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Socioeconomic, geographic and health system factors associated with rising C-section rate in Indonesia: a cross-sectional study using the Indonesian demographic and health surveys from 1998 to 2017

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ABSTRACT

Introduction Caesarean section (C-section) has been a public health concern globally. This study investigated the change in C-section rate in 1998–2017 in Indonesia and explored the socioeconomic, geographic and health system factors associated with the use of C-section.

Methods We analysed data from demographic health surveys in 2002–2003, 2007, 2012 and 2017 in Indonesia. We included women who reported giving birth within 5 years of each round of the survey (n=56 462) into the analysis. Cross-tabulation was used to examine change of C-section rate by year. We conducted bivariate and multivariate logistic regressions to study the determinants of C-section use.

Results In Indonesia, the C-section rate increased from 4.0% in 1998 to 18.5% in 2017. In 2017, the C-section rate in urban areas (22.9%) was almost two times that in rural areas (11.8%). It was almost three times among the richest wealth quintile (36.5%), compared with the poorest wealth quintile (12.9%). Between 2008 and 2017, the difference in the C-section rate by public services enlarged between the poorest and the richest groups. The absolute increase of the C-sections by private services was more than public services over time. In 2013–2017, the C-section rates by public and private services were 22.5% and 23.1%, respectively. After adjusting for all variables, higher education, higher household wealth, primiparity and use of public childbirth services were positively associated with C-section.

Conclusions The C-section rate increased steadily in the past two decades in Indonesia. Women's socioeconomic status and health system factors were associated with the increased use of C-section.

Strengths and limitations of this study

- The data used in this study are the nationally representative sample of birth data over an extensive time period of 20 years.
- There was a small number of missing entries within the dataset, indicating some non-response bias.
- Recall bias may be present because of the nature of survey collection on information from the past 5 years, but probably very limited because childbirth is a major life event.
- Although our analysis did explore regional variation in our results, we were unable to perform more in-depth exploration on the provincial level.

INTRODUCTION

Caesarean section (C-section) is a life-saving operation for women with pregnancy-related or delivery-related complications.[1] However, C-section, like any surgery, is also associated with risks of short-term and long-term adverse maternal and neonatal outcomes, with 100 times higher risk in developing countries.[2] In 2015, the WHO released the WHO statement on C-section rates, which highlights the goal to provide C-section to women in need. C-section rates at a population level >10% are not associated with reductions in maternal and newborn mortality rates.[1] Rapid increase in the C-section rate globally is a rising public health concern. Between 1990 and 2014, C-section rates increased from 6.7% to 19.1% globally, with a 4.2% rise in less-developed countries and a 12.7% rise in more-developedcountries. The greatest increase in C-section rate occurred in Latin America and the Caribbean.[3] Complex social, cultural, economic and health system factors are known drivers of C-section use. The co-existence of underuse and overuse of C-section in many low-income and middle-income countries represent challenges for the health systems from perspectives of equity and efficiency.[1 4 5]

Indonesia is the fourth most populous country on earth, home to >267 million

people. A previous study in Indonesia reported the C-section rate in Indonesia has likewise grown from 2% in 1991 to 16% in 2012, and that rich and well-educated women were most likely to have C-section, at rates of 11.2% and 20.0%, respectively, in 2012.[6] The most commonly cited reason for C-section in Indonesia from reporting hospitals in 2005 was malpresentation, representing 5.5% of all births, while maternal request without medical indication represented 2.2% of all births.[7] The Indonesian health system has undergone transition over the past 20 years. Health services delivery has a mixture of public and private providers. Public health services have been decentralised in administration with central, provincial and district government responsibility. General birth services are provided at primary care clinics (puskesmas), village maternity clinics (polindes) and other community posts primarily staffed by midwives, nurses and supervising doctors. Specialised care at hospitals is also available on referral. Both primary clinics and specialised hospitals have inpatient wards; however, not all have complete medical equipment to safely perform surgery.[8]

The Ministry of Health is in charge of financial and human resource distribution. Salaries of public staff are covered by budgetary allocation.[8 9] There is a range of private providers including not-for-profit and for-profit providers as well as individual doctors and midwives who engage in dual practice in both public and private health facilities.[10–12] In 2014, the government of Indonesia introduced the national health insurance scheme (Jaminan Kesehatan Nasional (JKN)) aiming for universal coverage with a comprehensive benefits package and minimal user fees or co-payments. The national health insurance covers childbirth care provided by both public and private providers. The national health insurance scheme provides payment determined by group-based cases for C-section.[8 13] Payment is determined by region, hospital level, luxury class and severity of health complications. Tariff payments from public insurance to cover the cost of the operation range from US$295 in an ordinary class 3 facility with few complications to US$513 in a class 1 VIP facility with heavy complications.[14]

This study investigated the change of C-section rate by location, women's sociodemographic characteristics and childbirth service use from 1998 to 2017 in Indonesia. We examined the factors associated with differentials in use of C-section across 20 years and analysed implications of socioeconomic and health system development on the use of C-section in Indonesia.

METHODS

Data sources and methods

This study used national data from the 2017, 2012, 2007 and 2002–2003 Indonesia Demographic and Health Surveys (IDHS). We obtained approval to access IDHS birth records. All data reported in this article are aggregate, and no attempt was made to identify study participants. Data used were the individual recode women's survey from the four most recent waves, including data from years 1997 to 2017. Owing to political instability, there are no data from the provinces Aceh, Maluku, North Maluku and Papua during the first wave. Maluku, North Maluku and Papua are grouped into the eastern region, so there are no data from the eastern region during this timeframe. Aceh is a part of the western region, so only data from the 17 other western provinces are reported during this time. IDHS used two-stage stratified sampling methods distributed across census blocks nationwide and weighted by province. Surveys are conducted approximately every 5 years, and participants are chosen based on their residence location. Trained field staff asked women aged 15–49 years in these households about topics including reproductive history, child health and demographics. Paper questionnaires were compiled in the central office and digitally entered into a computer for processing and distribution. More details of the sampling procedure have been described elsewhere (https://dhsprogram.com/publications/publication-FR342-DHS-Final-Reports.cfm). Owing to the use of secondary data, there was no patient or public involvement for this study.

The household surveys were administered to women aged 15–49 years at the selected residences. Surveys in 2007 and before only included ever-married women, while later surveys included all women. All data from 1997 were dropped due to low participant numbers (n=38). Women who had given birth within the past 5 years were included in the analysis. If a participant had given birth more than once within the last 5 years, only data on the most recent birth were used to avoid overrepresentation of high-parity women. We excluded data from overlapping birth dates from different survey waves to avoid statistical spikes in births every 5 years. Participants with some missing entries were included in the sample but were excluded for analyses concerning their respective missing variables. The birth records included questions regarding demographic characteristics, obstetric history, childbirth service usage and C-section. IDHS is funded by USAID (United States Agency for International Development) and the government of Indonesia.

Measures

The outcome measure was C-section rate, assessed by the number of births by C-section divided by the total number of births. Women were asked, 'was (name of baby) delivered by caesarean, that is, did they cut your belly open to take the baby out?' This question was labelled 'delivery by caesarean' in the IDHS dataset and coded into a binary response of yes or no based on the most recent birth.

The explanatory variables included the year of childbirth (1998–2017), maternal age (≤19, 20–29 and ≥30 years), educational attainment (primary school and below, junior and senior high school, university and above), residence (urban and rural), household wealth quintiles (poorest, poorer, middle, richer and richest), parity (1, 2–3 and ≥4), childbirth care services (public services, private services, homebirth and other) and region (western, central and

eastern). Wealth quintiles were computed each wave by the DHS team, including analysis of physical assets and home construction material. Parity referred to the total number of times a mother had given birth at the survey date. Childbirth care was grouped given the location of childbirth and characteristics of the providers (including public or private providers), extracted from the DHS variable 'place of delivery'. Participants who reported they gave birth at home were coded as 'homebirth'. The small number of participants reported unclear childbirth services, which was grouped into 'other'. Region was categorised according to time zones in Indonesia as of 2020.

Data analysis

Cross-tabulation was used to examine the change in C-section rate for women's geographic and socioeconomic characteristics, as well as childbirth care usage over time. A χ^2 test was used to quantify the difference over each wave of the survey. We conducted bivariate and multivariate logistic regressions adjusting for all explanatory variables to study the determinants of C-section rate while addressing possible confounders. More information on measurement bias in DHS data can be found online (https://dhsprogram.com/publications/publication-mr14-methodological-reports.cfm). Data were analysed using Stata V.16.0 (StataCorp, College Station, TX, USA).

RESULTS

Sociodemographic characteristics of women giving birth

Between 1998 and 2017, 59 264 women in the dataset had given birth. The 2802 observations from overlapping years were dropped, to total 56 462 observations included in the analysis. Table 1 presents the women's demographic characteristics. Around half of the women were aged 20–29 years, and the proportion of women who were >30 years old increased from 30.2% in 1998–2002 to 41.8% in 2013–2017. Women's educational attainment increased over time and 56.3% of them received junior or senior high school education in 2013–2017. In previous waves of the survey, rural women outnumbered urban women, though they almost reached equal in 2013–2017. The proportion of households at the poorest quintile decreased from 31.4% in 1998–2002 to 26.6% in 2013–2017. The proportion of the households in the middle and richer quintiles increased slightly over time. Less than one-third of women had only one child and half of all women had two or three children in 2013–2017. The proportion of women having >4 children decreased over time. Homebirth decreased significantly from 61.4% in 1998–2002 to 24.5% in 2013–2017. Women who used private childbirth services increased from 27.2% in 1998–2002 to 39.8% in 2013–2017. In the DHS survey, type of healthcare worker who provided childbirth services was asked, and we found that services were dominated by private midwives, accounting for 66.5% of services in 1998–2002 and 51.7% in 2013–2017. Those who used public services increased from 11.4% in 1998–2002 to 35.7% in 2013–2017. Public childbirth services were provided mainly by government hospitals. Regional distribution remained relatively stable over time due to sampling weights produced during data collection.

Change of C-section rate over time

C-section rate increased dramatically from 4.0% in 1998 to 18.5% in 2017 with a rapid increase in urban areas (figure 1). In 2017, the C-section rate in urban areas (22.9%) was almost two times that of rural areas (11.8%). The C-section rate increased in all regions, and it was the highest in the western region (21.5% in 2017), followed by the central region (15.6% in 2017) and the eastern region (10.7% in 2017; online supplemental figure 1).

C-section rates increased over time for all sociodemographic groups, with statistically significant changes between each survey period (table 2). Between 1998 and 2017, we observed the most increase in C-section rate among women who were >30 years old, were university educated and had only one child. The C-section rate among women from the richest wealth quintile had the most absolute increase compared with all other sociodemographic groups from 13.0% in 1998–2002 to 33.2% in 2013–2017. C-section rate increased from 10.5% in 1998–2002 to 22.8% in 2013–2017 for women who used any childbirth care services. C-section rate was higher among women who used public services than women who used private services in the first three waves of the surveys, while the absolute increase of C-sections by private services was more than that of the public services over the study period. In 2013–2017, the C-section rate of births by private services (23.1%) was slightly higher than that by the public services (22.5%) (table 2).

Between 2008 and 2017, homebirths decreased significantly even among the poorest wealth quintile. The difference in homebirth between the poorest wealth quintile and the richest quintile became smaller over time ($p<0.001$). Meanwhile, the difference of C-section rate at any service type between the poorest and the richest wealth quintile enlarged over the past decade, with a significant increase in C-section rate among well-off women for both public and private services (table 3). The C-section rate among women from the poorest wealth quintile who used private services increased over time, while it decreased among those who used public services. In 2017, the C-section rates among the poorest and richest wealth quintile were 12.9% and 36.5%, respectively. For both groups, there were no significant differences in C-section rates by public or private services.

Determinants of C-sections

Bivariate logistic regression analysis showed women who were >30 years old, received university and above education, were urban residents, from a higher household wealth quintile, had only one child, lived in the western region and used public childbirth services were more likely to give birth by C-section (table 4).

Table 1 Sociodemographic characteristics of women who gave birth, 1998–2017

	1998–2002 (n=13186) % (n)	2003–2007 (n=14581) % (n)	2008–2012 (n=14064) % (n)	2013–2017 (n=14631) % (n)	P value
Age (years)					<0.001
≤19	14.12 (1862)	11.76 (1715)	11.57 (1627)	9.38 (1372)	
20–29	55.63 (7336)	54.02 (7877)	53.75 (7560)	48.81 (7142)	
≥30	30.24 (3988)	34.22 (4989)	34.68 (4877)	41.81 (6117)	
Education*					<0.001
Primary school and below	49.86 (6574)	43.05 (6276)	33.40 (4698)	26.17 (3829)	
Junior or senior high school	43.59 (5748)	49.11 (7160)	53.43 (7514)	56.33 (8241)	
University and above	6.55(864)	7.84 (1143)	13.17 (1852)	17.50 (2561)	
Residence					<0.001
Urban	41.27 (5442)	38.24 (5576)	45.72 (6430)	49.25 (7206)	
Rural	58.73 (7744)	61.76 (9005)	54.28 (7634)	50.75 (7425)	
Wealth					<0.001
Poorest	31.37 (4137)	29.14 (4249)	28.80 (4051)	26.64 (3897)	
Poorer	19.60 (2585)	20.30 (2960)	28.28 (2852)	19.77 (2893)	
Middle	16.54 (2181)	17.69 (2579)	18.55 (2609)	18.75 (2743)	
Richer	15.82 (2086)	16.84 (2456)	17.23 (2423)	18.02 (2637)	
Richest	16.66 (2197)	16.03 (2337)	15.14 (2129)	16.82 (2461)	
Parity					<0.001
1	32.34 (4264)	31.66 (4616)	35.10 (4937)	30.98 (4533)	
2–3	46.21 (6093)	46.63 (6799)	47.58 (6691)	52.07 (7618)	
≥4	21.45 (2829)	21.72 (3166)	17.32 (2436)	16.95 (2480)	
Region					<0.001
Western	63.94 (8431)	57.75 (8421)	58.81 (8271)	59.85 (8757)	
Central	36.06 (4755)	31.86 (4646)	30.70 (4317)	30.52 (4465)	
Eastern†	0 (0.00)	10.38 (1514)	10.49 (1476)	9.63 (1409)	
Childbirth care*					<0.001
Private services	27.23 (3579)	28.82 (4189)	35.83 (5022)	39.77 (5805)	
Public services	11.41 (1499)	12.89 (1874)	20.71 (2903)	35.73 (5215)	
Homebirth	61.36 (8064)	58.28 (8471)	43.47 (6093)	24.51 (3577)	
Other	0.14(18)	0.24(35)	0.46(65)	0.23(33)	

*Two observations contained missing values for education in 2003–2007. For childbirth care, there were 44 missing values in 1998–2002, 47 missing values in 2003–2007, 46 missing values in 2008–2012 and 34 missing values in 2013–2017.
†Data from the eastern region not available from 1998 to 2002 due to political instability.

When we adjusted for maternal age, parity and survey year, the use of C-section was significantly higher in the survey of 2017 than the survey of 2002. Women who were >30 years old and primiparous women were more likely to give birth by C-section. We also found a positive association between women's educational attainment and household wealth for the use of C-section after adjusting for maternal age, parity, survey year, women's education and household wealth. After adjusting for all explanatory variables, we found similar results of women's sociodemographic determinants on C-section. The difference between urban and rural residences was not statistically significant (OR 0.97, 95% CI 0.90 to 1.04). Compared with women using private childbirth services, women using public childbirth services had higher odds of C-section (OR 1.58, 95% CI 1.48 to 1.69) (table 4).

DISCUSSION

Main findings

The C-section rate in Indonesia has steadily increased from 4.0% to 18.5% over the past 20 years across all demographics. The highest C-section rate was reported among women in the highest wealth quintile across the

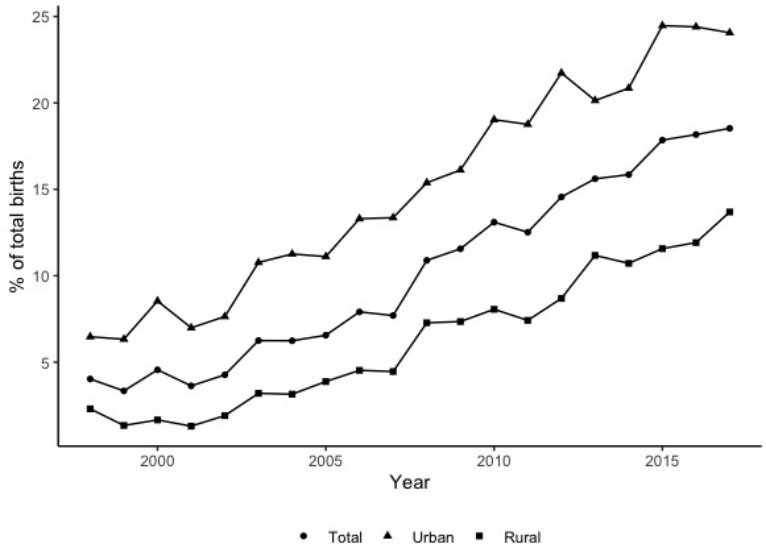

Figure 1 Caesarean section rate among urban and rural residents 1998–2017.

Table 2 Change in C-section rate by sociodemographic characteristics, 1998–2017

	1998–2002 (n=523)*	2003–2007 (n=1011)*	2008–2012 (n=1734)*	2013–2017 (n=2514)*	Absolute change (1998–2017)	
	% (n)	% (n)	% (n)	% (n)	%	P value
Age (years)						<0.001
≤19	1.78 (33)	3.98 (68)	6.04 (98)	9.46 (129)	7.68	
20–29	3.70 (270)	6.36 (497)	11.64 (877)	15.47 (1103)	11.77	
≥30	5.55 (220)	8.99 (446)	15.69 (759)	21.03 (1282)	15.48	
Education						<0.001
Primary school and below	1.53 (100)	2.90 (181)	6.04 (282)	9.14 (349)	7.61	
Junior and senior high school	5.00 (285)	8.08 (574)	12.81 (959)	16.50 (1356)	11.50	
University and above	16.18 (138)	22.63 (256)	26.79 (493)	31.65 (809)	15.47	
Wealth						<0.001
Poorest	0.65 (27)	1.279 (76)	4.08 (164)	6.64 (258)	5.99	
Poorer	1.24 (32)	4.34 (128)	9.13 (259)	12.97 (374)	11.73	
Middle	3.32 (72)	6.10 (156)	12.78 (332)	16.81 (460)	13.49	
Richer	5.33 (110)	10.30 (251)	18.00 (435)	23.12 (608)	17.79	
Richest	12.97 (282)	17.31 (400)	25.70 (544)	33.16 (814)	20.19	
Parity						<0.001
1	5.59 (237)	9.38 (430)	14.84 (730)	19.74 (892)	14.15	
2–3	3.73 (226)	6.58 (445)	12.39 (826)	17.22 (1309)	13.49	
≥4	2.13 (60)	4.32 (136)	7.39 (178)	12.68 (313)	8.36	
Childbirth care						<0.001
Any services†	10.46 (523)	16.94 (1011)	21.82 (1723)	22.82 (2513)	12.36	
Private services	8.64 (305)	15.10 (624)	19.50 (976)	23.10 (1340)	14.46	
Public services	14.81 (218)	21.08 (387)	25.84 (747)	22.51 (1173)	7.7	

*77 observations in 1998–2002, 94 observations in 2003–2007, 71 observations in 2008–2012 and 41 observations in 2013–2017 contained missing values for C-section. There were three missing values for childbirth care in 2007–2012.
†This was the C-section rate among women who reported use services provided by public or private providers. Home births were not included in this analysis.
C-section, caesarean section.

Table 3 C-section rate by wealth group, year and birth location

	Poorest	Poorer	Middle	Richer	Richest	RD*	RR*	P value*
Homebirth delivery rate								
2008	79.13 (580)	53.29 (275)	43.84 (217)	28.40 (121)	15.47 (67)	−63.66	0.20	<0.001
2017	44.00 (275)	19.00 (91)	13.88 (58)	10.20 (41)	2.25 (8)	−41.75	0.05	<0.001
Any services C-section rate†								
2008	13.33 (20)	15.90 (38)	21.74 (60)	22.62 (69)	26.24 (95)	12.91	1.97	0.004
2017	12.86 (45)	19.64 (22.28)	22.28 (80)	26.11 (94)	36.52 (126)	23.66	2.84	<0.001
Private services C-section rate								
2008	3.17 (2)	8.27 (11)	17.11 (32)	18.97 (44)	25.36 (71)	22.19	8.00	<0.001
2017	12.82 (10)	19.61 (30)	18.54 (33)	20.87 (43)	35.34 (88)	22.52	2.76	<0.001
Public services C-section rate								
2008	20.69 (18)	25.47 (27)	31.46 (28)	34.25 (25)	29.27 (24)	8.58	1.41	0.324
2017	12.87 (35)	19.66 (46)	25.97 (47)	33.12 (51)	39.58 (38)	26.71	3.08	<0.001

*RD=rate difference between poorest and richest quintiles, RR=rate ratio between poorest and richest quintiles. P value compares poorest quintile to richest quintile using χ^2 test.
†This was the C-section rate among women who reported use services provided by public or private providers. Home births were not included in this analysis.
C-section, caesarean section.

study periods. Homebirth decreased dramatically over time. The increase of C-sections by private services was significant by year. In 2017, the C-section rate by private services was slightly higher than public services. After adjusting for all variables, higher educational attainment, better household wealth quintile, having only one child and using public childbirth services were positively associated with C-section.

Strengths and limitations

A strength of our analysis is that we investigated the change in C-section rate over two decades in Indonesia using a nationally representative sample. Representation on the national and provincial level was undertaken by oversampling in sparser regions and weighting observations by province, all conducted by DHS prior to researcher access to the data. The quality of DHS data is widely accepted internationally, and generalisability is robust enough to guide policy development.[15] Using mode of delivery data from only the most recent birth instead of all births prevented overrepresentation of high parity women and was shown to not alter observed patterns in a previous study.[16] The study also had some limitations. There are a few missing values reported, especially in mode of delivery (n=283). Because this is small compared with the total number of responses, representing 4.9% of observations for C-section (n=5782) and 0.5% of total observations (n=56 462), we assume nonresponse bias is limited. Women may also suffer from recall bias during the survey. However, given childbirth is an important event, it is unlikely to have serious recall bias for the mode of delivery of the most recent birth. Our categorisation of all provinces into three convenient categories (western, central and eastern) did not support exploration of variation in C-section use at the provincial level. In addition, medical indication for a C-section was not asked in DHS surveys in Indonesia prior to the most recent wave, and thus we did not include it in the analysis of this study. This question was added in the survey of 2017, and it should be further examined in future studies.

Interpretation

The increase in the use of C-section in Indonesia may reflect availability and acceptability of this health technology, which are associated with health system development and social environment change. Indonesia has increased investment in health infrastructure and training health professionals.[8 17–19] The government of Indonesia has further encouraged cooperation with private institutions. In the past two decades, inpatient beds in both public and private hospitals, as well as primary health centres, have increased, while the distribution and quality of health facilities has shown significant geographical disparity across regions.[6 8 20] In this study, we observed a dramatic decrease in homebirth over time and an increase in the use of both public and private services for childbirth. We found higher C-section rates in urban areas and the relatively developed western region. However, there was no significant disparity in the use of C-section after adjusting for women's demographic and socioeconomic characteristics.

Women at an older age may face relatively more pregnancy-related risks and were more likely to have C-section. Consistent with other studies in southeast Asian countries and other developing countries, however, we found that women who were well educated, from wealthy households and primiparous were more likely to have C-sections,[21–25] which may be partly attributed to the

Table 4 Determinants of C-section in Indonesia 1998–2017, bivariate and multivariate logistic regression

	Crude odds OR (CI 95%)	Adjusted for age, parity, year	Adjusted for age, parity, year, education, wealth	Adjusting for all variables
Year				
1998–2002	1	1	1	1
2003–2007	1.81 (1.62 to 2.01)	1.72 (1.54 to 1.92)	1.72 (1.54 to 1.92)	1.76 (1.57 to 1.97)
2008–2012	3.40 (3.08 to 3.76)	3.08 (2.79 to 3.41)	3.06 (2.76 to 3.40)	2.47 (2.21 to 2.75)
2013–2017	5.01 (4.54 to 5.52)	4.36 (3.95 to 4.81)	4.17 (3.77 to 4.62)	2.54 (2.29 to 2.82)
Age (years)				
≤19	1	1	1	1
20–29	1.93 (1.71 to 2.17)	2.69 (2.38 to 3.03)	1.76 (1.55 to 1.99)	1.52 (1.34 to 1.73)
≥30	2.99 (2.66 to 3.37)	6.67 (5.84 to 7.62)	3.66 (3.19 to 4.20)	2.79 (2.42 to 3.22)
Education				
Primary school or below	1	–	1	1
Junior and senior high school	2.80 (2.60 to 3.02)	–	1.54 (1.42 to 1.67)	1.21 (1.11 to 1.31)
University and above	8.09 (7.42 to 8.82)	–	2.46 (2.23 to 2.72)	1.97 (1.77 to 2.18)
Residence				
Urban	1	–	–	1
Rural	0.35 (0.33 to 0.37)	–	–	0.97 (0.90 to 1.04)
Wealth				
Poorest	1	–	1	1
Poorer	2.24 (2.03 to 2.55)	–	1.89 (1.69 to 2.13)	1.23 (1.09 to 1.39)
Middle	3.38 (3.03 to 3.77)	–	2.47 (2.21 to 2.77)	1.38 (1.22 to 1.56)
Richer	5.17 (4.66 to 5.74)	–	3.42 (3.07 to 3.82)	1.68 (1.48 to 1.90)
Richest	8.72 (7.89 to 9.64)	–	5.04 (4.51 to 5.63)	2.19 (1.93 to 2.49)
Parity				
1	1	1	1	1
2–3	0.81 (0.76 to 0.86)	0.46 (0.43 to 0.49)	0.55 (0.52 to 0.60)	0.63 (0.59 to 0.68)
≥4	0.47 (0.43 to 0.52)	0.20 (0.18 to 0.22)	0.36 (0.33 to 0.41)	0.51 (0.46 to 0.58)
Region				
Western	1	–	–	1
Central	0.71 (0.66 to 0.75)	–	–	0.87 (0.81 to 0.93)
Eastern	0.55 (0.49 to 0.62)	–	–	0.87 (0.76 to 1.00)
Childbirth care				
Private services	1	–	–	1
Public services	1.33 (1.26 to 1.41)	–	–	1.58 (1.48 to 1.69)

C-section, caesarean section.

overuse of C-section. It has been argued that maternal request for C-section rather than medical indication contributes to the rise of C-section rates in many settings worldwide. In previous studies, the most common reasons for maternal request for C-section included fear of labour pain or trauma and perceived benefits to the mother, such as a feeling of control or mitigation of pelvic floor injury, among others.[5 26–28] It is not surprising that C-section rate is high among those who are willing and able to pay for the services rather than medical indications. However, there is a growing body of evidence on increased risks of unnecessary C-section to newborns and mothers.[2] C-section among primiparous women may complicate pregnancy in the future and be associated with repeat C-section.[1] It also has a negative impact on health system efficiency in terms of value-based health services delivery and equity in health.[1 2 4]

In 2014, the government of Indonesia launched the national health insurance scheme (JKN), aiming for universal population coverage. The national health insurance scheme provides a case-based payment for C-section in both public and private hospitals. The total

cost of C-section and its related hospital services varied by hospital facility class and was often higher than the amount covered by JKN. Thus, women have to pay the cost beyond the health insurance coverage out-of-pocket.[13 29] Previous analysis from the Indonesian Family Life Survey reported 13.6% of all JKN users suffered from catastrophic delivery expenditure in 2019.[30] Long hospital stays, pregnancy complications, and upgrades to more luxurious facilities were major contributors to high out-of-pocket payments.[13 29] There is a positive association between health insurance coverage and pre-labour planned C-section use in Indonesia.[31] Considering the recency of JKN implementation, this study did not have the opportunity to analyse the effect of insurance usage on C-section access.

Inconsistent with findings in other developing countries, Indonesian C-section rate by public services was higher than that by private services in 1998–2012.[23 24 32 33] The low rate of C-section in private services may be partially due to the large number of births occurring in private clinics only attended by midwives, as we found in this study. However, C-section rate by private services increased rapidly over time with a decrease in the percentage of midwife services, which may indicate the increase of availability and accessibility to private obstetric hospital services over time. In our study, the C-section rates among the richest women increased almost the same in private and public services. In Indonesia, the central government provides the salary of health professionals and operational costs to run public health facilities. However, most public health facilities still need to rely on user fees for financial and institutional sustainability, promoting profit-maximising behaviour.[8 9] In this study, we found the difference in C-section rate in public health facilities enlarged between the poorest and the richest wealth quintiles between 2008 and 2017, showing a decrease in C-section rate among the poorest group while a significant increase among the richest group. This may suggest childbirth care facilities are pursuing profits through performing C-section for those who are able to pay in public health facilities, as is the case in other countries.[5 34] Hospital profit maximising behaviour could reduce the accessibility of C-section to socially disadvantaged women at risk of suffering from catastrophic payment. However, the ratio of physicians to the population has increased steadily over the past 30 years. Greater availability of qualified staff to perform C-section may also be an indicator that accessibility to this service has increased.[8]

CONCLUSION

The C-section rate increased steadily in the past two decades in Indonesia. Women's socioeconomic status and health system factors were associated with increase in the use of C-section. Further studies are needed to understand the reasons why C-section is considered desirable by socially advantaged women and primiparous women, and to investigate health system facilitators and barriers to mitigate unnecessary C-section to propose adapted interventions to optimise the use of C-section in Indonesia.

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