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RESEARCH ARTICLE

REVISED **Determinants of maternal healthcare service utilisation among Indonesian mothers: A population-based study [version 2; peer review: 2 approved]**

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Abstract
Background: In Indonesia, maternal health care services are widely available, aiming to improve health and survival among mothers. However, these services remain underutilised, and its determining factor was unknown. This study sought to identify determinant factors of maternal healthcare services utilisation among Indonesian mothers.
Methods: This population-based cross-sectional study leveraged the 2017 Indonesia Demographic and Health Survey data. A total of 12,033 mothers aged from 15 to 49 years who had a live birth in the five years preceding the survey were included in the analysis. Multivariable logistic regressions were used to identify the determinant factors.
Results: Approximately 93.44% of the mothers had adequate antenatal care, 83.73% had a delivery at the healthcare facility, and 71.46% received postnatal care. The mother's age and household wealth index were the typical determinants of all maternal healthcare services. Determinants of antenatal care visits were husband's occupational status, the number of children, and access to the healthcare facility. Next, factors that drive mothers' delivery at the healthcare facility were the mother's education level, husband's educational level, and residential area. The use of postnatal care was determined by the mother's occupational status, husband's educational level, number of children, wealth index, access to the healthcare facility, and residential area.
Conclusions: The utilisation of each maternal healthcare service was determined by various socio-structural and intermediary determinants, but the mother's age and household wealth index were emerged as the typical determinants of all maternal healthcare

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services. Providing maternal healthcare services that are adjusted and tuned with these socio determinant factors may ensure that mothers can adequately utilise each service.

Keywords
antenatal care, institutional deliveries, maternal health, postnatal care, pregnancy

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> **REVISED** **Amendments from Version 1**
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> 1. Following the reviewer's suggestion, we added the explanations about ANC, INC, and PNC in the introduction to make sure the reader can understand these concepts earlier.
> 2. The definition concept of access to healthcare facilities was added to the method.
> 3. We focused on rural and urban areas which comprised 12033 residential areas in Indonesia.
> 4. As suggested by reviewers some changes have been made for the discussion part. According to the Social Determinant of Health (SDOH) framework, the discussion has been revised. The sentence has been revised accordingly.
> 5. We have revised our conclusion and made it more coherent with our findings.
>
> **Any further responses from the reviewers can be found at the end of the article**

Introduction

Maternal mortality is a serious global health problem that threatens healthcare systems. In 2017, approximately 810 mothers died every day from preventable causes related to pregnancy and delivery around the globe.[1] A vast majority of these mortalities occurred in low and middle-income countries, of which Indonesia is one.[2,3] In Southeast Asia, the maternal mortality rate among mothers aged 15-49 reached 16,000 per 295,000 mothers death or 5.4% of overall maternal mortality worldwide.[1] In Indonesia, the maternal mortality rate was about 305 deaths per 100,000 live births in 2015. This number was still threefold higher than the Millennium Development Goals (MDGs) target set up previously.[4,5] The Indonesian government's challenge will be more demanding as United Nations (UN) shifted to the new goals. The 2030 Sustainable Development Goals (SDGs) launched by the UN in 2016 was aimed to decrease maternal mortality to 70 deaths per 100,000 live births.[4] Thus, reaching SDG's target will be a considerable challenge for Indonesia.

Maternal healthcare (MHC) services are critical for maintaining pregnant woman's maternal health. Antenatal care (ANC), intra-natal care (INC) or institutionalized delivery, and postnatal care (PNC) are three critical services of MHC that are offered to the pregnant woman. First, ANC consists of three components: I assessment, which includes taking a patient's history, performing a physical examination, and ordering laboratory tests; (ii) health promotion, which includes nutrition counselling, birth planning, and information about pregnancy, subsequent contraception, and breastfeeding; and (iii) care provision, which includes tetanus toxoid vaccination, psychosocial support, and recordkeeping.[6] Next, the INC refers to delivery at any healthcare facility (clinic, public health centre, and hospital). Last, the PNC service standards include the examination of vital signs, the apex of the uterus, lochia and other vaginal fluids, and breasts, as well as counselling for exclusive breastfeeding; and the provision of communication, information, and education regarding PNC family planning.[6,7]

The utilisation of maternal healthcare services (MHC) among mothers remains a challenge for the health system across the countries. Adequate utilisation of MHC is crucial to reducing maternal mortality and improve pregnant mothers' well-being. However, maternal healthcare service utilisation among developing countries was relatively inadequate.[8–10] Particularly in Indonesia, it was reported that Antenatal care (ANC) visits in 2017 only reached 70%, which was lower than the government's target of 76%.[11] Mothers in favour of Intra-natal care (INC) at the healthcare facility was about 62%, which was below the targeted rate by the government at 85%.[12] Moreover, only 48% of mothers used the Postnatal care (PNC) service, where is still far below the expected target at 80%.[13] Since the maternal healthcare service has been underutilised among Indonesian mothers and it is much lower than the government target, hence an understanding of its determinant is deserved further investigation.

Studies across the countries have built knowledge for associated factors with the utilisation of MHC. For example, previous works by Kurniati *et al.* had identified that MHC utilisation among mothers influenced by education, occupation, age at first delivery, contraceptive use, age at first marriage, participation in household decision-making, and attitudes towards intimate partner violence.[14] However, a previous systematic review of studies in the lower and middle-income countries underscores that determinants for maternal healthcare service varied greatly in each population.[15] These factors are included in the World Health Organization's (WHO) Social Determinants of Health (SDOH) framework.[16] The framework consists of three levels (the socio-economic and political context that includes governance and public policies; social and structural determinants that include income, education, employment and ethnicity; and intermediary determinants such as health systems, distance to health facilities, social support, care-seeking practices, age and access to quality service).[16] Although WHO had introduced SDOH's framework in 2010, limited studies utilised this framework to guide their findings related to the determinants of three key components of MHC.[11,12,14] Nonetheless, none of the previous studies provide the entire picture about the determinants of these three MHC services utilisation. Based on these gaps, a study that utilized the SDOH framework with representative data generated from the population level is deemed necessary.

Investigating determinants of MHC utilisation among Indonesian mothers requires nationally representative data because it can control ethnic variability among the participants. Drawing from the 2017 Indonesian Demographic Health Survey (IDHS), this population-based study sought to identify determinant factors of MHC utilisation (ANC visit, institutionalised delivery, and PNC use) among Indonesian mothers. An understanding of determinants in each service could provide evidence for the government to develop a personalised intervention for Indonesian mothers based on the type of services.

Methods

Study design
This population-based, cross-sectional study used nationally representative data from the IDHS in 2017. This survey is part of the International Demographic and Health Survey (DHS) program, and its details can be found on the DHS program website (see the data availability statement for more detail).

Study setting and population
The population in this study was households from 34 provinces (comprised of 12033 residential areas) in Indonesia. The IDHS collected data from July 24th to September 30th, 2017, using a two-stage stratified sampling method. The first stage was selecting census blocks based on the wealth index that resulted in 1,970 blocks. In the second stage, 25 ordinary households were chosen from each block with systematic sampling from the list. A total of 49,627 women of childbearing age met the 2017 IDHS criteria to be interviewed. In the present study, the inclusion criteria of respondents included mothers aged 15 to 49 years who had a live birth in the five years preceding the survey. The exclusion criteria were whether the variables incomplete or missing. Of these, a sample of 12,033 mothers from 34 provinces in Indonesia was analysed.

Variables
The outcome variable in this study comprised the three key MHC components, namely ANC visits, institutionalised INC, and PNC after delivery obtained from participants self-reportedly. The ANC visit was categorised under two levels: adequate (4 times or more) and inadequate (fewer than 4 times). Institutionalised INC defined as a delivery that occurred at a healthcare facility regardless of its types (clinic, public health centre, and hospital) and ownership (government-owned and private sector). The use of PNC refers to a health check for the mother after delivery. According to the Ministry of Health Republic of Indonesia, PNC has to be carried out at least three times within the first six hours to the third day after delivery, on the fourth day to 28th after delivery, and the 29th day to the 42nd day after childbirth.

The explanatory variable in this study consisted of three categories that include mother's sociodemographic factors, husband's sociodemographic factors, and household-related factors. Under the category of mother's sociodemographic factors, there were three variables, namely mother's age in years (19-24, 25-34, and 35-49), mother's occupational status (employed and not employed), mother's educational level (primary, secondary, and higher). Three variables were under the category of husband's sociodemographic factors consisted of an age gap with husband (younger/older than their husband), husband's occupational status (employed and not employed), husband's educational level (primary, secondary, and higher). In regard to household-related factors, in this category, there were three variables comprised the number of children (0, 1-3, and more than 3), household wealth index (richest, rich, middle, poor, and poorest), residential area (urban and rural), and access to a healthcare facility (problem and not), which refers to percentage of women who reported that they have serious problems in accessing health care for themselves when they are sick.

Statistical analysis
Data obtained from the DHS dataset were analysed using STATA version 16.0 (Stata Corp, College Station, TX, USA). Data were analysed using the descriptive statistics method, and results were presented as weighted frequencies and percentages. The adjusted odds ratios (OR; AOR) with 95% confidence interval (CI) of factors associated with MHC (ANC, INC, and PNC) were estimated by multivariate logistic regressions.

Ethical consideration
The DHS program provided approval to use the 2017 IDHS data, and the data set is publicly available on DHS's website. The 2017 IDHS study protocol has been approved for ethical clearance from the national board review of the Ministry of Health of Republic Indonesia and Inner City Fund (ICF) Macro institutional review board (number 45 CFR 46). Before participants were interviewed, informed consent was sought by each interviewer.

Results

Population characteristics
A total of 12,033 mothers were eligible for data analyses in this study. Table 1 presents the descriptive characteristics of the study population. A high proportion of mothers were aged from 25 to 34 years (55.26%), employed (50.08%),

Table 1. Participants characteristics (n = 12,303).

Variable	n	%
Mother's age (years)		
19-24	2,584	21.47
25-34	6,649	55.26
35-49	2,800	23.27
Mother's occupational status		
Employed	6,026	50.08
Not employed	6,007	49.92
Mother's educational level		
Primary	2,743	22.80
Secondary	7,304	61.36
Higher	1,906	15.84
Age gap between mother and husband		
Younger than husband	9,801	81.45
Older than husband	2,232	18.55
Husband's occupational status		
Employed	11,970	99.48
Not employed	63	0.52
Husband's educational level		
Primary	3,108	25.82
Secondary	7,242	60.19
Higher	1,683	13.99
Number of children		
0	480	3.99
1-3	11,522	95.73
>3	33	0.28
Household wealth index		
Poorest	1,032	16.88
Poor	2,433	20.15
Middle	2,587	21.50
Rich	2,609	21.68
Richest	2,302	19.79
Access to healthcare facility		
No problem	10,819	89.83
Problem	1,224	10.17
Residential area		
Rural	6,069	50.44
Urban	5,964	49.56

had secondary education (61.36%), and were predominantly younger than their husbands (81.45%). The majority of husbands were working (99.48%) and had received their secondary education (60.19%). In this study, the mothers had predominantly had 1 to 3 children (95.73%) in their household, considered themselves as rich (21.68%), mostly did not have a problem (89.83%) when accessing health facilities, and resided in the rural area (50.44%).
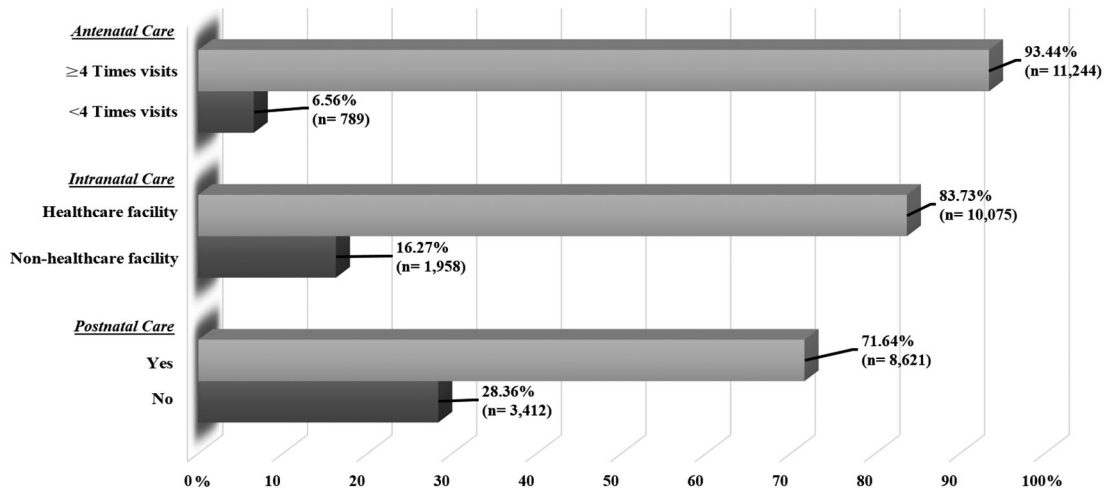
Figure 1. The proportion of maternal healthcare services utilization.

The proportion of maternal healthcare services utilization among Indonesian mothers

Figure 1 displays the proportion of Indonesian mothers' maternal healthcare service utilisation in ANC, INC, and PNC. About 93.44% of mothers had adequate ANC visits (≥4 visits), while only 6.56% had inadequate ANC visits (<4 visits). Regarding institutionalised INC, 83.73% of mothers had delivered at the healthcare facility, whereas about 16.27% did not receive the delivery at the healthcare facility. In terms of the use of PNC, only 71.64% of mothers had the PNC after delivery.

Factors associated with maternal healthcare services utilization

The multivariate logistic regressions analysis revealed five determinant variables of ANC visits (Table 2). A higher odds of adequate ANC visits was found for mothers aged 35-49 years (AOR = 2.14; 95%CI = 1.55–2.94) and those aged 25-34

Table 2. Factors associated with maternal healthcare services utilization.

Variables	Antenatal care			Intranatal care			Postnatal care		
	AOR	95% CI		AOR	95% CI		AOR	95% CI	
		Lower	Upper		Lower	Upper		Lower	Upper
Mother's socio-demographic factors									
Mother's age (Years)									
15-24	*Ref*			*Ref*			*Ref*		
25-34	1.48*	1.19	1.84	1.19*	1.01	1.41	1.23**	1.06	1.43
35-49	2.14***	1.55	2.94	1.92***	1.52	2.43	1.31***	1.09	1.58
Mother's occupational status									
Not employed							*Ref*		
Employed							1.15**	1.03	1.27
Mother's educational level									
Primary				*Ref*					
Secondary				1.57***	1.33	1.85			
Higher									
Husband's socio-demographic factors									
Age gap between mother and husband									
Older than husband									
Younger than husband									

Table 2. *Continued*

Variables	Antenatal care			Intranatal care			Postnatal care		
	AOR	95% CI		AOR	95% CI		AOR	95% CI	
		Lower	Upper		Lower	Upper		Lower	Upper
Husband's occupational status									
Not employed	*Ref*								
Employed	2.91**	1.39	6.09						
Husband's educational level									
Primary				*Ref*			*Ref*		
Secondary				1.20**	1.02	1.40	1.20**	1.05	1.37
Higher									
Household-related factors									
Number of children									
0	*Ref*						*Ref*		
1-3	1.66*	1.12	2.40				1.64***	1.31	2.05
> 3									
Household wealth index									
Poorest	*Ref*			*Ref*			*Ref*		
Poor	1.87***	1.44	2.42	2.14***	1.79	2.56			
Middle	2.07***	1.56	2.75	2.57***	2.07	3.20	1.30**	1.08	1.55
Rich	3.04***	2.18	4.25	3.44***	2.71	4.37	1.29*	1.07	1.56
Richest	5.93***	3.81	9.20	9.22***	6.54	13.00			
Access to a healthcare facility									
Problem	*Ref*						*Ref*		
No problem	1.55**	1.20	2.02				1.23*	1.03	1.46
Residential area									
Rural				*Ref*			*Ref*		
Urban				2.44***	1.96	3.03	0.81**	0.70	0.90

Note: AOR: Adjusted odds ratio; CI: Confidence interval.
*: p < 0.05.
**: p < 0.01.
***: p < 0.001.

years (AOR = 1.48; 95%CI = 1.19–1.84) compared to mothers aged 15-24 years. Mothers who had employed husbands had a 2.91 (95%CI = 1.39–6.09) increased likelihood of having adequate ANC visits than those who were not working. Mothers with 1 to 3 children had 1.66 times (95%CI = 1.12–2.4) greater in having adequate ANC visits than mothers who do not have children. Compared to mothers who were in the poorest category, those who were in richest, rich, middle, and poor had 5.93 (95%CI= 3.81–9.20), 3.04 (95%CI= 2.18–4.25), 2.07 (95%CI = 1.56–2.75), and 1.87 (95%CI = 1.44–2.42) times likely to have adequate ANC visits respectively. Mothers who considered that access to the healthcare facility was not a problem had a 1.55 greater odds (95%CI = 1.20–2.02) of having adequate ANC visits than those who had problem accessing the healthcare facility.

Regarding institutionalised INC, five determinant variables were identified as statistically significant (Table 2). A higher odds of delivering at a healthcare facility was found for mothers who aged 35-49 years (AOR = 1.92; 95%CI = 1.52–2.43) and aged 25-34 years (AOR = 1.19; 95%CI = 1.01–1.41) compared to mothers aged 15-24 years. Mothers who had secondary education had 1.57 times higher chances of delivering at healthcare facilities (95%CI = 1.33–1.85) than those with primary education. Also, mothers who had husbands with secondary education had 1.20 times more chances to deliver at healthcare facilities (95%CI= 1.02–1.40) than those with primary education. Compared to mothers who were in the poorest category, those who were in richest, rich, middle, and poor were 9.22 (95%CI = 6.54–13.00), 3.44 (95%CI = 2.71 4.37), 2.57 (95%CI = 2.07–3.20), and 2.14 (95%CI = 1.79–2.56) times likely to deliver at a healthcare facility

respectively. Moreover, mothers who resided in urban areas had a 2.44 greater odds (95%CI = 1.96–3.03) of delivering at a healthcare facility than those living in the rural area.

With regard to the use of PNC, seven determinant variables were identified as statistically significant (Table 2). A higher odds of PNC utilisation was found for mothers aged 35-49 years (AOR = 1.31; 95%CI = 1.09–1.58) and aged 25-34 years (AOR = 1.23; 95%CI = 1.06–1.43) compared to mothers aged 15-24 years. Mothers who were employed had 1.15 (95%CI = 1.03–1.27) times increased likelihood of utilising PNC after delivery than those who were not employed. Mothers who had husbands with secondary education had 1.20 times more chances to utilise PNC (95%CI = 1.05–1.37) than those with primary education. For mothers who had 1 to 3 children had 1.64 times (95%CI = 1.31–2.05) to use PNC than mothers who do not have children. Compared to mothers in the poorest category, those in the middle and rich categories were 1.30 (95%CI = 1.08–1.55) and 1.29 (95%CI = 1.07–1.56) times likely to use PNC. Also, mothers who considered that access to the healthcare facility was not a problem had a 1.23 greater odds (95%CI = 1.03–1.46) utilise PNC than those who thought that access to the healthcare facility had a problem. Moreover, mothers who resided in urban areas had 0.81 times (95%CI = 0.70–0.90) less chances of having PNC after delivery than those in rural areas.

Discussion

The present study sought to identify determinant factors of MHC utilisation (ANC visit, institutionalised delivery, and PNC use) among Indonesian mothers population using the 2017 IDHS data sets. The results demonstrated that MHC utilisation among Indonesian mothers were relatively high. The main findings from the present study indicated that there were commonalities and differences in the determinant factors of three key MHC, which echoes findings from other studies in the lower and middle-income countries.[15,17,18] Among Indonesian mothers, age and household wealth index were the typical determinants of MHC utilisation. Concerning the ANC visits, husband's occupational status, the number of children, and access to the healthcare facility were identified as its specific determinants. Next, factors that drove mother's delivery at the healthcare facility (INC) were the mother's education level, husband's educational level, and residential area. In addition, the use of PNC determined by several factors includes the mother's occupational status, husband's educational level, access to the healthcare facility, number of children, and residential area. Based on this finding, healthcare professionals should be considering these determinants in providing MHC to Indonesian mothers. A wide-system effort is required from the government sector to develop a programme tailored with these determinant factors that can ensure MHC can be accessed and adequately utilised by mothers. Furthermore, the present study may bring additional evidence for global maternal health research that contributes to establishing global maternal health determinants.

Socio-structural determinant

The present study observed that numerous socio-structural factors were identified as determinants of MHC use. Socio-structural factors are those that generate or reinforce social stratification in the society and that define the individual socio-economic position.[16] First, the household wealth index was identified to play a crucial role in determining utilisation of ANC visits, institutionalised delivery, and the use of PNC, which corresponded to other studies.[14,17] Well known as a structural factor, the wealth index influences mothers' ability to seek healthcare services through multiple mechanisms, including commute, financial capacity, geographic accessibility, and ability to comprehend the context of such services.[19] In doing so, those who are living in poverty condition are at risk for underutilised maternal health services. This finding warrants attention because 16.88% of mothers are in the poorest category, and 20.15% are in the poor at the present study. In order to improve the utilisation of MHC, health professionals need to reach and facilitate mothers who live in poverty.

Next, husband's educational level emerged as the determinant factor for institutionalised delivery and the use of PNC after delivery. Husband's education level may linked with better health awareness that may make the family aware and utilise healthcare services better.[20] Also, since the Indonesian culture adopted the patriarchy concept, the husband plays a major role in family decision-making. Subsequently, a husband with better education may lead the family to utilise MHC properly. Besides, husbands' occupational status also determine the utilisation of ANC service. Husbands' occupational status is thought to be linked with family income, which may later influence mothers' ability to access ANC service.[21,22] The husbands who are working are probably relatively more economically prepared to face the mother's needs during the pregnancy period.

This study identified the mother's educational level associated with institutionalised delivery that was also supported by other studies.[17,23] Mothers who hold secondary education are prone to having delivery at the healthcare facility. This result is plausible since education is a marker for various factors that affect health-seeking behaviours. Compared to those with lower education levels, women with higher levels of education possess the level of health literacy required to make the right choices about their health and are better placed to overcome the cultural barriers to maternal health care use.[24,25] Moreover, low education can create a social distance between pregnant women and service providers, leading to

poor quality client-provider interactions and discouraging services among women with low education.[26] Last, mother's occupational status also has a role in determining PNC utilisation. This result aligns with previous studies, where the risk for underutilised PNC among working mothers was lower than mothers who were not employed.[14,17] The possible explanation is that working mothers can control their earnings, preventing them from suffering from financial hardship and increasing their independence to seek healthcare services.[27] However, it should be noted that attending PNC requires mothers to spare their time from work which could cost working mothers loss of their incomes. Thus, providing flexible service hours and the availability of maternity leave would help working mothers remove their barriers to accessing health services.

Intermediary determinant

The current study demonstrates that several intermediary factors determined the MHC utilisation among mothers. These factors directly shape individual health choices and outcomes through which the structural determinants operate. They span material circumstances, psychosocial circumstances, behavioral factors, and the health system.[16] Age was an essential determinant factor for utilising ANC, institutional delivery, and PNC use among Indonesian mothers. Older mothers tend to utilised MHC correctly than younger mothers. This was thought because older mothers are more mature in appraising the benefit of using MHC. They know that ANC visit was necessary during pregnancy, delivery at a healthcare facility relative safe, and receiving PNC will be essential for mothers and babies.[28,29] This finding is important because Kurniati et al. found that about 32% of mothers give birth for the first time when they are younger than 19 years old.[14] Therefore, developing effective policies for improving MHC among younger mothers is necessary.

The residential area was found as the determinant of institutionalised delivery and the use of PNC services. Mothers who settled in the urban area were more likely to give birth at healthcare facilities and unlikely to utilised PNC services. Regarding institutionalised delivery, those who resided in urban areas had the privilege of a broad range of choices and had better access to the facility that provides delivery care. Unlike the urban area, mothers who settled in the rural or countryside often face difficulties finding and reaching healthcare facilities because their residence area was relatively least developed.[23,30] Apart from that, we discovered that mothers who settled in urban areas were unlikely to utilise PNC services. This might be attributed to mothers' misconceptions about insurance coverage. For instance, a previous qualitative study in Indonesia reported that some mothers thought national insurance could be used only for particular health care providers, such as the village midwife, and insurance cannot be used for PNC.[31] This finding is not exclusive to Indonesia, as studies from other countries also demonstrated similar findings.[17,18,32] Thus, providing equal services for mothers who settle in urban and rural areas is warranted. In favour of access to the healthcare facility, mothers who thought there was no problem tend to have adequate ANC visits and used the PNC service. Mothers may perceive numerous aspects could be causes of accessibility problems to a healthcare facility. However, a few elements that often become problems are transportation, distance, medication, and treatment. More importantly, transportation and distance are classical problems in Indonesia, where infrastructures developed disproportionately across the country.[33] Such issues significantly hinder mothers from initiating ANC and receiving PNC.[34,35] Although approximately 89% of mothers thought there was no problem accessing healthcare facilities in the present study, we thought this remains important because mothers do not often speak up about this matter to the local health authority. Another possibility is related to the lack of awareness on the important of PNC services for the mother and baby. However, further scrutiny need to be done as low PNC services in urban area may be related to many barriers. Thus, more effort from the health professional to explore the unseen problem in utilizing healthcare facilities among mothers is necessary.

With regard to the number of children, we found it was a determinant of ANC and PNC among Indonesian mothers. Compared to mothers who do not have children, those who had 1 to 3 children were more likely to have adequate ANC visits and PNC use, which was aligned with past works.[15,17] This was thought that as mothers became more experienced in motherhood and had appropriate knowledge from previous maternal experiences, they were encouraged to use those services.[36,37] In other words, those who were in their first-time pregnancy or delivery were at risk for underutilised ANC and PNC. We recognised that this finding might become an opportunity for health professionals to empower experienced mothers to encourage first-time mothers to use MHC correctly. However, experimental studies are required to prove this idea.

The data of this population-based study were collected by government bodies that have authority in maternal health surveys, namely the Central of Statistics Agency and the National Population and Family Planning Board, Indonesia. Also, study's findings are generated from a large sample size that tends to provide high statistical power. However, despite the strength of this study, the present study also has some limitations that should be considered. To begin with, the cross-sectional nature adopted in this study cannot be over-interpreted for implying causality. In addition, the answer given by mothers were self-reported and based on their recall preceding survey that has the potential to result in bias. Furthermore, this study used data from a nationally representative sample; hence, this finding may be generalised to Indonesian mothers only.

Conclusion

Amongst socio-structural and intermediary determinants, mother's age and household wealth index were typical determinant factors that may drive the use of ANC, INC, and PNC. Concerning the ANC visits, husband's occupational status, the number of children, and access to the healthcare facility were identified as its specific determinants. Following that, the mother's educational level, residence location, and the husband's educational level all played a role in utilizing a healthcare facility for delivery (INC). Additionally, the use of PNC is influenced by a variety of factors, including the mother's career, the husband's educational level, access to a healthcare facility, the number of children, and the residential neighborhood. These findings imply that each MHC service needs to be adjusted and tuned with these determinant factors to improve its utilisation and meet maternal health's target within the Sustainable Development Goals.

Data availability

Data used in this study are from the standard DHS VII recode dataset of the Indonesian 2017 Demographic and Health Survey (DHS) available from the Demographic and Health Survey (DHS) website. Access to the dataset requires registration and is granted only for legitimate research purposes. A guide for how to apply for dataset access is available at: https://dhsprogram.com/data/Access-Instructions.cfm. Other researchers will be able to access the data set in the same way as the authors and the authors do not have special access rights that others do not have.

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Open Peer Review

Current Peer Review Status: ✓ ✓

Version 2

Reviewer Report 09 May 2022

https://doi.org/10.5256/f1000research.132419.r135414

✓ **Danish Ahmad** (iD)

[1] Health Research Institute, Faculty of Health, University of Canberra, Canberra, ACT, Australia
[2] Public Health Foundation of India, Gurugram, India
[3] Australian National University, Canberra, ACT, Australia

The revised paper addresses my comments. While further improvements in the presentation of results and language can be made, these are mostly non-essential. I recommend the indexing of the revised version.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Global health, maternal health, health system strengthening.

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 28 February 2022

https://doi.org/10.5256/f1000research.77532.r121898

? **Danish Ahmad** (iD)

[1] Health Research Institute, Faculty of Health, University of Canberra, Canberra, ACT, Australia

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3 Australian National University, Canberra, ACT, Australia

The research findings provide guidance to improve maternal health care seeking in Indonesia. The use of a nationally validated dataset allows findings to be generalisable for the country. The paper's contribution needs to be set against global maternal health research which has conclusively established the determinants of maternal health.

In the current format, the paper's readability is affected by inconsistencies in language - this can however be remedied.

Indonesia as an archipelago provides an opportunity to review maternal health determinants across different provinces and regions in Indonesia. The paper's focus on maternal health determinants needs further clarity in places.

In table 2, the access to health services as being categorised as 'no problem' wasn't immediately clear. Please consider explaining how the variable was used.

The discussion section is rather wordy and repetitive. The authors may like to use a framework such as the social determinants of health or Andersons health care seeking model to present findings. Another option is to present across individual, household and community/health system headings. The authors may also like to consider the program implications arising from this research.

Is the work clearly and accurately presented and does it cite the current literature?
No

Is the study design appropriate and is the work technically sound?
No

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?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Global health, maternal health, health system strengthening.

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 16 Apr 2022

Ferry Efendi, Universitas Airlangga, Surabaya, Indonesia

1. Many thanks for the reviewer's suggestion about "The paper's contribution needs to be set against global maternal health research". We have added this information. Please see at the end of the first paragraph in the discussion section.
2. Many thanks for your on-point comment regarding the readability. The manuscript has been proofed by an English editor in the current version.
3. Thanks a lot for this query, in this study, we focused on rural and urban areas which comprised of 12033 residential areas in Indonesia.
4. We have added the concept definition of access to healthcare facilities.
5. Thank you very much for bringing this constructive feedback to our study. We have revised the discussion section and organized it based on the social determinant framework. Please see the discussion section.
6. We have revised the conclusion section.

Competing Interests: No competing interests were disclosed.

Reviewer Report 23 February 2022

https://doi.org/10.5256/f1000research.77532.r120405

✔️ **Kusrini S. Kadar** 🆔

Faculty of Nursing, Hasanuddin University, Makassar, Indonesia

Overall this is an interesting study and it provides new insight to improve the healthcare facilities and services for pregnant mothers.
However, the authors need to explain more about what kind of services that the mothers received in the ANC, INC and PNC, especially at the PNC as it is interesting why mothers who live in urban area use the PNC services less. There is no clear explanation as the authors only compare this situation with other countries and due to insurance issues. In the conclusion, it seems that the authors give new ideas but not conclusions from the results; for example using mobile health services and peer influence are not the conclusions of the results. Perhaps this is more a recommendation than conclusion.

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

Yes

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?
I cannot comment. A qualified statistician is required.

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: community health, family health, health education, health promotion

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.

Author Response 16 Apr 2022

Ferry Efendi, Universitas Airlangga, Surabaya, Indonesia

1. We appreciate the reviewer's positive feedback and recommendations. We added the explanations about ANC, INC, and PNC in the introduction to make sure the reader can understand these concepts earlier. Please see the second paragraph.
2. Thank you for your feedback. Regarding "there is no clear explanation as to the authors only comparing this situation with other countries and due to insurance issues", we have revised and added more explanation in the discussion section. Please see the second paragraph in the sub-section of intermediary determinants.
3. Thank you for your constructive feedback. We have revised our conclusion and made it more coherent with our findings.

Competing Interests: No competing interests were disclosed.

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