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Meta Analysis
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# Meta Analysis of Factors Determining Postnatal Care Utilization

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## ABSTRACT

**Background:** Maternal and infant morbidity and mortality continue to be a challenge today. Most maternal and newborn deaths occur during the early postnatal period. This condition can be caused by low utilization of postnatal care services. This study aims to analyze and estimate the influence of determining factors on the utilization of postnatal care services.
**Subjects and Method:** Meta-analysis was conducted using PRISMA guidelines and PICO format. Population: Postpartum Mothers. Intervention: high antenatal care, high maternal education, high family income and delivery in hospital. Comparison: low antenatal care, low maternal education, low family income, home birth. Outcome: postnatal care services. Cross-sectional study articles were collected from Google Scholar, PubMed, and Science Direct databases. The search strategy used the keywords: "Determinant Postnatal Care" AND "Maternal Health Service" AND "Cross-Sectional". The inclusion criteria for this study were full-text, cross-sectional studies published from 2014 to 2023. Data from articles were extracted with RevMan 5.3.
**Results:** The meta-analysis included 16 cross-sectional studies from Ethiopia, Ghana, Kenya, and Malawi. The total sample was 29,165 postpartum mothers. Postnatal mothers with high antenatal care visits (aOR= 2.64; 95% CI= 1.87 to 3.71; p= 0.001), high education (aOR= 2.09; 95% CI= 1.67 to 2.63; p = 0.001), high family income (aOR= 1.63; 95% CI= 1.25 to 2.11; p = 0.002), and hospital delivery (aOR= 1.58; 95% CI= 1.15 to 2.97; p= 0.010) allow the utilization of postnatal care services and these results were statistically significant.
**Conclusion:** The results of this study reveal that high antenatal care, high maternal education, high family income and delivery in hospital have a positive effect on the utilization of postnatal care services.

**Keywords:** antenatal care, health institutional, maternal education, family income, postnatal care.

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## BACKGROUND

Throughout the world, around 810 women die every day due to complications during pregnancy and childbirth that could have been avoided (WHO, 2018). Based on data released by (WHO), more than 585,000 or 60% of maternal deaths worldwide occur during the postnatal period (WHO, 2013). Then more than half of maternal deaths occur in the first 24 hours after delivery (Hordofa et al., 2015). Postnatal period, refers to the first six weeks (or 42 days) after the birth of the baby. The first week (7 days) after birth requires intensive attention and care for both mother and newborn baby (WHO, 2015). In this period there is the highest risk of death for mothers and newborns (Akibu *et al.,* 2018).

Postnatal care (PNC) services are a part of maternal and child health services that are rarely utilized (Kebede et al., 2022). One of the problems related to the use of postnatal care services in developing countries is the problem of the extent of pregnancy, complications that arise, and the neonatal mortality rate (WHO, 2018). The main factors influencing the use of PNC services, such as monthly family income, birth outcomes of the last child, maternal educational status, desire to become pregnant, and place of delivery have a significant relationship with the use of postnatal care (Mamuye, 2020).

Previous research has explained the importance of early postnatal care examinations to increase the survival rate of mothers and children (Izudi et al., 2017). During PNC treatment, health workers can assess and confirm bleeding, check the condition of the breasts, monitor the level of anemia, provide encouragement regarding nutrition, and provide education to mothers about early exclusive breastfeeding and umbilical cord care. In addition, through PNC, babies can receive various services such as birth registration, screening examinations and infection treatment, postnatal growth monitoring, and regular immunization services (Hordofa et al., 2015).

Therefore, postnatal care services are a very important factor in maintaining the health of mothers and babies, as well as preventing complications and deaths both in the short and long term due to the birth process. The aim of this study is to analyze and estimate the determining factors that influence the utilization of post-natal care services.

## SUBJECTS AND METHOD

### 1. Study Design

This study used systematic review and meta-analysis methods by referring to the PRISMA diagram. The articles collected from Google Scholar, Science Direct, and Pub-Med. Article searches were carried out using the keywords "Determinant Postnatal Care" AND "Maternal Health Service" AND "Cross-Sectional".

### 2. Steps of Meta-Analysis

Meta analysis was carried out in the following 5 steps:

1) Formulate research questions using the PICO model includes P= postnatal mother; I= ANC, high education, high family income, birth delivery in hospital; C= no ANC, low education, low family income, home birth; O= PNC.
2) Search for primary study articles from accredited electronic databases.
3) Conduct screening and carry out critical appraisal of primary studies.
4) Extract data and analyze effect estimates from each primary study in RevMan 5.3.
5) Present the results and draw conclusions.

### 3. Inclusion Criteria

The inclusion criteria for this study were full text articles of cross-sectional studies, multivariate analysis with adjusted odds ratio (aOR) to measure the estimated effect, research subjects were postnatal mothers, outcome was postnatal care.

**4. Exclusion Criteria**

The exclusion criteria in this article are related to research methods, namely reports published before 2014, articles that display bivariate analysis and reporting of final results in articles that only display OR, percent and mean difference.

**5. Operational Definition of Variable**

**Antenatal care (ANC)** is a care effort provided to maintain the health of the mother and fetus during pregnancy. High antenatal care is positively related to the utilization of postnatal care services.

**Formal education** that the research subject has taken. Higher education is positively related to the use of postnatal care services.

**Family income** is a human effort to fulfill their living needs by utilizing existing resources. High family income is positively related to the use of postnatal care services.

**Childbirth in hospital** is a place used to organize health service efforts. Giving birth in a hospital is positively related to the use of postnatal care services.

**Postnatal care (PNC)** is care that is carried out specifically for mothers and babies after giving birth.

**6. Instrument**

This study used PRISMA flow-chart guidelines and quality assessment in this study uses the Critical Appraisal of Cross-sectional from Master's Public Health, Universitas Sebelas Maret, Surakarta (Murti, 2023).

**7. Data Analysis**

Data analysis in this study used the RevMan 5.3 application to determine the magnitude of influence and heterogeneity between antenatal care (ANC), education, family opinion, delivery in hospital on postnatal care services. The results of data processing are presented in the form of forest plots and funnel plots.

## RESULTS

Search for articles in this meta-analysis through 3 databases such as Google Scholar, Science Direct, and Pub-Med. Articles published from 2014 to 2023. Figure 1 shows the article search process based on the PRISMA flow diagram. There were 19,144 up to 16 articles that met the full text review requirements. The article is spread across 1 continent, namely Africa (Figure 2).


**Figure 2. Map of research area**

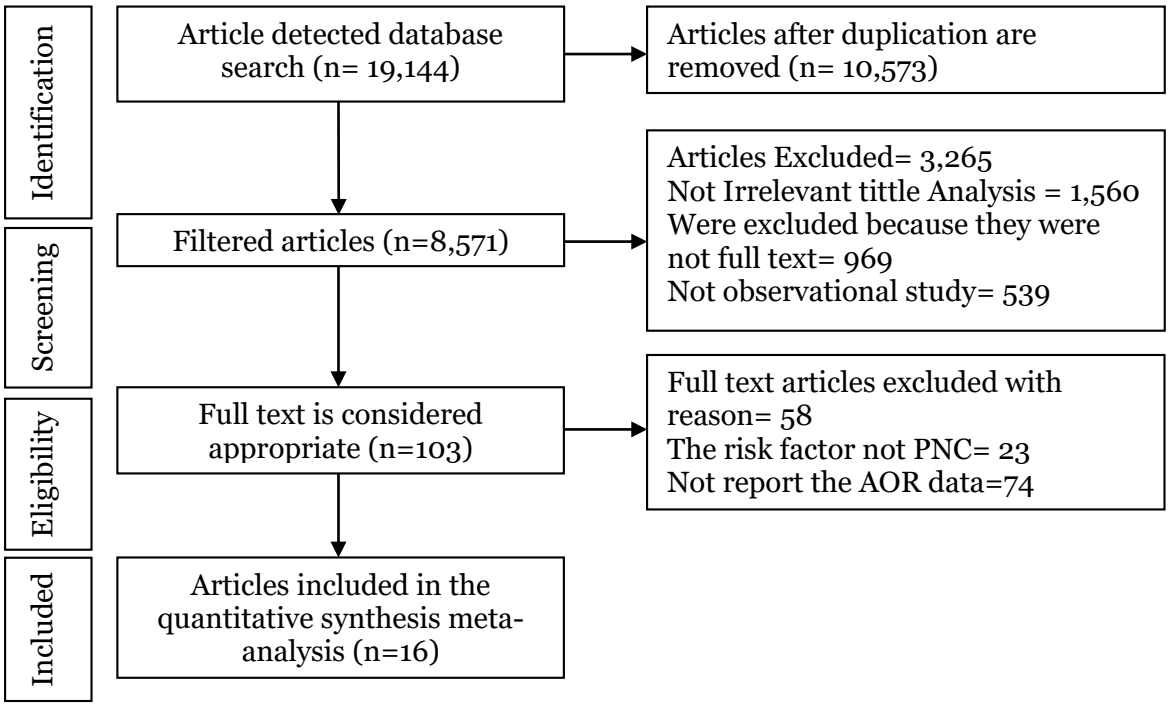


**Figure 1. Results of PRISMA flow diagrams of the influence of antenatal care, maternal education, family income and delivery in hospital to postnatal care services**

**Table 1. Critical appraisal of cross-sectional studies of the influence of antenatal care, maternal education, family income and delivery in hospital on PNC**

| Author (Year) | Appraisal Criteria | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1a | 1b | 1c | 1d | 2a | 2b | 3a | 3b | 4 | 5 | 6a | 6b | 7 | |
| Tesfahun et al. (2014) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Akungaa et al. (2014) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Hordofa et al. (2015) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Abosse et al. (2015) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Darega et al. (2016) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Limenih et al. (2016) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Birhanu et al. (2016) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Akibu et al. (2018) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Berhe et al. (2019) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Mamuye et al. (2020) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Appiah et al. (2021) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Sagawa et al. (2021) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Beyene et al. (2022) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Kebede et al. (2022) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Dona et al. (2022) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |
| Yosef et al. (2023) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 26 |

**Description of question criteria:**

**1. Formulation of research questions in the PICO**

a. Is the population in the primary study the same as the population in the PICO meta-analysis?

b. Is the operational definition of intervention, namely ex-posed status in the primary study the same as the definition intended in the meta-analysis?

c. Is the comparison, namely the unexposed status used in the primary study, the same

as the definition intended in the meta-analysis?

d. Are the outcome variables examined in the primary studies the same as the definitions intended in the meta-analysis?

**2. Methods for selecting research subjects**

a. In analytical cross-sectional studies, do researchers choose samples from the population randomly (random sampling)?

b. As an alternative, if in a cross-sectional analytical study the sample is not selected randomly, does the researcher select the sample based on outcome status or based on intervention status?

**3. Methods for measuring intervention and outcome variables**

a. Are the exposure and outcome variables measured with the same instruments (measuring tools) in all primary studies?

b. If the variable is measured on a categorical scale, are the cutoffs or categories used the same across primary studies?

**4. Design-related bias**

If the sample was not selected randomly, has the researcher made efforts to prevent bias in selecting research subjects? For example, selecting subjects based on outcome status is not affected by exposure status (intervention), or selecting subjects based on exposure status (intervention) is not affected by outcome status.

**5. Methods for controlling confounding**

Whether the primary study investigators have made efforts to control the influence of confounding (for example, conducting a multivariate analysis to control for the influence of a number of confounding factors).

**6. Statistical analysis methods**

a. Does the researcher analyze the data in this primary study with a multivariate analysis model (e.g., multiple linear regression analysis, multiple logistic regression analysis)

b. Does the primary study report effect sizes or associations resulting from multivariate analysis (e.g., adjusted OR, adjusted regression coefficient)

**7. Conflict of interest**

Is there no possibility of a conflict of interest with the research sponsor, which could cause bias in concluding the research results?

**Assessment Instructions:**

1. Total number of questions = 13 questions. Answer "Yes" to each question gives a score of "2". The answer "Undecided" gives a score of "1". The answer "No" gives a score of "0".
2. Maximum total score= 13 questions x 2= 26.
3. Minimum total score = 13 questions x 0 = 0. So the range of total scores for a primary study is between 0 and 26.
4. If the total score of a primary study is >= 22, then the study can be included in the meta-analysis.

**Table 2. Description of the primary study on the influence of antenatal care, maternal education, family income and delivery in hospital on postnatal care services**

| Author (Year) | Country | Study Design | Sample | Population (P) | Inter-vention (I) | Comparation (C) | Outcome (O) |
|---|---|---|---|---|---|---|---|
| Tesfahun et al. (2014) | Ethiopia | Cross Sectional | 820 | Mothers aged 15-49 years, Postpartum 6-12 months | ANC Visit >3, Health Institution | No ANC visit, No Health Institution | Postnatal Care |
| Akunga et al. (2014) | Kenya | Cross Sectional | 3.970 | Mothers aged 15-40 years | ANC Visit 4+ | No ANC visit | Postnatal Care |
| Hordofa et al. (2015) | Ethiopia | Cross Sectional | 788 | Postpartum mothers aged <20-49 years | Yes ANC Vis-it, Formal education | No ANC visit, No Formal education | Postnatal Care |

| Author (Year) | Country | Study Design | Sample | Population (P) | Inter-vention (I) | Comparation (C) | Outcome (O) |
|---|---|---|---|---|---|---|---|
| Abosse et al. (2015) | Ethiopia | Cross Sectional | 710 | Mothers aged <20->34 years | Yes ANC Visit, Primary schooI, 100-499, Health Institution | No ANC visit, Illiterate, <100, Home | Postnatal Care |
| Darega et al. (2016) | Ethiopia | Cross Sectional | 703 | Mothers aged 18->35 years, Postpartum 12 months | Yes ANC Visit, Health Institution | No ANC visit, No Health Institution | Postnatal Care |
| Limenih et al. (2016) | Ethiopia | Cross Sectional | 588 | Mothers aged <20-49 years, Postpartum <1 years | Yes ANC Visit, Secondary education and above, 25$–75$, Health Institution | No ANC visit, Cannot read and write, <25$, Home | Postnatal Care |
| Berhanu et al. (2016) | Ethiopia | Cross Sectional | 422 | Mothers aged <20->35 years, Post-partum 4 months | Yes ANC Visit, Secondary school, Health Center | No ANC visit, No formal education, Home | Postnatal Care |
| Akibu et al. (2018) | Ethiopia | Cross Sectional | 520 | Mother giving birth inside last ten months before the survey | Higher education | Illiterate | Postnatal Care |
| Berhe et al. (2019) | Ethiopia | Cross Sectional | 1690 | Mothers aged 18-49 years, Postpartum <6 months | ANC Visit >4, Above secondary school | ANC visit <2, No formal education | Postnatal Care |
| Mamuye et al. (2020) | Ethiopia | Cross Sectional | 413 | Mother aged 15-49 years, Postpartum 6-12 months | >1500 | <500 | Postnatal Care |
| Appiah et al. (2021) | Ghana | Cross Sectional | 1442 | Mother aged 15-49 years, Postpartum 6-12 month | Secondary+, Rich | No formal education, Poor | Postnatal Care |
| Beyene et al. (2022) | Ethiopia | Cross Sectional | 798 | Mothers aged 18-49 years, Postpartum 2 years | ANC, education > high school, health facility | No ANC, under primary school, home | Postnatal Care |
| Sagawa et al. (2021) | Malawi | Cross Sectional | 600 | Mother aged 18-49 years, Postpartum 2 years | Secondary & above, K150,000 | None Education, K20,000 | Postnatal Care |
| Kebede et al. (2022) | Ethiopia | Cross Sectional | 2,105 | Mother aged 15-49 years, Postpartum 2 years | Richest | Poorest | Postnatal Care |

| Author (Year) | Country | Study Design | Sample | Population (P) | Inter-vention (I) | Comparation (C) | Outcome (O) |
|---|---|---|---|---|---|---|---|
| Dona et al. (2022) | Ethiopia | Cross Sectional | 306 | Mothers aged 15->30 years, Postpartum >12 months | ANC, College, Health facility | No ANC, No formal education, Home | Postnatal Care |
| Yosef et al. (2023) | Ethiopia | Cross Sectional | 301 | Mother aged 18 years, Postpartum 12 months | >Average | Below average | Postnatal Care |

**Table 3. Adjusted Odd Ratio (aOR) of the influence of high antenatal care visits on postnatal care services (N= 10.795)**

| Author (Year) | aOR | 95 % CI | |
|---|---|---|---|
| | | Lower limit | Upper limit |
| Tesfahun et al. (2014) | 2.60 | 1.40 | 5.06 |
| Akunga et al. (2014) | 1.84 | 1.40 | 2.42 |
| Hordofa et al. (2015) | 4.14 | 2.45 | 6.99 |
| Abosse et al. (2015) | 1.00 | 0.03 | 0.56 |
| Darega et al. (2016) | 4.95 | 2.50 | 9.80 |
| Limenih et al. (2016) | 1.01 | 0.54 | 1.91 |
| Berhanu et al. (2016) | 5.93 | 1.00 | 30.50 |
| Berhe et al. (2019) | 4.84 | 1.57 | 14.9 |
| Beyene et al. (2022) | 2.07 | 1.28 | 3.36 |
| Dona et al. (2022) | 3.50 | 1.60 | 7.60 |

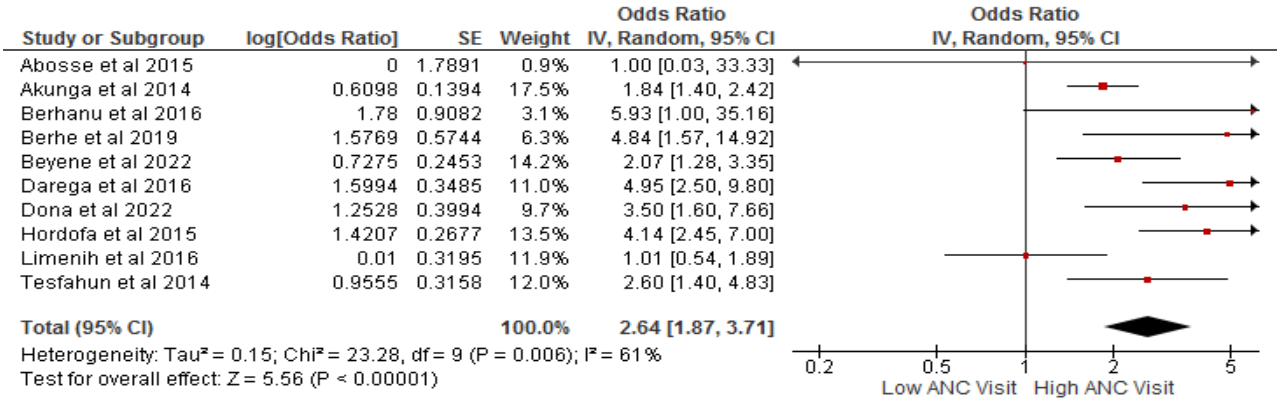


**Figure 3. Forest plot of the influence of antenatal care visits on postnatal care services**

The forest plot in Figure 3 shows that ANC visits have an effect on postnatal care services. Postpartum mothers who had a history of high ANC visits were 2.64 times more likely to utilize PNC services than mothers with a history of low ANC, this result was statistically significant (aOR= 2.64; 95% CI= 1.87 to 3.71; p= 0.001). The forest also showed high heterogeneity of effect estimates between primary studies $I^2$ = 61%; p= 0.006.

The funnel plot results in Figure 4 show that the distribution of effect estimates is more or less symmetrical between studies to the right and left of the vertical mean estimate line. The funnel plot did not show publication bias in the meta-analysis. The distribution of

effect estimates tends to be located to the left of the average vertical line, which is opposite to the location of the average effect estimate (diamond) which is located to the right, so publication bias tends to reduce the true effect (under-estimate). Thus, the calculation of the average estimated effect is carried out using a random effect model approach.

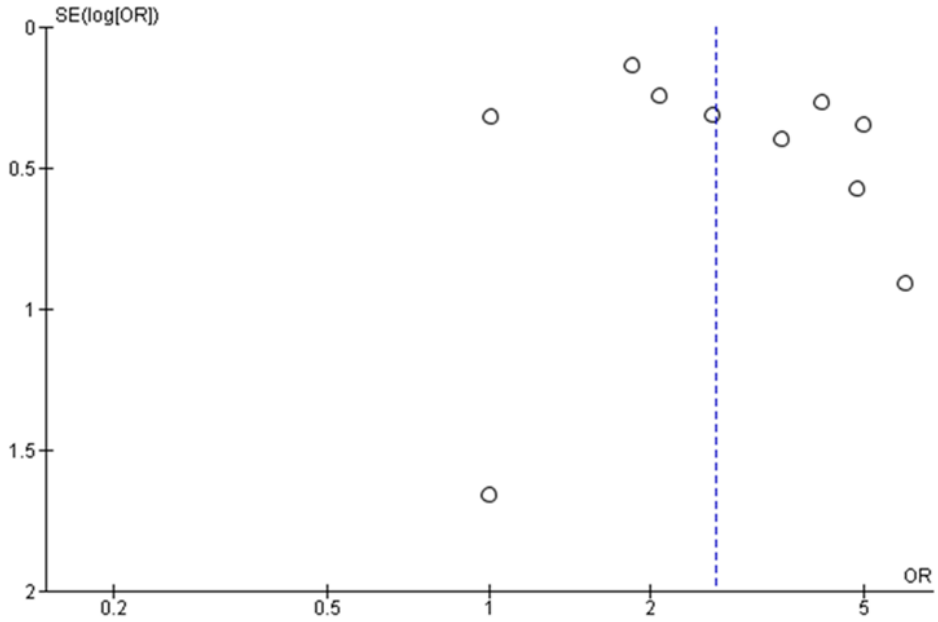


**Figure 4. Funnel plot of the influence of antenatal care visits on postnatal care services**

**Table 4. Adjusted Odd Ratio (aOR) of the effect of maternal education on postnatal care services (N= 7.864)**

| Author (Year) | aOR | 95% CI | |
|---|---|---|---|
| | | Lower limit | Upper limit |
| Hordofa et al. (2015) | 2.12 | 1.37 | 3.28 |
| Abosse et al. (2015) | 1.531 | 0.72 | 3.26 |
| Berhanu et al. (2016) | 2.22 | 0.92 | 5.36 |
| Limenih et al. (2016) | 1.44 | 0.79 | 2.60 |
| Akibu et al. (2018) | 3.20 | 1.19 | 9.20 |
| Berhe et al. (2019) | 3.60 | 1.32 | 9.83 |
| Appiah et al. (2021) | 1.12 | 0.75 | 1.65 |
| Sagawa et al. (2021) | 2.31 | 1.97 | 6.04 |
| Beyene et al. (2022) | 3.29 | 1.89 | 5.73 |
| Dona et al. (2022) | 2.60 | 1.70 | 7.40 |

The forest plot in Figure 5 shows that postnatal mothers with higher education are 2.09 times more likely to utilize PNC services compared to mothers with low education, and this result was statistically significant (aOR= 2.09; 95% CI= 1.67 to 2.63; p= 0.001 ). The forest also showed high heterogeneity of effect estimates between primary studies $I^2$ = 50%; p= 0.030.

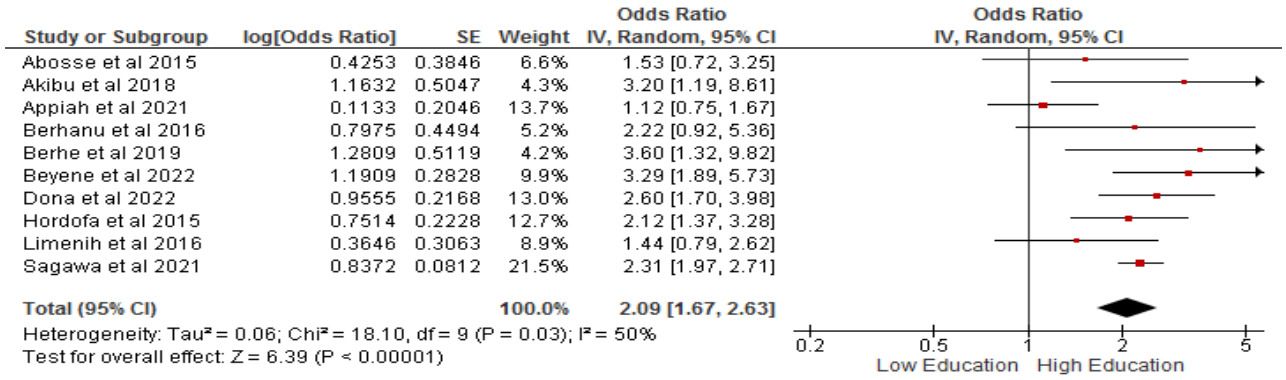


**Figure 5. Forest plot of the influence of maternal education on postnatal care services**

The funnel plot results in Figure 6 show an asymmetric distribution of effects. Effect estimates are more spread out to the right of the vertical line than to the left, indicating publication bias. The distribution of these effect estimates is mostly located to the right of the same vertical line as the location of the average effect estimate (diamond) which is also located to the right of the vertical line in the forest plot image, so publication bias tends to exaggerate the true effect (over-estimate). Thus, the calculation of the average estimated effect is carried out using a random effect model approach.

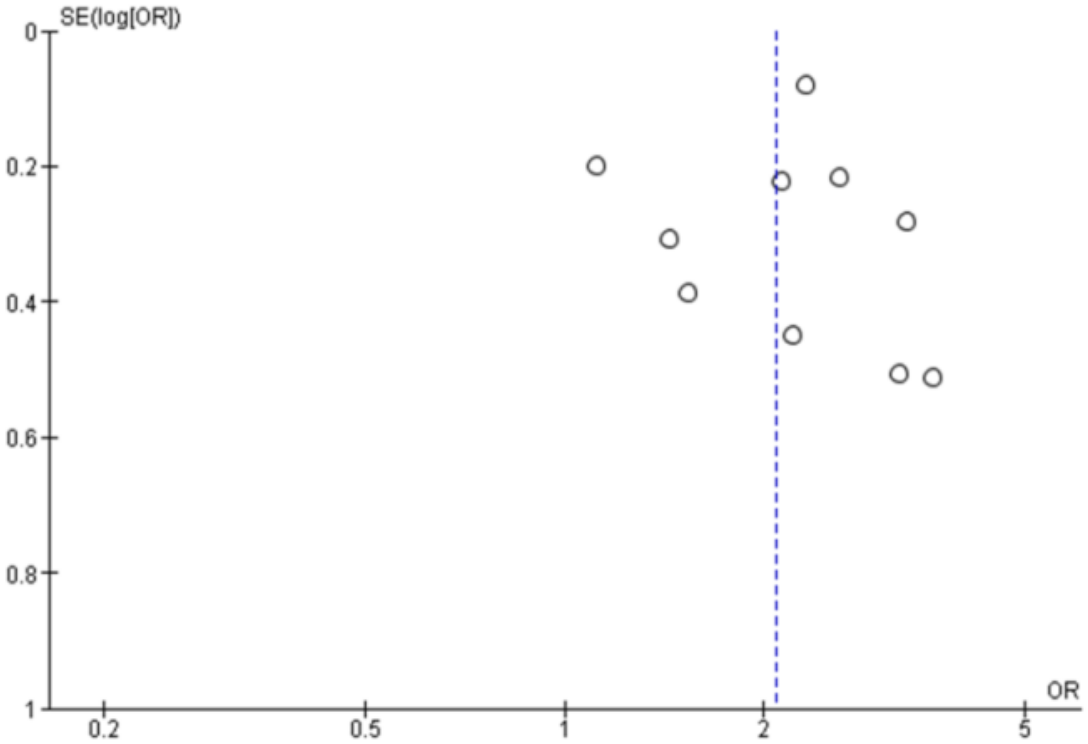


**Figure 6. Funnel plot of the influence of maternal education on postnatal care services**

**Table 5. Adjusted Odd Ratio (aOR) of the influence of family income on postnatal care services (N= 6.159)**

| Author (Year) | aOR | 95% CI | |
|---|---|---|---|
| | | Lower limit | Upper limit |
| Abosse et al. (2015) | 1.88 | 0.90 | 3.91 |
| Limenih et al. (2016) | 1.38 | 0.83 | 2.31 |
| Mamuye et al. (2020) | 2.85 | 1.21 | 6.68 |
| Appiah et al. (2021) | 1.53 | 0.85 | 2.74 |
| Sagawa et al. (2021) | 4.63 | 1.43 | 15.03 |
| Kebede et al. (2022) | 1.42 | 0.60 | 3.35 |
| Yosef et al. (2023) | 1.22 | 0.67 | 2.23 |

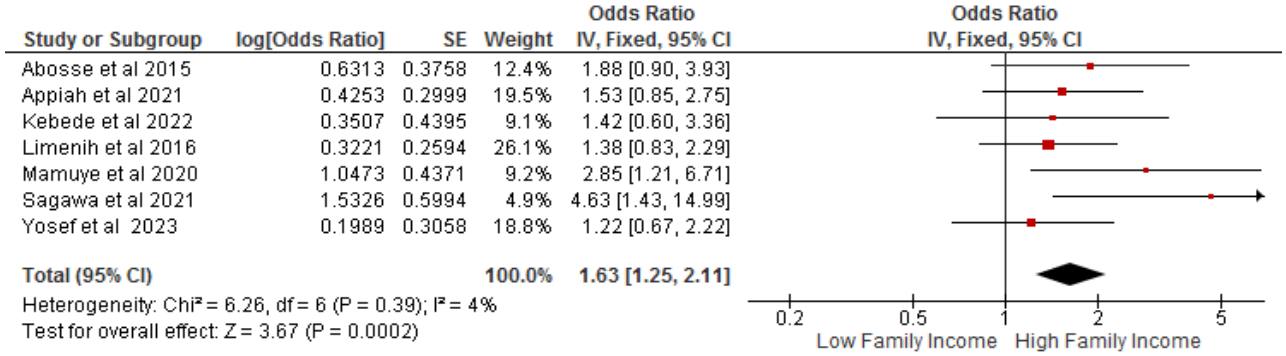


**Figure 7. Forest plot of the influence of family income on postnatal care services**

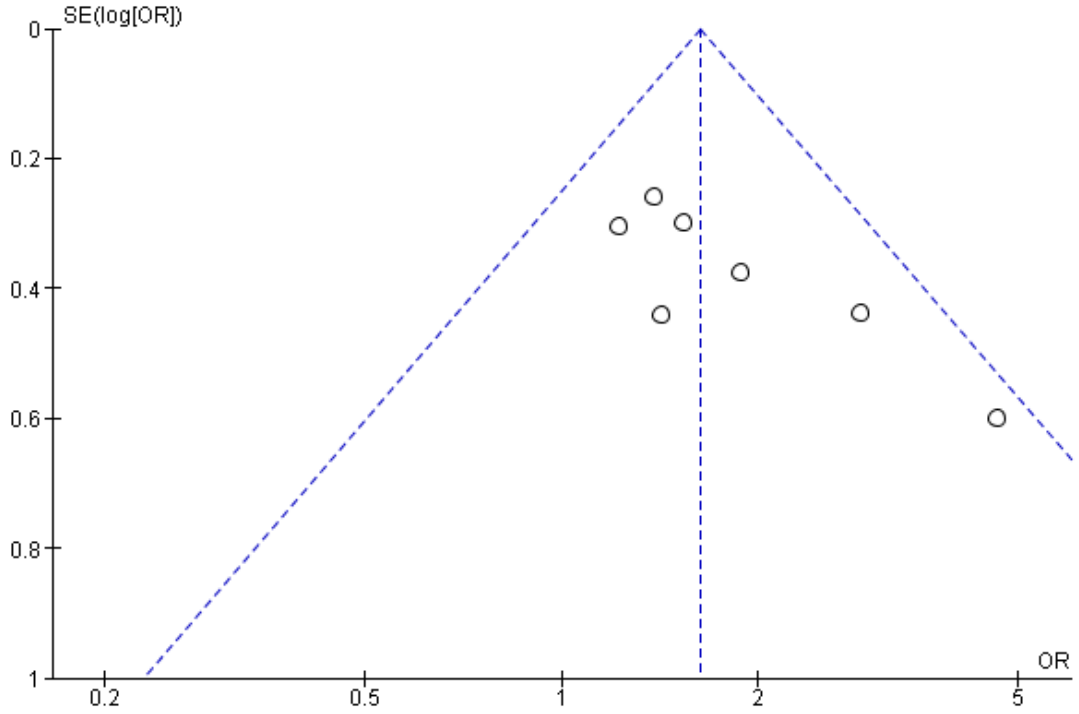


**Figure 8. Funnel plot of the influence of family income on postnatal care services**

The forest plot in Figure 7 shows that postnatal mothers with high family income are 1.63 times more likely to utilize PNC services compared to mothers with low family income and this result was statistically significant (aOR= 1.63; 95% CI= 1.25 to 2.11 ; p= 0.002). The forest showed low heterogeneity in effect estimates between primary studies $I^2$= 4%; p= 0.390.

The funnel plot in Figure 8 shows a roughly symmetrical distribution of effect estimates between studies to the right and left of the vertical mean estimate line. Thus, this funnel plot does not indicate publication bias in the meta-analysis. Part of the distribution of the effect estimate is located to the right of the average vertical line, which together with the location of the average effect estimate (diamond) which is located to the right, publication bias tends to exaggerate the true effect (overestimate). Thus, the calculation of the average estimated effect is carried out using the fixed effect model approach.

**Table 6. Adjusted Odd Ratio (aOR) of the influence of giving birth in a hospital on postnatal care services (N= 4.347)**

| Author (Year) | aOR | 95% CI | |
|---|---|---|---|
| | | Lower limit | Upper limit |
| Tesfahun et al. (2014) | 8.09 | 2.78 | 23.53 |
| Abosse et al. (2015) | 1.00 | 0.01 | 0.04 |
| Darega et al. (2016) | 1.85 | 1.10 | 3.12 |
| Limenih et al. (2016) | 1.68 | 1.01 | 2.79 |
| Berhanu et al. (2016) | 1.01 | 0.16 | 7.50 |
| Beyene et al. (2022) | 0.96 | 0.64 | 1.44 |
| Dona et al. (2022) | 2.30 | 1.20 | 4.70 |

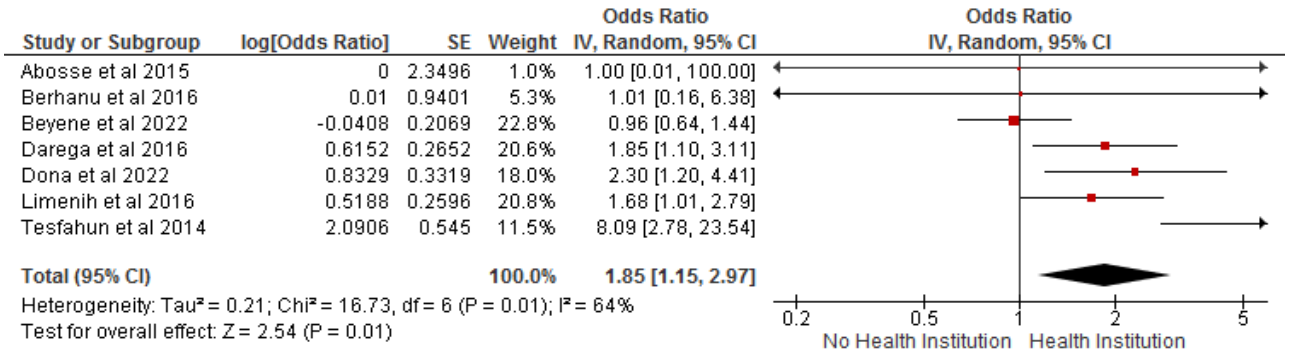


**Figure 9. Forest plot of the influence of giving birth in hospital on postnatal care services**

The forest plot in Figure 9 shows that postnatal mothers who delivered in hospital were 1.85 times more likely to utilize PNC services compared to mothers who delivered at home and this result was statistically significant (aOR= 1.85; 95% CI= 1.15 to 2.97 ; p= 0.010). The forest showed high heterogeneity in effect estimates between primary studies $I^2$ = 64%; p= 0.010.

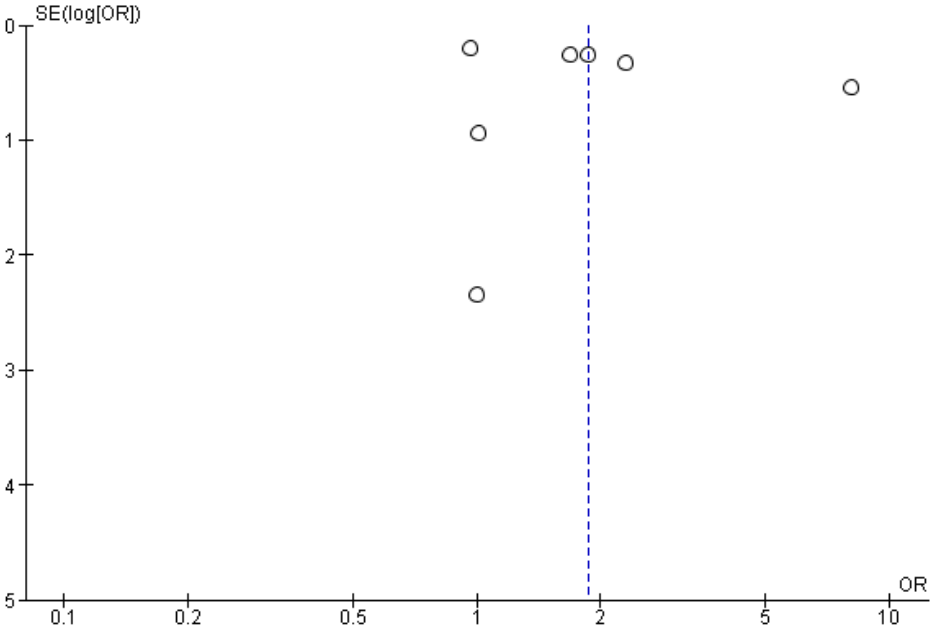


**Figure 10. Funnel plot of the influence of giving birth in hospital on postnatal care services**

The funnel plot in Figure 10 shows an asymmetric distribution of effect estimates between studies to the right and left of the vertical mean estimate line. Thus, this funnel plot indicates the presence of publication bias in the meta-analysis. Part of the distribution of the estimated effect is located to the left of the average vertical line, which is opposite to the location of the average estimated effect (diamond) which is located to the right, so publication bias tends to reduce the true effect (under-estimate). Thus, the calculation of the average estimated effect is carried out using a random effect model approach.

## DISCUSSION

### 1. The influence of rural residence on newborn mortality.

Babies living in villages have a 4.17 times higher risk of newborn death than those living in cities. These findings emphasize the significant role of residence factors (urban vs. rural) in maternal and infant health. Previous research, such as that conducted by Smith et al. (2019), shows that women living in urban areas have better access to health facilities, health education, and prenatal services, all of which contribute to improved maternal and infant health. On the other hand, the results of research by Johnson et al. (2020) highlighted the high rate of infant mortality in rural areas, caused by limited access to health facilities and the ability to obtain adequate medical care.

### 2. The influence of premature babies on newborn deaths

Babies born prematurely have a 5.17 times greater chance of experiencing newborn death compared to babies born not prematurely. These findings emphasize the importance of gestational age in the risk of infant mortality, in line with previous research. Smith et al. (2020) and Johnson et al. (2019) concluded that there is a clear relationship between gestational age and the risk of infant death. Babies born prematurely or at a very young or late gestational age have a higher risk of death. These data support the concept that the younger the gestational age,

the higher the risk of infant death. Furthermore, the literature also emphasizes that babies born prematurely have a high risk of complications such as respiratory distress syndrome, sepsis, and necrotizing enterocolitis, all of which can contribute to the high mortality rate of premature babies.

**3. The Effect of Low Birth Weight on Newborn Death.**

Babies with low birth weight have a 2.5 times higher risk of newborn death compared to babies born with normal weight. These results are in line with the meta-analysis conducted by Smith et al. (2018), who found a significant association between low birth weight and an increased risk of infant mortality. These findings reflect the broader view of Brown et al. (2018) and Johnson et al. (2020) regarding factors related to low birth weight, such as smoking behavior during pregnancy, inadequate prenatal care, and poor nutritional conditions in the mother. These studies provide a contextual understanding of the main causes of low birth weight and how these are associated with an increased risk of newborn death.

## AUTHOR CONTRIBUTION

Clelsy Sumardi Saputri, Ayun Widya Rizki, and Viola Holly Flora as the main researcher chose the theme, conducted a primary article search, processed the results and compiled interim results. Bhisma Murti and Ayu Novita provided a review of the results of the analysis, selected articles, gave directions in preparing the results of the analysis and discussion.

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This study used personal funds.

## CONFLICT OF INTEREST

There was no conflict of interest in this study.

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