Factors associated with rising C-section rate in Indonesia: findings from the Indonesian demographic and health surveys from 1998 – 2017

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Abstract

Objective: To investigate the change in C-section rate in 1998-2017 in Indonesia and explore the socioeconomic, geographic, and health system factors associated with the use of C-sections. Design: Analysis from demographic health survey (DHS) data in 2002-3, 2007, 2012, and 2017. Setting: Nationwide. Population: 40743 women who reported giving birth within five years of each round of the survey. Methods: 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. Main outcome measures: C-section rate at the population level. Results: In Indonesia, C-section rate increased from 4.0% in 1998 to 18.5% in 2017. In 2017, 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 to the poorest wealth quintile (12.9%). Between 2008 and 2017, the difference in C-section rate by public services enlarged between the poorest and the richest groups. The absolute increase of C-section 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.

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Introduction

Caesarean section (C-section) is a life-saving operation for women with pregnancy 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] 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 developed countries. [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- and middle-income countries represent challenges for the health systems from perspectives of equity and efficiency.[1,4,5]

In Indonesia, the C-section rate has grown from 2% in 1991 to 16% in 2012. A previous study in Indonesia reported 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 decentralized in administration with central, provincial, and district government responsibility. The Ministry of Health is in charge of financial and human resource distribution.[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.[10,11,12] In 2014, the government of Indonesia introduced the national health insurance scheme (JKN), which 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. Payment is determined by region, hospital level, luxury service class, and severity of health complications.[8,13,14]

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

Methods

Data sources and methods

The current study used national data from the 2017, 2012, 2007, and 2002-3 Indonesia Demographic and Health Surveys (IDHS). We obtained approval to access IDHS birth records. All data reported in this paper is aggregate, and no attempt was made to identify study participants. Data used was the individual recode women's survey from the four most recent waves, from 1997 to 2017. Due to political instability, there is 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 is 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. More details of the sampling procedure have been described elsewhere (https://dhsprogram.com/publications/publication-FR342-DHS-Final-Reports.cfm).

All data from 1997 was dropped due to low participant numbers. Women who had given birth within the past five years were included in the analysis. If a participant had given birth more than once within the last five years, only data on the most recent birth was used. We excluded data from overlapping birth dates from different survey waves to avoid statistical spikes in births every 5 years. The birth records included questions regarding demographic characteristics, obstetric history, childbirth service usage, and C-section. IDHS is funded by USAID 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 cesarean, that is, did they cut your belly open to take the baby out?" This question was labeled "delivery by cesarean" 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, [?]30), educational attainment (primary school and below, junior and senior high school, university and above), residence (urban, rural), household wealth quintiles (poorest, poorer, middle, richer, and richest), parity (1, 2 – 3, [?]4), childbirth care services (public services, private services, homebirth, 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 categorized 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 Chi-square test was used to quantify the difference over each wave of the survey. We conducted bivariate and multivariate logistic regressions adjusting for explanatory variables to study the determinants of C-section rate. Data were analyzed using Stata version 16.0 (StataCorp, College Station, USA).

Results

Sociodemographic characteristics of women giving birth

Between 1998-2017, a total of 40743 women who gave birth were 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 over 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 over four 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. The private childbirth 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) (Figure S1).

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 of C-section rate among women who were over 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 to 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 ($p<0.01$). 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 S1). 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 over 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 3).

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 older than 30 years 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 – 1.04). Compared to women using private childbirth services, women using public childbirth services had higher odds of C-section (OR 1.58, 95% CI 1.48-1.69) (Table 3).

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 amongst women in the highest wealth quintile across the 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 the using public childbirth services were positively associated with C-section.

Strengths and Limitations

We investigated the change in C-section rate over two decades in Indonesia using a nationally representative sample, a strength of our analysis. The study also had some limitations. There are a few missing values in reporting mode of delivery (n=243) and childbirth service use (n=171). Compared to the total number of responses (n=40743), we assume nonresponse bias should be 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 categorization of all provinces into three convenient categories (western, central, eastern) did not support exploration of variation in C-section use at the provincial level.

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.[8,15,16,17] The government of Indonesia has encouraged cooperation with private institutions. In the past two decades, inpatient beds in both public and private hospitals as well as primary health centers have increased, while the distribution and quality of health facilities has shown significant geographical disparity across regions.[8,6,18] 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 socio-economic characteristics.

It has been argued that maternal request for C-section rather than medical indication contributes to the rise of C-section rate in many settings worldwide. In previous studies, the most common reasons for maternal

request for C-section included fear of labor pain or trauma and perceived benefits to the mother, such as a feeling of control or mitigation of pelvic floor injury among others.[5,19,20,21] 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. Consistent with other studies in Southeast Asian countries and other developing countries, we found that women who were well educated, from wealthy households and primiparous were more likely to have C-section.[22,23,24,25,26] However, there is a growing body of evidence on increased risks of unnecessary C-section to newborns and mothers.[2] It also has a negative impact on health system efficiency in terms of value-based health services delivery and equity in health.[1,4]

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 severity of complications, but was often higher than the amount covered by JKN.[13] Tariff payments from public insurance to cover the cost of the operation range from $295 USD in an ordinary class 3 facility with few complications to $513 USD in a class 1 VIP facility with heavy complications.[14] Women have to pay the cost beyond the health insurance coverage out-of-pocket.[13,27] Previous analysis from the Indonesian Family Life Survey reported 13.6% of all JKN users suffered from catastrophic delivery expenditure in 2019.[28] Long hospital stays, pregnancy complications, and upgrades to more luxurious facilities were major contributors to high out-of-pocket payments.[13,27] There is a positive association between health insurance coverage and pre-labor planned C-section use in Indonesia.[29]

Inconsistent with findings in other developing countries, Indonesian C-section rate by public services was higher than that by private services in 1998-2012.[24,25,30,31] The low rate of C-section in private services may be partially due to the large numbers 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 and still need to rely on user fees for financial and institutional sustainability, promoting profit-maximizing behavior.[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.[5,32] Profit maximizing behavior could reduce the accessibility of C-section to socially disadvantaged women without suffering from catastrophic payment.

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 the 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 to investigate health system facilitators and barriers to mitigate unnecessary C-section to propose adapted interventions to optimize the use of C-section in Indonesia.

Disclosure of interests

The authors have no competing interests to declare

Contribution to authorship

SW contributed to the study concept, conducted the data analysis and wrote the first draft. PS and EF contributed to the results interpretations. QL initiated the study concept, participated in data analysis, interpreting findings and writing the manuscript. All authors read and approved final manuscript. Special thanks to Mutia Putri for her guidance and advice on working with IDHS data.

Details of ethics approval

Our analysis used previously published data available for public use and did not involve human subjects or medical records. No additional ethical approval was required.

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Tables

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

Table 1. Sociodemographic characteristi

Age	**Age**
	[?]19
	20 – 29
	[?]30
Education	**Education**
	Primary school and below
	Junior or senior high school
	University and above

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

Residence	**Residence**
	Urban
	Rural
Wealth	**Wealth**
	Poorest
	Poorer
	Middle
	Richer
	Richest
Parity	**Parity**
	1
	2 - 3
	[?]4
Region	**Region**
	Western
	Central
	Eastern
Childbirth Care	**Childbirth Care**
	Private services
	Public services
	Homebirth
	Other

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

Age	**Age**
19	1.78(33)
20 – 29	3.70(270)
30	5.55(220)
Education	**Education**
Primary school and below	1.53(100)
Junior and senior high school	5.00(285)
University and above	16.18(138)
Wealth	**Wealth**
Poorest	0.65(27)
Poorer	1.24(32)
Middle	3.32(72)
Richer	5.33(110)
Richest	12.97(282)
Parity	**Parity**
1	5.59(237)
2 - 3	3.73(226)
4	2.13(60)
Childbirth Care	**Childbirth Care**
Any services*	10.46(523)
Private services	8.64(305)
Public services	14.81(218)

*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

Table 3. Determinants of C-section in Indonesia 1998-2017, bivariate and multivariate logistic regression

Table 3. Determi

Year	**Year**
	1998-2002
	2003-2007
	2008-2012
	2013-2017
Age	**Age**
	[?]19
	20 – 29
	[?]30
Education	**Education**
	Primary school c
	Junior and senio
	University and a
Residence	**Residence**
	Urban
	Rural
Wealth	**Wealth**
	Poorest
	Poorer
	Middle
	Richer
	Richest
Parity	**Parity**
	1
	2 - 3
	[?]4
Region	**Region**
	Western
	Central
	Eastern
Childbirth Care	**Childbirth Car**
	Private Services
	Public Services