Determinants of safe delivery utilization among Indonesian women in eastern part of Indonesia [version 2; peer review: 2 approved]

Ferry Efendi1,2, Susy Katikana Sebayang3,4, Erni Astutik4,5, Setho Hadisuyatmana1,2, Eka Mishbahatul Mar’ah Has1, Heri Kuswanto6

1Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia
2School of Nursing & Midwifery, La Trobe University, Melbourne, Australia
3Department of Biostatistics and Population Studies, Faculty of Public Health, Universitas Airlangga, Banyuwangi Campus, Banyuwangi, Indonesia
4Research Group for Health and Wellbeing of Women and Children, Faculty of Public Health, Universitas Airlangga, Banyuwangi, Indonesia
5Department of Epidemiology, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia
6Department of Statistics, Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia

Abstract
Background: Improving maternal health and reducing maternal mortality are part of the United Nations global Sustainable Development Goals for 2030. Ensuring every woman’s right to safe delivery is critical for reducing the maternal mortality rate. Our study aimed to identify determinants of safe delivery utilization among women in the eastern Indonesia.
Methods: This study was cross-sectional and used a secondary data from the 2017 Indonesian Demographic and Health Survey (IDHS). A total of 2,162 women who had their last child in the five years preceding the survey and lived in the eastern part of Indonesia were selected as the respondents. Chi-squared test and binary logistic regression were used to understand the determinants of safe delivery.
Results: Higher child rank and interval ≤2 years (OR: 0.30, 95% CI: 0.19-0.47), unwanted pregnancy at time of becoming pregnant (OR: 1.48, 95% CI: 1.05-2.08), richest wealth quintile (OR: 5.59, 95% CI: 3.37-9.30), more than four antenatal care visits (OR: 3.62, 95% CI: 2.73-4.79), rural residence, good composite labor force participation, and a good attitude towards domestic violence were found to be significantly associated with delivery at health facility. Higher child rank and interval ≤2 years (OR: 0.49, 95% CI: 0.29-0.83), husband/partner having completed secondary or higher education (OR: 2.18, 95% CI: 1.48-3.22), being in the richest wealth quintile, and four other factors were found to be significantly associated with the assistance of skilled birth attendants.
Conclusions: This research extends our knowledge on the determinants of safe delivery among women in the eastern part of Indonesia. This study revealed that the economic status of household remains an important issue in improving safe delivery among women in eastern part of Indonesia. An open innovation and partnership process to improve safe delivery program that engages the full range of stakeholders should be developed based on economic situation.

Keywords
facility-based delivery, safe delivery, skilled birth delivery.
Introduction

Maternal morbidity and mortality is a global health concern (World Health Organization, 2017). Every day in 2017, around 830 mothers died due to pregnancy and childbirth (World Health Organization, 2018). The United Nations Sustainable Development Goals set a target to reduce maternal deaths to 70 per 100,000 live births by 2030 (United Nations, 2015). In Indonesia, the maternal mortality rate is still high, at 305 per 100,000 live births (BPS, 2015b). A higher rate was found in the eastern part of Indonesia, namely Nusa Tenggara, Maluku, and Papua Island, than in the other islands (BPS, 2015a). One of the major causes of maternal mortality is haemorrhage, which is followed by eclampsia (Tejayanti et al., 2012). Safe delivery as the critical policy of making motherhood safer requires skilled birth attendants and delivery at health facilities across the provinces of Indonesia (Efendi et al., 2019; Kementerian Kesehatan RI, 2014). As an archipelago country, institutional delivery and skilled assistant delivery are still a challenge because of the geographical situation (Belton et al., 2014; Ministry of Health [MoH], 2012). To increase safe delivery for Indonesian mothers, the government has set a goal to reach 85% of institutional deliveries in 2019 (Kementerian Kesehatan RI, 2017). Even though the government has not yet set a goal for skilled attendant delivery specifically in this document, it should be assumed that the government demands the highest standard of health attainment.

Studies that examine safe delivery have been conducted in some countries. A study conducted in Ethiopia found that residence, religion, educational level, age at first pregnancy, parity, and antenatal care (ANC) attendance have a significant association with safe delivery service utilization (Abera et al., 2011). Another study conducted in Tanzania reported that in addition to socio-demographic factors, women’s empowerment status contributed to the decision to give birth with a health professional (Shimamoto & Gipson, 2015). In a similar vein, studies in 13 sub-Saharan African countries found that living conditions and women’s autonomy are key factors of maternal healthcare utilization (Iacoella & Tirivayi, 2019). In Indonesia, a study about facility-based childbirth found that educational level, place of residence, working status, involvement in decision-making, economic status, and ANC visits are significantly associated with health facility delivery among women (Kurniati et al., 2018). Furthermore, the gap in age and education between a woman and her husband/partner, women’s self-esteem, age at first marriage, and age at pregnancy were found have a high association with institutional delivery among Indonesian women (Kurniati et al., 2018).

The 2017 IDHS found that there is a gap in coverage of institutional delivery and skilled birth attendants between western provinces and eastern provinces of Indonesia. Eastern provinces of Indonesia, including Bali, Nusa Tenggara Island, Sulawesi Island, Maluku, and Papua Island, have not reached 70% coverage of safe delivery in either institutional delivery or skilled assistant delivery, as depicted in Figure 1 (BPS et al., 2018).
provinces of Indonesia should be resolved to attain the Sustainable Development Goals by 2030. Particularly in eastern part of Indonesia, safe delivery, both delivery at health facilities and delivery assistance by skilled birth attendants remain a critical issue, we hypothesize that determinants associated with safe delivery utilization operate in a fundamentally different way among Indonesian women in this region. We tested this hypothesis using data from the Indonesia Demographic and Health Survey (IDHS) in 2017. Understanding the key factors related to safe delivery is key to prevent maternal morbidity and mortality in Indonesia. Therefore, this study aimed to determine safe delivery utilization among Indonesian women in the eastern part of Indonesia.

Methods
Ethical statement
IDHS ethical clearance was obtained from the Inner City Fund (ICF) International. For this study, permission to use the data was obtained from ICF International. This study used existing IDHS data and re-analysis was done under the original consent provided by the participants. Thus, no further consent was obtained from the participants.

Data source
This was an analytical cross-sectional study that used data from the 2017 IDHS. The 2017 IDHS was conducted in 34 provinces in Indonesia from July to December 2017 by the Central Statistics Agency (BPS), National Population and Family Planning Board (BKKB), and the Ministry of Health with technical help from ICF. The Individual Recode (IR) dataset was downloaded from www.dhsprogram.com after completing registration.

Sample size and sampling
This survey covered 1,970 census blocks in urban and rural areas. In the 2017 IDHS, a total of 49,627 women finished the survey from all 34 provinces in Indonesia. DHS sample designs were two-stage probability samples drawn from an existing sample frame. The sampling frame of the 2017 IDHS was the master sample of Census Blocks from the latest population census. The two-stage cluster sampling was used to select the respondents. The first stage was the selection of number of census blocks by systematic sampling proportional to size. In the second stage, 25 ordinary households were taken from the listing. All women aged 15–49 years in the households were eligible for interview. Interviews were performed as privately as possible with a detailed manual as reported by ICF (ICF Macro, 2020).

The inclusion criteria for this study were women aged 15–49 years who had their last child in the five years preceding the survey and lived in the eastern provinces of Indonesia. For the purpose of analysis, we divided Indonesia into two greater parts, western and eastern, based on the geographical location. The eastern provinces included Bali, West Nusa Tenggara, East Nusa Tenggara, North Sulawesi, Central Sulawesi, South Sulawesi, Southeast Sulawesi, Gorontalo, West Sulawesi, Maluku, North Maluku, West Papua and Papua. In total, survey data from 2,162 women meeting the criteria were accessed for this study’s analysis.

Variables
The dependent variables in this study were place of delivery and type of assistance at delivery. Place of delivery was divided into two categories: health facility and non-health facility. Health facility delivery or institutional delivery is delivery that is carried out at a health facility, including public health centers, clinics or maternity homes, and hospitals. The type of assistance at delivery variable was also divided into two categories: skilled birth attendants and unskilled birth attendants. Skilled birth attendants is defined as birth delivered with the assistance of skilled providers such as general practitioners, obstetricians, midwives, and skilled nurses (Croft et al., 2018).

There were several independent variables in this study. Age difference between man and woman was divided into four categories: woman older than man, 0–4 years younger, 5–7 years younger, and >7 years younger. Birth rank and interval was divided into five categories: second or third child with interval ≥2 years; first birth, second or third child with interval ≤2 years; fourth or higher child with interval ≥2 years; and fourth or higher child with interval ≤2 years. Planning status of births, women who had a birth or several births in the five years prior to their interview were asked whether the pregnancy had been wanted at the time it occurred (wanted then) or whether it had been wanted but had occurred sooner than wanted (wanted later), or whether the woman had wanted no further children at the time ( unwanted/no more). Husband/partner’s educational attainment was divided into three categories: incomplete primary education/none, complete primary or some secondary, and completed secondary or higher. Husband/partner’s occupation was divided into two categories: agricultural and non-agricultural. Wealth quintile was categorized as poorest, poorer, middle, richer, and richest (Rutstein & Johnson, 2004). Number of household members was divided into two categories: households that have less than four members and households with four or more members. Number of ANC visits was categorized as less than four times and four times or more. Covered by health insurance was divided into two categories: yes and no. Residence was categorized as urban and rural. Women’s empowerment variables, including composite labor force participation, attitude towards domestic violence (wife-beating), decision-making power, and women’s knowledge level, were divided into three categories: poor, moderate, and good. The women’s knowledge level variable was a composite of educational level and access to media. Further details on how these variables were assessed can be found in study as conducted by Sebayang et al. (2019).

Data analysis
The determinants of safe delivery were analyzed using a Chi-square test and binary logistic regression. Both analyses were performed in Stata version 16. The variables were significant at a p-value of 0.05, and the strength of the association was assessed using odds ratio (OR) with a 95% confidence interval (CI).

Results
Among the women who were included in this study, 71.6% used a health facility and 86.2% were assisted by a skilled birth attendants at their last birth. The majority of the respondents are 0–4 years younger than their husband (41.2%), from the poorest
wealth quintile (41.8%), have four or more members in the household (87.6%), are covered by health insurance (64.3%), and live in a rural residence (66.7%). Concerning the husband/partner’s education and occupation, 47.3% have completed secondary or higher education and more than half work in an agricultural occupation (54.1%). For almost half the respondents, their last child was a second or third child with an interval more than two years (44.9%). The majority of respondents had more than four ANC visits (88.4) and their pregnancy was wanted when they became pregnant (82.1%). In terms of women’s empowerment, most respondents have good composite labor force participation (35.7%), a moderate attitude towards domestic violence (34.8%), poor decision-making power (35.3%), and a poor level of knowledge (34.6%). Details about the descriptive characteristics of the respondents are shown in Table 1.

Table 1. Characteristics of the respondents regarding determinants of safe delivery utilization among Indonesian women in eastern part of Indonesia (n=2,162).

| Variable                                      | n    | %   |
|-----------------------------------------------|------|-----|
| Place of delivery                             |      |     |
| Non-health facility                           | 615  | 28.4|
| Health facility                               | 1,547| 71.6|
| Type of assistance at delivery                |      |     |
| Unskilled birth attendants                    | 298  | 13.8|
| Skilled birth attendants                      | 1,864| 86.2|
| Age difference between man and woman          |      |     |
| Woman older than man                          | 450  | 20.8|
| 0–4 years                                     | 890  | 41.2|
| 5–7 years                                     | 434  | 20.1|
| >7 years                                      | 388  | 17.9|
| Birth rank and interval                       |      |     |
| Second or third child, interval >2 years      | 970  | 44.9|
| First birth                                   | 603  | 27.9|
| Second or third child, interval ≤2 years      | 131  | 6.0 |
| Fourth or higher child, interval >2 years     | 384  | 17.8|
| Fourth or higher child, interval ≤2 years     | 74   | 3.4 |
| Planning status of births                     |      |     |
| Then                                          | 1,774| 82.1|
| Later                                         | 246  | 11.4|
| No more                                       | 142  | 6.5 |
| Husband/partner’s education attainment        |      |     |
| Incomplete primary education/none             | 299  | 13.8|

F1000Research 2020, 9:332 Last updated: 24 SEP 2020
In the bivariate analysis, most of the variables showed a significant association with a p-value of 0.05 with both outcomes: place of delivery and type of assistance at delivery. For the place of delivery outcome, three variables have a p-value of more than 0.05 (planning status of births, number of household members, decision-making power), while for the type of assistance at delivery outcome, four variables were not significant (age difference between man and woman, planning status of births, number of household members, decision-making power). Details about the bivariate analysis are shown in Table 2 and Table 3.

In the binary logistic regression analysis, delivery at a health facility was associated with several variables. Women who lived

### Table 2. Bivariate analysis of women’s characteristics and place of delivery outcome.

| Variable                                           | Non-health facility | Health facility | X²     |
|----------------------------------------------------|---------------------|-----------------|--------|
|                                                    | N    | %   | N    | %    |        |
| Age difference between man and woman               |       |     |       |      |        |
| Woman older than man                               | 117  | 26.1| 333  | 73.9 | 17.23**|
| 0–4 years                                          | 262  | 29.4| 628  | 70.6 |        |
| 5–7 years                                          | 108  | 24.8| 326  | 75.2 |        |
| >7 years                                           | 127  | 32.8| 261  | 67.2 |        |
| Birth rank and interval                            |       |     |       |      |        |
| Second or third child, interval >2 years           | 241  | 24.9| 729  | 75.1 | 200.57***|
| First birth                                        | 124  | 20.6| 479  | 79.4 |        |
| Second or third child, interval ≤2 years           | 48   | 36.8| 83   | 63.2 |        |
| Fourth or higher child, interval >2 years          | 156  | 40.6| 228  | 59.4 |        |
| Fourth or higher child, interval ≤2 years          | 45   | 60.2| 29   | 39.8 |        |
| Planning status of births                          |       |     |       |      |        |
| Then                                               | 513  | 28.9| 1261 | 71.1 | 3.51 |
| Later                                              | 68   | 27.8| 178  | 72.2 |        |
| No more                                            | 34   | 23.9| 108  | 76.1 |        |
| Husband/partner’s education attainment             |       |     |       |      |        |
| Incomplete primary education/none                  | 143  | 47.9| 156  | 52.1 | 233.59***|
| Completed primary or some secondary                | 277  | 32.9| 564  | 67.1 |        |
| Completed secondary or higher                      | 194  | 19.0| 828  | 81.0 |        |
| Husband/partner’s occupation                       |       |     |       |      |        |
| Agricultural                                       | 423  | 36.2| 746  | 63.8 | 162.94***|
| Non-agricultural                                   | 191  | 19.2| 802  | 80.8 |        |
| Wealth quintile                                    |       |     |       |      |        |
| Poorest                                            | 423  | 46.8| 480  | 53.2 | 607.20***|
| Poorer                                             | 105  | 23.2| 349  | 76.8 |        |
| Middle                                             | 45   | 14.3| 270  | 85.7 |        |
| Richer                                             | 29   | 11.3| 224  | 88.7 |        |
| Richest                                            | 13   | 5.6 | 224  | 94.4 |        |
| Variable                              | Non-health facility | Health facility | X²  |
|--------------------------------------|---------------------|-----------------|-----|
|                                      | N   | %  | N   | %  |     |
| Number of household members          |      |    |      |    |     |
| <4                                   | 67  | 25.2 | 201  | 74.8 | 3.40 |
| ≥4                                   | 547 | 28.9 | 1,347 | 71.1 |     |
| Number of antenatal care visits      |      |    |      |    |     |
| <4                                   | 153 | 61.6 | 98   | 38.4 | 328.54*** |
| ≥4                                   | 461 | 24.1 | 1,450 | 75.9 |     |
| Covered by health insurance          |      |    |      |    |     |
| No                                   | 242 | 31.3 | 530  | 68.7 | 10.16*  |
| Yes                                  | 373 | 26.8 | 1,017 | 73.2 |     |
| Residence                            |      |    |      |    |     |
| Urban                                | 88  | 12.2 | 631  | 87.8 | 296.56*** |
| Rural                                | 527 | 36.5 | 916  | 63.5 |     |
| Labor force participation            |      |    |      |    |     |
| Poor                                 | 248 | 35.8 | 444  | 64.2 | 123.78*** |
| Moderate                             | 221 | 31.7 | 477  | 68.3 |     |
| Good                                 | 145 | 18.8 | 627  | 81.2 |     |
| Attitude toward domestic violence    |      |    |      |    |     |
| Poor                                 | 237 | 35.1 | 437  | 64.9 | 46.49*** |
| Moderate                             | 194 | 25.8 | 559  | 74.2 |     |
| Good                                 | 184 | 25.0 | 551  | 75.0 |     |
| Decision making power                |      |    |      |    |     |
| Poor                                 | 218 | 28.5 | 546  | 71.5 | 0.64  |
| Moderate                             | 195 | 27.7 | 508  | 72.3 |     |
| Good                                 | 202 | 29.0 | 493  | 71.0 |     |
| Women’s knowledge level              |      |    |      |    |     |
| Poor                                 | 290 | 38.8 | 458  | 61.2 | 145.48*** |
| Moderate                             | 187 | 26.2 | 527  | 73.8 |     |
| Good                                 | 137 | 19.6 | 563  | 80.4 |     |

*p<0.05; **p<0.01; ***p<0.001

in a rural residence [AOR=0.49; 95% CI=0.36-0.66] were less likely to deliver in a health facility compared to women who lived in urban residence. A similar result was found for women whose last child was a fourth or higher child with an interval of two years or under [AOR=0.30; 95% CI=0.19-0.47]. Women from the richest wealth quintile family and those who had four or more ANC visits were five [AOR=5.59; 95% CI=3.37-9.30] and three times more likely to deliver in a health facility [AOR=3.62; 95% CI=2.73-4.79], respectively, compared to their reference.

Women who have good composite labor force participation [AOR=1.47; 95% CI=1.15-1.89] and a moderate attitude towards domestic violence [AOR=1.38; 95% CI=1.10-1.73] were more likely to deliver in a health facility. Women whose pregnancy was unwanted when they became pregnant [AOR=1.48
Table 3. Bivariate analysis of women’s characteristics and type of assistance at delivery.

| Variable                                      | Unskilled birth attendants | Skilled birth attendants | \( \chi^2 \) |
|------------------------------------------------|-----------------------------|---------------------------|---------------|
| Age difference between man and woman          |                             |                           |               |
| Woman older than man                          | 56  12.4                    | 394  87.6                 |               |
| 0–4 years                                     | 125 14.0                    | 765  86.0                 | 7.55          |
| 5–7 years                                     | 54  12.5                     | 380  87.5                 |               |
| >7 years                                      | 63  16.3                     | 325  83.7                 |               |
| Birth rank and interval                       |                             |                           |               |
| Second or third child, interval >2 years      | 113  11.6                    | 857  88.4                 |               |
| First birth                                   | 53  8.8                      | 550  91.2                 | 136.16***     |
| Second or third child, interval \( \leq \) 2 years | 22  16.6                    | 109  83.4                 |               |
| Fourth or higher child, interval >2 years     | 87  22.7                     | 297  77.3                 |               |
| Fourth or higher child, interval \( \leq \) 2 years | 24  31.9                    | 50  68.1                  |               |
| Planning status of births                     |                             |                           |               |
| Then                                          | 254  14.3                    | 1,520  85.7               | 5.43          |
| Later                                         | 29  11.8                     | 217  88.2                 |               |
| No more                                       | 15  10.5                     | 127  89.5                 |               |
| Husband/partner’s education attainment        |                             |                           |               |
| Incomplete primary education/none             | 106  35.4                    | 193  64.6                 | 367.17***     |
| Completed primary or some secondary           | 130  15.5                    | 711  84.5                 |               |
| Completed secondary or higher                 | 61  6.0                      | 961  94.0                 |               |
| Husband/partner’s occupation                  |                             |                           |               |
| Agricultural                                  | 229  19.6                    | 940  80.4                 | 155.85***     |
| Non-agricultural                              | 69  6.9                      | 924  93.1                 |               |
| Wealth quintile                               |                             |                           |               |
| Poorest                                       | 243  26.9                    | 660  73.1                 |               |
| Poorer                                        | 39  8.6                      | 415  91.4                 | 509.25***     |
| Middle                                        | 11  3.4                      | 304  96.6                 |               |
| Richer                                        | 3  1.3                      | 250  98.7                 |               |
| Richest                                       | 2  0.7                      | 235  99.3                 |               |
| Number of household members                   |                             |                           |               |
| <4                                            | 30  11.3                     | 238  88.7                 | 3.24          |
| \( \geq \) 4                                   | 267  14.1                    | 1,627  85.9               |               |
| Number of antenatal care visits               |                             |                           |               |
| <4                                            | 102  40.5                    | 149  59.5                 | 364.74***     |
| \( \geq \) 4                                   | 197  10.3                    | 1,714  89.7               |               |
According to the type of assistance at delivery outcome, women whose last child was a fourth or higher child with an interval of two years or under [AOR=0.49; 95% CI=0.29-0.83] were less likely to deliver with an assistance of skilled birth attendants. Women whose husband completed secondary or higher education were two times [AOR=2.18; 95% CI=1.48-3.22] more likely to deliver with an assistance of skilled birth attendants. Likewise, women who had four or more ANC visits and were from the richest wealth quintile were three [AOR=3.83; 95% CI=2.77-5.30] and 15 times [AOR=15.69; 95% CI=5.53-44.50] more likely to be helped by a skilled birth attendants, respectively.

Women whose husband worked in a non-agricultural occupation [AOR=1.35; 95% CI=1.00-1.81] were more likely to deliver with a skilled birth attendants. A similar result was found for women with good composite labor force participation [AOR=1.58; 95% CI=1.11-2.26] and a good level of knowledge [AOR=1.76; 95% CI=1.25-2.46] (Table 5).

### Discussion

Delivery was regarded as safe when it was attended by a skilled birth attendant and took place in a health facility. This study found that several variables have a significant association with place of delivery and type of assistance at delivery. Women from the richest wealth quintile were more likely to have a delivery in a health facility than those from the poorest wealth quintile. This finding is consistent with that of a previous study in Indonesia. The wealth index of the household

| Variable                        | Unskilled birth attendants | Skilled birth attendants | X²  |
|---------------------------------|----------------------------|--------------------------|-----|
|                                | N  | %  | N  | %  |           |
| Covered by health insurance    |    |    |    |    |           |
| No                              | 121| 15.7| 651| 84.3| 8.03*     |
| Yes                             | 177| 12.7| 1,213| 87.3|           |
| Residence                       |    |    |    |    |           |
| Urban                           | 38 | 5.3 | 681 | 94.7 | 139.61*** |
| Rural                           | 260| 18.0| 1,183| 82.0|           |
| Labor force participation       |    |    |    |    |           |
| Poor                            | 125| 18.0| 567 | 82.0|           |
| Moderate                        | 119| 17.0| 579 | 83.0| 95.35***  |
| Good                            | 56 | 7.2 | 716 | 92.8|           |
| Attitude toward domestic violence|    |    |    |    |           |
| Poor                            | 111| 16.5| 563 | 83.5| 20.25**   |
| Moderate                        | 106| 14.1| 647 | 85.9|           |
| Good                            | 80 | 10.9| 655 | 89.1|           |
| Decision-making power           |    |    |    |    |           |
| Poor                            | 119| 15.6| 645 | 84.4| 7.34      |
| Moderate                        | 92 | 13.1| 611 | 86.9|           |
| Good                            | 86 | 12.4| 609 | 87.6|           |
| Women's knowledge level         |    |    |    |    |           |
| Poor                            | 180| 24.1| 568 | 75.9| 231.52*** |
| Moderate                        | 74 | 10.4| 640 | 89.6|           |
| Good                            | 43 | 6.1 | 657 | 93.9|           |

*p<0.05; **p<0.01; ***p<0.001

95% CI=1.05-2.08] were also more likely to deliver in a health facility. Details about the binary logistic regression analysis with a place of delivery outcome are shown in Table 4.
Table 4. Binary logistic regression analysis with a place of delivery outcome.

| Variable                                           | AOR   | CI       | Lower | Upper |
|----------------------------------------------------|-------|----------|-------|-------|
| Age difference between man and woman               |       |          |       |       |
| Woman older than man                               |       |          |       |       |
| 0–4 years                                          | 0.88  | 0.69     | 1.11  |       |
| 5–7 years                                          | 1.14  | 0.88     | 1.46  |       |
| >7 years                                           | 0.96  | 0.73     | 1.26  |       |
| Birth rank and interval                            |       |          |       |       |
| Second or third child, interval >2 years           |       |          |       |       |
| First birth                                        | 1.37**| 1.09     | 1.71  |       |
| Second or third child, interval ≤2 years           | 0.60***| 0.43      | 0.84  |       |
| Fourth or higher child, interval >2 years         | 0.66***| 0.52     | 0.82  |       |
| Fourth or higher child, interval ≤2 years         | 0.30***| 0.19     | 0.47  |       |
| Planning status of births                          |       |          |       |       |
| Then                                               |       |          |       |       |
| Later                                              | 1.01  | 0.77     | 1.32  |       |
| Unwanted                                           | 1.48**| 1.05     | 2.08  |       |
| Husband/partner's education attainment             |       |          |       |       |
| Incomplete primary education/none                  |       |          |       |       |
| Completed primary or some secondary                | 1.23  | 0.94     | 1.60  |       |
| Completed secondary or higher                      | 1.26  | 0.94     | 1.69  |       |
| Husband/partner's occupation                      |       |          |       |       |
| Agricultural                                      |       |          |       |       |
| Non-agricultural                                  | 1.17  | 0.93     | 1.47  |       |
| Wealth quintile                                   |       |          |       |       |
| Poorest                                            |       |          |       |       |
| Poorer                                             | 1.94***| 1.53    | 2.47  |       |
| Middle                                             | 2.85***| 2.06    | 3.94  |       |
| Richer                                             | 3.23***| 2.25    | 4.64  |       |
| Richest                                            | 5.59***| 3.37    | 9.30  |       |
| Number of household members                        |       |          |       |       |
| <4                                                 |       |          |       |       |
| ≥4                                                 | 1.02  | 0.75     | 1.39  |       |

AOR, adjusted odds ratio; CI, confidence interval.

Number of antenatal care visits

| Variable                  | AOR   | CI       | Lower | Upper |
|---------------------------|-------|----------|-------|-------|
| <4                        | Ref   |          |       |       |
| ≥4                        | 3.62***| 2.73     | 4.79  |       |

Covered by health insurance

| Variable | AOR   | CI       | Lower | Upper |
|----------|-------|----------|-------|-------|
| No       | Ref   |          |       |       |
| Yes      | 1.15  | 0.95     | 1.38  |       |

Place of residence

| Variable | AOR   | CI       | Lower | Upper |
|----------|-------|----------|-------|-------|
| Urban    | Ref   |          |       |       |
| Rural    | 0.49***| 0.36     | 0.66  |       |

Labor force participation

| Variable | AOR   | CI       | Lower | Upper |
|----------|-------|----------|-------|-------|
| Poor     | Ref   |          |       |       |
| Moderate | 1.14  | 0.93     | 1.40  |       |
| Good     | 1.47**| 1.15     | 1.89  |       |

Attitude toward domestic violence

| Variable | AOR   | CI       | Lower | Upper |
|----------|-------|----------|-------|-------|
| Poor     | Ref   |          |       |       |
| Moderate | 1.38**| 1.10     | 1.73  |       |
| Good     | 1.33* | 1.04     | 1.69  |       |

Decision-making power

| Variable | AOR   | CI       | Lower | Upper |
|----------|-------|----------|-------|-------|
| Poor     | Ref   |          |       |       |
| Moderate | 0.85  | 0.69     | 1.06  |       |
| Good     | 0.84  | 0.66     | 1.06  |       |

Women’s knowledge level

| Variable | AOR   | CI       | Lower | Upper |
|----------|-------|----------|-------|-------|
| Poor     | Ref   |          |       |       |
| Moderate | 1.13  | 0.92     | 1.40  |       |
| Good     | 1.17  | 0.93     | 1.47  |       |

*p<0.05; **p<0.01; ***p<0.001

would contribute to the access to health care services, including institutional delivery (Caulfield et al., 2016; Do et al., 2015; Efendi et al., 2019; Roro et al., 2014). Women from the richest wealth quintile were more likely to have a delivery with a skilled birth attendant than those from the poorest wealth quintile. This finding is consistent with that of a previous study conducted in Bangladesh (Muhammed et al., 2017). Women from low-income families may find it difficult to pay for a skilled birth attendant, so they prefer to give birth without professional assistance (Muhammed et al., 2017). Therefore, the coverage of health insurance must be enhanced so that women...
Table 5. Binary logistic regression analysis with type of assistance at delivery.

| Variable                                      | AOR | CI Lower | CI Upper |
|-----------------------------------------------|-----|---------|---------|
| Age difference between man and woman          |     |         |         |
| Woman older than man                          |     |         |         |
| 0–4 years                                     | 0.89| 0.65    | 1.22    |
| 5–7 years                                     | 0.99| 0.71    | 1.36    |
| >7 years                                      | 1.01| 0.72    | 1.42    |
| Birth rank and interval                       |     |         |         |
| Second or third child, interval >2 years      |     |         |         |
| First birth                                   | 1.28| 0.93    | 1.76    |
| Second or third child, interval ≤2 years      | 0.80| 0.48    | 1.33    |
| Fourth or higher child, interval >2 years     | 0.73| 0.53    | 1.00    |
| Fourth or higher child, interval ≤2 years     | 0.49**| 0.29   | 0.83    |
| Planning status of births                     |     |         |         |
| Then                                          |     |         |         |
| Later                                         | 1.12| 0.74    | 1.68    |
| No more                                       | 1.58| 0.96    | 2.59    |
| Husband/partner’s education attainment        |     |         |         |
| Incomplete primary education/none             |     |         |         |
| Completed primary or some secondary           | 1.90***| 1.42   | 2.55    |
| Completed secondary or higher                 | 2.18***| 1.48   | 3.22    |
| Husband/partner’s occupation                  |     |         |         |
| Agricultural                                  |     |         |         |
| Non-agricultural                              | 1.35*| 1.00   | 1.81    |
| Wealth quintile                               |     |         |         |
| Poorest                                       |     |         |         |
| Poorer                                        | 2.33***| 1.70   | 3.18    |
| Middle                                        | 5.14***| 3.19   | 8.28    |
| Richer                                        | 10.84***| 5.34  | 22.01   |
| Richest                                       | 15.69***| 5.53  | 44.50   |
| Number of household members                   |     |         |         |
| <4                                            |     |         |         |
| ≥4                                            | 0.87| 0.56    | 1.35    |

A higher child rank and interval of ≤2 years was associated with a lower chance of women having a delivery in a health facility and being assisted by a health professional. This result is similar to those of studies conducted in Ethiopia and Nigeria (Abera et al., 2011; Ononokpono & Odimegwu, 2014). Women with a higher child rank will have more experience with pregnancy and delivery, so they feel that they have the confidence to have a delivery outside a health facility (Abera et al., 2011). Another argument is that women have in all the wealth quintiles can have equal access to health care services.
limited access to health services due to the burden of their economic situation (Ononokpon & Odimegwu, 2014). The results for delivery with a skilled birth attendant are similar to those of studies conducted in Sudan and Ethiopia (Mustafa & Mukhtar, 2015; Wilunda et al., 2015). Women with a higher birth rank tend to rely on their experience from previous pregnancies, believing they already know about childbirth. Consequently, they choose to give birth without professional assistance (Mustafa & Mukhtar, 2015). Review studies conducted in African countries also highlighted the link between higher parity and lower likelihood of delivery at health facility (Moyer & Mustafa, 2013). Therefore, health education about safe delivery should prioritize mothers with a high child rank by giving them greater access to free health care services.

Women who had more than four ANC visits during their pregnancy were found to be three times more likely to have a safe delivery. This is consistent with the results of studies conducted in Uganda and Ethiopia (Abera et al., 2011; Atusimire et al., 2019). Furthermore, a population-based study conducted in Bangladesh had a similar result, which emphasized the positive effect of the ANC on utilization of delivery at health facility (Pervin et al., 2012). The ANC can prevent unsafe delivery because it will provide health education for the mother, giving information and recommending the place of delivery according to the mother’s and fetus’s condition (Atusimire et al., 2019). Women who had more than four ANC visits during their pregnancy were found to be more likely to have a skilled birth attendant. This is consistent with the result of a study that was conducted in Kenya (Gitimu et al., 2015). ANC attendance will influence the decision of the mother to have an assisted delivery because the ANC emphasizes the importance of safe delivery (Gitimu et al., 2015). ANC visits must be optimized for pregnant women so that mothers are more exposed to information about safe delivery. The information that the mother receives will influence the decision on where to deliver the baby. Therefore, a minimum number of ANC visits should be given to all pregnant women so they can monitor the condition of the baby and have more knowledge about safe pregnancy and delivery.

Another finding was that women who wanted no more pregnancies when they became pregnant were more likely to give birth in a health facility. This finding is consistent with that of a study conducted in Egypt (Marston & Cleland, 2003). However, it is inconsistent with the results of a study conducted in Bangladesh, which showed that women who have an unintended pregnancy were less likely to visit an ANC service and more likely to have a home delivery (Kamal, 2013). There was no study that explained this issue, as it may be related to the social norms and health system of the country itself. We assume that the desire to limit childbearing may give sufficient time for women to plan ahead some alternatives including the place of delivery. Therefore, this topic should be analyzed further by considering other variables.

Women from a rural residence were found to be less likely to have a delivery in a health facility. This finding is similar to those of previous studies conducted in Bangladesh and Indonesia (Efendi et al., 2019; Kamal, 2013; Kenea & Jisha, 2017). Living in an urban residence allows easier access to health facilities than living in rural areas. In addition, access to information is easier in urban areas so information about safe delivery can be spread more easily (Kamal, 2013). Therefore, the gap between rural and urban areas should be taken into consideration by the government regarding the issue of maternal and child health.

Women who had good composite labor force participation and a good attitude towards domestic violence were more likely to have a delivery in a health facility and be assisted by a health professional. This is consistent with the result of studies conducted in Ethiopia and Bangladesh (Kamal, 2013; Tiruneh et al., 2017). In Bangladesh, women who were against domestic violence and more independent economically were more likely to have four or more ANC service visits, which may lead the women to have a delivery in a health facility (Kamal, 2013). Women who had good composite labor force participation and a good knowledge level were more likely to have a delivery with an assistance of skilled birth attendants. This is consistent with the result of studies conducted in Senegal and Tanzania (Shimamoto & Gipson, 2015). If women have greater empowerment, in terms of knowledge and economic power, this will lead to improvement in their health. They can choose the best for their health, including choosing to have a safe delivery (Prata et al., 2017). Therefore, gender equality needs to be improved so women can make decisions about their health.

Husband/partner’s education attainment was found to be significantly associated with skilled birth attendant delivery. Women whose husband/partner had completed secondary or higher education were more likely to have a skilled birth attendant. This is consistent with the results of studies conducted in Kenya and Somalia (Gitimu et al., 2015; Yusuf et al., 2017). Husbands with a higher level of education will have more knowledge about health, including safe delivery (Kifle et al., 2018). As the head of the household, the husband’s knowledge will affect the reproductive health decisions (Yusuf et al., 2017). Engagement of the husband in the issue of maternal health should be expanded in all levels of the community.

Women whose husband/partner’s occupation was non-agricultural were found to be significantly more likely to have a delivery with professional assistance. This finding is similar to those of studies conducted in Nigeria and Ethiopia (Adewemimo et al., 2014; Fekadu & Regassa, 2014). The husband’s occupation will affect the family’s income. If the family income increases, the decision to have a skilled birth attend- ant will also be affected. In addition, another study conducted in Ethiopia found that women whose husbands work in a non-agricultural occupation tend to use an ANC service, which encourages the decision to give birth with professional assistance (Tsegay et al., 2013). Therefore, health promotion about safe delivery is important for the husband/partner, especially for husbands/partners whose occupation is agricultural.

**Limitations and strengths**
This study used secondary data from the 2017 IDHS, so the selection of the variables was determined by the availability of
the data. Another limitation is that some questions in the survey needed respondents to recall what happened five years preceding the survey, so the information may not be precisely stated. In addition to the limitations, however, this study has strengths. The sample of this study was selected using two-stage cluster sampling, so the data were nationally representative. Therefore, the results can provide recommendations for policymakers to develop effective regulation so the coverage gap of safe delivery between western and eastern provinces in Indonesia can be reduced. The practical benefits of this study is to facilitate use of these data for planning, policy-making and program management in the area of maternal health especially the safe delivery.

Conclusions
Safe delivery was found to be determined by several factors, which reflected the need for multi-stakeholder intervention in increasing the practice of safe delivery across the country. Programmatic and structured policies that target poor women and those with a low education level and encourage husbands/partners’ participation in this issue may help increase the prevalence of safe delivery in the eastern part of Indonesia. This study gives some recommendations to the policymakers, such as health promotion about safe delivery should be prioritized for women who have a high birth rank. Moreover, not only the women, but also their husband/partner should be involved in health education. The coverage of health insurance and health facilities should be enhanced so that everyone can have equal access to health services. Furthermore, the women’s empowerment program should be maximized so that all the women can choose the best for their health.

Data availability
Data used in this study is available online from the Indonesian 2017 Demographic and Health Survey (DHS) website under the ‘Individual Recode’ section. 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.

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Open Peer Review

Reviewer Report 24 September 2020

https://doi.org/10.5256/f1000research.29415.r71837

Ryan Michael Flores Oducado
College of Nursing, West Visayas State University, Iloilo City, Philippines

I have no further comments to make. The researchers did a good job in revising the article.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Public Health and Community Health Nursing

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 21 August 2020

https://doi.org/10.5256/f1000research.25747.r66055

Asmaa Salah Eldin Mohamed Saleh
Community Health Nursing, Faculty of Nursing, Beni Suef University, Beni Suef, Egypt

This is a good written article, but there are little things I think to make it perfect if the author follows it.
First: in Introduction: the author does not mention study hypotheses. Explain why the current research is important.
What value does the paper add? What practical benefits will it provide?

Second: Sample and sampling, it is important to add and mention the procedure of taking sampling for this huge sample size.

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?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: community health nursing, geriatric health, MCH, health promotion, school health, pediatrics, maternity

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 26 May 2020
https://doi.org/10.5256/f1000research.25747.r63312

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Ryan Michael Flores Oducado
College of Nursing, West Visayas State University, Iloilo City, Philippines

This article looks into the determinants of safe delivery in the eastern part of Indonesia. The report addresses an important topic and contributes to the advancement of knowledge on maternal health and in reducing maternal mortality.
I only have a few comments regarding the research article:

1. The authors mentioned that the dependent variables were facility-based delivery and assisted delivery. Will it be more appropriate to consider a) place of delivery and b) proportion of women assisted by skilled birth attendants as dependent variables?

2. It was reported in the article that 71.6% used a health facility and 86.2% were assisted by a health professional at their last birth. I wonder, isn't that health professionals typically assist health facility delivery? What is the reason for the discrepancy?

3. Please clarify women's knowledge level. This variable pertains to women's level of knowledge about what?

4. An interesting finding in this study was that women who wanted no more pregnancies when they became pregnant were more likely to give birth in a health facility. The authors mentioned that it might be related to the social norms and health system of the country itself. Can the authors expound on this? Can the researchers offer their plausible explanation of this result?

5. Can the authors restate the conclusions in the abstract? Can household factors be changed to a more encompassing term reflective of the result? Can the facility-based delivery term be deleted and focus on safe delivery as directed in the title of the article?

6. Can the use of secondary data be mentioned in the abstract?

Thank you very much for the opportunity to review this article.

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?
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: Public Health and Community Health Nursing
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 04 Sep 2020

Ferry Efendi, Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

We thank all reviewers for their generous and positive comments on our manuscript. With regard to their reviews, we have edited the manuscript to respond to their comments. In particular, we have made updates in track changes to indicate changes as suggested. We thank you for the opportunity to submit our revised manuscript.

Reviewer 1

This article looks into the determinants of safe delivery in the eastern part of Indonesia. The report addresses an important topic and contributes to the advancement of knowledge on maternal health and in reducing maternal mortality.

I only have a few comments regarding the research article:

1. The authors mentioned that the dependent variables were facility-based delivery and assisted delivery. Will it be more appropriate to consider a) place of delivery and b) proportion of women assisted by skilled birth attendants as dependent variables?

   Thank you for these constructive comments, we have changed the terminology into place of delivery (health facility Vs non-health facility) and type of assistance at delivery (skilled birth attendants Vs unskilled birth attendants) as guided by guide to DHS statistics DHS-7 and your comments.

2. It was reported in the article that 71.6% used a health facility and 86.2% were assisted by a health professional at their last birth. I wonder, isn't that health professionals typically assist health facility delivery? What is the reason for the discrepancy?

   Thank you for raising this issue, all delivery in health facility must be assisted by health professionals. However, not all delivery assisted by health professionals occurred in health facility.

3. Please clarify women's knowledge level. This variable pertains to women's level of knowledge about what?

   Thank you very much, we have added the explanation in variables section.

4. An interesting finding in this study was that women who wanted no more pregnancies when they became pregnant were more likely to give birth in a health facility. The authors mentioned that it might be related to the social norms and health system of the country itself. Can the authors expound on this? Can the researchers offer their plausible explanation of this result?

   Thank you very much, we have added the explanation in discussion section.

5. Can the authors restate the conclusions in the abstract? Can household factors be changed to a more encompassing term reflective of the result? Can the facility-based delivery term be deleted and focus on safe delivery as directed in the title of the article?

   Thank you very much, we have revised the abstract.
6. Can the use of secondary data be mentioned in the abstract?
Thank you very much, we have added in the abstract section.

**Competing Interests:** None

---

**Author Response 04 Sep 2020**

**Ferry Efendi**, Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

We thank all reviewers for their generous and positive comments on our manuscript. With regard to their reviews, we have edited the manuscript to respond to their comments. In particular, we have made updates in track changes to indicate changes as suggested. We thank you for the opportunity to submit our revised manuscript.

**Reviewer 2**

1. This is a good written article, but there are little things I think to make it perfect if the author follows it.
   First: in Introduction: the author does not mention study hypotheses. Explain why the current research is important. What value does the paper add? What practical benefits will it provide?

   Thank you very much, we have added on introduction section for the hypothesis and the value. While, we have added the practical benefits on the limitation and strength section.

   2. Second: Sample and sampling, it is important to add and mention the procedure of taking sampling for this huge sample size.
   Thank you very much, we have added on sample size and sampling section.

**Competing Interests:** None
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