications (PAR: 0.38; CI: 0.34 to 0.45) and those  
 183 delivered by non-health professionals (PAR: 0.60; CI: 0.54 to 0.66).

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

Variable	Prevalence		Adjusted
	N	%* (95% CI)	OR (95% CI)
<i>Environmental factor</i>			
<b>Residence type</b>			
Urban	7278	36.8 (33.4—40.3)	<i>Ref</i>
Rural	13189	69.4 (67.1—71.5)	1.69(1.40—2.06)
<b>Geopolitical zone</b>			
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)	
<i>Socio-demographic factor</i>			
<b>Household wealth index</b>			
Rich	3604	20.4 (17.8—23.2)	<i>Ref</i>

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)
<b>Mother's education</b>			
Secondary or higher	6758	29.0 (27.0—31.1)	<i>Ref</i>
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)
<b>Mother's working status</b>			
working	13190	53.1 (50.9—55.2)	
Not-working	7258	66.4 (63.6—69.0)	
<b>Mother's age</b>			
< 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)	
<b>Marital status</b>			
Currently married	19397	58.5 (56.5—60.4)	
Formerly/ never married	1070	45.3 (41.1—49.6)	
<b>Father's education</b>			
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)	
<b>Birth rank and birth interval</b>			
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)	
<b>Child sex</b>			
Male	10282	57.3 (55.2—59.4)	
Female	10185	58.2 (56.1—60.3)	
<i>Health knowledge</i>			
<b>Frequency of reading newspaper or magazine</b>			
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)	
<b>Frequency of listening to radio</b>			
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)	
<b>Frequency of watching television</b>			
At least once a week	6027	31.0 (28.7—33.4)	<i>Ref</i>
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)
<b>Knowledge of delivery complications</b>			
Yes	9032	33.8 (31.8—35.9)	<i>Ref</i>
None	11283	76.9 (75.0—78.6)	2.05(1.83—2.29)

1				
2				
3	<i>Enabling factor</i>			
4	<b>Seek permission to visit health services</b>			
5	Not a big problem	17865	55.1 (53.1—57.1)	
6	Big problem	2502	76.7 (72.5—80.4)	
7				
8	<b>Getting money to pay health services</b>			
9	Not a big problem	11410	52.5 (50.1—54.8)	
10	Big problem	8956	64.5 (62.1—66.8)	
11				
12	<b>Distance to health facility</b>			
13	Not a big problem	13907	51.0 (48.9—53.0)	
14	Big problem	6472	72.3 (69.7—74.9)	
15	<b>Want to be accompany to health facility (19830)</b>			
16	Not a big problem	17437	54.6 (52.7—55.6)	
17	Big problem	2934	76.4 (73.4—79.1)	
18				
19	<b>Behaviour of health workers</b>			
20	Not a big problem	16928	55.4 (53.3—57.4)	Ref
21	Big problem	3434	69.4 (66.4—72.1)	1.18(1.03—1.36)
22				
23	<i>Need factor</i>			
24	<b>Contraceptive use</b>			
25	Yes	3260	26.8 (24.3—29.4)	
26	No	17207	63.6 (61.8—65.5)	
27				
28	<b>Wanted pregnancy at the time</b>			
29	Wanted then	18368	59.5 (57.4—61.4)	
30	Wanted later	1554	41.5 (38.2—44.8)	
31	Unwanted	444	40.0 (34.7—45.5)	
32				
33	<b>Mother's perceived birth size</b>			
34	Large	8996	54.6 (52.3—56.8)	Ref
35	Average	8307	56.7 (54.2—59.2)	1.03(0.97—1.15)
36	Small	3026	69.4 (66.4—72.2)	1.41(1.22—1.64)
37				
38	<i>Previous use of health services</i>			
39	<b>Delivery assistance</b>			
40	Health professional	8582	20.5 (18.9—22.2)	Ref
41	Non-health professional	11793	84.8 (83.2—86.2)	3.50(2.88—4.27)
42				
43	<b>Mode of delivery</b>			
44	Non-caesarean	19981	59.0 (57.0—60.9)	Ref
45	Caesarean section	486	8.6 (6.2 — 11.7)	2.29(1.61—3.27)
46				
47	<b>Place of delivery</b>			
48	Health facility	7649	17.3 (15.7—19.0)	Ref
49	Home	12780	81.9 (80.3—83.3)	4.51(3.75—5.43)

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

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

Variable	Adjusted		
	% <sup>~</sup>	OR	PAR (95% CI)
<i>Environmental factor</i>			
<b>Residence type</b>			
Urban	0.23	1.00	-
Rural	0.77	1.69	0.32(0.19—0.37)
<i>Socio-demographic factor</i>			
<b>Household wealth index</b>			
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)
<b>Mother's education</b>			
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)
<i>Health knowledge</i>			
<b>Frequency of watching television</b>			
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)
<b>Knowledge of delivery complications</b>			
Yes	0.26	1.00	-
None	0.73	2.05	0.38(0.34—0.45)
<i>Enabling factor</i>			
<b>Behaviour of health workers</b>			
Not a big problem	0.79	1.00	-
Big problem	0.20	1.18	0.03(-0.02—0.19)
<i>Need factor</i>			
<b>Mother's perceived birth size</b>			
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)
<i>Previous use of health services</i>			
<b>Delivery assistance</b>			
Health professional	0.15	1.00	-
Non-health professional	0.85	3.5	0.60(0.54—0.66)
<b>Place of delivery</b>			
Health facility	0.11	1.00	-
Home	0.88	4.51	0.59(0.19—0.73)

193 Proportion of mothers who did not use postnatal care services

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195

1  
2  
3 196 **Discussion**

4  
5 197 Non-use of PNC services was used as the main outcome variable in this current study. The main  
6  
7 198 factors that posed risk to patronage of PNC services included the type of residence (rural or urban),  
8  
9 199 household wealth, maternal education, mothers' knowledge of delivery-related complications,  
10  
11 200 mothers' access to the mass media, and perceived size of the baby at birth.

12  
13  
14 201 The current study has several strengths that included the use of nationally-representative data, with a  
15  
16 202 relatively large sample size that yielded a high response rate (97.6%) [6]. The current findings are  
17  
18 203 generalizable to the entire country since the demographic and health surveys are internationally  
19  
20 204 validated and nationally adapted. Furthermore, to the best of our knowledge, this is the first study to  
21  
22 205 use nationally representative data to study the determinants of non-use of PNC services in Nigeria.

23  
24 206 There are however, a number of limitations that are worthy of note when interpreting results of the  
25  
26 207 current study. Firstly, being a cross-sectional study, causal associations of the observed findings could  
27  
28 208 not be clearly established. Secondly, variables available to measure the demographic, health  
29  
30 209 knowledge and social structure factors were limited. Finally, the survey relied on retrospective  
31  
32 210 information, which may have suffered a recall bias. However, such bias might not be problematic, as  
33  
34 211 the study involved only mothers who gave birth within five years preceding the survey.

35  
36  
37 212 Living in a rural area was found in the current study to be negatively associated with utilization of  
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39 213 PNC services in Nigeria. This finding implied that utilization of PNC was associated with infants  
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41 214 whose mothers lived in urban areas, which is consistent with a past study from Nepal [22]. Generally,  
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43 215 cultural practices are more prevalent in rural areas than in urban areas. PNC patronage is limited by  
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45 216 the cultural tradition of keeping a newborn indoors, especially among mothers who give birth at  
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47 217 home. Several other studies have reported this tradition of seclusion [23, 24]. The finding can also be  
48  
49 218 explained by the fact that in rural areas, there is inadequate access to public services such as  
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51 219 transportation, roads and health services, meaning that urban dwellers are more likely to have access  
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53 220 to adequate transportation and health services [25]. Adequate physical accessibility has been found to  
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55 221 increase maternal health utilization as reported by past studies from Ghana [26] and Nepal [27]. Our  
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57 222 finding suggests the need to provide PNC services through alternative means, such as home visits by  
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3 223 health professionals. The utilization of PNC services during the seclusion period when mother and  
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5 224 baby are confined to their room could be increased in communities by involving community leaders  
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7 225 including religious leaders in health programmes [24]. It may also be worthwhile to implement  
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9 226 community-based newborn programmes to focus on providing home-based PNC services to mothers  
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11 227 [28].

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14 228 One key finding of the current study was that non-use of PNC services was significantly associated  
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16 229 with infants from poor households. Using household wealth index as a proxy indicator for the socio-  
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18 230 economic status of the household, mothers of low socio-economic status were significantly less likely  
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20 231 to utilise PNC services. This implied that mothers from rich households or of high socio-economic  
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22 232 status were significantly more likely to patronise PNC services. This finding is consistent with other  
23  
24 233 past studies from India, Nepal and Nigeria [14, 29-33], and can be explained by the availability of  
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26 234 money to be able to pay for such healthcare services. The government of Nigeria and other  
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28 235 stakeholders should make these maternal health care services affordable to mothers from low-income  
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30 236 families.

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33 237 There is evidence in the extant literature that mothers with higher levels of education are better  
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35 238 informed about health risks and are more likely to demand and gain access to healthcare [14, 31].  
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37 239 Several past studies have highlighted the fact that utilization of PNC services was significantly  
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39 240 associated with mothers with higher levels of education, implying that the risk of non-utilization of  
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41 241 PNC services was higher among mothers with no schooling [27, 34, 35]. This is similar to a finding in  
42  
43 242 our study where mothers with no formal education were more likely not to access PNC services in  
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45 243 Nigeria.

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48 244 In this current study, non-utilization of PNC services was found to be significantly higher among  
49  
50 245 mothers who had limited or no access to the mass media. This is consistent with results from studies  
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52 246 in Bangladesh [36] and Indonesia [9]. Limited or non-access to the mass media implies lack of  
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54 247 exposure to information and health knowledge about pregnancy and PNC. Apart from entertainment,  
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56 248 the mass media are generally meant to educate. Education enhances women's knowledge of the  
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3 249 significance of health. It also increases women's confidence and improves their ability to seek  
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5 250 appropriate healthcare services [37].  
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8 251 **Conclusions**

9  
10 252 The current study reveals that the majority of Nigerian women did not utilise PNC services. Factors  
11  
12 253 associated with this lack of patronage included household poverty, Rural dwelling, poor maternal  
13  
14 254 educational attainment and limited access to the mass media. The government of Nigeria and other  
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16 255 non-governmental organisations should provide focused financial support to mothers from  
17  
18 256 economically disadvantaged households in order to minimise the inequitable access to pregnancy and  
19  
20 257 delivery healthcare services with trained healthcare personnel in Nigeria. Such an intervention could  
21  
22 258 be complemented with community-based promotion programmes that would enhance awareness of  
23  
24 259 the benefits of both pregnancy and delivery healthcare services. Devices such as television sets and  
25  
26 260 radios should be made affordable to women, especially those who reside in rural areas. Furthermore,  
27  
28 261 the use of home visits by health professionals should also be implemented to ensure that those  
29  
30 262 mothers living in remote areas are not disadvantaged.  
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34 263• **Contributors:**

35  
36 264• KEA and OKE were involved in the conception and design of this study. KEA conducted the  
37  
38 265 literature review, carried out the analysis and drafted the manuscript. OKE, AII, AIE, SB and AMNR  
39  
40 266 provided advice on interpretation, and revised and edited the manuscript. All authors read and  
41  
42 267 approved the manuscript.  
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45  
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47  
48 270 or not-for-profit sectors.  
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51  
52 272• **Competing interests:** None.

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3 274• **Ethics approval:** This study was based on an analysis of existing public domain survey data sets that  
4  
5 275 is freely available online with all identifier information removed. The first author communicated with  
6  
7 276 MEASURE DHS/ICF International, Rockville, MD, USA and permission was granted to download  
8  
9 277 and use the data.

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11 278•

12  
13 279• **Provenance and peer review:** Not commissioned; externally peer reviewed.

14  
15 280• **Data sharing statement:** No additional data are available.

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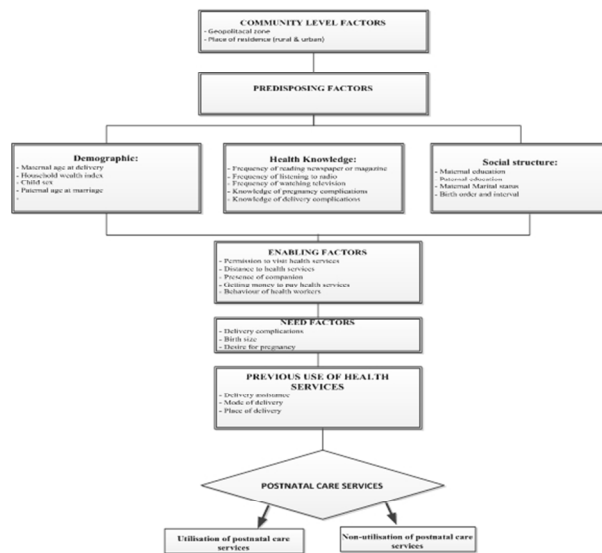


Figure 1 Conceptual frame work adapted from Anderson behavioural model.

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

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

	Item No	Recommendation	Page number
<b>Title and abstract</b>	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
<b>Introduction</b>			
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
<b>Methods</b>			
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) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		<i>Case-control study</i> —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 <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —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) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	

*Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy

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(e) Describe any sensitivity analyses

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<b>Results</b>			
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) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time <i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> —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 (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	8-12 9-11
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
<b>Discussion</b>			
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
<b>Other information</b>			
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](http://www.strobe-statement.org).



# BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2015-010493.R1
Article Type:	Research
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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 Ekpoma, Economics Department Baines, Surinder; University of Newcastle, School of Health Sciences Renzaho, Andre; Western Sydney University, School of Social Sciences and Psychology
<b>Primary Subject Heading</b>:	Global health
Secondary Subject Heading:	Epidemiology
Keywords:	Postnatal care, Mortality, Nigeria

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3 1 **Population-attributable risk estimates for factors associated with non-use of postnatal**  
4 2 **care services among women in Nigeria**  
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8 4 Agho, KE<sup>1\*</sup>, Ezeh, OK<sup>1</sup>, Issaka, AI<sup>3</sup>, Enoma, AI<sup>2</sup>, Baines, S<sup>4</sup> & Renzaho, AMN<sup>3</sup>  
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37 25 **Keywords:** Postnatal care, Mortality, Nigeria  
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3 28 **Abstract**  
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5 29 **Objectives:** To determine Population-Attributable risk (PARs) estimates for factors  
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7 30 associated with the non-use of postnatal care in Nigeria.

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10 31 **Design, setting and participants:** The most recent Nigeria Demographic and Health Survey  
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12 32 (NDHS, 2013) was examined. The study consisted of 20,467 mothers aged 15-49 years. Non-  
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14 33 use of postnatal care (PNC) services was examined against a set of demographic, health  
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16 34 knowledge and social structure factors, using multilevel regression analysis. PARs estimates  
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18 35 were obtained for each factor associated with non-use of PNC in the final multivariate  
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20 36 logistic regression model.

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23 37 **Main outcome:** Postnatal care (PNC) services

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25 38 **Results:** Non-use of PNC services was attributed to 68% (95%CI: 56%-76%) of mothers  
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27 39 who delivered at home, 61% (95%CI: 55%-75%) of those who delivered with the help of  
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29 40 non-health professionals and 37% (95% CI- 31%-45%) of who lacked knowledge of delivery  
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31 41 complications in the study population. Multiple variable analyses revealed that non-use of  
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33 42 PNC services among mothers was significantly associated with rural residence, household  
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35 43 poverty, no or low levels of mothers' formal education, small perceived size of neonate, poor  
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37 44 knowledge of delivery-related complications, and limited or no access to the mass media.  
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43 46 **Conclusions:** PAR estimates for factors associated with the non-use of postnatal care in  
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45 47 Nigeria highlight the need for community-based interventions regarding maternal education  
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47 48 and services that focus on mothers who delivered their babies at home. Our study also  
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49 49 recommends financial support from the Nigerian government for mothers from low  
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51 50 socioeconomic settings, so as to minimise the inequitable access to pregnancy and delivery  
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53 51 healthcare services with trained healthcare personnel.  
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3 53 **Strengths and limitations of this study.**  
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- 5 54 • Our analysis was restricted to mothers who received PNC services within five years prior to the  
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7 55 survey; in order to minimise recall bias.  
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9 56 • Data was from a population based national representative survey with a response rate of about 98%  
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11 57 • This study was a cross-sectional design and therefore inferences on causes and effects  
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14 58 could not be substantiated.  
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16 59 • This study did not assess the quality of postnatal care offered to mothers.  
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## 61 Introduction

62 There is evidence that most maternal deaths occur during labour, delivery or the first 24 hours  
63 postpartum [1, 2]. Although the neonatal period is only 28 days, it accounts for as much as  
64 38% of all deaths in children younger than 5 years [3]. There could be a drastic reduction in  
65 these maternal and neonatal problems if women received the requisite medical attention and  
66 postnatal care during the postnatal period (i.e. health care services received in the first six  
67 weeks after delivery) [4]. The postnatal period is thus critical for the health and survival of  
68 both mother and newborn alike. It is against this background that the World Health  
69 Organization (WHO) has strongly advocated improvements of maternal health services as  
70 part of its Safe Motherhood Initiative (SMI) [5]. The WHO recommends that women should  
71 be given postnatal care within the first 24 hours, followed by check-ups on the second or  
72 third day, and then on the seventh day after giving birth [4].

73  
74 Globally, postnatal care has been recognized to be crucial to the maintenance and promotion  
75 of the health and survival of a mother and her newborn baby. It also provides health  
76 professionals the opportunity of identifying, monitoring and managing the health conditions  
77 of both the mother and her baby during the postnatal period. Furthermore, health  
78 professionals use postnatal care to undertake health promotional programs to encourage  
79 exclusive breastfeeding, personal hygiene, appropriate infant feeding practices as well as  
80 family planning counselling and services [4].

81  
82 The government of Nigeria has made tremendous efforts to meet the Millennium  
83 Development Goals (MDGs) relating to the survival of children under five years of age and  
84 that of mothers. However, the most recently estimated maternal mortality ratio indicated a  
85 slight rise of approximately 6% - from 545 maternal deaths per 100,000 live births in 2008 to

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3 86 576 per 100,000 live births in 2013[6], indicating poor maternal health care services.  
4  
5 87 Neonatal mortality rates during this period decreased by 8% - from 40 deaths per 1,000 live  
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7 88 births to 37 deaths per 1,000 live births [6]. Despite the benefits and effectiveness of  
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9  
10 89 postnatal care (PNC), the 2013 Nigeria Demographic and Health Survey (NDHS) reported  
11  
12 90 that 58% of Nigerian women had no postnatal check-ups despite the recommendations [6].  
13

14  
15  
16 92 Several population-based studies have been carried out on both use and non-use of PNC  
17  
18 93 services, particularly in low and middle income countries, including Bangladesh [7, 8],  
19  
20  
21 94 Indonesia[9], and Timor-Leste [10] . However, in Nigeria the literature is limited. A majority  
22  
23 95 of past studies were community based studies that focused on small-scale research [11-13] .  
24  
25 96 Recently, a population-based study on determinants of PNC non-utilization among women in  
26  
27 97 Nigeria was conducted [14]. However, this study did not examine the attributable risks of  
28  
29 98 factors associated with non-use of PNC. Hence, this current study aimed to extrapolate PAR  
30  
31 99 proportions to provide estimates of the total magnitude of each of the factors associated with  
32  
33  
34 100 non-use of PNC in Nigeria. Results of our investigation using nationally-representative data  
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36 101 could provide policy makers with information to implement interventions that will encourage  
37  
38 102 the patronage of PNC services among women, thereby improving maternal and newborn  
39  
40 103 survival rates.  
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#### 43 104 44 45 105 **Methods**

46  
47 106 Data from the 2013 NDHS dataset were used for this study. The 2013 NDHS household  
48  
49 107 survey was conducted by the National Population Commission (NPC) in conjunction with  
50  
51 108 ICF International. The household survey information on demographic and health issues such  
52  
53 109 as maternal and child health, childhood mortality, and education were gathered by  
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55  
56 110 interviewing eligible reproductive age women and men, aged 15-49 and 15-59 years  
57  
58  
59  
60

1  
2  
3 111 respectively. Three questionnaires (household, women's and men's questionnaires) were used  
4  
5 112 to record all information gathered. Sampling procedures utilised in the NDHS have earlier  
6  
7 113 been published in detail elsewhere [15].  
8

9  
10 114 A total of 38,948 women were successfully interviewed, yielding a response rate of 97.6%.  
11  
12 115 More than 50% (20,467) of these women had the most recent birth within five years prior to  
13  
14 116 the survey interview, and were used for our study analyses. The analysis was restricted to  
15  
16 117 births that occurred within the previous five years because only those births had detailed  
17  
18 118 information on the use of perinatal health services, and to limit the potential for differential  
19  
20 119 recall of events from mothers who had delivered at very different durations prior to the  
21  
22 120 survey date.  
23

## 24 121 **Study variables**

### 25 122 *Dependent variable*

26  
27  
28 123 The outcome variable for this current study was non-use of PNC services. This takes a binary  
29  
30 124 form, such that postnatal care will be regarded as a 'case' (1 = if healthcare service was not  
31  
32 125 received during the first six weeks after delivery) or a 'non-case' (0 = if healthcare service  
33  
34 126 was received during the first six weeks of infant life"). The outcome variable was examined  
35  
36 127 against all potential confounding variables (Figure 1).  
37  
38  
39

### 40 128 *Independent variables*

41  
42  
43 129 A behavioural conceptual framework of maternal health care services developed by Anderson  
44  
45 130 [16] is frequently referenced in other studies on perinatal care services [17-19]. As a result,  
46  
47 131 our study used the Anderson [16] framework as the basis for identifying key risk factors  
48  
49 132 associated with non-use of PNC services in Nigeria. Figure 1 presents all potential  
50  
51 133 confounding variables based on information available in the 2013 NDHS. These variables  
52  
53 134 were classified into five distinct groups: community level factors (geopolitical zone and place  
54  
55 135 of residence); predisposing level factors (demographic, health knowledge and social structure  
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59  
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1  
2  
3 136 factors); demographic and social structure factors (household wealth index, level of mother's  
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5 137 education, mother's age at delivery, level of father's education, mother's marital status,  
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7 138 child's sex and a combination of birth order and birth interval); health knowledge  
8  
9 139 characteristics (frequency of reading newspaper or magazine, frequency of watching  
10  
11 140 television, frequency of listening to radio and knowledge of delivery complication); enabling  
12  
13 141 factors (permission to visit health services, distance to health services, presence of  
14  
15 142 companion, ability to pay for health services and behaviour of health workers); need factors  
16  
17 143 (delivery complications, birth size and desire for pregnancy); and previous use of health  
18  
19 144 services (delivery assistance, mode of delivery and place of delivery).  
20  
21  
22  
23  
24

25 146 [Figure 1 about here]  
26  
27 147  
28  
29

### 30 148 **Statistical analysis**

31  
32 149 The prevalence of non-use of PNC services was described by conducting a frequency  
33  
34 150 tabulation of all potential risk factors included in the study. Logistic regression generalized  
35  
36 151 linear latent and mixed models (GLLAM) with the logit link and binomial family [20] were  
37  
38 152 then used for multivariable analyses that independently examined the effect of each factor,  
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40 153 after adjusting for confounding variables.  
41  
42

43 154 A hierarchical modelling technique [21] was used in the multivariable logistic regression to  
44  
45 155 allow more distal factors to be appropriately examined without interference from more  
46  
47 156 proximate factors. A five stage modelling was used by following a similar conceptual  
48  
49 157 framework to that described by Anderson [16] (Figure 1). First, *community level factors* were  
50  
51 158 entered into the baseline model to assess their relationship with the study outcome. A  
52  
53 159 manually processed stepwise backwards elimination was performed and variables with *p*-  
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55 160 values < 0.05 were retained in the model. Second, *predisposing level factors* were examined  
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3 161 with the community level factors that were significantly associated with the non-use of PNC,  
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5 162 and those variables with  $p$ -values  $< 0.05$  were retained.  
6

7 163 In the third stage, *enabling level factors* were investigated with the community and  
8  
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10 164 predisposing level factors that were significantly related with the study outcome. As before,  
11  
12 165 those variables with  $p$ -values  $< 0.05$  were retained. A similar procedure was used for *need*  
13  
14 166 and *previous use of health services level factors* in the fourth and fifth stages, respectively. In  
15  
16 167 our final model, we double-check for colinearity in order to reduce any statistical bias. All  
17  
18 168 analyses were conducted using “SVY” commands in STATA version 13.1 (STATA  
19  
20 169 Corporation, College Station, TX, USA) to adjust for the cluster sampling survey design, and  
21  
22 170 weights.  
23

24  
25 171 The population attributable risk (PAR) was calculated for the significant risk factors to  
26  
27 172 estimate contribution of each risk factor to the total risk for non-use of PNC services between  
28  
29 173 2009 and 2013. We obtained PAR and 95% confidence Intervals (CI) by using the following  
30  
31 174 similar method employed by Stafford et al [22].  
32

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

33  
34  
35  
36  
37 175 where  $pr$  is the proportion of the population exposed to risk factor, and  $aOR$  was the adjusted  
38  
39 176 odds ratio for non-use of PNC.  
40

## 41 177 **Results**

42  
43 178 Of the weighted total of 20,467 mothers' eligible for PNC services for their most recent live-  
44  
45 179 born infants within five years preceding the 2013 NDHS survey interview date,  
46  
47 180 approximately 58% of the eligible mothers did not use PNC services during the first six  
48  
49 181 weeks of an infant's life. The prevalence of mothers who were assisted by non-health  
50  
51 182 professionals during delivery was approximately 85% (95%CI: 83.2 to 86.2). Greater than  
52  
53 183 three-quarters (81.9%; 95%CI 80.3 to 83.3) of mothers delivered their infants at non-health  
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55 184 facilities and 81% (95%CI: 79.2 to 82.7) of mothers were from poor households  
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3 185 The multivariable analysis showed that community, predisposing, enabling, need and  
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5 186 previous use of health services level factors were significantly associated with non-use of  
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7 187 PNC services in Nigeria (Table 1). Infants whose mothers resided in rural areas (OR= 1.69;  
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9 188 CI: 1.40 to 2.06) had higher odds of not patronising PNC services compared to those living in  
10  
11 189 urban areas. The odds of non-use of PNC services increased significantly among infants born  
12  
13 190 to mothers from poor households (OR= 1.66; CI: 1.35 to 2.05) and those whose mothers had  
14  
15 191 no formal education. A higher likelihood of non-use of PNC services was associated with  
16  
17 192 infants whose mothers had no knowledge of delivery-related complications and lack of  
18  
19 193 exposure to mass media, particularly watching television. It was also observed that attitude of  
20  
21 194 health workers had a significant effect on non-use of PNC services among nursing mothers.  
22  
23 195 An increased odds of non-use of PNC services was observed among infants whose birth size  
24  
25 196 was perceived as small at birth compared to large-sized infants (OR= 1.41; CI: 1.22 to 1.64).  
26  
27 197 The mothers whose infants were delivered by non-health professionals had a 3.5 times greater  
28  
29 198 odds of not using PNC services than those infants who were delivered by health  
30  
31 199 professionals. Other significant factors that were associated with the non-use of PNC  
32  
33 200 services included mothers whose infants were delivered at non health facilities (OR= 4.51;  
34  
35 201 CI: 3.75 to 5.43), and those whose deliveries occurred by caesarean section (OR= 2.29; CI:  
36  
37 202 1.61 to 3.27).  
38  
39 203 Out of the total population attributable risk for non-use of PNC services, nearly 0.70 (PAR:  
40  
41 204 0.68; CI: 0.56 to 0.76) was attributable to infants who were delivered at non-health facilities  
42  
43 205 (Table 2). Our findings also showed that non-use of PNC was associated with infants whose  
44  
45 206 mothers lacked knowledge of obstetric complications (PAR: 0.37; CI: 0.31 to 0.45) and those  
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47 207 delivered by non-health professionals (PAR: 0.61; CI: 0.55 to 0.75).  
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210 Table 1 Distribution of characteristics, unadjusted and adjusted odds ratio (OR) for factors associated  
 211 with non-use of postnatal care services in Nigeria, 2013 NDHS.

Variable	N	%* (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
<i>Environmental factor</i>				
<b>Residence type</b>				
Urban	7278	36.8 (33.4—40.3)	<i>Ref</i>	<i>Ref</i>
Rural	13189	69.4 (67.1—71.5)	3.89 (3.20—4.73)	1.69(1.40—2.06)
<b>Geopolitical zone</b>				
North Central	2890	50.2 (45.4—55.1)	<i>Ref</i>	
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)	
<i>Socio-demographic factor</i>				
<b>Household wealth index</b>				
Rich	3604	20.4 (17.8—23.2)	<i>Ref</i>	<i>Ref</i>
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)
<b>Mother's education</b>				
Secondary or higher	6758	29.0 (27.0—31.1)	<i>Ref</i>	<i>Ref</i>
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)
<b>Mother's working status</b>				
working	13190	53.1 (50.9—55.2)	<i>Ref</i>	<i>Ref</i>
Not-working	7258	66.4 (63.6—69.0)	1.75 (1.54—1.97)	0.84(0.76—0.92)
<b>Mother's age</b>				
< 20	2813	66.5 (63.7—69.2)	<i>Ref</i>	
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)	
<b>Marital status</b>				
Currently married	19397	58.5 (56.5—60.4)	<i>Ref</i>	
Formerly/ never married	1070	45.3 (41.1—49.6)	0.59 (0.49—0.70)	
<b>Father's education</b>				
Secondary or higher	8372	36.5 (34.3—38.8)	<i>Ref</i>	
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)	
<b>Birth rank and birth interval (years)</b>				
2 or 3 child, interval > 2	7053	53.8 (51.3—56.2)	<i>Ref</i>	
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)	
<b>Child sex</b>				

1					
2					
3	Male	10282	57.3 (55.2—59.4)	Ref	
4	Female	10185	58.2 (56.1—60.3)	1.04 (0.97—1.11)	
5	<i>Health knowledge</i>				
6	<b>Frequency of reading newspaper or magazine</b>				
7					
8	At least once a week	1228	22.0 (19.0—25.2)	Ref	Ref
9	Less than once a week	1716	24.2 (21.2—27.5)	1.14 (0.92—1.41)	1.08(0.81—1.45)
10	Never	17393	63.5 (61.6—65.4)	6.19 (5.11—7.51)	1.40(1.09—1.79)
11	<b>Frequency of listening to radio</b>				
12					
13	At least once a week	7317	43.7 (41.3—46.1)	Ref	
14	Less than once a week	5131	54.9 (51.8—58.0)	1.57 (1.37—1.79)	
15	Never	7951	72.6 (70.6—74.5)	3.41 (3.02—3.85)	
16	<b>Frequency of watching television</b>				
17					
18	At least once a week	6027	31.0 (28.7—33.4)	Ref	Ref
19	Less than once a week	3517	45.6 (42.2—48.9)	1.87 (1.61—2.17)	1.23(1.07—1.41)
20	Never	10833	76.7 (74.8—78.5)	7.35 (6.30—8.57)	1.63(1.41—1.88)
21	<b>Knowledge of delivery complications</b>				
22					
23	Yes	9032	33.8 (31.8—35.9)	Ref	Ref
24	None	11283	76.9 (75.0—78.6)	6.50 (5.71—7.40)	2.05(1.83—2.29)
25	<i>Enabling factor</i>				
26	<b>Seek permission to visit health services</b>				
27					
28	Not a big problem	17865	55.1 (53.1—57.1)	Ref	Ref
29	Big problem	2502	76.7 (72.5—80.4)	2.68 (2.13—3.36)	1.27(1.09—1.47)
30	<b>Getting money to pay health services</b>				
31					
32	Not a big problem	11410	52.5 (50.1—54.8)	Ref	Ref
33	Big problem	8956	64.5 (62.1—66.8)	1.65 (1.47—1.85)	1.26(1.14—1.39)
34	<b>Distance to health facility</b>				
35					
36	Not a big problem	13907	51.0 (48.9—53.0)	Ref	Ref
37	Big problem	6472	72.3 (69.7—74.9)	2.52 (2.18—2.91)	1.25(1.12—1.40)
38	<b>Want to be accompany to health facility</b>				
39					
40	Not a big problem	17437	54.6 (52.7—55.6)	Ref	
41	Big problem	2934	76.4 (73.4—79.1)	2.69 (2.30—3.15)	
42	<b>Behaviour of health workers</b>				
43					
44	Not a big problem	16928	55.4 (53.3—57.4)	Ref	Ref
45	Big problem	3434	69.4 (66.4—72.1)	1.82 (1.60—2.09)	1.18(1.03—1.36)
46	<i>Need factor</i>				
47	<b>Contraceptive use</b>				
48					
49	Yes	3260	26.8 (24.3—29.4)	Ref	Ref
50	No	17207	63.6 (61.8—65.5)	4.78 (4.16—5.49)	1.12(0.98—1.28)
51	<b>Wanted pregnancy at the time</b>				
52					
53	Wanted then	18368	59.5 (57.4—61.4)	Ref	
54	Wanted later	1554	41.5 (38.2—44.8)	0.48 (0.42—0.56)	
55	Unwanted	444	40.0 (34.7—45.5)	0.45 (0.36—0.57)	
56	<b>Mother's perceived baby size at birth</b>				
57					
58	Large	8996	54.6 (52.3—56.8)	Ref	Ref
59	Average	8307	56.7 (54.2—59.2)	1.09 (0.98—1.21)	1.03(0.97—1.15)
60	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)

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

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

Variable	%	Adjusted	
		OR	PAR (95% CI)
<i>Environmental factor</i>			
<b>Residence type</b>			
Urban	0.23	1.00	-
Rural	0.77	1.69	0.31(0.21—0.39)
<i>Socio-demographic factor</i>			
<b>Household wealth index</b>			
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)
<b>Mother's education</b>			
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)
<i>Health knowledge</i>			
<b>Frequency of watching television</b>			
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)
<b>Knowledge of delivery complications</b>			
Yes	0.26	1.00	-
None	0.73	2.05	0.37(0.31—0.45)
<i>Enabling factor</i>			
<b>Behaviour of health workers</b>			
Not a big problem	0.79	1.00	-
Big problem	0.20	1.18	0.03(0.02—0.25)
<i>Need factor</i>			
<b>Mother's perceived birth size</b>			
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)
<i>Previous use of health services</i>			
<b>Delivery assistance</b>			
Health professional	0.15	1.00	-
Non-health professional	0.85	3.5	0.61(0.55—0.75)
<b>Place of delivery</b>			
Health facility	0.11	1.00	-
Home	0.88	4.51	0.68(0.56—0.76)

217 Proportion of mothers who did not use postnatal care services

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1  
2  
3 220 **Discussion**

4  
5 221 The non-use of PNC services was used as the main outcome variable in this current study. The main  
6  
7 222 factors that posed risk to patronage of PNC services included the type of residence (rural or urban),  
8  
9 223 household wealth, maternal education, mothers' knowledge of delivery-related complications,  
10  
11 224 mothers' access to the mass media, and perceived size of the baby at birth.

12  
13  
14 225 The current study has several strengths that included the use of nationally-representative data, with a  
15  
16 226 relatively large sample size that yielded a high response rate (97.6%) [6]. The current findings are  
17  
18 227 generalizable to the entire country since the demographic and health surveys are internationally  
19  
20 228 validated and nationally adapted. Furthermore, to the best of our knowledge, this is the first study to  
21  
22 229 use nationally representative data to study the determinants of non-use of PNC services in Nigeria.

23  
24 230 There are however, a number of limitations that are worthy of note when interpreting results of the  
25  
26 231 current study. Firstly, being a cross-sectional study, causal associations of the observed findings could  
27  
28 232 not be clearly established. Secondly, variables available to measure the demographic, health  
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30 233 knowledge and social structure factors were limited. Finally, the survey relied on retrospective  
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32 234 information, which may have suffered a recall bias. However, such bias might not be problematic, as  
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34 235 the study involved only mothers who gave birth within five years preceding the survey.

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37 236 Living in a rural area was found in the current study to be negatively associated with use of PNC  
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39 237 services in Nigeria. This finding implied that use of PNC was associated with infants whose mothers  
40  
41 238 lived in urban areas, which is consistent with a past study from Nepal [23]. Generally, cultural  
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43 239 practices are more prevalent in rural areas than in urban areas. PNC patronage is limited by the  
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45 240 cultural tradition of keeping a newborn indoors, especially among mothers who give birth at home.

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47 241 Several other studies have reported this tradition of seclusion during the postnatal period [24, 25]. The  
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49 242 finding can also be explained by the fact that in rural areas, there is inadequate access to public  
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51 243 services such as transportation, roads and health services, whereas urban dwellers are more likely to  
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53 244 have access to adequate transportation and health services [26]. Adequate physical accessibility to  
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55 245 health care services has been found to increase maternal health utilization as reported by past studies  
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57 246 from Ghana [27] and Nepal [28]. Our findings support the need to provide PNC services, especially in

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3 247 rural areas, through alternative means, such as home visits by health professionals. The use of PNC  
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5 248 services during the seclusion period when mother and baby are confined to their room could be  
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7 249 increased in communities by involving community leaders including religious leaders in health  
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9 250 programmes [25]. It may also be worthwhile to implement community-based newborn programmes to  
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11 251 focus on providing home-based PNC services to mothers [29].  
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14 252 One key finding of the current study was that non-use of PNC services was significantly associated  
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16 253 with infants from poor households. Using household wealth index as a proxy indicator for the socio-  
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18 254 economic status of the household, mothers of low socio-economic status were significantly less likely  
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20 255 to use PNC services. This implied that mothers from rich households or of high socio-economic status  
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22 256 were significantly more likely to patronise PNC services. This finding is consistent with other past  
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24 257 studies from India, Nepal and Nigeria [30-35], and can be explained by the availability of money to be  
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26 258 able to pay for such healthcare services. The government of Nigeria and other stakeholders should  
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28 259 look to make these maternal health care services affordable to mothers from low-income families.  
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31 260 There is evidence in the extant literature that mothers with higher levels of education are better  
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33 261 informed about health risks and are more likely to demand and gain access to healthcare [32, 35].  
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35 262 Several past studies have highlighted the fact that use of PNC services was significantly associated  
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37 263 with mothers with higher levels of education, implying that the risk of non-use of PNC services was  
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39 264 higher among mothers with no schooling [28, 36, 37]. This is similar to a finding in our study where  
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41 265 mothers with no formal education were more likely not to access PNC services in Nigeria.  
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44 266 In this current study, non-use of PNC services was found to be significantly higher among mothers  
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46 267 who had limited or no access to the mass media. This is consistent with results from studies in  
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48 268 Bangladesh [38] and Indonesia [9]. Limited or non-access to the mass media implies lack of exposure  
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50 269 to information and health knowledge about pregnancy and PNC. Apart from entertainment, the mass  
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52 270 media also inform and educate. Education and availability of information can help to enhance  
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54 271 women's knowledge of the significance of health and increase women's confidence and improve their  
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56 272 ability to seek appropriate healthcare services [39].  
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3 273 **Conclusions**  
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6 274 The current study reveals that the majority of Nigerian women did not use PNC services. Factors  
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8 275 associated with this lack of patronage included household poverty, rural dwelling, poor maternal  
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10 276 educational attainment and limited access to the mass media. The government of Nigeria and other  
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12 277 non-governmental organisations should provide focused financial support to mothers from  
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14 278 economically disadvantaged households in order to minimise the inequitable access to pregnancy and  
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16 279 delivery healthcare services with trained healthcare personnel. Such an intervention could be  
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18 280 complemented with community-based promotion programmes that would enhance awareness of the  
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20 281 benefits of both pregnancy and postnatal care health services. Devices such as television sets and  
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22 282 radios should be made affordable to women, especially those who reside in rural areas. Furthermore,  
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24 283 the use of home visits by health professionals should also be implemented to ensure that those  
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26 284 mothers living in remote areas are not further disadvantaged.  
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3 286 **Contributors:**

4  
5 287 KEA and OKE were involved in the conception and design of this study. KEA carried out the  
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7 288 analysis. KEA and AII drafted the manuscript. OKE, AII, AIE, SB and AMNR provided advice on  
8  
9 289 interpretation, and revised and edited the manuscript. All authors read and approved the manuscript.

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12  
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14  
15 292 or not-for-profit sectors.

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19 294 **Competing interests:** None.

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23 296 **Ethics approval:** This study was based on an analysis of existing public domain survey data sets that  
24  
25 297 is freely available online with all identifier information removed. The first author communicated with  
26  
27 298 MEASURE DHS/ICF International, Rockville, MD, USA and permission was granted to download  
28  
29 299 and use the data.

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33 301 **Provenance and peer review:** Not commissioned; externally peer reviewed.

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35 302 **Data sharing statement:** No additional data are available.

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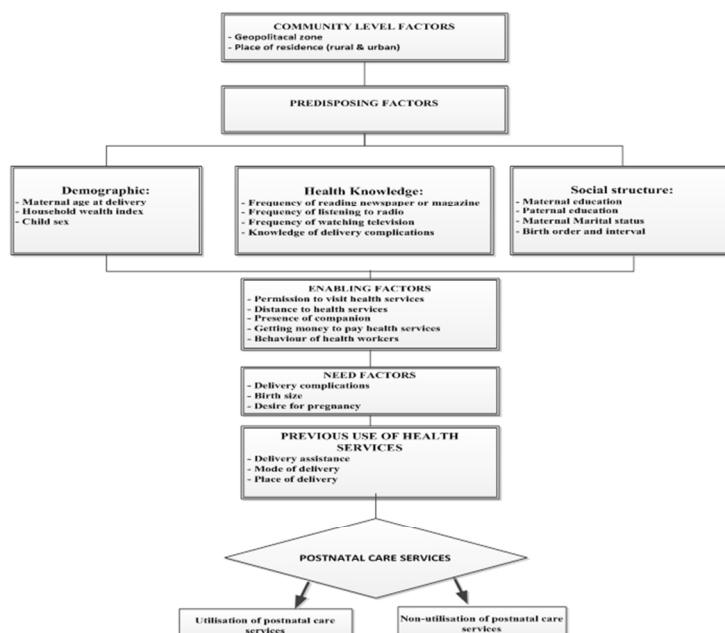


Figure 1 Conceptual frame work adapted from Anderson behavioural model.

Figure 1 Conceptual frame work adapted from Anderson behavioural model.  
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## STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page number
<b>Title and abstract</b>	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
<b>Introduction</b>			
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
<b>Methods</b>			
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) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		<i>Case-control study</i> —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 <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —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) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	

*Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy

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(e) Describe any sensitivity analyses

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<b>Results</b>			
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) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time <i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> —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 (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	8-12 9-11
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
<b>Discussion</b>			
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
<b>Other information</b>			
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](http://www.strobe-statement.org).