

CAESAREAN BIRTH IN INDONESIA: UNDERSTANDING INEQUALITIES, INEFFICIENCIES, AND INTENTIONALITIES

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ABSTRACT

BACKGROUND

Caesarean section use is increasing globally with limited additional benefits for women and newborns. Similar to global trends, caesarean section use in Indonesia increased significantly, from 1.6% in 1990 to 17.6% in 2017. Importantly, caesarean section contributed to the most financial burden for the national insurance health system in Indonesia, accounting for 36% of all births in 2019. Increases in caesarean section rates in Indonesia demonstrate widening inequality across socioeconomic determinants. These inequalities highlight the role that social factors play in the increase of caesarean section rates in Indonesia. Understanding factors influencing increasing caesarean section rates is critical in contextualising the rising rates and informing the development of interventions to optimise its use. However, no studies have explored the drivers of caesarean section increase in Indonesia. This PhD study aims to explore drivers influencing increasing rates of caesarean section in Indonesia and examine factors influencing the success of interventions to optimise caesarean section use.

METHODS

The PhD study was conducted using a mixed methods approach through three study components: social media analysis, qualitative longitudinal study, and caesarean intervention analysis. The social media analysis used computational and qualitative content analysis to understand the portrayal of caesarean section in Indonesia through Instagram. The qualitative longitudinal study interviewed women twice from pregnancy to birth to understand women's decision-making process and how the mode of birth selection may change. Lastly, the caesarean section intervention analysis utilised qualitative comparative analysis to investigate important intervention components that influence the success of interventions to optimise caesarean section use.

RESULTS

This PhD study found that caesarean section was highly commoditised in Indonesia through Enhanced Recovery After Caesarean Surgery (ERACS) promotion. Despite being a perioperative initiative, ERACS was advertised as *"a new and advanced technique of caesarean section"* that allows women to have comfortable, painless, and quick recovery births. Despite this pervasive advertisement, Indonesian women still desired a vaginal birth. However, many ended up having a caesarean section due to their provider's mandate. Women felt they did not receive adequate information from providers and felt disappointed with the change in their mode of birth plan. The

caesarean section intervention analysis highlighted that support for women is central to promoting the success of interventions targeting women. The support should be emotional and informational from partner or family, peers, and healthcare providers. Training on labour management, disseminating caesarean indications, conducting audits and feedback, implementing multidisciplinary collaboration, and ensuring healthcare providers' willingness are important to optimise the success of interventions targeting healthcare providers.

CONCLUSION

This PhD study revealed alarming caesarean promotion and a strong influence of healthcare providers on women's mode of birth. The pervasive ERACS advertisement and substantial power imbalances between providers and women open a loophole that can result in a continuous caesarean increase in Indonesia. This study highlights there is a need for better communication, evidence-based information, and more opportunities for women to discuss the mode of birth collaboratively with providers. The pervasive caesarean advertisements warrant the need for the Ministry of Health and medical professional bodies to re-examine Indonesia's regulations on advertisements related to health procedures. There is also a need to standardise and regulate ERACS use in the country.

DECLARATION

This declaration is to certify that:

- This thesis comprises only my original work towards the Doctor of Philosophy degree, except where indicated in the preface;
- Due acknowledgment has been made in the text to all other material used; and
- This thesis is fewer than 100,000 words in length, exclusive of tables, figures, bibliographies, and appendices approved by the Higher Degrees Research Committee.

Signed on 1 December 2023,

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PREFACE

PUBLICATIONS

It is important to note that my PhD study is a continuation of the previous research I conducted during my master's degree. It is grounded and based on my first author publication on caesarean section use and inequality trends in Indonesia from 1987 to 2017, published in *BMJ Global Health* in 2020. This study was conducted for total fulfilment of the requirements for the degree of Master of Public Health from The University of Melbourne and can be read more below:

Zahroh, R. I., Disney, G., Betrán, A. P. & Bohren, M. A. Trends and sociodemographic inequalities in the use of caesarean section in Indonesia, 1987-2017. *BMJ Global Health* **5**, e003844 (2020).

This PhD thesis is a “thesis with publications”. This PhD resulted in four manuscripts: two have been published, one has been accepted and is in the proofing stage, and one is under review. I am the first author of all the manuscripts and contributed to more than 50% of the work to complete the studies and manuscripts. With guidance from my supervisors, I did the study conception, protocol development, collaboration invitation, ethics approval application, data collection, analysis, and write-up of the study. Despite being the first author, the studies and manuscripts were completed collaboratively with other excellent researchers, who became the co-authors of my papers, including my supervisors and advisors. The co-authors substantially contributed to the study by delivering feedback on the study protocol, assisting the data collection by becoming an observer, being part of the analysis as 2nd reviewers and coders, and contributing to substantial feedback and edits on the manuscripts. The co-authors include researchers from:

- **The University of Melbourne, Australia:** Associate Professor Meghan Bohren, Ms Alya Hazfiarini, Ms Martha Vazquez Corona, Dr Marc Cheong
- **Burnet Institute, Australia:** Professor Caroline Homer
- **University College London, United Kingdom:** Associate Professor Katy Sutcliffe, Dr Dylan Kneale
- **World Health Organization, Switzerland:** Dr Ana Pilar Betrán, Dr Newton Opiyo
- **University of Gadjah Mada, Indonesia:** Professor Ova Emilia, Dr Fitriana Ekawati
- **THESE Initiatives, Indonesia:** Ms Moya A. D. Martiningtyas

The list of manuscripts, including their publication status, can be seen below:

- **Zahroh, R.I.**, Cheong, M., Hazfiarini, A., Vazquez-Corona, M., Ekawati, F., Emilia, O., Homer, C.S.E, Bétran, A.P., Bohren, M.A. The portrayal of caesarean section on Indonesian Instagram: a mixed-methods social media analysis. Under review: Journal of Medical Internet Research; submitted February 2023.
- **Zahroh, R.I.**, Hazfiarini, A., Martiningtyas, M.A.D, Ekawati, F., Emilia, O., Cheong, M., Bétran, A.P., Homer, C.S.E, Bohren, M.A. Rising caesarean section rates and factors affecting women's decision-making about mode of birth in Indonesia: a longitudinal qualitative study. Under review: BMJ Global Health; submitted October 2023 (accepted and currently in proofing stage).
- **Zahroh, R.I.**, Sutcliffe, K., Kneale, D., Vazquez-Corona, M., Bétran, A.P., Newton, O., Homer, C.S.E, Bohren, M.A. Educational interventions targeting pregnant women to optimise the use of caesarean section: What are the essential elements? A qualitative comparative analysis. BMC Public Health 23, 1851 (2023). <https://doi.org/10.1186/s12889-023-16718-0>
- **Zahroh, R.I.**, Kneale, D., Sutcliffe, K., Vazquez-Corona, M., Newton, O., Homer, C.S.E, Bétran, A.P., Bohren, M.A. Interventions targeting healthcare providers to optimise use of caesarean section: a qualitative comparative analysis to identify important intervention features. BMC Health Serv Res 22, 1526 (2022). <https://doi.org/10.1186/s12913-022-08783-9>

This PhD study requires field data collection, which I conducted from September 2022 to April 2023. The data collection was conducted with approval and help from the Provincial and District of Health Office in Jakarta, including primary health centres in Johar Baru and Cempaka Putih. Despite not being involved in the study's conduct, analysis, and write-up of the manuscripts, the people at these institutions have tremendously helped me navigate the study's logistics.

FUNDING

In conducting this PhD, I received a scholarship from the Gender and Women's Health Unit, University of Melbourne School of Population and Global Health for the first six months of my PhD, and the University of Melbourne Human Rights Scholarship for the remaining three years.

I am fortunate to receive various funding to support my PhD study and awards to acknowledge the impact of my PhD study. I received \$22,335 in funding to fund the different components of my PhD study. This includes \$8000 from the Indonesia Democracy Hallmark Research Initiative (IDeHaRI) Collaborative Grant to fund my social media study, \$7000 open access funding from the Nossal Institute Professional & Academic Development Award and Centre for Health Equity Open Access Funding Scheme, \$5735 funding from Birmingham University to attend an international conference in South Africa, and \$1600 from MSPGH PHIRST to fund the longitudinal data study.

In the third year of my PhD, I also received the *“New Investigator Award”* from the Perinatal Society of Australia and New Zealand based on my social media study's novel approach and findings, *“Research Achievement Award”* for Graduate Researcher from Melbourne School of Population and Global Health based on the findings and impact that my PhD has, and *“2nd Place Oral Lightning Award on Epidemiology and Public Health”* from The University of Melbourne based on my social media study presentation.

PRESENTATIONS

The results of my PhD have been presented at a total of 10 conferences since the beginning of my PhD. This includes:

- 2023, Presenter, MDHS Graduate Research Conference, Melbourne, Australia
- 2023, Presenter, Indonesia Forum – Health Translation, Melbourne, Australia
- 2023, Presenter, Early Career Research Network Symposium, Melbourne, Australia
- 2023, Presenter, International Maternal Newborn Health Conference (IMNHC), Cape Town, South Africa
- 2023, Presenter, Perinatal Society of Australia and New Zealand (PSANZ) Congress, Melbourne, Australia
- 2022, Presenter, Perinatal Society of Australia and New Zealand (PSANZ) Congress, Adelaide, Australia
- 2022, Presenter, GLOW Conference: Caesarean Section Births: Right Time, Right Mother, Right Way, Virtual
- 2021, Presenter, Engaging Evidence, Virtual
- 2021, Presenter, Perinatal Society of Australia and New Zealand (PSANZ) Congress, Virtual
- 2021, Presenter, Indonesia Forum, Virtual

I would like to end this preface by confirming that I did not use any third-party editorial assistance in the preparation of my PhD thesis.

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This PhD thesis would not be able to be completed without the help and guidance from many people that I am forever thankful for.

First and foremost, I would like to express my gratitude to my primary supervisor, Associate Professor Meghan Bohren, for her unwavering support, mentorship, and guidance throughout my PhD journey. Thank you for having confidence in me, giving me space to do the work I am passionate about, and always giving me insightful feedback that has greatly improved this PhD. Thank you for being incredibly patient, kind, supportive, and generously sharing valuable knowledge, lessons, and opportunities for my personal and professional growth. Meghan's sincerity, values towards life, equality, justice, and, importantly, love of food have made working and learning from her an enjoyable and exciting pursuit. She is not only an accomplished maternal health researcher, but also one of the kindest and most compassionate people that I have ever met. She has always made me feel seen and valued – and has been a guiding light, a role model, and a source of inspiration throughout my PhD. I am forever indebted to her for the life-changing knowledge, lessons, journeys, and experiences throughout my PhD.

I would also like to also thank my amazing co-supervisor and advisors for their relentless support throughout my PhD journey: Professor Caroline Homer for her amazing, valuable, and thought-provoking feedback, which has intellectually enriched me and this PhD thesis – I am fortunate to be able to learn from prominent maternal health researcher and will forever remember her feedback on women's autonomy and power, and the importance of midwives. Dr Marc Cheong, for being very patient and generous in guiding me through a complicated computer science world – weekly, which makes me more confident in conducting my study. I am very lucky that Marc is also very familiar with Bahasa, the Indonesian context, and ethics surrounding research – which has helped me navigate my PhD. Dr Ana Pilar Betrán, I am very lucky to have the world's experts on the caesarean section on my PhD committee; getting to know her very interesting studies even before publication – in fact, I feel that I cited her more than anyone – thank you for your kindness, warmth, and for always sharing the very useful and interesting references. Professor Ova Emilia, thank you for your encouragement and very helpful feedback on my PhD, and for always taking the time to meet and review my work despite your busy schedule.

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the interesting discussions being an Indonesian researcher. I would also like to thank Dr Dylan Kneale and Associate Professor Katy Sutcliffe for their generosity in sharing their knowledge and assisting me with the third component of my PhD. I am very lucky to be able to learn about qualitative comparative analysis from the world's experts. It was an intimidating and whole new world for me, yet Dylan and Katy have made it an enjoyable experience. Thank you to Professor Cathy Vaughan, my PhD chair, who always willingly organised my milestones meetings and filled out massive administration forms despite her busy schedule. Jim Berryman from Brownless Library, thank you for tutoring me on devising strategies to “search” – it was really helpful and reassuring! And to Myra Malcom, for always helping me navigate PhD administrative requirements and supplying me with delicious cheesecake. Thank you!

My PhD studies were greatly supported by Alya Hazfiarini and Martha Vazquez Corona, who worked with me on data collection and analysis. They provided invaluable assistance as second reviewers, coders, and observers. I am immensely grateful for their intelligence, fresh perspectives, and positivity throughout the process, despite the massive amount of data and, often, very tight deadlines. Without their help, I would not have been able to complete this PhD.

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CHAPTER ONE

Introduction

1.1 BACKGROUND: CAESAREAN SECTION

Caesarean section is a life-saving procedure during childbirth. Caesarean section is an alternative to vaginal birth when the latter is not possible to ensure that women and babies can give birth safely. In the 1990s to early 2000s, performing a caesarean section was an act of desperation, a gamble between its life-giving or life-threatening potential. In the past decade, however, caesarean section has become the most used obstetric practice¹. Globally, caesarean section rates have been increasing, from 5.0% in 1990 to 21.0% in 2018². Despite caesarean section rates being higher in high (27.2%) compared to middle (24.2%) and low-income countries (8.2%), the largest increase was observed in middle-income countries, with Asia as the region with the greatest increase in rates of caesarean section between 1990 to 2018². The global caesarean section rates are predicted to continue to increase over the next 30 years, reaching up to 28.5% in 2030². Nearly 80% of caesarean is predicted to occur in middle-income countries, including Indonesia².

Inequalities in the rates of, and access to, caesarean section persist across and within countries³. Caesarean section rates vary from 5% in some countries in sub-Saharan Africa to 42.8% in Latin America and the Caribbean². Within countries, urban, richer, and more educated women have higher caesarean rates compared with their rural, poorer, and less educated counterparts^{1,3}. Furthermore, caesarean rates are higher in private as compared to public health facilities worldwide, suggesting that the financial capabilities and preferences of women or families are associated with the increase in caesarean section rates¹. Understanding the factors driving increasing rates and inequalities in caesarean section rates is vital to optimise the use of this surgery and ensure that it is available to women who need it in a timely manner.

Globally, there is no consensus on the optimal rates of caesarean section that a country, region, or facility should have⁴. Despite the absence of this consensus, some studies have concluded that caesarean section rates higher than 10-15% are not correlated with the improvement of women's and babies' health⁵⁻⁷. Therefore, 10-15% CS rates have been used pragmatically worldwide as a target or ideal rate^{1,3,4,8}. The 10-15% threshold can be useful as a proxy if caesarean sections are underused (<10%) or overused (>15%). While the underuse of caesarean section refers to an unmet need despite a woman medically needing it, the overuse of caesarean is when the intervention is used despite no medical indication. This increases the risks of increasing childbirth-related morbidity and mortality due to unmet needs, unsafe provision, and overuse of caesarean sections². Along with the predicted increase in caesarean section rates, both underuse and overuse of caesarean section will likely co-exist².

In 2015, the World Health Organization (WHO) issued a statement that caesarean section should be provided when women and babies medically need it⁷. Caesarean section comes with higher risks in the short and long term for women and babies when it is undertaken without medical indications^{4,9}. These risks include postpartum haemorrhage, complications due to anaesthetic, renal failure, puerperal infection, and increased risk of complications in subsequent pregnancies, such as preterm birth, stillbirth, placenta accreta, and ectopic pregnancy^{9,10}. Importantly, these risks are higher in women with limited access to comprehensive maternal and newborn care¹¹. Worldwide evidence, however, demonstrated that many caesarean sections are undertaken based on non-clinical factors instead of medical indications^{12–17}, meaning that women and babies are potentially exposed to risks and with no additional benefits^{4,5}.

The reasons for caesarean section are complex and multifactorial. The Lancet Series on Optimising Caesarean Section Use released in 2018 outlined that women, communities, healthcare providers and systems, play an important role in caesarean section uptake and usage¹⁸. In some contexts, women may prefer caesarean section over vaginal birth due to fear of vaginal birth, previous history of caesarean section and negative experiences of childbirth, convenience in choosing the day of birth, and the belief that caesarean section is safer, quick and painless compared to vaginal birth^{12–15,18}. Preference for a caesarean section may be more pronounced among wealthier women who may have better access to higher level care and the financial capability to afford it^{13,15,18}. Additionally, the portrayal of caesarean section as trendy or fashionable may influence women to take up caesarean¹⁸. Furthermore, healthcare providers may prefer caesarean section as they perceive it as a safer option than vaginal birth, fearing blame or litigation if complications occur during a labour and vaginal birth, convenience in timing, women's autonomy, and financial incentives^{12,15,16,18}. Lastly, health systems may influence the decision to perform caesarean sections through financial incentives that favour them over vaginal births, insufficient labor rooms and staffing, time constraints in using labor facilities, power dynamics among healthcare providers, and a culture that medicalises childbirth^{16,18,19}. Therefore, WHO proposed that complex interventions addressing the multi-layers of influence are needed to optimise the caesarean section use¹¹.

1.1.1 Caesarean section in Indonesia

Caesarean section in Indonesia has increased significantly over the past decade²⁰. In 1990, the caesarean section rate was only 1.6%, which increased to 17.6% in 2017²⁰. While no updated data has been published on the national rates in 2023 at the time of writing, the Indonesian Association for Obstetrics and Gynaecology has found that some private health facilities have reached caesarean section rates up to 90% in 2022²¹. The overuse of caesarean sections is found in the country, where

rich and educated women have way more caesarean sections (>30%), compared to their counterparts (<10%)^{20,22}. Caesarean rates are higher in Western Indonesia, especially Java and Bali, the most developed regions, when compared to Eastern Indonesia, particularly Maluku and Papua, the least developed region in the country²⁰. Higher caesarean rates are also observed among women in urban areas when compared to rural areas²⁰. Unlike the trends in facility-based births, skilled birth attendance, and antenatal care – where inequalities are closing between advantaged and disadvantaged groups^{23–25} – inequalities in caesarean are widening across time in the country²⁰. Understanding how caesarean rates and its inequalities are increasing in Indonesia is imperative to optimise its use, improve the equal distribution of the procedure towards different sub-groups of women, and prevent the increase of non-medically indicated caesareans in the country.

As described already, caesarean sections carry risks for both women and babies⁹, and are expensive, which could increase the burden on the health system and impact the care on other important health issues and procedures, which include quality of care, time, resources, and many others. The National Social Security Agency reported that caesarean has reached 36% of all births in 2019²¹. Due to the significant cost to the national insurance spent to cover caesarean section, The National Social Security Agency issued a call to control the use of caesarean section in the country²¹.

Despite the importance of this topic, few studies in Indonesia have examined factors contributing to increasing caesarean rates and its associated inequalities. Existing studies of caesarean section in Indonesia have only used quantitative research methods, identifying the odds of having a caesarean were higher for women who had pregnancy complications, who had previous caesarean section, and for those who had attended a higher number of antenatal care visits^{26–28}. No research has examined women's, communities', and healthcare providers' opinions on caesarean section. An improved understanding of these different perspectives may lead to effective and efficient policies in optimising caesarean section use and reducing its inequalities.

It is also crucial to develop and implement interventions and programmes to optimise the use of caesarean section. Interventions aimed at reducing and optimising caesarean use have been evaluated in several countries²⁹. The evidence of effectiveness among these interventions, however, is mixed²⁹ and more research is needed to understand what factors affect the effectiveness of caesarean interventions.

This PhD study specifically aims to provide new evidence to inform policy and practice to optimise caesarean section use and more equitable access to maternity care services in Indonesia. The overall study considered how both external and woman-driven factors contribute to increasing rates and inequalities of caesarean section by analysing the portrayal of caesarean section in social media in

Indonesia, conducting a primary qualitative research study with women, and investigating factors and processes that lead to successful interventions in optimising caesarean section use.

1.1.2 Research questions

To fill these evidence gaps about the situation with caesarean in Indonesia, this PhD aims to answer the following questions:

1. How is the caesarean section portrayed and represented by social media in Indonesia?
2. What are women's preferences, priorities, and decision-making processes on their mode of birth in Indonesia?
3. What are the key features that are aligned with the successful implementation of interventions aimed at optimising caesarean section use globally?

1.1.3 Reducing unnecessary caesarean sections versus optimising caesarean section use

Throughout this first section, I have given the overview of caesarean section issues and my research questions. Importantly, I highlight the importance of ensuring caesarean sections are accessible to women who medically need it. Optimising caesarean section use means reducing the rate of caesarean section in women who do not medically need it and increasing the rate for women who need it. Many studies have focused on reducing the unnecessary caesarean section, due to the increasing rates we observed globally^{29,30}. However, I feel that it is important to use "optimised" instead of "reduce" as the caesarean section situation varies across countries, where some settings are overusing it while others underusing it. So, it is important to capture these two complexities. Therefore, throughout this PhD thesis, I will use the term "optimising caesarean section use" instead of "reducing caesarean section use".

In the following sections, I will give an overview of Indonesia as a country, the journey on how I ended up researching about caesarean section, and the structure of my thesis.

1.2 COUNTRY PROFILE: INDONESIA

Indonesia is an archipelagic state located on the equatorial line of Southeast Asia, comprising over 18,000 islands³¹. Indonesia is divided into 38 provinces, with five main Island divisions, which are Sumatera, Java, Kalimantan, Sulawesi, and Papua³¹. The country's capital city is Jakarta, the most populous city in the country³², located on Java Island. Java Island is the most developed and populous island in the country compared to other islands³². The islands of Indonesia are often divided, anecdotally, into the "West" and the "East". The West part of Indonesia, which includes Sumatera, Java, and Kalimantan, is the richest and most developed region of the country, while the

East, which includes the area between Sulawesi and Papua, are the poorest and least developed region in the country (Figure 1). This means that development is often centralised in the West part, where the capital city is located.

Figure 1.1. Map of Indonesia



Indonesia is one of the countries with the largest population in the world, ranking fourth worldwide, as of the time of writing³³. Comprising over 273.75 million people in 2021³⁴, Indonesians have a diverse wealth of cultures, religions, languages, and traditions. There are over 1,300 ethnicities in Indonesia³⁵. The majority ethnic group is the Javanese (40.2%), followed by Sundanese (15.5%), Batak (3.6%), Sulawesi ethnic (3%), and smaller ethnic groups making up less than 3.0%, including but not limited to Betawi, Mingangkabau, Buginese, Malay, Bantenese, Banjarese, Balinese, Tionghoa, Acehnese and Papuans³⁵. The population in Indonesia is heavily religious; thus, Indonesia's laws, politics, and life are rooted in and based on religion. Most people practice Islam (87.2%) – making it the largest Muslim country in the world, followed by Protestant (7.0%), Catholic (2.9%), Hindu (1.7%), Buddhist (0.7%), and others (0.9%)³⁵. The people of the country speak over 2,500 local languages³⁵, with the official language of Bahasa Indonesia, the standardised version of the Malay language. It is important to note, due to the diverse cultures and ethnicities the country has, every part of Indonesia has different customs and beliefs about birth, which makes it hard to generalise one aspect of practices to the whole population.

Indonesia is an emerging middle-income country with the largest economy, and still growing, in Southeast Asia³³. Due to its population size, Indonesia is often seen as a “hot spot” for a market that attracts businesses from all over the world. Rich in natural resources, Indonesia is the major producer of palm oil worldwide, on top of gas, oil, minerals, and coals. Indonesia’s gross domestic product or GDP was US\$ 1.19 trillion in 2021, which is the highest among other Southeast Asian countries³⁶. Unemployment is declining over the years reaching 3.6% in 2022, from the peak of 8.1% in 2007³⁷. Indonesia is ranked as a country with a moderate human development index, ranking 114 out of 189 countries³⁸, with over 96% of the population being literate³⁹, and life expectancy reaching up to 67.5 years³⁸.

Despite the strengths of its geography, population, and economy, Indonesia faces numerous and increasing inequalities⁴⁰. There is a significant difference in the income level between the rich and the poor^{41,42}. According to the Indonesian National Bureau of Statistics, the top 20% of income earners in Indonesia hold 43% of the country’s income, while the bottom 20% only hold 7% of the country’s income. The World Bank reported the Gini index – income inequality measure of 0% (perfect equality) to 100% (perfect inequality) – of 37.9% for Indonesia in 2021, an increase from 29.5% in 2000, showing an increasing inequality in the distribution of income⁴⁰. A greater enrolment in higher education among wealthy families compared to poor families is also observed⁴³, which aggravates inequality of opportunity and a bigger income gap between the poor and the rich, and consequently impacting access to healthcare. Furthermore, 60.4% of the population lives on US\$ 6.90 a day and 9.54% of the population lives under the national poverty line, which is living with US\$ 2.15 a day³⁴.

Gender inequality also persists in Indonesian society. In 2022, Indonesia ranks 92 out of 153 countries on the World Economic Forum Global Gender Gap Index, referring to a large gap in the gender gap on economic, political, educational and health opportunities⁴⁴. In 2021, there is still a large gender gap between men and women for the share of seats in parliament (21% women held by women), secondary education (51.0% women vs 58.2% men), and labour force participation (53.7% women vs 81.7% men)⁴⁵. Some cultural stereotypes and norms in the country impose gender roles, which leads to limitations on opportunities and mobilities for women. Women persistently encounter discrimination in accessing education, employment, and healthcare. For example, social constructs of the “ideal woman” in the country expected women to be the caretakers for families after marriage⁴⁶. Women should care for the children and husband, take care of the house, and only be expected to join the workforce to improve the family’s economic condition⁴⁶. Women can work with permission from their husbands, but it should not interfere with household roles, subsequently leading women to low-paid jobs⁴⁶. Employers also often give lower wages to women compared to

men (with a reported average of 23%⁴⁷) and prioritise men for career advancement due to masculine culture and perceptions that women may leave work suddenly due to family responsibilities at some points in their lives, such as childcare, maternal leave, relocating based on husbands' work, etc⁴⁸. The rates of violence and sexual harassment against women are also high. In 2022, The Commission on Violence Against Women in Indonesia identified a more than 50% increase in gender-based violence against women from 2019, an increase from 302,686 to 457,895 cases⁴⁹.

1.3 THE RESEARCHER

1.3.1 Background, experience, interests

I still remember that night, I was ready for sleep when I felt piercing pain in my pelvis. It was really painful. I felt my pelvic bones being cut in half by a jigsaw, slowly but surely. I was curling on the bed, crying, and screaming. The pain was getting stronger. It comes and goes like an oscillation. The rhythms got much faster, every 15 minutes, every 10 minutes, and every 5 minutes. As I was suffering from pain, my husband and parents decided to bring me to the hospital.

It was a private hospital, located in the inner city of the most industrialised area in the province. The hospital was 30 minutes away from our house by car. I have been visiting the obstetrician in that hospital in my third trimester due to his reputation. Upon arrival, the obstetrician and midwives performed a vaginal examination on me, showing 1 cm dilation. They told me to wait at the hospital due to the distance, which I did. The contraction was still there in the next 48 hours, it was painful but bearable. I was still able to eat well and sleep a few hours throughout the two nights I stayed at the hospital.

On the third day, at around 5 am, the obstetrician came to my mum, dad, and husband, telling them the baby's vital signs were fine, but a caesarean will be a better option for me as there was no progress in labour and I seemed to be tired. The obstetrician suggested a caesarean at 10 am in the morning that same day. I was stunned and upset. I disagreed. I did not feel tired, I could still wait, and I believed I could still gain more energy as I still ate well. I told them I prefer induction to a caesarean. Yet the obstetrician rejected saying that as I have asthma, induction was not an option for me.

As we were in Indonesia, where reproductive decision is often family's decision, my family decided that I should go for a caesarean as the doctor suggested. Being

*in pain, and powerless, I gave in and let the doctor dissect me to birth my baby.
My baby was born that day on 23 December 2017, two days before her due date.
I was in despair and am still questioning if that was the right time for a baby to be
born, perhaps she was not ready to go out, and if that was really the safest bet
for my baby and me.*

This is a snippet of my own personal experience of having a caesarean section in 2017, despite my unwillingness to have one. This experience is also the reason why I became interested in caesarean section from a research perspective. My caesarean section journey was unplanned, but it was also not an emergency. The reason for my caesarean section was the perceived tiredness due to the long labour and the belief that I may not be able to persist through the next stages of labour. While writing this chapter, I attended a conference that mentioned that due to the pelvic anatomy, and human baby size, long labour is expected, which is why, women who have had long labour still have a good outcome. The first thing I thought about when I heard this was; that could be me?

Long before I gave birth to my daughter, I pursued my undergraduate degree with a full scholarship in South Korea, undertaking a biology major with a neuroscience speciality, due to my passion for human health and research. I returned to Indonesia upon graduation, seeking neuroscience research opportunities. However, due to the limited neuroscience research in the country at that time, I ended up working in Public Health research on implementing mobile health (m-Health) in rural areas of West Nusa Tenggara, to prevent maternal mortality. I fell in love with maternal health, due to the importance of the work, the engagement I had with the community, and the burning passions that I only realized after having worked in the field. During my work there, I witnessed severe inequalities in gaining access to good quality healthcare between rich and poor women and saw how gender roles aggravated this inequality. I still remember a woman who passed away after birth due to a haemorrhage and her family rejected the referral as they were waiting for her husband's approval. Due to this work, I decided to pursue a master's degree in public health, receiving a Master's scholarship from Australia Awards, at The University of Melbourne.

It was only five months after my baby's birth when I first arrived in Australia to pursue my master's degree. Within the next year or so, I also realized that most of my friends had a caesarean section, which made me really curious about why more and more women had a caesarean section. It was only when I took a health inequalities subject taught by A/Prof Meghan Bohren (my primary supervisor) that I realized that the caesarean section rates are increasing globally, and even called "a global epidemic"^{50,51}. I decided to do research on caesarean sections in Indonesia for my master's research, which investigated the trends of caesarean sections in Indonesia from 1991 to 2017 and

found an increase in caesarean sections in the country²⁰. There is a vast inequality in the use of caesarean section across the country. The rich had more caesarean sections than the poor, with a large gap of >30% vs <10% caesarean section rates respectively. Urban areas had higher caesarean section use, with Jakarta and Bali, the most developed regions in the country having more caesarean sections. Due to my own lived experience and these research findings, I started to question the causes of these increases and inequalities. Why is caesarean section rate increasing in the country? Why does caesarean section use increase systematically in certain groups of women? Do women really choose to have a caesarean section? Do the communities, healthcare providers, and health systems influence them to have caesarean section? My master's research in caesarean section lit up my interest further in the topic which leads me to this PhD study. I received a University of Melbourne Research Scholarship and Human Rights Scholarship to pursue my PhD, due to the importance of this topic.

1.3.2 Conception of the study and researcher position

My undergraduate university in South Korea was heavily positivist, focusing on objectivity and finding the “absolute” truth. It was difficult taking off on this lens as I embarked on my Master of Public Health degree, despite realizing that there is no such thing as an absolute truth – truth is subjective. This was also, to some extent, the reason why I ended up doing quantitative research on my master's thesis to see the trends of caesarean in Indonesia, “the what” instead of “the why”. As I embarked on my PhD journey, I realized that I need to take out the positivist lens and adopt the constructivist lens. This is because we know what the state of caesarean section in Indonesia is, but not why caesarean section use is increasing. Therefore, in this study, I decided to explore potential influencers on why and how women ended up having a caesarean section, and this includes external as well as women's factors, before finally looking for ways to optimise caesarean section use in the country.

As an Indonesian, I have a complex intersectional position on this research. First, I am a woman raised in a strong patriarchal culture. I am also a Muslim, despite not identifying myself as religious. I am married, and I have personal experience of caesarean section. In recent years, I have been more exposed to feminist ideas, and decided to call myself a feminist. I am opposed to any ideologies, traditions, and propaganda that intentionally and unintentionally oppress women, especially any traditional gender roles created to intentionally limit women's power and agency to exercise their rights as an individual. These multi-identities resulted in me having assumptions and beliefs on all aspects of this research. For example, during the interviews with women, I realised that I had been unconsciously assuming that all obstetricians that my participants mentioned were males, until they

clarified that many of them were females. I am also a mother, which makes me relate to certain stories and experiences that women discuss, often making my conversation with women longer, as we feel connected. I also had a caesarean section despite my unwillingness, which makes me believe that the increase in the caesarean section was due to healthcare providers' preferences and health system factors. I felt angry upon finding out about the pervasive advertisements for caesarean sections targeted at women, and I did cry and laugh with the women that I talk to in this study.

I have both an external and internal position in this research, as a researcher and a lived experience undergoing caesarean in Indonesia. My dual identities provide both benefits and risks. As an Indonesian who has had a caesarean section, I can understand the contexts easily, but risk trapping myself in my own assumptions. I do not see my beliefs and identities as a risk in this study, but rather, an asset that I can use to reflectively create the knowledge generated from the study. Throughout the process of conducting this research, and as I am writing this dissertation, I am trying to reflectively review and look in-depth into my assumptions and beliefs and how they may drive the research, and how I can ensure that I will be able to rely on the voices of the women clearly and transparently without clouding them with my own opinions. In doing this, I created a reflexive journal throughout the study process, and during my discussions with women, I am lucky to be able to be accompanied by my colleague, Ms Alya Hazfiarini, which has kindly assisted me as an observer. In every stage of this study, including interviews and up to the writing phase, I discussed with her reflectively and interpretatively the voices and themes that we produce from my study to ensure that, at times, I could distance myself from the women's stories, as the researcher.

1.3.3 Researcher's hypotheses

In this PhD, I came up with the following hypothesis: Caesarean section increase in Indonesia is mainly influenced by healthcare providers' preferences and the health system structure, which eventually make women decide or even end up having a caesarean section. Through this PhD, I found that the decision to have a caesarean section was influenced by a range of factors, but mainly it was the healthcare provider's decision. This PhD thesis will guide you further on how I unravelled the influences that women had when deciding their mode of birth, and how this decision-making can be optimised to ensure that women receive the best mode of birth based on their needs and clinical circumstances.

1.4 STRUCTURE OF THE THESIS

1.4.1 Road map of the chapters on this thesis

My PhD thesis is structured into 10 chapters. The first three chapters are literature reviews. Chapter 1, I have provided an overview of the topic, Indonesia's country profile, my background, the process of conception of the study, my position in the research, and my hypothesis. In Chapter 2, I discuss caesarean section history and caesarean section increase in the global context as well as in Indonesia. Chapter 3 provides in-depth information on Indonesia's maternal health system, including maternal health status and maternity care system.

In Chapter 4, I explain the study's aim and provide an overview of methods. As my research used diverse methods to answer the different research questions, Chapter 4 includes an overview of the different methods I used. Detailed explanations of these different methods, including justifications for the methods selection, are subsequently presented in Chapters 5 through 8.

Chapters 5 to 8 are the results chapters in which I will share the results of my study through two published papers, and two papers that are currently still with the journal (one has been accepted and in proofing stage, and one undergoing peer review). Specifically, Chapter 5 is the results of first study, answering the first research question: *"How is caesarean section is portrayed and represented by social media in Indonesia?"*. This paper examines the portrayal of caesarean section on Instagram in Indonesia, and demonstrated pervasive advertisements targeted at women to have a caesarean section. The manuscript is currently under review at the Journal of Medical Internet Research.

Based on the results of Chapter 5, I decided to talk to women about how they decided on their mode of birth, conducting a qualitative longitudinal study following them from pregnancy to birth, and exploring how their decision-making on birth would have changed. Thus, the Chapter 6 answered my second research question: *"What are women's preferences, priorities, and decision-making process on their mode of birth in Indonesia?"*. From talking to women, it is clear to see the influences of caesarean section uptake, and how often instilling fear and imposing the concept of maternal sacrifice results in women having the caesarean section. The manuscript is under review at BMJ Global Health.

Chapter 7 and 8 presents the results of the last component of my PhD study, in which I conducted a qualitative comparative analysis to investigate the most important components for an intervention to optimise caesarean section use. This answered the third research question: *"What are key features that are aligned with the successful implementation of interventions aimed in optimising caesarean section use globally?"*. The results of this study were divided into two manuscripts,

important intervention components for interventions targeting women (Chapter 7, published by BMC Public Health), and interventions targeting healthcare providers (Chapter 8, published by BMC Health Services Research). The results of this study show that the engagement of women and healthcare providers, and the health system are all needed to optimise the caesareans section use in a health facility.

In Chapter 9, I synthesise the results and holistically discuss the results along with the implications and conclusions.

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CHAPTER TWO

Background

*Overview of caesarean section globally and in
Indonesia*

2.1 CHAPTER 2 PREAMBLE

The preceding introduction chapter has provided an overview of the reasons why I researched the caesarean section in Indonesia, the context of Indonesia as a country, and the study conception process. In this chapter, I described in more detail the state of caesarean section issues globally and in the Indonesia context, WHO recommendations on caesarean section, interventions that have been implemented globally to optimise caesarean section use, and the gap in caesarean section research.

2.2 CAESAREAN SECTION: BENEFITS, INDICATIONS, AND RISKS

As described in Chapter 1, a caesarean section is surgery conducted when vaginal birth is not possible. For some women, it is the safest and the only possible way to give birth. The surgery involves incising the woman's abdomen and uterus to extract the baby¹. The incision to the skin and uterus could be done vertically or horizontally (transverse), though the latter is preferred due to faster recovery and tolerability by women¹. There are various reasons why women are unable to have a vaginal birth and consequently recommended to have a caesarean section. These reasons could be due to a woman's or baby's conditions, such as prolonged obstructed labour, abnormal fetal heart rate or fetal distress, and fetal malpresentation².

2.2.1 Risks associated with caesarean sections

Despite being a lifesaving procedure, like other surgical procedures, caesarean section comes with a certain degree of risks for women and babies. Women and babies may experience both short and long-term consequences of caesarean section^{3,4}, and maternal mortality due to elective repeat caesarean section is higher compared to vaginal birth⁵.

2.2.1.1 *Short-term risks for women and babies*

Women who had elective or emergency caesarean section have increased risks of experiencing severe acute maternal morbidity compared to vaginal birth^{3,4}. A systematic review by Sandall et al (2018) reported that this severe acute maternal morbidity included increased risks of haemorrhage requiring hysterectomy and blood transfusion, cardiac arrest, renal failure, obstetric shock, organ injury, assisted ventilation and intubation, postpartum thromboembolism, postpartum infection, and complications related to anaesthesia⁴. This is similar to the analyses of 373 health facilities' medical records in 24 countries by Souza et al to examine the outcomes of non-medically indicated caesarean

section, which found that women who had non-medically indicated caesarean section had increased risks of ICU admissions, blood transfusion, hysterectomy, and mortality⁶. There were dose-relationships on caesarean section number and these associated risks, where risks are increased incrementally as repeat caesarean sections conducted⁴. Currently, there is no evidence of benefits in conducting caesarean section in women who do not medically need it⁷. Importantly, the short-term risks associated with caesarean section outlined above are higher for women and newborns who have limited access to comprehensive obstetric care. In addition to the risks to women, there are also risks to the babies. Some studies have reported that babies born through caesarean section have increased risks of skin laceration, skull or bone fracture, nerve damage, and cephalohematoma^{3,4}. Babies born by caesarean section before 39 weeks, in which elective caesarean is often conducted, have increased risks of hypoglycaemia and respiratory problems^{8,9}.

2.2.1.2 Long-term risks for women and babies

Caesarean section poses long-term risks for women, including chronic pain, pelvic adhesions, dysmenorrhoea, menorrhagia, incontinence, sexual dysfunction, fertility issues, small bowel obstruction, and pelvic organ prolapse^{3,4}. Some risks are increased with subsequent caesarean sections, which include the development of adhesions and subfertility⁴. Babies born by caesarean section may also have increased risks of allergy, asthma, atopy, altered immunity, and reduced intestinal microbiome diversity compared to vaginal birth⁸. Caesarean section also increases the risk of obesity in children up to five years old¹⁰. In addition, there are iatrogenic consequences of uncertainty in the estimation of gestational age resulting in conducting caesarean section in preterm babies. Increasing evidence shows that early planned births (<39 gestational weeks) are associated with cognitive deficits (low APGAR score at birth and poor child development at school age), increased hospitalizations, and special needs among children^{11,12}. Babies born <39 gestational weeks are more likely to need specialized care when born and have more risks of having learning difficulties in later years¹³.

2.2.1.3 Maternal risks in next pregnancy

Women's future pregnancies are also impacted by history of previous caesarean section⁴. Abdominal adhesions have been reported to increase as the number of caesarean sections a woman has increases; 12-46% after two caesarean sections and 26-75% after more than two⁴. Abdominal adhesions increase women's subfertility, intestinal and small bowel obstruction, chronic pain, and complications in subsequent surgeries¹⁴⁻¹⁷. Pregnancy after a previous caesarean section is associated with increased risks of stillbirth, preterm birth, uterine rupture, ectopic pregnancy, abnormal placentation, and hysterectomy^{10,16}. Likewise, as the number of caesarean sections increases for an individual woman,

there are risks of higher occurrences of bleeding, blood transfusion, surgical injury, adhesions and hysterectomy^{18–20}. This suggests that mitigating the risk of a woman having a first caesarean section is critical to ensure healthy future pregnancies.

2.2.1.4 Risks to health system

High rates of caesarean section pose risks to the healthcare system in terms of cost. Conducting a caesarean section typically requires more costs than vaginal birth, due to higher costs of operating room time and staffing, longer hospitalization, medications, increased risk of complications, and ICU admission time²¹. This means that conducting a caesarean section may result in increased healthcare costs²². Furthermore, in settings where resources are limited, caesarean sections may drain resources²², put a strain on the health system²², and consequently increase maternal morbidity and mortality by reallocating resources²³. Lastly, the use of the resources also means that the healthcare system may constrain the delivery of care to the population in which caesarean section is underused²⁴.

2.3 STATE OF CAESAREAN SECTION GLOBALLY

Despite the risks that caesarean section has, in recent years, the caesarean section has become a “global epidemic”^{25–27}. Borrowing the term from the infectious disease field, it refers to the rapid increase of the procedure used globally. Caesarean section has quadrupled over the last 30 years from 5.0% in 1990 to 21% in 2021²³. It is predicted that the global caesarean section will continue to rise to at least 28.9% by 2030²³.

There is an unequal distribution of caesarean sections globally. Examining the caesarean section distribution, there are countries where the rate of caesarean section has reached more than 50% at the population level, for example, Egypt, Columbia, Dominican Republic²³. However, there are also countries where caesarean section rates are still below 5% such as Timor-Leste, Papua New Guinea, Ethiopia, Chad, and Niger²³. It is important to note that the greatest increase in caesarean was observed in the least developed countries compared to more developed countries²⁸. In 2021, Betrán et al conducted a caesarean section rates analysis and found that caesarean section rates increased the highest in less developed countries (22.9 percentage points), compared to high (15.1 percentage points) and least developed countries (8.6 percentage points)²³. It is predicted that in 2030, 80% of the caesarean sections will be in from less-developed countries, which includes Indonesia²³.

Asia is the region with the highest increase in caesarean sections rate per year globally, reaching up to a 5% incremental increase yearly²⁹. This observation is similar to the Betrán et al study which revealed that Eastern Asia, which includes Indonesia, and Western Asia, contributed to the highest increase of caesarean worldwide, having a 44.9 and 37.5 per cent points increase respectively from

1990 to 2018²³. Betrán et al predicted that by 2030, Eastern and Western Asia would be the regions with the highest increased rate of caesarean section, reaching over 60% and 50% respectively at the population level²³. Betrán et al hypothesised that this increase will lead to an increase in maternal morbidity and mortality²³. It is imperative to understand the drivers of caesarean section increase in Asia to ensure that the rate of caesarean section can be addressed, and its use optimised.

Globally, there are caesarean section inequalities across countries but also within countries. Boatin et al analysed caesarean section inequalities across 72 countries and found that richer women received more caesarean section compared to their poorer counterparts³⁰. In 2014, the median of caesarean section in the poorest fifth group was 3.7%, but reaching up to 18.4% in the richest fifth³⁰. The countries with high caesarean section rates had high absolute inequalities between the poor and rich compared to the countries with low caesarean section rates³⁰. The caesarean rates increase faster in the richest fifth compared to the poorest fifth, meaning that inequalities will keep widening over time³⁰. This shows that not all women who medically need a caesarean section receive one, on the other hand, women who may not receive a caesarean section end up receiving one.

2.4 WORLD HEALTH ORGANIZATION RECOMMENDATIONS ON CAESAREAN SECTION

In 1985, it was considered that the ideal caesarean section rate was 10-15% at the population level³¹. Since then, the 10-15% threshold has been used pragmatically to understand whether the caesarean section is underused or overused. Underuse of caesarean sections (<10%) refers to an unmet need for caesarean section – which means that women who need caesarean do not get it. On the other hand, overuse (>10%) of caesarean sections refers to the use of caesarean section, which is not medically indicated – this means that women who do not need caesarean end up getting one. Underuse of caesarean section leads to maternal and perinatal morbidity as well as mortality, while overuse creates harm and exposes risks to women and babies²⁴. In 2015, the WHO stated that caesarean section is beneficial only when they are required medically, and it should be provided to women who are medically indicated instead of “striving to each specific rate”⁷. Despite there is no consensus on the optimal caesarean section rates, increasing evidence, including one which was conducted by WHO, shows that caesarean section rates of more than 10% at the population level do not improve women’s and babies’ health outcomes^{7,32}. Although we cannot ascertain the urgency or need for a caesarean section from these percentages, the 10-15% rate threshold, is a useful proxy to examine and evaluate the state of caesarean section use in certain settings and contexts. To summarise, WHO emphasizes the need to ensure that caesarean sections are only conducted on women who medically need it, to minimise risks and maximise benefits for women and babies⁷.

2.5 CLASSIFICATION OF CAESAREAN SECTION

There are various ways of classifying caesarean section. It is often classified based on the timing for the decision to have a caesarean section, which can be pre-labour or in-labour, referring to before and after the onset of labour³³, or also elective (planned) and emergency (unplanned) caesarean section, referring to caesarean conducted outside of emergency (elective before labour happens), and during labour respectively. There are also four categories of caesarean section based on urgency, which are category: (1) immediate threat to woman's and baby's life, (2) maternal and fetal compromise but not immediately life-threatening, (3) maternal and fetal compromise but needs early delivery, and (4) elective where it is conducted on time that suit woman or healthcare providers³⁴. This classification could be useful to become a proxy in understanding when and whether the caesarean section is conducted based on medical indication.

The WHO has recommended the use of the Robson 10-group classification to monitor and compare caesarean section rates at the facility level^{7,35}. The Robson-10 group classification is basically a system for classifying pregnant women who undergo childbirth^{7,35}. The classification system divides women into ten groups based on five factors: parity, singletons or multiples pregnancy, previous caesarean section, spontaneous onset of labour, gestational age at delivery (term or preterm), and lastly, fetal presentation^{7,35}. The classification can be used as a quality improvement intervention to understand which groups of women contribute to the high rates of caesarean section^{7,35}. The Robson 10 group details can be seen in Table 2.1 below. Women in Robson groups 1 to 5 (term, cephalic presentation, single fetus, and previous caesarean section history) are reported to be the main contributors to the increasing caesarean section rates and are the groups where most unnecessary caesarean sections take place²⁸.

Table 2.1. Robson group classification and definition.

Robson group	Definition
Group 1	Nulliparous women with single cephalic pregnancy, ≥ 37 weeks' gestation in spontaneous labour
Group 2	Nulliparous women with single cephalic pregnancy, ≥ 37 weeks' gestation who either had labour induced or were delivered by caesarean section before labour
Group 3	Multiparous women without a previous uterine scar, with single cephalic pregnancy, ≥ 37 weeks' gestation in spontaneous labour
Group 4	Multiparous women without a previous uterine scar, with single cephalic pregnancy, ≥ 37 weeks' gestation who either had labour

	induced or were delivered by caesarean section before labour
Group 5	All multiparous women with at least one previous uterine scar, with single cephalic pregnancy, Group ≥ 37 weeks gestation
Group 6	All nulliparous women with a single breech pregnancy
Group 7	All multiparous women with a single breech pregnancy, including women with previous uterine scars
Group 8	All women with multiple pregnancies, including women with previous uterine scars
Group 9	All women with a single pregnancy with a transverse or oblique lie, including women with previous uterine scars
Group 10	All women with a single cephalic pregnancy < 37 weeks' gestation, including women with previous scars

Adapted from Robson Classification: Implementation Manual. Geneva: WHO; 2017³⁵.

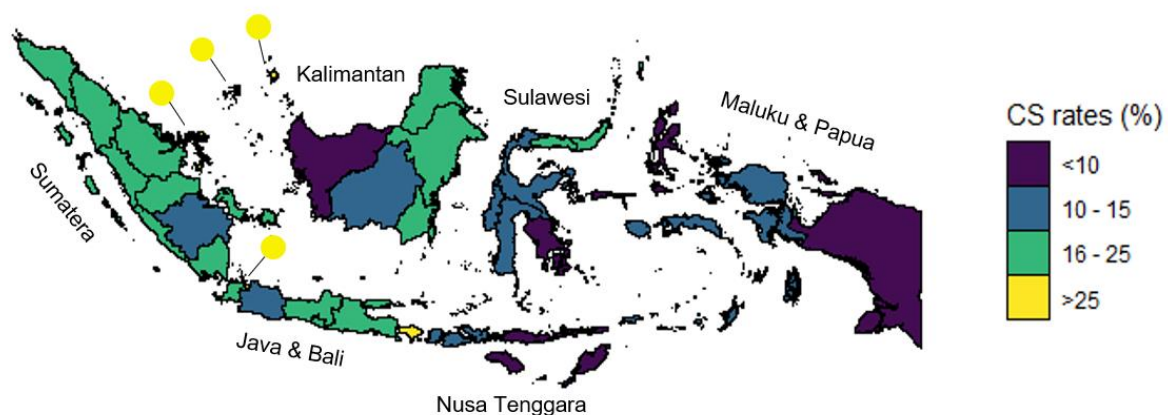
2.6 THE STATE OF CAESAREAN SECTION IN INDONESIA

Similar to global trends, the caesarean section rates in Indonesia have increased steadily from 1.6% in 1987 to 17.6% in 2017³³. Looking at trends in other countries and prediction by Betran et al, it is highly probable that rates of caesarean section in Indonesia will continue to rise in the coming years^{29,36}. There is no formal data published on the recent rates. However, the Indonesian Society of Obstetricians and Gynecologists has found caesarean section rates up to 90% at some private health facilities in 2022. The National Security Agency in Indonesia, a body which is responsible for the planning and execution of national health insurance, has also issued a call to monitor and optimise the caesarean section use in the country, as it contributed to the largest expense of the health budget, taking into account of 36% of all births in 2019³⁷.

As explained in Chapter 1, my Master of Public Health research found that caesarean rates in Indonesia are higher in Western Indonesia (Figure 2.1), especially Java and Bali, the most developed regions, as compared to Eastern Indonesia, particularly Maluku and Papua, the least developed regions in the country³³. Jakarta and Bali provinces, located in Java and Bali region, are the provinces with the highest caesarean section rates in 2017, reaching above 30% at the population level³³. Higher caesarean rates are also observed among women living in urban compared to rural areas, among richer compared to poorer women, and among more educated compared to less educated women³³. The difference is considerable; for example, in 2017, 33.4% of higher educated women had caesarean, contrasting to 9.3% only for non-educated or primary school level educated women (24.0 percentage points difference)³³. Women in the richest wealth quintile also have higher caesarean sections (32.1%),

compared to women in the poorest wealth quintile (6.5%), indicating 25.6 percentage points difference³³. Unlike the trends in access to facility-based births, skilled birth attendance, and Antenatal Care (ANC), where inequalities are closing between advantaged and disadvantaged groups^{38–40}, inequalities in the caesarean section are widening³³.

Figure 2.1. Map of caesarean section distribution in 2017 in Indonesia.



Taken from BMJ Global Health on trends of use and inequalities of caesarean section in Indonesia³³.

The rate of caesarean section before the onset of labour increases as wealth quintiles increased in Java and Bali as well as Sumatra, the more developed regions in the country, and also where the highest caesarean section rates are observed³³. Understanding how caesarean section rates and inequalities are increasing in Indonesia is imperative to optimise its use, improve the equal distribution of the procedure towards different sub-groups of women, and prevent the increase of unnecessary and non-medically indicated caesarean sections in the country.

2.6.1 Increasing rates of caesarean section during the COVID-19 pandemic

The COVID-19 pandemic may also had an impact on the increased rate of caesarean section in the country. The Indonesian Society of Obstetricians and Gynecologists issued the first birth guidelines early in the COVID-19 pandemic in March 2020, later revised in August 2020, which stated that COVID-19-positive women should have a caesarean section to limit the virus transmission⁴¹. This was not based on good quality evidence and was not the policy in many countries. Online media further propagated this misinformation stating that all women should give birth through caesarean section during the pandemic⁴². An anecdotal story has reported that there is a rapid increase of 490 women receiving caesarean in the Pamekasan District of East Java between January to May 2020, an increase of 20%⁴³. A study examining pregnancy outcomes in Surabaya revealed that 63% of COVID-19-positive women, and 72% of COVID-19-negative women underwent caesarean section during the pandemic⁴¹.

This is similar to global trends, which show more women had caesarean sections during the pandemic^{44,45}.

Furthermore, there are no clear measures or protocols for vaginal birth after caesarean (VBAC) in place in the country. This is despite previous studies reporting that previous caesarean section history is one of the main factors driving increasing rates of caesarean section^{46–48}. These ongoing issues emphasise the potential rapid increase of caesarean section rates in the country, which may worsen in the future.

2.7 INCREASING TRENDS IN NON-MEDICALLY INDICATED CAESAREAN SECTION

This chapter has provided evidence about increasing caesarean section trends. A study by Vogel et al analysing 287 facilities in 21 countries between 2004-2008 demonstrated that there was an increase in pre-labour caesarean rates and the largest contributor to the overall and increased caesarean section rate was the nulliparous (women having their first baby) women (Robson groups 1 and 2)²⁸. This means that there has been an increasing uptake of unmedically indicated caesarean sections over the years. This is similar to the findings of a study by Souza et al which revealed that, globally, women who had a non-medically indicated caesarean section before labour were normally primiparous and educated and multiparous women who had no history of pregnancy and birth complications from previous pregnancies⁶. In Souza et al study, some women who underwent caesarean indeed had co-morbidities, but they were not the indication for caesarean section⁶.

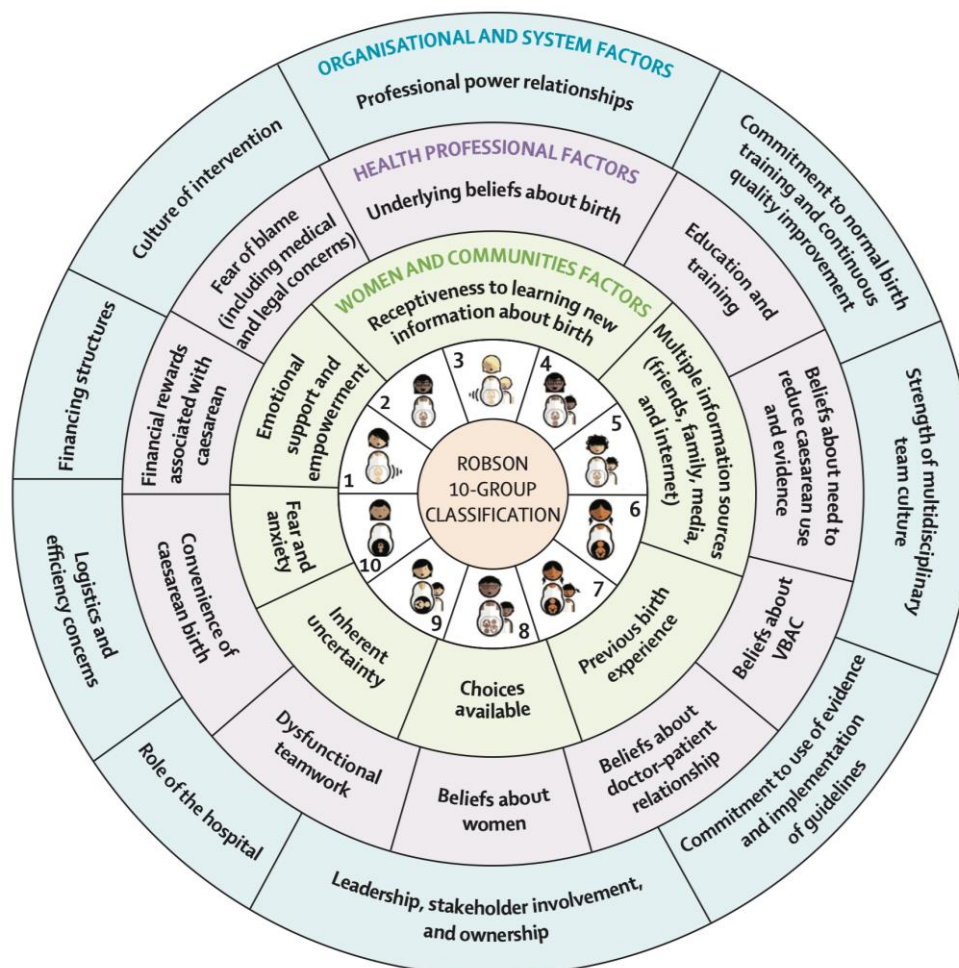
In the context of Indonesia, a study in two hospitals in Bali revealed that caesarean sections were mostly conducted on women aged 20-35 years old, who were having their first baby (primiparous), and their pregnancy was at term⁴⁹. The analysis showed that women in Robson groups 4 (multiparous without caesarean history, singleton ≥ 37 weeks' gestation with a pre-labour caesarean) and 10 (all women with single cephalic pregnancy < 37 weeks' gestation with a pre-labour caesarean) contributed to the largest increase in caesarean sections⁴⁹. In Jakarta, Robson classification analysis in the largest public hospital in the country revealed that Robson groups 1 (nulliparous women, singleton ≥ 37 weeks' gestation in spontaneous labour), 3 (multiparous women with no caesarean history, singleton ≥ 37 weeks' gestation in spontaneous labour), and 10 (all women with single cephalic pregnancy < 37 weeks' gestation) were the largest contributors to the caesarean section rate in the facility⁵⁰. Another study in Surabaya showed that women in Robson groups 2 (nulliparous women, singleton ≥ 37 weeks' gestation in pre-labour caesarean), 4 (multiparous without caesarean history, singleton ≥ 37 weeks' gestation with pre-labour caesarean) and 5 (multiparous with caesarean history, singleton ≥ 37 weeks' gestation with a pre-labour caesarean) were the largest contributors to caesarean section the health facilities⁵¹. This evidence suggests that caesarean

section increased worldwide and in Indonesia, is likely not medically indicated. Thus, potentially exposing avoidable risks to women during childbirth.

2.8 FACTORS DRIVING INCREASING CAESAREAN SECTION RATES AND ITS INEQUALITIES

Many studies globally have tried to understand the reasons for the increasing caesarean section globally^{52,53}. The Lancet series on optimising caesarean section use examined influencers on caesarean section uptake, both clinical and non-clinical factors²⁴. The non-clinical factors are categorised using an ecological framework and span to women's factors, communities, healthcare providers, and systems²⁴ (Figure 2.1). Unfortunately, to date, no studies have explored these non-clinical factors that are driving caesarean section rates in Indonesia.

Figure 2.2. Ecological framework on factors influencing caesarean section uptake.



From Lancet Series on optimising the use of caesarean section³⁶.

2.8.1 Women's and community's factors

Women play an important role in decision-making for caesarean section. While a number of studies show that many women prefer to have vaginal birth over a caesarean section, except when it is clinically indicated^{24,54,55}, some women do have a preference for a caesarean section. Women reported reasons for preferring caesarean section over vaginal birth were due to fear of labour pain, previous traumatic childbirth, fears of vaginal birth risks which include incontinence and pelvic floor damage, the convenience of scheduling birth for an auspicious day, and belief that caesarean section is safer, quick and painless compared to vaginal birth^{24,52,56,57}. Additionally, other socio-economic factors, such as preferences for a caesarean section may be more pronounced among wealthier women who may have access to such a choice as a caesarean section and the financial capability to afford it^{52,57}. Women also reported being influenced by their husbands or partners, which reported supporting caesarean due to perceived inconvenience compared to vaginal birth and also traumatic experiences of birth²⁴.

The media is increasingly found to be influencing women to have caesarean sections^{58–61}. In contemporary society, women often seek information through media and thus there is the growing influence of media on decision-making around the mode of birth. Elective caesarean section was portrayed as “controllable, convenient, fashionable, and modern”^{24,59,61}, which may influence women to have a caesarean section. During pregnancy and childbirth, severe maternal outcomes are uncommon occurrences²⁸. Thus positive media portrayal of caesarean section may cause people to mistakenly believe that caesarean sections are safe, which can result in the procedure being overused²⁸.

2.8.2 Healthcare providers' factors

Women often rely on their healthcare providers to provide advice on the best mode of birth, as they trust providers to be the most knowledgeable⁶². Unfortunately, this means that healthcare providers' preference towards caesarean section may influence women to undergo caesarean section^{24,63}. Despite this, healthcare providers identified women's requests for caesarean as an important factor in delivering un-medically indicated caesarean section to women²⁴. Healthcare providers can also schedule the caesarean section based on their availability and the competing schedule they have, instead of waiting for women to go into spontaneous labour, which can be unpredictable^{24,53,57,63}. For example, some studies show that caesarean section is often conducted during working hours, on weekdays, and especially on Fridays²⁴. Furthermore, healthcare providers perceived caesarean section as a “protective procedure” due to fears of blame and medical litigation if a complication occurs during vaginal birth, which consequently can impact on their reputation, professional career, and confidence^{24,53,57,63}. Healthcare providers may prefer performing caesarean sections over supporting

vaginal births due to their beliefs about childbirth, viewing caesarean sections as “quicker” and “safer” than vaginal birth, and fears associated with vaginal birth, including VBAC^{53,57,63}. Higher incentive for conducting caesarean section as compared to vaginal birth also influence providers to prefer caesarean section^{53,57,63}.

2.8.3 Health system’s factors

The health system may also influence women to have caesarean sections. The health system may play a role in encouraging healthcare providers and women to have caesarean section through financial structures with higher financial incentives for caesarean section compared to vaginal birth, logistical needs which include inadequacy of labour rooms and staff as well as expectations around time in using existing labour facilities, power relationships between midwives, obstetricians and other healthcare providers, and a culture of the medicalisation of birth^{24,63,64}. Healthcare providers’ decreasing skills in conducting assisted vaginal birth or vaginal birth in general, especially among junior doctors, have also been increasingly reported to increase the caesarean section²⁴.

2.9 CAESAREAN SECTION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT GOALS (SDGs)

In 2015, the United Nations established the Sustainable Development Goals (SDGs) to address an array of social, economic, and environmental issues, and to advance sustainable development⁶⁵. Out of the 17 goals set on SDGs, the third goal, “good health and well-being,” aims to ensure healthy lives and promote well-being for people of all ages⁶⁶. This includes targets, such as, reducing maternal mortality, preventing deaths of newborns and young children, and achieving universal health coverage⁶⁶. In the context of the caesarean section, the SDGs are relevant in terms of enhancing the health outcomes of women and babies.

As mentioned earlier, despite caesarean being a life-saving procedure, there are growing concerns that excessive use of caesarean may expose women and babies to iatrogenic harm and impact the long-term sustainability of maternity care provision²³. The SDGs prioritize the need for equitable access to quality healthcare services, meaning that safe and medically indicated caesarean procedures should be accessible and provided to women who medically need them. This is in line with Goal 3, which aims to ensure universal health coverage and access to essential healthcare services⁶⁶. Countries can help achieve the SDGs by encouraging evidence-based practices and employing methods to optimise caesarean section use⁶⁷. Furthermore, the SDGs also highlighted the interconnectedness of different goals and the need for an integrated approach to sustainable development. This means that efforts to address caesarean section rates should consider the broader social, economic, and environmental factors that influence its uptake⁶⁷. In summary, the SDGs

emphasize the importance of equitable access to quality healthcare services and the need to reduce unnecessary procedures. Ensuring the optimisation of caesarean use means supporting the process in achieving the sustainable development goals.

2.10 INTERVENTIONS ADDRESSING CAESAREAN SECTION

There is a need to address increasing caesarean section rates by implementing interventions to optimise caesarean section use. In 2018, WHO issued global guidance on non-clinical interventions to reduce unnecessary caesarean section use³¹. The recommendations are summarized into three key categories, which are interventions targeting women, targeting healthcare providers, and targeting health organizations, facilities, and systems. Table 2.2 lists the different interventions targeting the three key stakeholders.

Table 2.2. WHO recommendations on non-clinical interventions to reduce unnecessary caesarean section use.

Population	Type of intervention	Type of recommendation
Targeted at women	Childbirth training workshops, nurse-led applied relaxation training programs, psychosocial couple-based prevention programs, psychoeducation	Context-specific recommendation with targeted monitoring and evaluation
Targeted at healthcare providers	Implementation of evidence-based clinical practice guidelines along with either a) mandatory second opinion; or b) audit and feedback	<i>Mandatory second opinion:</i> context-specific recommendation <i>Audit and feedback:</i> recommended
Targeted at health organizations, facilities or systems	Collaborative midwife-obstetrician models of care, financial strategies (e.g. equalizing pay)	Context-specific recommendation (in the context of rigorous research)

*Adapted from WHO recommendations: Non-clinical interventions to reduce unnecessary caesarean sections, by World Health Organization³¹.

2.10.1 Interventions targeting women and families

Some interventions have targeted pregnant women and partners or families by delivering childbirth training workshops^{68,69}, which aim to provide women and partners with information regarding advantages and disadvantages across different modes of birth, stages of vaginal birth, how to cope with childbirth fear, managing labour pain, using different pain relief methods, and encouraging partners to be involved throughout the pregnancy and labour process^{68,69}. These types of interventions may reduce pregnant women's and partners' concerns around childbirth and prepare them for vaginal birth. When women and partners are provided with knowledge, they may feel more

confident in their ability to have a vaginal birth, and this may reduce women's requests for a caesarean section. However, there are mixed results reported: some studies targeting women alone or with their partner have been reported to reduce caesarean section risk and increase spontaneous vaginal birth (low-certainty evidence)⁷⁰.

2.10.2 Interventions targeting healthcare providers

Several interventions targeting healthcare providers have also been implemented aiming to optimise caesarean section use, such as the implementation of clinical guidelines combined with either mandatory secondary opinion, audit and feedback, and local opinion leader to healthcare providers⁷¹⁻⁷³. Through mandatory secondary opinion and local opinion leaders, additional layers are placed to review healthcare providers' decisions for the caesarean section^{71,72}. This additional layer of reviews may catalyse adherence of healthcare providers to offer women the most appropriate modes of birth based on guidelines and medical indication instead of healthcare providers preference. Additionally, implementation of audit and feedback, such as through the Robson classification process, can be a method for assessing if healthcare providers' practices have resulted in an appropriate distribution of caesarean sections across different groups of women. When a combination of interventions is implemented, healthcare providers' recommendations around the mode of birth will be regularly monitored and assessed, which may optimise caesarean sections use. Interventions targeting healthcare providers also had mixed results: few studies reported reducing overall caesarean section and elective caesarean section rates, which include implementation of clinical guidelines combined with either mandatory secondary opinion, audit and feedback, and local opinion leader to healthcare providers (high certainty of evidence)⁷⁰.

2.10.3 Interventions targeting organisations, facilities, and health systems

Some interventions have been implemented to address factors relevant to organisations, facilities, and health system factors. Many of these relate to equalising incentives for healthcare providers and hospitals for both caesarean section and vaginal birth^{70,74}. Having equal financial incentives across both modes of birth may reduce the incidence of caesarean section that is incentivised due to financial benefits. Another challenge that may drive healthcare providers' preference towards caesarean section is difficulties in balancing different tasks, such as surgery schedule, outpatient attendance, and personal responsibilities⁷⁵. In the United States of America, implementation of a collaborative midwifery-laborist care has been reported as a potential intervention in addressing caesarean section rates⁷⁵. The collaborative-midwifery laborist model of care proposes care provided primarily by midwives, with 24-hour back-up from an obstetrician who provides in-house labour and childbirth care without other competing clinical duties. Implementing a collaborative-midwifery laborist model

of care model decreased the competition of other clinical duties for obstetricians. It was proposed that this model may increase the tolerance and patience of obstetricians in waiting for vaginal birth stages, which in turn may decrease caesarean section rates. There are mixed results on these interventions, however implementation of collaborative care during labour (midwife and obstetrician collaboration), care was reported to reduce primary caesarean section (low certainty evidence)⁷⁰.

2.10.4 Interventions targeting financial, regulatory, and legislative structures

Opiyo et al (2020) have reviewed interventions targeting financial, legislative, and regulatory structures to optimise caesarean section use⁷⁴. The review included 16 studies from six different countries on payment methods for health workers and organisations (equalising financial incentives, diagnosis-related groups, global payment system, etc.) as well as regulatory and legislative interventions, which include legislatively imposed guidelines for healthcare providers, multi-faceted strategies to control maternal request for caesarean section, and existing policies in place⁷⁴. The impact of these interventions however is inconclusive due to the inconsistency of effects and low quality of evidence⁷⁴.

2.11 GAPS IN INTERVENTION EVIDENCE TO OPTIMISE CAESAREAN SECTION USE

Different types of interventions aimed at optimising caesarean sections use have been trialled globally with mixed results^{70,74}. The reasons for this limited success may be due to the multifactorial nature of the driving forces of the increase in the caesarean section itself, which includes multi-level reasons from different stakeholders – women, healthcare providers, and health systems^{52,53,56,57,63}. The reviews conducted by Chen et al (2018) and Opiyo et al (2020) in investigating the effectiveness of caesarean section interventions highlight the importance of understanding the priorities, preferences, and perspectives of the different stakeholders around birth and interventions that target them^{70,74}. A gap however remains on what aspects and processes from the interventions may contribute to the successful interventions. In the guidelines, the WHO highlighted the uncertainty in the effects of the interventions due to the mixed effectiveness of the study conducted on the guidelines³¹. WHO emphasized the complex challenges in reducing unnecessary caesarean sections, where a single component of interventions was proven to be not ideal to optimise caesarean sections use³¹. Complex multifactorial or multi-component nature of interventions is needed to potentially promote the reduction of caesarean sections at health facilities³¹. There is a need to understand the mechanisms involved that may lead to the success or failure of intervention and enable future researchers to consider the design features (process and outcomes) likely to lead to success, including for multi-component interventions to optimize the use of caesarean section. This will facilitate policymakers

and researchers to design and implement context-specific, efficient, and potentially successful interventions to optimize caesarean section use.

2.12 RESEARCH GAPS IDENTIFIED IN INDONESIA

Based on the literature that I have discussed in this chapter, I have identified two main research gaps in relation to caesarean section in Indonesia to be the focus of this PhD. These two gaps are the influences and decision-making facing women in Indonesia in relation to decisions about caesarean section and a better understanding of intervention components that may contribute to the success in optimising caesarean section use.

2.12.1 Research gap 1. Factors influencing decision making around caesarean in Indonesia

Despite its importance, few studies in Indonesia have examined the factors contributing to increasing caesarean section rates and its inequalities. Existing studies in Indonesia have only examined the quantitative association of caesarean, where the odds of caesarean section are increased in women with pregnancy complications, a higher number of ANC visits, and previous caesarean section^{76–78}, and also the Robson classification analysis^{49–51}. However, there is currently no research that has examined women, partners, and healthcare providers' opinions, perceived barriers, and drivers affecting caesareans section use in Indonesia. An improved understanding of these different perspectives may lead to effective and efficient policies in optimising caesarean use and reducing inequalities in Indonesia.

The influence of the COVID-19 pandemic in the country should also be understood further to see if any factors may change the preferences and perceptions around caesarean for women, partners, and healthcare providers. Online media provides a unique opportunity to explore these changes and to understand how shared cultural values and norms on caesarean have been represented during this event. This analysis has not been conducted in the country. This highlights the need to conduct these analyses and assess how representations of caesarean in the media have changed due to the COVID-19 pandemic and how these may influence changes in preferences and decision-making around caesarean. The result of these analyses could inform policymakers in improving information dissemination around caesareans and births in Indonesia.

2.12.2 Research gap 2. Interventions to optimise the use of caesarean section

It is also crucial to develop and implement interventions and programmes to optimise the caesarean section use. As mentioned earlier, there are many caesarean section interventions that have been launched and trialled in several countries, aimed at reducing and optimising caesarean use⁷⁰. The

meta-analysis conducted by Chen et al in 2018, investigating effective interventions to optimise caesarean section use in 18 countries, has found 29 intervention studies targeting three different participant groups: women, healthcare providers, and health systems⁷⁰. These interventions span from childbirth education for women and partners, additional layers of feedback and review for healthcare providers before deciding on caesarean, and equalising financial incentives between caesarean and vaginal birth at a health system level⁷⁰. The WHO has also recommended a range of different interventions targeting women, healthcare providers, and health systems to optimise caesarean use³¹.

The evidence of effectiveness among these interventions, however, is mixed⁷⁰ and more research is needed to understand which factors affect the effectiveness of caesarean interventions. A gap remains on what aspects and processes from the implemented interventions may contribute to successful interventions.

2.13 CHAPTER 2 SUMMARY

To summarise, global trends of caesarean section are increasing in Indonesia, with widening inequalities on who receive the caesarean section. There is a need to understand the influences and factors driving this increase and inequalities. However, limited study in Indonesia regarding caesarean section. I found two main gaps in research and literature on a caesarean section in Indonesia:

1. The absence of an understanding of how women decide to have a caesarean section.
2. The intervention components that may be helpful to optimise caesarean section use in the country.

In this PhD, I address these two gaps to provide more evidence on caesarean section in the country.

But before that, in chapter 3, I will explain the maternal health context in Indonesia to build an understanding of the context for the readers.

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CHAPTER THREE

Background

*Overview of the health system and maternal health
in Indonesia*

3.1 CHAPTER 3 PREAMBLE

In the previous chapter, I defined and positioned the caesarean section issues globally and in Indonesia and the gap in caesarean section research in Indonesia. Before proceeding further, this chapter will give an overview of Indonesia's health system. This includes the maternity care system, health system financing, referral system, maternity health status and efforts that have been implemented to improve maternal health in the country.

3.2 OVERVIEW OF THE HEALTH SYSTEM IN INDONESIA

3.2.1 Maternity care system

The health system in Indonesia is a mixture of public (government-funded) and private healthcare services. Women can choose to go to private or public facilities for their maternity care, which often depends on their financial capability. Rich and educated women often go straight to private facilities, as they are seen to have better quality care and services compared to private facilities¹. Conversely, for financial reasons, women of low socioeconomic status prefer to access public health facilities¹. The public facilities are stratified into four different layers: at the village, sub-district, district, and provincial or national levels².

The village level has different services available in women can access to get their maternity care², which include *Polindes*, *Poskesdes*, *Pustu* and *Posyandu*². *Polindes* (*pondok bersalin desa*, literally, village maternity hut) is a hut where women can get antenatal care (ANC) and give birth with midwives². *Poskesdes* (*pos kesehatan desa*) are village-based health posts, providing basic care services and health promotion by community health workers². *Pustu* (*Puskesmas Pembantu*), are village-based primary health centres, where the people living in the village can get access to healthcare from health extension workers, like midwives, nutritionists, and vaccinators at the village level, but do not provide birthing facilities². Lastly, the *Posyandu* (*pos pelayanan terpadu*), literally, integrated services posts are health posts offering vaccination services to children and maternity care of ANC and postnatal care (PNC), without birth facilities, and often in a village hall or public-owned places².

At the sub-district level, primary health centres offer the first point of care for any health issues, including maternity care, such as contraception, ANC, birth, and PNC². Some of the primary health centres at the sub-district level have Basic Emergency Obstetrics and Neonatal Care (BEmONC)³ capabilities. Instrumental birth, caesarean section, or ultrasound, however, is not available at this level

of facility². When emergencies or risks occur during pregnancy, birth, and postpartum, women will be referred to the first referral hospital at the district level, or a second referral hospital at the provincial or national level to receive appropriate care². These referral hospitals are Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) facilities, where caesarean section is available². The referral hospitals can be both public and private health facilities.

3.2.2 Health system financing

Health system financing is a major issue for caesarean section. There is considerable inequality in the distribution of healthcare resources and facilities in Indonesia, which prompted the government to implement significant health financial reforms over the years. In 1997, as the economic crisis hit the country, the Indonesian government created the Social Safety Net Health Card for people accessing healthcare⁴. In 2004, the National Social Security system was established to strengthen access to healthcare by creating *Askeskin* (*Asuransi Kesehatan untuk Keluarga Miskin*), literally, health insurance for the poor in 2005 and transformed into *Jamkesmas* in 2008 (*Jaminan Kesehatan Masyarakat*, literally, societal health insurance - by including the near poor)⁵⁻⁷. In 2011, *Jampersal* (*Jaminan Persalinan*, literally, birth insurance) was specially created to provide health insurance for all pregnant women in the country to access maternity care⁵⁻⁷.

The fragmented health insurance for the poor, near poor, and pregnant women, was merged in 2014, as an effort to build a universal health coverage system called *Jaminan Kesehatan Nasional* (JKN), to ensure that all populations regardless of socioeconomic status can access healthcare^{7,8}. JKN is operated by a single agency called *BPJS Kesehatan* (Social Security Agency for Health) and can be used in all public and most private facilities in Indonesia^{7,8}. With JKN, Indonesia aims to achieve universal health coverage for 98% of its population by 2024⁹. As of July 2023, JKN's subscription has reached 93%, reaching more than 250 millions of its population¹⁰. Several efforts have supported the implementation of JKN from both the demand and supply sides. On the demand side, JKN has been campaigning nationally to improve the awareness of the public¹¹. On the supply side, private facilities have been actively approached to expand service provider networks, ensure mandatory accreditation of health facilities, and restructure financing; the latter includes pilot implementation of a payment-for-performance scheme for primary health care, capitation, and Indonesia Case-Based Groups for provider payments¹¹.

JKN consists of the contributory payment by the participants and categorises them into non-contributory and contributory members¹¹. The non-contributory members are members who do not pay premiums and are mostly people from low socio-economic groups, while the contributory members are people who pay contributions who are either employed, employed without salary (i.e.,

freelancer) or non-employed¹¹. The employed members pay premiums of approximately 5% of their salary, while the non-employed can voluntarily pay their premiums based on their benefit package and co-payment preference¹¹. JKN covers all procedures and services provided to women during pregnancy, labour and birth, postnatal care and contraception⁸. This includes laboratory tests, ambulance services, surgical procedures, and many more⁸. Any mode of birth, both vaginal and caesarean section, is covered by JKN, as far as the caesarean sections are conducted based on medical indications (presence of fetal distress, obstructed labour, breech position, umbilical cord prolapse, asphyxia, and signs of birth defects)⁸. Therefore, by rule, women are unable to have elective caesarean.

The JKN services are categorized into three levels depending on the premiums paid¹¹. Level 3 corresponds to the lowest level, with less comfortable services (more than 10 beds in one room), while Level 1 corresponds to private luxury rooms¹¹. Women can upgrade their services during by paying an extra charge to the hospital. Currently, 64% of health facilities accepting JKN are private facilities¹¹. Private health facilities receive 3% and 5% higher fees for inpatient and outpatient services compared to public health facilities¹¹. The hospitals are paid through a case-based group payment system, while the primary centres are paid through the capitation system¹¹.

Throughout the implementation of JKN, out-of-pocket spending has significantly decreased from 59% of current health expenditure in 2010 to 34.8% in 2018¹¹. Although universal health coverage has made some progress in Indonesia, the country's health expenditure remains one of the lowest globally. In 2018, it accounted for only 2.9% of the GDP, significantly lower than the average of 5.7% for upper-middle-income countries¹¹. The percentage of government health spending in relation to current health expenditure nearly doubled from 25.7% in 2010 to 49.3% in 2018¹¹. Despite this increase, the amount spent per person is only around US\$49¹¹, which may compensate for quality care delivered to women and exacerbate inequality in healthcare access through JKN.

3.2.3 Maternal healthcare pathways

The JKN referral system requires women to have an appropriate referral from primary health care to specialist care, such as to obstetricians¹¹. Therefore, for the pathway to access care through JKN, women first need to visit facilities at village- or district levels, with the primary health centre as the first contact point. Women's maternity care is mainly provided by midwives at the primary health centre, with one general practitioner occasionally involved. If women have low-risk pregnancies and can give birth vaginally with midwives, they will stay at the village-level facilities or primary health centres throughout the pregnancy and birth. Ultrasound facilities are not available at primary health centres. Hence, women will need to go to other facilities, with a referral from the primary health

centres, to obtain an obstetric ultrasound that is covered by national health insurance, and return the result to the primary health centres. This referral is normally limited by number of visits or time. The Indonesian Ministry of Health recommends that women receive an ultrasound a minimum of three times in their pregnancy, once during each of the three trimesters¹².

When women's have or develop risk factors, the primary health centres will refer them to higher facilities. Depending on the availabilities of facilities and obstetricians, women can choose where they are referred to, which includes public and private health facilities. The referral could take place twice: for example, from primary health centres to district hospitals, and then, from the district hospital to provincial or national hospitals.

If women decide to use private health facilities, they can bypass the public system and go directly to the private health facilities, with either out-of-pocket expenses or a private health insurance scheme. Women cannot use JKN if they go to private facilities without a referral from a primary health centre¹¹.

3.3 OVERVIEW OF MATERNAL HEALTH IN INDONESIA

Indonesia is one of the countries with the largest number of births in the world. In 2021, the Indonesia Ministry of Health reported 4,438,141 births nationally¹³, which is ranked fifth globally after India, China, Nigeria, and Pakistan¹⁴. In 2020, Indonesia's fertility rate was 2.19, which is declining over the years, but is higher than the neighbouring countries, Malaysia and Singapore¹⁵. Indonesia's median birth interval is 65 months¹⁶. The median age at first marriage for Indonesian women is 20.8 years old, while the age at first birth is 22.4 years old¹⁶. The Demographic Health Survey 2017 reported that adolescent pregnancy in the country is 7%¹⁶, with individual studies reporting variation in rates between 10-12%^{17,18}.

3.3.1 Access and utilisation of maternal health services in Indonesia

Maternal health services in Indonesia are provided through antenatal, labour and birth and the postnatal period.

3.3.1.1 Antenatal care

ANC is provided through private and public facilities, including primary healthcare centres, maternity clinics and hospitals, with services provided by midwives, general practitioners, or directly obstetricians. Initially, the Indonesian government recommended that women attend at least four ANC visits. Since 2022, however, the government has increased the recommended ANC minimum to six visits¹³, which is still lower than the recommended eight ANC visits by WHO.

A minimum of two visits to ANC should happen in the first trimester, one visit in the second trimester and the last three visits in the third trimester. Additional ANC visits should be provided by a doctor in the first and third trimester^{13,19}. The visit in the first trimester aims to conduct screening for women for early detection of any identified pregnancy complications^{13,19}. The subsequent visits in the second trimester are to conduct follow-ups to manage identified complications^{13,19}. The purpose of the visits in the third trimester is to screen women for any birth-related risks and to decide on the most appropriate birthplace and mode of birth^{13,19}. Women can have more than one visit if needed and if there are any complications in the pregnancy^{13,19}.

The number of ANC visits in Indonesia ANC is relatively high. In 2021, 88.8% of women received four ANC visits, which is higher compared to the 85.0% target set by Indonesia's National Medium-Term Development Plan 2015-19¹³. However, this number decreased for women who received the recommended six ANC visits, which is only 63.0% nationally. Again, there are discrepancies across regions, where "West" Indonesia has a higher ANC rate compared to the "East".

3.3.1.2 Birth

The Indonesian government has implemented various efforts to ensure that women's births are assisted by skilled healthcare providers, which has proven to be almost successful statistically. In 2021, 90.9% of women gave birth at a healthcare facility, passing the Indonesia's National Medium-Term Development Plan 2020-2024 target of 89% at the national level¹³. This percentage is also an increase compared to 2021, where facility-based births were 86%. Despite this, again, the "West" have more women giving birth at healthcare facilities compared to the "East".

3.3.1.3 Postnatal care

PNC in Indonesia is recommended to occur four times, between 6 hours to 48 hours, between day 3 to 7, between day 8 to day 28, and between day 29 to day 42 postpartum¹³. During PNC, women are assessed to check if there are any complications following birth, to manage them, and to ensure women recover well. Unfortunately, social and emotional support and assistance with breastfeeding are not the focus of PNC visits in Indonesia. The PNC Like ANC, PNC visits are relatively high in the country, with 90.7% of women receiving four visits to PNC¹³.

3.3.2 Maternal mortality in Indonesia

Determining the maternal mortality rate in Indonesia is challenging, as the data are often estimates which can vary due to survey sampling methods and the inaccuracy of data. The maternal mortality ratio may be inaccurate due to misclassification of cause of death, recall bias, and missing data. Therefore, there might be slight differences in maternal mortality rate reported across institutions.

For this reason, I have decided to use the WHO data in this thesis. WHO defines maternal mortality as the death of a woman during pregnancy, labour, and within 42 days after birth²⁰.

Maternal mortality in Indonesia has decreased significantly over the last decades. In 2020, WHO reported Indonesia's maternal mortality rate to be 173 deaths per 100,000 live births²⁰, which is a more than 70% decrease from 1990 when the maternal mortality rate was 446 maternal deaths per 100,000 live births²¹. Despite this improvement, Indonesia's maternal mortality rate is far from achieving the UN Sustainable Development Goals, that is, a maternal mortality rate of 70 deaths per 100,000 live births by 2030 globally^{22,23}.

Indonesia's maternal mortality rate is lower than the global rate of 223 deaths per 100,000 live births in 2020²⁰. However, Indonesia has a higher maternal mortality rate compared to Southeast Asian regions, with a rate of 121 deaths per 100,000 live births in 2020²⁰; considerably much higher compared to neighbouring countries. For example, in 2020, Malaysia's rate is only 21 deaths, Thailand with only 29 deaths, and Singapore with 7 deaths per 100,000 live births²⁰. In 2021, the highest cases of maternal deaths in Indonesia are observed in East Java (1279 deaths), West Java (1204 deaths), Central Java (976 deaths), Banten (298 deaths), and West Sumatra (248 deaths)²⁰. These five provinces dominate in their maternal mortality rates even before COVID-19 started in 2020²⁰.

3.3.3 Causes of maternal mortality

In 2021, the Indonesia Ministry of Health reported that there were 7,389 maternal deaths in Indonesia, an increase from 4,627 deaths in 2020²⁰. The leading causes of maternal deaths in Indonesia were COVID-19 (2,982 deaths), postpartum haemorrhage or excessive bleeding (1,320 deaths), followed by hypertensive disorders (1,077 deaths), cardiovascular issues (335 deaths), sepsis (207 deaths)¹³.

Maternal mortality in Indonesia is influenced by factors, including access to good quality healthcare, social norms surrounding pregnancy and births, education, and poverty. Good quality maternal care is not always accessible to women, especially in rural areas. When it is readily accessible, women are not always able to access the health facility due to social norms, including gender inequalities, which limits women's authority in deciding to seek healthcare. The national study funded by USAID called Expanding Maternal and Newborn Survival (EMAS) confirmed that the direct causes of maternal mortality in Indonesia are the "three delays"²⁴, which include: (1) delay in the decision to seek care where women come in late-stage conditions, (2) delay in reaching care due to inappropriate first care or issues on referral, (3) delay in receiving appropriate care upon arrival to a health facility^{24,25}. Maternal mortality can be attributed to the three delays, which are often linked together²⁵. For

instance, a woman who fears childbirth may postpone seeking medical attention, and this may be compounded by the challenge of reaching a health facility due to distance or lack of transportation. Even if she manages to reach the facility, inadequate staffing or essential medicines may prevent her from receiving proper care.

Maternal mortality is decreasing in the country parallel to the increase in caesarean section. While it is difficult to find the link between a caesarean section increase and the decrease in maternal mortality, a caesarean section may have played a role in decreasing maternal mortality in Indonesia. Especially when medically indicated, caesarean section provides a safer birth alternative for women compared to vaginal birth. However, with rapidly increasing rates of caesarean section, and relatively slow progress on the reduction of maternal mortality in the country, caesarean section use should be revisited and monitored. This is to ensure that caesarean section is readily accessible for women who medically need it but ensuring that no caesarean section is conducted without medical indications.

3.3.4 Initiatives to improve maternal health in Indonesia

The Indonesian government has made substantial efforts in improving maternal health in the country^{7,26}. In 1987 and 1989, the Safe Motherhood and Village Midwife Program were implemented to train and deploy midwives to provide and improve maternal and child services throughout Indonesia, especially in rural areas^{7,26–28}. These two programs led to more than 50,000 new midwives being deployed across Indonesia, which were then sustained through “small birthing units” program called maternal huts (*Polindes*, introduced in Section 3.1.1), where at least one midwife was assigned to a village to provide services with full-time employment^{7,26–28}. These initiatives are still sustained until now.

In 1999, The Emergency Obstetric and Neonatal Care (EmONC) program was launched in the country to promote access to emergency obstetric care in the country, including a caesarean section facility⁷. The program not only includes the provision of health facilities resources but also training to improve the capacity of healthcare providers to provide emergency obstetric care. Following this, there were other programs implemented to improve the quality and coverage of maternal and child health services in the country, which includes the Making Pregnancy Safer strategy in 2000, Development of National 18 Health Indicators in 2008 and Expanding Maternal and Neonatal Survival Program in 2011^{7,24}. Despite the continuous initiatives and efforts in combating maternal health in Indonesia, it is difficult to evaluate the impact these initiatives have in reducing the high MMR in Indonesia due to limited evidence in the literature.

3.3.5 Challenges in improving maternal health in Indonesia

There are some challenges that remain to be addressed to improve the maternal health status in Indonesia. Inequitable access to healthcare is a persistent issue in the country, which makes it difficult for some women to access adequate healthcare services. The inequitable access is not only due to socioeconomic disparities but also unequal healthcare distribution throughout the regions. This can be seen from the provision and uptake of ANC, high rates of skilled birth attendants, and uptake of PNC being centralised in provinces located in West Indonesia¹³, as well as how more educated, rich, urban women having more caesarean sections compared to their counterparts²⁹. Many health facilities lack essential medicines and equipment, and they may not have enough qualified staff. This can lead to delays in receiving care, which can increase the risk of maternal death. The distribution of healthcare facilities and providers is still centralised in West Indonesia compared to East Indonesia¹³.

The relationships between healthcare providers and women in Indonesia are also important to consider as they impact access to maternal health care. The relationship between healthcare providers and women in Indonesia is still very unilateral, paternalistic, and hierarchical³⁰. Healthcare providers have dominant roles in decision-making on women's care³⁰. Healthcare providers occupy positions of authority and women are expected to show respect and deference to their medical practitioners³⁰. From the women's perspective, healthcare providers are often seen as "the know-it-all" by women and families³⁰, and women are expected to listen and follow what healthcare providers say and suggest. There is an overwhelming trust put in healthcare providers by women, and there is also a culture of "saving face" in the country, as women who express their opinions on their own care or question their healthcare provider's decisions or statements might be construed as an embarrassment and disrespect to the healthcare providers. More efforts are needed in the country to promote the practice of patient-centred care and shared decision-making between healthcare providers and women, especially in promoting trust, open communication, and mutual respect between healthcare providers and patients.

3.4 CHAPTER 3 SUMMARY

Indonesia's maternal health has improved significantly through massive initiatives and efforts by the government. Inequality and maternal mortality, however, still are persisting issues, despite the increase of caesarean sections in the country. Universal health care coverage, or JKN, was implemented to curb inequalities in access to healthcare across different socio-economic groups, however, its payment scheme may encourage caesarean section uptake by healthcare providers. Moreover, the hierarchical relationship between women and healthcare providers may not allow women to have shared decision-making regarding the mode of birth. In the next chapter, I will list the focus of my PhD study and explain the methods that I have used to answer my PhD research questions.

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CHAPTER FOUR

Overview of methods

4.1 CHAPTER 4 PREAMBLE

As elaborated on in the preceding chapters, rising rates of caesarean section are an ongoing challenge in Indonesia. There is limited to no evidence of the drivers of the caesarean section in Indonesia. Furthermore, there is still a lack of evidence on what factors influence the success of interventions that aim to optimise caesarean section use. At the time of starting my PhD, caesarean section was an under-researched field in Indonesia, despite the World Health Organization listing caesarean section as a global issue that needs to be addressed¹.

As described in Chapter 1, the overarching aim of my PhD is to understand potential drivers of caesarean section increase in Indonesia and potential non-clinical interventions that can be implemented to optimise caesarean section use in the country. The specific objectives of this PhD are to:

1. Explore how caesarean is discussed, portrayed, and represented by Indonesians in social media, specifically through Instagram;
2. Explore Indonesian women's preferences, priorities, and decision-making process around mode of birth;
3. Investigate the reasons for the mode of birth change from during pregnancy to birth;
4. Identify intervention components that result in successful implementation of interventions to optimise the use of caesarean section globally;

I have designed and conducted three distinct studies in my PhD. In the following sections, I will give an overview of the different methods I used on each of the study components. However, as the study methods used are substantially different across each of the study PhD components, each of the methods will be thoroughly explained *in situ* in subsequent Chapters 5-8, which are the chapters that provide the study findings in the form of papers for publication.

4.2 CONCEPTUAL FRAMEWORK

This PhD study has been designed based on multi-level factors affecting caesarean decision-making per Betrán et al (2018), which I have explained in detail in Chapter 2². Betrán et al (2018) reported that factors affecting the decision to undertake a caesarean section can be seen through three interconnected, and sometimes, overlapping levels of factors². The first level is the clinical factors affecting caesarean use, followed by three levels of non-clinical factors affecting caesarean section; which include women and communities, health professionals, and organisational and system factors².

In my PhD study, the multi-level factors model by Betrán et al (2018)² was used as a guide in designing the study aims, methods, and analysis. Due to the limitations of this PhD in terms of timing, scope, and funding, I have focused this PhD on collecting data from the women and community levels. This decision was made because women are at the heart of the decision-making process regarding childbirth. Focusing on women and the community offers a women-centred perspective and provides a holistic understanding of the factors contributing to the increase in caesarean sections, which is essential for developing effective strategies to optimise caesarean section use. During the analysis, however, the results were continuously assessed and mapped to examine what factors influence the decision-making process on the mode of birth at the level of women and communities, healthcare providers, and the healthcare organisation and system. This considers how both external and woman-driven factors contribute to increasing rates of caesarean section in Indonesia. Utilising this framework facilitated in-depth exploration, analysis, and understanding of what factors play a role in driving caesarean rates. In the end, through this model, I was able to identify enabling factors that should be in place at different levels to equip women with best mode of birth for their circumstances.

4.3 PHD COMPONENTS AND METHODS

The three PhD study components are social media analysis, primary data collection, and caesarean intervention analysis. The overview of the three PhD components can be seen in Table 4.1 below:

Table 4.1. Overview of study stages (aim, research questions, methodology, methods, participants/data, setting, ethics, outputs).

PhD Component	Study objectives	Research questions	Methodology	Methods	Participants/Data	Settings	Outputs
Study 1 – Social media analysis	1. Explore how caesarean is discussed, portrayed, and represented by Indonesians through Instagram	1. How caesarean is portrayed and represented by social media in Indonesia? 2. How has the portrayal and representation of caesarean changed during COVID-19 pandemic in Indonesia?	Mixed-methods study	Social media analysis utilising computational and qualitative content analysis	Instagram public posts using #caesareansection #hashtags in Bahasa Indonesia	Indonesia (online)	Chapter 5: 1 manuscript (under review)
Study 2 – Primary data collection	1. Explore women's preferences, priorities, and decision-making process around the mode of birth 2. Investigate the reasons for the mode of birth change from pregnancy to birth	1. What are women's preferences, experiences, and decision-making processes around the mode of birth in Indonesia? 2. What factors influence women's mode of birth change?	Qualitative longitudinal study	Repeat qualitative in-depth interviews (first interview on women's third trimester and second interview in postpartum period)	Pregnant women on third trimester pregnancy (27-40 weeks)	Special Capital Region of Jakarta, Indonesia	Chapter 6: 1 manuscript (under review)
Study 3 – Caesarean intervention analysis	1. Identify intervention components that result in the successful implementation of interventions to optimise the use of caesarean section	1. What are the key features that are aligned with successful intervention implementation for interventions optimising the use of caesarean section?	Mixed methods study	Qualitative comparative analysis	Studies that assess intervention to optimise caesarean section use and consist of process evaluation components	Global context (not confined to Indonesia)	Chapter 7 and 8: 2 manuscripts (published in BMC Public Health and BMC Health Services Research)

4.3.1 Study 1 – Social media analysis

The aim of this component is to answer the first objective of my PhD: Explore how caesarean is discussed, portrayed, and represented by Indonesians in social media through Instagram. Instagram was used as our platform of observation, as it is the most used social media platform in Indonesia³. As is the case with other health issues, it is possible that popular perceptions of caesarean are influenced by social media⁴⁻⁶. Investigating media representation of caesarean allowed me to explore how the shared cultural norms and values relating to caesarean are constructed and articulated⁴. Instagram is also a unique platform for examining the kind of information that Indonesian society is exposed to in relation to caesarean section, and how it may potentially influence the caesarean section perceptions on the country. The specific research questions for this social media analysis are:

1. How is caesarean portrayed and represented by social media in Indonesia?
2. How has the portrayal and representation of caesarean changed during the COVID-19 pandemic in Indonesia?

I downloaded Instagram public posts using caesarean section #hashtags in Bahasa Indonesia using an established software called 4KStogram. I analysed the data using a mixed-methods approach, specifically computational and qualitative content analysis. More detail on the study methods for this component is provided in Chapter 5.

4.3.2 Study 2 – Primary qualitative data collection

This second component addressed two objectives of this PhD: to explore Indonesian women's preferences, priorities, and decision-making process around the mode of birth, and investigate the reasons for the mode of birth change from pregnancy to birth. To address these two objectives, I formulated two research questions:

1. What are women's preferences, experiences, and decision-making processes around the mode of birth in Indonesia?
2. What factors influence the change in women's mode of birth?

To answer this research question, this study adopts a qualitative longitudinal approach using in-depth interviews⁷ with pregnant women. Initially, I wanted to approach women, their partners, and their healthcare providers. However, due to the limitation of time, scope, and funding, I have decided to focus on the women, as the main recipient of caesarean procedure. Exploring women's preferences and decision-making process on mode birth is imperative in understanding drivers to

caesarean increase and designing potential interventions to optimise its use. The in-depth interviews were conducted in the Special Capital Region of Jakarta which is located in Western Indonesia, the region with the highest increase in the percentage of caesarean section in Indonesia⁸. I interviewed women twice, once during their third trimester of pregnancy (27-40 weeks of gestational age), and secondly when they were in the post-partum period (4-6 weeks post birth). This repeat interview is conducted to capture how the mode of birth selection may change from the end of pregnancy to birth. All the interviews were audio-recorded, transcribed verbatim, and analysed using a reflexive thematic analysis approach. More details of study methods are provided in Chapter 6.

4.3.3 Study 3 – Caesarean intervention analysis

The last component of this PhD study addressed the last objective: Identify intervention components that result in the successful implementation of interventions to optimise the use of caesarean section. As mentioned in Chapter 2, several studies have tried to implement and trial interventions to optimise the use of caesarean, however, the evidence surrounding its impact is mixed⁹. There is a need to understand what features and processes lead to the successful implementation of caesarean interventions. In filling this gap, this PhD study utilised qualitative comparative analysis (QCA) to investigate intervention components that potentially trigger the successful implementation of interventions aimed to optimise caesarean section use. The specific research question for this study component is:

1. What are the key features that are aligned with successful intervention implementation for interventions optimising the use of caesarean section?

QCA is a relatively new evidence synthesis approach that bridges quantitative and qualitative methodology. I conducted the QCA in six stages as recommended by Thomas et al¹⁰, and more detail can be found in Chapters 7 and 8. This QCA was not specific to Indonesia and papers from all over the world were included.

4.4 CHAPTER 4 SUMMARY

To summarise, my PhD aimed to understand potential drivers of caesarean section increase in Indonesia and potential interventions that can be implemented to optimise caesarean section use.

To address my PhD objectives, I designed three distinct study components for my PhD: social media analysis, primary data collection, and caesarean intervention analysis. As the methods for these components greatly vary from each other, this chapter provides an overview of the methods, to give a brief introduction to the range of methods used in this study. More detailed steps on study methods and procedures can be found in the results chapters (Chapters 5-8).

4.5 CHAPTER 4 REFERENCES

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CHAPTER FIVE

Manuscript 1

*The portrayal of caesarean section on Indonesian
Instagram: a mixed-methods social media
analysis*

5.1 CHAPTER 5 PREAMBLE

Optimising caesarean section use in the country requires an examination of factors contributing to its use. Despite this, as discussed in Chapter 2, one of the main gaps in understanding the increase in caesarean sections in Indonesia is the limited understanding of social influencers. As is the case with other health issues, it is possible that popular perceptions of caesarean section are influenced by social media. Trends and data on social media can provide insights and potential pathways for public health advocacy and policy changes. Investigating media representation of the caesarean section allows us to explore how the shared cultural norms and values relating to the caesarean section are constructed and articulated. Therefore, social media analysis opens opportunities to understand how such content may collectively influence perceptions and preferences around the caesarean section in society.

In this chapter, I report findings from the first component of my PhD study: social media analysis. I explored the portrayal and representation of the caesarean section in Indonesia using social media analysis on Instagram. As I started this study during the COVID-19 pandemic, I could compare the portrayal and representation of caesarean sections before and during the COVID-19 pandemic to explore any changes in caesarean section representation. I examined 9,978 Instagram public posts using caesarean section #hashtags in Bahasa Indonesia. These Instagram posts were analysed at the surface level using computational and in-depth level using qualitative content analysis. The manuscript of this social media analysis study was submitted to the Journal of Medical Internet Research in February 2023 and is currently under review.

Citation:

Zahroh, R.I., Cheong, M., Hazfiarini, A., Vazquez-Corona, M., Ekawati, F., Emilia, O., Homer, C.S.E, Bétran, A.P., Bohren, M.A. The portrayal of caesarean section on Indonesian Instagram: a mixed-methods social media analysis. Under review: Journal of Medical Internet Research; submitted February 2023.

5.2 INTRODUCTION

Caesarean section rates are increasing rapidly worldwide^{1,2}. Although WHO does not recommend an ideal caesarean section rate at the population level, in 2015, WHO stated that caesarean section rates higher than 10% are not associated with reductions in maternal and newborn mortality³⁻⁵. Mirroring global trends, Indonesia's caesarean section rates are likewise increasing, reaching more than 17% in 2017, with stark contrasts across the socioeconomic spectrum^{6,7}. Women with higher education had a higher proportion of caesarean section (33.4%) compared with less educated women (9.3%), demonstrating a situation of both over- and under-use of caesarean section in Indonesia^{6,7}. The reasons for the rise of caesarean section rates are multiple, but non-clinical factors – which may include societal perceptions, influences, and misinformation – have been increasingly implicated^{8,9}. Therefore, there is an urgent need to understand what social factors are driving these rates to optimise the use of caesarean sections in Indonesia.

More than half of the global population uses social media, and evidence suggests that exposure to information on social media may predict future health behaviour^{10,11}. For example, young adults' exposure to tobacco use on social media has been correlated with future smoking behaviour¹⁰. Therefore, trends and data on social media can provide insights and potential pathways for public health advocacy and policy changes^{12,13}. Information about pregnancy and birth is widely available on social media, but less is understood about what information women are exposed to that may influence their preferences. Previous studies conducted in Brazil and Spain explored the representation of caesarean section in women's magazines and found that caesarean section was portrayed neutrally, but the associated long-term risks were often inaccurately represented as lower than expected^{14,15}. A study on Googling caesarean section in Brazil also found that limited, unreliable, and incomplete information about caesarean section is shared online¹⁶. In contrast, a more recent social media study on Mexican media Facebook pages found that caesarean section was not promoted over vaginal birth and the information shared about caesarean section risks was mostly accurate; however, some comments rejected evidence about caesarean section risks, some defended the choice of caesarean section as a mode of birth, while others stigmatised women who underwent caesarean section¹⁷.

While these social media studies have provided important insights on how caesarean section is portrayed through media in Latin America and Europe, to our knowledge, no studies have been conducted to explore how caesarean section is portrayed in Asia, the region with the second highest rates of increase in caesarean section¹. Caesarean section in Asia is predicted to increase continuously

and is projected to reach above 50% by 2030¹⁸. The absence of effective interventions in reversing caesarean section trends in limited resource settings may drain resources that cause an insufficient or unsafe provision of caesarean section and consequently increase morbidity and mortality.

Instagram is one of the most popular social media platforms, with 1 billion active users globally¹⁹. In Indonesia, Instagram holds the largest share of users and the most popular social media platform in 2022, with over 173 million active users^{20,21}. Most people who use Instagram in Indonesia are women of reproductive age, aged between 18 to 44 years old²¹. Instagram is also the most popular social media platform among Indonesian influencers (users with large followers and well-established credibility, which makes them able to influence others, aided by a considerably large audience)²². Analysing images and associated text related to the caesarean section shared on Instagram may provide an understanding of the types of content that users are exposed to in relation to the mode of birth. Therefore, this study aimed to explore how the caesarean section is portrayed on Indonesian Instagram.

5.3 METHODS

5.3.1 Study design

We adopted a mixed-methods approach, using both quantitative and qualitative analysis. The quantitative analysis focuses on surface-level data, such as the frequency of words mentioned, which does not require any subjective interpretation²³. The qualitative content analysis focuses on the latent content: the underlying meanings of text as subjectively interpreted by the authors²⁴. The mixed-methods approach allowed us to conduct an in-depth analysis of the portrayal of caesarean section at the surface and interpretative levels.

5.3.2 Data source, data collection, and sampling

The data source is public Instagram posts that use caesarean section #hashtags. #hashtags are a feature on Instagram for users to specify a topic, emotion, or context of a posted image and text caption (hereafter referred to as 'posts')²⁵. #hashtags allow other users to search for and view relevant posts, even if they do not follow a specific user account²⁶. To identify relevant caesarean section posts, we searched for eighteen #hashtags comprised of different terms and spellings in Bahasa Indonesia (Appendix 5.1 presents the #hashtags list).

We retrieved all public Instagram posts using the specified #hashtags that were posted over a three-year period between 31 August 2018 and 31 August 2021. Based on the date posted, we categorised two time periods: "before COVID-19" (before 11 March 2020, when WHO declared the COVID-19

pandemic²⁷ and “during COVID-19” (on and after 11 March 2020), to explore if the portrayal of caesarean section changed during COVID-19. We used 4K Stogram to download and assemble the dataset of public Instagram posts. 4K Stogram is a program that can download images and videos posted on Instagram users’ feeds or search for #hashtags and other search strings, which has been used in previous social media research^{28–30}. Posts with video content were not downloaded, as the methods of analysis are different due to the dynamicity (compared to a static image). Therefore, the dataset in this study only encompasses posted images, their caption text, and any associated metadata of the post, including the date of posts.

The downloaded posts were merged to remove duplicates, for example, if there were users who used multiple #hashtags in a single post. The merged dataset was then analysed quantitatively to ascertain the frequency of emerging image subjects, objects, and words used. In order to establish the validity of our quantitative methodology, 20 posts were randomly selected from each month using R programming software³¹, for further qualitative analysis to explore emerging themes.

5.3.3 Data analysis

5.3.3.1 *Quantitative analysis*

In order to conduct a large-scale analysis of the posted images, we utilised Microsoft Azure Cognitive Services³² to extract the attributes of the posted images. Microsoft Azure Cognitive Services provides an application programming interface (API) for ‘cloud-based’ artificial intelligence algorithms to be easily used by software developers and researchers without requiring machine-learning expertise. We used the Computer Vision API from Cognitive Services to extract objects found within a post’s image, which can be associated with a caesarean section, including buildings, people, animals, settings, food, etc. Additionally, the content tags and most dominant colours used within these images were also extracted to understand the meanings that may be carried by the post. This is because colours may attract attention, carry specific meanings, communicate information and evoke certain emotions, motivations, or memories in the viewers³³. We used the optical character recognition feature of the Computer Vision API to extract text captured within the photos (e.g., signboards, labels). We accessed these Azure APIs using Python to process and extract the data from the posted images.

We conducted descriptive statistical analysis by quantifying the most frequent objects, content tags, and colours appearing on the extracted images. Comparisons between the pre- and post-COVID-19 periods were tested using the two-proportion z-test (left-tailed test). Natural language processing was also conducted to analyse the extracted text from the image using a text mining approach, by examining the type of words frequently mentioned and clustered together to identify the type of

topics or themes present in the posts. We visualised the word clusters using co-occurrence and correlation networks³⁴: in other words, the prevalence of words and their connections with other words (i.e., if they appear in the same post). The co-occurrence network was limited to those above 50 occurrences for clarity in identifying relationships. Fifty occurrences were chosen as larger or smaller occurrences (>50 or <50), as showing too many or too few networks, making it difficult to see the connection between words. We examined correlation networks with coefficient > 0.8, as coefficient equal to 1 means word always appear together. These analyses were conducted using the R programming platform³¹, using with *widyr* package, with graphs plotted with *ggplot2*, *igraph* and *ggraph* packages³⁵.

5.3.3.2 Qualitative analysis

Qualitative content analysis was used to analyse randomly sampled posts. The sampled posts were gathered by randomly sampling 20 posts each month, for a total of 720 posts. The unit of analysis for the qualitative content analysis was an individual post's image and its caption text. First, we developed the codebook, adapting from a previous study of *#HookaLife* (public health-related issues in smoking hookahs or waterpipes) on Instagram³⁶. We coded the posts to the initial domains (definition can be seen on Table 5.1): metadata and post-type, advertisements, health messages, birth stories, descriptive content of image, content of caption, and tags, and positionality towards caesarean section. The initial codebook was tested by two authors by independently coding 10% of the sample dataset. We discussed any coding discrepancies, and the codebook was revised accordingly. Using the revised codebook, one author coded all the posts, the coding was then reviewed by another author.

Table 5.1. List of coding domains used for extraction.

Coding domains used for extracting Instagram posts
Metadata and post-type We extracted the location of the post owners (if available), the date of the post (reclassified as pre- or during the COVID-19 pandemic), and the type of the post (birth story, health message, or advertisement).
Advertisements We categorised posts that were advertisements, operationally defined as posts aimed to promote services or products relevant to the caesarean section. This included the type of products offered and the type of institutions doing the advertising (commercial companies, private or public health facilities, individual health workers or sellers, and individual non-sellers).
Health messages We classified posts aimed at sharing or giving health information (i.e., tips, indications, overview) as health messages. The health messages related to the caesarean section were coded based on the content of health messages and the type of poster. Where health messages were posted by healthcare providers or a health facility account (as claimed by the accounts), we categorized these

posts as “health messages from trusted sources”. If accounts other than healthcare providers or health facilities posted content, we classified these as “health messages from non-trusted sources”.

Birth stories

We coded women’s birth stories, including types of health facilities where women gave birth and their mode of birth. We inductively analysed the story told by women on the image post caption.

Descriptive content of image, caption, and tags

We extracted type of image posted (people or objects), identified demographic characteristics of the people posted (gender, age, profession), post captions, #hashtags, and emotions portrayed based on the image and text. This data was then summarised and thematically analysed to explore the identified themes discussed in the text, including emotions and overall meaning of the caption together with the image.

Positionality about caesarean section

We defined positionality about caesarean section as whether the post explicitly or implicitly promoted or encouraged caesarean section. The specific definitions for each category were:

- Explicitly encouraging: poster strongly promoted or encouraged caesarean section irrespective of medical facts or conditions
- Implicitly encouraging: poster talked about caesarean section benefits or a having a positive experience with caesarean section
- Neutral: poster did not preference either caesarean section or vaginal birth
- Implicitly discouraging: poster discussed caesarean section risks or having a negative experience with caesarean section
- Explicitly discouraging: poster discouraged caesarean section use

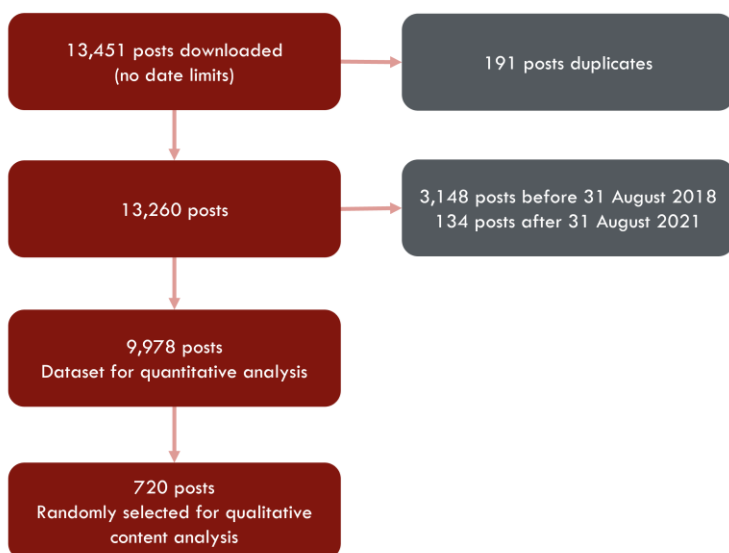
5.3.4 Ethical considerations

Ethics approval was received from the Office of Research Ethics and Integrity at The University of Melbourne (Project ID: 22782); see Appendix 5.2. This study only used publicly available data on Instagram posted by non-private accounts. To download the posts, we created a new Instagram account with no followers or users following it to ensure that private account posts were not inadvertently downloaded. Further, the creation of a new account ensured that any algorithmic recommendations generated by the Instagram platform did not influence data collection. Social media sites such as Instagram are prone to exhibit a ‘filter bubble’³⁷ effect, which uses one’s social network and past activities to personalise the sorts of content an end user sees. Privacy was ensured by anonymising posts prior to data analysis taking place and by adhering to best practices identified in ethics protocol (i.e., no Instagram account names and images were included in this manuscript) and by paraphrasing quotes used in the manuscript to avoid back translation and identification of the poster.

5.4 RESULTS

A total of 13,451 public Instagram posts were downloaded. After the removal of duplicates and posts outside of the study time frame, 9,978 posts remained, which were analysed quantitatively. Out of 9,978 posts, 720 were randomly selected to be analysed qualitatively (Figure 5.1).

Figure 5.1. Flowchart depicting data retrieval, cleaning, and sampling.



5.4.1 Quantitative results

5.4.1.1 Most frequent objects, content tags and colours

The three most frequent objects in caesarean section images were related to people (44.1%), texts (7.7%), and advertisement material (i.e., posters, flyers; 5.0%) (Appendix 5.3). The most frequent content tags were text (70.7%), suggesting that many caesarean section posts are used for sharing information. Women (17.4%) and babies (16.4%) were the most common types of people in the images. White (70.6%), grey (23.5%), black (12.8%), yellow (12.5%), and pink (7.9%) were the five most frequently used colours. There were statistically significant increases in the use of text, advertisement materials, and screenshots as the objects on images, with content tags showing that the use of infographics (i.e., illustrations, cartoon, design) and healthcare-related figures (i.e., medical equipment) were used more during the pandemic as compared to before the pandemic ($P<.05$) (Table 5.2). Brighter and warmer colours were also being used more often during COVID-19 compared to before COVID-19, such as yellow, green, and orange ($P<.05$) (Table 5.2).

Table 5.2. Statistical comparison on objects, content tags, colours, bigram and #hashtags trends of use before and during COVID-19 pandemic.

Trends of	Before COVID-19	During COVID-19	Ppre-cov* (%, n = 4,065)	Ppost-cov** (%, n = 5,913)	Z-score ***	P-value ****
Objects used on caesarean section images						
Person	2781	3795	68.41	64.18	4.38	P=1.00
Text	242	527	5.95	8.91	-5.45	P<.001
Advertisement material (i.e., posters, flyers)	83	411	2.04	6.95	-11.11	P<.001
Bottle	113	123	2.78	2.08	2.26	P=.99
Food	65	82	1.59	1.39	0.87	P=.81
Infant bed	80	43	1.97	0.72	5.52	P=1.00
Office supplies	27	73	0.66	1.24	-2.81	P=.003
Chair	30	51	0.74	0.86	-0.68	P=.25
Mammal	28	49	0.69	0.83	-0.79	P=.22
Dining table	48	26	1.18	0.44	4.24	P=1.00
Animal	30	41	0.74	0.69	0.26	P=.60
Bowl	49	16	1.21	0.27	5.70	P=1.00
Plant	16	41	0.39	0.69	-1.95	P=.02
Bed	22	28	0.54	0.47	0.47	P=.68
Emoji	8	33	0.19	0.56	-2.77	P=.003
Cup	20	13	0.49	0.22	2.33	P=.99
Fruit	16	16	0.39	0.27	0.86	P=.86
Glasses	9	21	0.22	0.36	-1.19	P=.12
Seating	9	17	0.22	0.29	-0.64	P=.26
Vegetable	20	5	0.49	0.08	4.00	P=1.00
Sports ball	1	23	0.03	0.39	-3.65	P<.001
Cell phone	9	13	0.22	0.22	0.02	P=.51
Broccoli	18	4	0.44	0.07	3.93	P=1.00
Tableware	12	9	0.29	0.15	1.53	P=.94

Flower	1	17	0.03	0.29	-3.04	P=.001
Content tags on caesarean section images						
Text	2521	4535	62.02	76.70	-15.83	P<.001
Person	2249	2448	55.33	41.40	13.69	P=1.00
Human face	1803	2107	44.35	35.63	8.77	P=1.00
Screenshot	1317	2504	32.40	42.35	-10.05	P<.001
Clothing	1625	1967	39.98	33.27	6.86	P=1.00
Indoor	1640	1383	40.34	23.39	18.11	P=1.00
Woman	837	902	20.59	15.25	6.90	P=1.00
Baby	938	697	23.08	11.79	14.97	P=1.00
Font	433	1053	10.65	17.81	-9.87	P<.001
Design	313	1049	7.70	17.74	-14.35	P<.001
Toddler	685	416	16.85	7.04	15.38	P=1.00
Child	720	356	17.71	6.02	18.50	P=1.00
Cartoon	236	799	5.81	13.51	-12.41	P<.001
Newborn	561	438	13.80	7.41	10.45	P=1.00
Wall	462	531	11.37	8.98	3.91	P=1.00
Smile	462	522	11.37	8.82	4.18	P=1.00
Girl	550	263	13.53	4.45	16.29	P=1.00
Room	245	469	6.03	7.93	-3.67	P<.001
Illustration	146	566	3.59	9.57	-11.40	P<.001
Food	422	265	10.38	4.48	11.44	P=1.00
Boy	403	283	9.91	4.79	9.95	P=1.00
Medical Equipment	240	410	5.90	6.93	-2.05	P=.02
Healthcare	207	378	5.09	6.39	-2.72	P=.003
Medical	197	410	4.85	6.93	-4.29	P<.001
Advertisement material (i.e., posters, flyers)	124	386	3.05	6.53	-7.75	P<.001
Dominant color used on caesarean section images						
White	3008	4038	74.0	68.29	6.15	P=1.00
Grey	1218	1129	29.96	19.09	12.58	P=1.00

Yellow	419	825	10.31	13.95	-5.42	P<.001
Black	645	633	15.87	10.71	7.58	P=1.00
Pink	330	459	8.12	7.76	0.65	P=.74
Green	152	406	3.74	6.87	-6.68	P<.001
Brown	418	279	10.28	4.72	10.71	P=1.00
Blue	178	175	4.38	2.96	3.77	P=1.00
Red	110	166	2.71	2.81	-0.30	P=.38
Orange	24	131	0.59	2.22	-6.45	P<.001
Teal	83	122	2.04	2.06	-0.07	P=.47
Purple	6	16	0.15	0.27	-1.29	P=.09
Notable bigram topic on caesarean section images						
Products or words related to faster caesarean section recovery	2895	1266	71.22	21.41	49.58	P=1.00
Healthcare providers	0	524	0.0	8.86	-19.49	P<.001
Hospitals	770	652	18.94	11.03	11.11	P=1.00
Mental health	0	302	0.0	5.11	-14.63	P<.001
Breastfeeding	53	53	1.30	0.89	1.95	P=.97
Post-partum weight loss	56	93	1.38	1.57	-0.79	P=.22
Notable #hashtags topic on caesarean section posts						
Ultrasound	106	2399	2.61	40.57	-42.97	P<.001
Feng Shui services	56	110	1.38	1.86	-1.85	P=.03
Comfortable birth/painless labour	278	2358	6.84	39.88	-36.78	P<.001
ERACS technique*	0	124	0.0	2.09	-9.29	P<.001
Contractions/labour pain	242	16	5.95	0.27	17.57	P=1.00
Cheap labour	22	27	0.54	0.46	0.59	P=.72
Vaginal birth after caesarean section (VBAC)	87	307	2.14	5.19	-7.69	P<.001
Advertised products	2748	2746	67.6	46.44	20.88	P=1.00
Caesarean section wound	3002	1199	73.85	20.38	53.26	P=1.00
Medicine for caesarean section	2363	560	58.13	9.47	52.48	P=1.00
Natural medicine of caesarean section	1133	145	27.87	2.45	37.33	P=1.00
Speedy recovery of caesarean section	1296	89	31.88	1.51	43.12	P=1.00

Healthcare providers	304	2974	7.48	50.30	-44.74	P<.001
Hospitals	917	1460	22.56	24.69	-2.46	P=.007

Ppre-cov: proportion of used before COVID-19 pandemic; **Ppost-cov: proportion of used during COVID-19 pandemic;*We used left-tailed test for this analysis, which means a null hypothesis is use before COVID-19 pandemic is greater or equal to during COVID-19 pandemic ($H_0 : P_{pre-cov} - P_{post-cov} \geq 0$), while our alternative hypothesis is use before COVID-19 pandemic is less than during COVID-19 pandemic ($H_a : P_{pre-cov} - P_{post-cov} < 0$). We set the significance level as $\alpha=0.05$, and the critical value for a left-tailed test is $Z = -1.64$. Therefore, the rejection region for this left-tailed test is $R = \{Z: Z < -1.64\}$. ****P<.05 means that trends of use are greater during COVID-19 compared to before ($P_{pre-cov} < P_{post-cov}$), while $P \geq .05$ refers that there is no evidence to reject null hypothesis, which means that $P_{pre-cov} > P_{post-cov}$ or no difference between pre- and during COVID-19 other than due to chance.*

Analysing the co-occurrence of words showed the word pairs that occurred most often in the text (Figure 5.2 panel A). The co-occurrence network showed three main word clusters representing 1) advertisements, 2) health facilities and providers, and 3) health messages. The advertisements cluster seems to be the dominant cluster (red shade, Figure 5.2 Panel A). We examined the correlation of these words further by looking at words that occur more often together than with other words (Figure 5.2 panel B). From this network, we can see clearer groups of words that suggest that Instagram posts using caesarean section posts were often related to advertisements (red shade), health facilities and providers (purple shade), and health messages (green shade). A glossary containing a sample of words in Bahasa with English translations can be found in Appendix 5.4.

Occurrence > 50

Coeficient > 0.8

A

B

Legend for Panel A:
 - Occurrence: 100 (small), 200 (medium), 300 (large), 400 (very large), 500 (largest)
 - Correlation: 0.85 (light pink), 0.90 (medium pink), 0.95 (dark pink), 1.00 (red)

Legend for Panel B:
 - Occurrence: 100 (small), 200 (medium), 300 (large), 400 (very large), 500 (largest)
 - Correlation: 0.85 (light pink), 0.90 (medium pink), 0.95 (dark pink), 1.00 (red)

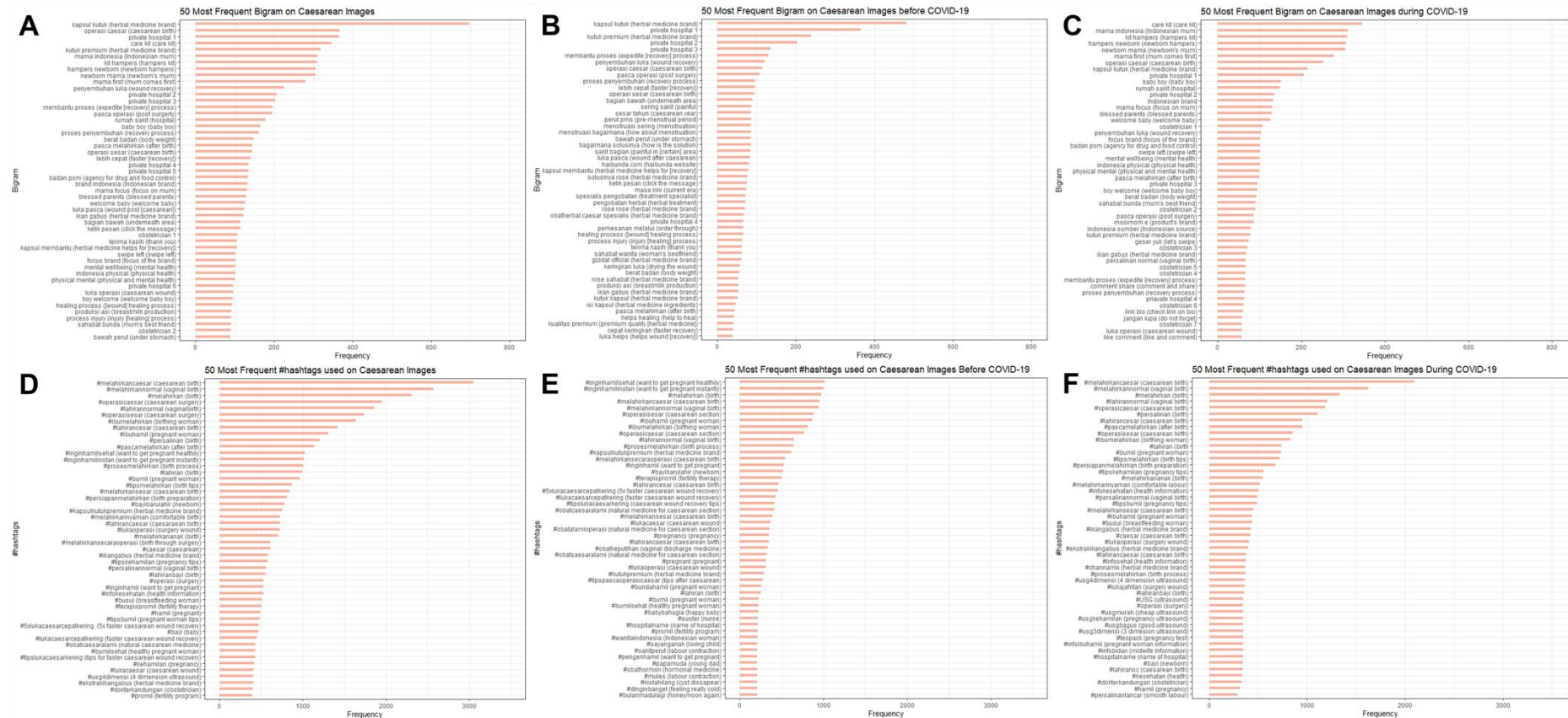
Category Legend:
 - Advertisements (pink circle)
 - Healthcare providers or facilities (purple circle)
 - Health messages or tips (green circle)

5.4.1.3 Most frequent text appearing on caesarean section images

71

results to network analysis (Figure 5.3 Panel A, B, C). The 50 most frequent bigrams that appeared on caesarean section images are mostly related to advertisements (31.0%) of products to accelerate caesarean section recovery (Figure 5.3 Panel A). Private hospital and obstetricians' names (anonymised in our visualisation in the interest of privacy) also appeared on this list (17.1%), as well as words referring to mum or parents (12.5%), care kits for women and newborns (9.6%), different words of caesarean section (5.1%), baby (3.9%), mental and physical wellbeing (3.0%), post-partum weight loss (1.5%), breastfeeding (0.9%), and others (3.2%) which consisted of typical Instagram posts (i.e., 'type message', 'swipe left', 'thank you'). The trends of observed bigrams before and during COVID-19 were similar, except for bigrams related to healthcare providers' names and mental well-being, which were more common during COVID-19 compared to before COVID-19 ($P<.05$) (Table 5.2; Figure 5.3 Panel C).

Figure 5.3. 50 most used bigram and #hashtags on caesarean section images (n all period = 9,978 posts, n before pandemic = 4065, n during pandemic = 5913).



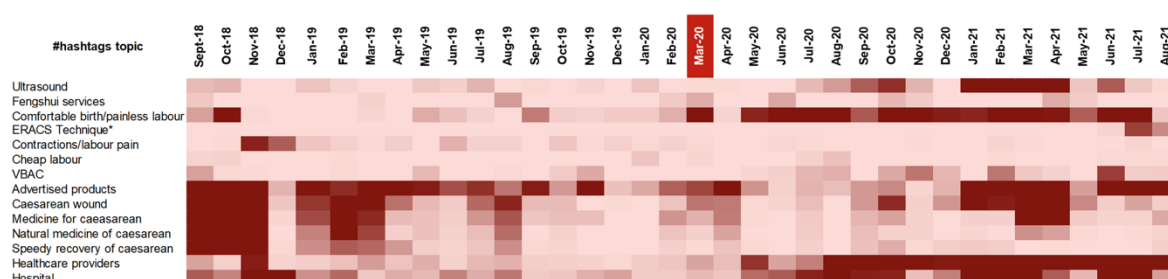
Panel A, B, and C showed the most frequent bigram appearing on caesarean section images. Bigram is text comprised of two words; Panel D, E, and F showed the most frequent #hashtags used on caesarean section posts.

5.4.1.4 Most frequent #hashtags appearing on caesarean section images

The #hashtags used on the caesarean section were related to fertility, pregnancy, birth, postpartum, caesarean section recovery, and others (i.e., health information and obstetrician names) (Figure 5.3 Panel D, E, F). The most frequent #hashtags across all periods were related to different words of birth (81.5%), with 27.0% referring to birth preparation and 7.3% referring to comfortable birth (Figure 5.3 Panel D). Mode of birth was also commonly tagged, with 50.0% of posts tagging vaginal birth, while all posts tagged caesarean section. There were 51.0% #hashtags related to pregnancy, with 36.3% referring to pregnant women, 10.7% to pregnancy tips, and 4.1% to ultrasound. Forty-six per cent #hashtags were about caesarean section recovery, and specifically, 17.5% mentioned products to boost recovery post-caesarean section, 13.6% referring to faster recovery of caesarean section wound, 11.4% about caesarean section wound, and 4.3% referring to natural medicine for caesarean section recovery. There were 34.8% about fertility, and 29.1% #hashtags related to postpartum, mentioning words about newborns (12.5%), postpartum care (11.4%), and breastfeeding (5.1%). Two kinds of #hashtags worth highlighting are comfortable labour and speedy recovery of caesarean section – in which tags passed the message that painless labour through caesarean section and fast wound recovery of caesarean section was possible. When comparing the 50 most frequent #hashtags before and during COVID-19, we found that the themes of speedy recovery post-caesarean section were more often observed before COVID-19 (Figure 5.3 Panel E), while comfortable and smooth labour were more often observed during COVID-19 (Figure 5.3 Panel F).

As the “comfortable labour” tag seems to appear more during COVID-19, we were motivated to explore the trends of notable #hashtags used across time (Figure 5.4). The heatmap in Figure 5.4 (darker colours denoting higher frequency) confirmed that #hashtags related to comfortable labour, including painless labour, as well as a clinical technique called *Enhanced Recovery After Caesarean Surgery or ERACS* (aspects of peri-operative care that may accelerate patient recovery, including for caesarean section), ultrasound, name of healthcare providers and hospitals seems to be more prominent after COVID-19 pandemic started. The two-proportions z-test analysis (Table 5.2) also confirmed further that there were statistically significant increases ($P<.05$) of #hashtags related to ultrasound, fengshui services, comfortable or painless labour, ERACS technique, vaginal birth after caesarean section (VBAC), name of hospitals and healthcare providers. On the other hand, #hashtags related to caesarean section recovery were seen to have greater numbers before the pandemic or no difference across the two periods other than chance ($P=1.00$).

Figure 5.4. Trends of notable #hashtags over time (month to month) during the study period dates.



11 March 2020 was the day the WHO declared the COVID-19 pandemic ²⁷.

5.4.2 Qualitative results

Of 720 posts randomly sampled for qualitative analysis, advertisements were the most common post (47.5%), followed by health messages (33.5%), and birth stories (23.6%). There were 295 (54.9%) posts that used caesarean section #hashtags yet did not cover topics in relation to caesarean section. Appendix 5.5 presents the themes emerging from these posts.

Among the remaining 325 (45.1%) posts that mentioned caesarean section explicitly, 189 (58.1%) posts were before the COVID-19 pandemic, and 136 (41.9%) posts were during the pandemic. Only 23.4% of posts referred to the location of the poster, most of whom were from the Jakarta Metropolitan Area (60.5%), followed by East Java (10.5%), West Sumatra (10.5%), South Sumatra (6.6%), Central Java (6.6%), Kalimantan (2.6%), South Sulawesi (1.3%), and Papua (1.3%).

5.4.2.1 Advertisements

Advertisement posts typically aimed to advertise products or services and were posted by commercial companies, individual sellers, or private health facilities. Almost half of the advertisement posts (47.0%) were accompanied by health messages from non-trusted sources and endorsement by influencers through their experiences using the products or services.

5.4.2.1.1 Advertisements by commercial companies or individual sellers

Most products were advertised by commercial companies or individual sellers; these were consumable or wearable products for women to allegedly boost recovery after caesarean section. Most consumable products advertised were herbal medicine, nutritional supplements, treatment oils, and drinks, while the wearable products were “health” belts and pendants for speedy recovery. Maternity corsets were also advertised specifically to reduce pain post-caesarean section and to promote body shape return to pre-birth. Services offered included *Feng Shui* (Chinese geomancy)

consultations to choose an auspicious day of birth, and free pregnancy and health consultations with non-healthcare providers, such as sellers of a renowned honey brand. Themes from the images, captions, and tags when promoting consumables and wearable products tried to persuade women by claiming the products were natural, safe, trusted, effective, and internationally recognised to heal the caesarean section wound faster – thus emphasising that quick post caesarean section recovery is possible. These products were also advertised to have multiple benefits, like balancing women's hormones to promote regular menstruation after caesarean section, alleviating pain post-caesarean section, cleaning the remaining blood in the uterus, and making the uterus return to its normal shape. Themes more commonly identified from advertising of services were related to the importance of birth timing, suggesting that auspicious days and golden hours of birth impacted the person's harmony of life, their future luck, and purported intelligence of the baby – encouraging planned caesarean section uptake to achieve this.

There was no change to the kind of products and ways of advertising by commercial companies and individual sellers before and during the pandemic. Postpartum fitness coach advertisements were the exception: they were not observed before the pandemic. Themes identified from such advertisements included norms on the postpartum body, expectations that women would be able to return to their body shape prior to pregnancy and birth, and encouragement to women to lose their "pregnancy fat". Posters mentioned that the adage that said woman with caesarean section cannot undo their belly size is a myth and excuse. Posters used *#PostPartumBody*, *#FatBurn*, *#FitMom*, *#langsing* (which means slim), and *#sexy* tags on their posts. The emotions portrayed in the advertisement's posts were positive, happy, and persuasive, except when risks were mentioned, which could be serious and tense. Positionality about caesarean section when advertising products and services were mostly explicitly and implicitly encouraging caesarean section to women (79.8%) by emphasising that fast recovery is possible, neutral (14.3%), and implicitly discouraging caesarean section (5.9%) when risks were emphasised.

5.4.2.1.2 Advertisements by private health facilities

Posts by private facilities typically aim to promote their services. Some posts (11.6%) promoted caesarean section uptake by giving discounts on caesarean section rates in light of Mother's Day celebrations or other events (e.g., Indonesian Independence Day). These advertisements relayed the message to women that "painless and comfortable labour" (referring to caesarean section) and "cheap and affordable caesarean section" could be done at their facilities. The other posts were trying to promote their facilities by congratulating women for giving birth (all through caesarean section) at their facility and offering free consultations through WhatsApp. The positionality about

the caesarean section on these posts was neutral, mainly promoting their facility instead of the caesarean section specifically.

Similar advertisement posts by private hospitals or clinics to promote their facilities were observed before and during COVID-19. During the pandemic, some posts (30.2%) were also implicitly or explicitly encouraging caesarean section by posting about women's caesarean section experiences at their facilities and posting images of healthcare providers in surgery rooms post-caesarean section. The tags used on these posts include caesarean section related tags, with no tags related to vaginal birth – but instead *#SafeLabour*, *#ComfortableLabour* and *#AlwaysSafe* – relaying an overall message that caesarean section is safe to be done despite the COVID-19 pandemic. Other posts (48.8%) were more neutral on caesarean section positionality and were advertising their facility through advertising seminars on caesarean section myths, thanking women who have delivered at their facility, and showing the caesarean section process. The emotions portrayed on advertisement posts posted by private health facilities were positive and happy overall across all periods.

5.4.2.2 Health messages

The health message posts aimed to share information with women and the larger public. About half (52.3%) of health messages were posted by healthcare providers or health facilities – which we refer to as “health messages from trusted sources”, while 41 (47.7%) health messages were posted by non-healthcare providers or facilities, and these are referred as “health messages from non-trusted sources”. The non-trusted category of messages was often posted by personal or community groups (like parenting, birth, breastfeeding, etc.) accounts. Some had commercial purposes, such as promoting their Instagram accounts or certain products, but were not as explicit as posts categorised in the advertisement section.

The themes covered in health messages from trusted and non-trusted sources were typically similar before and during COVID-19. Posts often covered three main themes. Firstly, general facts and figures for childbirth and postpartum (shared sparingly), including indications, benefits, risks, and process of vaginal birth and caesarean section, VBAC, danger of traditional medicines and services, as well as mode of birth selection. Secondly, childbirth tips to share with women include information on ways to induce labour, how to turn the baby's position, preparation before caesarean section, preventing infection post-labour, and supporting caesarean section recovery. And lastly, motivational messages and encouragement to women to address social stigma related to caesarean section. Messages motivated women ‘not to be sad’ if they cannot undergo vaginal birth, reminding women that all modes of birth are valid and that they should be kind to other women. During the pandemic, there were reminders to undergo COVID-19 testing in the third trimester to deliver care

for women safely, adherences to COVID-19 protocol, how to use masks appropriately, childbirth prices during pandemic, and information on national health insurance payment for caesarean section. Interestingly, like quantitative analysis (Figure 5.4), more posts were found promoting caesarean section during the pandemic in the context of ERACS (Enhanced Recovery After caesarean section Surgery) techniques, which facilities and providers advertised as an “advanced technique of caesarean section” and “painless and quick recovery labour”. Providers claimed that, with caesarean section ERACS, women were able to return to their normal activity within 24 hours. Compared to before COVID-19, more posts from healthcare providers and facilities were found during COVID-19.

The positionality about caesarean section of these posts was neutral (34.5%), with some (34.5%) explicitly (mostly on promoting ERACS and risks of undergoing vaginal birth) and implicitly encouraging (when addressing the stigma associated with caesarean section), and some (31.0%) implicitly discouraging caesarean section when talking about caesarean section indication and risks. Overall, emotions were positive, informative, and motivational to women.

5.4.2.3 Birth stories

Birth stories were mostly told by women telling their birth journey, with a few posted by their partners. Around 28.4% posts mentioned women gave birth at private health facilities, while 9.0% posts mentioned at public health facilities. Mode of birth was mentioned in almost all (96.7%) posts, where 93.9% posts capturing women with caesarean section, and only 7 posts mentioned VBAC.

More than half posts (78.4%) depicted caesarean section as a positive labour experience, while 21.5% posts portrayed struggles, frustration, hopelessness, anxiety, pain, and sadness women felt on their birth journey. The positionality towards caesarean section was mostly neutral (47.5%), followed by explicitly or implicitly encouraging caesarean section when women had negative labour experiences (38.5%), and lastly explicitly or implicitly discouraging caesarean section (13.9%), when they did not desire caesarean section yet ended up with one or talking about caesarean section pain. Five themes were identified related to caesarean section from the birth stories before and during the pandemic, which are caesarean section as an effort, VBAC as pride, standing up against stigma, relationships with healthcare providers, and powerless over birth (Table 5.3).

Table 5.3. Themes emerging from birth stories.

Caesarean section as an effort

Overall, through their birth stories, women expressed their pride in their effort to undergo caesarean section for their babies by utilising *#perjuangan* (literally, fight or effort) *#hashtags*. While some women had elected to have a caesarean section during pregnancy, some women desired vaginal birth and were heartbroken, sad, nervous, and anxious when their healthcare providers indicated they should undergo a caesarean section. After birth, however, women felt gratitude to have had a safe birth—women expressed that their priority was their baby’s safety.

VBAC as a pride

Women and partners portrayed pride in being able to undergo VBAC. Most posts used *#VBACsuccess* to illustrate this. Women and partners mentioned that they had greatly planned for women to undergo VBAC, by looking for healthcare providers who were pro-VBAC, attending VBAC classes, praying to God, and changing their lifestyle. One woman wrote: *“Thank God for allowing me to have VBAC with a birth gap of less than 2 years. I believe effort will not betray results or results will not betray effort”*. While one woman described her experiences as the most horrible, painful, traumatic, and terrifying night of her life, others are more positive about their VBAC journey.

Standing up against stigma

Some posts portrayed stigma towards women who had caesarean sections. Firstly, women and her partners felt upset with communities that devalued women with caesarean sections, saying women who underwent caesarean section were not “complete” or “strong” women, they were “too posh to push”, and would not love their babies like women with vaginal birth. Many posts advocated that all modes of birth were the same, that having a caesarean section also required women’s sacrifice and pain, and reminding other women to be kind to women who underwent caesarean section. One woman wrote on her post: *“I am waiting for you in a different way, I meet you through incision instead of pushing you out, I am waiting for you just like other mothers, I am a mom although I undergo caesarean section”*. Women desired acknowledgment of their experience instead of being undermined just because they underwent caesarean section. Some posts also mentioned expectations around body shape after a caesarean section. Women reported desiring to lose weight and to return to their “normal” bodies utilising *#fashionable* and *#BackToSlimBody* *#hashtags*. They depicted their efforts in returning to their body before birth by posting their pictures while exercising. One woman said: *“Anxious and sad seeing old photos, I want to be skinny again”*.

Relationships with healthcare providers

Many women who underwent caesarean section expressed trust in healthcare providers' recommendation on the mode of birth and gratitude to healthcare providers for helping during labour. Women who desired VBAC, however, said that they often met healthcare providers who were pro caesarean section; thus, doctors were highly against VBAC, telling them about scary stories of VBAC consequences, and making them feel rejected. Women who perceived experiences of caesarean section or VBAC as not pleasant were often upset with their patient-doctor relations. Their providers were reported to blame her for not being able to bear the pain and push the baby out, and she mentioned she would look for a doctor that is pro caesarean section in the future.

Powerless over birth

Some women said that they were not knowledgeable about birth before, felt powerless over birth, and ended up on the surgery table: *“I used to be an uneducated person, helpless about giving birth, and end up on surgery table”*. Women reported regretting having caesarean section and wishing to undergo VBAC in the future. They felt it was important to empower themselves, to ensure that their body and mind were ready for the labour process, including accepting any mode of birth she would end up taking.

5.5 DISCUSSION

Our study aimed to explore how the caesarean section was portrayed on Indonesian Instagram. We downloaded 13,451 public Instagram posts, analysed 9,978 posts quantitatively, and 720 qualitatively. Quantitative analysis revealed that caesarean section posts mostly used people, text, and advertisement materials (i.e, flyer, poster) in their images. The use of text and advertisement materials increased during the pandemic, suggesting that information sharing on the caesarean section has increased over time. We also found the use of infographics, brighter colours, and #hahstags related to comfortable or painless birth, ERACS, VBAC, *Feng Shui* services, ultrasound, hospitals, and healthcare providers were more prominent during the pandemic. Qualitative analysis identified that caesarean section was portrayed on Instagram through advertisements, health messages, and birth stories. Posts were trying to advertise products to women for faster caesarean section recovery and services to offer women consultation in choosing an auspicious day for childbirth. Some private health facilities and healthcare providers explicitly promote caesarean section by giving discounts for caesarean section and promoting ERACS for comfortable, painless birth and faster recovery. Women felt powerless during their birth, unheard, and unsupported by their providers. There were also many posts that aimed to debunk the stigma attributed to women who underwent caesarean section.

Advertisement posts were the most common type of posts across time. Interestingly, we found two different types of sources of advertisements on Instagram. Firstly, advertisements are posted by healthcare providers and facilities, and secondly, by companies or individual sellers. The ethics code of doctors in Indonesia³⁸ and Ministry Health Regulations on advertisement and publication of health services³⁹ do not allow healthcare providers in Indonesia to intentionally advertise their services, any products, or techniques for profit making, including promoting discounts on health service delivery^{38,39}. However, this study has conversely shown that private health facilities and healthcare providers actively promoted their services on Instagram, including caesarean section. For example, cheap caesarean section was promoted and became accessible to women on Mother's Day and Indonesian Independence Day. Interestingly there are no posts posted by public health facilities or providers working in the public sector, which could be due to the need to generate profit in the private sector⁴⁰. The regulations from the Ministry of Health provide detailed consequences that providers may receive when they violate it, from administrative action to revocation of practice license³⁹. However, given how these advertisements are actively promoted on Instagram, more efforts are needed to monitor the advertisement of services and medical procedure by healthcare providers and facilities in Indonesia and enforce the regulations when necessary.

Our study also revealed that healthcare providers and facilities actively promoted caesarean section ERACS uptake. ERACS derives from ERAS (Enhanced Recovery After Surgery), in which the term was first used for patients undergoing colorectal surgery, as a series of evidence-based interventions used for perioperative care to accelerate patient recovery post-surgery⁴¹. The term has recently been adopted in obstetrics as ERACS⁴¹. The components of ERACS included preoperative patient education to improve patient involvement in managing their expectations and compliance to ERACS protocol, reduced hours of fasting, multimodal analgesia, limited use of opioids, and scheduled non-opioid analgesics and therapies to reduce pain⁴². However, in Indonesia, caesarean section ERACS was promoted as an “advanced” caesarean section technique claimed to expedite women’s recovery post-caesarean section within 24 hours and was accessible for women who want to have painless labour. We observed that inadequate information was shared regarding ERACS, where only benefits were mentioned without details on potential risks and under which indications women were able to receive or suggested to receive ERACS. This is similar to what we observed on information regarding the mode of birth, where we found health messages on Instagram did not give adequate information on the pros and cons of vaginal birth (including assisted and VBAC) and caesarean section. Sharing adequate and credible information on birth through social media will facilitate, enhance, and empower women to make informed decisions, as it may influence their preferences and behaviours at birth. Ongoing and proactive health information sharing from government organisations may also be needed to encounter bias in promoting caesarean section over vaginal birth.

The observed advertisements in this study could also lead to beliefs that caesarean section is better than vaginal birth. For example, our study observed that most products advertised on Instagram were trying to convey that a faster caesarean section is possible, and these products were “natural” medicine for caesarean section. *Feng Shui* practice was actively promoted, where selecting an auspicious day and time for labour is suggested for a better life for the baby^{8,43,44}. This practice encourages women to give birth on the chosen day and thus favours planned caesarean section. One woman who had an elective caesarean section at a private facility even shared a story that there were 24 other women in the queue waiting to have a caesarean section on that day as it was a “pretty” date (referring to 19/09/2019). Unbalanced ERACS promotion may also give the impression to women that painless birth with caesarean section ERACS is a better alternative compared to vaginal birth. Furthermore, the uncertainties and lack of control due to the COVID-19 pandemic may also exacerbate and shift women’s preferences to caesarean section compared to vaginal birth¹³. There is a need to counteract these unbalanced advertisements with more neutral and credible

information to women regarding the mode of birth to ensure that women can make an informed choice and participate actively in their care.

Our analysis shows that women may be exposed to misinformation about caesarean section on social media, and may have limited capacity to distinguish between trustworthy and untrustworthy sources of health information. Misconceptions can emerge from unregulated sources of information, with the potential for substantial impacts on behaviour and decision-making. While social media is not the only source of misinformation, it has a massive reach and capacity to influence health behaviours. For example, an analysis of diet and exercise on Instagram showed influencers actively promoted diet supplements and sportswear fashion as key to attaining ideal body shapes and improving happiness, which has the potential to negatively impact young people's mental and physical health and development⁴⁵. Similarly, WHO's recent report on exploitative marketing by the formula milk industry showed that women were persistently targeted using personalised approaches – including via social media influencers – to dissuade exclusive breastfeeding⁴⁶. This is despite the International Code of Marketing of Breast-milk Substitutes banning the advertisement of breastmilk substitutes to the general public⁴⁶. These examples show that similar to the caesarean section, health misinformation on social media is common, and more work is needed to combat health misinformation via evidence-based health communications and exploration of regulations to limit the spread of misinformation.

Furthermore, advertising is part of the consumerism societal model, where “selling more to make more profit” is non-negotiable, despite most of what is sold does not have evidence to support it. Alarming, the power of propaganda in advertisements in regard to birth is based on the notion of “maternal sacrifice”⁴⁷ - the fact that woman naturally put their baby's health as a priority. Maternal sacrifice has been long used to justify certain ideologies or practices, where women were given a choice, yet the maternal sacrifice idea was deployed to influence women in making the “right” choice, invoking women's guilt when one does not pursue it⁴⁷. Policies regulating advertisements for birth and their enforcement may be cornerstones to ensure women are exposed to credible information.

It is important to note that we found many posts with caesarean section #hashtags, yet unrelated to the caesarean section. Although these posts are not related to the caesarean section, the caesarean section #hashtags were possible to gain a wider audience, especially women in their reproductive age regardless of pregnancy status – a common phenomenon called #hashtags hijacking⁴⁸. This suggests that caesarean section-related #hashtags may be a popular #hashtag searched among women, which may prompt sellers and advertisers to use caesarean section #hashtags in their posts, as an

effective broadcast strategy. We also observed that caesarean section posts utilised partnerships with influencers to increase their posts' credibility, showing that “who says it” is more important than “what it says” in changing behaviour. Engaging influencers when delivering social-based media interventions may thus be imperative to promote visibility and change.

Lastly, we found some women felt devalued for undergoing caesarean section and were not considered “complete” mothers because they did not experience labour contractions. The existence of stigma attributed to caesarean section and increasing caesarean section seems paradoxical, however, this was also observed in Mexico, in which caesarean section was reported to be over 45%¹⁷. In Mexican Facebook pages, users commonly used derogatory terms to describe women who had caesarean sections and considered women who underwent vaginal birth as braver and stronger¹⁷. In Indonesia, sociocultural and religious beliefs may promote vaginal birth with limited intervention as the natural mode of birth⁴⁹. These beliefs, coupled with the recent rise of caesarean section in the country⁷, may result in the stigmatisation of women with caesarean section. We identified many posts that aimed to debunk the stigma placed on women who underwent caesarean section, indicating that there seems to be a shift in how society perceived caesarean section in recent years. Messages, however, need to be complete (including the pro and cons) and evidence-informed between the two modes of birth, to ensure that caesarean section is not unintentionally promoted as superior compared to vaginal birth.

5.5.1 Strengths and limitations of the study

To our knowledge, this is the first study exploring the portrayal of caesarean section in Indonesia through Instagram. It uses modern machine learning approaches, which enable us to analyse large quantities of data, and adopts a mixed-methods approach, which enables us to explore surface and in-depth level data. However, our study has some limitations. Jakarta was the predominant location of the posts, which is the wealthiest region of the country, where most business activities happen, and economic agglomeration occurs. People living in Jakarta have different access to healthcare, education, and the workforce. Thus, it is more difficult to generalise if the portrayal and discourse about the caesarean section is similar to other regions of Indonesia. This also means that the posters and people who contribute to, or are able to access the social media posts are people who can access internet and have the privilege to do so, which may exclude segments of the population with limited access to the internet or social media, such as older adults or those from lower socio-economic backgrounds. We are also unable to conduct facial analysis on images due to ethical considerations (anonymity, privacy, and credibility on emotion analysis), even though the most

frequent objects appearing in photos are people. Yet we have compensated via a thorough qualitative analysis to explore themes in depth.

5.5.2 Implications for future research and practice

More efforts are needed to regulate service advertisements by healthcare providers and facilities in the country and mobilise its enforcement to ensure that women receive credible and evidence-based information that is beneficial to them. There is also a need to promote and disseminate clear, transparent, factual, and unbiased information about the mode of birth on social media, including more research on the most efficient way to disseminate this information and what the impact is. More evidence is also needed to understand women's perceptions and preferences on different modes of birth in Indonesia. Additional studies to investigate how social media influences the mode of birth uptake will be useful in identifying areas of improvement in social media communication around birth.

5.6 CONCLUSION

Our study revealed how caesarean sections were portrayed in Indonesia through Instagram. Most Instagram posts about caesarean sections aimed to advertise products or services, which may influence women to perceive that caesarean section is a better alternative than vaginal birth and that inconveniences can be easily addressed. This study highlights the need for advertisement regulation and its enforcement around birth-related medical services and more health promotion aiming to provide accurate, balanced, and appropriate information for women regarding mode of birth.

5.7 CHAPTER 5 SUMMARY

In this chapter, I have presented the findings of my social media analysis on Instagram. The results show that the majority of posts related to caesareans are actually advertisements. The four highlights from this social media analysis relating to caesarean increase drivers are 1) the rise of ERACS during the pandemic; 2) The commodification of caesarean section in the country through discounts and ERACS; 3) violation of medical ethics in the promotion of caesarean; 4) Propagation on misinformation around caesarean through social media, where only benefits are mostly emphasised.

The use of such advertisement materials has increased during the pandemic. Interestingly, the use of infographics, brighter colours, and hashtags pertaining to comfortable or painless birth, ERACS, VBAC, Feng Shui services, ultrasound, hospitals, and healthcare providers were found to be more prominent during the pandemic than before the pandemic. These might be due to accompanying fears of birth due to fears of contracting COVID-19 and the effects of misinformation stating that all women need to give birth using caesarean section during the pandemic.

Through social media analysis, I found that caesarean section is highly commoditised in the country. Some private health facilities and healthcare providers explicitly promoted “affordable” caesareans by giving discounts on special days, like Mother’s Day and Indonesia Independence Day.

Furthermore, some private health facilities and providers also actively promoted the procedure, called “caesarean ERACS”, which was claimed to be an “advanced” caesarean technique. “Caesarean ERACS” was claimed to expedite women’s recovery post-caesarean within 24 hours and was accessible for women who want to have painless labour in private health facilities. On Instagram, ERACS was promoted as a comfortable and painless method of labour and giving birth. These promotions may influence women and society to perceive that caesarean section is painless, comfortable, and affordable. Many of these advertisements were also advertised by providers and facilities, violating the ethics code of medical conduct in Indonesia [Indonesian Medical Code of Ethics (articles 3 and 4 of 2012)³⁸ and Minister of Health Regulations (no 1787/Menkes/PER/XII/2010)³⁹]. Women were exposed to imbalanced information about caesarean section, over-emphasising the benefits, compared to limited information on risks associated with the procedure.

Some advertisement posts I found on Instagram also advertised “natural” products to promote recovery after a caesarean section. Services were also offered for women to choose an auspicious day to give birth, encouraging elective caesarean section uptake by women. These pervasive advertisements on the caesarean section highlight the need for regulations and enforcement on

birth-related advertisements. There needs to be more health promotion to provide unbiased, accurate, and appropriate information to women on social media.

The next chapter will present the results of the second study component of my PhD, which is the longitudinal qualitative study that aimed to explore women's preferences, priorities, and decision-making process around the mode of birth as well as investigate the reasons for the mode of birth change from pregnancy to birth.

5.8 CHAPTER 5 REFERENCES

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CHAPTER SIX

Manuscript 2

*Rising caesarean section rates and factors
affecting women's decision-making about mode
of birth in Indonesia: a longitudinal qualitative
study*

6.1 CHAPTER 6 PREAMBLE

Understanding the perceptions and preferences of women, partners, and health providers around decision-making around birth is vital to optimise the use of caesarean section in the country.

Exploring these perceptions and preferences helps to understand factors driving the increase of caesareans at these different societal levels, identify the appropriate interventions to optimise caesarean section use, and how to best implement it in specific contexts and settings. The WHO has emphasised the need to conduct formative research and understand women's perceptions and preferences on caesarean section before implementing interventions to optimise caesarean section use in any setting¹. As discussed in Chapter 2, however, there are no studies that have explored the decision-making process around caesarean section from the perspective of women in Indonesia.

This chapter presents the second study component of my PhD, which aimed to understand women's decision-making process regarding the mode of birth, including preferences and priorities. It also explored the reasons for changes in the mode of birth, from the end of pregnancy to birth. To explore how preferences changed (or not) over time, I conducted two in-depth interviews with the same women, firstly, during their third trimester of pregnancy and, secondly, in the postpartum period. I conducted this study in the Special Capital Region of Jakarta, as it is the region with the highest use of caesarean section in Indonesia. I recruited women who accessed private and public facilities as preferences on mode of birth may vary across these women's groups. A total of 28 women were included in the first interviews, with two lost to follow up for the second interviews, totalling 54 interviews for the study. The analysis was conducted by adopting the reflexive thematic analysis approach by Clarke and Braun². The manuscript of this primary qualitative study was submitted to BMJ Global Health in October 2023 and has been accepted for publication (currently in proofing stage).

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6.2 INTRODUCTION

Similar to global trends, the rate of caesarean section in Indonesia has increased rapidly from 1.6% in 1991 to 17.6% in 2017.³⁻⁵ While more recent statistics are not yet available, the Indonesia Social Security Administrator for Health (*BPJS Kesehatan*) reported that caesarean section contributed to the largest national insurance expenditure in 2019.⁶ The highest caesarean section rates were observed in Western Indonesia, the most affluent and developed regions.³ Increases in pre-labour caesarean section have been observed as women's socioeconomic status increased, especially in Western Indonesia.³ High caesarean section rates may result in unmet needs and unsafe provision of caesarean section, with potential harm to women and babies.⁷ Caesarean section also exposes women and babies to short and long-term risks.⁸ Women may experience surgical complications, chronic pain, subfertility, and adverse outcomes on future pregnancies.^{9,10} Surgical lacerations and increased risks of altered immune development, allergy and asthma may also affect babies.⁹ Therefore, optimising use of caesarean section is imperative to minimise risks for women and babies.

Enhanced Recovery After Caesarean Surgery (ERACS) - peri-operative care ostensibly to improve women's comfort and recovery from caesarean section - is also increasingly popular in Indonesia. There are no standardised ERACS clinical protocols nor consensus on the most effective ERACS components.^{11,12} However, what is advertised as ERACS are typically recommended evidence-based practices that should be implemented for all women receiving caesarean section, including antenatal education, breastfeeding preparation, reduced fasting time, prophylactic antibiotics, long-acting anaesthesia intra- and post-surgery, delayed cord clamping and skin-to-skin contact.^{11,13} In Indonesia, however, ERACS is actively advertised on social media by private health facilities and healthcare providers as an advanced method of caesarean section that is painless, comfortable, and results in faster recovery within 24 hours post-surgery.¹⁴ The spread of misinformation on ERACS may influence Indonesian women's preferences over caesarean section and further increase the rates in the country.

Decision-making around caesarean section is complex and includes interconnected clinical and non-clinical factors from women, communities, healthcare providers and system.^{10,15-17} Women may prefer caesarean section over vaginal birth due to fears of labour pain or perceived vaginal birth complications and see caesarean section as safer, quick, and more convenient.^{10,15,17} They may also be influenced by the news and social media, where caesarean section is presented as "convenient, fashionable, and modern"^{10,16} and ERACS is advertised as a good alternative to vaginal birth or more

fashionable than caesarean section without ERACS.¹⁴ Healthcare providers may influence women to have a caesarean section due to fear of litigation, perceptions that a caesarean section is the best and “a protective procedure”, low confidence to perform assisted vaginal birth, and convenience in scheduling birth.^{10,15} Lastly, the health system may influence decisions about caesarean section by giving higher financial incentives for healthcare providers to undertake caesarean section.^{10,15,16}

Given this complexity, the World Health Organization emphasises the importance of understanding the major drivers influencing preferences and decision-making for caesarean section before undertaking any intervention in any setting or country.¹ Previous research in other settings has explored how women’s preferences around mode of birth change throughout pregnancy;^{10,18–20} however, most studies using a longitudinal design have only focused on women with previous caesarean section.^{18,20,21} There remain gaps in understanding how women’s preferences for mode of birth may change throughout pregnancy and birth - regardless of their parity and caesarean section history. Furthermore, despite rising caesarean section rates and calls from Indonesian health authorities to optimise the use of caesarean section, to our knowledge, there are no studies about women’s perceptions and decision-making processes about mode of birth in Indonesia. Therefore, the aim of this study is to explore Indonesian women’s preferences and decision-making about the mode of birth, and how mode of birth preferences may change throughout pregnancy and birth.

6.3 METHODS

We conducted a longitudinal qualitative study using semi-structured in-depth interviews, interviewing women twice: during pregnancy and after birth. This manuscript is reported according to COREQ (COnsolidated criteria for REporting Qualitative research) Checklist (Appendix 6.1)²².

6.3.1 Study sites

The study was conducted in the Special Capital Region of Jakarta, the wealthiest and most metropolitan region in Western Indonesia with the highest caesarean section rates: 31.3% in 2017 (most recent data).³ In Indonesia, the healthcare system is a combination of public and private services. The national health insurance – *Jaminan Kesehatan Negara (JKN)* – covers all procedures in both public and private facilities during labour and birth, including both vaginal and caesarean section births, as long as the caesarean section is medically necessary.²³ Women who want to have a caesarean section at higher-level health facilities or hospitals with JKN coverage must obtain referrals from primary health centres, as primary health centres do not provide caesarean section. Under the JKN scheme, health facilities receive higher reimbursements for caesarean section

compared to vaginal births.²⁴ To explore perspectives of women with different socio-economic status, we recruited women accessing private health facilities in any districts of Jakarta and women accessing primary health centres (*Pusat Kesehatan Masyarakat; Puskesmas*) in two districts: (1) Johar Baru, the poorest and most populated district in Jakarta²⁵, and (2) Cempaka Putih, the richest district and most urbanised municipality in Central Jakarta.²⁵

6.3.2 Participants and data collection procedure

We adopted purposive sampling.²⁶ Women were eligible if they were at least 18 years old, accessing public or private health facilities in Jakarta, and in their third trimester of pregnancy (27-40 weeks; reported by women). We recruited women regardless of their parity and previous caesarean section history to understand if preferences about the mode of birth differed across different groups of women. We interviewed the same woman twice, in their third trimester of pregnancy and postpartum (4-8 weeks after birth), to understand how preferences for mode of birth may change from pregnancy to the time of birth. We did not interview women in the first and second trimesters because previous research has shown that birth preferences are typically not firmly established in early pregnancy, and there is also uncertainty regarding the preferred mode of birth during the first two trimesters.^{18,21}

We recruited pregnant women through posters circulated by researchers at primary health centres, WhatsApp groups hosted by the primary health centres for pregnant women, and social media (Facebook, WhatsApp, Instagram) for women accessing private facilities. We informed women about the two interviews at the time of the recruitment. Potential participants were asked to contact the first author (RIZ) to receive more details and confirm eligibility. Based on women's convenience, they were interviewed by WhatsApp, phone, Zoom, or in person at their homes or primary health centres.

All interviews were conducted by the first author (RIZ) in Bahasa Indonesia and took approximately 45-60 minutes. Another researcher (AH/MADM) was present during the interviews as an observer and note-taker to ensure that any challenges could be addressed before future interviews and to engage in participatory reflection. Field notes were written to collect information on settings, behaviour, actions, and interviewer's reflections.²⁷ All interviews were audio recorded. Participants referred researchers to other potentially eligible pregnant women to participate. We continued recruitment until data saturation was reached, decided through discussion within the research team, and defined as no new information discussed in the interviews.^{28,29}

Four weeks after each woman's expected due date, the first author contacted them to confirm that they had given birth and if they would like to schedule a second interview. We followed similar procedures from the first interview for the follow-up interview. One woman's baby died, and she was offered the opportunity for the second interview, noting that there would be no negative impacts if she declined. We determined a loss to follow up if interviews could not be arranged after three attempts.

6.3.3 Study instruments

We created the interview guides (Appendix 6.2) based on the Betrán et al (2018) ecological framework¹⁰ and Bohren et al (2019) formative protocol for caesarean section intervention preparation.³⁰ The first interview asked about women's preferences for different modes of birth across the pregnancy and factors considered when deciding the mode of birth. The second interview focused on women's birth journey, and for those women whose actual mode of birth is different from their preferred ones, we explored factors influencing this change. Before data collection, we conducted four pilot interviews with pregnant and non-pregnant women to test and finalise the guide.

6.3.4 Data analysis

Audio recordings were manually transcribed verbatim in Bahasa Indonesia, and a sample was reviewed by the second author (AH) for accuracy. Written field notes were integrated into the transcripts. We analysed the qualitative data in Bahasa Indonesia to maintain language nuance throughout the analysis. The first author (RIZ) translated the final themes and relevant quotes into English at the time of writing and were double-checked by the second author (AH).

We conducted a reflexive thematic analysis.² The analysis began with an initial analysis of 16 transcripts where researchers (RIZ, AH, MADM) collaboratively coded line-by-line text and organised codes into hierarchical groups by grouping related codes into over-arching themes. Based on the discussions from the initial analysis, the first author (RIZ) then iteratively analysed the data through data familiarisation, coding, initial theme generation, theme development, theme refining, defining, naming, and writing up. We defined women's 'preferred mode of birth' as women's desired mode of birth, and women's 'actual mode of birth' as the mode of birth she ultimately had, irrespective of initial preferences. We used NVivo 12³¹ to manage qualitative data. Member checking was conducted when clarity was needed from the participants.

6.3.5 Ethical considerations

Ethics approval was granted by the University of Melbourne (2022-24768-30123-1) and the Universitas Gadjah Mada (KE/FK/1180/EC/2022). Permissions were received from Indonesia National Research and Innovation Agency, Jakarta Provincial and District health offices, and Primary Health Centres (Appendix 6.3). We provided women with detailed study information through Plain Language Statement and written informed consent form. We gave women three days to consider participation after sharing these forms. Once informed consent was obtained, we scheduled the interview at a mutually convenient time and place based on women's preferences. At the end of each interview, the participants received a shopping voucher of 100,000 Rupiah (approximately \$US 6) to compensate for their contribution and time.³² We used pseudonyms in direct quotations to protect participants' confidentiality and humanise findings.

6.4 RESULTS

We conducted 54 interviews with 28 women. Two women were lost to follow-up at the second interview, with one woman's mode of birth unknown. One woman was unavailable to join the second interview, and the other did not respond. Eighteen women were recruited from the primary health centre, and 10 were recruited online (accessing private facilities). Seventeen women were multiparous, with four women having a previous caesarean section. Table 6.1 shows women's characteristics.

Table 6.1. Women's characteristics.

Characteristic	n (%) N=28
Age	
<20	1 (4%)
20-24	1 (4%)
25-29	12 (43%)
30-34	10 (36%)
≥35	4 (14%)
Parity and caesarean section history	
Nulliparous	11 (39%)
Multiparous <i>without</i> previous caesarean section	13 (46%)
Multiparous <i>with</i> previous caesarean section	4 (14%)
Residence	
Central Jakarta	16 (57%)
South Jakarta	4 (14%)
East Jakarta	3 (11%)
North Jakarta	2 (7%)
Tangerang	2 (7%)

	West Jakarta	1 (4%)
Highest education		
	Elementary school	1 (4%)
	Junior high school	1 (4%)
	Senior high school	9 (32%)
	Diploma degree	3 (11%)
	Bachelor's degree	12 (43%)
	Master's degree	2 (7%)
Profession		
	Private employee	11 (39%)
	Housewife	8 (29%)
	Healthcare provider	4 (14%)
	Public officer	2 (7%)
	Waitress	1 (4%)
	Housekeeper	1 (4%)
	Public health practitioner	1 (4%)
Recruitment source		
	Online (private facility)	10 (36%)
	Johar Baru Primary Health Centre	10 (36%)
	Cempaka Putih Primary Health Centre	8 (29%)

At the time of the first interview, 26 out of 28 women preferred vaginal birth (Table 6.2). However, by the second interview, 13 women ultimately had caesarean section, including eight with ERACS. All caesarean section were conducted before the onset of labour, with six conducted at <39 weeks' gestation and seven conducted at ≥39 weeks' gestation. All four women with previous caesarean section had a repeat caesarean section.

Table 6.2. Women's birth preference, plan, and final mode of birth.

Characteristics	n (%) n = 28
Preferred mode of birth	
Vaginal birth	26 (93%)
Caesarean section	2 (7%)
Actual mode of birth	
Vaginal birth	14 (50%)
Caesarean section	13 (46%; 8 using ERACS)
Unknown	1 (4%)
Gestational age when caesarean section conducted (n=13)	
37 weeks	2 (15%)
38 weeks	4 (21%)
39 weeks	4 (21%)
40 weeks	3 (23%)
Place of birth	
Public facility	17 (61%; 6 caesarean section – 2 with ERACS – and 11 vaginal birth)

Private facility	10 (36%; 7 caesarean section – 6 with ERACS – and 3 vaginal birth)
Unknown	1 (4%)
Mode of birth preference for future birth	
Vaginal birth	20 (71%)
Caesarean section	6 (21%; 5 using ERACS)
Unknown	2 (7%)

We generated three themes from the interviews: (1) Preferences about mode of birth, (2) Decision-making about mode of birth, and (3) Regrets about the actual mode of birth. Each theme is comprised of sub-themes, detailed below.

6.4.1 Preferences about mode of birth

6.4.1.1 *Desire to have a vaginal birth*

During pregnancy, almost all women in our study expressed desire to have vaginal birth, as they felt experiencing labour contractions made them a “complete woman”. Some perceived vaginal birth as “kodrat” referring to the destiny that women have in their lives.

“My mindset is that [vaginal birth] is “kodrat” for a woman, as a mother-to-be. God has created a birth canal in her body, so I am sure that baby will be born through the birth canal that has been created by God” – Seruni, 40 years old, 1st interview, vaginal birth.

In addition to these gendered beliefs, some women preferred vaginal birth as they felt the benefits outweighed its risks.

“First, [vaginal birth] process is really painful, but it will be much easier to heal than caesarean section because caesarean section seems riskier due to stitches and others. Secondly, vaginal birth can stimulate the baby. If the baby passed through the vagina, the baby received stimulation, so they were more active; that's what some research said. Then thirdly, vaginal birth stimulates breast milk. So, I think those are three benefits for giving birth vaginally better than caesarean section” – Alamanda, 30 years old, 1st-interview, caesarean section.

Some women felt that caesarean section was painful, expensive, had a slow recovery, and required greater birth spacing. Women also believed that “once caesarean section; forever caesarean section” for future births. Therefore, they saw caesarean section as the last resort when vaginal birth was not possible.

“If there are already complications, like it or not, we will choose caesarean section” – Anggrek, 28 years old, 1st-interview, vaginal birth.

6.4.1.2 ERACS to address inconveniences of caesarean section

When discussing caesarean section risks at the first interview, despite no prompts, many women mentioned ERACS. Despite still preferring vaginal birth, some women stated that many of the caesarean section risks are not applicable anymore as there is ERACS. Women referred to ERACS as an improved or modern method of caesarean section. Women believed that ERACS was superior compared to “regular caesarean section” (caesarean section without ERACS) as it used improved pain management, had a shorter duration of pre-surgical fasting, and had different approaches to tissue opening, which were perceived to result in different and smaller cuts on women’s uterus.

“The type of surgery knife used [in ERACS] is said to be smaller, so the incision may not hurt too much. And using different kinds of painkillers. And before the surgery, normally fasting is 12 hours, but with ERACS, as I remember, it’s 6 or 8 hours before the surgery” – Melati, 37 years old, 1st-interview, caesarean section.

Women perceived that ERACS would make their birth less painful, more comfortable, and faster recovery. Women highly valued ERACS, despite never experiencing it themselves, as they believed it would address inconveniences and negative aspects of caesarean section without ERACS. Women equalised ERACS with vaginal birth as a mode of birth with faster recovery, but more comfortable as women do not have contractions.

“Now there is ERACS, the process is much more comfortable, so it’s like vaginal birth, after the operation, you can do anything right away [...] With ERACS you can return to regular activity within 6 hours after surgery. It is painless, the price is a little bit more expensive, but I think it will be more comfortable” – Alamanda, 28 years old, 1st-interview, caesarean section.

Women learned about ERACS from posters posted around the hospitals, obstetricians, midwives, families and friends, with majority first knew it from social media.

“I first knew about ERACS from celebrities in Instagram. ERACS is really booming. They said women can recover really fast. Few hours after the surgery, they can stand, walk, sit. Even the celebrities can move around and do tiktok right away” – Seroja, 30 years old, 1st interview, vaginal birth.

6.4.2 Decision-making on mode of birth

6.4.2.1 Differences between preferred and actual mode of birth

Despite only two women who preferred caesarean section at the first interview, 13 ultimately had caesarean section. The inconsistency between women's preferred and their actual mode of birth was mainly due to the influence of obstetricians. Some women who planned to have a vaginal birth at the time of the first interview reported that they started to change their minds about having caesarean section after consultation with obstetricians around the time of birth. Nulliparous and multiparous women without previous caesarean section reported that their obstetricians recommended them to have caesarean section due to medical indications, like having anaemia, haemorrhoids, being overweight, having a big placenta, baby being mature at 38 weeks of age, having no signs of labour in the 40th week, and reduced movement, fetal heart rate, and amniotic fluid. All women who had a previous caesarean section ended up having caesarean section, despite three of them desiring vaginal birth. Women reported the reasons for this were that the birth spacing should be more than 5 years for them to be eligible for vaginal birth after caesarean section (VBAC), and vaginal birth would not be covered at the private hospital for women arriving with referral from primary health centres due to previous history of caesarean section. Women's reported reasons for caesarean section can be seen in Table 6.3.

Table 6.3. Women reported reasons for having caesarean section.

Women-related	Baby-related	Labour and childbirth-related	Non-medical
Women suggested to have caesarean section by obstetricians and ended up with caesarean section			
• Haemorrhoids and overweight • Anaemia • Repeat caesarean section as the birth gap was less than 2 years • Not eligible for VBAC as the previous caesarean section birth gap was < 5 years • Woman has congenital condition	• Baby “ready to be born” at 38-week gestation • Reduced movement and fetal heart rate • No signs of labour in 40th week, so healthcare providers asked woman to choose induction or caesarean section	• Big placenta • Water broke and amniotic fluid was green • Big baby and low volume of amniotic fluid	• Vaginal birth is not covered by national insurance (woman already referred to private hospital from primary health centres due to previous caesarean section) • Repeat caesarean section due to preference for caesarean section

Women recommended to have caesarean section by obstetrician, but had vaginal birth			
• Young age (19 years old)	• 37 weeks' gestation and baby had not entered pelvis • 41 weeks' gestation and presence of nuchal cord • 40 weeks' gestation with no labour onset, and low amniotic fluid – obstetrician told woman that baby should be born in the next 24 hours and suggested caesarean section	n/a	n/a

It is important to note that while some women met their obstetricians directly at private facilities, women who went to primary health centres typically met obstetricians at higher-level facilities via referral from primary health centres. Some referrals had limits on the time or number of visits. For example, women with referrals for ultrasound scans were expected to return to primary health centres for follow-up. Therefore, midwives and doctors at primary health centres often did not discuss mode of birth before referral. Thus, women were informed about having caesarean section by obstetricians at hospitals unexpectedly during these referral visits – with some urging women to undergo caesarean section within the next 24-hours. This made women feel that they were blindsided by the decision and lacked appropriate communication about the decision. Women likewise believed that obstetricians preferred them to have a caesarean section rather than trying for induction of labour.

“I thought I only needed to have an ultrasound. I didn’t bring anything, just documents. After the ultrasound, the obstetrician said it’s useless to have induction: ‘You will only feel pain, and the baby would not want to be born because the baby is too big, and the amniotic fluid has also started to decrease’. I’m confused because I am scared” – Krisan, 30 years old, 2nd interview, caesarean section.

For women accessing private facilities, the decision to have caesarean section was often made after consultation with obstetricians during the regular schedule for antenatal visits. For example:

“The doctor said that if I want to have caesarean section, it is possible, as the baby is mature already [38 weeks], but the decision is up to me. Then it turned out that right after the antenatal clinic, my husband needs to go on a business trip, so I contacted the doctor again, to inform that’s my plan [to have caesarean section].” – Lili, 26 years old, 2nd interview, caesarean section.

6.4.2.2 Trust in healthcare providers vs autonomy

Women’s decision-making on mode of birth was also influenced by trust in healthcare providers. Some women put immense trust in their obstetricians and midwives to guide them in choosing their mode of birth. They felt healthcare providers were the ones who knew the best about the baby’s condition, and they would comply with the obstetrician’s advice.

“As the obstetrician is the one doing the work, let’s just follow his [suggestion], instead we force what we want but actually it’s hard to do, it’s scary too. Because this isn’t just a matter of ‘ouch I am wounded, should it be bandaged or not’, it’s not that simple, because there is a human being inside us, there is a living creature that we also don’t know what the condition is inside us.” – Melati, 37 years old, 1st-interview, caesarean section.

However, there were also some women who were suggested to have a caesarean section during their antenatal care yet persisted by looking for a second opinion and were able to give birth vaginally (Table 6.3). Women felt glad and relieved that they waited until labour contractions came instead of going for caesarean section immediately. One woman said:

“Originally, I couldn’t have vaginal birth [suggested to have caesarean section] because I was still young. They fear complications. But I ended up having labour contraction first, so it didn’t turn into caesarean section. [...] The doctor said there are a lot of risks as I am still young. He’s afraid the child won’t survive or what. But thank God I can give birth vaginally” – Magnolia, 19 years old, 2nd interview, vaginal birth.

6.4.2.3 The role of social networks in influencing women’s preferences

We found that women’s social networks influence their preferences and decision-making regarding the mode of birth. For women who had a vaginal birth as preferred, their preferences were strongly influenced by family and people around them. Women often sought opinions from their husbands, mothers, and mothers-in-law. Some women discussed strong encouragement from their families to have a vaginal birth, not only due to the benefits of a vaginal birth but also family expectations to continue birthing traditions.

“My husband supports [to have vaginal birth] 100%. Because my mother-in-law has nine children and all were born through vaginal birth, all nine of them (laugh), they compare [her with me]. My mom also said if I can have a vaginal birth, that’s better, so that I recover quickly. So, my parents and in-laws really support me to have a vaginal birth.” – Anggrek, 28 years old, 1st interview, vaginal birth.

Some women were also encouraged to have a caesarean section, specifically ERACS, after the family received information from healthcare providers, friends, and social media. Husbands particularly encourage women to have ERACS as it was perceived as an “easy way” to give birth.

“He [husband] said something like ‘Yeah, I’m also sure you can have vaginal birth, but if there’s an easy way, why not?’ (laugh)” – Alamanda, 30 years old, 1st interview, caesarean section.

Women were also influenced by their friends and colleagues.

“I was 40 weeks, and it turned out that I didn’t have any signs of labour. No rupture of membranes, no contractions. There is no dilation yet, no spots yet. So, the due date is over, the choices are whether I want to have an induction or caesarean section. So far that time, the information we got from friends was not to go for induction, as the pain is twice. My older sibling had also been induced but ended up with caesarean section. So, in the end [woman decided to] directly had ERACS without induction” – Kenanga, 30 years old, 2nd interview, caesarean section.

6.4.3 Regrets about the actual mode of birth

6.4.3.1 Desire for evidence-based instead of fear-based information

After birth, some women who had a caesarean section despite preferring vaginal birth, questioned if the caesarean section was really needed and felt disappointed and upset. These negative feelings were attributed to limited communication and fear that obstetricians instilled in them about the poor outcomes if they did not follow the recommendation to have caesarean section.

“After I gave birth, I joined Facebook group where women talk about babies. There is a woman who had experiences like mine. Her amniotic fluid was decreasing, etc. It’s the same case but she had vaginal birth. [Instead of caesarean section] she was waiting for the contraction to come for about two weeks, and she had vaginal birth. So why then did I end up with caesarean section? Actually, [the obstetrician] said ‘I really don’t want to take risks,

but it's up to you, everything is up to you'. But it's just that I was feeling scared [hearing that], aren't you? It just seems that the obstetrician is pro-caesarean, so he doesn't want to try for me to have vaginal birth.” – Krisan, 30 years old, 2nd interview, caesarean section.

Women desired emotional support instead of an emphasis on the impossibility of having a vaginal birth. Women felt that obstetricians should transparently provide them with evidence-based information on the risks and benefits of choosing caesarean section instead of vaginal birth and vice versa, so they can make decisions based on how their bodies feel and prepare for any risks, instead of feeling persuaded.

“Like, it's unforgivable for doctors who are not giving women the option to choose, I mean, it's not like pre-eclampsia, the point is, there aren't any complications, so I can give birth vaginally. But then why should it be suggested for ‘Oh you should have caesarean section’, without educating about the pro and cons of caesarean section, vaginal birth, and why should I be given caesarean section?” – Kamelia, 29 years old, 1st interview, caesarean section.

“At the time of deciding the mode of birth, I wish I could get more explanation [from the obstetrician] on the process [of caesarean section with ERACS], how I would feel physically, and how I should prepare. If I could turn back time, I would ask for more information. So, I am not shocked, can prepare myself in advance for any side effects, and learn to manage them appropriately.” – Melati, 37 years old, 2nd interview, caesarean section.

Women also felt that stakeholders should stop advertising birth as something painless and comfortable – referring to ERACS advertisements posted on social media accounts of health facilities and healthcare providers. Rather, women preferred to focus more on motivating and supporting women to go through labour and vaginal birth instead of taking a ‘so-called’ easy way.

“As I am an ordinary woman, I want more information on how to encourage and motivate pregnant women to give birth vaginally, rather than having caesarean section. Now, there's a lot more information that encourages how to give birth comfortably, easily, with minimal injuries and so on, so people now tend to prefer ERACS.” – Seruni, 40 years old, 1st interview, vaginal birth.

6.4.3.2 *Unexpected experiences and effects after ERACS*

Despite women valuing the presence of ERACS, in the second interview, women who had ERACS reported mixed experiences. Some women reported they were satisfied with ERACS as they believed that they had faster recovery compared to if they had a vaginal birth. However, other women felt that ERACS did not deliver what it promised: that is, they did feel pain and did not recover within 24-hours as advertised.

“I thought like ‘Okay, well, with ERACS doesn’t look like it’s going to be painful, it’s just going to be so-so, it’s going to be normal’. But the reality, it really hurts. I’m actually really surprised that it hurts. I can tilt left, tilt right, then stand up, walking slowly, but it really hurts, the pain turns out to be really painful. I didn’t think it [ERACS] will be too bad compared to vaginal birth. But it turns out that it hurts” – Kamelia, 29 years old, 2nd interview, caesarean section.

Some women also reported side effects that they experienced with ERACS, such as vomiting, pain, itchiness, dizziness, spasms, and delayed breastfeeding – which are similar side effects with caesarean section.

“During the surgery, I felt my shoulder become heavy, like there was a sudden heavy weight. And [felt] nausea, vomiting all over. So, the process of operation doesn’t feel good. After it’s done, I feel dizzy, nauseous. I think this is just a personal assumption; maybe I was not suitable with the anaesthetic.” – Melati, 37 years old, 2nd interview, caesarean section.

6.4.3.3 *Woman-centred care*

Regardless of the mode of birth, some women felt they were being rushed due to midwives and obstetricians being impatient while they were in labour. Participants’ negative experiences of vaginal birth were attributed to labour induction, episiotomy, and medications. Women were unclear about the purposes of medications and other interventions, perceiving them as unnecessary and only used to expedite labour and birth due to midwives’ impatience. Women desired more woman-centred care by midwives since they felt the midwives prioritised clinical procedures over their feelings and comfort.

“Um, I feel a bit [disappointed] about the induction. I was like, why are we in such a hurry, I still can try to give birth [without induction]. And the [cervical] dilatation is not stuck, it keeps

dilating, from 4 to 6 to 8 centimetres, why do the midwife have to take the action [induction] so quickly?" – Anggrek, 28 years old, 2nd interview, vaginal birth.

Some women who had negative caesarean section experiences attributed experiences to obstetricians' lack of communication, pain, and reduced mobility after caesarean section.

"What's not good is the [caesarean section wound] stitching and the bottom area, it's uncomfortable, until now. I can't move much. It was swollen too on the right side, but after a long time it went away, but then it hurts again, [keep going on and off] like that." – Krisan, 30 years old, 2nd interview, caesarean section.

6.5 DISCUSSION

Our study explored Indonesian women's preferences about mode of birth, and to understand how preferences about mode of birth may change from pregnancy to birth. We found that during pregnancy, most women preferred to have a vaginal birth. With the rise of ERACS, however, women saw ERACS as a new method of birth similar, even superior, to vaginal birth. Despite most women desiring a vaginal birth, we found that more women had caesarean section than planned. Our findings suggest that this change was primarily due to the influence of obstetricians around the time of birth. Women felt they lacked adequate information from obstetricians and felt disappointed with the change to caesarean section. Women desired emotional and transparent information and better communication from healthcare providers.

We found that most pregnant women preferred vaginal birth, which is similar to previous studies conducted in countries with high caesarean section rates,¹⁰ such as Brazil and Chile.⁷ Our study found that preferences for vaginal birth are influenced by sociocultural factors, rooted in gendered beliefs, perceived benefits of vaginal birth, and strongly influenced by social networks. This is aligned with previous studies^{15–17} and the ecological framework by Betrán et al (2018) that depicts factors influencing mode of birth across different levels, such as women, family, community and healthcare providers.¹⁰ Our study's findings are consistent with other longitudinal studies that track women who previously had caesarean section.^{18,20} These studies suggest that a history of caesarean section, coupled with healthcare providers recommending repeat caesarean section instead of attempting VBAC, are the primary factors influencing whether women with previous caesarean section have repeat caesarean section.^{18,20} Similar to Chen et al (2018), our study also found that many women complied with healthcare providers' suggestions for repeat caesarean section without being informed of alternatives.²⁰ Importantly, in our study, some healthcare providers suggested repeating

caesarean section despite the gap between births being over 18 months, as recommended by clinical guidelines.^{33–35} This highlights that healthcare providers need to deliver complete, reliable and evidence-based information to women regarding the mode of birth.

The rise of ERACS in Indonesia, however, is alarming. A search on Google Trends on the term “ERACS” showed that an overwhelming majority of search interest for the term came from Indonesia in the context of birth and caesarean section (with a peak *circa* November 2021); while in the United Kingdom and the United States of America it appears sporadically, albeit in the contexts of software and cardiac surgery (Google's estimated search interest 'score' for the latter is 1/100th compared to Indonesia).³⁶ Women appear to be targeted in ERACS promotion for financial gain by mainly promoting its benefits through social media, health facilities and healthcare providers.¹⁴ A recent social media analysis study found pervasive caesarean section advertisements, including ERACS, mostly coming from Jakarta¹⁴, which is also our study site. The social media analysis findings aligned with our study in which women in Jakarta described learning about ERACS through celebrities and healthcare providers on social media sharing the benefits of ERACS that can help women recover within 24 hours post-caesarean. Caesarean section in Indonesia is covered by national health insurance, both in private and public health facilities, with higher reimbursements for caesarean section compared to vaginal birth for the facilities.²⁴ Global studies have revealed this financial incentive as one of the major drivers influencing healthcare providers' preference towards caesarean section.^{37–39} Therefore, the popularity of ERACS may further incentivise facilities and healthcare providers to actively advertise ERACS for profit-making, especially since ERACS costs have been reported to be higher than the regular caesarean section⁴⁰. Despite this pervasive promotion of ERACS, the experiences of women having ERACS in our study, however, were varied, with some women believing it met advertised expectations, but some experienced adverse effects after undergoing ERACS. The negative experience with ERACS highlights the need for balanced, evidence-based, transparent, and free-from-financial incentive information on not only benefits but also risks being disseminated to women.

We found that in this study, obstetricians were key drivers of women's actual mode of birth. Women placed substantial trust in obstetricians, viewing them as the most knowledgeable and, therefore, happy to follow their advice. Beyond clinical expertise, this might be due to the hierarchical status of the woman-doctor relationship. Previous research revealed that doctors in Indonesia used paternalistic and unidirectional communication styles with patients, where the doctor leads and dictates consultation with little attention given to patients' concerns.⁴¹ This communication style means conversations mostly deliver medical content and direction instead of providing psycho-

emotional support.⁴¹ This paternalistic style is also observed in the context of the mode of birth preferences, where healthcare providers felt frustrated when they could not influence women – desired to retain control and felt it was not always possible to communicate the risks and benefits of birth mode.⁴² Unfortunately, some women who underwent caesarean section in our study regretted their actual mode of birth. Some studies reported that regret post-birth was associated with perceived loss of control, inability to advocate themselves, poor communication, and lack of trust in healthcare providers.^{43–45} This is similar to what we observed in our study, where women experienced regret because they felt they could have had a vaginal birth if they persevered and were disappointed with the healthcare providers' communication with them.

Our study shows women desired meaningful conversation and evidence-based information on risks and benefits from their healthcare providers. Promoting two-way communication between health providers and women is imperative to ensure that women feel well-informed and participate in decision-making around birth. Furthermore, more information is also needed surrounding emergencies during birth to ensure women can be prepared for any arising circumstances during labour and make an informed decision if they need a caesarean section. Providing evidence-based information and meaningful conversation also aligns with the factors influencing success in interventions targeting women to optimise the caesarean section use.⁴⁶ These factors include providing educational materials to women, support from family, peer support, and adequate time and opportunities to interact with healthcare providers.^{46,47} All this support provides not only informational but also emotional support, which is important because emotional support may reduce the likelihood of experiencing regret over birth decisions.⁴⁴ Thus, ensuring the provision of these four types of support is imperative to facilitate women's participation and women-centred care.

This is the first study exploring women's preferences in Indonesia, and uses a longitudinal design, enabling the understanding of drivers to change across time. We explored the perspectives of women across different socio-economic backgrounds and public-private facilities. Findings from our study may not be transferable to women in settings that are different from Jakarta. Furthermore, we only interviewed women in their third trimester of pregnancy, which means we may miss important factors regarding the mode of birth preference early in the pregnancy. Women self-selected for participation, and women who chose to participate may have a particular interest, experience, or perspective that influenced their decision. Our study also does not include perspectives from healthcare providers (doctors, midwives, obstetricians, etc), facility managers, and policymakers, which will be important to explore. More studies are needed to understand if caesarean section use

in Indonesia is clinically indicated. Intervention studies are pivotal to be implemented to optimise caesarean section use in Indonesia.

6.6 CONCLUSION

Our study revealed potentially alarming ERACS promotion impact on women and the strong influence of healthcare providers on women's mode of birth. The pervasive ERACS advertisement and substantial power imbalances between healthcare providers and women open a loophole that can result in a continuous increase in caesarean section in Indonesia. This study highlights that there is a need for better communication, evidence-based information, space for women's autonomy and more opportunities for women to discuss the mode of birth collaboratively with healthcare providers. There is also a need to standardise and regulate ERACS use in the country.

6.7 CHAPTER 6 SUMMARY

This chapter provides some of the results from the qualitative longitudinal study – which is the second component of my PhD. This analysis shows that most women preferred to have a vaginal birth and saw caesarean section as the last option when a vaginal birth is not possible. With the rise of ERACS, however, women were given inaccurate information about the procedure, which made women see ERACS as the same as vaginal birth. Some women even perceived ERACS as superior, as they believed that not only does ERACS make women have faster recovery, but it is also “painless”.

The four highlights from this study's findings in relation to caesarean section increase drivers in Indonesia: 1) the commodification of ERACS targeting women by mainly emphasising its benefits – very similar to the findings on the first study component (Chapter 5); 2) Non-transparent, non-balanced, and non-evidence-based information when caesarean is suggested; 3) Hierarchic relationship between healthcare providers and women; 4) fear-based, instead of information-based, consultation by providers to women.

I found that women's decision-making on the mode of birth in the third trimester was heavily influenced by trust in providers and family support. Despite most women in my study desiring vaginal birth, more women ended up having a caesarean section at the second interview compared to their plan. Women's changes in mode of birth were typically due to obstetricians' discretion. Comparing the women's reported reason for their caesarean section and existing clinical guidelines (Appendix 6.4), I found that not all reasons provided for having a caesarean section were evidence-based. Not all women were happy with their ultimate mode of birth decision: some women felt rushed in decision-making on the mode of birth and felt ERACS did not deliver what it promised. This study highlights the need to provide more transparent and evidence-based information to women and ensure that women are given adequate time to receive and process this information before labour. I also observed that there is a need to give more opportunities for women to have collaborative interactions and meaningful discussions with their providers in regard to their birth plans.

The next chapter presents the results of my PhD's third study component, the caesarean section intervention analysis. Specifically, the next chapter covers important intervention components that influence the success of interventions targeting pregnant women to optimise caesarean section use.

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CHAPTER SEVEN

Manuscript 3

Educational interventions targeting pregnant women to optimise the use of caesarean section: What are the essential elements? A qualitative comparative analysis

7.1 CHAPTER 7 PREAMBLE

This thesis has provided, to some extent, an understanding of the increase of caesarean sections in Indonesia. The next step is a need to understand how to optimise the caesarean section use in the country. Several studies have tried to implement and trial interventions to optimise the use of the caesarean section globally, however, the evidence surrounding their impact is mixed. There is a need to understand what features and processes lead to the successful implementation of caesarean section interventions. This chapter presents the third component of my PhD, which is an analysis of caesarean section interventions that have been implemented globally.

The third component of my PhD is, however, divided into two chapters based on its results: Chapter 7 presents the results of caesarean intervention analysis targeting women, and Chapter 8 presents the results of caesarean intervention analysis targeting providers. I conducted the caesarean intervention analysis using the qualitative comparative analysis (QCA) approach. QCA is the evidence-synthesis approach that enabled exploration of what intervention characteristics led to successful outcomes (e.g., reducing caesarean section). I conducted the QCA by examining a systematic review of intervention studies that were used to inform World Health Organization guidelines on non-clinical interventions to optimise caesarean section use¹. Please note that the interventions included in the QCA are global and not specific to Indonesia, however, the results will be able to be considered and applicable in the context of Indonesia. The results of this study have been published in BMC Public Health.

Citation:

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7.2 INTRODUCTION

In recent years, caesarean section rates have increased globally²⁻⁵. Caesarean section can be a life-saving procedure when vaginal birth is not possible; however, it comes with higher risks both in the short- and long-term for women and babies^{2,6}. Women with caesarean section have increased risks of surgical complications, complications in future pregnancies, subfertility, bowel obstruction, and chronic pain⁶⁻⁹. Similarly, babies born through caesarean section have increased risks of hypoglycaemia, respiratory problems, allergies and altered immunity¹⁰⁻¹². At a population level, caesarean section rates exceeding 15% are unlikely to reduce mortality rates^{2,13}. Despite these risks, an analysis across 154 countries reported a global average caesarean section rate of 21.1% in 2018, projected to increase to 28.5% by 2030⁴.

There are many reasons for the increasing caesarean section rates, and these vary between and within countries. Increasingly, non-clinical factors across different societal dimensions and stakeholders (e.g. women and communities, health providers, and health systems) are contributing to this increase¹⁴⁻¹⁸. Women may prefer caesarean section over vaginal birth due to fear of labour or vaginal birth, previous negative experience of childbirth, perceived increased risks of vaginal birth, beliefs about an auspicious or convenient day of birth, or beliefs that caesarean section is safer, quick, and painless compared to vaginal birth¹⁴⁻¹⁶.

Interventions targeting pregnant women to reduce caesarean section have been implemented globally. A Cochrane intervention review synthesised evidence from non-clinical interventions targeting pregnant women and family, providers, and health systems to reduce unnecessary caesarean section, and identified 15 interventions targeting women¹⁹. Interventions targeting women primarily focused on improving women's knowledge around birth, improving women's ability to cope during labour, and decreasing women's stress related to labour through childbirth education, and decision aids for women with previous caesarean section¹⁹. These types of interventions aim to reduce the concerns of pregnant women and their partners around childbirth, and prepare them for vaginal birth.

The effectiveness of interventions targeting women in reducing caesarean section is mixed^{19,20}. Plausible explanations for this limited success include the multifactorial nature of the factors driving increases in caesarean section, as well as the contextual characteristics of the interventions, which may include the study environment, participant characteristics, intensity of exposure to the intervention and method of implementation. Understanding which intervention components are essential influencers of the success of the interventions is conducive to optimising benefits. This study used a Qualitative Comparative Analysis (QCA) approach to re-analyse evidence from existing

systematic reviews to identify essential intervention components that lead to the successful implementation of non-clinical interventions focusing on pregnant women to optimise the use of caesarean section. Updating and re-analysing existing systematic reviews using new analytical frameworks may help to explore the heterogeneity in effects and ascertain why some studies appear to be effective while others are not.

7.3 METHODS

7.3.1 Logic model, data sources, case selection, and defining outcomes

7.3.1.1 *Developing a logic model*

We developed a logic model to guide our understanding of different pathways and intervention components potentially leading to successful implementation (Appendix 7.1). The logic model was developed based on published qualitative evidence syntheses and systematic reviews^{19,21–25}. The logic model depicts the desired outcome of reduced caesarean section rates in low-risk women (at the time of admission for birth, these women are typically represented by Robson groups 1–4²⁶ and are women with term, cephalic, singleton pregnancies without a previous caesarean section) and works backwards to understand what inputs and processes are needed to achieve the desired outcome. Our logic model shows multiple pathways to success and highlights the interactions between different levels of factors (women, providers, societal, health system) (Appendix 7.1). Based on the logic model, we have separated our QCA into two clusters of interventions: 1) interventions targeting women, and 2) interventions targeting health providers. The results of analysis on interventions targeting health providers have been published elsewhere²⁷. The logic model was also used to inform the potential important components that influence success.

7.3.1.2 *Identifying data sources and selecting cases*

We re-analysed the systematic reviews which were used to inform the development and update of World Health Organization (WHO) guidelines. In 2018, WHO issued global guidance on non-clinical interventions to reduce unnecessary caesarean section, with interventions designed to target three different levels or stakeholders: women, health providers, and health systems¹. As part of the guideline recommendations, a series of systematic reviews about caesarean section interventions were conducted: 1) a Cochrane intervention review of effectiveness by Chen et al (2018)¹⁹ and 2) three qualitative evidence syntheses exploring key stakeholder perspectives and experiences of interventions focusing on women and communities, health professionals, and health organisations, facilities and systems by Kingdon et al (2018)^{21–23}. Later on, Opiyo and colleagues (2020) published a scoping review of financial and regulatory interventions to optimise the use of caesarean section²⁴.

Therefore, the primary data sources of this QCA are the intervention studies included in Chen et al (2018)¹⁹ and Opiyo et al (2020)²⁴. We used these two systematic reviews as not only they are comprehensive, but they were also used to inform the WHO guidelines development. A single intervention study is referred to as a “case”. Eligible cases were intervention studies focusing on pregnant women and aimed to reduce or optimise the use of caesarean section. No restrictions on study design were imposed in the QCA. Therefore, we also assessed the eligibility of intervention studies excluded from Chen et al (2018)¹⁹ and Opiyo et al (2020)²⁴ due to ineligible study designs (such as cohort study, uncontrolled before and after study, interrupted time series with fewer than three data points), as these studies could potentially show other pathways to successful implementation. We complemented these intervention studies with additional intervention studies published since the last review updates in 2018 and 2020, to include intervention studies that are likely to meet the review inclusion criteria for future review updates. No further search was conducted as QCA is suitable for medium-N cases, approximately around 10-50 cases, and inclusion of more studies may threaten study rigour²⁸.

Once eligible studies were selected, we searched for their ‘sibling studies’. Sibling studies are studies linked to the included intervention studies, such as formative research or process evaluations which may have been published separately. Sibling studies can provide valuable additional information about study context, intervention components, and implementation outcomes (e.g. acceptability, fidelity, adherence, dosage), which may not be well described in a single article about intervention effectiveness. We searched for sibling studies using the following steps: 1) reference list search of the intervention studies included in Chen et al (2018)¹⁹ and Opiyo et al (2020)²⁴, 2) reference list search of the qualitative studies included in Kingdon et al (2018) reviews^{21–23}; and 3) forward reference search of the intervention studies (through “Cited by” function) in Scopus and Web of Science. Sibling studies were included if they included any information on intervention components or implementation outcomes, regardless of the methodology used. One author conducted the study screening independently (RIZ), and 10% of the screening was double-checked by a second author (MAB). Disagreements during screening were discussed until consensus, and with the rest of the author team if needed.

7.3.1.3 Defining outcomes

We assessed all outcomes related to the mode of birth in the studies included in the Chen et al (2018)¹⁹ and Opiyo et al (2020)²⁴ reviews. Based on the consistency of outcome reporting, we selected “overall caesarean section rate” as the primary outcome of interest due to its presence across studies. We planned to rank the rate ratio across these studies to select the 10 most

successful and unsuccessful intervention studies. However, due to heterogeneity in how caesarean section outcomes were reported across studies (e.g. odds ratios, rate ratios, percentages across different intervention stages), the final categorisation of successful or unsuccessful interventions is based on whether the caesarean section rate decreased, based on the precision of the confidence interval or p-value (successful, coded as 1), or caesarean section rate increased or did not change (unsuccessful, coded as 0).

7.3.2 Assessing risk of bias in intervention studies

All intervention studies eligible for inclusion were assessed for risk of bias. All studies included in Chen et al (2018) and Opiyo et al (2020) already had risk of bias assessed and reported^{19,24}, and we used these assessments. Additional intervention studies outside the included studies on these reviews were assessed using the same tools depending on the type of evidence (two randomized controlled trials and one uncontrolled before and after study), and details of the risk of bias assessment results can be found in Appendix 7.2. We excluded studies with a high risk of bias to ensure that the analysis was based on high-quality studies and to enhance the ability of researchers to develop deep case knowledge by limiting the overall number of studies.

7.3.3 Qualitative comparative analysis (QCA)

QCA was first developed and used in political sciences and has since been extended to systematic reviews of complex health interventions^{25,29–31}. Despite the term “qualitative”, QCA is not a typical qualitative analysis, and is often conceptualised as a methodology that bridges qualitative and quantitative methodologies based on its process, data used and theoretical standpoint²⁵. Here, QCA is used to identify if certain configurations or combinations of intervention components (e.g. participants, types of interventions, contextual characteristics, and intervention delivery) are associated with the desired outcome³¹. These intervention components are referred to as “conditions” in the QCA methodology. Whilst statistical synthesis methods may be used to examine intervention heterogeneity in systematic reviews, such as meta-regression, QCA is a particularly suitable method to understand complex interventions like those aiming to optimise caesarean section use, as it allows for multiple overlapping pathways to causality³¹. Moreover, QCA allows the exploration of different combinations of conditions, rather than relying on a single condition leading to intervention effectiveness³¹. Although meta-regression allows for the assessment of multiple conditions, a sufficient number of studies may not be available to conduct the analysis. In complex interventions, such as interventions aiming to optimise the use of caesarean section, single condition or standard meta-analysis may be less likely to yield usable and nuanced information about what intervention components are more or less likely to yield success³¹.

QCA uses ‘set theory’ to systematically compare characteristics of the cases (e.g. intervention in the case of systematic reviews) in relation to the outcomes^{31,32}. This means QCA compares the characteristics of the successful ‘cases’ (e.g. interventions that are effective) to those unsuccessful ‘cases’ (e.g. interventions that are not effective). The comparison is conducted using a scoring system based on ‘set membership’^{31,32}. In this scoring, conditions and outcomes are coded based on the extent to which a certain feature is present or absent to form set membership scores^{31,32}. There are two scoring systems in QCA: 1) crisp set QCA (csQCA) and 2) fuzzy set QCA (fsQCA). csQCA assigns binary scores of 0 (“fully out” to set membership for cases with certain conditions) and 1 (“fully in” to set membership for cases with certain conditions), while fsQCA assigns ordinal scoring of conditions and outcomes, permitting partial membership scores between 0 and 1^{31,32}. For example, using fsQCA we may assign a five-level scoring system (0, 0.33, 0.5, 0.67, 1), where 0.33 would indicate “more out” than “in” to the set of membership, and 0.67 would indicate “more in” than “out”, and 0.5 would indicate ambiguity (i.e. a lack of information about whether a case was “in” or “out”)^{31,32}. In our analysis, we used the combination of both csQCA and fsQCA to calibrate our data. This approach was necessary because some conditions were better suited to binary options using csQCA, while others were more complex, depending on the distribution of cases, and required fsQCA to capture the necessary information. In our final analysis, however, the conditions run on the final analysis were all using csQCA scoring system.

Two relationships can be investigated using QCA^{25,31}. First, if all instances of successful interventions share the same condition(s), this suggests these features are ‘necessary’ to trigger successful outcomes^{25,31}. Second, if all instances of a particular condition are associated with successful interventions, this suggests these conditions are ‘sufficient’ for triggering successful outcomes^{25,31}. In this QCA, we were interested to explore the relationship of sufficiency: that is, to assess the various combinations of intervention components that *can* trigger successful outcomes. We were interested in sufficiency because our logic model (explained further below) highlighted the multiple pathways that can lead to caesarean section and different interventions that may optimise the use of caesarean section along those pathways, which suggested that it would be unlikely for all successful interventions to share the same conditions. We calculated the degree of sufficiency using consistency measures, which evaluate the frequency in which conditions are present when the desired outcome is achieved^{31,32}. The conditions with a consistency score of at least 0.8 were considered sufficient in triggering successful interventions^{31,32}. At present, there is no tool available for reporting guidelines in the re-analysis of systematic reviews using QCA, however, CARU-QCA is currently being developed for this purpose³³. QCA was conducted using R programming software

with a package developed by Thiem & Duşa (2013) and QCA with R guidebook³². QCA was conducted in six stages based on Thomas et al (2014)³¹ and explained below.

7.3.3.1 QCA stage 1: Identifying conditions, building data tables and calibration

We used a deductive and inductive process to determine the potential conditions (intervention components) that may trigger successful implementation. Conditions were first derived deductively using the developed logic model (Appendix 7.1). We then added additional conditions inductively using Intervention Component Analysis from the intervention studies³⁴, and qualitative evidence (“view”) synthesis²³ using Melendez-Torres’s (2018) approach³⁵. Intervention Component Analysis is a methodological approach that examines factors affecting implementation through reflections from the trialist, which is typically presented in the discussion section of a published trial³⁴. Examples of conditions identified in the Intervention Component Analysis include using an individualised approach, interaction with health providers, policies that encourage caesarean section and acknowledgement of women’s previous birth experiences. After consolidating or merging similar conditions, a total of 52 conditions were selected and extracted from each included intervention and analysed in this QCA (Details of conditions and definitions generated for this study can be found in Appendix 7.3 and 7.4). We adapted the coding framework from Harris et al (2019)²⁵ by adapting coding rules and six domains that were used, to organize the 52 conditions and make more sense of the data. These six domains are broadly classified as 1) context and participants, 2) intervention design, 3) program content, 4) method of engagement, 5) health system factors, and 6) process outcomes.

One author (RIZ) extracted data relevant to the conditions for each included study into a data table, which was then double-reviewed by two other authors (MVC, MAB). The data table is a matrix in which each case is represented in a row, and columns are used to represent the conditions.

Following data extraction, calibration rules using either csQCA or fsQCA (e.g. group-based intervention delivery condition: yes = 1 (present), no = 0 (absent)) were developed through consultation with all authors. We developed a table listing the conditions and rules of coding the conditions, by either direct or transformational assignment of quantitative and qualitative data^{25,32} (Appendix 7.3 depicts the calibration rules). The data tables were then calibrated by applying scores, to explore the extent to which interventions have ‘set membership’ with the outcome or conditions of interest. During this iterative process, the calibration criteria were explicitly defined, emerging from the literature and the cases themselves. It is important to note, that maximum ambiguity is typically scored as 0.5 in QCA, however, we decided it would be more appropriate to assume that if

a condition was not reported it was unlikely to be a feature of the intervention, so we treated not reported as “absence” that is we coded it 0.

7.3.3.2 QCA stage 2: Constructing truth tables

Truth tables are an analytical tool used in QCA to analyse associations between configurations of conditions and outcomes. Whereas the data table represents individual cases (rows) and individual conditions (columns) – the truth table synthesises this data to examine configurations – with each row representing a different configuration of the conditions. The columns indicate a) which conditions are featured in the configuration in that row, b) how many of the cases are represented by that configuration, and c) their association with the outcome.

We first constructed the truth tables based on context and participants, intervention designs, program content, and method of engagement; however, no configurations to trigger successful interventions were observed. Instead, we observed limited diversity, meaning there were many instances in which the configurations were unsupported by cases, likely due to the presence of too many conditions in the truth tables. We used the learning from these truth tables to return to the literature to explore potential explanatory theories about what conditions are important from the perspectives of participants and trialists to trigger successful interventions (adhering to the ‘utilisation of view’ perspective³⁵). Through this process, we found that women and communities liked to learn new information about childbirth, and desired emotional support from partners and health providers while learning²³. They also appreciated educational interventions that provide opportunities for discussion and dialogue with health providers and align with current clinical practice and advice from health providers²³. Therefore, three models of truth tables were iteratively constructed and developed based on three important hypothesised theories about how the interventions should be delivered: 1) how birth information was provided to women, 2) emotional support was provided to women (including interactions between women and providers), and 3) a consolidated model examining the interactions of important conditions identified from model 1 and 2. We also conducted a sub-analysis of interventions targeting both women and health providers or systems (‘multi-target interventions’). This sub-analysis was conducted to explore if similar conditions were observed in triggering successful interventions in multi-target interventions, among the components for women only. Table 7.1 presents the list of truth tables that were iteratively constructed and refined.

Table 7.1. List of constructed truth tables constructed and refined.

Model	Conditions considered
Final models	
Model 1: How birth information was provided to women	Information, communication, education (IEC) materials, antenatal education, psychoeducation, group-based intervention delivery
Model 2: Emotional support was provided to women	Partner or family member involvement, group-based intervention delivery, interaction with health providers
Consolidated model	IEC materials, interaction with health providers, partner or family members involvement, group-based intervention delivery
Sub-analysis of multi-target interventions	IEC materials, interaction with health providers, partner or family members involvement, group-based intervention delivery, multi-target intervention
Other models explored but no configurations observed	
Context and participants	Number of participants, partner or family members involvement, delivery at health facility, delivery at home or community, number of health facility, baseline caesarean section rates
Intervention designs	Antenatal education, psychoeducation, decision aids, theory-driven, facilitators, group-based intervention delivery, personal based intervention delivery, IEC materials
Program content	Information about mode of birth, pain relief, mental health and coping strategies, partner's roles, didactic-based intervention delivery, practice-based delivery
Methods of engagement	Recruitment through health facility, recruitment through advertisement, timing of engagement, frequency of engagement, duration of engagement, incentives, potential competing interests
Population of women targeted by the intervention	Partner or family member involvement, women with low risk pregnancies, women with previous caesarean section, women with fear of birth, group-based intervention delivery, control group equivalent
Provision of emotional support for women (another pathway)	IEC materials can be taken home, partner or family member involvement, group-based intervention delivery

7.3.3.3 QCA stage 3: Checking quality of truth tables

We iteratively developed and improved the quality of truth tables by checking the configurations of successful and unsuccessful interventions, as recommended by Thomas et al (2014)³¹. This includes by assessing the number of studies clustering to each configuration, and exploring the presence of any contradictory results between successful and unsuccessful interventions. We found contradictory configurations across the five truth tables, which were resolved by considering the theoretical perspectives and iteratively refining the truth tables.

7.3.3.4 QCA stage 4: Identifying parsimonious configurations through Boolean minimization

Once we determined that the truth tables were suitable for further analysis, we used Boolean minimisation to explore pathways resulting in successful intervention through the configurations of different conditions³¹. We simplified the “complex solution” of the pathways to a “parsimonious solution” and an “intermediate solution” by incorporating logical remainders (configurations where no cases were observed)³⁶.

7.3.3.5 QCA stage 5: Checking the quality of the solution

We presented the intermediate solution as the final solution instead of the most parsimonious solution, as it is most closely aligned with the underlying theory. We checked consistency and coverage scores to assess if the pathways identified were sufficient to trigger success. We also checked the intermediate solution by negating the outcome to see if it predicts the observed solutions.

7.3.3.6 QCA stage 6: Interpretation of solutions

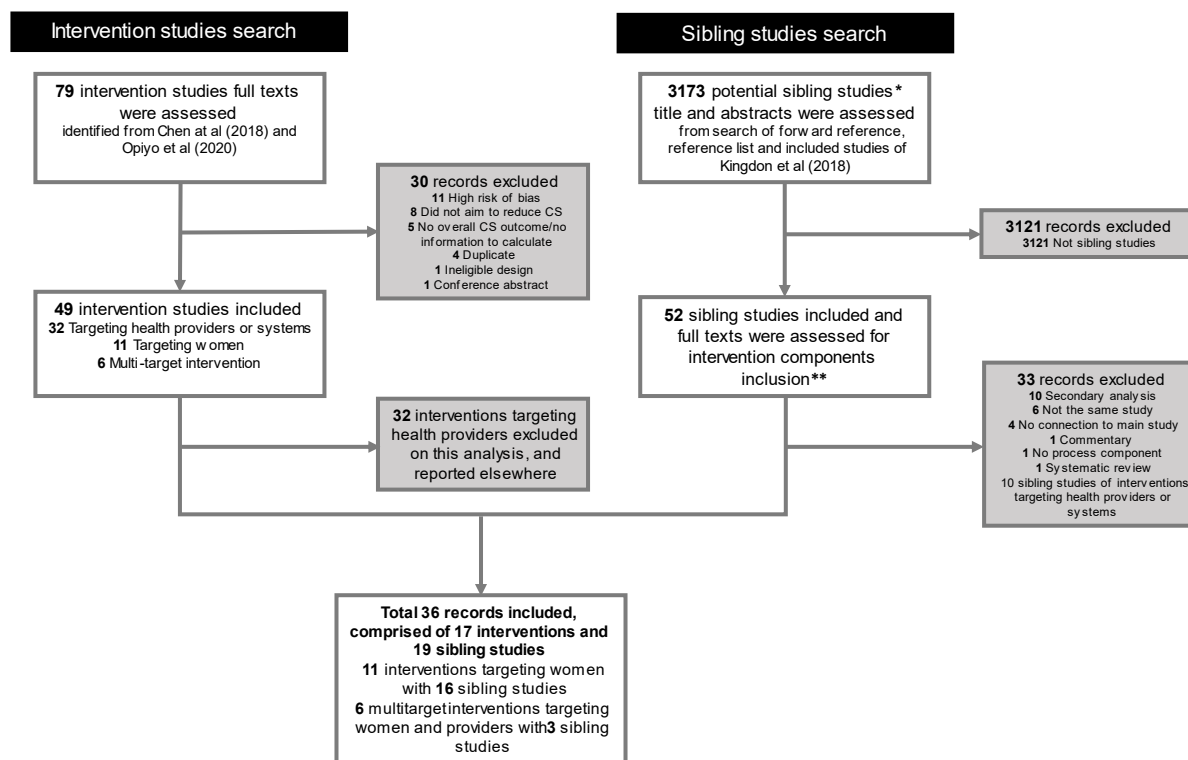
We iteratively interpreted the results of the findings through discussions among the QCA team. This reflexive approach ensured that the results of the analysis considered the perspectives from the literature discourse, methodological approach, and that the results were coherent with the current understanding of the phenomenon.

7.4 RESULTS

7.4.1 Overview of included studies

Out of 79 intervention studies assessed by Chen et al (2018)¹⁹ and Opiyo et al (2020)²⁴, 17 intervention studies targeted women and are included, comprising 11 interventions targeting only women^{37–43} and six interventions targeting both women and health providers or systems^{44–49}. From 17 included studies, 19 sibling studies were identified^{43,49–67}. Thus, a total of 36 papers from 17 intervention studies are included in this QCA (See Figure 7.1: PRISMA Flowchart).

Figure 7.1. PRISMA flowchart.



**Sibling studies: studies that were conducted in the same settings, participants, and timeframe;*

***Intervention components: information on intervention input, activities, and outputs, including intervention context and other characteristics.*

The 11 interventions targeting women comprised of five successful interventions^{37,68–71} and six unsuccessful interventions^{37–43} in reducing caesarean section. Sixteen sibling studies were identified, from five out of 11 included interventions^{37,41,43,70,71}. Included studies were conducted in six countries across North America (2 from Canada³⁸ and 1 from United States of America⁷¹), Asia-Pacific (1 from Australia⁴¹), 5 from Iran^{39,40,68–70}, Europe (2 from Finland^{37,42}, 1 from United Kingdom⁴³). Six studies were conducted in high-income countries, while five studies were conducted in upper-middle-income countries (all from Iran). All 11 studies targeted women, with three studies also explicitly targeting women's partners^{68,69,71}. One study delivering psychoeducation allowed women to bring any family members to accompany them during the intervention but did not specifically target partners³⁷. All 11 studies delivered childbirth education, with four delivering general antenatal education^{38,40,68,69}, six delivering psychoeducation^{37,39,41,42,70,71}, and one implementing decision aids⁴³. All studies were included in Chen et al (2018), and some risks of bias were identified¹⁹ (Appendix 7.2).

The multi-target interventions consisted of five successful interventions^{44–48} and one unsuccessful intervention⁴⁹. Sibling studies were only identified from one study⁴⁸. The interventions were delivered in five countries across: South America (1 from Brazil⁴⁶), Asia-Pacific (4 from China^{44,45,47,49}), Europe (1 from Italy⁴⁸, 1 from Ireland⁴⁸, and 1 from Germany⁴⁸). Three studies were conducted in high-income countries and five studies in upper middle-income countries. The multi-target interventions targeted women, health providers and health organisations. For this analysis, however, we only consider the components of the intervention that targeted women, which was typically childbirth education. One study came from Chen et al (2018)¹⁹ and was graded as having some concerns⁴⁷, two studies from Opiyo et al (2020)²⁴ were graded as having no serious concerns^{45,46}, and three studies are newly published studies assessed as low⁴⁴ and some concerns about risk of bias^{48,49} Table 7.2 and 7.3 show characteristics of included studies.

Table 7.2. Summary of characteristics of included intervention studies.

Characteristic	N of studies (%), N=17	Studies
Setting		
High-income countries	7 (41.2%)	37,38,41–43,71
Upper middle-income countries	10 (58.8%)	39,40,44–49,60,68,69
Data collection period		
<2000	2 (11.8%)	38,42
2000–2010	4 (23.5%)	37,43,70,71
>2010*	8 (47.0%)	39,41,44–49
Unclear/NI	3 (17.7%)	40,68,69
Study design		
Randomized controlled trial	13 (76.5%)	37–43,49,60,66,68,69,71
Before and after	3 (17.7%)	44,45,47
Interrupted time series	1 (5.9%)	46
Sample size		
<100	2 (11.8%)	40,68
100–1000	8 (47.0%)	37,39,41–43,69–71
>1000	7 (41.2%)	38,44–49
Type of women		
Women with low-risk pregnancy	9 (52.9%)	39,44–47,49,68,69,71
Women with fear of childbirth	5 (29.4%)	37,40–42,70
Women with previous caesarean section	3 (17.7%)	38,43,48
Baseline caesarean section rate		
<30%	2 (11.8%)	37,43
30–40%	0 (0%)	-
>40%	10 (58.8%)	39,40,44–47,49,66,68,69
Unclear/NI	5 (29.4%)	38,41,42,70,71

Outcomes		
Successful interventions	10 (58.8%)	37,44–48,68–71
Unsuccessful interventions	7 (41.2%)	38–43,49

**Study started before 2010 and ended after 2010 is categorised as >2010^{45,47}*

Table 7.3. Characteristics of included intervention studies.

Author	Sibling studies	Country & study years	Intervention	Comparison	Methods	Settings	Type of women	Study sample	Baseline caesarean section rates	Relative effect	Caesarean section outcomes	Risk of Bias*
Interventions targeting women												
Fraser 1997	None	Canada 1992 - 1994	Individualised prenatal education and support programme versus written information in pamphlet	Pamphlet	Randomized controlled trial	Hospital	Women with previous caesarean section	1,301	Baseline caesarean section rates were not stated but high preference in region of caesarean section was cited	RR 0.88 (0.58-1.33)	Little or no difference	Some concerns
Fenwick 2015	4 studies: protocol ⁵⁰ , randomized controlled trial ⁵¹ , cost-effectiveness ⁵² , economic evaluation ⁵³	Australia 2012 - 2013	Midwife psychoeducation by telephone	Usual maternity care	Randomized controlled trial	Delivered by telephone	Women with fear of childbirth	339	Baseline caesarean sections were not stated but increasing caesarean sections in the country were cited	RR 0.81 (0.56-1.18)	Little or no difference	Some concerns
Masoumi 2016	None	Iran 2012 - 2013	Antenatal education programme for physiologic childbirth	Routine prenatal education	Randomized controlled trial	Hospital	Women with low-risk pregnancy	150	48% at country level	RR 1.03 (0.72-1.49)	Little or no difference	Some concerns
Montgomery 2007	7 studies: protocol ⁴³ , formative qualitative ^{54,55} , cost analysis ⁵⁶ , qualitative	UK 2004 - 2006	Computer decision aids versus usual care	Usual care	Randomized controlled trial	Maternity units	Women with previous caesarean section	742	22%-25% at facility level	Decision analysis group: RR 0.90 (0.79-1.02) &	Little or no difference	Some concerns

	evaluation ^{57,58} , observational ⁵⁹									informa tion group: RR 1.02 (0.90- 1.14)		
Navaee 2015	None	Iran Unclear	Role-play education versus standard education using lectures	Lecture education group	Blind clinical trial	Health centres	Women with fear of childbirth	67	47% at country level	RR 0.66 (0.39- 1.12)	Little or no difference	Some concerns
Saisto 2001	None	Finland 1996 - 1999	Intensive group therapy (cognitive behavioural therapy and childbirth psychotherapy)	Conventional therapy	Randomized controlled trial	Outpatient clinic	Women with fear of childbirth	176	Baseline caesarean section rates were not stated but high preference for caesarean section was cited among women with fear of birth (region not stated)	RR 0.90 (0.65- 1.36)	Little or no difference	Some concerns
Bastani 2005	1 study: randomized controlled trial ⁶⁰	Iran 2002 - 2003	Nurse-led applied relaxation (breathing techniques & muscle relaxation) training programme	Routine prenatal care	Randomized controlled trial	Prenatal clinics	Women with fear of childbirth	110	Baseline caesarean section rates were not stated but increasing caesarean section worldwide was cited	RR 0.22 (0.11- 0.43)	Decrease	Some concerns
Feinberg 2015	2 studies: randomized	USA 2004 - 2006	Psychosocial couple- based prevention programme	Routine care (no	Randomized controlled trial	Unclear	Women with low-	169	Not stated	RR 0.53 (0.32- 0.90)	Decrease	Some concerns

	controlled trials ^{61,62}			educational classes)			risk pregnancy					
Rouhe 2013	2 studies: randomized controlled trials ^{63,64}	Finland 2007 - 2009	Psychoeducation	Conventional care group	Randomized controlled trial	Hospital	Women with fear of childbirth	271	19.9% at country level	RR 0.70 (0.49-1.01)	Decrease	Some concerns
Sharifirad 2013	None	Iran Unclear	Prenatal education for husbands	Unclear	Randomized controlled trial	Unclear	Women with low-risk pregnancy	88	41.6% at province level	Caesarean section rate in case and control groups was 29.5% and 50% (P < 0.05)	Decrease	Some concerns
Valiani 2014	None	Iran Unclear	Childbirth training workshop	Mothers (alone), couples (mothers and partners), and control	Randomized controlled trial	Healthcare centres	Women with low-risk pregnancy	180	60% at province level	Mother group: RR 0.55 (0.33-0.89) & couple group: RR 0.59 (0.37-0.94)	Decrease	Some concerns
Interventions targeting women and health providers												
Zhang 2020	None	China 2015 - 2017	Targeted health education to pregnant women, improved hospital caesarean section policy, and	Usual practice	Randomized controlled trial	Tertiary and secondary hospitals	Women with low-risk pregnancy	10,752	42.50% at facility level	OR = 0.92; 95% CI 0.73, 1.15	Little or no difference	Some concerns

			training of midwives/doulas for 8 months									
Borem 2020	None	Brazil 2014 - 2016	A coalition of stakeholders, empowerment of pregnant women to choose mode of delivery, psychologic birth promotion, information system for providers	Baseline	Interrupted time series	Hospitals	Women with low-risk pregnancy	119,378	78.3% at facility level	Vaginal deliveries RR 1.62 (95% CI 1.27 to 2.07, p < 0.001)	Decrease	Not serious
Clarke 2020	3 studies: process evaluation ⁶⁵ , protocol ⁶⁶ , formative qualitative ⁶⁷	Italy, Ireland, Germany 2012 - 2016	Education of clinicians and women with one previous caesarean section, appointment of opinion leaders, audit/peer review, and joint discussions by women and clinicians	Usual practice	Randomized controlled trial	Maternity units	Women with previous caesarean section	2,002	VBAC rates < 35% at facility level	RR 0.9 (95%CI 0.85 to 0.98)	Decrease	Some concerns
Runmei 2012	None	China 2005 - 2011	Continuous quality improvement programme (education for staff and women, audits, public health education, monitoring caesarean section rates, and neonatal outcomes)	Baseline	Controlled before-after study	Regional referral centre	Women with low-risk pregnancy	25,280	53.5%-56.1% at facility level	OR 0.56 (0.52–0.59)	Decrease	Some concerns
Yu 2017	None	China 2006 - 2014	Face-to-face weekly educational meetings between patients and hospital staff, training for providers, new regulations adoption and projects on caesarean section (i.e. encourage mothers to choose	Baseline	Pre-post intervention study	Tertiary public hospitals	Women with low-risk pregnancy	131,312	55-56% at facility level	Overall caesarean section rate declined by 1.29%	Decrease	Not serious

			vaginal delivery, strictly control indications for caesarean section and maternal request for caesarean section)							(p = 0.002)		
Xia 2019	None	China 2010 - 2016	Programs for population health education, skills training for healthcare professionals, equipment and technical support for local healthcare facilities, and capacity building for the maternal near-miss care system	Baseline	Uncontrolled before-after study	Hospitals and community	Women with low-risk pregnancy	1,923,687	42% at facility level	Decreasing trend in the monthly caesarean section rates (Z = 75.067, p < 0.001)	Decrease	Low risks of bias

**See Appendix 7.2 for details of risk bias assessment.*

The childbirth education interventions included information about mode of birth, birth process, mental health and coping strategies, pain relief methods, and partners' roles in birth. Most interventions were delivered in group settings, and only in three studies they were delivered on a one-to-one basis^{38,41,42}. Only one study explicitly stated that the intervention was individualised to a woman's unique needs and experiences³⁸.

Overall, there was limited theory used to design interventions among the included studies: less than half of interventions (7/17) explicitly used theory in designing the intervention. Among the seven interventions that used theory in intervention development, the theories included the health promotion-disease prevention framework³⁸, midwifery counselling framework⁴¹, cognitive behavioural therapy⁴², Ost's applied relaxation⁷⁰, conceptual model of parenting⁷¹, attachment and social cognitive theories³⁷, and healthcare improvement scale-up framework⁴⁶. The remaining 10 studies only relied on previously published studies to design the interventions. We identified very limited process evaluation or implementation outcome evidence related to the included interventions, which is a limitation of the field of caesarean section and clinical interventions more broadly.

7.4.2 Qualitative comparative analysis

7.4.2.1 *Model 1 – How birth information was provided to women*

Model 1 is constructed based on the finding from Kingdon et al (2018)²³ that women and communities enjoy learning new birth information, as it opens up new ways of thinking about vaginal birth and caesarean section. Learning new information allows them to understand better the benefits and risks of caesarean section and vaginal births, as well as increase their knowledge about caesarean section²³.

We used four conditions in constructing model 1 truth table: 1) the provision of information, education, and communication (IEC) materials on what to expect during labour and birth, 2) type of education delivered (antenatal education or psychoeducation), and 3) group-based intervention delivery. We explored this model considering other conditions, such as type of information provided (e.g. information about mode of birth including birth process, mental health and coping strategies, pain relief), delivery technique (e.g. didactic, practical) and frequency and duration of intervention delivery; however, these additional conditions did not result in configurations.

Of 16 possible configurations, we identified seven configurations (Table 7.4). The first two rows show perfect consistency of configurations (inclusion = 1) in five studies^{37,68–71} in which all

conditions are present, except antenatal education or psychoeducation. The remaining configurations are unsuccessful interventions. Interestingly, when either IEC materials or group-based intervention delivery are present (but not both), implementation is likely to be unsuccessful (rows 3-7).

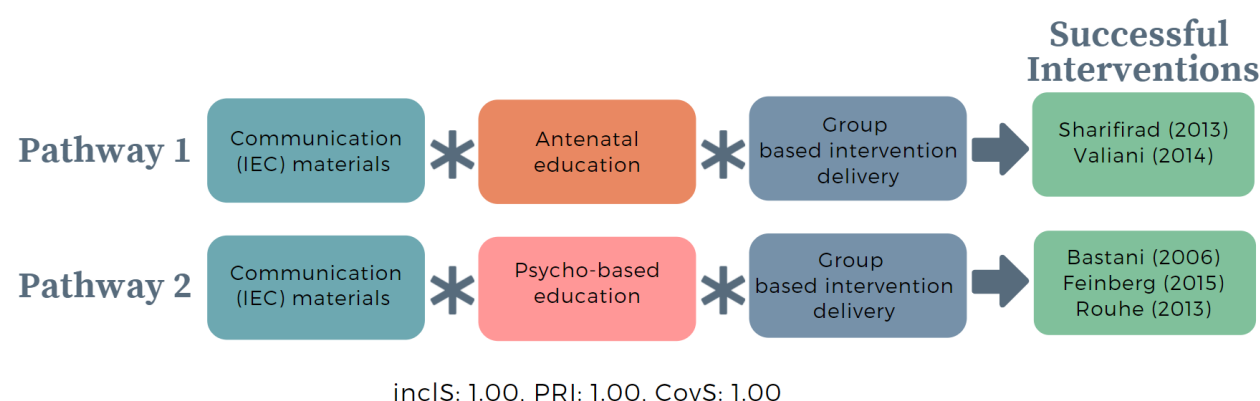
Table 7.4. Truth table model 1 – how birth information was provided to women.

Row	Communication (IEC) materials	Antenatal Education	Psychoeducation	Group based intervention delivery	Outcome	Number of cases	InclS*	PRI**	Cases
1	1	0	1	1	1	3	1	1	Bastani (2005), Feinberg (2015), Rouhe (2013)
2	1	1	0	1	1	2	1	1	Sharifirad (2013), Valiani (2014)
3	0	0	1	1	0	1	0	0	Masoumi (2016)
4	0	1	0	1	0	1	0	0	Navaee (2015)
5	1	0	0	0	0	1	0	0	Montgomery (2007)
6	1	0	1	0	0	2	0	0	Fenwick (2015), Saisto (2001)
7	1	1	0	0	0	1	0	0	Fraser (1997)

**Inclusion score (InclS), also known as consistency, indicates the degree to which the evidence is consistent with the hypothesis that there is sufficient relation between the configuration and the outcome; **Proportional Reduction in Inconsistency (PRI) refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome.*

Boolean minimisation identified two intermediate pathways to successful interventions (Figure 7.2). The two pathways are similar, except for one condition: type of education. The antenatal education or psychoeducation materials is the content tailored to the type of women they target. Therefore, from the two pathways, we can see that the presence of distribution of IEC materials on birth information and group-based intervention delivery of either antenatal education to the general population of women (e.g. not groups of women with specific risks or conditions) or psychoeducation to women with fear of birth trigger successful interventions. From this solution, we can see that the successful interventions are consistently characterised by the presence of both IEC materials and group-based intervention delivery.

Figure 7.2. Intermediate pathways from model 1 that trigger successful intervention.



In QCA, asterisk () denotes an 'AND' relationship; Inclusion score (InclS), also known as consistency, indicates the degree to which the evidence is consistent with the hypothesis that there is sufficient relation between the configuration and the outcome; Proportional Reduction in Inconsistency (PRI) refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome; Coverage score (CovS) refers to percentage of cases in which the configuration is valid.*

7.4.2.2 Model 2 – Emotional support was provided to women

Model 2 was constructed based on the theory that women desire emotional support alongside the communication of information about childbirth²³. This includes emotional support from husbands or partners, health professional, or doulas²³. Furthermore, Kingdon et al (2018) describe the importance of two-way conversation and dialogue between women and providers during pregnancy care, particularly to ensure the opportunity for discussion²³. Interventions may generate more questions than they answered, creating the need and desire of women to have more dialogue with

health professionals²³. Women considered intervention content to be most useful when it complements clinical care, is consistent with advice from health professionals and provides a basis for more informed, meaningful dialogue between women and care providers²³.

Based on this underlying theory, we constructed model 3 truth table by considering three conditions representative of providing emotional support to women, including partner or family member involvement, group-based intervention delivery which provide social or peer support to women, and opportunity for women to interact with health providers. Of 8 possible configurations, we identified six configurations (Table 7.5). The first three rows represent successful interventions with perfect consistency (inclusion = 1). The first row shows successful interventions with all conditions present. The second and third row shows successful interventions with all conditions except partner or family member involvement or interaction with health providers. The remaining rows represent unsuccessful interventions, where at least two conditions are absent.

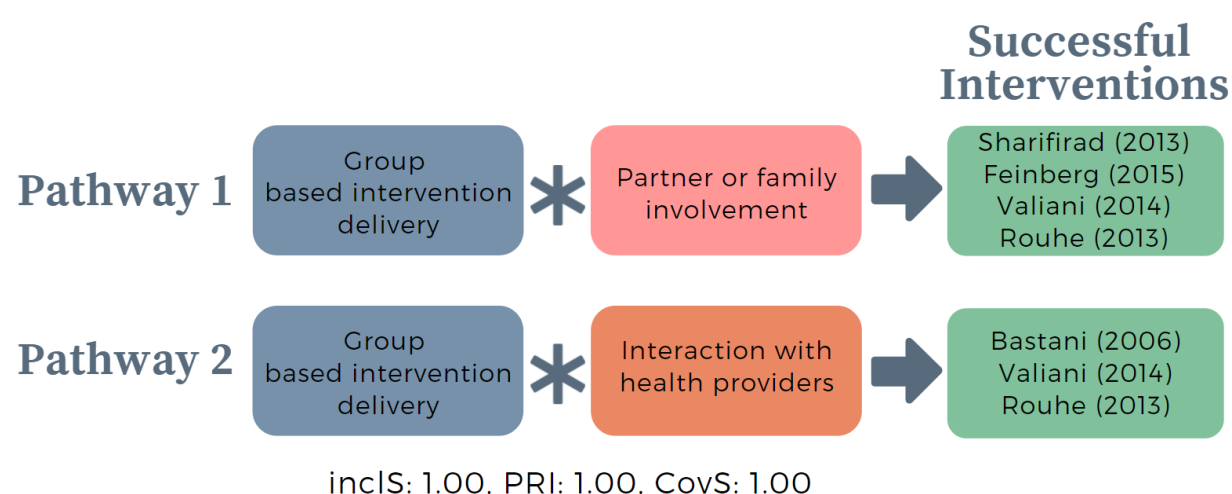
Table 7.5. Truth table model 2 – Emotional support was provided to women.

Row	Group-based intervention delivery	Partner or family member involvement	Interaction with health provider	Outco me	Number of cases	inclS*	PRI**	Cases
1	1	1	1	1	2	1	1	Valiani (2014), Rouhe (2013)
2	1	0	1	1	1	1	1	Bastani (2005)
3	1	1	0	1	2	1	1	Sharifirad (2013), Feinberg (2015)
4	0	0	0	0	1	0	0	Montgomery (2007)
5	0	0	1	0	3	0	0	Fraser (1997), Fenwick (2015)
6	1	0	0	0	2	0	0	Masoumi (2016), Navaee (2015)

**Inclusion score (InclS), also known as consistency, indicates the degree to which the evidence is consistent with the hypothesis that there is sufficient relation between the configuration and the outcome; **Proportional Reduction in Inconsistency (PRI) refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome.*

Boolean minimisation identified two intermediate pathways to successful interventions (Figure 7.3). In the first pathway, the partner or family members involvement and group-based intervention delivery enable successful interventions. In the second pathway, however, when partner or family members are not involved, successful interventions can happen only when interaction with health providers is included alongside group-based intervention. From these two pathways, we can see that group-based intervention, involvement of partner and family member, and opportunity for women to interact with providers seem to be important in driving intervention success.

Figure 7.3. Intermediate pathways from model 2 that trigger successful intervention.



In QCA, asterisk () denotes an 'AND' relationship; Inclusion score (InclS), also known as consistency, indicates the degree to which the evidence is consistent with the hypothesis that there is sufficient relation between the configuration and the outcome; Proportional Reduction in Inconsistency (PRI) refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome; Coverage score (CovS) refers to percentage of cases in which the configuration is valid.*

7.4.2.3 Consolidated model – Essential conditions to prompt successful interventions focusing on women

Using the identified important conditions observed in models 1 and 2, we constructed a consolidated model to examine the final essential conditions which could prompt successful educational interventions targeting women. We merged and tested four conditions: the provision of IEC materials on what to expect during labour and birth, group-based intervention delivery, partner

or family member involvement, and opportunity for interaction between women and health providers.

Of the 16 possible configurations, we identified six configurations (Table 7.6). The first three rows show configurations resulting in successful interventions with perfect consistency (inclusion = 1). The first row shows successful interventions with all conditions present; the second and third rows show successful interventions with all conditions present except interaction with health providers or partner or family member involvement. The remaining three rows are configurations of unsuccessful interventions, missing at least two conditions, including the consistent absence of partner or family member involvement.

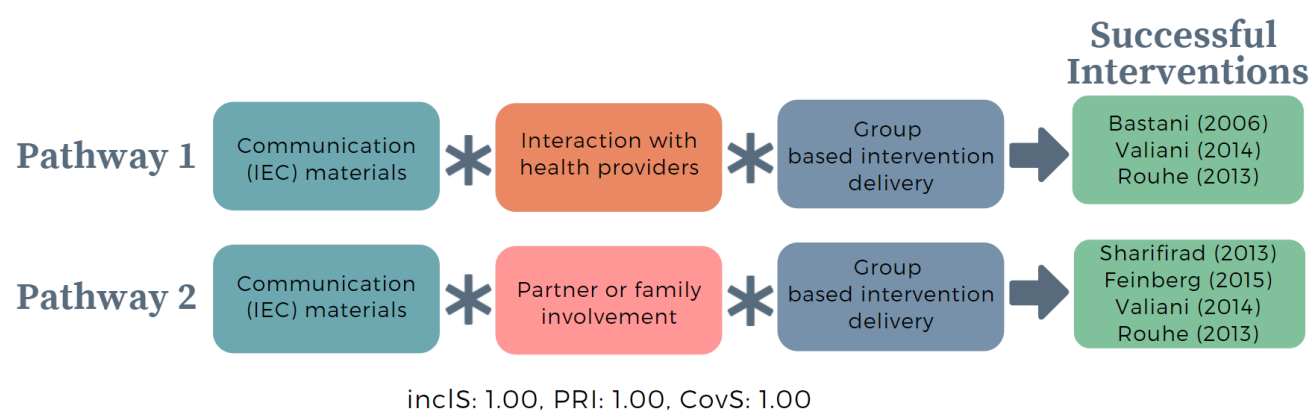
Table 7.6. Truth table of consolidated model – essential conditions to prompt successful educational interventions focusing on pregnant women.

Row	Group based delivery	Communication (IEC) materials	Partner of family member involvement	Interaction with providers	Outcome	Number of cases	inclS*	PRI**	Cases
1	1	1	1	1	1	2	1	1	Valiani (2014), Rouhe (2013)
2	1	1	1	0	1	2	1	1	Sharifirad (2013), Feinberg (2015)
3	1	1	0	1	1	1	1	1	Bastani (2005)
4	0	1	0	0	0	1	0	0	Montgomery (2007)
5	0	1	0	1	0	3	0	0	Fraser (1997), Fenwick (2015), Saisto (2001)
6	1	0	0	0	0	2	0	0	Masoumi (2016), Navaee (2015)

**Inclusion score (InclS), also known as consistency, indicates the degree to which the evidence is consistent with the hypothesis that there is sufficient relation between the configuration and the outcome; **Proportional Reduction in Inconsistency (PRI) refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome.*

Boolean minimisation identified two intermediate pathways to successful intervention (Figure 7.4). The first pathway shows that the opportunity for women to interact with health providers, provision of IEC materials, and group-based intervention delivery prompts successful interventions. The second pathway, however, shows that when there is no opportunity for women to interact with health providers, it is important to have partner or family member involvement alongside group-based intervention delivery and provision of IEC materials. These two pathways suggest that the delivery of educational interventions accompanied by provision of IEC materials and presence of emotional support for women during the intervention is important to trigger successful interventions. These pathways also emphasise that emotional support for women during the intervention can come from either partner, family member, or health provider. For the consolidated model, we did not simplify the solution further, as the intermediate solution is more theoretically sound compared to the most parsimonious solution.

Figure 7.4. Pathways from consolidated model that trigger successful intervention.



In QCA, asterisk () denotes an 'AND' relationship; Inclusion score (InclS), also known as consistency, indicates the degree to which the evidence is consistent with the hypothesis that there is sufficient relation between the configuration and the outcome; Proportional Reduction in Inconsistency (PRI) refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome; Coverage score (CovS) refers to percentage of cases in which the configuration is valid.*

7.4.2.4 Sub-analysis – Interventions targeting both women and health providers or systems

In this sub-analysis, we ran the important conditions identified from the consolidated model, added the condition of multi-target intervention, and applied it to 17 interventions: 11 interventions

targeting women, and six interventions targeting both women and health providers or systems (multi-target interventions).

Of 32 possible configurations, we identified eight configurations (Table 7.4). The first four rows show configurations with successful interventions with perfect consistency (inclusion = 1). The first row is where all the multi-target interventions are clustered, except the unsuccessful intervention Zhang (2020)⁴⁹, and where all the conditions are present. All the conditions in the second to fourth rows are present, except multi-target interventions (all rows), interaction with health providers (third row) and partner and family member involvement (fourth row). The remaining rows are all configurations to unsuccessful interventions, where at least three conditions are missing, except row 8, which is a single case row. This case is the only multi-target intervention that was unsuccessful and in which partner or family members were not involved.

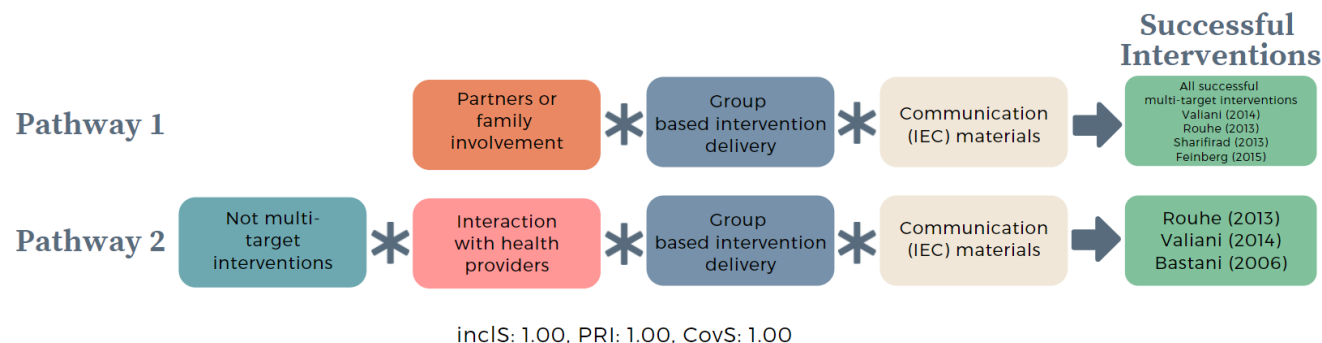
Table 7.7. Truth table of multi-target interventions sub-analysis – interventions targeting both women and health providers or systems.

Row	Group based delivery	Communication (IEC) materials	Partner or family member involvement	Interaction with health providers	Multi-target intervention	Outcome	Number of cases	inclS*	PRI**	Cases
1	1	1	1	1	1	1	5	1	1	Runmei (2012), Borem (2020), Yu (2017), Xia (2019), Clarke (2020)
2	1	1	1	0	0	1	2	1	1	Sharifirad (2013), Feinberg (2015)
3	1	1	1	1	0	1	2	1	1	Valiani (2014), Rouhe (2013)
4	1	1	0	1	0	1	1	1	1	Bastani (2005)
5	0	1	0	0	0	0	1	0	0	Montgomery (2007)
6	0	1	0	1	0	0	3	0	0	Fraser (1997), Fenwick (2015), Saisto (2001)
7	1	0	0	0	0	0	2	0	0	Masoumi (2016), Navaee (2015)
8	1	1	0	1	1	0	1	0	0	Zhang (2020)

**Inclusion score (InclS), also known as consistency, indicates the degree to which the evidence is consistent with the hypothesis that there is sufficient relation between the configuration and the outcome; **Proportional Reduction in Inconsistency (PRI) refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome.*

The Boolean minimisation identified two intermediate pathways (Figure 7.5). The first pathway shows that partner or family involvement, provision of IEC materials, and group-based intervention delivery prompt successful interventions. The first pathway is comprised of all five successful multi-target interventions^{44–48} and four of 11 interventions targeting only women^{37,68,69,71}. The second pathway shows that when multi-target interventions are absent, but when interaction with health providers is present, alongside provision of IEC materials and group-based intervention delivery, it prompts successful interventions (3/11 interventions targeting women only^{37,69,70}). The first pathway shows that there are successful configurations with and without multi-target interventions. Therefore, similar to the interventions targeting women, when implementing multi-target interventions, intervention components targeting women are more likely to be successful when partners or family members are involved, interventions are implemented through group-based intervention delivery, IEC materials were provided, and there is an opportunity for women to interact with health providers.

Figure 7.5. Pathways from multi-target interventions sub-analysis that trigger successful intervention.



In QCA, asterisk () denotes an 'AND' relationship; Inclusion score (InclS), also known as consistency, indicates the degree to which the evidence is consistent with the hypothesis that there is sufficient relation between the configuration and the outcome; Proportional Reduction in Inconsistency (PRI) refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome; Coverage score (CovS) refers to percentage of cases in which the configuration is valid.*

To summarise, there are four essential intervention components which trigger successful educational interventions focusing on pregnant women to reduce caesarean section, this includes 1) group-based intervention delivery, 2) provision of IEC materials on what to expect during labour and

birth, 3) partner or family member involvement on the intervention, and 4) opportunity for women to interact with health providers. These conditions do not work in siloed or independently but instead work jointly as parts of configurations to enable successful interventions.

7.5 DISCUSSION

Our extensive QCA identified configurations of essential intervention components which are sufficient to trigger successful interventions to optimised caesarean section use. Educational interventions focusing on women were successful by: 1) leveraging social or peer support through group-based intervention delivery, 2) improving women's knowledge and awareness of what to expect during labour and birth, 3) ensuring women have emotional support through partner or family participation in the intervention, and 4) providing opportunities for women to interact with health providers. We found that the absence of two or more of the above characteristics in an intervention result in unsuccessful interventions. Unlike our logic model, which predicted engagement strategies (i.e. intensity, frequency, technique, recruitment, incentives) to be essential to intervention success, we found that "support" seems to be central in maximising benefits of interventions targeting women.

Group-based intervention delivery is present across all four truth tables and eight pathways leading to successful intervention implementation, suggesting that group-based intervention delivery is an essential component of interventions targeting women. Despite this, we cannot conclude that group-based intervention delivery is a *necessary* condition, as there may be other pathways not captured in this QCA. The importance of group-based intervention delivery may be due to the group setting providing women with a sense of confidence through peer support and engagement. In group-based interventions, women may feel more confident when learning with others and peer support may motivate women. Furthermore, all group-based interventions in our included studies are conducted at health facilities, which may provide women with more confidence that information is aligned with clinical recommendations. Evidence on benefits of group-based interventions involving women who are pregnant has been demonstrated previously^{72,73}. Women reported that group-based interventions reduce their feelings of isolation, provide access to group support, and allow opportunities for them to share their experiences^{72,74–76}. This is aligned with social support theory, in which social support through a group or social environment may provide women with feelings of reassurance, compassion, reduce feelings of uncertainty, increase sense of control, access to new contacts to solve problems, and provision of instrumental support, which eventually influence positive health behaviours^{72,77}. Women may resolve their uncertainties around mode of birth by sharing their concerns with others and learning at the same time how others cope with it.

These findings are consistent with the benefits associated with group-based antenatal care, which is recommended by WHO^{78,79}.

Kingdon et al (2018) reported that women and communities liked learning new birth information, as it opens new ways of thinking about vaginal birth and caesarean section, and educates about benefits of different modes of birth, including risks of caesarean section. Our QCA is aligned with this finding where provision of information about birth through education delivery leads to successful interventions but with certain caveats. That is, provision of birth information should be accompanied by IEC materials and through group-based intervention delivery. There is not enough information to distinguish what type of IEC materials lead to successful intervention; however, it is important to note that the format of the IEC materials (such as paper-based or mobile application) may affect success. More work is needed to understand how women and families react to format of IEC materials; for example, will paper-based IEC materials be relegated over more modern methods of reaching women with information through digital applications? The QUALI-DEC (Quality decision-making (QUALI-DEC) by women and healthcare providers for appropriate use of caesarean section) study is currently implementing a decision-analysis tool to help women make an informed decision on preferred mode of birth using both a paper-based and mobile application that may shed some light on this⁸⁰.

Previous research has shown that women who participated in interventions aiming to reduce caesarean section desired emotional support (from partners, doulas or health providers) alongside the communication about childbirth²³. Our QCA is aligned with this finding in which emotional support from partners or family members is highly influential in leading to successful interventions. Partner involvement in maternity care has been extensively studied and has been demonstrated to improve maternal health care utilisation and outcomes⁸¹. Both women and their partners perceived that partner involvement is crucial as it facilitates men to learn directly from providers, thus promoting shared decision-making among women and partners and enabling partners to reinforce adherence to any beneficial suggestions⁸²⁻⁸⁶. Partners provide psychosocial support to women, for example through being present during pregnancy and the childbirth process, as well as instrumental support, which includes supporting women financially⁸²⁻⁸⁴. Despite the benefits of partner involvement, partner's participation in maternity care is still low⁸², as reflected in this study where only four out of 11 included interventions on this study involved partner or family member involvement. Reasons for this low participation, which include unequal gender norms and limited health system capability^{82,84-86}, should be explored and addressed to ensure the benefits of the interventions.

Furthermore, our QCA demonstrates the importance of interaction with health providers to trigger successful interventions. The interaction of women with providers in caesarean section decision-making, however, is on a “nexus of power, trust, and risk”, where it may be beneficial but can also reinforce the structural oppression of women¹⁴. A recent study on patient-provider interaction in caesarean section decision-making concluded that the interaction between providers who are risk-averse, and women who are cautious about their pregnancies in the health system results in discouragement of vaginal births⁸⁷. However, this decision could be averted by meaningful communication between women and providers where caesarean section risks and benefits are communicated in an environment where vaginal birth is encouraged⁸⁷. Furthermore, the reasons women desire interaction with providers can come from opposite directions. Some women see providers as the most trusted and knowledgeable source, in which women can trust the judgement and ensure that the information learned is reliable and evidenced-based²³. On the other hand, some women may have scepticism towards providers where women understand that providers’ preference may negatively influence their preferred mode of birth²³. Therefore, adequate, two-way interaction is important for women to build a good rapport with providers.

It is also important to note that we have limited evidence (3/17 intervention studies) involving women with previous caesarean section. Vaginal birth after previous caesarean section (VBAC) can be a safe and positive experience for some women, but there are also potential risks depending on their obstetric history^{88–90}. Davis (2020) found that women were motivated to have VBAC due to negative experiences of caesarean section, such as the difficult recovery, and that health providers’ roles served as pivotal drivers in motivating women towards VBAC⁹¹. Other than this, VBAC also requires giving birth in a suitably staffed and equipped maternity unit, with staff trained on VBAC, equipment for labour monitoring, and resources for emergency caesarean section if needed^{89,90}. There is comparatively less research conducted on VBAC and trial of labour after caesarean section⁸⁸. Therefore, more work is needed to explore if there are potentially different pathways that lead to successful intervention implementation for women with previous caesarean section. It may be more likely that interventions targeting various stakeholders are more crucial in this group of women. For example, both education for women and partners or families, as well as training to upskill health providers might be needed to support VBAC.

7.5.1 Strength and limitations

We found many included studies had poor reporting of the interventions, including the general intervention components (e.g. presence of policies that may support interventions) and process evaluation components, which is reflective of the historical approach to reporting trial data. This

poor reporting means we could not engage further in the interventions and thus may have missed important conditions that were not reported. However, we have attempted to compensate for limited process evaluation components by identifying all relevant sibling studies that could contribute to a better understanding of context. Furthermore, there are no studies conducted in low-income countries, despite rapidly increasing caesarean section rates in these settings. Lastly, we were not able to conduct more nuanced analyses about caesarean section, such as exploring how caesarean section interventions impacted changes to emergency versus elective caesarean section, VBAC, or instrumental birth, due to an insufficient number of studies and heterogeneity in outcome measurements. Therefore, it is important to note that we are not necessarily measuring the optimal outcome of interest - reducing unnecessary caesarean section. However, it is unlikely that these non-clinical interventions will interfere with a decision of caesarean section based on clinical indications.

Despite these limitations, this is the first study aiming to understand how certain interventions can be successful in targeting women to optimise caesarean section use. We used the QCA approach and new analytical frameworks to re-analyse existing systematic review evidence to generate new knowledge. We ensure robustness through the use of a logic model and worked backwards in understanding what aspects are different in the intervention across different outcomes. The use of QCA and qualitative evidence synthesis ensured that the results are theory-driven, incorporate participants' perspectives into the analysis, and explored iteratively to find the appropriate configurations, reducing the risk of data fishing. Lastly, this QCA extends the understanding of effectiveness review conducted by Chen et al (2018)¹⁹ by explaining the potential intervention components which may influence heterogeneity.

7.5.2 Implications for practice and research

To aid researchers and health providers to reduce caesarean section in their contexts and designing educational interventions targeting women during pregnancy, we have developed a checklist of key components to consider when designing the interventions that may help lead to successful implementation (Figure 7.6):

1. Is the intervention delivered in a group setting?
2. Are IEC materials on what to expect during labour and birth disseminated to women?
3. Are women's partners or families involved in the intervention?
4. Do women have opportunities to interact with health providers?

Figure 7.6. Checklist of key components to consider when designing interventions focusing on pregnant women

Key components to consider when designing educational interventions focusing on pregnant women	
	The intervention delivered in group settings
	Information, education and communication (IEC) materials on what to expect during labour and birth disseminated to women
	Women's partners or family involved in the intervention
	Women have opportunities to interact with health provider

We have used this checklist to explore the extent to which the included interventions in our QCA include these components using a matrix model (Figure 7.7).

Figure 7.7. Matrix model assessing the extent to which the included intervention studies have essential intervention components identified in the QCA.

Have the educational interventions included essential intervention components?					
Included studies	Are women's partners or family involved in the intervention?	Is the intervention be delivered in group settings?	Are IEC materials on what to expect during labour and birth disseminated to women?	Do women have opportunities to interact with health providers?	Outcome of intervention
Interventions targeting women					
Fraser 1997					Unsuccessful
Masoumi 2016					Unsuccessful
Navaee 2015					Unsuccessful
Fenwick 2015					Unsuccessful
Saisto 2001					Unsuccessful
Montgomery 2007					Unsuccessful
Sharifirad 2013					Successful
Valiani 2014					Successful
Bastani 2005					Successful
Feinberg 2015					Successful
Rouhe 2013					Successful
Multi-target interventions					
Zhang 2020					Unsuccessful
Runmei 2012					Successful
Borem 2020					Successful
Yu 2017					Successful
Xia 2019					Successful
Clarke 2020					Successful

Yes
No/Not reported

Additionally, future research on interventions to optimise the use of caesarean section should report the intervention components implemented, including process outcomes such as fidelity, attrition, contextual factors (e.g. policies, details of how the intervention is delivered), and stakeholder factors (e.g. women's perceptions and satisfaction). These factors are important in not just evaluating whether the intervention is successful or not, but also in exploring why similar interventions can work in one but not in another context. There is also a need for more intervention studies implementing VBAC to reduce caesarean section, to understand how involving women with previous caesarean section may result in successful interventions. Furthermore, more studies understanding impact of the interventions targeting women in LMICs are needed.

7.6 CONCLUSION

This QCA illustrates crucial intervention components and potential pathways that can trigger successful educational interventions to optimise caesarean section use, focusing on pregnant women. The following intervention components are found to be sufficient in triggering successful outcomes: 1) group-based delivery, 2) provision of IEC materials, 3) partner or family member involvement, and 4) opportunity for women to interact with health providers. These intervention components do not work in siloed or independently but instead work jointly as parts of configurations to enable successful interventions. Researchers, trialists, hospitals, or other institutions and stakeholders planning interventions focusing on pregnant women can consider including these components to ensure benefits. More studies understanding impact of the interventions targeting women to optimise caesarean section use are needed from LMICs. Researchers should clearly describe and report intervention components in trials, and consider how process evaluations can help explain why trials were successful or not. More robust trial reporting and process evaluations can help to better understand mechanisms of action and why interventions may work in one context yet not another.

7.7 CHAPTER 7 SUMMARY

To summarise, I found support provisions are central to promoting success in interventions targeting pregnant women. The support can be provided in the intervention through four kinds of support:

- **Informational support:** Provide women with communication materials on what to expect during birth.
- **Emotional support:** Provide emotional support to women by encouraging women's partners or families to participate in the intervention.
- **Social or peer support:** Promote social and peer support by delivering group-based intervention delivery.
- **Healthcare provider support:** Provide women adequate opportunities and time to interact with health providers.

To maximise intervention benefits, the interventions that will be implemented to optimise caesarean section use in Indonesia should consider the inclusion of these intervention components.

The next chapter will cover the results of caesarean intervention analysis targeting providers. Similar to this chapter, I found intervention components that can be implemented to promote the success of interventions targeting healthcare providers. More details can be read in the next chapter.

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CHAPTER EIGHT

Manuscript 4

*Interventions targeting healthcare providers to
optimise use of caesarean section: a qualitative
comparative analysis to identify important
intervention features*

8.1 CHAPTER 8 PREAMBLE

This chapter presents the second results of the third component of my PhD study. While the first results are related to caesarean interventions *targeting women* (Chapter 7), the second part of the results, which is this Chapter, are about the caesarean intervention *targeting healthcare providers*. The analysis of interventions to reduce caesarean section targeting healthcare providers also used the same methods as the analysis of the caesarean intervention targeting women in Chapter 7, which uses the QCA. The results of the intervention targeting providers have also been published at BMC Health Services Research.

Citation:

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8.2 INTRODUCTION

Rapid increases in caesarean section rates have been observed globally in recent years¹⁻⁴; however, caesarean section rates exceeding 15% at a population-level have limited benefits for women and babies^{1,5}. Globally, caesarean section rates have increased from around 5.0% in 1990 to 21.1% in 2018, and projected to reach 28.5% by 2030³. Caesarean section is a life-saving surgical procedure for women and babies when vaginal birth is not possible. Despite the life-saving benefits, women undergoing caesarean section are at risk of haemorrhage, anaesthetic complications, obstetric shock, renal failure, puerperal infection, and complications in subsequent pregnancies⁶⁻⁹. Similarly, babies born through caesarean section have increased risk of respiratory problems, hypoglycaemia, allergies and altered immunity¹⁰⁻¹². Therefore, optimising use of caesarean section is critical to maximise benefits and avoid unnecessary risks for women and babies.

While caesarean section should be done based on medical indications, non-clinical factors have been increasingly driving high caesarean section rates. Some women may prefer to have caesarean section over vaginal birth due to fears undergoing vaginal birth, negative previous birth experiences, prioritising the baby's life, choosing an "auspicious" day of birth, perceptions that caesarean section is safer, quick and painless, and the financial ability to choose "better" healthcare services¹³⁻¹⁶. Similarly, healthcare providers may prefer caesarean section due to the perception that it is a safer option than vaginal birth, the convenience of scheduled caesarean section compared to the unpredictability of vaginal birth, a preference to play safe instead of taking risks in being blamed if complications occur during vaginal birth, and desire to respect women's autonomy when they opt for caesarean section over vaginal birth^{13,14,17}. Exacerbating this further, health systems also play a role in encouraging healthcare providers and women to have caesarean section. This can be through financial structures in which higher financial incentives are given for caesarean section compared to vaginal birth, logistical needs which includes inadequacy of labour rooms, expectations around time in using existing labour facilities, unequal power relationships between providers, and culture of medicalisation of birth^{17,18}.

Globally, interventions targeting healthcare providers to change their behaviours around caesarean section have been tested. A Cochrane intervention review identified 16 intervention studies targeting healthcare providers and systems, typically focusing on implementation of audit and feedback of caesarean section data combined with either implementation of clinical guidelines and protocols, mandatory secondary opinion for caesarean section decision-making, or working with local opinion leaders to influence change¹⁹⁻²¹. Audit and feedback can help healthcare providers to assess the distribution of caesarean section across different groups of women, and identify areas for

appropriate increases or decreases in these groups based on obstetric characteristics²². Hospital policies of mandatory secondary opinion at the time of decision-making may influence healthcare provider attitudes regarding indication for caesarean section²³. Similarly, local opinion leaders can change organisational culture by modelling appropriate behaviour to their colleagues²⁴.

Across contexts and studies, the effectiveness of interventions targeting healthcare providers in reducing caesarean section has had mixed results¹⁹. Contextual characteristics of the interventions (i.e. participant characteristics, intensity of exposure to the intervention, implementation method, type of health facility) may impact implementation and thus influence effectiveness of the intervention. Therefore, understanding which intervention components, and in which contexts, are important to the success of interventions is imperative to optimise benefits of caesarean section. The aim of this study was to identify important intervention components that lead to successful non-clinical interventions targeting healthcare providers to optimise the use of caesarean section.

8.3 METHODS

8.3.1 Qualitative comparative analysis (QCA)

Utilising QCA, we re-analysed evidence from existing systematic reviews using new analytical frameworks to explore the heterogeneity in effects and ascertain why some studies appear to be effective while others not. QCA is often conceptualised as a “bridge between qualitative and quantitative methodologies” based on its data, process and theoretical standpoint²⁵. QCA is an evidence synthesis method that allows researchers to explore different commonly occurring characteristics of complex interventions²⁶. These properties include recognition that different pathways may lead to the same outcome (equifinality), and that intervention components may only be activated to have an influence on the outcome in the presence of other components (conjunctural causation)²⁶.

QCA facilitates comparisons of intervention components – referred as “conditions” in QCA – present in successful (effective interventions) and unsuccessful (ineffective interventions) “cases”^{26,27}. This is done using a scoring system based on “set membership”. In this scoring system, all potential conditions and outcomes are coded based on the extent to which they are present or absent to form set membership^{26,27}. There are two types of scoring systems in QCA, which are crisp set QCA (csQCA) and fuzzy set QCA (fsQCA)^{26,27}. In csQCA, conditions and outcomes are coded to binary values either to 0 (“fully out” of set membership) or 1 (“fully in” set membership)^{26,27}. By “fully out”, we mean the condition is entirely absent, while “fully in” means that the condition is entirely present. In fsQCA, the conditions and outcomes can be coded in ordinal values between 0 to 1^{26,27}. In our study, we

adopted both csQCA and fsQCA to code our data, as some data have explicit binary options (e.g. yes, no), while others are more nuanced (e.g. adherence or participant satisfaction). However, our final analysis only includes conditions using csQCA scoring system due to the explicit binary nature of the data included in the final solutions.

QCA is based on set-theory in which two types of relationships are explored: necessary and sufficient^{25,26}. When all successful interventions share the same exact condition(s), this condition(s) is deemed “necessary” to trigger successful interventions^{25,26}. Necessary condition must be present to prompt successful interventions, yet necessary condition alone do not provide sufficient cause for successful intervention^{25,26}. However, when all instances of a particular condition(s) is associated with successful interventions, this condition(s) is “sufficient” to trigger successful interventions^{25,26}, although other pathways towards a successful intervention may also exist. In our QCA, we were interested in exploring “sufficiency”, as our logic model (Appendix 7.1) highlighted that there are multiple pathways to optimise caesarean section use, suggesting that it would be unlikely for all successful interventions to share the same conditions. The degree of sufficiency was calculated using consistency scores, which measure the frequency in which conditions are present when the desired outcome is achieved^{26,27}. We conducted the QCA using R programming software with QCA package developed by Thiem and Duşa and QCA with R guidebook²⁷. QCA was conducted in six stages based on Thomas et al (2014)²⁶ and explained below.

8.3.2 Data sources, case selection, and defining outcomes

8.3.2.1 *Developing a logic model*

We developed a logic model to guide our understanding about the different pathways and intervention components potentially leading to successful implementation (Appendix 7.1), which was based on existing qualitative evidence syntheses and quantitative systematic reviews^{18,19,25,28–30}. With the logic model, we worked backwards to understand what inputs are needed to achieve our desired outcome, that is reduced caesarean section rates in what it has been conceptualized as low-risk women (e.g. women with term, singleton, cephalic pregnancies without previous caesarean section, who are typically represented by the Robson groups 1-4³¹). The logic model was used to guide the analysis.

8.3.2.2 *Identifying data sources and selecting cases*

In 2018, the World Health Organization (WHO) issued global guidance on non-clinical interventions to reduce unnecessary caesarean section, with interventions designed to target three different stakeholders: women, healthcare providers, and health systems³². As part of the guideline

development, a series of systematic reviews about caesarean section interventions were conducted: 1) a Cochrane intervention review of effectiveness by Chen et al¹⁹, and 2) three qualitative evidence syntheses exploring key stakeholders (women and communities, health professionals, and health systems) perspectives and experiences of caesarean section interventions by Kingdon et al^{18,28,29}. Following this, Opiyo and colleagues published a scoping review of financial and regulatory interventions to optimise use of caesarean section³⁰. Therefore, the primary data sources of this QCA are the intervention studies included in the Chen et al¹⁹ and Opiyo et al³⁰. To guide the analysis of the study, we used two qualitative evidence syntheses by Kingdon et al^{18,28}.

The intervention studies included in Chen et al¹⁹ and Opiyo et al³⁰ are referred to as “cases” in this QCA. The main criteria to select eligible cases are the intervention should target healthcare providers and aim to reduce or optimise caesarean section use. We did not impose restrictions on study designs, therefore studies that were excluded in Chen et al¹⁹ and Opiyo et al³⁰ due to study design (i.e. uncontrolled before and after study, interrupted time series with less than three data points) were re-assessed for eligibility in this analysis as it may help to show other pathways influencing success. We also assessed intervention studies published since the last review updates in 2018 and 2020, to ensure the inclusion of intervention studies that are likely included in future review updates.

To ensure that we have the most detailed and comprehensive information on each eligible case (intervention), we searched for sibling studies of eligible cases. Sibling studies (i.e. formative research, process evaluation) are studies that are linked to the main intervention study yet may have been published separately. Sibling studies can provide additional information about intervention components, study contexts, and implementation outcomes, which may not be sufficiently described in a single intervention effectiveness article. To locate the sibling studies, we conducted reference list search of Chen et al¹⁹, Opiyo et al³⁰, all eligible cases, and Kingdon qualitative evidence syntheses^{18,28}. Additionally, we forward reference searched all the eligible cases using “Cited by” function in Scopus and Web of Science. Sibling studies were eligible for inclusion when they included any information on intervention components or implementation outcomes, regardless of methodology used. One review author (RIZ) screened all the potential sibling studies, and 10% of the screening was double checked by the second review author (MAB). Disagreements were discussed and adjudicated by the third review author, if needed.

In total, we identified 32 intervention studies targeting only healthcare providers or systems and six intervention studies targeting both women and healthcare providers or systems. The types of interventions targeting providers were comprised of audit and feedback (15 studies)^{22,33–46}, financial

reforms (11 studies)^{47–57}, implementation of second opinion without audit and feedback (2 studies)^{23,58}, training to improve providers’ knowledge and skills (1 study)⁵⁹, introduction of collaborative midwifery and obstetrician models of care (1 study)⁶⁰, national publication of caesarean section rates (1 study)⁶¹ and legislatively-imposed practice guidelines (1 study)⁶². Due to an imbalance of successful and unsuccessful interventions in financial reform group (two successful^{54,55}, 9 unsuccessful^{47–53,56,57}), and a limited number of studies using interventions other than audit and feedback and financial reform (6/32 studies)^{23,58–62}, these interventions could not be analysed (as QCA requires similar number of successful and unsuccessful interventions, typically at least 10 cases to be compared). Therefore, this QCA is based only on 15 audit and feedback interventions^{22,33–46} and six multi-target interventions^{63–68}.

8.3.2.3 *Defining outcomes*

Our primary outcome is “overall caesarean section rate” in all women admitted for labour. Due to variation in outcome reporting, we categorised successful intervention (coded as 1) when the caesarean section rate decreased and when a 95% confidence interval that did not cross the line of no effect or p-value ≤ 0.05 ; an unsuccessful intervention (coded as 0) was categorised when we observed that caesarean section rate was increased or did not change.

8.3.3 Assessing risk of bias in main intervention studies

Risk of bias of included studies was considered throughout the study conduct. Risk of bias were reported for studies included in either Chen et al¹⁹ or Opiyo et al³⁰ reviews, therefore we used their risk of bias results in this analysis. For studies that were not assessed by either Chen et al¹⁹ or Opiyo et al³⁰, we assessed risk of bias using the same tools as used in the original review depending on their study design (Appendix 8.1). We excluded studies assessed as high risk of bias, which may resulted us in missing information from relevant studies, yet necessary to ensure that this analysis is based on high quality studies and to allow researchers to develop deep case knowledge by limiting the overall number of included studies^{69,70}.

8.3.4 QCA stage 1: Identifying conditions, building data tables and calibration

We identified potential conditions from the eligible cases using a combined deductive and inductive process. Firstly, we derived potential conditions deductively using our logic model (Appendix 7.1). Secondly, additional potential conditions were inductively derived from each eligible case using qualitative evidence “views” synthesis using Melendez-Torres’s approach⁶⁹ and intervention component analysis⁷¹, where we examine potential conditions based on trialist’ reflections. The trialist’ reflections typically can be found in the discussion section of the paper and included

contextual conditions like healthcare providers' beliefs on caesarean section, providers' willingness to change, institutional culture, baseline caesarean section rates, and policy relating caesarean section. After consolidating similar conditions together, a total of 58 potential conditions were selected and extracted from each eligible case. Due to large numbers of potential conditions, we organized these conditions using a coding framework adapted from Harris et al²⁵ to six main domains: 1) context and participants, 2) intervention design, 3) program content, 4) method of engagement, 5) health system factors, and 6) process outcomes (Appendix 8.2).

As the next step, we created the data table, which is a matrix where each eligible case is presented in a row and each potential condition in a column (Appendix 8.3). One author (RIZ) extracted conditions from each eligible case to the data table, which was then double reviewed by a second author (MVC or MAB). After the completion of the extraction, the extracted data needs to be calibrated before further analysis. The calibration (or often referred as coding) rules either using csQCA or fsQCA were developed based on the data and through consultations with all authors (Appendix 8.2). The calibration was then conducted using either direct or transformational assignment of qualitative and quantitative data^{25,27}, to explore the extent to which interventions have 'set membership' with the outcome or conditions of interest. The calibration process was iterative, and the rules were revisited and re-defined based on the cases and literature.

8.3.5 QCA stage 2: Constructing truth tables

Once all data were calibrated, truth tables were constructed. Truth tables are an analytical tool in QCA to analyse associations between configurations of conditions and outcomes. Whereas the data table represents individual cases (rows) and individual conditions (columns) – the truth table synthesises this data to examine configurations – with each row representing a different configuration of the conditions. The truth tables indicate a) which conditions are featured in the configuration in that row; b) how many of the cases are represented by that configuration; and c) their association with the outcome.

Adhering to the "views synthesis as theory" perspective⁶⁹, existing qualitative evidence syntheses and theoretical literature were used to guide the construction of truth tables. Our truth tables examined potential configurations of sufficient and necessary intervention, implementation and contextual conditions associated with a reduction in caesarean section rates. After several iterations based on hypothesised theories about how the interventions should be delivered and assessment of the quality of the truth table, four final truth tables were constructed: 1) implementing training and education; 2) audit and feedback process; 3) multi-disciplinary collaboration; 4) consolidated model examining interactions of important conditions identified from models 1 to 3. Sub-analysis was also

conducted to explore if similar conditions were observed in successful interventions in *interventions targeting both women and healthcare providers or systems* (“multi-target interventions”), among the components for providers only.

8.3.6 QCA stage 3: Checking quality of truth tables

As suggested by Thomas et al²⁶, truth tables were iteratively developed, refined and improved through several measures. This includes assessing the number of studies contributing on each configuration, investigating the presence of contradictory results, and resolving any contradictions by considering theoretical perspectives. As there was an imbalance in the number successful and unsuccessful interventions, where the number of successful interventions was higher, we also conducted sensitivity analysis to see if the observed solutions found on our main solutions are similar or not when the number of successful and unsuccessful interventions were more balanced. In conducting the sensitivity analysis, we further selected studies which have provided impact of caesarean section rate reduction among women in Robson group 1-4, as well as caesarean section rate reduction in all women.

8.3.7 QCA stage 4: Identifying parsimonious configurations through Boolean minimisation

The final truth tables were then simplified using Boolean minimization to explore simplified pathways observed in successful interventions. The initial solutions were “complex solutions”, which were then further minimized to the most “parsimonious solution” using R²⁷ which incorporates information about logical remainders (configurations where no cases were observed). We then explored intermediate solutions in which assumptions about logical remainders (e.g. those that are logically implausible) are specified by the analysts rather than by R⁷².

8.3.8 QCA stage 5: Checking the quality of the solution

We checked the quality of the solutions by checking consistency (i.e. the proportion of cases with a particular configuration that are associated with the outcome of interest) and coverage scores (i.e. the proportion of cases in the outcome set that are supported or ‘covered’ by cases with a particular configuration or condition) as well as by analysing configurations associated with the negation of the outcome to see if it predicts the observed solutions. As the final consolidated solution, we present the intermediate solution instead of the parsimonious solution, as it is the most logical and closely aligned with the real-world settings.

8.3.9 QCA stage 6: Interpretation of solutions

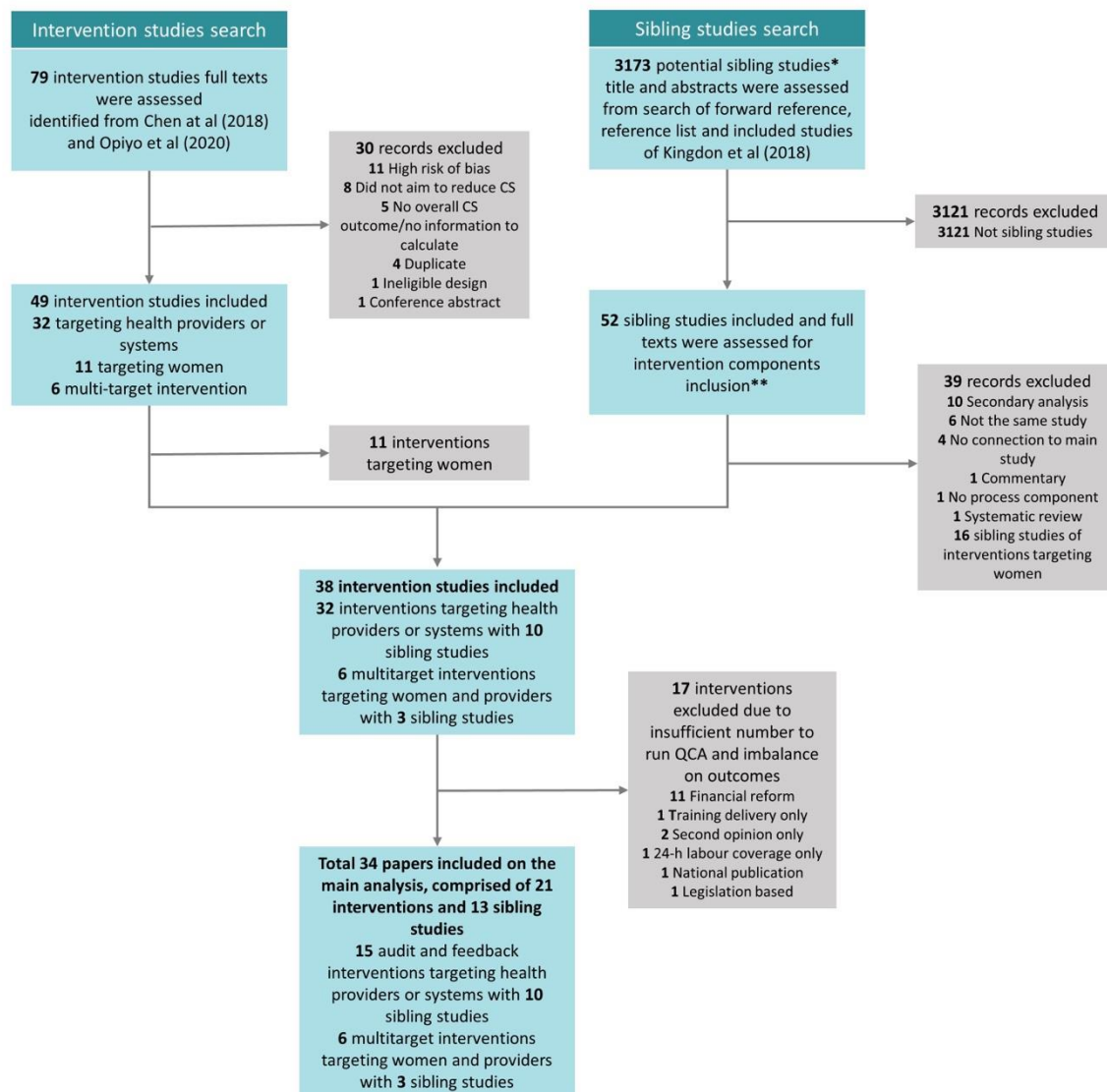
We interpreted the results iteratively through discussion among all authors. We adopted this reflexive approach to ensure that the interpretation is aligned with the theoretical and research literature, possible clinical pathways, methodological approaches, and coherent with current understandings of the phenomenon.

8.4 RESULTS

8.4.1 Overview of included studies

This QCA is based on 15 audit and feedback interventions targeting healthcare providers^{22,33–46} and six interventions targeting both healthcare providers and women (multi-target interventions)^{63–68}. The interventions are reported in 34 papers, comprising of 21 intervention evaluation studies and 13 sibling studies (See Figure 8.1: PRISMA Flowchart). Table 8.1 (summarised version) and Appendix 8.4 (full version) show characteristics of included studies.

Figure 8.1. PRISMA flowchart.



**Sibling studies: studies which were conducted on the same settings, participants, and timeframe*

***Intervention components: information on intervention input, activities, outputs, including intervention context and other characteristics*

Table 8.1. Summary of selected characteristics of studies included with interventions focused on audit and feedback.

Study characteristics	n (%) n=21	References
Setting		
High income countries	12 (57.1%)	22,24,33,38–44,67,73
Middle-income countries	8 (38.1%)	34,45,46,63–66,68
Low-income countries	1 (4.8%)	35
Data collection period		
<2000	7 (33.3%)	22,33,38,39,43,44,73
2000-2010	5 (23.8%)	40–42,45,46
>2010†	9 (42.9%)	24,34,35,63–68
Study design		
Randomized controlled trial	5 (23.8%)	24,33,35,67,68
Before and after	7 (33.3%)	40,42,45,46,63,64,66
Interrupted time series	8 (38.1%)	22,34,38,39,41,43,44,65
Retrospective cohort	1 (4.8%)	73
Type of women		
All pregnant women	14 (66.7%)	22,24,33–35,38–40,42–46,73
Women with low-risk pregnancy	6 (28.6%)	41,63–66,68
Women with previous caesarean section	1 (4.8%)	67
Baseline caesarean section rate		
<20%	3 (14.3%)††	22,33,42
20-39%	7 (33.3%)††	24,35,39,40,42,44,73
30-39%	3 (14.3%)	38,41,43
≥40%	9 (42.9%)	34,45,46,63–68
Outcomes		
Successful interventions	14 (66.7%)	22,24,33–35,38–40,63–67,73
Unsuccessful interventions	7 (33.3%)	41–46,68

†study started before 2010 and ended after 2010 is categorised as >2010.

††One study⁴² involved facilities which have two different caesarean section rates.

The 15 studies of interventions targeting healthcare providers comprised of nine successful^{22,33–40} and six unsuccessful interventions^{41–46} in reducing caesarean section. Ten sibling studies were identified^{37,74–82}, associated with six intervention studies^{24,33–35,45,73}. The 15 intervention studies were conducted in seven regions: North America (5 from United States of America^{22,38,39,44,73}, 2 from Canada^{24,33}), Latin America and Caribbean (1 from Chile⁴¹), Asia and Pacific (1 From Malaysia⁴⁵, 1 from Taiwan⁴³, 1 from India³⁴), Europe (1 from Spain⁴², 1 from Netherlands⁴⁰), Middle East & North Africa (1 from Iran⁴⁶), Sub-Saharan Africa (1 from Burkina Faso³⁵). These countries comprised of 11 high-income, three middle-income countries, and one low-income country. Six studies were included in Chen et al in which one was graded as low risk of bias²⁴ and five graded as having some

concerns^{33,41,43,44,46}, two studies were newly published studies graded as having some concerns^{34,35}, and the remaining seven were excluded studies of Chen et al and graded as having some concerns^{22,38–40,42,45,73}.

The six multi-target intervention studies consisted of five successful interventions^{63–67} and one unsuccessful intervention⁶⁸. Three sibling studies^{83–85} were identified from one multi-target intervention⁶⁷. The interventions were delivered across three regions: Latin America and Caribbean (1 from Brazil⁶⁵), Asia and the Pacific (4 from China^{63,64,66,68}), Europe (1 from Italy⁶⁷, 1 from Ireland⁶⁷, and 1 from Germany⁶⁷). One study was conducted in a high-income country, while five studies were conducted in an upper middle-income country (four from China). Out of the six intervention studies, one intervention study was included in Chen et al¹⁹ was graded as having some concerns⁶⁶, two studies included in Opiyo et al³⁰ were graded as having not serious concerns^{64,65}, and three studies were newly published where one study assessed as having not serious concerns⁶³ and two studies assessed as having some concerns on their risk of bias^{67,68} (Appendix 8.1).

Among the audit and feedback interventions targeting healthcare providers, only four used theory or programme theory to inform intervention design^{22,41,45,73}, while the remaining referred to previous intervention studies as the basis for intervention design, or did not refer to other evidence to inform intervention design. The four theory-based interventions adopted either Robson ten groups classification system^{22,41}, quality improvement framework⁷³, plan-act-reflect cycle⁴⁵, or the logical framework⁴⁵ to guide intervention design. Audit and feedback was often accompanied by other interventions, including implementation of guidelines or protocols for caesarean section indications^{24,34,35,39–44,46,82}, training to improve providers' knowledge and skills^{24,34,35,38,42,43,73}, mandatory second opinion^{38,43}, opinion leaders^{24,33,43,45}, or implementation of collaborative midwifery and obstetrician models of care⁴⁴. Four interventions used top-down enforcement or were "dictated" in nature^{42,43,46,73}, while the remaining were "reflective", meaning that interventions leveraged bottom-up approach through discussions and consultations. Training for healthcare providers typically focused on improving knowledge and skills on antenatal and labour management (i.e. fetal monitoring training, perineal massage, external cephalic version), caesarean section indications, and the purpose of intervention. Eight intervention studies promoted multi-disciplinary collaboration between obstetricians, midwives, nurses, and other doctors^{22,24,34,35,40,41,73}. The six multi-target audit and feedback interventions typically also included training for healthcare providers^{63–68} and dissemination of caesarean section indications^{64,66}, while the intervention component targeting women consisted of childbirth education^{63–68}. Across all 21 studies, there were very limited data on implementation outcomes such as adherence, attrition, fidelity, and satisfaction.

8.4.2 Qualitative comparative analysis of the audit and feedback interventions

We conducted six analyses ('models') to explore factors leading to successful interventions". The first three (models 1-3) assessed different aspects of audit and feedback interventions within the 15 interventions targeting healthcare providers only. These models were developed based on theoretical rationales from views synthesis (Table 8.2). The fourth 'consolidated model' brought together important conditions from model 1-3. The fifth model also included the six multi-target cases to explore if conditions from the consolidated model were also observed in the interventions targeting both women and healthcare providers. Finally, the sixth model was a sensitivity analysis to confirm that the imbalance in number between successful and unsuccessful cases among the 15 interventions targeting healthcare providers only did not skew results. The definitions of conditions used in constructing truth tables are depicted in Table 8.3. Some of the conditions may overlap between the models, as views synthesis indicated that certain component could be important on intervention targeting health providers (e.g. willingness to change, dictated nature of intervention). It is important to note that the referred "important" conditions on this paper are *sufficient*, not necessary, conditions in prompting successful interventions.

Table 8.2. Views synthesis driving the construction of model 1-3 and its truth tables.

Model 1 – Implementing training to improve providers knowledge and clinical skills

The existing qualitative evidence synthesis and intervention component analysis indicated four different themes relating to training^{18,28,34,44,86}. Firstly, healthcare providers are often reluctant to implement new caesarean section programs or to implement overall change due to perceived insufficiency of skills and knowledge on labour and vaginal birth management, especially the younger generation²⁸. Secondly, healthcare providers and other stakeholders (i.e. policy makers, hospital managers) emphasised the importance of implementing various training or education for healthcare providers^{18,28,86}. This training includes clinical skills training in labour and vaginal birth, recommendations in practice, clinical audit and program content itself^{18,28,86}. Thirdly, both providers^{28,86} and trialists^{34,44} mentioned that the underlying factor of success lies on providers' beliefs about caesarean section and vaginal birth, as well as whether providers are willing to step out of their comfort zone to. Lastly, providers mentioned that they preferred the intervention to be reflective in nature, instead of dictatorial and enforcing²⁸.

Model 2 – The audit and feedback process

In relation to audit and feedback process, the existing qualitative evidence synthesis and intervention component analysis revealed three different themes^{28,86}. Firstly, the process of conducting audit and feedback was considered critical by healthcare providers, as the content, methods of delivery, and timing of audit and feedback influenced how they feel about the intervention overall⁸⁶. Secondly, some providers were concerned that audit and feedback may pose a threat to their identities and careers²⁸. Therefore, the more acceptable the structure of feedback is to the providers (i.e. feedback delivered individually instead in group), the better they respond to it, thus increasing its effectiveness⁸⁶. Thirdly, findings by Kingdon et al also revealed organisations which were able to reduce caesarean section are often characterised by having healthcare providers who valued continuous quality improvements, such as clinical audits, second opinion, continuing education²⁸.

Model 3 – Working relationship and environment

In terms of working relationship and environment, existing qualitative evidence syntheses by Kingdon et al revealed three themes^{18,28}. Firstly, multi-disciplinary collaboration between doctors, midwives, nurses and other maternity care providers was pointed as a key element in optimising caesarean section use^{18,28}. Multi-disciplinary collaboration has been observed as very poor in health facilities with high caesarean section rates, and actively present in health facilities with low caesarean section rates^{18,28}. Secondly, healthcare providers reported about the unequal and hierarchical power relations when caring for women. Working relationships, collaboration and communication may also be diminished through hierarchy-driven fear, which may be present when for example midwives are considered to have fewer skills than doctors^{18,28}. Thirdly, Kingdon et al also emphasized the effectiveness of interventions to reduce unnecessary caesarean section is strongly mediated by stakeholder commitment and organizational buy-in or, systems and policy changes that facilitate vaginal birth¹⁸.

Table 8.3. Definitions of conditions used in constructing truth tables.

Actionable recommendations: each audit and feedback cycle produced actionable recommendations that healthcare providers could act upon until next cycle.

Active dissemination of caesarean section indications: implementation caesarean section indications, such as clinical algorithms on when to conduct caesarean section, through guidelines or protocol implementation, information, education and communication (IEC) materials, or reminder systems).

Dictated nature of intervention: intervention which used top-down enforcement where mandate to reduce caesarean section was imposed.

Frequent audit and feedback cycle: frequent audit and feedback cycle which classified either weekly or monthly.

Healthcare providers' willingness to change: providers willingness to adopt to change and adhere to the intervention. Willingness to change was added as it becomes an overarching factor across qualitative evidence syntheses^{28,86} and discussion section of trials reports^{34,44} – where both providers and trialists mentioned that the underlying factor of success lies on providers' beliefs about caesarean section and vaginal birth, as well as whether providers are willing to step out of their comfort zone to change.

Individual dissemination of audit and feedback results: dissemination of audit and feedback results to providers individually instead in group settings.

Internal policies that support vaginal birth: whether internal policies that support vaginal birth or the intervention exists outside of the intervention. This include national consensus in improving caesarean section rates where caesarean section is nationally treated as a measure of institutional and individual practice quality⁴⁴, recommended maternity practices supporting physiologic birth^{39,41,43,45}, national guidelines on vaginal birth after caesarean (VBAC)⁶⁷, equipment and technical support for local healthcare facilities⁶³, implementation of new care models favouring physiologic birth⁶⁵, additional rooms to support physiologic birth⁶⁵, hire full-time obstetricians³⁴, and increase staffing in the labour ward³⁴.

Multidisciplinary collaboration: when the intervention involved different cadre of health workers in caring for women, which could include team of obstetricians, midwives, nurses, and doctors working together.

Reflective nature of intervention: Leveraged bottom-up approach through discussions and consultations.

Training to improve providers' knowledge and skills: implementation of theory-based or practical education session for healthcare providers to improve their knowledge and skills on labour management.

8.4.2.1 Model 1 – Implementing training to improve providers knowledge and clinical skills (n=15 cases)

Based on the views syntheses as seen on Table 8.2, we constructed a truth table using csQCA with 15 interventions targeting healthcare providers only by considering four different conditions relating to training: 1) training to improve providers' knowledge and skills, 2) active dissemination of caesarean section indications, 3) healthcare providers' willingness to change, 4) dictated nature of the intervention.

Out of 16 possible configurations, we identified eight configurations (Table 8.4). The first four rows depict the configurations of successful interventions with perfect consistency (inclusion score = 1), while the remaining four rows are configurations of unsuccessful interventions. Among the configurations of successful interventions, when both training and active dissemination of caesarean section indications are implemented (row 1), or either training or active dissemination of caesarean section indications are implemented in a context where providers' show willingness to change (row 2 and 3), dictated nature is not needed to prompt successful outcomes. However, when only training is present without other intervention or contextual conditions, dictated nature is necessary to achieve successful outcomes (row 4). Unsuccessful interventions were characterised by consistent absence of willingness to change by providers (row 5-8), adopted dictated nature of intervention in the presence of training and active dissemination of caesarean section indications (row 5), and when only active dissemination of caesarean section indications (without training) present (row 7).

Table 8.4. Truth table model 1 - implementing training to improve providers' knowledge and clinical skills based on 15 intervention studies.

Row	Training to improve knowledge and skills	Active dissemination of caesarean section indications	Providers' willingness to change	Dictated	Caesarean section outcome	Number of studies	Inclusion score	PRI	Cases
1	1	1	0	0	1	2	1	1	Chaillet (2015), Kabore (2019)
2	0	1	1	0	1	3	1	1	Socol (1993), Van Dillen (2008), Lomas (1991)
3	1	0	1	0	1	3	1	1	Bhartia (2020), Lagrew (1996), Robson (1996)
4	1	0	0	1	1	1	1	1	Kazandjian (1998)
5	1	1	0	1	0	2	0	0	Calvo (2009), Liang (2004)
6	0	1	0	0	0	2	0	0	Poma (1998), Scarella (2011)
7	0	1	0	1	0	1	0	0	Mohammadi (2012)
8	1	0	0	0	0	1	0	0	Ho (2011)

Inclusion score: sometimes referred as consistency indicates the degree to which the evidence is consistent with the hypothesis that there is sufficiency relation between the configuration and the outcome; PRI: Proportional Reduction in Inconsistency, refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome.

Boolean minimisation revealed four pathways to successful interventions (Figure 8.2A). The first two pathways show that when there is providers' willingness to change and either training to improve providers' knowledge and skills or active dissemination of caesarean section indications, successful outcomes are observed. However, when there is no providers' willingness to change and active dissemination of caesarean section indications, it is important to implement training and dictated nature of intervention at the same time to trigger successful intervention (third pathway). Lastly, the fourth pathway shows that dictated nature of intervention is not needed when both training and active dissemination of caesarean section indications are present at the same time to prompt successful intervention. These solutions show that all the four conditions seem to play a role in influencing intervention success: providers' willingness to change, dictated nature of intervention, training to improve knowledge and skills, and active dissemination of caesarean section indications.

Figure 8.2. Intermediate pathways that lead to the successful reduction of caesarean section from four models of analysis, that is model 1-3 and consolidated model.

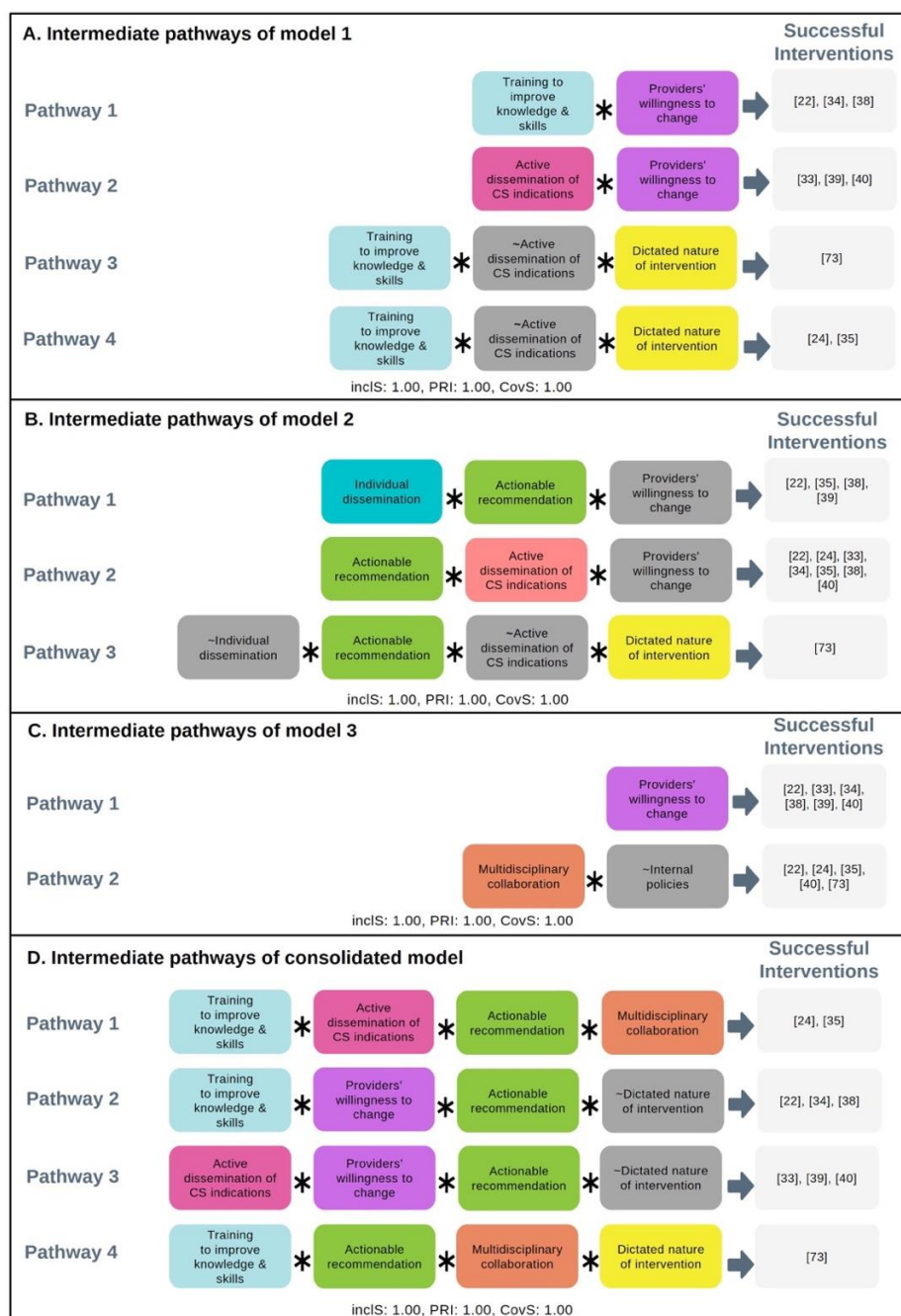


Figure 2 footnote: Grey box with “~” notation referred to absence of such condition; Inclusion score (InclS) sometimes referred as consistency indicates the degree to which the evidence is consistent with the hypothesis that there is sufficiency relation between the configuration and the outcome; PRI stands for Proportional Reduction in Inconsistency and refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome; Coverage score (CovS) refers to percentage of cases for which the configuration is valid.

8.4.2.2 *Model 2 – The audit and feedback process (n=15 cases)*

When constructing this truth table using csQCA, four conditions relevant to the structure of audit and feedback were included: 1) frequent audit and feedback cycle, 2) individual dissemination of audit and feedback results, 3) actionable recommendations, and 4) dictated nature of intervention.

Out of 16 possible configurations, we observed nine configurations (Table 8.5). The first four rows show the configurations of successful conditions with perfect consistency (inclusion = 1), while the remaining five rows show configurations of unsuccessful interventions. From the truth tables, among the successful interventions, the presence of actionable recommendations with dictated nature of intervention in the absence of frequent audit and feedback cycle and individual dissemination (row 1), or the presence of actionable recommendations and frequent audit and feedback cycle in the absence of dictated and individual dissemination (row 2), prompt successful implementation. Successful implementation was also prompted when actionable recommendations and individual dissemination were present at the same time either in the absence (row 4) or presence (row 3) of frequent audit and feedback cycle. Unsuccessful interventions were characterised by the absence of all the conditions above (row 5), the absence of actionable recommendations (row 7-9), as well as the present of dictated nature of intervention when actionable recommendations and frequent audit and feedback cycle are present (row 6).

Table 8.5. Truth table model 2 - The table demonstrates the truth table results from model 2 – audit and feedback process based on 15 intervention studies.

Row	Individual dissemination	Actionable recommendations	Frequency of audit and feedback cycle	Dictated	Caesarean section outcome	Number of studies	Inclusion score	PRI	Cases
1	0	1	0	1	1	1	1	1	Kazandjian (1998)
2	0	1	1	0	1	4	1	1	Van Dillen (2008), Bhartia (2020), Lomas (1991), Chaillet (2015)
3	1	1	0	0	1	1	1	1	Socol (1993)
4	1	1	1	0	1	3	1	1	Lagrew (1996), Robson (1996), Kabore (2019)
5	0	0	0	0	0	1	0	0	Ho (2019)
6	0	1	1	1	0	2	0	0	Calvo (2009), Liang (2004)
7	1	0	0	0	0	1	0	0	Poma (1998)
8	1	0	1	0	0	1	0	0	Scarella (2011)
9	1	0	1	1	0	1	0	0	Mohammadi (2003)

Inclusion score: sometimes referred as consistency indicates the degree to which the evidence is consistent with the hypothesis that there is sufficiency relation between the configuration and the outcome; PRI: Proportional Reduction in Inconsistency, refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome.

Boolean minimisation identified three intermediate pathways (Figure 8.2B). The first and second pathways show that despite the absence of dictated nature of the intervention, the presence of actionable recommendations and individual dissemination, or actionable recommendations with frequent audit and feedback cycle, prompt successful implementation. The last pathway shows that when individual dissemination and frequent audit and feedback cycle are absent, successful implementation can only be triggered when actionable recommendations and dictated nature of intervention are present. From these solutions, we conclude that actionable recommendations work jointly with other conditions (frequent audit and feedback cycle, individual dissemination or dictated nature of intervention) in influencing success.

8.4.2.3 Model 3 – Working relationship and environment (n=15 cases)

Utilising csQCA, this truth table was constructed by including three conditions in relation to working relationships and environment: 1) multidisciplinary collaboration, (2) healthcare providers' willingness to change, and 3) internal policies that support vaginal birth.

Out of eight possible configurations, we identified eight configurations, comprising of five configurations with successful interventions with perfect consistency (inclusion score = 1), and three configurations with unsuccessful interventions (Table 8.6). The presence of all conditions prompt successful intervention as shown on row 1. On the second and third row, we can see that successful outcomes are observed where willingness to change is present in combination with another condition, including presence of multidisciplinary collaboration (row 2) and internal policies (row 3). Interestingly, the presence of only multi-disciplinary collaboration or only providers' willingness to change in the absence of other conditions also triggers successful intervention (row 4 & 5), noting that the cases are comparatively older studies (1996, 1998)^{22,38} when social, medical and legal pressures may have not been (or may have not been perceived) as strong as at present.

Unsuccessful interventions were consistently characterised by the absence of all the conditions above (row 7) and willingness to change (row 6-7).

Table 8.6. Truth table from model 3 – working relationships and environment based on 15 intervention studies.

Row	Multidisciplinary collaboration	Providers' willingness to change	Internal policies	Caesarean section outcome	Number of studies	Inclusion score	PRI	Cases
1	1	1	1	1	1	1	1	Bhartia (2020)
2	1	1	0	1	2	1	1	Van Dillen (2008), Robson (1996)
3	0	1	1	1	1	1	1	Socol (1993)
4	1	0	0	1	3	1	1	Kazandjian (1998), Chaillet (2015), Kabore (2019)
5	0	1	0	1	2	1	1	Lagrew (1996), Lomas (1991)
6	0	0	0	0	2	0	0	Calvo (2009), Mohammadi (2012)
7	0	0	1	0	2	0	0	Liang (2004), Poma (1998)
8	1	0	1	0	2	0	0	Scarella (2011), Ho (2011)

Inclusion score: sometimes referred as consistency indicates the degree to which the evidence is consistent with the hypothesis that there is sufficiency relation between the configuration and the outcome; PRI: Proportional Reduction in Inconsistency, refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome.

Boolean minimisation identified two intermediate pathways (Figure 8.2C). On the first pathway, providers' willingness to change results in successful interventions. On the second pathway, when internal policies supporting vaginal birth are missing, the presence of multidisciplinary team collaboration results in a successful intervention. From these solutions, providers' willingness to change and multidisciplinary collaboration seem to be important in influencing success.

8.4.2.4 Consolidated model – Important conditions to prompt successful interventions targeting healthcare providers (n=15 cases)

We consolidated the learning from the three models explored above to find the final important conditions that prompt successful interventions targeting healthcare providers. In constructing this consolidated model, we included the important conditions identified in the first three models explored. These important conditions are 1) training to improve providers' knowledge and skills, 2) active dissemination of caesarean section indications, 3) providers' willingness to change, 4) actionable recommendations, 5) multidisciplinary collaboration, and 6) dictated nature of intervention.

Out of 64 possible configurations, 11 configurations are observed, consisting of 6 successful configurations with perfect consistency (inclusion score = 1) and 5 unsuccessful configurations (Table 8.7). Boolean minimisation revealed four pathways to success (Figure 8.2D). The first pathway shows that the presence of training to improve providers' knowledge and skills, active dissemination of caesarean section indications, actionable recommendations, and multidisciplinary collaboration prompt successful intervention. On the second and third pathways, we can see that the presence of training or active dissemination of caesarean section indications combined with providers' willingness to change and actionable recommendations prompt successful intervention, even in the absence of the dictated nature of the intervention. Interestingly, in the last pathway, when providers' willingness to change and active dissemination of caesarean section indications seems to be absent, dictated nature intervention is necessary alongside the implementation of training, actionable recommendations, and multidisciplinary collaboration to trigger successful intervention.

Table 8.7. Truth table of consolidated model based on 15 interventions.

Row	Training to improve knowledge and skills	Active dissemination of caesarean section indications	Providers' willingness to change	Actionable recommendations	Multidisciplinary collaboration	Dictated	Caesarean section outcome	Number of studies	Inclusion score	PRI	Cases
1	0	1	1	1	0	0	1	2	1	1	Socol (1993), Lomas (1991)
2	0	1	1	1	1	0	1	1	1	1	Van Dillen (2008)
3	1	0	1	1	1	0	1	2	1	1	Bhartia (2020), Robson (1996)
4	1	0	0	1	1	1	1	1	1	1	Kazandjian (1998)
5	1	0	1	1	0	0	1	1	1	1	Lagrew (1996)
6	1	1	0	1	1	0	1	2	1	1	Chaillet (2015), Kabore (2019)
7	0	1	0	0	0	0	0	1	0	0	Poma (1998)
8	0	1	0	0	0	1	0	1	0	0	Mohammadi (2012)
9	0	1	0	0	1	0	0	1	0	0	Scarella (2011)
10	1	0	0	0	1	0	0	1	0	0	Ho (2011)
11	1	1	0	1	0	1	0	2	0	0	Calvo (2009), Liang (2004)

Inclusion score: sometimes referred as consistency indicates the degree to which the evidence is consistent with the hypothesis that there is sufficiency

relation between the configuration and the outcome; PRI: Proportional Reduction in Inconsistency, refers to the extent in which a configuration is sufficient

in triggering successful outcome as well as the negation of the outcome.

From these solutions, we identified five important components that may prompt successful intervention 1) provide training to improve providers' knowledge and skills, 2) active dissemination of caesarean section indications, 3) actionable recommendations, 4) leverage multidisciplinary collaboration, and 5) providers' willingness to change. Importantly, when one or more of these components are absent (especially willingness to change and training or active dissemination of caesarean section indications), dictated nature of intervention is needed to prompt successful interventions.

8.4.2.5 Sub-analysis – Interventions targeting both women and healthcare providers or systems (n=21 cases)

We conducted a sub-analysis to explore if similar important conditions are observed in the interventions targeting both women and healthcare providers. In doing this analysis, we have included an additional six intervention studies targeting both women and healthcare providers, therefore 21 studies were included in this analysis. For this model, the six conditions identified from the consolidated model plus an additional 'multi-target intervention' condition were used to run the truth tables using csQCA (Table 8.8).

Table 8.8. Truth table of sub-analysis with multi-target interventions based on 21 intervention studies.

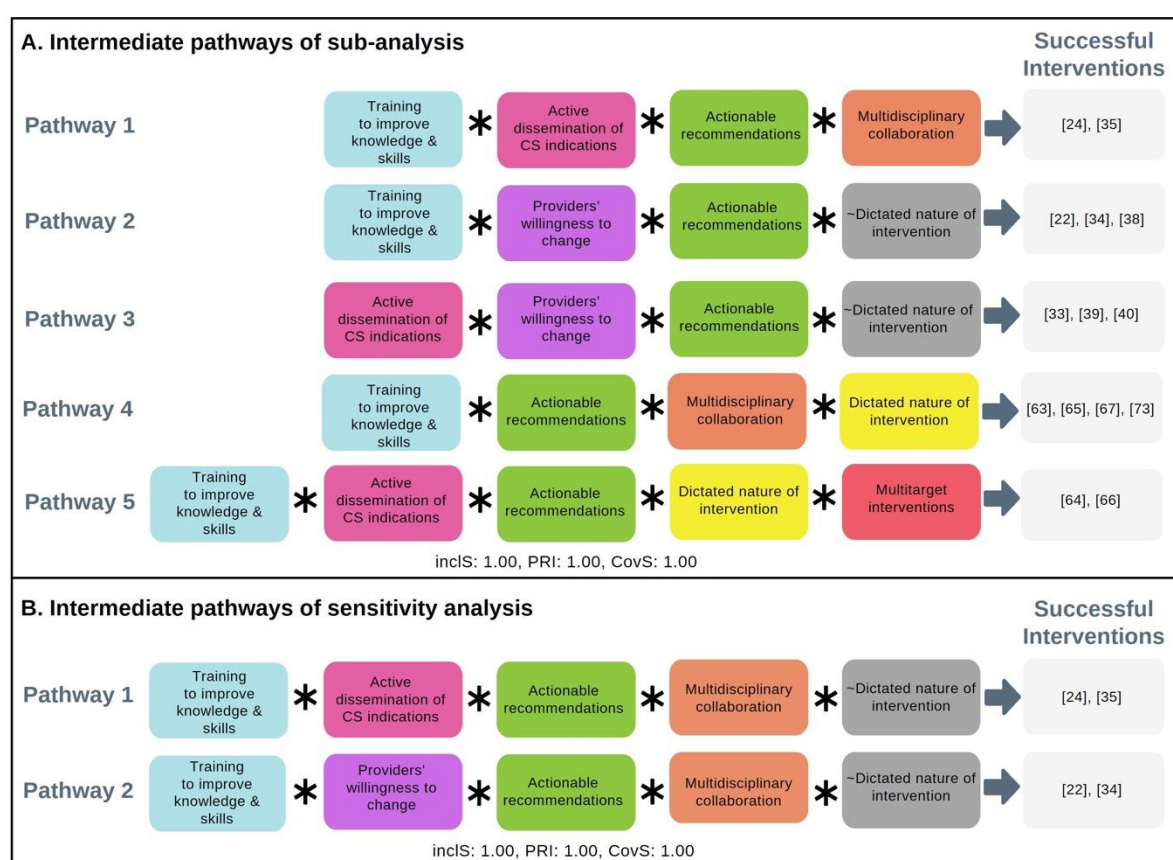
Row	Training to improve knowledge and skills	Active dissemination of caesarean section indications	Providers' willingness to change	Actionable recommendations	Multidisciplinary collaboration	Dictated	Multi-target interventions	Caesarean section outcome	Number of studies	Inclusion score	PRI	Cases
1	0	1	1	1	0	0	0	1	2	1	1	Socol (1993), Lomas (1991)
2	0	1	1	1	1	0	0	1	1	1	1	Van Dillen (2008)
3	1	0	0	1	1	1	0	1	1	1	1	Kazandjian (1998)
4	1	0	0	1	1	1	1	1	3	1	1	Xia (2019), Borem (2020), Clarke (2020)
5	1	0	1	1	0	0	0	1	1	1	1	Lagrew (1996)
6	1	0	1	1	1	0	0	1	2	1	1	Bhartia (2020), Robson (1996)
7	1	1	0	1	0	1	1	1	2	1	1	Runmei (2012), Yu (2017)
8	1	1	0	1	1	0	0	1	2	1	1	Chaillet (2015), Kabore (2019)
9	0	1	0	0	0	0	0	0	1	0	0	Poma (1998)
10	0	1	0	0	0	1	0	0	1	0	0	Mohammadi (2012)
11	0	1	0	0	1	0	0	0	1	0	0	Scarella (2011)
12	1	0	0	0	1	0	0	0	1	0	0	Ho (2011)
13	1	0	0	1	0	1	1	0	1	0	0	Zhang (2020)
14	1	1	0	1	0	1	0	0	2	0	0	Calvo (2009), Liang (2004)

Inclusion score: sometimes referred as consistency indicates the degree to which the evidence is consistent with the hypothesis that there is sufficiency

relation between the configuration and the outcome; PRI: Proportional Reduction in Inconsistency, refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome.

Boolean minimisation reveals similar intermediate pathways with the consolidated model of interventions targeting healthcare providers only (Figure 8.3A). The only difference is that among multi-target interventions only (pathway 5), in the absence of providers' willingness to change and multidisciplinary collaboration, the dictated nature of intervention is needed alongside training to improve knowledge and skills, active dissemination of caesarean section indications, and actionable recommendations to prompt successful interventions. However, more investigation is needed to examine interactions between components targeting women and providers.

Figure 8.3. Intermediate pathways or solutions from sub-analysis and sensitivity analysis.



Grey box with “~” notation referred to absence of such condition; Inclusion score (InclS) sometimes referred as consistency indicates the degree to which the evidence is consistent with the hypothesis that there is sufficiency relation between the configuration and the outcome; PRI stands for Proportional Reduction in Inconsistency and refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome; Coverage score (CovS) refers to percentage of cases for which the configuration is valid.

8.4.2.6 Sensitivity analysis (n=15)

We conducted a sensitivity analysis as there is a modest imbalance between successful (n=9) and unsuccessful interventions (n=6) in the data for the main analysis. The sensitivity analysis was conducted to explore whether the observed solutions in the main consolidated solutions are similar when the number of successful and unsuccessful interventions is more balanced.

Out of nine successful interventions, we selected studies that successfully decreased caesarean section among healthy women in Robson group 1-4 (e.g. women with term, singleton, cephalic pregnancies without previous caesarean section. A total of four studies successfully decreased caesarean section in Robson group 1-4^{22,24,34,35}. Therefore, 10 studies were included for the sensitivity analysis, comprising four successful interventions^{22,24,34,35} and six unsuccessful interventions⁴¹⁻⁴⁶, where the same six conditions from the consolidated model were used (Table 8.9).

Table 8.9. Truth table of sensitivity analysis based on 15 intervention studies.

Row	Training to improve knowledge and skills	Active dissemination of caesarean section indications	Providers' willingness to change	Actionable recommendations	Multidisciplinary collaboration	Dictated	Caesarean section outcome	Number of studies	Inclusion score	PRI	Cases
1	1	0	1	1	1	0	1	2	1	1	Bhartia (2020), Robson (1996)
2	1	1	0	1	1	0	1	2	1	1	Chaillet (2015), Kabore (2019)
3	0	1	0	0	0	0	0	1	0	0	Mohammadi (2012)
4	0	1	0	0	0	0	0	1	0	0	Poma (1998)
5	0	1	0	0	1	0	0	1	0	0	Scarella (2011)
6	1	0	0	0	1	0	0	1	0	0	Ho (2011)
7	1	1	0	1	0	1	0	2	0	0	Calvo (2009), Liang (2004)

Inclusion score: sometimes referred as consistency indicates the degree to which the evidence is consistent with the hypothesis that there is sufficiency relation between the configuration and the outcome; PRI: Proportional Reduction in Inconsistency, refers to the extent in which a configuration is sufficient in triggering successful outcome as well as the negation of the outcome.

Overall, the sensitivity analysis supports the main analysis results (consolidated model), as the sensitivity analysis shows that when all conditions except the dictated nature of intervention are present, it prompts successful interventions (Figure 8.3B). However, when some components are absent, dictated nature of intervention is needed to prompt successful interventions, as shown on the main analysis results.

8.5 DISCUSSION

Our QCA aimed to explore important intervention components which can trigger the success in optimising caesarean section use under the umbrella of audit and feedback interventions. Through the consolidated model, the QCA revealed successful audit and feedback interventions targeting healthcare providers were characterised by the presence of training to improve providers' knowledge and skills, active dissemination of caesarean section indications, actionable recommendations, multidisciplinary collaboration, and providers' willingness to change. Importantly, when one or more of these components are absent (especially willingness to change and training or active dissemination of caesarean section indications), adoption of dictated nature in the intervention is needed to trigger successful interventions. These important conditions do not work in silos, but work jointly as parts of configurations to enable successful interventions.

Willingness to change was shown to be one of the sufficient conditions driving the success of intervention. Previous studies have shown that willingness to change influence participants' adherence to the intervention^{28,86}. This is aligned with the theory of planned behaviour, which links individual beliefs, norms, and attitudes to intentions and behaviours⁸⁷. In the context of audit and feedback, some providers reported doubts about the intervention and alignment to their priorities as cause on the reluctance to engage and adhere to intervention⁸⁶. Specifically for caesarean section, providers were also sometimes unwilling to engage with change due to concerns about potential loss of income, threats to professional status if litigation occurs, and differing values and beliefs about caesarean section provision^{18,28}. Irrespective of the root causes of provider unwillingness to change, when unwillingness to change is present, it is more difficult to encourage intervention adherence and sustainability.

Kingdon et al stated that while individual willingness to change is important, it may not be sustainable, especially when factors influencing change from social, organisational and system levels are not addressed¹⁸. Interestingly from our QCA, willingness to change is closely tied to training and active dissemination of caesarean section indications. When willingness to change is absent, our QCA shows that training and active dissemination of caesarean section indications should be present

to prompt successful intervention. Existing research on behaviour change interventions suggests that training and information dissemination improved knowledge and professional competency, which then improved decision-making and clinical outcomes⁸⁸. However, research also shows that training and information alone are not sufficient in many cases to change behaviour^{89,90}, which supports the configurations of sufficient conditions on our QCA. While exploring the critical elements of training and dissemination were of interest in this QCA (i.e. frequency, duration, mode of interaction, practice sessions), there was insufficient detail in the included studies to conduct this analysis.

We also found that continuity of action is an important condition to trigger successful intervention alongside the other components. From our study, we found two differing types of audit and feedback in relation to continuity: 1) audit and feedback were only done to evaluate providers' adherence and 2) audit and feedback were also used to produce actionable recommendations and implement continuous improvement action^{24,34,35}. We found the latter to be important in influencing success of the intervention. For example, in one study the first audit and feedback cycle produced new clinical protocol and guidelines as an action, and the next cycles resulted in implementation of training programs followed by improvement of labour wards, strengthened antenatal class and improvement collaboration participation³⁴. Continuity of action seems to be important in the context of caesarean section intervention as it introduces changed of culture, specifically "culture of continuous improvement", at organisation level which directly influence individuals by promoting learning^{18,91}. Furthermore, Foy et al (2020) also propose that the success of audit and feedback depends on the clear actionable messages for both the organisations and individuals, "emphasising action over measurement"⁹². Therefore, ensuring actionable recommendations in audit and feedback is crucial in ensuring benefits.

Hierarchies and imbalanced power relations are common in clinical settings and can create communication barriers as well as marginalisation of midwives, nurses and junior doctors from decision-making that may affect care decisions^{18,28}. To address this, multidisciplinary collaboration^{18,28,93} was introduced in some studies, and our QCA results show that multidisciplinary collaboration prompts successful reductions of caesarean section together with other components mentioned above. One of the reasons why multidisciplinary collaboration reduced caesarean section is more related to the general atmosphere and ethos which were built when it was leveraged: strong teamwork where every member in the team has greater awareness on what their roles are, work collaboratively in resolving issues, and communicate with each other respectfully. For example, a recent study in Brazil reported that implementing multidisciplinary collaboration among providers,

along with engagement with pregnant women and improvements to hospital facilities reduced caesarean section and increased vaginal birth²⁰.

Whether the intervention should be dictatorial (top down) or reflective (bottom up) in nature is a delicate balance. While top-down dictatorial interventions can direct change, reflective, participatory, or bottom-up interventions shift the power to people to drive the change themselves⁹⁴. Moreover, healthcare providers preferred a reflective tone instead of dictatorial to feedback^{18,28}. Our QCA found that both dictatorial and reflective interventions can be important in different situations. When all other important intervention components are present (training, dissemination of caesarean section indications, multidisciplinary collaboration, willingness to change), dictated nature of feedback was not needed to evoke change, and thus reflective feedback was more beneficial. However, when other interventions were missing, dictated nature of interventions was important, possibly to strengthen the intervention delivery. Therefore, the decision about dictatorial or reflective intervention will depend on the structure of the other intervention components.

Lastly, use of theory in intervention design was important to maximise benefits and change behaviours^{25,92}. However, very few intervention studies aiming to optimise use of caesarean section used implementation science or theory in intervention design, which represents a major limitation as evidence consistently demonstrates that the use of theoretically informed interventions leads to better outcomes^{95,96}. Future intervention studies addressing high rates of caesarean section should use theory-based intervention design to ensure the potential mechanisms of action that may affect behaviour are adequately identified and targeted by the intervention, and that proposed interventions are known and able to influence the targeted behaviours^{90,97}.

8.5.1 Strength and limitations

Due to limited studies and imbalance in the number of successful and unsuccessful interventions, we cannot assess important components that may trigger success on implementation of financial reform, opinion leaders, mandatory opinion, and vaginal birth after caesarean (VBAC) policy. We also encountered challenges on detailed reporting of complex interventions (including implementation evaluation outcomes) which prevented us from engaging further with the interventions and may have missed important conditions that the studies have yet not reported. We have tried to compensate for this lack of detailed reporting through sibling studies search. Our QCA also did not contemplate endemic difference between high versus low- and middle-income countries (e.g. health systems functioning) that could explain the need of some conditions in certain countries but not in others. The Case:Condition ratio for the consolidated model could be a

limitation of this analysis; to address this, we have run sub-analysis by adding more cases to ascertain that similar intermediate solutions are observed in a more balanced ratio. Lastly, we were unable to understand the impact of the interventions to changes on intrapartum versus elective caesarean section, spontaneous vaginal birth, instrumental birth, or VBAC as studies did not consistently report these outcomes.

Our study is the first global analysis exploring how certain intervention components can influence the success of interventions targeting healthcare providers in the context of caesarean section. This study used new analytical frameworks and existing evidence to generate new knowledge. The views synthesis and logical framework were used to ensure that the results were theory-driven and aligned with participants' perspectives. Sensitivity analysis was also conducted to ensure the robustness of the study. Importantly, this study also extends the understanding of Chen et al ¹⁹ caesarean section intervention effectiveness review study by explaining potential intervention components which may influence heterogeneity. A critical strength of this QCA is that audit and feedback is one of the most common and accessible interventions; it is highly implemented and used and comprises a wide range of components that are normally considered in facilities. Thus, this analysis will be useful as a guide to increase success and optimise benefits when implementing one of the most prevalent intervention used to reduce unnecessary caesarean section and used to increase quality of care and evidence-based practices in general.

8.5.2 Implications for practice, policy, and research

When designing audit and feedback interventions targeting healthcare providers in the context of optimising caesarean section use, we recommend researchers, healthcare providers and institutions to consider the following key questions that may help lead to successful implementation, which are derived from our QCA findings (Figure 8.4):

1. Are trainings to improve providers' knowledge and skills on both the intervention and labour management implemented?
2. Are materials on caesarean section indications actively disseminated to healthcare providers?
3. To what extent are providers willing to change behaviours regarding caesarean section? Have their views been assessed and addressed (e.g. as part of formative research contributing to intervention design)?
4. Do audit and feedback cycles produce clear and actionable implementation recommendations?

5. Is multidisciplinary collaboration between obstetricians and midwives promoted when delivering care to women?
6. Based on questions 1-5, are dictated or reflective nature of interventions more appropriate?

Figure 8.4. Checklist of key components to consider when designing interventions targeting healthcare providers.

Key components to consider when designing audit and feedback interventions targeting health providers	
	Trainings are delivered to improve providers' knowledge and skills on both labour management and the intervention itself
	Caesarean section indications are actively disseminated through guidelines, information, education and communication (IEC) materials, and reminder systems
	Each audit and feedback cycle produce clear and actionable recommendations to be implemented
	Multidisciplinary collaboration across cadre of health workers (obstetricians, doctors, nurses, midwives) are encouraged and promoted
	Health providers' willingness to change are assessed and addressed
	Utilising reflective nature of intervention when all above components are implemented

Our QCA highlights the key role of the combination of provider training, active education and dissemination of caesarean section indications, and audit and feedback which emphasize the need for adopting robust approaches to monitoring caesarean section rates and indications at the health facility level. Although assessing and comparing caesarean section rates and indications has been historically challenging and one of the barriers to implement effective measures to optimise the use of caesarean section, in 2015, WHO recommended the use of the ten-group Robson classification. This system allows for a more standardized assessment and reporting of caesarean section use and when adopted on regular basis, it assists to define concrete actions to improve practices^{98,99}. In 2021, WHO launched an interactive Platform for health facilities worldwide to share their data using the Robson classification and have data-driven conversations¹⁰⁰. To increase to quality of evidence, more research is needed about interventions implementing financial reform, opinion leaders,

mandatory second opinion, VBAC, multi-faceted, and multi-target interventions (targeting both women and healthcare providers). Future caesarean section intervention studies should also ensure a complete reporting of intervention components implemented, including process outcomes, such as fidelity, attrition, adherence, contextual factors (details on what, where, when, how the interventions were delivered) and stakeholder perceptions of the interventions. This information is crucial in assessing not just if the intervention is successful, but also how similar interventions can work in one context and but not another.

8.6 CONCLUSIONS

Our study is the first study that has investigated important intervention components and potential pathways which may trigger successful audit and feedback interventions targeting healthcare providers in the context of optimising caesarean section use. Through our robust QCA, we identified five important components that jointly work together to promote successful outcomes 1) training to improve providers' knowledge and skills, 2) active dissemination of caesarean section indications, 3) actionable recommendations, 4) multidisciplinary collaboration, and 5) providers' willingness to change. When designing the interventions targeting healthcare providers, health facility managers, researchers, and policymakers can consider the inclusion of the components above to ensure benefits. We also note that more research is needed on financial reform, opinion leaders, mandatory second opinion, VBAC, multi-faceted, and multi-target interventions (targeting both women and healthcare providers) and that study reports should include a detailed intervention process to ensure feasibility in examining heterogeneity in the future.

8.7 CHAPTER 8 SUMMARY

To summarise, the key intervention components that influence success in interventions targeting healthcare providers are different with those targeting women. I found that there are five key important intervention components that prompt successful interventions targeting healthcare providers. These five components are:

- **Provision of training to improve knowledge and skills:** the interventions provided training to improve healthcare providers' knowledge and skills in labour management and the intervention itself.
- **Active dissemination of caesarean indications:** the interventions disseminate caesarean section indications actively through information, education, and communication materials and reminder systems.
- **Actionable recommendations from audit and feedback:** the interventions produce clear and actionable recommendations to be implemented from each audit and feedback cycle.
- **Multidisciplinary collaboration:** the interventions encourage and promote multidisciplinary collaboration across different cadre of health workers, including midwives, doctors, nurses, and obstetricians)
- **Health providers' willingness to change:** importantly, health providers' willingness to change needs to be present. Therefore, it is important that, before any intervention is implemented, health providers' perspectives, willingness to change, and preferences towards caesarean are assessed and addressed.

Similar to interventions targeting women, the inclusion of these key components when implementing intervention-targeting providers in Indonesia will be pivotal to maximise the benefits of the interventions.

The next chapter will be the last chapter of my PhD thesis. In the next chapter, I will provide the discussion and conclusion remarks from my PhD.

8.8 CHAPTER 8 REFERENCES

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CHAPTER NINE

Discussion & Conclusion

9.1 CHAPTER 9 PREAMBLE

The overarching aim of my PhD was to understand the potential drivers of caesarean section increase in Indonesia and to find approaches to optimise the use of caesarean in the country.

I have done this by examining caesarean portrayal in Indonesia through Instagram; interviewing women in the third trimester and in the postpartum period to see their perspectives and decision-making processes on mode of birth; and investigating intervention components that influence the success of interventions to optimise caesarean section use, in a wider context.

In this final chapter, I summarise my research findings, compare the findings with existing literature, address the strengths and limitations of the study, discuss implications for future practice and research, and offer some concluding remarks.

9.2 SUMMARY OF KEY FINDINGS

In summary, there are four key findings from my PhD study. Firstly, the social media analysis in Chapter 5 found that caesarean section is commoditised in Indonesia predominately through advertising. The social media analysis revealed four types of advertisements for caesarean section: (1) products and medications to expedite the recovery post caesarean section – relaying to women that faster recovery from a caesarean section is possible; (2) services providing feng shui consultation, which is a consultation to choose the most auspicious day of birth – encouraging women to have elective caesarean section; (3) fee discounts for caesarean sections on special days like Mother's Day or Indonesia Independence Day; and, (4) caesarean section ERACS . ERACS was claimed to be an advanced technique for caesarean section, promoted as a painless, and comfortable method for birth that results in faster recovery. The main actors in caesarean advertisements on Instagram were private health facilities, healthcare providers, individual sellers, and commercial bodies.

Secondly, the longitudinal qualitative study in Chapter 6 revealed that due to the pervasiveness of caesarean section advertisements - especially for ERACS - women in Indonesia have shifted their beliefs around caesarean section. Women reported knowing about ERACS through celebrities, social media, healthcare providers, friends, and families. Caesarean section was no longer seen as a last option, but instead an option that was equivalent to vaginal birth. Despite this, most women still desired and planned to have a vaginal birth, even though many ended up having a caesarean section. The change in planned mode of birth was mainly due to the influence of their providers.

Providers often suggested or recommended that women have caesarean sections, and this occurred close to the time of birth with non-transparent and imbalanced information. Some women who underwent caesarean section felt they did not receive adequate information from providers and were ultimately disappointed with the changed birth plan. Women expressed desire for emotional support from providers instead of the providers' emphasis on the impossibility of having a vaginal birth. Furthermore, while some women believed ERACS met the advertised expectations, others experienced adverse effects during and after the procedure, expressing disappointment that it did not deliver what it promised – women still felt pain and did not recover within 24 hours.

Thirdly, through the caesarean section intervention analysis for interventions targeting women covered in Chapter 7, found that support for pregnant women is central to optimising caesarean section use. Through the caesarean section intervention analysis, I found that involving and providing pregnant women with support was important as an intervention to optimise caesarean section use. Women should be provided with support in four ways. Firstly, they need emotional support from their providers and partners, and involvement of these support in the interventions. Secondly, peer support should be provided through group-based interventions. Thirdly, informational support should provide informational and educational material on what to expect during birth and labour. Lastly, women should receive support from their healthcare providers by giving the adequate time and an open conversation.

Lastly, in Chapter 8, through caesarean intervention analysis on interventions targeting healthcare providers, my PhD study also found there are ways to promote success when implementing caesarean section intervention targeting healthcare providers. This can be done by improving providers knowledge and skills by providing training in labour management to maternity healthcare providers and disseminating caesarean indications actively through information, education, and communication materials and reminder systems. The caesarean section use should also be monitored by conducting audit and feedback and producing clear and actionable recommendations to be implemented from each audit and feedback cycle. Lastly, positive work environment should also be promoted by encouraging multidisciplinary collaboration across different cadre of health workers, including midwives, junior doctors, nurses, and obstetricians, and health providers' perspectives, willingness to change, and preferences towards caesarean are assessed and addressed.

9.3 THE COMMODIFICATION OF CAESAREAN SECTION IN INDONESIA: EXPANDING THE BETRAN ET AL (2018) FRAMEWORK

Aligned with Betrán et al framework¹, my PhD study found that women's decision to have a caesarean section was influenced by multi-level factors. From the women and community level, the social media and longitudinal qualitative study indicated that decision-making regarding caesarean sections was influenced by multiple information sources, including healthcare providers, partners, family, friends and social media. Additionally, women's belief in the benefits and risks of the caesarean section, fears about birth-related risks, previous birth experiences, and available choices within the context of ERACS also influence women to undertake caesarean section over vaginal birth. Importantly, similar to the Betrán et al. framework, the women in my study expressed a need for emotional support and the opportunity to be involved in decision-making. Although I did not directly investigate healthcare providers and organisational levels' factors, my PhD study reveals the pervasiveness of advertisements for caesarean sections through Instagram. Caesarean section was advertised through product promotion, services to choose the most auspicious day of birth, caesarean discounts and caesarean ERACS promotion, mainly by private health facilities and providers. Unfortunately, all these advertisements encourage women to undertake elective caesarean sections, which drives a further increase in caesarean sections in the country. The commodification of the caesarean section, especially in the context of ERACS promotion, has not been described elsewhere and expanding the understanding of the Betrán al framework on influencers of caesarean uptake¹.

The commodification of caesarean section is heavily connected with the commodification of the healthcare system. Commodification and privatisation of healthcare is also termed "commodified healthcare model"² in the literature. Driven by capitalism and neoliberalism, this model has led the healthcare system to no longer focus on the provision of care based on need but rather on maximising profit-making². The commodification of healthcare also encourages our health system to medicalise birth and promotes the use of unnecessary procedures². In the context of this study, caesarean section is no longer seen as a life-saving procedure, but as a commodity that healthcare providers and women can opt for. The commodification of caesarean section exacerbates the conflict of interest between private and public interest, which may compensate for women's and babies' well-being for the sake of profit-making. It may also lead to the increased use of unnecessary caesarean sections which expose women and babies to preventable risks, but also perpetuates inequality in access to caesarean section for more disadvantaged women.

The actors behind advertisement posts on the caesarean section include private health facilities, providers, individual sellers, and commercial bodies. Previous studies have reported the involvement of the advertisement of medical procedures by healthcare providers in social media^{3,4}. Surveys conducted by 523 surgeons in Mexico revealed that half used social media as a marketing platform, mostly to describe services provided as well as disseminate sales and promotions³. This is similar to what I observed in my social media analysis study where private health facilities and providers in Indonesia use their Instagram for personal branding and marketing. They collaborated with 'celebgrams' (celebrities on Instagram) to give positive personal testimonies after having caesarean sections. They also created a special event to provide discounts or vouchers for women to have caesarean sections with them. While the involvement of healthcare facilities and providers in health promotion in social media opens endless possibilities for influencing beneficial health behaviour and improving the health of the public, it has become a paradox, as it opens opportunities for health facilities and providers to promote themselves and certain procedures for profit making. Previous studies have reported that financial incentives have been the driving force for healthcare providers to prefer caesarean sections globally^{5,6}. This may be the case in the Indonesian context, where facilities and providers are paid and reimbursed more when they assist women in having a caesarean section, including through the national insurance system⁷. Profit-making seems to be the main driver behind the caesarean section marketing. Therefore, there is an urgent and clear need to implement regulations around advertisements in the context of caesarean sections by healthcare facilities and providers specifically. It would also be useful to examine the correlation between caesarean section uptake and the payment structure in the country, to ensure reform of the payment structure if needed.

The ethics of advertising caesarean sections are questionable. From women's stories in my PhD, the caesarean sections were not only advertised through social media, but also in hospital settings through posters depicting ERACS or associated discounts on hospital walls, as well as during consultation. For example, an obstetrician told a woman to just give birth through him because he could perform ERACS. As mentioned in Chapter 5, both the online and offline advertisements of the caesarean section by health facilities and providers violated national regulations and ethics in Indonesia. The Indonesian Medical Code of Ethics (articles 3 and 4 of 2012)⁸ and Minister of Health Regulations (no 1787/Menkes/PER/XII/2010)⁹ concerning advertising and health services states that healthcare providers are prohibited from advertising healthcare services, products, or techniques for profit-making^{8,9}. This includes distributing advertisements, receiving compensation from the advertisements, giving discounts, and promoting oneself, hospitals, medicine, or medical services for profit^{8,9}. Interestingly, there is an exception for hospitals, where hospitals are allowed to conduct

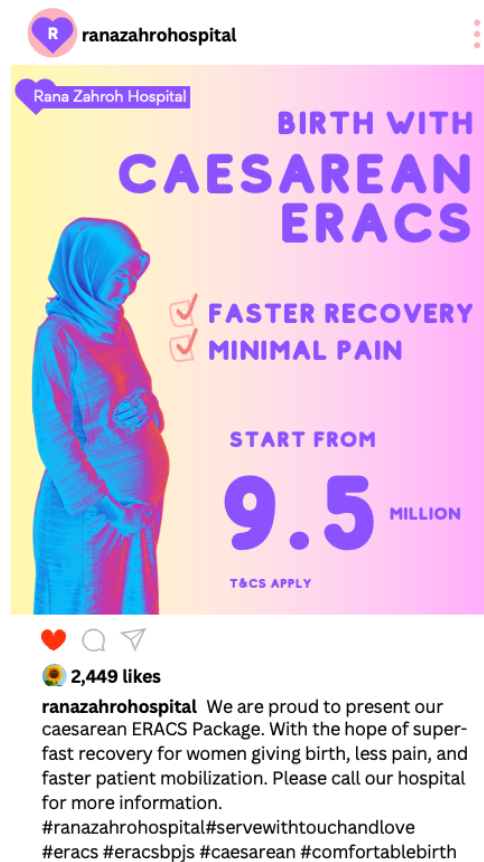
advertisements with some caveats⁹. This includes advertising procedures in which effectiveness is unknown⁹: in which ERACS, to some extent, maybe the case. There is a need to re-examine the advertisement exception for hospitals, as it is unethical to advertise caesarean section as a comfortable and painless method of birth when women still feel pain and are exposed to all the surgical risks. Violations of national regulations and ethics codes by health facilities and providers also warrant the need to revisit the regulations on caesarean advertisements in the country and formulate ways to reinforce the advertisements and policies surrounding this.

The advertisements for caesarean section are often not accompanied by provision of and communication about evidence-based information. The promotion of medicinal and herbal products which were claimed as natural medicine for caesarean section, as well as the correlation between date of birth and baby's prosperity, are not based on scientific evidence and clinical advice. The caesarean section posts, specifically on ERACS, heavily emphasized benefits instead of giving balanced information on the benefits and risks of the procedure. Misinformation propagation is not new in social media¹⁰. For example, vaccine misinformation is the most prevalent in social media¹⁰. Misinformation on vaccination which was propagated by anti-vaccine groups amplified the controversy on vaccines and resulted in vaccine hesitancy by the public¹⁰. While social media is a unique and critical platform for disseminating health information quickly and far-reaching, misinformation propagation in social media can be easily perpetuated and may result in negative effects. This highlights the need to implement efforts to counter this misinformation propagation on the caesarean section with accurate, balanced and evidence-based information for women in social media.

9.4 THE RISE OF CAESAREAN SECTION ERACS IN INDONESIA

One of the very interesting points from my PhD is the increased popularity of caesarean ERACS. It is important to note that ERACS is widely promoted through social media through celebrities, health facilities and providers' accounts, advertisements of health facilities, offers from healthcare providers during the consultation, and mouth-to-mouth within the society (Figure 9.1). ERACS is advertised as a "new" and "advanced" technique of caesarean section that will increase recovery. ERACS is advertised as a painless and comfortable method of birth. If not intervened, the rise of ERACS in Indonesia may likely influence the further increase of caesarean section in the country.

Figure 9.1. Example of the Instagram post promoting caesarean section ERACS.



This is a synthetic image recreated to protect the anonymity of the poster.

The term ERACS itself does not seem to be well-known globally. As mentioned in Chapter 5, Google's search trends show that Indonesia is the country where ERACS is the most searched¹¹. The most search queries are related to "What is ERACS?", "How much does it cost to have ERACS?", and "Is ERACS covered by national health insurance system?". ERACS is only related to obstetric care in these searches. The search of ERACS in other countries is 1/100th that of Indonesia (based on Google's scoring mechanisms). Searches of ERACS outside Indonesia were not related to caesarean nor obstetrics, but instead it relates to an electrical engineering term, specifically of ERACS software for power systems analysis, and cardiac surgery¹¹. These search results suggest that ERACS is not a global practice at this point and not publicly advertised and commoditised as in Indonesia.

The reason for ERACS's popularity in Indonesia is unknown. Google Trends shows that ERACS's popularity peaked in November 2021, during the COVID-19 pandemic. At that time, the Indonesian Society of Obstetricians and Gynaecologists issued a guideline that recommended all COVID-19-positive women should give birth through caesarean section during the pandemic¹². So, it may be possible that the uncertainties and fears of the public, especially for pregnant women, opened the

opportunity for the private sector to advertise ERACS. This recommendation also gave women reassurance that caesarean section was the best mode of birth during the pandemic, and this has persisted.

ERACS is not a medical procedure per se; it is a package of peri-operative care that is implemented before, during, and after surgery^{13,14}. ERACS is implemented to improve women's comfort post caesarean surgery^{13,14}. Some studies have tried to assess ERACS adoption and effectiveness in obstetrics¹⁵⁻¹⁷. These studies found that there is a paucity of evidence on ERACS outcomes and there is no consensus on what constitutes the best components for ERACS implementation¹⁵⁻¹⁷. In addition, there is not yet a standardised procedure on how ERACS should be implemented and the components and implementation vary between facilities^{15,16}. To this point, ERACS use is not part of recommendations or guidelines from the WHO, Royal Australian and New Zealand College of Obstetricians and Gynaecologists or United Kingdom National Institute for Health and Care Excellence.

As ERACS is not a standardised procedure, it is hard to examine the elements as a complex intervention. The systematic reviews of the ERACS protocol show that early reintroduction of fluids and food was an intervention that was consistently included across all protocols¹⁵. In my study, women talked about very different things about ERACS. When asked about the difference between caesarean with and without ERACS, women believed that ERACS included different surgical tools, for example, smaller scalpels that resulted in smaller incisions in the uterus. This highlights the level of misinformation in Indonesia about ERACS as a surgical procedure instead of being a package of perioperative care.

There is also uncertainty on the effectiveness of ERACS. Several systematic reviews have tried to examine the ERACS outcomes, however, due to the heterogeneity of ERACS components and outcomes measurements, it is difficult to compare and pool the analysis^{15,16,18,19}. Only two meta-analyses have been conducted on ERACS effectiveness^{18,19}. These reported that ERACS use in caesarean section reduced hospital stays, time for first mobilisation, time to urinary catheter removal, costs, complications, pain and opioid use. However, these meta-analyses only included twelve studies with large heterogeneity and high risks of bias, with three and four studies using randomized-controlled trials, and less than ten studies on most of the pooled analyses^{18,19}. Therefore, it was concluded that more randomized-controlled trials are needed to assess effectiveness¹⁸ and also on which ERACS components should be implemented¹⁹, and which outcomes should be measured¹⁹.

The two meta-analyses highlight cost effectiveness^{18,19}. However, cost effectiveness of ERACS may be questionable in Indonesia as women in my PhD study reported that caesarean with ERACS costs is higher compared to caesarean without ERACS. If ERACS is proven to be beneficial for women and babies, the costs associated with having ERACS in Indonesia may compensate for the quality of care to women who cannot afford ERACS – further perpetuating inequality on high-quality caesarean section access.

9.5 WOMEN'S INTERACTIONS AND RELATIONSHIPS WITH HEALTHCARE PROVIDERS

My PhD project has highlighted the hierarchical nature of the relationships between women and their care providers in Indonesia. Despite the advertisements for caesarean section, many women in my study still wanted to have a vaginal birth. However, their plans to have a vaginal birth changed to a caesarean section due to the influence of their care providers, specifically obstetricians. Some women felt upset when this happened expressing disappointment in obstetricians' communication and care for them. They wanted better access to evidence-based information and women-centred care. However, the communication they received about the mode of birth was often unilateral; promoting caesarean section while instilling fears about vaginal birth. A previous study in Argentina has shown that this unilateral communication is the case in the context of the mode of birth discussion²⁰. Providers (also mostly obstetricians) maintained control during the consultation, often feeling frustrated when women did not listen to them and persisted in wanting vaginal birth²⁰. Providers also expressed difficulty in relaying transparent information on benefits and risks and felt that it was not possible²⁰. They felt they were supporting women's choices²⁰, but this is not the case in terms of women's perspectives.

A unilateral style of communication may not be suitable in the case of mode of birth discussion. Firstly, women know the best about their bodies and have the right and autonomy to express how they want their birth to be. Secondly, as someone who has medical knowledge, providers can advise women on what might be possible, however, the conversation should be mutual, involving the active participation of both parties, and any decision should be made collaboratively with information and support²¹. These findings on women's desire for information and support aligns with the results of my third study where I found that support provision (emotional, informational, peer, and provider) is central for women is central to optimise caesarean section use. Particularly, meaningful interaction with providers is important. Restructuring communication is pivotal to ensure that women are heard and are involved in the decision-making process surrounding their care – which subsequently may result in the optimised caesarean section use in the country.

It is interesting to note that women in my study perceived communication with midwives differently from obstetricians. Many women of high socio-economic status in my study intentionally went to both primary health centres and private hospitals for antenatal care. The reason for this is that they felt that midwives are more supportive of vaginal birth, unlike obstetricians who are perceived to be more supportive of caesarean section. Thus, women went to the two health facilities to ensure they could receive emotional support and receive a second opinion from midwives in case their obstetricians told them to have a caesarean section. Unlike with obstetricians, women in my study expressed satisfaction with their interaction with midwives at primary health centres, and the receipt of emotional support and motivation from midwives to have vaginal birth throughout the antenatal visit's consultations and births. This is however different in the case of midwives' treatment at the hospitals during birth. Women expressed dissatisfaction and felt rushed by midwives during birth, women also felt that midwives always check what they need to do with the obstetricians in charge instead of leading the women confidently. From this story, it is probable that there is a hierarchy in place between obstetricians and midwives in Indonesia. This hierarchical relationship between midwives and doctors has been observed in the case of hypertensive disorders of pregnancy pathways in Indonesia, where midwives are positioned at a lower hierarchical level than doctors²². However, no study has been explored in the context of caesarean section, which is imperative to optimise caesarean section use in the country.

Lastly, in my PhD study, I explored women's reported reasons for caesarean section. This highlighted that the stated reasons for the caesarean section were not evidence-based. For example, obstetricians informed one woman to have a caesarean section due to a big placenta, however, no evidence of the need for a caesarean section due to a big placenta. It is important to note that it is unclear what the definition of big placenta that providers referring to, as there is no fetal growth restriction diagnosed for the baby. Furthermore, the placenta is normally not measured either before the baby is born or after, its size is usually one-sixth of the baby's weight should not influence the capacity of the baby to be born. Some women were also told that the birth gap from the previous birth with caesarean section should be more than 5 years to be eligible for VBAC. This is despite birth spacing from previous caesarean births is recommended to be 18 months (1.5 years) to be eligible for VBAC²³⁻²⁵, not 5 years. One woman was also told that she was anaemic, so caesarean section was a 'must'. However, anaemia is not an indication for caesarean section, as studies showed that there is an increased risk of women with low haemoglobin levels undergoing caesarean²⁶. Women lose more blood with a caesarean section compared with a vaginal birth, and women with anaemia who had a caesarean section have an increased risk of having a severe postpartum anaemia^{27,28}. Therefore, these reasons are not aligned with clinical recommendations.

While I am unsure if providers are unaware that these are not evidence-based, or that they intentionally tell women to influence them to have a caesarean section, or that women did not know or understand the reason behind their caesareans, it is clear that interventions targeting knowledge of healthcare providers need to be implemented to optimise caesarean section use. This can be done by implementing intervention components that are aligned with success, as found in my last study, such as implementing training, disseminating caesarean indications, conducting audits and feedback, implementing multidisciplinary collaboration, and ensuring health providers' willingness.

9.6 STRENGTHS AND LIMITATIONS

9.6.1 Strengths

My PhD study is the first comprehensive examination of the increase of caesarean section in the country. Understanding the driving factors of the increase is pivotal to understanding how caesarean section use can be optimised. Thus, my PhD study gives the first layout or foundation for the country, researchers, and policymakers, to formulate interventions or conduct further study in the country to optimise the caesarean section use.

This project used a range of strong and evidence-based approaches from social media analysis, qualitative longitudinal study, and qualitative comparative analysis. This is the first study that has tried to examine the portrayal of a caesarean section through Instagram utilising computational analysis – in particular, computer-assisted visual and text-based analysis. Investigating the temporal understanding of the decision-making process on mode of birth, that is, following women from pregnancy to postpartum, is also a novel contribution. Lastly, my PhD study is also the first study that has utilised qualitative comparative analysis to fill the gap in the literature in understanding the recipes of success when implementing caesarean section intervention.

My PhD study captures not just one dimension of influence but across levels of stakeholders, from the community through social media, women, providers, and families, from the qualitative longitudinal study. Furthermore, my study does not only try to understand drivers but also strategies that can promote the success of the intervention.

9.6.2 Limitations

My study, like all research, has a number of limitations. The studies mainly included women who have access to technology, especially in the context of social media analysis. I tried to consider the different socio-economic backgrounds in the second study, which is the qualitative longitudinal study. However, one big limitation is the settings – I have only examined perspectives of women from Jakarta for the second study; and for the first study, settings where the internet is accessible

and potentially urbanised. Therefore, my study may not be transferable to rural areas in Indonesia, and settings that are likely outside Jakarta or urban areas.

Furthermore, my study mainly focuses on the perspectives of women and what women are exposed to on social media. While I did find findings related to providers and health systems and I found intervention components that can be implemented on target providers, there are still limitations: I have not examined the perspectives of the healthcare providers, including obstetricians, midwives, nurses, facility managers, and policymakers like the Ministry of Health and the national insurance system body. Furthermore, as mentioned earlier in this study, I did not access medical records and relied on the women's reported reasons for caesarean section, which may be prone to recall bias.

The intervention studies included in qualitative comparative analysis, which is the method that I use to find important caesarean intervention components to influence success, were also mostly from high-income and upper-middle income countries, as this is where the interventions were conducted. Furthermore, due to limited studies and imbalance in the number of successful and unsuccessful interventions, I could not assess important components that may trigger success on implementation of financial reform, opinion leaders, mandatory opinion, VBAC policy. Due to the variation on outcomes measurements, I was also unable to understand the impact of the interventions to changes on intrapartum versus elective caesarean section, spontaneous vaginal birth, instrumental birth, or VBAC as studies did not consistently report these outcomes.

9.7 IMPLICATIONS FOR POLICY, PRACTICE, AND RESEARCH

9.7.1 Policy and practice

The pervasive advertisements promoting caesarean section and associated misinformation warrant the need for the Ministry of Health and medical professional bodies to re-examine Indonesia's regulations on advertisements related to health procedures and healthcare more broadly. The regulations on advertising health procedures on social media or health settings, by providers, facilities, and commercial bodies should be revisited and reforms are possibly needed for this. This does not only involve revisions and reforms on these regulations, but also the reinforcement of these regulations.

Additionally, the practice of ERACS in Indonesia should be reviewed and standardized.

Countermeasures are needed to combat misinformation on social media, such as awareness campaigns targeted at women, and providing evidence-based information about modes of birth, including ERACS. These campaigns should be backed by scientific evidence and disseminated by

governments, health authorities, and researchers to counteract false or misleading information from private actors.

In addition to this, the hierarchical relationships between providers and women are pivotal to address in Indonesia. As my dissertation has described, supporting women -- both emotionally and informationally -- is pivotal in optimising caesarean section use. There is a clear need to reform the way healthcare providers communicate with women and their families. Training should be delivered to providers not only on medical knowledge and skills, but also skills on ways to best support women.

9.7.2 Research

More research is needed to understand the best components included in ERACS, the best outcomes to be measured, and its safety and effectiveness in Indonesia. If ERACS is found to be safe and effective to improve women's recovery for caesarean section, there is a need to ensure that ERACS can be used as a standard of care for all women instead of women who can afford it. Ensuring equitable access to ERACS by all women (once proven safe and effective) will prevent inequities in maternity care, allowing every woman, regardless of socioeconomic status, to benefit from improved post caesarean recovery care.

Additionally, more studies involving healthcare providers (particularly midwives and obstetricians), facilities, and policymakers are also needed. This includes examining the perspectives of providers, facility managers, and policymakers on the caesarean section increase and ERACS, examining hierarchic relationships across providers that may exacerbate non-medically indicated caesarean section uptake, and using Robson classification to identify where potentially high rates of caesarean section may be in a given segment of obstetric population, thus appropriate intervention can be delivered.

The QCA analyses demonstrate the importance of having both interventions targeting women and providers to optimise caesarean use. My PhD study found important intervention components that can be used when designing intervention targeting healthcare providers and pregnant women. However, more intervention studies are needed in low- and middle-income countries where caesarean section rates are increasing. More interventions are needed in these settings to account for the differences between high-income and low- and middle-income countries (e.g., health system functionality). These differences may explain if certain conditions are necessary in some countries but not in others. Further studies may also be required to evaluate the best format for promoting and disseminating trustworthy information on the mode of birth, or such outreach, and to

determine which channels work best for different populations, geographical settings, and cultural contexts.

It is important to note that in my PhD, 18 out of 28 women I interviewed accessed primary health centres. Women who access primary health centres but end up having a caesarean section were referred from primary health centres to higher facility levels, both public and private. This is because primary health centres are not equipped with emergency equipment and standards, such as ultrasound and caesarean section. Many of these referrals were temporary or limited – by dates or number of visits, which means that the midwives at primary centres referred women to be reviewed by obstetricians yet expected them to return to primary health centres before birth happens to continue with antenatal care. However, when women arrived at hospitals, they were urged to have a caesarean section. Midwives in primary healthcare centres that I had conversations with during my fieldwork referred to hospitals as “stealing women” from them, as primary health centres have a set of targets for number of services delivered, including births. Furthermore, some women visiting private clinics were told by providers to go to public hospitals during their agreed caesarean date (agreed date between the obstetrician and woman) and asked the women to enter the hospital through the emergency ward (despite not having an emergency), so they could get their caesarean – with ERACS – covered by national health insurance. This violates regulations set by the insurance system in the country, as the caesarean section fee is only covered by the national insurance system if it is medically indicated. These aspects of my PhD study warrant that more research is needed to understand the upper-level factors of healthcare providers and system (obstetricians, midwives, nurses, doctors, facility managers, and policy makers perspectives) on the increase of caesarean section, including ERACS. Furthermore, it is also important to understand the effectiveness of referrals in the country and its correlations with unnecessary caesarean section use.

9.8 CONCLUSION

Similar to global trends, caesarean section use is significantly increasing in Indonesia. This PhD study has provided new insights and knowledge on the drivers of caesarean section increase in Indonesia and potential intervention components that can help to optimise caesarean section use. This PhD study comprised three study components, which are social media analysis to examine the portrayal of caesarean section in Indonesia through Instagram, a longitudinal qualitative study to investigate women’s preferences and decision-making process on the mode of birth, and lastly, caesarean section intervention analysis adopting qualitative comparative analysis approach to identify important intervention components that influence successful interventions to optimise caesarean section use.

One of the main factors driving the high rate of caesarean sections in Indonesia is the commodification of this procedure. Caesarean sections are marketed and advertised as a painless and comfortable birthing option through ERACS. Additionally, obstetricians and other healthcare providers play a significant role in promoting caesarean sections, often instilling fear and pressure on women, leading to women feeling a lack of information and being blindsided. Women's reproductive rights and autonomy are not respected during labor, and they desire more women-centred care and information.

There are clear and effective ways to improve interventions aimed at optimising caesarean use in Indonesia. This can be achieved by providing essential support to women during pregnancy and childbirth, such as informational support, emotional support from family members, peer support, and support from health care providers. It is also crucial to improve healthcare providers' knowledge and skills in labor management, monitor caesarean section use, and promote a positive work environment. Advertisements and the use of ERACS should be monitored and regulated in Indonesia. Importantly, ensuring maternal health delivery through a rights-based approach is an essential step in fulfilling women's rights to receive high-quality and respectful healthcare services, which consequently may optimise caesarean section use in the country.

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APPENDICES

Chapter listing appendices

APPENDIX 5.1. LIST OF #HASHTAGS USED TO SEARCH FOR CAESAREAN SECTION POSTS.

Category	Bahasa Indonesia words	English translation
Caesarean birth	#kelahirancaesar	Caesarean birth (kelahiran comes from the word of “lahir”, which means birth; caesar means caesarean)
	#lahirancaesar #lahirancesar #lahiransc #lahiransecar #lahiransesar	Caesarean birth (lahiran comes from the word of “lahir”, which means birth; sc is the short version of caesarean, while caesar, cesar, secar, and sesar are different spellings of caesarean)
	#melahirkancaesar #melahirkancesar #melahirkansc #melahirkansecar #melahirkansesar	Caesarean birth (melahirkan comes from the word of “lahir”, which means birth; sc is the short version of caesarean, while caesar, cesar, secar, and sesar are different spellings of caesarean)
	#melahirkansecaraoperasi	Giving birth through surgery [caesarean birth] (melahirkan comes from the word “lahir”, which means birth; secara means through; operasi means surgery)
Caesarean surgery	#operasicaesar #operasisesar	Caesarean surgery (caesar and sesar are different spellings of caesarean; operasi means surgery)
	#operasicaesaribuhamil	Caesarean surgery of pregnant women (caesar means caesarean section; operasi means surgery; ibu hamil means pregnant women)

APPENDIX 5.2. APPROVAL FOR SOCIAL MEDIA ANALYSIS.



Office of Research Ethics and Integrity

Human Ethics Application Approval

ATTENTION: DR Meghan Bohren

145 - Melbourne School of Population and Global Health
140 - Medicine, Dentistry and Health Sciences
The University of Melbourne

Research Application

Reference Number: 2021-22782-22472-3

Project Title: Birthing on Instagram: Exploring portrayal and representation of caesarean section among Indonesians

Dear DR Meghan Bohren,

The Committee agreed to **approve** the application on the basis that it meets the requirements of the National Statement on Ethical Conduct in Human Research (2007, Updated 2018). Please see overleaf, *Summary Details for the Approved Human Ethics Project* and *Conditions of Approval*. It is your responsibility to ensure that all people associated with the Project are made aware of what has been approved.

Desk-based elements of your project and face-to-face research can commence now, as can data collection that can be conducted online or via telephone, subject to necessary approvals or amendments to ethics applications.

Please consult the COVID-19 website for research guidance, FAQ and updates. <https://staff.unimelb.edu.au/covid-19-response/research-activity>

If you have any queries on these matters, or require additional information, please contact me using the details below. Please quote the ethics ID number and the title of the Project in any future correspondence.

Yours sincerely,

MR Tom Wright

Research Ethics Officer

Human Ethics Team

Office of Research Ethics and Integrity | Research, Innovation & Commercialisation
Level 5, Alan Gilbert Building, 161 Barry Street, Carlton
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Summary Details for the Approved Human Ethics Project

Project Title:	Birthing on Instagram: Exploring portrayal and representation of caesarean section among Indonesians
Reference Number:	2021-22782-22472-3
Approval Date:	27/10/2021
Expiry Date:	27/10/2024
Responsible Human Ethics Committee LNR	2C
Project Supervisor	DR Meghan Bohren
Other Investigators	Dr Fitriana Ekawati, Ms Alya Hazfiarini, DR Marc Cheong, PROF Caroline Homer, Rana Islamiah Zahroh
External Investigators	Professor Ova Emilia, Dr Ana Pilar Betrán

Documents table:

Document Type	File Name	Date	Version
Other	Birthing on Instagram_Ethics_Data Management Plan_v2	05/10/2021	2
Full protocol (for medical research)	Social media analysis on CS_Protocol_05102021	05/10/2021	3

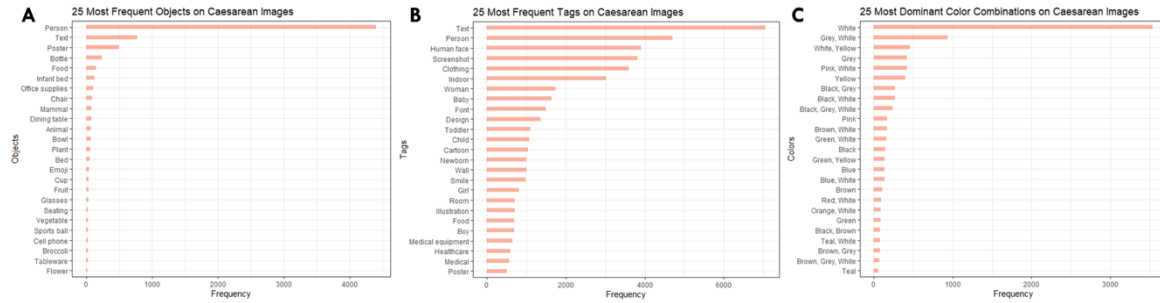
Conditions of Approval:

Research projects are normally approved to the anniversary date of the approval. Projects may be renewed yearly for up to a total of three years upon receipt of a satisfactory annual report. If a project is to continue beyond three years, two optional extensions of one year each (3+1+1) will need to be applied for. Anything beyond 5 years will need a new application to be submitted.

Please note that the following conditions apply to your approval. Failure to abide by these conditions may result in suspension or discontinuation of approval and/or disciplinary action.

1. **Limit of Approval:** Approval is limited strictly to the research as submitted in your Project application.
2. **Variation to Project:** Any subsequent variations to the Project must be notified formally to the Committee for consideration and approval before they are implemented. If the Committee considers that the proposed changes are significant, you may be required to submit a new application.
3. **Incidents or adverse events:** Researchers must report immediately to the Committee anything that could affect the ethical acceptability of the project, including adverse effects on participants or unforeseen events. Failure to do so may result in suspension or cancellation of approval.
4. **Monitoring:** All projects are subject to monitoring at any time by the Committee.
5. **Annual Report:** An annual report must be submitted each year on the anniversary of project approval, and at the conclusion of the project. Ethics approval will lapse if an annual report is not submitted.
6. **Auditing:** All projects are subject to audit by members of the Committee.

APPENDIX 5.3. TWENTY-FIVE MOST FREQUENT OBJECTS, TAGS, AND COLOURS COMBINATIONS USED IN CAESAREAN SECTION POSTS.



APPENDIX 5.4. GLOSSARY OF EXAMPLE WORDS IN BAHASA INDONESIA WITH ENGLISH TRANSLATIONS.

Category	Bahasa Indonesia words	English translation
Words relating to advertised products for faster recovery	Channamix	Brand name of supplements for faster caesarean recovery
	Kapsul kutuk	Herbal medicine brand for caesarean wound recovery
	Lebih cepat	Faster [recovery]
	Obat herbal	Herbal medicine
	Pengobatan	Treatment
	Penyembuhan luka	Wound recovery
	Proses penyembuhan	Recovery process
	Royalmix	Brand name of supplements for faster caesarean
Most frequent #hashtags appearing on caesarean images	#InginHamillNstan	“want to get pregnant instantly”
	#KapsulKutukPremium	Herbal medicine to expedite caesarean recovery
	#LukaOperasi	[caesarean] surgery wound
	#MelahirkanCaesar	Caesarean birth
	#MelahirkanNyaman	Comfortable labour
	#ObatCaesarAlami	Natural medicine for caesarean
	#OperasiSesar	Caesarean surgery
	#PersalinanLancar	Smooth labour
#Hashtags related to ERACS	#5xLukaCaesarCepatKering	Caesarean wound heals 5 times faster
	#ERACS	ERACS
	#OperasiCaesarSecaraERACS	Caesarean with ERACS
	#OperasiERACS	Caesarean with ERACS
	#OperasiSesarSecaraERACS	Caesarean with ERACS
	#OperasiTanpaNyeri	Surgery without pain
	#OperasiTanpaSakit	Surgery without pain
	#SCSecaraERACS	Caesarean with ERACS
	#SesarSecaraERACS	Caesarean with ERACS
	#TeknikERACS	ERACS Technique

APPENDIX 5.5. TYPE OF POSTS AND THEMES EMERGING FROM POSTS USED CAESAREAN SECTION

#HASHTAGS YET WERE NOT RELEVANT TO THE CAESAREAN SECTION.

Type of posts	Number of posts (%)	Themes of the posts
Advertisement	223 (56.5%)	Promoting products to sell, which are not relevant to caesarean, which include: • Postpartum food catering service • Postpartum skin care product (mostly for eliminating stretchmark) • Hospital promotion (by sharing patient testimony, service promotion, facility offered, discounts, provider profile) • Medicine (herbal and non-herbal) and supplement for pregnancy, birth and postpartum • Vaginal wash product • Maternity photoshoot or birth documenting service • Infertility treatment product • Postpartum diet service and product for "returning" to normal body shapes • Breastfeeding booster product • Aqiqah (Islamic ceremony for newborns) product • Postpartum kit package and service • Gentle and hypno birth service • Baby products • Plastic surgery product advertisement • Medical instruments products (mostly advertise during COVID-19) • Other non-maternity related products (armpit cleaner, towel, phone case, multipurpose belt)
Trusted health messages	50 (12.7%)	These health messages came from either clinicians, midwives, or hospitals. The posts mostly aimed to not only educate public but also advertise their names, services, and hospitals/clinics. Posts shared information (symptoms, tests, and treatments) in relating to variety of diseases - which not related to caesarean section - as well as reminders and tips. The diseases covered include flu, hepatitis, cirrhosis, cancer and tumor, dengue, heart disease, sexual transmitted infections (AIDS, syphilis), blood disorder (thrombocytosis), skin disorders, bones disease, diaper rash, hair loss (alopecia), hernia, rubella and measles, appendicitis, insomnia, bleeding gums, toxoplasmosis, premature birth, morning sickness, vaginal discharge, bipolar, impetigo, tuberculosis, cataracts. Reminders and tips include: • Danger of smokes from forest burn • Danger of electric cigarettes • Childbirth tips during COVID-19 pandemic

		• Myth about birth • Hypno birth information • Breastfeeding education • Danger of massaging pregnant women • Pregnancy tips • Jet lag tips • Reminder to exercise
Non-trusted health messages	105 (26.6%)	Health messages source could not be trusted and often come to community accounts, sellers which aims to advertise their products, or individual accounts. Most messages are related to maternity including some which aim for social movement, yet there are some which are non-maternity related. Maternity related health messages: • Pregnancy: bonding with fetus, skin care (managing stretchmark), danger on eating sushi, pre-eclampsia symptoms, hemorrhoids during pregnancy, fetal development, mood swings, reminder that pregnancy is based on God's will • Birth: information on contractions and its types, hypno birth, lotus birth, national insurance coverage, urine vs rupture membrane, tax on birth, infection control, and childbirth tips (including shopping checklist, packing, documentation preparation, and birth during pandemic tips) • Postpartum: information about weight loss, postpartum bleeding, traditions (oukup bath, ngeboreh, jamu consumptions), postpartum care, starting sexual activity, postpartum confinement, massages, wound recovery, baby blues • Newborn care and development: information about breastfeeding, vitamin K injection, neonatal jaundice, how to swaddle baby, solid food and weight management, sense of day and night for baby, safety using "gurita", birth mark, myths, speech delay, shaken baby syndrome, what baby poop color means, establishing routine • Parenting: tips to prepare in becoming parents, dad, and returning from maternity leave • Social movement: encouragement to improve partner's involvement during childbirth and postpartum, being kind to other moms, and strength of human body in accommodating changes Non-maternity related messages: • Benefits of grape, green tea, apple, bitter bean, dragon fruit, cabbage, and dates to range of health conditions
Birth story	5 (1.3%)	Classified as birth story due to images which depict newborns or birth process, however, no sufficient detail can be extracted to understand the mode of birth.
Non-birth story	12 (3.0%)	Individual sharing their non-birth stories, which include: • Sharing family portraits • Experience of having kids and breastfeeding

		• Sharing about their babies, through quote, poem and figures • Meme about pregnancy, including comparing about first vs second pregnancy
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APPENDIX 6.1. CONSOLIDATED CRITERIA FOR REPORTING QUALITATIVE STUDIES (COREQ): 32-
ITEM CHECKLIST.

#	Item	Guide questions/description	Section of article
Domain 1: Research team and reflexivity			
Personal characteristics			
1	Interviewer/facilitator	Which author/s conducted the interview or focus group?	Participants and data collection procedure
2	Credentials	What were the researcher's credentials? E.g. PhD, MD	Authors' information
3	Occupation	What was their occupation at the time of the study?	Authors' information
4	Gender	Was the researcher male or female?	Authors' information
5	Experience and training	What experience or training did the researcher have?	Authors' information
Relationship with participants			
6	Relationship established	Was a relationship established prior to study commencement?	Participants and data collection procedure
7	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Participants and data collection procedure and ethical considerations
8	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Authors' information
Domain 2: Study design			
Theoretical framework			
9	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Methods
Participant selection			
10	Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Participants and data collection procedure
11	Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Participants and data collection procedure
12	Sample size	How many participants were in the study?	Results
13	Non-participation	How many people refused to participate or dropped out? Reasons?	Results
Setting			
14	Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Participants and data collection procedure

15	Presence of non-participants	Was anyone else present besides the participants and researchers?	Participants and data collection procedure
16	Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Results
Data collection			
17	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Study instruments and Appendix 2
18	Repeat interviews	Were repeat interviews carried out? If yes, how many?	Participants and data collection procedure
19	Audio/visual recording	Did the research use audio or visual recording to collect the data?	Participants and data collection procedure
20	Field notes	Were field notes made during and/or after the interview or focus group?	Participants and data collection procedure
21	Duration	What was the duration of the interviews or focus group?	Participants and data collection procedure
22	Data saturation	Was data saturation discussed?	Participants and data collection procedure
23	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	Data analysis
Domain 3: analysis and findings			
Data analysis			
24	Number of data coders	How many data coders coded the data?	Data analysis
25	Description of the coding tree	Did authors provide a description of the coding tree?	Results
26	Derivation of themes	Were themes identified in advance or derived from the data?	Data analysis
27	Software	What software, if applicable, was used to manage the data?	Data analysis
28	Participant checking	Did participants provide feedback on the findings?	Data analysis
Reporting			
29	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number	Results
30	Data and findings consistent	Was there consistency between the data presented and the findings?	Results
31	Clarity of major themes	Were major themes clearly presented in the findings?	Results
32	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Results

APPENDIX 6.2. SEMI-STRUCTURED INTERVIEW GUIDE FOR WOMEN.

This interview guide was adapted from Bohren MA, Opiyo N, Kingdon C, Downe S, Betrán AP. Optimising the use of caesarean section: a generic formative research protocol for implementation preparation. Reproductive Health. 2019 Nov 19;16(1):170.

FIRST INTERVIEW WITH WOMEN: THIRD TRIMESTER

RESEARCHER INTRODUCTION

“Hello, my name is Rana, I’m a PhD student at The University of Melbourne in Australia. Once again, thank you for your willingness to participate in this study. As mentioned in the Plain Language Statement and Informed Consent Form you signed, this study aims to understand your preferences and decision-making p you give birth to your baby. I would like to talk with you two times, which is now, in the last few weeks of your pregnancy, and later after you have given birth to your baby. Please note that I have no medical background or skills and any conversation we have during this interview should not be used as medical advice or consideration in choosing your mode of birth. This interview will be audio-recorded, but the recording will only be used for us to be able to write down what you say and will not be published. All your identity and personal information will be anonymised and will not be disclosed to anyone. In this time we have now, I will ask you some questions relating to your pregnancy and birth plan, but you do not have to answer any specific questions if you don’t want to. So, please let me know if you would like to pass any questions or stop our talk. Before we begin, do you have any questions about the study?”

CONSENT RETRIEVAL

1. If you are fine, I would like to turn on the recorder for the interview now, so I don’t miss any of your comments. Would this be alright with you?
 - a. If yes, proceed to the next question
2. Have you read the Plain Language Statement and Informed Consent Form that I provided?
 - a. If yes, proceed to the next question
3. Do you have any questions regarding the Plain Language Statement and Informed Consent Form?

- a. *Probe:* are you fine with being interviewed after your birth as well?
- 4. Do you agree to participate in this interview?
 - a. If yes, continue the interview
 - b. If no, stop the interview

PARTICIPANT INTRODUCTION

- 1. Can you tell me a little bit about yourself and your family?
 - a. *Probe:* How old are you
 - b. *Probe:* What is your job?
 - c. *Probe:* How many children do you have?
 - d. *Probe:* When is your expected due date?

INTERVIEW QUESTIONS

- 1. Can you talk about your previous childbirth experience? How many times have you given birth, and how did you give birth?
- 2. Can you tell me about the care during pregnancy? Did you see any health care workers for your pregnancy visits?
- 3. Where do you learn information about childbirth?
 - a. *Probe:* Do you attend any antenatal care education? Where do you go? Who delivers this? How have these helped you?
 - b. *Probe:* Are there certain social media sites that you frequently go to learn?
- 4. Have you thought about how do you want to give birth?
 - a. *Probe:* Where do you plan to give birth?
 - b. *Probe:* How do you think you will give birth?
- 5. How did you decide to give birth at *[the place mentioned by participant]* and through *[methods mentioned by participant]*?
 - a. *Probe:* What factors did you think about when deciding this?
 - b. *Probe:* How do you make this decision?
- 6. How will you pay for your care during your baby's birth?

- a. *Probe:* Do you have any private or public insurance to cover your birth?
 - b. *Probe:* How do you make this decision?
- 7. How have other people influenced your decision about where and how to give birth?
 - a. *Probe:* How have your healthcare providers influenced your decision? What did your care providers suggest?
 - b. *Probe:* How have your husband/partner or family influenced your decision? What did your husband/partner or family say?
 - c. *Probe:* How have your friends influenced your decision? Did your friends share their experiences with you?
 - d. *Probe:* How have your health insurance policy influenced your decision?
- 8. How do you feel about the different ways to give birth? Are there any ways that you think are better for you? How do you think women make the decision that is right for them?
 - a. *Probe:* What do you think are some positive and negative aspects of vaginal birth, assisted vaginal birth, caesarean section, vaginal birth after caesarean section?
- 9. Do you feel there are more women having normal births in your community compared caesarean section, or the other way around? Why do you think this is the case?
 - a. *Probe:* Do you think this is a problem? Why or why not?
- 10. Do you have any other comments, questions, or feedback in regard to your birth plan?

CLOSING

[Researcher to summarise the main points of the interview with participants and confirm if there is anything that participants would like to add]. That was the last question for me, and I think this will mark the end of this interview. I would like to thank you for being generous with your time and for your willingness to share your experiences and thoughts with me in this interview. If this interview has brought up some uncomfortable feelings or issues for you, please do not hesitate to speak with your doctor or contact one of the support services listed here [Researcher gives the list of support services to participant] and you can find these contacts on plain language statement too. I will be looking forward to our second interview on the next few weeks or months. Please feel free to contact me when you have given birth. I will also contact you as well four weeks after your due date to follow up. In the meantime, please stay healthy and take care.

SECOND INTERVIEW WITH WOMEN: POSTPARTUM

RESEARCHER INTRODUCTION

“Nice to see you again! I hope everything is well. You have been through a lot over the past couple of months, and I hope you manage to get some rest. **[If the baby is alive]** Congratulations on the birth of your baby. Once again, thank you for your willingness to participate in this study again. As mentioned in the Plain Language Statement and Informed Consent Form that you signed, this study aims to understand your preferences and decision-making process regarding the way women give birth. Like our first interview, this interview will be audio-recorded, yet the recording will only be used for transcription and will not be published. All your identity and personal information will be anonymised and will not be disclosed to anyone. In this interview, I will ask you some questions relating to your pregnancy and birth plan, but you have the right to not answer me if you are uncomfortable. So, please let me know if you would like to pass any questions or stop this interview. Before we begin, do you have any questions about the study?”

CONSENT RETRIEVAL

1. If you are fine, I would like to turn on the recorder for the interview now, so I don't miss any of your comments. Would this be alright with you?
 - c. If yes, proceed to the next question
2. Have you read the Plain Language Statement and Informed Consent Form that I provided?
 - a. If yes, proceed to the next question
3. Do you have any questions regarding the Plain Language Statement and Informed Consent Form?
 - a. *Probe:* are you fine with being interviewed after your birth as well?
4. Do you agree to participate in this interview?
 - a. If yes, continue the interview
 - b. If no, stop the interview

INTERVIEW QUESTIONS

1. Where did you give birth and who helped you to give birth?
 - a. *Probe:* Did you give birth at clinic or hospital? Was it public or private?

- b. *Probe:* What do you feel about the care that you received? Did you give birth with the help midwives, obstetricians, or doctor? Did you have someone from your family with you in labour?
- 2. How did you end up paying for your care during the birth of your baby?
 - a. *Probe:* Did you use any private or public insurance?
 - b. *Probe:* Were there extra costs that you had to pay for?
- 3. Can you tell me how your labour and birth went?
 - a. *Probe:* how did your labour start – did you go into labour on your own or was there an induction to help?
 - b. *Probe:* Were you in the hospital before or after the labour starts?
 - c. *Probe:* If it is caesarean section, did you go into labour first?
- 4. How did you give birth to your baby? How did this come about?
- 5. How did you decide about the way you gave birth?
 - a. *Probe:* did you feel you made the choice or was it made for you?
 - b. *Probe:* How did you know about your options (including its pro and cons)?
 - c. *Probe:* How did you feel about the way you gave birth?
- 6. Did other things happen to you through your labour and birth (episiotomy, vaginal examinations, intravenous drip etc)? Do you know why?
 - a. *Probe:* How were you aware about these things happening? Did you feel you had enough information about them, and do you feel you gave permission for them to happen?
- 7. Would you choose this same way to give birth for your next pregnancy? Why or why not?
- 8. Do you feel that your birth experience went as you planned and wished? Why or why not?
 - a. *Probe:* Compared to our last interview, did you eventually give birth the way that you wanted to?
 - b. *Probe:* Why did you not end up with the way that you preferred?

- c. *Probe:* [If different mode of birth than planned] Would you choose your planned or actual way to give birth again for your next pregnancy? Why or why not?
- 9. What do you like or don't like about your birth experience?
 - a. *Probe:* How was your communication with your health providers?
 - b. *Probe:* Did your family, providers, and husband support your decision?
- 10. How do you think your birth experience can be improved?
- 11. Do you have any other comments, questions or feedback in regard to your birth experience?

CLOSING

[Researcher to summarise the main points of the interview with participants and confirm if there is anything that participants would like to add] That was the last question for me, and I think this will mark the end of this interview. I would like to thank you for being generous with your time and for your willingness to share your experiences and thoughts with me in this interview. If this interview has brought up some uncomfortable feelings or issues for you, please do not hesitate to speak with your doctor or contact one of the support services listed here [Researcher gives the list of support services to participant], you can also find these contacts on the plain language statement. Thank you.

APPENDIX 6.3. APPROVALS FOR THE QUALITATIVE LONGITUDINAL STUDY.



Office of Research Ethics and Integrity

Human Ethics Application Approval

16 August 2022

ATTENTION: A/PROF Meghan Bohren

145 - Melbourne School of Population and Global Health
140 - Medicine, Dentistry and Health Sciences
The University of Melbourne

Reference Number: 2022-24768-31642-3

Project Title: Preferences, perceptions, and decision-making process on mode of birth in Indonesia: a qualitative study

Dear A/PROF Bohren,

Thank you for your response to queries raised by the STEM3 ethics committee.

The committee agreed to approve your application on the basis that it meets the requirements of the [National Statement on Ethical Conduct in Human Research \(2007, Updated 2018\)](#). Please see below **Summary Details for the Approved Human Ethics Project and Conditions of Approval**. It is your responsibility to ensure that all people associated with the project are made aware of what has been approved.

Desk-based elements of your project and face-to-face research can commence now, as can data collection that can be conducted online or via telephone, subject to necessary approvals or amendments to ethics applications.

Please contact us via the Correspondence tab if you have any questions or if you require further assistance.

Kind regards,

Ms Karen Sosa

Research Ethics Officer

Human Ethics Team
Office of Research Ethics and Integrity | Research, Innovation & Commercialisation
Level 5, Alan Gilbert Building, 161 Barry Street, Carlton
The University of Melbourne, Victoria 3010, Australia
E: karen.sosa@unimelb.edu.au

Summary Details for the Approved Human Ethics Project:

Project Title: Preferences, perceptions, and decision-making process on mode of birth in Indonesia: a qualitative study
Reference Number: 2022-24768-31642-3
Approval Date: 16/08/2022
Expiry Date: 16/08/2025
Responsible Human Ethics Committee: STEM3
Project Supervisor: A/PROF Meghan Bohren
Other Investigators: Ms Rana Islamiah Zahroh, Ms Alya Hazfiarini, Dr Marc Cheong, PROF Caroline Homer
External Investigators: Dr Ana Pilar Betrán, Dr Fitriana Ekawati, Ms Moya Aritisna, Professor Ova Emilia

Documents Table:

Document Type	File Name	Date	Version
Recruitment materials	CS Qual_AdvertisementText_12072022	12/07/2022	v2
Recruitment materials	CS Qual_AdvertisementText_Bahasa Indonesia_12072022	12/07/2022	v2
Participant distress protocol	CS Qual_DistressProtocol_11082022	11/08/2022	v3

Other	Data Management Plan_11082022	11/08/2022	v3
Interview questions and/or themes	CS Qual_InterviewGuide_11082022	11/08/2022	v3
Recruitment materials	CS Qual_PosterFlyer_Eng Bahasa_11082022	11/08/2022	v3
Consent form	CS Qual_ConsentForm_11082022	11/08/2022	v3
Consent form	CS Qual_ConsentForm_Bahasa Indonesia_11082022	11/08/2022	v3
Recruitment materials	CS Qual_PLS_11082022	11/08/2022	v3
Recruitment materials	CS Qual_PLS_Bahasa Indonesia_11082022	11/08/2022	v3
Full protocol (for medical research)	CS Qual_Protocol_11082022	11/08/2022	v3
Other	Ethics Committee Feedback_16082022_cleaned	16/08/2022	v4

Conditions of Approval:

Research projects are normally approved to the anniversary date of the approval. Projects may be renewed yearly for up to a total of three years upon receipt of a satisfactory annual report. If a project is to continue beyond three years, two optional extensions of one year each (3+1+1) will need to be applied for. Anything beyond 5 years will need a new application to be submitted.

Please note that the following conditions apply to your approval. Failure to abide by these conditions may result in suspension or discontinuation of approval and/or disciplinary action.

1. **Limit of Approval:** Approval is limited strictly to the research as submitted in your Project application.
2. **Variation to Project:** Any subsequent variations to the Project must be notified formally to the Committee for consideration and approval before they are implemented. If the Committee considers that the proposed changes are significant, you may be required to submit a new application.
3. **Incidents or adverse events:** Researchers must report immediately to the Committee anything that could affect the ethical acceptability of the project, including adverse effects on participants or unforeseen events. Failure to do so may result in suspension or cancellation of approval.
4. **Monitoring:** All projects are subject to monitoring at any time by the Committee.
5. **Annual Report:** An annual report must be submitted each year on the anniversary of project approval, and at the conclusion of the project. Ethics approval will lapse if an annual report is not submitted.
6. **Auditing:** All projects are subject to audit by members of the Committee.



MEDICAL AND HEALTH RESEARCH ETHICS COMMITTEE (MHREC)
FACULTY OF MEDICINE, PUBLIC HEALTH AND NURSING
UNIVERSITAS GADJAH MADA – DR. SARDJITO GENERAL HOSPITAL



ETHICS COMMITTEE APPROVAL

Ref. No. : KE/FK/1180/EC/2022

Title of the Research Protocol : Preferences, perceptions, and decision-making process on mode of birth in Indonesia: a qualitative study

Document(s) Approved and version : 1. Study Protocol version 02 2022
2. Information for Subjects version 01 2022
3. Informed consent form version 01 2022

Principle Investigator : Rana Islamiah Zahroh, MPH.

Participating Investigator(s) : 1. A/Prof Meghan Bohren
2. Prof Caroline Homer
3. Prof Ova Emilia
4. Dr Fitriana Ekawati
5. Dr Ana Pilar Betrán
6. Alya Hazfiarini, MPH.
7. Moya Aritisna, MPH.

Date of Approval : **14 SEP 2022**
(Valid for one year beginning from the date of approval)

Institution(s)/place(s) of research : DKI Jakarta at all Puskesmas in Johar Baru and Cempaka Putih districts

The Medical and Health Research Ethics Committee (MHREC) states that the document above meets the ethical principle outlined in the International and National Guidelines on ethical standards and procedures for researches with human beings.

The Medical and Health Research Ethics Committee (MHREC) has the right to monitor the research activities at any time.

The investigator(s) is/are obliged to submit:

- ☒ Progress report as a continuing review (state its due time)
- ☒ Report of any serious adverse events (SAE)
- ☒ Final report upon the completion of the study

Signature redacted for publication

Prof. dr. Tri Wibawa, Ph.D., Sp.MK(K).
Panel's chairperson

Signature redacted for publication

dr. Yana Supriatna, Sp.Rad(K), Ph.D.
Panel's secretary

P.S: This letter uses signature scan of the panel's chairperson and Secretary of the Ethics Committee. The hardcopy official letter with authority's signature will be issued when it is possible and are kept as an archive of the Ethics Committee

Validation number :
6320121fa8899
(<http://komisi Etik.fk.ugm.ac.id/validasi>)



Recognized by Forum for Ethical Review Committees in Asia and the Western Pacific (FERCAP)
12-Sep-22

Nomor : B/1292/II.7.3/FR/9/2022 Jakarta, 20 September 2022
Lampiran : -
Hal : Permohonan **Surat Keterangan Penelitian**

**Yth. Dirjen Politik dan Pemerintahan Umum
u.p. Direktur Kewaspadaan Nasional
Kementerian Dalam Negeri**

Jl. Medan Merdeka Utara No.7 Jakarta Pusat 10110
Tlp. (021) 3450038 Fax. (021) 3851193

Dengan ini kami sampaikan bahwa:

Nama : **Sdri. Rana Islamiah Zahroh, MPH**
Warga : **Indonesia**
Negara

adalah PhD Candidate dari Gender and Women's Health, Melbourne School of Population and Global Health, University of Melbourne yang akan melakukan penelitian di DKI Jakarta (Kodya Jakarta Pusat: Kecamatan Johar Baru, Kecamatan Cempaka Putih) dalam bidang Kesehatan masyarakat dengan judul penelitian "*Preferences, perceptions, and decision-making process on mode of birth in Indonesia: a qualitative study*". Penelitian ini bertujuan untuk memahami preferensi, pengalaman, dan proses pengambilan keputusan perempuan tentang cara melahirkan dan meneliti pandangan perempuan atas hambatan dan fasilitator yang dirasakan terhadap operasi *caesar* dan persalinan pervaginam, dengan mitra kerja di Indonesia adalah Fakultas Kedokteran, Kesehatan Masyarakat dan Keperawatan Universitas Gadjah Mada (Prof. Ova Emilia; Dr Fitriana Ekawati).

Penelitian tersebut diperkirakan akan memerlukan waktu 5 (lima) bulan, mulai 3 Oktober 2022 s.d. 31 Maret 2023 dan telah mendapatkan klirens etik dari The University of Melbourne (Ref No: 2022-24768-31642-3) dan Universitas Gadjah Mada (Ref No: KE/FK/1180/EC/2022). Sehubungan dengan hal tersebut, kami mohon kerjasama Saudara, agar kiranya kepada yang bersangkutan dapat diberikan **Surat Keterangan Penelitian (SKP)**.

Demikian, atas perhatian dan kerjasamanya, kami mengucapkan terima kasih.

Plt. Direktur Tata Kelola Perizinan Riset dan
Inovasi dan Otoritas Ilmiah

 **TT ELEKTRONIK**

Tri Sundari, S.Si, Apt., M.HS.
NIP. 198002252003122001



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APPENDIX 6.4. WOMEN REPORTED CAESAREAN REASONS ALONG WITH EMPIRICAL EVIDENCE SUPPORTING IT BY INDICATION.

Caesarean reasons as reported by woman	Caesarean before labour onset	Based on evidence	Empirical evidence
Woman who actual birth was caesarean			
Haemorrhoids	Yes	No	No evidence of caesarean section indication for haemorrhoids. Haemorrhoids are common in pregnancy and do not warrant for caesarean.
Overweight	Yes	No	Being overweight is not an indication for caesarean section, however, due to risk factors associated with being overweight, women with high BMI have increased risks of caesarean, both elective and emergency ¹ . Some people may recommend elective caesarean section for obese women as they are concerned about an emergency caesarean section. However, UK NICE guidelines stated that body mass index (BMI) alone cannot be used as an indication for planned caesarean birth ² .
Anaemia, providers told women that there were increased risks of haemorrhage with vaginal birth	No, woman insisted trying vaginal birth and only came to hospital when labour started but directly allocated for caesarean	No	Anaemia is not an indication for caesarean section, despite studies showed that there is an increased risks of women low haemoglobin level undergo caesarean ³ . Women lose more blood with a caesarean section compared with a vaginal birth, and women with anaemia who had caesarean section have an increased risk in having a severe postpartum anaemia ^{4,5} .
Baby is ready to be born at 38-week gestation	Yes	No	Increasing evidence shows that early planned births (<39 gestational weeks) are associated with cognitive deficits (low APGAR score at birth and poor child development at school age), increased hospitalizations, and special needs among children ^{6,7} . Every week counts towards pregnancy on baby's development, 40 weeks gestational age is desirable to ensure that baby is less likely needing specialized care when born and less risk in having learning difficulties in later years ⁸ . In addition, we have the iatrogenic consequences of uncertainty in the estimation of gestational age resulting in conducting caesarean section in preterm babies.
Big placenta	Yes	No	No evidence around caesarean section on big placenta. It is important to note that it is unclear what the definition of big placenta

			that providers referring to, as there is no fetal growth restriction diagnosed for the baby. Placenta is normally not measured either before the baby is born or after. The placenta is usually one sixth of the baby's weight should not influence the capacity of the baby to be born.
Not eligible for vaginal birth after caesarean section (VBAC) as previous caesarean birth gap was less than 5 years (despite over 3 years)	Yes	No	Birth spacing from previous caesarean birth is recommended to be 18 months (1.5 years) to be eligible for VBAC ⁹⁻¹¹ , not 5 years.
Repeat caesarean as birth gap less than 2 years	Yes	Yes	Minimum gap from previous caesarean birth is recommended to be 18 months (1.5 years) to be eligible for VBAC ⁹⁻¹¹ .
40th week and no labour signs so providers asked woman to choose induction vs caesarean, and woman chose the later	Yes	No	No labour sign on the 40 th week of gestational age is not an indication to have caesarean section.
Woman has congenital heart disease	Yes	No	Increasing evidence recommends vaginal birth as mode of birth for women with congenital heart disease based on significant cardiovascular changes and fluctuations in hemodynamic status in caesarean due to more blood loss and spinal anaesthesia ¹²⁻¹⁴ .
Water broke and amniotic fluid is green	No (water broke but labour contraction has not started)	Maybe	The presence of meconium stained amniotic is not an absolute indication of caesarean section ¹⁵ . However, meconium stained liquor may be an indication for caesarean section, thus caesarean section may be pertinent, due to possible impact and complications to the baby ¹⁶ .
Big baby and low amniotic fluid volume	Yes	Yes	Macrosomia is one of the most common indications for caesarean section ¹⁷ , however it is often poorly assessed during pregnancy.
Reduced fetal heart rate	Yes	Yes	Fetal distress is one of the most common indications for caesarean section ¹⁷ .
Reduced fetal movement	Yes	Yes (as reduced fetal heart rate is confirmed, see	Reduced fetal movement is not an indication for caesarean section. Delivery should be considered after the examination of fetal heart rate through CTG, or abnormal ultrasound (both diagnosis or exclusion of intrauterine fetal death) ¹⁸ . Reduced fetal movement however increased women's

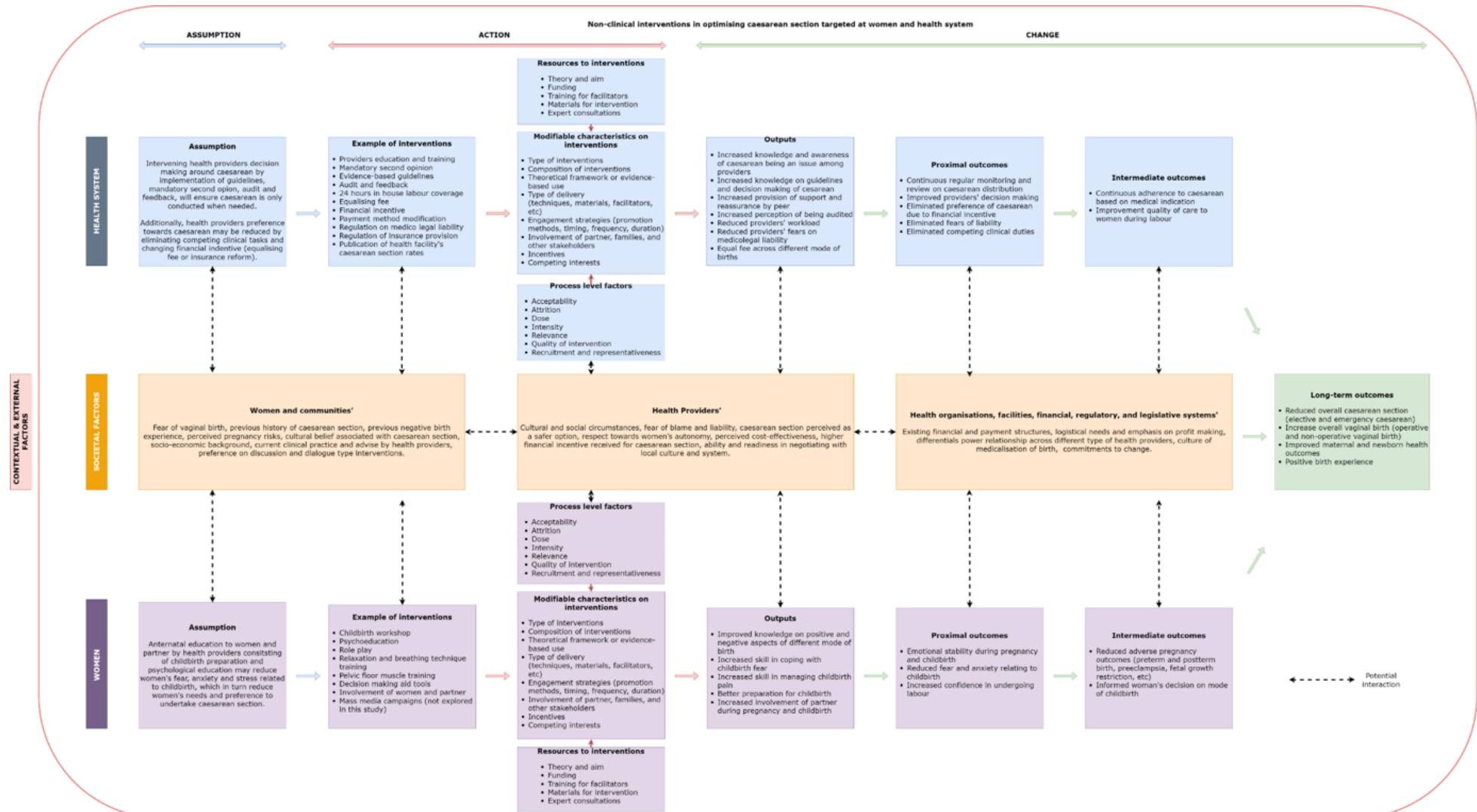
		previous row)	chance in having induction or caesarean section ¹⁹ .
Woman suggested to have caesarean section during ANC, yet had a vaginal birth			
Young age (19 years old)	Not applicable, woman went to facility after onset of labour and ended up with vaginal birth.	No	Young maternal age is not an indication for caesarean section. Instead studies have shown that increased risks of caesarean section was observed among women with advanced maternal age >35 years old ^{2,20} .
One week past due date and presence of nuchal cord (unclear if it is around baby's neck or body)	Not applicable, woman went to facility after onset of labour and ended up with vaginal birth.	No	The 40 th week plus 7 days and presence of nuchal cord are not indications for caesarean section. The presence of nuchal cord has been shown to not influence progression of labour and birth outcomes ^{21,22} .
40 weeks gestational age with no labour onset, and low amniotic fluid – obstetrician told woman that baby should be born by tomorrow and suggested CS	Not applicable, woman went to facility after onset of labour and ended up with vaginal birth.	No	No labour sign on the 40 th week of gestational age is not an indication to have caesarean section.
37 weeks and baby had not entered pelvic	Not applicable, woman went to facility after onset of labour and ended up with vaginal birth.	No	It is too early to deem that woman should have caesarean section due to the baby's head has not entered pelvic.

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APPENDIX 7.1. LOGIC MODEL IN OPTIMISING CAESAREAN SECTION USE.



APPENDIX 7.2. RISK OF BIAS ASSESSMENTS FOR INTERVENTION TARGETING PREGNANT WOMEN.

Risk of bias assessment – overview

Author	Year	Methods	Risks of Bias	Source	Tools
Targeting women					
Fraser 1997	1997	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Masoumi 2016	2016	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Navaee 2015	2015	Blind clinical trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Fenwick 2015	2015	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Saisto 2001	2001	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Montgomery 2007	2007	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Sharifirad 2013	2013	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Valiani 2014	2014	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Bastani 2005	2006	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Feinberg 2015	2015	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Rouhe 2013	2013	Randomised controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Multi-target					
Xia 2019	2019	Uncontrolled before-after study	Low risks of bias	Current study	Cochrane EPOC 'Risk of bias' criteria
Zhang 2020	2020	Randomised controlled trial	Some concerns	Current study	Cochrane Risk of Bias Tool for randomised trials
Yu 2017	2017	Pre-post intervention study	Not serious	Opiyo et al (2020)	GRADE
Borem 2020	2020	Interrupted time series	Not serious	Opiyo et al (2020)	GRADE
Runmei 2012	2012	Controlled before-after study	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Clarke 2020	2020	Randomised controlled trial	Some concerns	Current study	Cochrane Risk of Bias Tool for randomised trials

Risk of bias assessment of randomised controlled trial using Cochrane Risk of Bias Tool for randomised trials

Components assessed	Zhang (2020)	Clarke (2020)
Risk of bias arising from the randomization process	Low risk	Some concerns
Notes	Allocation random and concealed after assignment. No significant baseline differences	Allocation random and concealed after assignment. Significantly higher number of women in the intervention group with higher number of VB history (before previous births)
Risk of bias arising from the timing of identification or recruitment of participants	Low risk	Low risk
Notes	Hospitals are recruited before randomisation	Cluster (hospitals) recruited before randomisation but women were recruited after randomisation
Risk of bias due to deviations from the intended interventions	Low risk	Some concerns
Notes	Participants (women and health providers) are aware of the trials and may be aware of the assigned intervention. It was mentioned that "No masking was applied in this study"	Participants (women and health providers) are aware of the trials and may be aware of the assigned intervention. It was mentioned that "the trial team were blinded to the results of the trial" but not the assigned intervention
Risk of bias due to missing outcome data	Low risk	Low risk
Notes	Random selection at pre- and post-intervention	No missing outcome data
Risk of bias in measurement of the outcome	Some concerns	Some concerns
Notes	Unclear if the outcomes assessor is blinded or not	Unclear if the outcomes assessor is blinded or not
Risk of bias in selection of the reported result	Low risk	Low risk
Notes	Seems to be intention to treat analysis. Results are not assessed based on multiple measurements or multiple analysis	Seems to be intention to treat analysis. Results are not assessed based on multiple measurements or multiple analysis
Final Assessment	Some concerns	Some concerns

Risk of bias assessment of uncontrolled before and after study using Cochrane EPOC 'Risk of bias' criteria

Components assessed	Xia (2019)
Intervention independent of other changes	Low risk
Notes	Covariance assessed
Shape of the intervention effect pre-specified	Low risk
Notes	Point of intervention and analysis seems relevant
Intervention unlikely to affect data collection	Low risk
Notes	Sources and methods of data collection were the same before and after the intervention: using medical records
Knowledge of the allocated interventions adequately prevented during the study	Low risk
Notes	Outcomes are objectively assessed
Incomplete outcome data (attrition bias)	Low risk
Notes	1000 out of almost 2,000,000 data
Selective outcome reporting (reporting bias)	Low risk
Notes	All relevant outcomes in the methods section are reported in the results section
Other risks of bias	N/A
Notes	N/A
Final Assessment	Low risk of bias

APPENDIX 7.3. CODING AND CALIBRATION RULES FOR INTERVENTIONS TARGETING PREGNANT WOMEN.

Condition	Field	Instructions for extractors	Calibration type	Coding values and calibration rules
Domain 1	Setting and participants			
1.1	Number of participants	Recorded total number of participants involved in intervention (record only the number of people that received the intervention)	Transformational assignment (Ragin's direct method)	100 or more participants = 0 75 participants = 0.5 50 or fewer = 1 Other values span between 0 to 1
1.2	Composition of participants	What were the composition of participants? Is it only women, or women and partners?	Direct assignment	Partner or family members involvement: yes = 1, no = 0 Women with fear/anxiety of birth: yes = 1, no = 0 General pregnant women: yes = 1, no = 0 Women with previous CS: yes = 1, no = 0 When we code this, we considered partner or family members involvement with "involvement of other stakeholders" condition 4.2
1.3	Intervention location	Did the interventions delivered at health facilities, home, or communities?	Direct assignment	Health facility = yes: 1, no: 0 Home or communities = yes: 1, no: 0
1.4	Number of health facility	Recorded number of health facilities implementing the intervention	Transformational assignment (Ragin's direct method)	10 or more health facilities = 0 7 health facilities = 0.5 5 or fewer = 1 Other values span between 0 to 1
1.5	Number of health facility	Recorded number of health facilities implementing the intervention	Transformational assignment (Ragin's direct method)	10 or more health facilities = 0 7 health facilities = 0.5 5 or fewer = 1 Other values span between 0 to 1
1.6	Baseline caesarean rates	Recorded baseline caesarean rates at the health facility	Direct assignment	Take into account if they considered baseline CS rates at facility/area/country for implementing the intervention High baseline caesarean rates (>15%) at study facility = 1

				High baseline caesarean rates (>15%) at area/country= 0.66 Not reported = 0 Not considering baseline rates but mention high preference of caesarean /increasing caesarean = 0.33 Not considering caesarean at all OR low based caesarean rates<10% caesarean rates = 0
Domain 2 Intervention design				
2.1	Component of interventions	Extract the type of interventions included: i.e antenatal education, psychosocial education, audit and feedback implementation	Direct assignment to all listed interventions	Any type of education? (including ante, psycho and decision aid): yes = 1, no = 0 Antenatal education (including childbirth classes, couple education): yes = 1, no = 0 Pyscho education/therapy (including cognitive therapy, relaxation/breathing technique): yes = 1, no = 0 Decision aids (information leaflet, website): yes = 1, no = 0 Acknowledgement of women's previous birth experience: yes = 1, no = 0
2.2	Utilisation of theoretical framework or evidence-based intervention	Did the study name a theoretical framework that underpins the intervention design or delivery style?	Direct assignment	Theory driven = 1 Citing previous study only = 0.25 Missing/Not using any/ambiguous = 0
2.3	Type of intervention facilitators or instructors	Who were the instructors or facilitators of the intervention? i.e. peers, obstetrician, midwives, doula, other trained staff	Direct assignment to all listed facilitators	Maternity health providers (nurse, midwife, obstetrician): yes = 1; not mentioned as an instructor/facilitator = 0 Any interaction with health providers? Both in individual and group settings: yes = 1, no = 0 Opportunity of having interaction with health providers in group settings: yes = 1, no = 0, not reported = 0
2.4	Personal or group delivery	Did the intervention delivered in a group or personal based delivery through workshop or class?	Direct assignment	Group delivery: yes = 1, no = 0 Personalised/individualised: yes = 1, no = 0
2.5	Type of materials used	Did the intervention used specific type of materials? i.e. video, computer-based tool, pamphlet, handbook, guidelines	Direct assignment to all listed materials	IEC materials (written, audio, video, decision aids): yes = 1, no/not reported = 0 IEC materials can be taken home by women: yes = 1, no/not reported = 0

2.7	Resources required	What were the cost required to implement and deliver the intervention?	Direct assignment	Cost less than usual care = 1 Cost more the same as usual care = 0.66 Cost more than usual care = 0.33 Not reported= 0
2.8	Information about control condition	Described whether the authors provided a control for the main intervention (intended to capture complexity of running an intervention and a control) - are they equivalent or not?	Transformational assignment, 1 equal to equivalent control	No control described = 0 Ambiguous = 0.33 Yes, but not an equivalent = 0.66 Yes, an equivalent control = 1
Domain 3 Program content				
3.1	Content delivered to mother and partners	What type of content themes or curriculum delivered to mother and partners? i.e. relaxation technique, information on vaginal birth vs caesarean section risks	Direct assignment to all listed content	Topic focus - general childbirth: yes = 1, no = 0 Topic focus - fear and anxiety: yes = 1, no = 0 Information about mode of birth including delivery process: yes = 1, no = 0 Pain and pain relief: yes = 1, no = 0 Mental health and coping strategies: yes = 1, no = 0 Partner's role and communication: yes = 1, no = 0
3.4	Educational or training technique	What were the education or training technique used? i.e. role-play, lecture-based, study cases	Direct assignment to all listed content	Practice based (practical session, behavioural rehearsal, role play): yes = 1, no = 0, not reported = 0 Lecture/didactic based: yes = 1, no = 0, not reported = 0
Domain 4 Engagement				
4.1	Methods of recruitment	How were participants recruited to the study? i.e. flyers, snowballing, hospital-based recruitment	Direct assignment to all listed content	Recruited at health facility (enrollment at certain programs, health providers, registry, facility/provider office, phone call): yes = 1, no = 0, not reported = 0 Advertisements (media, flyers, word of mouth): yes = 1, no = 0, not reported = 0
4.2	Involvement with partners, families, other stakeholders	Other than participants, were there any other stakeholders included in the intervention?	Direct assignment	Yes = 1 No = 0 This code was merged with composition of participants condition 1.2 on the first page
4.3	Timing of engagement	In which pregnancy stage the intervention was delivered? i.e. first trimester, last trimester, before	Direct assignment to all listed content	Antenatal: yes = 1, no = 0 Intrapartum: yes = 1, no = 0, no int delivered during intrapartum Postnatal: yes = 1, no = 0

		pregnancy, at hospital admission for birth, after birth, prior to pregnancy		
4.4	Frequency of engagement	How often did the intervention delivered (or frequency of engagement/encounter between participants and intervention)? i.e. once in a month, every 3 months	Direct assignment	No engagement= 0 1-time contact = 0.33 Ambiguous/not reported = 0 2 times contacts = 0.66 3 or more times/contacts = 1
4.5	Required time engaged in the interventions	Record any statement or recommendation from the authors as to how long the interventions had or should occurred (i.e during the course of the pregnancy, hours required)	Direct assignment	No engagement/not reported = 0 5 hours or fewer = 0.33 5 - 10 hours or more = 0.66 10 hours or more = 1
4.6	Existing competing interest	Was there any competing interest stated?	Direct assignment	No = 1 Yes/ Not reported = 0
Domain 5 Health system				
5.1	Presence of internal policies	Were there any existing policies in place to support the intervention (both at facility, regional, or country level)?	Direct assignment	No = 0 Not reported = 0 Yes = 1
5.2	Presence of any other support and resources	Were there any existing support from health system which directly or indirectly support the intervention?	Direct assignment	No = 0 Not reported = 0 Yes = 1
5.3	Perceptions of stakeholders related to the interventions or the caesarean section itself	What were the perceptions of both participants and other relevant stakeholders in regard to caesarean section?	Direct assignment	Missing/not reported = 0 Negative = 0.33 Medium/neutral = 0.5 More positive, despite few dissatisfaction = 0.66 Positive = 1
Domain 6 Process outcomes				
6.1	Intervention fidelity	Extract level of fidelity (%) or extract qualitative statement on intervention fidelity. Intervention	Direct assignment	There is evidence on high fidelity = 1 Med fidelity 0.66

		fidelity refers to the degree to which the prescribed components of the intervention, as described in the study protocol, have been delivered		Low fidelity = 0.33 Not reported = 0
6.2	Participants satisfaction	Extract level of satisfaction (%) or extract qualitative statement on participants' satisfaction with the intervention experience	Direct assignment	Direct assignment - qualitative: where there is a positive statement = 0.66; negative statement = 0.33; where not mentioned = 0 Direct assignment - quantitative: Interventions with 25% or fewer participants satisfied = 0; with 50% of participants satisfied = 0.5; not mentioned = 0; interventions with >75% participants satisfied = 1
6.3	Participants attrition	Extract participants' level of completion (%) or record qualitative statement on participants' completion rate	Direct assignment	Direct assignment - qualitative: where there is a statement indicating high level of completion, assign value of 0.66; where a statement indicating problematic completion, assign value of 0.33. Where data are missing, assign value of 0 Direct assignment - quantitative: Interventions with 66% or fewer participants completing the intervention = 0; interventions with 75% of participants completing the intervention = 0.5; interventions with 83% or more participants completing the intervention = 1. Missing data coded as 0
6.4	Participants dosage level	Did the participant receive the intended dosage of the intervention? "intended dosage is the amount of the components of the intervention delivered by implementers and the extent to which participants received and used materials or other resources". Extract level of dosage (%) or record qualitative statement	Direct assignment	Direct assignment - qualitative: where there is a qualitative statement indicating high level of dosage, assign value of 0.66; where a qualitative statement indicating problematic dosage, assign value of 0.33. Where data are missing, assign value of 0 Direct assignment - quantitative: Interventions with 66% or fewer participants receiving the full dosage = 0; interventions with 75% of participants receiving the full dosage = 0.5; interventions with 83% or more of participants receiving the full dosage = 1. Missing data coded as 0
6.5	Participant adherence	Did participants adhere to the intervention instructions, e.g. women and partners attending classes; health providers conducted		Direct assignment - qualitative: where there is a statement indicating high level of adherence, assign value of 0.66; where a qualitative statement indicating problematic adherence, assign value of 0.33. Where data are missing, assign value of 0

		mandatory second opinion. Extract level of adherence (%) or qualitative statement		Direct assignment - quantitative: Interventions with 66% or fewer participants adherent = 0; interventions with 75% of participants adherent = 0.5; interventions with 83% or more participants adherent = 1. Missing data coded as 0
6.6	Certainty of evidence	Certainty or confidence in which we can place into finding	Direct assignment	Moderate = 1 Low or very low = 0
6.7	Collateral effect other than to participants	Is there any stated collateral effects on others (other than participants)? i.e. if women obtain 24/7 epidural but no additional human resources are provided to the unit, doctors may need to do more shifts or work longer hours to their in satisfaction.	Not coded	Not coded only for consideration whether the intervention is successful or not
6.8	Any other factors affecting the success/unsuccessful of the implementation?	Any other factors affecting the success/unsuccessful of the implementation?	Not coded	Not coded only for consideration whether the intervention is successful or not
Domain 7 Type of interventions				
7.1	Type of interventions	What is the type of interventions? Is it interventions targeting women or multi-target interventions?	Direct assignment	Interventions targeting women: yes = 1, no = 0 Multi-target interventions: yes = 1, no = 0

APPENDIX 7.4. CODING FRAMEWORK AS APPLIED TO EACH INTERVENTION TARGETING PREGNANT WOMEN (DATA TABLE).

Domain	Conditions	Fraser 1997	Masoumi 2016	Navae 2015	Fenwick 2015	Saisto 2001	Montgomery 2007	Sharifirad 2013	Valiani 2014	Bastani 2005	Feinberg 2015	Rouhe 2013	Runmei 2012	Borem 2020	Yu 2017	Xia 2019	Zhang 2020	Clarke 2020
Domain 1 - settings and participants	Number of participants	0	0	0.991085	0	0.235452	0	0.974695	0.854042	0.01595	0.16126	0.001365	0	0	0	0	1	0
Domain 1 - settings and participants	Partner/families involvement	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	0	1
Domain 1 - settings and participants	Women with fear	0	0	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0
Domain 1 - settings and participants	Women with low risks pregnancy	0	1	0	0	0	0	1	1	0	1	0	1	1	1	1	1	0
Domain 1 - settings and participants	Women with previous caesarean	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Domain 1 - settings and participants	Intervention location - health facility	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1
Domain 1 - settings and participants Domain 1 - settings and participants	Intervention location - Home or community	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0
Domain 1 - settings and participants	Number of health facility	0.007337	0.999854	0.95	1	0.999854	1	0.999854	0	0.997238	0	0.999854	1	0	1	0	0	0
Domain 1 - settings and participants	Baseline caesarean rates	0.33	0.66	0.66	0.33	0.33	1	0.66	0.66	0.33	0	0.66	1	1	1	1	1	1
Domain 2 - intervention designs	Any type of education? (including ante, psycho and decision aid)	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1

Domain 2 - intervention designs	Antenatal education	1	0	1	0	0	0	1	1	0	0	0	1	1	1	1	1	1
Domain 2 - intervention designs	Psychoeducation/therapy (including breathing and relaxation technique)	0	1	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0
Domain 2 - intervention designs	Decision aids	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Domain 2 - intervention designs	Acknowledgement of women's previous birth experience	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Domain 2 - intervention designs	Utilisation of theoretical framework or evidence-based intervention	1	0.25	0.25	1	1	0.25	0.25	0.25	1	1	1	0.25	1	0.25	0.25	0.25	0.25
Domain 2 - intervention designs	Any interaction with health providers? Both in individual and group settings	1	0	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1
Domain 2 - intervention designs	Opportunity of having interaction with health providers in group settings	0	0	1	0	0	0	0	0	1	0	1	0	1	1	1	1	1
Domain 2 - intervention designs	Facilitator- Maternity health providers (nurse, midwife, obstetrician)	1	0	1	1	1	0	0	0	1	0	0	0	1	1	1	1	1
Domain 2 - intervention designs	Group delivery	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1
Domain 2 - intervention designs	Personalised/individualised delivery	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0
Domain 2 - intervention designs	IEC materials (including written,	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	audio, video, with decision aid)																	
Domain 2 - intervention designs	IEC materials can be taken home	0.75	0	0	0.75	0.75	1	0.75	0.75	0.75	0	0	0.75	0	0.75	1	1	1
Domain 2 - intervention designs	Resources required	0	0	0	0.33	0	0	0	0	0	0	0.33	0	0	0	0	0	0
Domain 2 - intervention designs	Information about control condition	0.66	1	0.33	1	1	1	1	1	1	1	1	0.33	1	0.33	0.33	1	1
Domain 3 - program content	Topic focus - general childbirth	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Domain 3 - program content	Topic focus - fear and anxiety	0	1	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0
Domain 3 - program content	Content delivered to mother and partners - Information about mode of birth including delivery process	1	1	1	0	1	1	1	1	0	0	0	1	1	1	1	1	1
Domain 3 - program content	Content delivered to mother and partners - mental health and coping strategies	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0
Domain 3 - program content	Content delivered to mother and partners - Pain and pain relief	1	1	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0
Domain 3 - program content	Content delivered to mother and partners - Partner's roles and communication	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Domain 3 - program content	Educational or training technique - Practice based (practical session, behavioral rehearsal, role play)	0	1	1	0	0	0	0	1	1	1	0	0	1	1	0	0	0
Domain 3 - program content	Educational or training technique - Lecture/didactic based	0	1	0	0	0	0	1	1	0	1	0	1	1	1	1	1	1

Domain 4 - engagement	Methods of recruitment - Recruited at health facility (enrollment at certain programs, health providers, registry, facility/provider office, phone call)	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1
Domain 4 - engagement	Methods of recruitment - Advertisements (media, flyers, word of mouth)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Domain 4 - engagement	Timing of engagement - Ante	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Domain 4 - engagement	Timing of engagement - Post	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
Domain 4 - engagement	Frequency of engagement	0.66	1	0.33	0.66	1	0	0.33	1	1	1	1	0	1	0.66	0	0	0.66
Domain 4 - engagement	Required time engaged in the interventions	0	1	0.33	0.33	0.66	0	0.33	1	1	0	1	1	1	0	1	1	0.66
Domain 4 - engagement	Existing competing interest	0	1	0	1	0	1	1	1	0	0	1	0	0	0	0	0	0
Domain 4 - engagement	Incentives of any type	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
Domain 5 - health system factors	Presence of internal policies	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1
Domain 5 - health system factors	Presence of any other support and resources	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Domain 5 - health system factors	Perceptions of stakeholders related to the interventions or the caesarean section itself	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0.5
Domain 6 - Participants satisfaction and fidelity	Intervention fidelity	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1

Domain 6 - Participants satisfaction and fidelity	Participants satisfaction	0.5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Domain 6 - Participants satisfaction and fidelity	Participants attrition	0	1	0	0	0	1	0	0	1	1	0	0	0.6 6	0	0	0	1
Domain 6 - Participants satisfaction and fidelity	Participants dosage level	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Domain 6 - Participants satisfaction and fidelity	Participant adherence	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Domain 6 - Participants satisfaction and fidelity	Certainty of evidence	1	1	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0
Domain 7 - Type of interventions	Multi-target interventions	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Domain 7 - Type of interventions	Interventions targeting women	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Outcome	caesarean outcome	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1

Coding framework on the final models presented

Author	Caesarean outcome	Communication (IEC) materials	Partner or family member involvement	Group based intervention	Antenatal education	Psychoeducation	Interaction with health providers	Multi-target intervention
Fraser 1997	0	1	0	0	1	0	1	0
Masoumi 2016	0	0	0	1	0	1	0	0
Navaee 2015	0	0	0	1	1	0	0	0
Fenwick 2015	0	1	0	0	0	1	1	0
Saisto 2001	0	1	0	0	0	1	1	0
Montgomery 2007	0	1	0	0	0	0	0	0
Sharifirad 2013	1	1	1	1	1	0	0	0
Valiani 2014	1	1	1	1	1	0	1	0
Bastani 2005	1	1	0	1	0	1	1	0
Feinberg 2015	1	1	1	1	0	1	0	0
Rouhe 2013	1	1	1	1	0	1	1	0
Zhang 2020	0	1	0	1	1	0	1	1
Runmei 2012	1	1	1	1	1	0	1	1
Borem 2020	1	1	1	1	1	0	1	1
Yu 2017	1	1	1	1	1	0	1	1
Xia 2019	1	1	1	1	1	0	1	1
Clarke 2020	1	1	1	1	1	0	1	1

APPENDIX 8.1. RISK OF BIAS ASSESSMENTS FOR INTERVENTIONS TARGETING HEALTHCARE PROVIDERS.

Overview of risk of bias assessments.

Author	Methods	Risks of Bias	Source	Tools
Targeting healthcare providers or systems				
Calvo 2009	Pre- and post-intervention design	Some concerns	Current study	Cochrane EPOC 'Risk of bias' criteria
Ho 2011	Before and after study	Some concerns	Current study	Cochrane EPOC 'Risk of bias' criteria
Liang 2004	Interrupted time series	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Mohammadi 2012	Retrospective, before-after study	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Poma 1998	Interrupted time series	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Scarella 2011	Interrupted time series	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Bhartia 2020	Interrupted time series	Some concerns	Current study	Cochrane EPOC 'Risk of bias' criteria
Chaillet 2015	Randomized controlled trial	Low risks of bias	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Kabore 2019	Randomized controlled trial	Some concerns	Current study	Cochrane Risk of Bias Tool for randomised trials
Kazandjian 1998	Retrospective cohort, observational study	Satisfactory study	Current study	New-castle Ottawa Scale
Lagrew 1996	Interrupted time series	Some concerns	Current study	Cochrane EPOC 'Risk of bias' criteria
Lomas 1991	Randomized controlled trial	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria
Robson 1996	Interrupted time series	Some concerns	Current study	Cochrane EPOC 'Risk of bias' criteria
Socol 1993	Interrupted time series	Some concerns	Current study	Cochrane EPOC 'Risk of bias' criteria
van Dillen 2008	Uncontrolled before-after study	Some concerns	Current study	Cochrane EPOC 'Risk of bias' criteria
Multi-target interventions				
Xia 2019	Uncontrolled before-after study	Low risks of bias	Current study	Cochrane EPOC 'Risk of bias' criteria
Zhang 2020	Randomized controlled trial	Some concerns	Current study	Cochrane Risk of Bias Tool for randomised trials
Yu 2017	Pre-post intervention study	Not serious	Opiyo et al (2020)	GRADE
Borem 2020	Interrupted time series	Not serious	Opiyo et al (2020)	GRADE
Runmei 2012	Controlled before-after study	Some concerns	Chen et al (2018)	Cochrane EPOC 'Risk of bias' criteria

Clarke 2020	Randomized controlled trial	Some concerns	Current study	Cochrane Risk of Bias Tool for randomised trials
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Risk of bias assessments of observational study using Newcastle Ottawa Scale.

Domain		Kazandjian 1998	
		Score	Notes
Selection (Max. 5)	Representativeness	1	Truly representative (all births during period of interest in the entire hospital network)
	Sample size	1	Justified and satisfactory
	Non-respondents	0	No provided
	Measurement (exposure)	1	Non-validated tool but described
Comparability (Max. 2)	Confounding control	0	Non-participating hospitals as control
Outcomes Measures & Analysis (Max. 3)	Assessment (outcome)	1	Unblinded
	Statistical test	1	Statistical test used and appropriate
Final Score / Final Assessment		5	Satisfactory study

Risk of bias assessment of randomised controlled trial using Cochrane Risk of Bias Tool for randomised trials

Author	Kabore 2019	Clarke 2020	Zhang 2020
Risk of bias arising from the randomization process	Some concerns	Some concerns	Low risks
Notes	Allocation random and concealed after assignment. Higher previous caesarean history in intervention group	Allocation random and concealed after assignment. Significantly higher number of women in the intervention group with higher number of VB history (before previous births)	Allocation random and concealed after assignment. No significant baseline differences
Risk of bias arising from the timing of identification or recruitment of participants	Low risks	Low risks	Low risks
Notes	Cluster (hospitals) recruited before randomisation but women were recruited after randomisation	Cluster (hospitals) recruited before randomisation but women were recruited after randomisation	Hospitals are recruited before randomisation

Risk of bias due to deviations from the intended interventions	Low risks	Some concerns	Low risks
Notes	Participants (women and healthcare providers) are aware of the trials and may be aware of the assigned intervention	Participants (women and healthcare providers) are aware of the trials and may be aware of the assigned intervention. It was mentioned that "the trial team were blinded to the results of the trial" but not the the assigned intervention	Participants (women and healthcare providers) are aware of the trials and may be aware of the assigned intervention. It was mentioned that "No masking was applied in this study"
Risk of bias due to missing outcome data	Low risks	Low risks	Low risks
Notes	No missing outcome data	No missing outcome data	Random selection at pre- and post-intervention
Risk of bias in measurement of the outcome	Low risks	Some concerns	Some concerns
Notes	Seems that the outcomes assessor is blinded -> "Data collectors were aware of the randomization assignments but were not involved in outcome assessments. Access to the database was restricted to the data manager until the trial was completed"	Unclear if the outcomes assessor is blinded or not	Unclear if the outcomes assessor is blinded or not
Risk of bias in selection of the reported result	Low risks	Low risks	Low risks
Notes	Seems to be intention to treat analysis. Results are not assessed based on multiple measurements or multiple analysis	Seems to be intention to treat analysis. Results are not assessed based on multiple measurements or multiple analysis	Seems to be intention to treat analysis. Results are not assessed based on multiple measurements or multiple analysis
Final Assessment	Some concerns	Some concerns	Some concerns

Risk of bias assessment of uncontrolled before and after study using Cochrane EPOC 'Risk of bias' criteria

Author	Intervention independent of other changes	Notes	Shape of the intervention effect pre-specified	Notes	Intervention unlikely to affect data collection	Notes	Knowledge of the allocated interventions adequately prevented during the study	Notes	Incomplete outcome data (attrition bias)	Notes	Selective outcome reporting (reporting bias)	Notes	Other risks of bias	Notes	Final Assessment
Calvo 2009	Unclear risks	Unclear, not stated	Low risks	Point of intervention and analysis seems relevant	Low risks	Sources and methods of data collection were the same before and after the intervention: using medical records	Low risks	Outcomes are objectively assessed	Unclear risks	Unclear how many missing data	Low risks	All relevant outcomes in the methods section are reported in the results section	N/A	N/A	Some concerns
Ho 2011	Low risks	Covariance assessed	Low risks	Point of intervention and analysis seems relevant	Low risks	Sources and methods of data collection were the same before and after the intervention: using medical records	Low risks	Outcomes are objectively assessed	Unclear risks	Unclear how many missing data	Low risks	All relevant outcomes in the methods section are reported in the results section	N/A	N/A	Some concerns

Bhartia 2020	Low risks	Contributing factors are related to the implemented interventions	Low risks	Point of intervention and analysis seems relevant	Low risks	Sources and methods of data collection were the same before and after the intervention: using medical records	Low risks	Outcomes are objectively assessed	Unclear risks	Unclear how many missing data	Low risks	All relevant outcomes in the methods section are reported in the results section	N/A	N/A	Some concerns
Lagrew 1996	Unclear risks	Unclear, not stated	Low risks	Point of intervention and analysis seems relevant	Low risks	Sources and methods of data collection were the same before and after the intervention: using medical records	Low risks	Outcomes are objectively assessed	Unclear risks	Unclear how many missing data	Low risks	All relevant outcomes in the methods section are reported in the results section	Some concerns	Unclear how long is the intervention implementation	Some concerns
Robson 1996	Some concerns	There could have been other historic events during	Low risks	Point of intervention and analysis seems relevant	Low risks	Sources and methods of data collection were the same before	Low risks	Outcomes are objectively assessed	Unclear risks	Unclear how many missing data	Low risks	All relevant outcomes in the methods	Some concerns	Unclear intensity of the audit and feedback during 1989-1992 (prospective/r	Some concerns

		this period that weren't mentioned				and after the intervention: using medical records						section are reported in the results section	retrospective audit?).		
Socol 1993	Unclear risks	Unclear, not stated	Low risks	Point of intervention and analysis seems relevant	Low risks	Sources and methods of data collection were the same before and after the intervention: using medical records	Low risks	Outcomes are objectively assessed	Unclear risks	Unclear how many missing data	Low risks	All relevant outcomes in the methods section are reported in the results section	N/A	N/A	Some concerns
van Dillen 2008	Unclear risks	Unclear, not stated	Low risks	Point of intervention and analysis seems relevant	Low risks	Sources and methods of data collection were the same before and after the intervention: using medical records	Low risks	Outcomes are objectively assessed	Low risks	3% missing data	Low risks	All relevant outcomes in the methods section are reported in the results section	N/A	N/A	Some concerns

Xia 2019	Low risks	Covariance assessed	Low risks	Point of intervention and analysis seems relevant	Low risks	Sources and methods of data collection were the same before and after the intervention: using medical records	Low risks	Outcomes are objectively assessed	Low risks	1000 out of almost 2,000,000 data	Low risks	All relevant outcomes in the methods section are reported in the results section	N/A	N/A	Low risks of bias
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APPENDIX 8.2. CODING FRAMEWORK AND CALIBRATION RULES FOR INTERVENTIONS TARGETING HEALTHCARE PROVIDERS.

Condition	Field	Instructions for extractors	Calibration type	Coding values and calibration rules
Domain 1 Setting and participants (7 conditions)				
1.1	Number of participants	Recorded total number of participants involved in intervention	Not calibrated	All studies did not report number of providers but instead only number of women exposed to the interventions, except one study (37).
1.2	Composition of participants	What were the composition of participants? Is it only women, or women and partners?	Direct assignment	Healthcare providers: = yes: 1, no: 0 Engaging women: = yes: 1, no: 0
1.3	Intervention location	Did the interventions delivered at health facilities, home, or communities?	Direct assignment	Health facility = yes: 1, no: 0
1.4	Number of health facility	Recorded number of health facilities implementing the intervention	Transformational assignment (Ragin's direct method)	100 or more health facilities = 0 10 or more health facilities = 0.5 10 or fewer = 1 Other values span between 0 to 1
1.5	Health facility type	Was the health facility public or private owned?	Direct assignment	Public: = yes: 1, no: 0 Private = yes: 1, no: 0
1.6	Baseline caesarean rates	Recorded baseline caesarean rates at the health facility	Direct assignment	High baseline caesarean rates (>15%) at study facility = 1 High baseline caesarean rates (>15%) at area/country= 0.66 Not reported = 0 Not considering baseline rates but mention high preference of caesarean/increasing caesarean = 0.33 Not considering caesarean at all OR low based caesarean rates<10% caesarean rates = 0
Domain 2 Intervention design (24 conditions)				
2.1	Component of interventions	Extract the type of interventions included: i.e antenatal education,	Direct assignment to all listed interventions	Audit and feedback: yes = 1, no = 0 Training for healthcare providers: yes = 1, no = 0

	psychosocial education, audit and feedback implementation			Actionable recommendations of each audit and feedback cycle: yes = 1, no = 0 Multi-disciplinary collaboration: yes = 1, no = 0 Organisation of care, including 24-h labour coverage: yes = 1, no = 0 Mandatory second opinion: yes = 1, no = 0 Opinion leaders: yes = 1, no = 0 VBAC advocacy: yes = 1, no = 0 Incentives as reward system: yes = 1, no = 0 Robson implementation: yes = 1, no = 0 Improvement collaboration participation: yes = 1, no = 0 Active dissemination of caesarean indications: yes = 1, no = 0
2.2	Utilisation of theoretical framework or evidence-based intervention	Did the study name a theoretical framework that underpins the intervention design or delivery style?	Direct assignment	Theory driven = 1 Citing previous study only = 0.33 Missing/Not using any/ambiguous = 0
2.3	Type of intervention facilitators or instructors	Who were the instructors or facilitators of the intervention? i.e. peers, obstetrician, midwives, doula, other trained staff	Direct assignment to all listed facilitators	Maternity healthcare providers (nurse, midwife, obstetrician): yes = 1; not mentioned as an instructor/facilitator = 0 Hospital administrators: yes = 1; not mentioned as an instructor/facilitator = 0 Recruited staffs: yes = 1; not mentioned as an instructor/facilitator = 0
2.4	Personal or group delivery (training)	Did the intervention delivered in a group or personal based delivery through workshop or class?	Direct assignment	Group delivery: yes = 1, no = 0 Personalised/individualised: yes = 1, no = 0
2.5	Audit and feedback results dissemination	Did audit and feedback delivered in public or one to one?	Direct assignment	Publicly: yes = 1, no = 0 One to one: yes = 1, no = 0

2.6	Language tone of the intervention	Is language tone one the interventions reflective or dictated?	Direct assignment	Reflective: yes = 1, no = 0 Dictated: yes = 1, no = 0
2.7	Type of materials used	Did the intervention used specific type of materials? i.e. video, computer-based tool, pamphlet, handbook, guidelines	Direct assignment to all listed materials	IEC materials: yes = 1, no/not reported = 0 Guidelines dissemination: yes = 1, no/not reported = 0
2.8	Information about control condition	Described whether the authors provided a control for the main intervention (intended to capture complexity of running an intervention and a control) - are they equivalent or not?	Direct assignment	No control described/ambiguous = 0 Yes, there is control group = 1
Domain 3 Program content (6 conditions)				
3.1	Content delivered to healthcare providers	What type of content themes or curriculum delivered to mother and partners? i.e. relaxation technique, information on vaginal birth vs caesarean section risks	Direct assignment to all listed content	Caesarean indication: yes = 1, no = 0 Labour management: yes = 1, no = 0 VBAC: yes = 1, no = 0 Women's autonomy: yes = 1, no = 0
3.2	Educational or training technique	What were the education or training technique used? i.e. role-play, lecture-based, study cases	Direct assignment to all listed content	Practice based (practical session, behavioural rehearsal, role play): yes = 1, no = 0, not reported = 0 Lecture/didactic based: yes = 1, no = 0, not reported = 0
Domain 4 Engagement (3 conditions)				
4.1	Involvement with partners, families, other stakeholders	Other than participants, were there any other stakeholders included in the intervention?	Direct assignment	Yes = 1 No = 0
4.2	Frequency of engagement	How often did the intervention delivered (or frequency of engagement/encounter	Direct assignment	Weekly to monthly = 1 Every two or three months = 0.75 Not reported/Annual = 0

		between participants and intervention)? i.e. once in a month, every 3 months		
4.3	Existing competing interest	Was there any competing interest stated?	Direct assignment	No = 1 Yes/ Not reported = 0
Domain 5 Health system (12 conditions)				
5.1	Presence of internal policies	Were there any existing policies in place to support the intervention (both at facility, regional, or country level)?	Direct assignment	No = 0 Not reported = 0 Yes = 1
5.2	Presence of any other support and resources	Were there any existing support from health system which directly or indirectly support the intervention?	Direct assignment	No = 0 Not reported = 0 Yes = 1
5.3	Perceptions of stakeholders related to the interventions or the caesarean section itself	What were the perceptions of both participants and other relevant stakeholders in regard to caesarean section?	Direct assignment	Missing/not reported = 0 Negative = 0.33 Medium/neutral = 0.5 More positive, despite few dissatisfaction = 0.66 Positive = 1
5.4	Local adaptation	Any acknowledgment to local adaptation?	Direct assignment	No = 0 Not reported = 0 Yes = 1
5.5	Willingness to change	Do providers show willingness in engaging with interventions or change on caesarean practice?	Direct assignment	No = 0 Not reported = 0 Yes = 1
5.6	Obstacles perceived	Were there any obstacles mentioned by participants or trialists?	Direct assignment	Complexity of systems: yes = 1, no = 0, not reported = 0 Perceived poor training, skills and experience: yes = 1, no = 0, not reported = 0

				Unsupportive hierarchies/poor teamwork: yes = 1, no = 0, not reported = 0 Fear of blame: yes = 1, no = 0, not reported = 0
5.7	Belief associated with caesarean	Recorded any belief regarding caesarean and birth from providers' perspective	Direct assignment	Belief on unnecessary caesarean: yes = 1, no = 0, not reported = 0 Belief on women's autonomy: yes = 1, no = 0, not reported = 0 Norms on caesarean as acceptable: yes = 0, no = 1, not reported = 0
Domain 6 Process outcomes (5 conditions)				
6.1	Intervention fidelity	Extract level of fidelity (%) or extract qualitative statement on intervention fidelity. Intervention fidelity refers to the degree to which the prescribed components of the intervention, as described in the study protocol, have been delivered	Direct assignment	There is evidence on high fidelity = 1 Med fidelity 0.66 Low fidelity = 0.33 Not reported = 0
6.2	Participants satisfaction	Extract level of satisfaction (%) or extract qualitative statement on participants' satisfaction with the intervention experience	Direct assignment	Direct assignment - qualitative: where there is a positive statement = 0.66; negative statement = 0.33; where not mentioned = 0 Direct assignment - quantitative: Interventions with 25% or fewer participants satisfied = 0; with 50% of participants satisfied = 0.5; not mentioned = 0; interventions with >75% participants satisfied = 1

6.3	Participants attrition	Extract participants' level of completion (%) or record qualitative statement on participants' completion rate	Direct assignment	Direct assignment - qualitative: where there is a statement indicating high level of completion, assign value of 0.66; where a statement indicating problematic completion, assign value of 0.33. Where data are missing, assign value of 0 Direct assignment - quantitative: Interventions with 66% or fewer participants completing the intervention = 0; interventions with 75% of participants completing the intervention = 0.5; interventions with 83% or more participants completing the intervention = 1. Missing data coded as 0
6.4	Participants dosage level	Did the participant receive the intended dosage of the intervention? "intended dosage is the amount of the components of the intervention delivered by implementers and the extent to which participants received and used materials or other resources". Extract level of dosage (%) or record qualitative statement	Direct assignment	Direct assignment - qualitative: where there is a qualitative statement indicating high level of dosage, assign value of 0.66; where a qualitative statement indicating problematic dosage, assign value of 0.33. Where data are missing, assign value of 0 Direct assignment - quantitative: Interventions with 66% or fewer participants receiving the full dosage = 0; interventions with 75% of participants receiving the full dosage = 0.5; interventions with 83% or more of participants receiving the full dosage = 1. Missing data coded as 0
6.5	Participant adherence	Did participants adhere to the intervention instructions, e.g. women and partners attending classes; healthcare providers conducted mandatory second opinion. Extract level of adherence (%) or qualitative statement		Direct assignment - qualitative: where there is a statement indicating high level of adherence, assign value of 0.66; where a qualitative statement indicating problematic adherence, assign value of 0.33. Where data are missing, assign value of 0 Direct assignment - quantitative: Interventions with 66% or fewer participants adherent = 0; interventions with 75% of

				participants adherent = 0.5; interventions with 83% or more participants adherent = 1. Missing data coded as 0
6.6	Collateral effect other than to participants	Is there any stated collateral effects on others (other than participants)? i.e. if women obtain 24/7 epidural but no additional human resources are provided to the unit, doctors may need to do more shifts or work longer hours to their in satisfaction.	Not coded	Not coded only for consideration whether the intervention is successful or not
6.7	Any other factors affecting the success/unsuccessful of the implementation?	Any other factors affecting the success/unsuccessful of the implementation?	Not coded	Not coded only for consideration whether the intervention is successful or not
Domain 7 Type of interventions (1 condition)				
7.1	Type of interventions	What is the type of interventions? Is it interventions targeting women or multi-target interventions?	Direct assignment	Multi-target interventions: yes = 1, no = 0

APPENDIX 8.3. DATA TABLE ON THE FINAL MODELS PRESENTED FOR INTERVENTION TARGETING HEALTHCARE PROVIDERS.

Author	Caesarean outcome	Frequent engagement	Actionable recommendations	Active dissemination of caesarean indications	Multi-disciplinary collaboration	Providers' willingness to change	Internal policies	Engaging women	Dictated	Training to improve knowledge and skills	Individual dissemination	Multi-target intervention
Interventions targeting healthcare providers												
Calvo 2009	0	1	1	1	0	0	0	0	1	1	0	0
EC9 Ho 2011	0	0	0	0	1	0	1	0	0	1	0	0
Liang 2004	0	1	1	1	0	0	1	0	1	1	0	0
Mohammadi 2012	0	1	0	1	0	0	0	0	1	0	1	0
Poma 1998	0	0	0	1	0	0	1	0	0	0	1	0
Scarella 2011	0	1	0	1	1	0	1	0	0	0	1	0
Bhartia 2020	1	1	1	0	1	1	1	0	0	1	0	0
Chaillet 2015	1	1	1	1	1	0	0	0	0	1	0	0
Kabore 2019	1	1	1	1	1	0	0	0	0	1	1	0
Kazandjian 1998	1	0	1	0	1	0	0	0	1	1	0	0
Lagrew 1996	1	1	1	0	0	1	0	1	0	1	1	0
Lomas 1991	1	1	1	1	0	1	0	1	0	0	0	0
Robson 1996	1	1	1	0	1	1	0	1	0	1	1	0
Socol 1993	1	0	1	1	0	1	1	0	0	0	1	0
van Dillen 2008	1	1	1	1	1	1	0	0	0	0	0	0

Multi-target interventions												
Zhang 2020	0	0	1	0	0	0	0	1	1	1	0	1
Borem 2020	1	1	1	0	1	0	0	1	1	1	0	1
Clarke 2020	1	1	1	0	1	0	1	1	1	1	0	1
Runmei 2012	1	0	1	1	0	0	0	1	1	1	0	1
Xia 2019	1	0	1	0	1	0	1	1	1	1	0	1
Yu 2017	1	1	1	1	0	0	1	1	1	1	0	1

APPENDIX 8.4. CHARACTERISTICS OF INCLUDED INTERVENTIONS TARGETING HEALTHCARE PROVIDERS.

Author	Sibling studies	Country & study years	Intervention	Methods	Settings	Type of women	Sample	Baseline caesarean rates	Relative effect	Caesarean Outcomes	Risk of Bias
Interventions targeting healthcare providers											
Calvo 2009	None	Spain 2006-2007	Audit and feedback, protocol implementation, weekly debate, courses for providers and the correction of deficiencies in organization (structural and organizational; not clearly mentioned)	Before and after study	Two public Spanish hospitals	All pregnant women	Unclear	17.5% and 29.0%	Overall caesarean rates at decreased (not statistically significant) from 17.5 to 15.8% and from 29.0 to 22.0%, respectively	Little or no difference	Some concerns
Ho 2011	2 studies: protocol and methodology (development of logical framework)	Malaysia 2005-2008	Audit and feedback, opinion leader's appointment, evidence-based workshops for nurses and doctors, training, academic exchanges	Before and after study	Two Malaysian hospital	All pregnant women	4628	43.0%	Unadjusted RD 7.75 (95% CI 5.3 to 10.2) and adjusted RD 7.56 (2.92 to 12.20)	Increase	Some concerns
Liang 2004	None	Taiwan 1997-2000	Audit and feedback, mandatory second opinion, weekly conference, trial of labour after one caesarean	Interrupted time series	A tertiary hospital	All pregnant women indicated with caesarean	35,602	37.0%	Change in level of total caesarean at 12 months: -2.4% (-11.4 to 6.7)	Uncertain	Some concerns

									Change in slope: 1.34% (-2.5 to 5.2)		
Mohammadi 2012	None	Iran 2005	Audit and feedback, financial incentives	Before and after study	An Iranian hospital	All pregnant women	3494	40.0%	Change in level of total caesarean at 12 months: -14.6% (-24.4 to -4.8), P = 0.02 Change in slope: -0.07% (-1.5 to 1.3)	Uncertain	Some concerns
Poma 1998	None	USA 1991-1996	Audit and feedback, guidelines implementation, review meetings, publication of anonymous individual and department rates, 24-hour in-house coverage	Interrupted time series	Community hospital obstetric unit	All pregnant women	12,912	22.5%	Change in level of total caesarean at 12 months: -6.6% (-10.1 to -3.2) Change in slope: -0.11% (-0.25 to 0.02)	Uncertain	Some concerns
Scarella 2011	None	Chile 2007-2008	Audit and feedback, Robson classification implementation, monthly caesarean rates distributed by letters, meetings every three month	Interrupted time series	A hospital (maternity ward)	All pregnant women admitted in spontaneous labor or for pregnancy interruption	4831	36.8%	Change in level of caesarean during intervention: -11% (-23.2 to 1.2), NS; change in	Uncertain	Some concerns

									slope -1.1% (-6.4 to 4.2)		
Bhartia 2020	1 study: collaboration development	India 2011-2016	Audit and feedback, antenatal class, additional providers recruitment, protocol/guidelines development and implementation, international improvement collaboration, regular training, empowerment of junior obstetrician, group practice, VBAC promotion	Interrupted time series	A private hospital in India	All pregnant women	Unclear	79.0%	Between 2011 and 2016, the caesarean rate declined from 52 to 18%, (p < 0.001)	Decrease	Some concerns
Chaillet 2015	2 studies: budget impact analysis and cost- effectiveness analysis	Canada 2008-2011	Audit and feedback, providers' training, evidence-based guidelines, local opinion leader	Randomized controlled trial	32 hospitals in Quebec	All pregnant women	184,952	22.50%	RD -1.8 (-3.8 to -0.2) OR 0.90 (0.80 to 0.99)	Decrease	Low risks of bias
Kabore 2019	2 studies: study protocol and observational study	Burkina Faso 2014-2016	Audit and feedback, clinical algorithms (protocol/guidelines), providers' training, dissemination of algorithms through posters, and weekly SMS reminders	Randomized controlled trial	22 referral hospitals	All pregnant women	4174	21.40%	The overall caesarean rate changed from 21.4% (baseline) to 20.0% (post- intervention) in the hospitals in	Decrease	Some concerns

									the intervention group and from 18.7% (baseline) to 20.3% (post-intervention) in the control hospitals (absolute risk difference – 3.1%; 95% CI – 7.2 to 2.6%, P = 0.203)		
Kazandjian 1998	2 studies: conceptual framework development and case studies	USA 1991-1996	Adoption of reporting system on caesarean section (QI Project) - similar to audit and feedback	Observational study	Hospitals	All pregnant women	Unclear	22.5%	The total caesarean rate declined from 22.5% in 1991 to 19.4% in 1996 (p<0.01)	Decrease	Satisfactory study
Lagrew 1996	None	USA 1998-1994	Audit and feedback, guidelines implementation, education, program promotion, prenatal education on VBAC, departmental	Interrupted time series	A private hospital	All pregnant women	12,118	31.1%	The overall caesarean rate fell from 31.1 % to 15.4% (p<0.000001)	Decrease	Some concerns

			conferences and meetings								
Lomas 1991	1 study: cross-sectional study	Canada 1988-1989	Audit and feedback, local opinion leader, guidelines implementation	Randomized controlled trial	16 community hospitals	All pregnant women		18.3% and 20.2%	Control: 85.5%, Audit and feedback: 88.3%, opinion leader: 75.1%	Decrease	Some concerns
Robson 1996	None	USA 1984-1992	Medical audit cycle implementation	Interrupted time series	A hospital	All pregnant women	21,125	12.0%	The overall caesarean rate was decreased (9.5% vs 12%, $p < 0.0001$)	Decrease	Some concerns
Socol 1993	None	USA 1987-1991	Audit and feedback, guidelines implementation	Interrupted time series	A private tertiary university facility	All pregnant women	26,894	27.3%	The overall caesarean rate fell from 27.3% to 16.9% ($p < 0.0001$)	Decrease	Some concerns
van Dillen 2008	None	Netherlands 2005-2006	Audit and feedback, daily report meetings	Before and after study	A teaching hospital	All pregnant women	1221	23.4%	The overall caesarean rate fell from 23.4% to 18.7%	Decrease	Some concerns
Multi-target interventions											
Zhang 2020	None	China 2015 - 2017	Targeted health education to pregnant women,	Randomized controlled trial	Tertiary and	Women with low-risk pregnancy	10,752	42.50% at facility level	OR = 0.92; 95% CI 0.73, 1.15	Little or no difference	Some concerns

			improved hospital caesarean policy, and training of midwives/doulas		secondary hospitals						
Borem 2020	None	Brazil 2014 - 2016	A coalition of stakeholders, empowerment of pregnant women to choose mode of delivery, psychologic birth promotion, information system for providers	Interrupted time series	Hospitals	Women with low-risk pregnancy	119,378	78.3% at facility level	Vaginal deliveries RR 1.62 (95% CI 1.27 to 2.07, p < 0.001)	Decrease	Not serious
Clarke 2020	3 studies: process evaluation, protocol, formative qualitative	Italy, Ireland, Germany 2012 - 2016	Education of clinicians and women with one previous caesarean, appointment of opinion leaders, audit/peer review, and joint discussions by women and clinicians	Randomized controlled trial	Maternity units	Women with previous caesarean	2,002	VBAC rates < 35% at facility level	RR 0.9 (95%CI 0.85 to 0.98)	Decrease	Some concerns
Runmei 2012	None	China 2005 - 2011	Education for staffs and women, audits, public health education, monitoring caesarean rates, and neonatal outcomes	Before and after study	Regional referral centre	Women with low-risk pregnancy	25,280	53.5%- 56.1% at facility level	OR 0.56 (0.52–0.59)	Decrease	Some concerns
Yu 2017	None	China 2006 - 2014	Face-to-face weekly educational meetings between patients	Before and after study	Tertiary public hospitals	Women with low-risk pregnancy	131,312	55-56% at facility level	Overall caesarean rate declined	Decrease	Not serious

			and hospital staff, training for providers, new regulations adoption and projects on caesarean (i.e. encourage mothers to choose vaginal delivery, strictly control indications for caesarean and maternal request for caesarean)						by 1.29% (p = 0.002)		
Xia 2019	None	China 2010 - 2016	Programs for population health education, skills training for healthcare professionals, equipment and technical support for local healthcare facilities, and capacity building for the maternal near-miss care system	Before and after study	Hospitals and community	Women with low-risk pregnancy	1,923,687	42% at facility level	Decreasing trend in the monthly caesarean rates (Z = 75.067, p < 0.001)	Decrease	Low risks of bias