Determinants of newborn care utilization in Pakistan: Findings from the Demographic and Health Surveys [version 2; peer review: 2 approved]

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Abstract
Background: Information on determinants of postnatal care is essential for maternal health services, and this information is scarce in Pakistan. This study aimed to determine the factors of newborn postnatal care utilization from the Pakistan Demographic and Health Surveys (PDHS) conducted from 2006–2018.

Methods: We analyzed data from three rounds of cross-sectional, nationally representative PDHS 2006–07, 2012–13, and 2017–18. Multivariable logistic regression models were applied to explore factors associated with utilization of newborn postnatal care within two months.

Results: This study included 5724 women from the 2006–07 PDHS, 7461 from the 2012–13 survey, and 8287 from the 2017–18 survey. The proportion of women receiving newborn postnatal care within the first two months of delivery increased from 13% in 2006–07 to 43% in 2012–13 but dropped to 27% in 2017–18. Respondent's occupation and prenatal care utilization of maternal health services were common factors that significantly influenced newborn postnatal care utilization within two months. The utilization of postnatal care was greater among women having educated husbands and where the first child was a male in PDHS 2007 round. Higher wealth index and educated respondent had higher postnatal care utilization odds in DHS 2012 and DHS 2018. However, the odds of using postnatal care decreased with the number of household members and total number of children ever born in DHS 2012 and 2018 rounds.

Conclusions: There was a general increase in the proportion of women who utilized postnatal care for their newborns during 2006–2013 but a decrease in 2018. The decreased utilization in 2018 warrants further investigation. Improving women's economic status, education, employment, and antenatal care attendance and reducing parity may increase newborn postnatal care utilization.
Keywords

determinants, newborn, postnatal care, utilization, Pakistan
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Introduction
The postnatal period – defined as the first six weeks after birth – is the most critical phase in the lives of mothers and their newborns. Approximately 50% of all maternal and neonatal deaths occur within 24 hours after birth, approximately 60% occur during the first week of life, and the rest occur within six weeks after birth1,2.

In low and middle income countries, problems such as preterm birth, birth asphyxia, and infections are the leading causes of neonatal deaths3. A striking 99% of the global maternal and neonatal deaths occur in developing countries including Pakistan. Only ten countries, mostly from Asia, account for two-thirds of neonatal deaths. Pakistan reports 7% of global neonatal deaths2 and an estimated 298,000 deaths annually at a mortality rate of 42 per 1000 live births3.

Nowadays, we can save the lives of many newborns through interventions that require only simple technology4. These interventions can be delivered effectively by a skilled birth attendant at home from the first 24 hours of life to 6 weeks4.

Various policies and health programs5 have been introduced in Pakistan since 1990 to reduce maternal and infant mortality. These include the National Health Policy, National Maternal Newborn and Child Health Program, Pakistan initiative for mothers and newborns, People’s primary healthcare initiative, and Lady Health Worker programs6. However, the effectiveness of a program in improving health indicators depends on the utilization and quality of the services provided. Moreover, reproductive status, family influence, community context, and social and cultural beliefs were found to be significant determinants of postnatal care (PNC)5.

Studies have mentioned that Pakistan does not have a national policy on newborn health, and programs aiming on newborn care are partial in coverage7. Most of the previous studies have focused on assessing the utilization of antenatal or antepartum care services, but only a few have tried to look at postnatal care delivery and utilization. Further most of the studies have focused postnatal care in relation to maternal care, not many studies have focused of newborn postnatal care. We sought to explore the determinants of newborn PNC utilization over the period from 1991 to 2018 in Pakistan.

Methods
Study design and data source
This this was a secondary analysis of data from three rounds of Pakistan Demographic and Health Survey (PDHS): PDHS 2006/07, PDHS 2012/13, and PDHS 2017/18. The PDHS 1990–91 did not collect data on postnatal care and hence was excluded from this analysis. The PDHS are nationally representative cross-sectional surveys conducted by the Pakistan Bureau of Statistics with technical support from Opinion Research Corporation (ORC) Macro and funding from US Agency for International Development (USAID). The surveys used a multistage cluster sampling design to collect data on reproductive health, fertility, mortality, family planning, nutrition, and health care utilization. Details about the design of PDHS can be found in published reports1.

This paper was based on previously published data and did not require ethical approval. Permission to use the PDHS datasets was obtained from the DHS Program.

Study population
The study population comprised women of reproductive age (15–49 years) who gave birth during the last five years preceding the surveys. This included 5725 women from the PDHS 2007/08, 7461 from PDHS 2012/13, and 8287 from the PDHS 2017/18.

Variables
A conceptual framework proposed by the World Health Organization to explore the social determinants of maternal health was used to consider the various sociodemographic factors that might affect postnatal care utilization. We considered only the variables that were common across the rounds of PDHS.

As there are no nationwide separate newborn health interventions, newborn services are provided with different health programs also considering low postnatal care utilization in Pakistan; the outcome variable constructed was postnatal care of the newborn within two months. Independent variables were categorized as shown in Box 1.

Box 1. Categorization of independent variables

1. Place of residence (urban, rural)
2. Wealth index quintile (poorest, poorer, middle, richer, richest)
3. Number of household members (1–10, 11–20, >20)
4. Number of children younger than five years in household (None, 1–2, 3–4, >4)
5. Births in the last five years (1, 2, >2)
6. Total children ever born (1–2, 3–4, >4)
7. Age of the respondent mother (15–24 years, 25–34 years, 35 years and above)
8. Education status of the respondent mother (No education, primary, secondary, higher)
9. Occupation of the respondent mother (unemployed, employed)
10. Husband’s age (15–24 years, 25–34 years, 35 years and above)
11. Husband’s education (no education, primary, secondary, higher)
12. Husband’s occupation (unemployed, employed)
13. Number of antenatal care (ANC) visits received (no ANC received, <4 visits, >4 visits)
Statistical analysis
Descriptive statistics were used to summarize participants’ characteristics. Because PDHS collected information on postnatal care during the past 5 years, we used the information on the date of birth of the child and receipt of PNC to calculate the coverage of newborn PNC by year for each round of DHS. We used logistic regression models to determine unadjusted and adjusted odds ratios with 95% confidence intervals for the association between the independent variables and newborn PNC. Variables with p < 0.1 in the unadjusted (univariable) analysis were included in adjusted (multivariable) analysis. Data were analyzed using SPSS 22.0 software, and P-values < 0.05 were considered to indicate statistical significance.

Results
Sociodemographic characteristics of mothers during the three DHS rounds
The mean age of the mothers and her husband was 29.59 and 34 years, respectively, across the three rounds with a little variation as shown in Table 1. The median number of household members was 9, 8, and 8 respectively over the three rounds. However, the number of children ever born was the same in the three rounds. This indicates that the age and family characteristics were nearly the same for Pakistan over the period of 2007–18 as depicted in Table 1.

Factors associated with the utilization of newborn postnatal care
Table 2 shows the results of univariable analysis of factors associated with newborn PNC utilization. The following factors are significantly associated in positive relation in all three surveys: rural residence (p=<0.001), wealth index (p=<0.001), education status of the respondent (p=<0.001), and number of antenatal care visits received (p=<0.001). While the number of household members (p=<0.001), number of children aged 5 years or below in the household (p=<0.001), total children ever born (p=<0.001), and births in the last 5 years (p=0.004, p=0.001) were negatively associated with newborn PNC in the 2013 and 2018 surveys.

Regression analysis was performed for the significant independent variables found in each dataset to control for confounding and derive adjusted odds ratio (Table 3). Multivariable logistic regression analysis unadjusted results are shown in Table 3. In the 2007 survey, occupation of the respondent (p=0.015, OR=1.26), husband’s education (p=0.006), prenatal care utilization (p=<0.001 OR= 3.57), sex of the previous child (p=0.002, OR= 1.30), and number of antenatal visits (p=0.001) were significantly associated with newborn PNC within two months.

In the 2012 survey, the same factors as those of the 2007 survey, namely, occupation of the respondent (p=<0.00, OR= 1.43), husband’s education (p=0.034), prenatal care utilization (p=<0.001, OR= 2.74), and number of antenatal visits (p=<0.001), also showed significantly positive associations. In addition, factors such as wealth index (p=<0.001), education of the respondent (p=<0.001), and husband occupation (p=0.004, OR= 1.61) also showed positive associations. However, the number of household members (p=0.042) and total children ever born (p=0.001) were negatively associated with newborn PNC utilization.

In the 2018 survey, receiving postnatal care within two months of birth was significantly associated with the occupation of the respondent (p=<0.001, OR=1.45), education of the respondent (p=<0.001), wealth index (p=0.001), number of antenatal visits (p=<0.001), and sex of the first child (p=<0.011, OR=1.14). However, women who had more total children ever born (p=<0.001) were less likely to receive newborn care utilization.

Discussion
The current study aimed to explore newborn postnatal care determinants from three subsequent rounds of DHS 2006–07,
Table 2. Factors affecting newborn postnatal care (PNC) within 2 months in univariable analysis.

| Variable                        | 2007 (N=746) |                | P value | 2012 (N=3224) |                | P value | 2018 (N=2235) |                | P value |
|---------------------------------|--------------|----------------|---------|--------------|----------------|---------|--------------|----------------|---------|
|                                 | Unadjusted OR (95% CI) | P value | Unadjusted OR (95% CI) | P value | Unadjusted OR (95% CI) | P value |
| **Rural residence***            |              |              |         |              |              |         |              |              |         |
|                                 | 0.73 (0.61-0.87) | <0.001 | 0.75 (0.68-0.82) | <0.001 | 0.70 (0.63-0.77) | <0.001 |
| **Wealth Index**                |              |              |         |              |              |         |              |              |         |
| Poorest                         |              |              |         | Reference    | Reference    | <0.001 | Reference    | Reference    | <0.001 |
| Poorer                          |              | 1.11 (0.89-1.40) | 0.36 | 1.40 (1.20-1.63) | <0.001 | 1.09 (0.93-1.27) | 0.3   |         |              |         |
| Middle                          |              | 1.23 (0.97-1.56) | 0.084 | 1.64 (1.41-1.92) | <0.001 | 1.42 (1.22-1.67) | <0.001 |         |              |         |
| Richer                          |              | 1.62 (1.26-2.07) | <0.001 | 2.53 (2.18-2.94) | <0.001 | 1.66 (1.42-1.95) | <0.001 |         |              |         |
| Richest                         |              | 2.39 (1.78-3.21) | <0.001 | 5.16 (4.43-6.01) | <0.001 | 2.55 (2.19-2.98) | <0.001 |         |              |         |
| **Number of household members** |              |              |         |              |              |         |              |              |         |
| 1 to 10                         |              | 0.432 |              | <0.001 |              | <0.001 |              |              |         |
| 11 to 20                        |              | 1.12 (0.94-1.33) | 0.216 | 0.78 (0.71-0.87) | <0.001 | 0.83 (0.74-0.93) | 0.001 |         |              |         |
| More than 20                    |              | 0.96 (0.64-1.43) | 0.830 | 0.64 (0.49-0.84) | 0.001 | 0.55 (0.39-0.76) | <0.001 |         |              |         |
| **Number of children 5 and under in household** | 0.478 | <0.001 |              | <0.001 |              |         |              |              |         |
| No children                     |              | Reference    | Reference | Reference    | Reference    |         |              |              |         |
| 1–2 children                    |              | 0.72 (0.48-1.10) | 0.129 | 1.02 (0.80-1.31) | 0.869 | 0.80 (0.61-1.04) | 0.091 |         |              |         |
| 3–4 children                    |              | 0.71 (0.46-1.10) | 0.124 | 0.82 (0.63-1.07) | 0.139 | 0.67 (0.51-0.88) | 0.004 |         |              |         |
| Five or more                    |              | 0.71 (0.43-1.17) | 0.181 | 0.72 (0.53-0.97) | 0.031 | 0.52 (0.38-0.73) | <0.001 |         |              |         |
| **Births in last five years**   |              |              |         |              |              |         |              |              |         |
| 1 child birth                   |              | 0.413 |              | 0.004 |              | 0.001 |              |              |         |
| 2 child births                  |              | 1.11 (0.94-1.32) | 0.217 | 0.92 (0.84-1.02) | 0.117 | 0.83 (0.74-0.92) | <0.001 |         |              |         |
| 3 or more child births          |              | 0.98 (0.75-1.29) | 0.906 | 0.77 (0.65-0.90) | 0.001 | 0.84 (0.70-1.01) | 0.057 |         |              |         |
| **Births in last three years**  |              |              |         |              |              |         |              |              |         |
| No births                       |              | 0.543 |              | 0.334 |              | 0.498 |              |              |         |
| 1 child birth                   |              | 1.11 (0.91-1.36) | 0.302 | 1.08 (0.97-1.21) | 0.173 | 1.05 (0.94-1.18) | 0.386 |         |              |         |
| 2 or more child births          |              | 1.13 (0.87-1.47) | 0.365 | 1.10 (0.94-1.28) | 0.225 | 0.98 (0.84-1.15) | 0.817 |         |              |         |
| **Total children ever born**    |              |              |         |              |              |         |              |              |         |
| 1–2 children                    |              | 0.063 | <0.001 | <0.001 |              |         |              |              |         |
| 3–4 children                    |              | 1.03 (0.84-1.27) | 0.763 | 0.75 (0.67-0.84) | <0.001 | 0.72 (0.64-0.81) | <0.001 |         |              |         |
| 5 or more children              |              | 0.83 (0.69-1.01) | 0.067 | 0.54 (0.48-0.60) | <0.001 | 0.59 (0.52-0.67) | <0.001 |         |              |         |
| **Age of respondent**           |              |              |         |              |              |         |              |              |         |
| 15–24 yrs                       |              | <0.001 |              | 0.505 |              | 0.237 |              |              |         |
| 25–34 yrs                       |              | 0.92 (0.76-1.12) | 0.391 | 0.99 (0.88-1.11) | 0.853 | 1.08 (0.96-1.22) | 0.200 |         |              |         |
| 35 yrs and above                |              | 0.65 (0.51-0.82) | <0.001 | 0.93 (0.81-1.07) | 0.299 | 0.99 (0.86-1.15) | 0.902 |         |              |
### Table 3. Factors affecting newborn postnatal care (PNC) within two months in multivariable analysis.

| Variable                  | 2007 (N=746) | 2012 (N=3224) | 2018 (N=2235) |
|---------------------------|-------------|---------------|--------------|
|                           | Adjusted OR (95% CI) | P value | Adjusted OR (95% CI) | P value | Adjusted OR (95% CI) | P value |
| **Rural residence**       |             |          |              |          |              |          |
| Rural residence*          | 0.99 (0.81-1.23) | 0.984     | 1.68 (1.49-1.90) | <0.001 | 0.98 (0.87-1.10) | 0.717   |
| **Wealth Index**          |             |          |              |          |              |          |
| Poorest                   | Reference   | Reference  | <0.001       | Reference |
| Poorer                    | 0.94 (0.74-1.19) | 0.604     | 1.29 (1.09-1.52) | 0.003 | 0.93 (0.79-1.10) | 0.415   |
| Middle                    | 0.91 (0.69-1.19) | 0.492     | 1.41 (1.18-1.68) | <0.001 | 1.03 (0.86-1.24) | 0.757   |
| Richer                    | 1.01 (0.75-1.37) | 0.939     | 2.05 (1.69-2.49) | <0.001 | 1.05 (0.86-1.29) | 0.626   |
| Richest                   | 1.15 (0.78-1.69) | 0.489     | 3.67 (2.93-4.59) | <0.001 | 1.39 (1.11-1.74) | 0.004   |
| **Number of household members** | NS         | 0.042     | Reference    |          |
| 1 to 10                   | Reference   | Reference  | Reference    |          |
| 11 to 20                  | 0.85 (0.75-0.97) | 0.015     | 0.93 (0.81-1.07) | 0.307 |         |          |
| More than 20              | 0.78 (0.56-1.11) | 0.167     | 0.76 (0.51-1.12) | 0.166 |         |          |
| Variable                                      | 2007 (N=746) |          | 2012 (N=3224) |          | 2018 (N=2235) |          |
|----------------------------------------------|--------------|----------|---------------|----------|---------------|----------|
|                                              | Adjusted OR  | P value  | Adjusted OR   | P value  | Adjusted OR   | P value  |
|                                              | (95% CI)     |          | (95% CI)      |          | (95% CI)      |          |
| Number of children 5 and under in household | NS           | 0.491    | 0.165         |          |               |          |
| No children                                 | Reference    | Reference| Reference      |          |               |          |
| 1–2 children                                | 1.15 (0.88-1.50) | 0.323    | 0.92 (0.70-1.21) | 0.554   |               |          |
| 3–4 children                                | 1.07 (0.80-1.44) | 0.630    | 0.82 (0.61-1.10) | 0.19    |               |          |
| Five or more                                | 0.98 (0.68-1.41) | 0.905    | 0.71 (0.48-1.03) | 0.071   |               |          |
| Births in last five years                   | NS           | 0.233    | 0.079         |          |               |          |
| 1 child birth                               | Reference    | Reference| Reference      |          |               |          |
| 2 child births                              | 1.09 (0.98-1.22) | 0.122    | 0.94 (0.84-1.05) | 0.287   |               |          |
| 3 or more child births                      | 1.13 (0.93-1.38) | 0.229    | 1.19 (0.96-1.48) | 0.111   |               |          |
| Births in last three years                  | NS           | NS       | NS            |          |               |          |
| Total children ever born                    | NS           | 0.001    | <0.001        |          |               |          |
| 1–2 children                                | Reference    | Reference| Reference      |          |               |          |
| 3–4 children                                | 0.79 (0.69-0.91) | 0.001    | 0.79 (0.70-0.89) | <0.001 |               |          |
| 5 or more children                          | 0.78 (0.67-0.91) | 0.002    | 0.79 (0.69-0.91) | 0.001   |               |          |
| Age of respondent                           | 0.436        |          | NS            |          | NS            |          |
| 15–24 yrs                                   | Reference    |          | NS            |          | NS            |          |
| 25–34 yrs                                   | 1.03 (0.81-1.30) | 0.839    |               |          |               |          |
| 35 yrs and above                            | 0.88 (0.64-1.21) | 0.422    |               |          |               |          |
| Education status of respondent              | 0.266        |          | <0.001        |          | <0.001        |          |
| No education                                | Reference    | Reference| Reference      |          | Reference      |          |
| Primary                                     | 1.18 (0.91-1.52) | 0.211    | 1.38 (1.19-1.61) | <0.001 | 1.17 (0.99-1.38) | 0.059 |
| Secondary                                   | 1.33 (0.97-1.81) | 0.074    | 1.17 (0.99-1.37) | 0.052 | 1.15 (0.99-1.34) | 0.076 |
| Higher                                      | 1.04 (0.57-1.89) | 0.908    | 1.54 (1.25-1.90) | <0.001 | 1.53 (1.26-1.84) | <0.001 |
| Employed respondent                         | 1.26 (1.05-1.51) | 0.015    | 1.43 (1.26-1.62) | <0.001 | 1.45 (1.26-1.68) | <0.001 |
| Husband's age                               | 0.192        |          | NS            |          |               |          |
| 15–24 yrs                                   | Reference    |          | NS            |          |               |          |
| 25–34 yrs                                   | 0.77 (0.55-1.07) | 0.118    | 1.21 (0.98-1.49) | 0.075   |               |          |
| 35 yrs and above                            | 0.71 (0.49-1.03) | 0.070    | 1.35 (1.08-1.69) | 0.010   |               |          |
| Husband's education status                  | 0.006        |          | 0.034         |          | 0.189         |          |
| No education                                | Reference    | Reference| Reference      |          | Reference      |          |
| Primary                                     | 1.37 (1.07-1.74) | 0.011    | 1.24 (1.06-1.47) | 0.010 | 0.98 (0.82-1.17) | 0.846 |
| Secondary                                   | 1.24 (0.99-1.55) | 0.062    | 1.01 (0.88-1.16) | 0.885 | 0.95 (0.82-1.10) | 0.479 |
| Higher                                      | 1.62 (1.19-2.19) | 0.002    | 1.10 (0.92-1.31) | 0.264 | 0.84 (0.70-1.00) | 0.046 |
| Employed Husband                            | 1.61 (1.16-2.24) | 0.004    |               |          |               |          |
| No Pre-natal care                           | 3.57 (2.13-5.98) | <0.001   | 2.74 (2.08-3.61) | <0.001 | 0.57 (0.22-1.43) | 0.229 |
Table 3

| Variable                        | 2007 (N=746) | P value | 2012 (N=3224) | P value | 2018 (N=2235) | P value |
|---------------------------------|--------------|---------|---------------|---------|---------------|---------|
|                                | Adjusted OR (95% CI) |         | Adjusted OR (95% CI) |         | Adjusted OR (95% CI) |         |
| No ANC received                 | Reference    | 0.001   | Reference     | <0.001  | Reference     | <0.001  |
| Less than 4 visits              | 0.65 (0.39-1.09) | 0.100   | 0.76 (0.59-0.98) | 0.031   | 1.12 (0.45-2.79) | 0.816   |
| 4 or more visits                | 1.01 (0.59-1.71) | 0.986   | 1.18 (0.92-1.51) | 0.199   | 1.67 (0.67-4.18) | 0.271   |
| Male sex of previous child      | 1.30 (1.09-1.54) | 0.002   | Reference     | 1.14 (1.03-1.26) | 0.011   |

OR = odds ratio, NS - Not significant in univariable analysis; not included in the multivariable analysis

2012–13, and 2017–18 in Pakistan. Various sociodemographic factors along with household characteristics and utilization of antenatal care services determine the utilization of PNC, in general, from past literature8,10. We also extracted relevant data from three rounds of PDHS pertaining to potential factors, which could affect the utilization of newborn postnatal care in this study as described in the methods section. The number of respondents for the three rounds of PDHS was 5724, 7461, and 8287, respectively, for the years 2007, 2013, and 2018, respectively. It was found that the utilization of PNC for mothers and newborn within two months following delivery increased from 13% to 43% in 2013 and the subsequently reduced to 27% in 2018. Similarly, the utilization of PNC within 24 hours increased from 7% in 2007 to 33% in 2013 and reduced to 7% in 2018 (Table 1). This non-linear pattern in service utilization could be due to distinct geographical regions in which the survey was carried out. During DHS 2006-07, data were collected from four regions: Punjab, Sindh, Khyber Pakhtunkhwa (KPK), and Balochistan. In the next round of DHS 2012–13, along with Punjab, Sindh, and Balochistan; three other districts of KPK, Gilgit Baltistan (GB), and Islamabad were included. Similarly, in DHS 2017–18, seven regions, namely, Balochistan, Punjab, Sindh, KPK, GB, Azad Jamu and Kashmir, Islamabad Capital Territory and Fata constituted the sampling frame. The sociodemographic characteristics along with the distribution of health services and quality would have been different, which may have resulted in varied PNC utilization levels across sample11. The study conducted by Iqbal S et al. also indicated variability in PNC service utilization across different regions from where the data were collected10. Among all the sociodemographic determinants included in this study, the occupation of the respondent and the utilization of ANC (Table 4) were found to be significantly associated with newborn PNC utilization within two months after delivery across all the three rounds of DHS. It was found that the odds of using PNC was 1.26 times more among women who were employed than among unemployed mothers. Previous studies conducted in Pakistan10 and from other neighboring countries also showed a positive association among mothers with employment12-14 (Table 3). However, wealth index of household15,16, education status of the respondents8,16, and total children ever born8,17 were significantly associated with newborn PNC for two DHS rounds: 2012–13 and 2017–18. Utilization of maternal health services, especially antenatal or prenatal care, was also a strong predictor of PNC throughout all PDHS; it is evident from the literature that ANC is the entry point for the utilization of maternal health services during and after pregnancy12-21. The respondent’s occupation and utilization of antenatal care were found to be associated with newborn PNC from the DHS 2006–07 and 2012–13 data in previous studies8,10. This study indicates that the occupation of the respondent and prenatal care services utilization by respondents influenced the utilization of newborn PNC across all the three rounds of the PDHS. Other common factors such as wealth index, education of the respondent, and total number of children ever born also influenced the uptake of newborn PNC services. Another strength of this study is the number of sociodemographic and outcome variables included, which is far higher than those included in previous studies8,10. However, we could not see determinants of newborn PNC utilization due to data unavailability on PNC from the 1990–91 PDHS. Moreover, the data on the reasons for not getting the PNC by the women after delivery were not available. There are limitations to the data, which we noticed while conducting this analysis. These limitations may be considered as recommendations for further improving the scope of the DHS. There was no information available on the distribution of health services in the DHS data. This information is important, as differential health service availability and accessibility directly influence PNC utilization, which we could not explore in the current study. In future research, the data could be used to link the availability and accessibility of services with their utilization. The second limitation in data, we noticed, was regarding the quality of PNC, which was not captured in the DHS questionnaire. This question is crucial to explain the reducing uptake of newborn PNC services, especially in 2017–18. The DHS also did not contain any information on the domains for which PNC is provided, which is again important for improving the health of the mother and the newborn.
Table 4. Significant factors influencing newborn postnatal care (PNC) utilization within two months.

| 2007       | 2012       | 2018       |
|------------|------------|------------|
| Significant factors for new-born PNC utilization within two months |
| Occupation of respondent | Occupation of respondent | Occupation of respondent |
| Husband's education | Husband's education | Education of respondent |
| Prenatal care utilization | Wealth index | Wealth index |
| Sex of previous child | Education of respondent | Total children ever born |
| No. of antenatal visits | Husband's age | No. of antenatal visits |
| Number of household members | Husband's occupation | Sex of first child |
| Total children ever born | Prenatal care utilization |
| No. of antenatal visits |

Conclusions
This study reveals that women being employed, utilization of ANC or prenatal services, wealth index, and education of respondents or their husbands increases the uptake of newborn PNC utilization. An increasing number of children ever born to women are less likely to have newborn PNC utilization. Hence, there is a need to address the issues of improving economic status, education, employment of the women, and population control to increase newborn PNC utilization. Similarly, interventions that increase the coverage and quality of ANC services will also increase the utilization of newborn PNC among women in Pakistan.

Data availability
Source data
The data for this study is owned by the DHS Program. The Individual Recode datasets for the PDHS 2006–07, 2012–13 and 2017–2018 were used for this study and can be obtained here: https://www.dhsprogram.com/data/available-datasets.cfm?ctryid=31

The electronic data is available from the DHS Program under its terms of use. Before downloading the data, users must register as a DHS user for reasons laid out on the DHS Program website and dataset access is only granted for legitimate research purposes.

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References
1. Say L, Chou D, Gemmill A, et al.: Global causes of maternal death: a WHO systematic analysis. Lancet Glob Health. 2014; 2(6): e323–33. PubMed Abstract | Publisher Full Text
2. Lozano R, Naghavi M, Foreman K, et al.: Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012; 380(9859): 2095–128. PubMed Abstract | Publisher Full Text
3. Demographic P: Health Survey (PDHS)(2017-18). National Institute of Population Studies, Islamabad, Pakistan, and United States Agency for International Development (USAID). 2018. Reference Source
4. World Health Organization: WHO recommendations on postnatal care of the mother and newborn. World Health Organization; 2014. Reference Source
5. Khan A, Kinney MV, Hazin T, et al.: Newborn survival in Pakistan: a decade of change and future implications. Health Policy Plan. 2012; 27(suppl 3): iii72–87. PubMed Abstract | Publisher Full Text
6. Somefun OD, Ibisomi L: Determinants of postnatal care non-utilization among women in Nigeria. BMC research notes. 2016; 9(1): 21. PubMed Abstract | Publisher Full Text | Free Full Text
7. Ahmed M, Won Y: Cross-national systematic review of neonatal mortality and postnatal newborn care: special focus on Pakistan. Int J Environ Res
8. Yunus A, Iqbal S, Munawar R, et al.: Determinants of postnatal care services utilization in Pakistan-insights from Pakistan demographic and health survey (PDHS) 2006-07. Middle-East Journal of Scientific Research. 2013; 18(10): 1440–7.

9. Kerber KJ, de Graft-Johnson JE, Bhutta ZA, et al.: Continuum of Care for Maternal, Newborn, and Child Health: From Slogan to Service Delivery. Lancet. 2007; 370(9595): 1358–69.

10. Iqbal S, Maqsood S, Zakar R, et al.: Continuum of care in maternal, newborn and child health in Pakistan: analysis of trends and determinants from 2006 to 2012. BMC Health Serv Res. 2017; 17(1): 189.

11. Majrooh MA, Hasnain S, Akram J, et al.: Coverage and Quality of Antenatal Care Provided at Primary Health Care Facilities in the ‘Punjab’ Province of Pakistan. PLoS One. 2014; 9(11): e113390.

12. Dhakal S, Chapman GN, Simkhada PP, et al.: Utilisation of postnatal care among rural women in Nepal. BMC Pregnancy Childbirth. 2007; 7(1): 19.

13. Onah HE, Ikeako LC, Ilobachi GC: Factors associated with the use of maternity services in Enugu, southeastern Nigeria. Soc Sci Med. 2006; 63(7): 1870–8.

14. Situ KC, Neupane S: Women's Autonomy and Skilled Attendance during Pregnancy and Delivery in Nepal. Matern Child Health J. 2016; 20(6): 1222–9.

15. Chakraborty N, Islam MA, Chowdhury RL, et al.: Determinants of the use of maternal health services in rural Bangladesh. Health Promot Int. 2003; 18(4): 327–37.

16. Singh PK, Kumar C, Rai RK, et al.: Factors associated with maternal healthcare services utilization in nine high focus states in India: a multilevel analysis based on 14 385 communities in 292 districts. Health Policy Plan. 2014; 29(5): 542–59.

17. Jat TR, Ng N, San Sebastian M: Factors affecting the use of maternal health services in Madhya Pradesh state of India: a multilevel analysis. Int J Equity Health. 2011; 10(1): 59.

18. Rai RK, Singh PK, Kumar C, et al.: Factors associated with the utilization of maternal health care services among adolescent women in Malawi. Home Health Care Serv Q. 2013; 32(2): 106–25.

19. Sein KK: Maternal health care utilization among ever married youths in Kyimyindaing Township, Myanmar. Matern Child Health J. 2012; 16(5): 1021–30.

20. Sharma SK, Sawangdee Y, Sirirassamee B: Access to health: women's status and utilization of maternal health services in Nepal. J Biosoc Sci. 2007; 39(5): 671–92.

21. Bhatta DN, Aryal UR: Paternal factors and inequity associated with access to maternal health care service utilization in Nepal: a community based cross-sectional study. PLoS One. 2015; 10(6): e0130380.
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Version 2

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No more comment and question in this article.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: reproductive health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 07 October 2020

https://doi.org/10.5256/f1000research.28364.r70513

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✔ Ejaz Ahmad Khan
Department of Epidemiology and Biostatistics, Health Services Academy (HSA), Islamabad, Pakistan

1. Title of the manuscript need to aligned with the objective of the study i.e., post natal care
and NOT the postpartum case.

2. Abstract needs to be rewritten in proper academic English with flow.

3. Authors leave the conclusion with a question about 2018 data, which they should have had discussed in their discussion section before concluding their remarks.

4. Introduction: Pakistan is a Low-middle income country and NOT a low income country as per the World Bank ranking. Introduction needs more robust literature cited.

5. Methods need to be in the past tense and so should be the results.

6. Results need to be rewritten in a proper sequence and flow. The DHSs analysed year-wise need to be written together for each background factor.

7. Discussion must discuss the most important results as per the objectives of the study, and critique 2018's unexpected results with good literature support.

**Is the work clearly and accurately presented and does it cite the current literature?**
Partly

**Is the study design appropriate and is the work technically sound?**
Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**
Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**
Yes

**Are all the source data underlying the results available to ensure full reproducibility?**
Yes

**Are the conclusions drawn adequately supported by the results?**
Partly

*Competing Interests:* No competing interests were disclosed.

*Reviewer Expertise:* Systematic reviews, epidemiology, burden of disease

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 10 September 2020

https://doi.org/10.5256/f1000research.28364.r70514
Korravarn Yodmai
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1. In a part of the introduction, the gap of knowledge based on current studies should be identified.

2. Some details of methods such as target population, where was data collected such as there was collected data from community or health facility. It may important to present the data collecting process (briefly).

3. Interpretation of the result should explain more detail the magnitude of the result rather than explain just the association.

4. In the discussion, the authors should explain more detail about PNC services in each area. What is a barrier of service in those areas, even they may use the same health policy or need to succeed in the same indicators?

5. According to the introduction part, this study has filled the gap of knowledge or not.

Is the work clearly and accurately presented and does it cite the current literature? Partly

Is the study design appropriate and is the work technically sound? Yes

Are sufficient details of methods and analysis provided to allow replication by others? Partly

If applicable, is the statistical analysis and its interpretation appropriate? Partly

Are all the source data underlying the results available to ensure full reproducibility? Yes

Are the conclusions drawn adequately supported by the results? Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: reproductive health

I confirm that I have read this submission and believe that I have an appropriate level of
expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 15 Oct 2020

ABDUL GHAFFAR, Chulalongkorn University, Bangkok, Thailand

In response to comment 1, from Korravarn Yodmai
Knowledge gap added

In response to comment no 2 from Korravarn Yodmai,
DHS has standard protocols and data method process is already briefly mentioned, for more details reader are referred to reference below.

In response to comment 3, from Korravarn Yodmai
More details added, OR added in results description

In response to comment 4, from Korravarn Yodmai
These data represent entire Pakistan and barrier in different provinces may not be possible to consider in discussion section as we don't have data about barriers in DHS surveys. Details about PNC services are provided in the introduction and were not included in discussion section due to repetition, and also it is mentioned that currently there is no separate newborn health policy in Pakistan

Response to comment 5 from Korravarn Yodmai
Yes the study fulfilled the knowledge gap, as conclusion describes the findings which are consistent in all three surveys like education of women and utilization of prenatal services

**Competing Interests:** No competing interests were disclosed.
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