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

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Abstract

Background: Caesarean section (CS) rates in Indonesia are rapidly increasing for both sociocultural and medical reasons. However, there is limited understanding about the role social media plays in influencing preferences around mode of birth (vaginal or CS). Social media provides a platform for users to seek and exchange information, including information on the mode of birth, which may help to unpack social influences on health behaviour.

Objective: This study aimed to explore how CS is portrayed on Instagram in Indonesia.

Methods: We downloaded public Instagram posts from Indonesia containing CS #Hashtags and extracted their attributes (image, text, #Hashtags, and objects and texts within images). Posts were divided into two periods: "before COVID-19" and "during COVID-19" to examine changes in CS portrayal during the pandemic. We used a mixed-methods approach to analysis, utilising text mining, descriptive statistics, and qualitative content analysis.

Results: A total of 9,978 posts were analysed quantitatively, and 720 posts were sampled and analysed qualitatively. The use of text (527/5193, 8.91% vs 242/4065, 5.95%; P<.05) and advertisement materials (411/5913, 6.95% vs 83/4065, 2.04%; P<.05) increased during COVID-19 pandemic compared to before the pandemic, indicating growth of information-sharing on CS over time. Posts with CS hashtags primarily promoted herbal medicine for faster recovery and services for choosing auspicious childbirth dates, encouraging elective CS. Some private health facilities offered discounts on CS for special events like Mother's Day and promoted techniques like Enhanced Recovery After CS (ERACS) for comfortable, painless, and faster recovery after CS. #Hashtags related to comfortable or painless birth (2358/5193, 39.88% vs 278/4065, 6.84%; P<.05), ERACS (124/5193, 2.09% vs 0/4065, 0.0%; P<.05), Feng Shui services (110/5193, 1.86% vs 56/4056, 1.38%; P<.05), name of healthcare providers (2974/5193, 50.30% vs 304/4065, 7.48%; P<.05), and name of hospitals (1460/5193, 24.69% vs 917/4065, 22.56%; P<.05), were more prominent during compared to before the pandemic.

Conclusions: This study highlights the necessity of enforcing advertisement regulations around birth-related medical services in the commercial and private sectors. Enhanced health promotion efforts are crucial to ensure women receive accurate, balanced, and appropriate information about birth options. Continuous and proactive health information dissemination from government organisations is essential to counteract biases favouring CS over vaginal birth.

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Background

Caesarean section (CS) rates in Indonesia are rapidly increasing for both sociocultural and medical reasons. However, there is limited understanding about the role social media plays in influencing preferences around mode of birth (vaginal or CS). Social media provides a platform for users to seek and exchange information, including information on the mode of birth, which may help to unpack social influences on health behaviour.

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Results

A total of 9,978 posts were analysed quantitatively, and 720 posts were sampled and analysed qualitatively. The use of text (527/5193, 8.91% vs 242/4065, 5.95%; $P<.05$) and advertisement materials (411/5913, 6.95% vs 83/4065, 2.04%; $P<.05$) increased during COVID-19 pandemic compared to before the pandemic, indicating growth of information-sharing on CS over time. Posts with CS hashtags primarily promoted herbal medicine for faster recovery and services for choosing auspicious childbirth dates, encouraging elective CS. Some private health facilities offered discounts on CS for special events like Mother's Day and promoted techniques like Enhanced Recovery After CS (*ERACS*) for comfortable, painless, and faster recovery after CS. #Hashtags related to comfortable or painless birth (2358/5193, 39.88% vs 278/4065, 6.84%; $P<.05$), *ERACS* (124/5193, 2.09% vs 0/4065, 0.0%; $P<.05$), *Feng Shui* services (110/5193, 1.86% vs 56/4056, 1.38%; $P<.05$), name of healthcare providers (2974/5193, 50.30% vs 304/4065, 7.48%; $P<.05$), and name of hospitals (1460/5193, 24.69% vs 917/4065, 22.56%; $P<.05$), were more prominent during compared to before the pandemic.

Conclusions

This study highlights the necessity of enforcing advertisement regulations around birth-related medical services in the commercial and private sectors. Enhanced health promotion efforts are crucial to ensure women receive accurate, balanced, and appropriate information about birth options. Continuous and proactive health information dissemination from government organisations is essential to counteract biases favouring CS over vaginal birth.

Keywords: caesarean section, social media analysis, maternal health, childbirth, mode of birth

Introduction

Caesarean section (CS) rates are increasing rapidly worldwide [1,2]. Although World Health Organization (WHO) does not recommend an ideal CS rate at the population level, in 2015, WHO stated that CS rates higher than 10% are not associated with reductions in maternal and newborn mortality [3–5]. Mirroring global trends, Indonesia's CS rates are likewise increasing, reaching more than 25% in 2023, with stark contrasts across the socioeconomic spectrum [6–8]. Women with higher education had a higher proportion of CS (33.4%) compared with less educated women (9.3%), demonstrating a situation of both over- and under-use of CS in Indonesia [6,7]. The reasons for the rise of CS rates are multi-factorial, but non-clinical factors – which may include societal perceptions, influences, and misinformation – have been increasingly implicated [9,10]. Therefore, there is an urgent need to understand what social factors are driving these rates, to optimise the CS use in Indonesia.

Over half of the global population uses social media and evidence suggests that exposure to information on social media may predict future health behaviour [11,12]. For example, young adults exposed to tobacco use on social media are more likely engage in future smoking behaviour [11]. Therefore, trends and data on social media can provide insights and potential pathways for public health advocacy and policy changes [13,14]. While pregnancy and birth information is widely available on social media and women often rely on it [15,16]; there is limited understanding of how this information influences their preferences on birth mode. Previous studies in Brazil and Spain found that women's magazines portrayed CS neutrally, but often inaccurately depicted associated long-term risks as lower than expected [17,18]. A study on Googling CS in Brazil revealed limited, unreliable, and incomplete information about CS [19]. Likewise, a recent social media study on Mexican media Facebook pages showed that CS was not promoted over vaginal birth [20]. Information about CS risks was generally accurate, but some comments either disregarded or defended CS risks, and others stigmatised women who chose CS [20]. While these social media studies offer insights into CS portrayal in Latin America and Europe, no studies have explored how CS is depicted on social media in Asia. CS rates in Asia are expected to exceed 50% by 2030 [21], highlighting a critical need for interventions to manage these trends in resource-limited settings to prevent potential adverse outcomes.

Instagram is one of the most popular social media platforms, with 1 billion active users globally [22]. In Indonesia, Instagram holds the largest share of users and most popular social media platform in 2022, with over 173 million active users [23,24]. Most people who use Instagram in Indonesia are women of reproductive age, aged between 18 to 44 years old [24]. 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) [25]. Analysing images and associated text related to CS that are shared on Instagram may provide an understanding on the types of content that users are exposed in relation to mode of birth. Therefore, this study aimed to explore how CS is portrayed on Indonesian Instagram.

Methods

Study design

We adopted a mixed-methods approach, combining quantitative and qualitative analyses. Quantitative analysis assessed surface level data, such as word frequency, without subjective interpretation [26]. Qualitative content analysis explored underlying meanings, subjectively interpreted by the research team [27]. This approach enabled an in-depth analysis of CS portrayal at both surface and interpretative levels.

Data source, data collection, and sampling

The data source is public Instagram posts using CS #Hashtags. These hashtags help users specify the topic or context of their posts and make them searchable to others [28,29]. We searched for 18 different #Hashtags related to CS in Bahasa Indonesia to find relevant posts (see Table S1 in Multimedia Appendix 1).

We collected all public Instagram posts that used specific #Hashtags from August 31, 2018, to August 31, 2021. Posts were divided into two time periods: "before COVID-19" (prior to March 11, 2020, when the WHO declared the COVID-19 pandemic [30]) and "during COVID-19" (on and after March 11, 2020) to examine changes in CS portrayal during the pandemic. We used 4K Stogram to gather the dataset, which is a program capable of downloading images and videos posted on Instagram users' feeds and searching for #Hashtags. This software has been previously used in social media research [31–33]. We excluded posts with video content, as the methods of analysis differ from those used for static images. Therefore, this study's dataset only includes posted images, their caption text, and any associated metadata, including #Hashtags and date of the posts (which we refer as “posts” throughout).

We merged downloaded posts to remove duplicates from users who used multiple #Hashtags in a single post. The merged dataset was then analysed quantitatively. To increase rigour of our quantitative analysis, we randomly selected 20 posts from each month using R programming software [34], totalling to 720 posts. This sampled data was analysed qualitatively to explore emerging themes.

Data analysis

Quantitative analysis

For large-scale analysis of the posted images, we utilised Microsoft Azure Cognitive Services [35] to extract image attributes. This ‘cloud-based’ artificial intelligence provides an application programming interface (API) that can be easily used without machine-learning expertise. Using Computer Vision API, we extracted objects within post’s image (e.g., buildings, people, mask), content tags, and dominant colour - to understand meanings conveyed by the post. This is because colours may attract attention, convey specific meanings, and evoke certain emotions or motivations of the viewers [36]. We used the

Optical Character Recognition to extract text from the post's image. We accessed these APIs using Python to process and extract the attributes from the posted images.
We conducted descriptive statistical analysis to quantify the most frequent objects, content tags, colours, and texts appearing on the images, and #Hashtags appearing on the captions. We compared pre- and during COVID-19 period using the two proportions z-test (left-tailed test). Natural language processing was employed to analyse the extracted text from the image using text mining approach, by examining the type of words which are frequently mentioned and clustered together to reveal topics or themes present in the posts. We visualised the word clusters using co-occurrence and correlation networks [37]: which map word pairs that often appear together in the same post. The co-occurrence network included words that appear more than 50 times together. Fifty occurrences were selected as larger (>50) or smaller (<50) showed too few or many networks which makes it difficult to see the connection between words. We examined correlation networks with coefficient > 0.8, as coefficient equals to 1 means word always appear together. We conducted the analysis using the R programming platform [34], utilising *widyr* package, with graphs plotted using *ggplot2*, *igraph* and *ggraph* packages [38].

Qualitative analysis

We analysed the randomly sampled post using qualitative content analysis. The unit of analysis was an individual post's image and its caption text. First, we developed the codebook, adapting from a previous study of #HookahLife (public health-related issues in smoking hookahs or waterpipes) on Instagram [39]. We coded the posts to the developed domains: metadata and post-type, advertisements, health messages, birth stories, descriptive content of image, content of caption, and tags, and positionality towards CS (definition can be seen on Table S2 in Multimedia Appendix 1). The 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. sadasdEthics approval
Ethics approval was obtained from Office of Research Ethics and Integrity at The University of Melbourne (Project ID: 22782). This study used publicly available data on Instagram posted by non-private accounts. To ensure that private account posts were not inadvertently downloaded, we created a new Instagram account with no followers or users following it. This approach ensured that algorithmic recommendations from Instagram did not influence data collection. Social media sites, including Instagram, are prone to exhibit a "filter bubble" effect [40] which uses one's social network and past activities to personalize the sorts of content an end user sees. Privacy was ensured by anonymising posts before data analysis and adhering to best practices identified in ethics protocol (i.e., no Instagram account names and images were included on this manuscript) and by paraphrasing quotes in manuscript to avoid back translation and identification of the poster.

Results

A total of 13,451 public Instagram posts were downloaded. After removing duplicates and

posts outside of the study time frame, 9,978 posts remained which were analysed quantitatively. Out of 9,978 posts, 720 posts were randomly selected to be analysed qualitatively (Figure S1 in Multimedia Appendix 1).

Quantitative results

Most frequent objects, content tags and colours

The three most frequent objects on CS images were related to people (6576/9978, 44.1%), texts (769/9978, 7.7%), and advertisement material (i.e., posters, flyers; 494/9978, 5.0%) (Figure S2 in Multimedia Appendix 1). The most frequent content tags were text (7056/9978, 70.7%), suggesting that most CS posts are used for sharing information. Women (1739/9978, 17.4%) and babies (1635/9978, 16.4%) were the most common types of people on the images. White (7046/9978, 70.6%), grey (2347/9978, 23.5%), and black (1278/9978, 12.8%) were most frequent colours used. During the pandemic, there were significant increases in the use of text (527/5913, 8.91% vs 242/4065, 5.95%; *P*<.05) and advertisement materials (411/5913, 6.95% vs 83/4065, 2.04%, *P*<.05) as image objects. Content tags revealed greater use of screenshots, infographics (e.g., illustrations), and healthcare-related images (e.g., medical equipment) compared to pre-pandemic levels, reflecting increased information sharing on CS over time (see Table 2). Brighter colours were notably more prevalent during compared to before pandemic, such as yellow (825/5913, 13.95% vs 419/4065, 10.31%, *P*<.05), green (406/5913, 6.87% vs 152/4065, 3.74%, *P*<.05), and orange (131/5913, 2.22% vs 24/4065, 0.59%, *P*<.05) (Table 2) – this trend suggests an effort to convey positivity through CS posts during the pandemic [36].

Table 1. 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[a] (%, n = 4,065)	Ppost-cov[b] (%, n = 5,913)	Z-score[c]	P-value[d]
Objects used on CS 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 CS 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 CS 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 CS images							
	Products or words related to faster CS 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 CS 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[e]	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 CS (VBAC)	87	307	2.14	5.19	-7.69	*P*<.001
	Advertised products	2748	2746	67.6	46.44	20.88	*P*=1.00
	CS wound	3002	1199	73.85	20.38	53.26	*P*=1.00
	Medicine for CS	2363	560	58.13	9.47	52.48	*P*=1.00
	Natural medicine of CS	1133	145	27.87	2.45	37.33	*P*=1.00
	Speedy recovery of CS	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

Table 2 Footnote: [a]Ppre-cov: proportion of used before COVID-19 pandemic; [b]Ppost-cov: proportion of used during COVID-19 pandemic; [c]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 : Ppre-cov – Ppost-cov ≥ 0), while our alternative hypothesis is use before COVID-19 pandemic is less than during COVID-19 pandemic (H_a : Ppre-cov – Ppost-cov < 0). We set the significance level as α=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}. [d]*P*<.05 means that trends of use are greater during COVID-19 compared to before (Ppre-cov < Ppost-cov), while *P*≥.05 refers that there is no evidence to reject null hypothesis, which means that Ppre-cov > Ppost-cov or no difference between pre- and during COVID-19 other than due to chance. [e]*ERACS* = Enhanced Recovery after Caesarean Section.

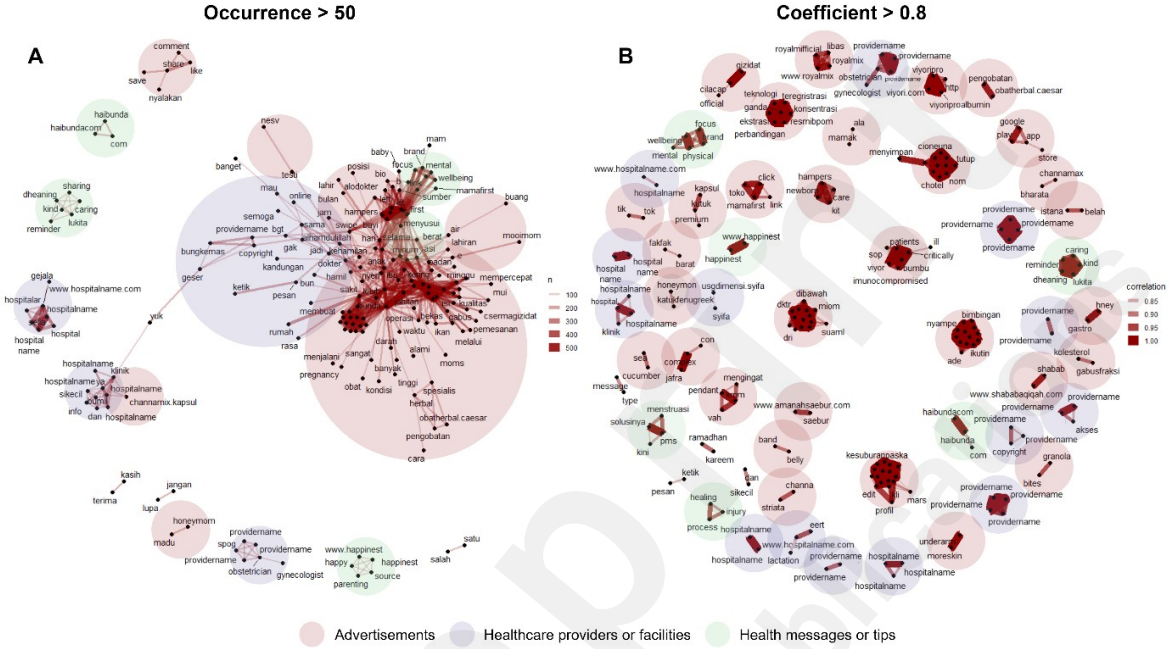
Word clusters on CS images

Analysing co-occurrence of words showed the word pairs which occurred most often in the text (Figure 2 panel A). The co-occurrence network showed three main word clusters representing: 1) advertisements; 2) health facilities and providers; 3) health messages. The advertisements cluster seems to be the dominant cluster (red shade, Figure 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 2 panel B). From this network, we can see clearer groups of words which suggest that Instagram posts using CS posts were mostly related to advertisements (red shade), followed by health facilities and providers (purple shade), and health messages (green shade). Glossary containing sample of words in Bahasa with English

translations can be found on Table S3 in Multimedia Appendix 1.

Figure 1. Network of words co-occurrence and correlation on CS images.

Panel A is a co-occurrence network presenting word pairs that occur most often (only word pairs that occur above 50 times shown); Panel B shows words that occur more often together than with other words (we only show word pairs with coefficient > 0.8; coefficient = 1 means words always appear together).



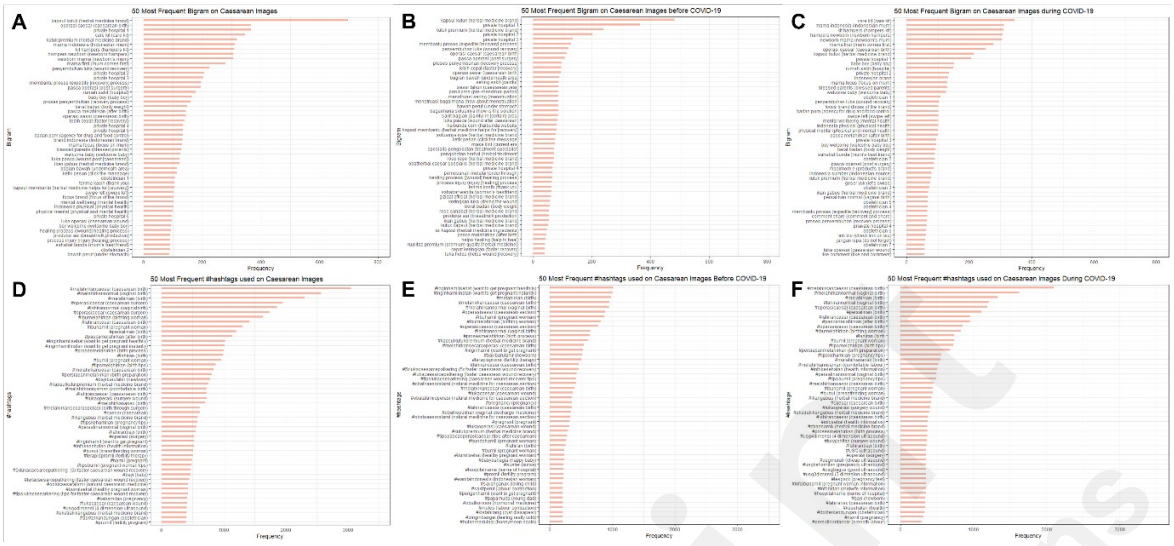
Most frequent text appearing on CS images

The text mining analysis explored the most used bigrams (pairs of words) appearing on CS images to see topics mentioned on the images and showed similar results to network analysis (Figure 3 Panel A, B, C). The most frequent bigrams appeared on CS images are mostly related to advertisements of products to accelerate CS recovery (4161/9978, 41.7%) (Figure 3 Panel A). Private hospital and obstetricians' names (anonymised in our visualization in the interest of privacy) also appeared on this list (1946/9978, 19.5%), as well as words referring to mum or parents (1245/9978, 12.5%), care kits for women and newborns (962/9978, 9.6%), different words of CS (511/9978, 5.1%), baby (386/9978, 3.9%), mental and physical wellbeing (302/9978, 3.0%), post-partum weight loss (149/9978, 1.5%), breastfeeding (91/9978, 0.9%), and others (322/9978, 3.2%) which consisted of typical Instagram posts (i.e., 'type message', 'swipe left', 'thank you'). The trends of observed bigrams before and during pandemic were similar, except bigrams related to healthcare providers names (524/5913, 8.86% vs 0/4065, 0.0%, P<.05) and mental wellbeing (302/5913, 5.11% vs 0/4965, 0.0%, P<.05) which were more common during compared to before COVID-19 pandemic (Table 2; Figure 3 Panel C).

Figure 2. 50 most used bigram and #Hashtags on CS images (n all period = 9,978 posts, n before pandemic = 4065, n during pandemic = 5913).

Panel A, B, C showed most frequent bigram appearing on CS images. Bigram is texts

comprising of two words; Panel D, E, F showed most frequent #Hashtags used on CS posts.



Most frequent #Hashtags appearing on CS images

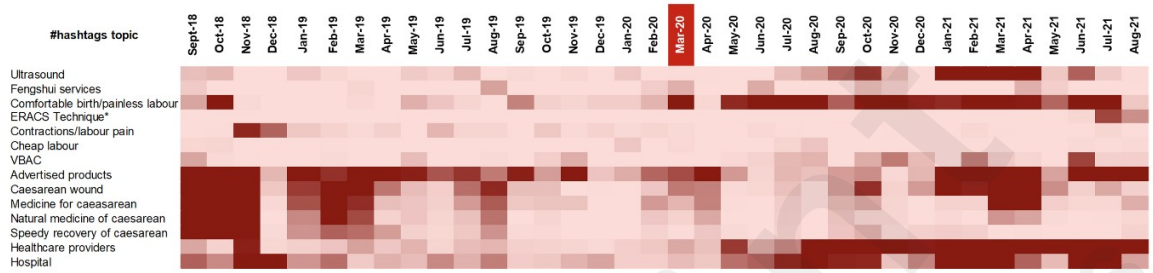
Multiple #Hashtags were commonly used in a single post. Most #Hashtags used on CS posts were related to mode of birth (16,473 #Hashtags, comprising of 11,486 *#CaesareanSection* and 4987 *#VaginalBirth*), followed by birth (10,829 #Hashtags, comprising of 7408 *#Birth*, #2694 *#BirthTips*, and 727 *#ComfortableBirth*) (Figure 3 Panel D, E, F). Other #Hashtags were related to pregnancy (5093 #Hashtags), CS recovery (4670 #Hashtags, including 1744 *#AdvertisedProduct*, 1355 *#FasterCSRecovery*, 1137 *#CaesareanWound*, and 434 *#NaturalMedicine*), fertility (3469 #Hashtags), postpartum (2900 #Hashtags), health information (529 #Hashtags), and obstetricians (403 #Hashtags). Two kinds of #Hashtags worth highlighting are comfortable birth and faster recovery of CS – in which tags passed the message that painless birth through CS and fast wound recovery of CS were possible. Comparing the top 50 #Hashtags before and during COVID-19, we found more posts about faster CS recovery before COVID-19 pandemic (Figure 3 Panel E), and more posts about comfortable and smooth birth during COVID-19 pandemic (Figure 3 Panel F).

As the “comfortable birth” tag seems to appear more during COVID-19, we were motivated to explore the trends of notable #Hashtags used across time (Figure 4). The heatmap in Figure 4 (darker colours denoting higher frequency) confirmed that #Hashtags related to comfortable birth including painless birth, as well as a clinical technique called *Enhanced Recovery After Caesarean Surgery or ERACS* (peri-operative care initiative that may accelerate patient recovery after CS [41]), ultrasound, name of healthcare providers and hospitals seems to be more prominent after COVID-19 pandemic started. The two-proportions z-test analysis (Table 2) also confirmed this further that there were statistically significant increases ($P<.05$) of #Hashtags related to comfortable or painless birth (2358/5913, 39.88% vs 278/4065, 6.84%), *ERACS* technique (124/5913, 2.09% vs 0/4065, 0.0%), *Feng Shui* services (110/5913, 1.86 vs 56/4065, 1.38), ultrasound (2399/5913, 40.57% vs 106/4065, 2.61%), vaginal birth after CS (VBAC) (307/5913, 5.19% vs 87/4065, 2.14%), name of hospitals (1460/5913, 24.69% vs 917/4065, 22.56%) and name of healthcare providers (2974/5913, 50.30% vs 304/4065, 7.48%). On the other hand, #Hashtags related to CS recovery were seen

to have greater before the pandemic or no difference across the two-period other than chance (89/5913, 1.51% vs 1296/4065, 31.88%, *P*=1.00).

Fig 3. 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 [30].



Qualitative results

Of 720 posts randomly sampled for qualitative analysis, advertisements were the most common post (n= 342, 47.5%), followed by health messages (n=241, 33.5%), and birth stories (n=137, 19.0 %). There were 395/720 (54.9%) posts which used CS #hashtags yet did not cover topics in relation to CS. Table S4 in Multimedia Appendix 1 presents the themes emerging from these posts.

Among the remaining 325/720 (45.1%) posts which mentioned CS explicitly: 189 (58.1%) posts were before the COVID-19 pandemic and 136 (41.9%) posts were during the pandemic. Only 76/325 (23.4%) posts referred to the location of the poster, most of whom were from Jakarta Metropolitan Area (n=46, 60%), followed by East Java (n=8, 10%), West Sumatra (n=8, 10%), South Sumatra (n=5, 6%), Central Java (n=5, 6%), Kalimantan (n=2, 2%), South Sulawesi (n=1, 1%), and Papua (n=1, 1%).

Advertisements

Advertisement posts aimed to advertise products or services, and were either posted by commercial companies, individual sellers, or private health facilities. Advertisement posts were often accompanied by health messages from non-trusted sources and endorsement by influencers through their experiences in using the products or services.

Advertisements by commercial company or individual sellers

CS posts advertised consumable products, wearable products, and services. Most consumable products advertised were herbal medicine, nutritional supplements, treatment oils, and drinks, while the wearable products were “health” belts, pendants, and corsets – all products allegedly to improve recovery after CS. These products were also advertised to balance women’s hormones, promote regular menstruation, alleviate pain, cleanse uterine blood, and restore the uterus post-CS. Themes from the images, captions, and #Hashtags when promoting consumables and wearable products aimed to persuade women that the products

were natural, safe, trusted, effective, and internationally-recognised to heal the CS wound faster – emphasizing that quick post CS recovery is possible. 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 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 baby's harmony of life, future luck, and purported baby's intelligence – encouraging planned CS to achieve this. There was no change in the types of products and advertising methods before and during the pandemic, except for postpartum fitness advertisements, which only appeared during the pandemic. These advertisements focused on postpartum body norms, encouraging women to regain their pre-pregnancy body shape, and lose "pregnancy fat." Posters mentioned that the adage which said woman with CS cannot undo their belly size is a myth and excuse, and used hashtags like *#PostPartumBody, #FatBurn, #FitMom, #langsing* (slim), and *#sexy*.

Overall, the emotions portrayed on the advertisement's posts were positive, happy, and persuasive, except when risks were mentioned, which could be serious and tense. When analysing the positionality CS in advertisement, we found that most posts (73/101, 72.3%) implicitly encouraged CS through emphasis on the possibility of a fast recovery post-CS. Only one post (1.0%) explicitly promoted CS through a *Feng Shui* promotion. Meanwhile, 17 posts (14.3%) remained neutral on the matter. Notably, two posts (2.0%) explicitly discouraged CS and ten posts (9.9%) implicitly discouraged CS by highlighting associated risks.

Advertisements by private health facilities

Posts posted by private facilities typically aimed to promote their services. Some posts promoted CS uptake by giving discounts on CS costs during special events, such as during Mother's Day celebrations, Indonesian Independence Day, and hospital anniversary. These advertisements relayed the message to women that "painless and comfortable labour" (referring to CS) and "cheap and affordable CS" could be done at their facilities. The other posts aimed to promote their facilities by congratulating women in giving birth (all through CS) at their facility, offering free WhatsApp consultations, sharing women's testimonials, and providing free seminars. Overall, similar advertisement posts by private hospitals or clinics were observed before and during COVID-19 pandemic. However, during the pandemic, some posts shared women's CS experiences with images of woman and/or healthcare providers with baby in surgery room post-CS. The #Hashtags used on these posts include CS related #Hashtags and *#SafeLabour, #ComfortableLabour and #AlwaysSafe* – relaying an overall message that CS is safe to be done despite the COVID-19 pandemic.

The emotions portrayed on advertisement posts posted by private health facilities were overall positive and happy across all periods. The positionality of CS on these posts were neutral 9/16 (56%) by promoting their facility instead of CS specifically, some (5/16, 31%) explicitly encouraging through discounted CS costs, and 2/16 (12%) implicitly encouraging through portrayal of safe CS during the pandemic.

Health messages

The health messages posts aimed to share information to women and the larger public. About half (45/86, 52%) of health messages were posted by healthcare providers or health facilities – which we refer to as “health messages from trusted sources”, while 41/86 (47%) health messages were posted by non-health care providers or facilities, and these are referred as “health messages from non-trusted sources”. The non-trusted category of messages were often posted by either personal or community groups (like parenting, birth, breastfeeding, etc.) accounts. Some had commercial purposes, such as promoting their Instagram accounts or certain products – yet were not as explicit, compared to posts categorised in advertisement section.

The themes covered on health messages from both trusted and non-trusted sources were typically similar across before and during COVID-19 pandemic. Posts typically covered three main themes. First, general statistics about childbirth and postpartum (shared sparingly) – which included indications, benefits, risks, and process of vaginal birth and CS, VBAC, danger of traditional medicines and services, as well as mode of birth selection. Second, childbirth tips for women including information on ways to induce labour, how to turn the baby’s position, preparation before CS, post-labour infection prevention, and how to support CS recovery. Third, motivational messages and encouragement to women to confront social stigma related to CS. These messages aimed to reassure women not to feel disheartened if they could not undergo vaginal birth, emphasising the validity of all birth modes and promoting kindness towards other women. During the pandemic, there were reminders to undergo COVID-19 testing on the third trimester to ensure safe care for women, adherence to COVID-19 protocol, guidelines on appropriate mask usage, childbirth costs during pandemic, and details about national health insurance coverage for CS. Interestingly, aligned with quantitative analysis results (Figure 4), more posts were found in promoting CS during pandemic in the context of *ERACS* techniques, which facilities and providers advertised as an “advanced technique of CS” and “painless and quick recovery labour”. Providers claimed that, with CS *ERACS*, women were able to return to their normal activity within 24 hours. Compared to before COVID-19 pandemic, more posts from healthcare providers and facilities were found during the pandemic.

Overall emotions of these posts were positive, informative, and motivational to women. The positionality about CS of these posts was neutral 35/86 (41%), with some 30/86 (35%) implicitly encouraging (when addressing stigma associated with CS) and 3/86 (3%) explicitly encouraging (mostly on promoting *ERACS* and risks of undergoing vaginal birth), and some 18/86 (21%) explicitly and implicitly discouraging CS when talking about CS indication and risks.

Birth stories

Birth stories were mostly told by women telling their birth journey, with a few posted by their partners. Around 25/120 (20.8%) posts mentioned women gave birth at private health facilities, while 8/120 (6.7%) posts mentioned at public health facilities. Mode of birth was mentioned in almost all 116/120 (96.7%) posts, where 109/120 (90.8%) posts capturing

women with CS, and only 7/120 (5.8%) posts mentioned VBAC.

Table 2 depicts the five themes identified related to CS from the birth stories before and during the pandemic, which are: CS as an effort, VBAC as pride, standing up against stigma, relationships with healthcare providers, and powerless over birth. Women shared diverse perspectives on childbirth experiences, expressing pride in their efforts giving birth to their baby through CS or VBAC. Despite some women chose CS, others desired vaginal birth and felt emotional distress when advised otherwise by healthcare providers. Post-birth, however, gratitude for a safe delivery and baby's safety were expressed by women regardless of mode of birth. Some women also confronted stigma, defending all birth modes and calling for kindness towards CS mothers. Desire for body image recovery post-CS was evident with *#fashionable* and *#BackToSlimBody* tags, showing efforts through exercise. Women also shared their relationship with their healthcare providers, where trust in healthcare providers were varied. Some women expressed gratitude for support during CS, yet dissatisfaction arose when VBAC desires clashed with providers' pro-CS advice. Miscommunication and blame from providers were reported, prompting some women to seek more supportive and women centred care for future births. Reflecting on their journeys, women sought empowerment and readiness for childbirth decisions, regretting past experiences and aiming for informed choices, whether CS or VBAC, to regain control over their birthing experiences.

Most posts depicted CS as a positive birth experience, while the rest portrayed struggles, frustration, hopelessness, anxiety, pain, and sadness women felt on their birth journey. The positionality towards CS was mostly neutral (65/120, 54.2%), followed by explicitly or implicitly encouraging CS when women had negative labour experiences (38/120, 31.7%), and lastly explicitly or implicitly discouraging CS (17/120, 14.2%), when they did not desire CS, yet had CS or discussing CS pain.

Table 2. Themes emerging from birth stories.

CS as an effort Overall, through their birth stories women expressed her pride upon their effort in undergoing CS for their babies by utilising *#perjuangan* (literally, fight or effort) #Hashtags. While some women had elected to have CS during pregnancy, some women desired vaginal birth and were heartbroken, sad, nervous, and anxious when their healthcare providers indicated they should undergo CS. 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 which 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 CS. Firstly, women and her partners felt upset with communities that devalued women with CS, saying women underwent CS were not a "complete" or "strong" woman, 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 CS also required women's sacrifice and pain, and reminding other women to be kind to women who underwent CS. 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 CS"*. Women desired acknowledgment to her experience instead of being undermined just because she underwent CS. Some posts also mentioned expectations around body shape after CS. Women reported desiring to lose weight and to return to her "normal" body 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 CS expressed trust in healthcare providers recommendation on mode of birth and gratitude to healthcare providers for helping during labour. Women who desired VBAC, however, told that they often met healthcare providers who were pro CS; thus, said doctors were highly against VBAC, telling them about scary stories of VBAC consequences, and made them feel rejected. Women who perceived experiences of CS or VBAC as not pleasant were often upset with their patient-doctor relations. Their providers were reported to blame her for not able to bear pain and push the baby out, and she mentioned she would look for doctor that is pro CS 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 surgery table: *"I used to be an uneducated person, helpless about giving birth, and end up on surgery table"*. Women reported regret having CS and wish to undergo VBAC in the future. They felt it is 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.

Discussion

Our study explored how CS was portrayed on Instagram in Indonesia. We downloaded 13,451 public Instagram posts, analysed 9,978 posts quantitatively, and 720 qualitatively. Quantitative analysis revealed that CS posts mostly used people, text, advertisement materials on their images. The use of text and advertisement materials increased during the pandemic, suggesting that information sharing on CS is increasing 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 CS was portrayed on Instagram through advertisements, health messages, and birth stories. Posts were trying to advertise products to women for faster CS recovery and services to offer women consultation in choosing auspicious day for childbirth. Some private health facilities and healthcare providers explicitly promoting CS by giving discounts for CS 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 stigma attributed to women who underwent CS.

Advertisement posts were the most common type of posts across time. We identified two types of sources of advertisements on Instagram: 1) posted by healthcare facilities and providers, and 2) by companies or individual sellers. The ethics code of doctors in Indonesia [42] and Ministry Health Regulations on advertisement and publication of health services [43], 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 [42,43]. However, this study has shown that private health facilities and healthcare providers actively promoted their services on Instagram, including CS. For example, cheap CS were promoted and being accessible to women on Mother's Day and Indonesian Independence Day. The regulations from Ministry of Health provided detailed consequences that providers may receive when they are involved in advertisement, from administrative action to revocation of practice license [43]. However, given how these advertisements are actively promoted on Instagram, policies and monitoring efforts regulating advertisements for birth by healthcare providers and facilities and its enforcement maybe a cornerstone to ensure women are exposed to credible information.

Our study also revealed that healthcare providers and facilities actively promoted CS *ERACS* uptake. *ERACS* derives from ERAS (Enhanced Recovery After Surgery) in which the term was first used for patients undergoing colorectal surgery, as series of evidence-based interventions used for perioperative care to accelerate patient recovery post-surgery [44]. The term has recently been adopted in obstetrics as *ERACS* [44]. 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, limit use of opioids, and scheduled non-opioid analgesics and therapies to reduce pain [41]. However, in Indonesia, CS *ERACS* was promoted as an "advanced" CS technique claimed to expedite women's recovery post CS within 24 hours and was accessible for

women who want to have painless birth. 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 or suggested to receive *ERACS*.

The advertisements included in this study have the potential to influence beliefs that CS is superior to vaginal birth. For example, our study observed that most products advertised on Instagram aimed to convey that faster CS is possible, and these products were "natural" medicine for CS. *Feng Shui* practices were actively promoted, whereby selecting an auspicious day and time for birth was recommended for the baby's benefit – a practice favouring planned CS [9,45,46]. One woman who had elective CS at private facility even shared a story that there were 24 other women in queue waiting to have CS on that day as it was a "pretty" date (referring to 19/09/2019). Moreover, unbalanced promotion of *ERACS* may also give impression to women that painless birth with CS *ERACS* is a better alternative compared to vaginal birth. Lastly, the uncertainties and lack of control due to COVID-19 pandemic may have exacerbated and influenced women's preferences to CS compared to vaginal birth [14]. There is a need to counteract these unbalanced advertisements with more neutral and credible information about birth options, enabling women to make informed choices and participate actively in their care.

Our analysis shows that women may be exposed to misinformation about CS on social media and may have limited capacity to distinguish between what 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 attain ideal body shapes and improve happiness, which has the potential to negatively impact young people's mental and physical health and development [47]. In fact, recent study found that more time on Instagram led to increased body dissatisfaction, frequent appearance comparisons, and lower self-esteem [48]. Similarly, WHO's recent a 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 breastfeeding [49]. This is despite the International Code of Marketing of Breast-milk Substitutes banning the advertisement of breastmilk substitutes to the general public [49]. These examples show that, similar to CS, health misinformation on social media is common. According to Cornelia (2021), information on Instagram typically "tend to mimic hegemonic discourses rather than create resistant alternatives" [15]. Therefore, 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 it is sold does not have evidence behind supporting it. Alarmingly, the power of propaganda in advertisements in regards to

birth are based on the notion of “maternal sacrifice” [50] - the fact that woman naturally put their baby’s health as priority. Maternal sacrifice has been long used to justify certain ideologies or practices, where women were given choice yet maternal sacrifice idea was deployed to influence women in making the “right” choice, invoking women’s guilt when one does not pursue it [50]. This phenomenon was also observed in a study of maternity discourse on Spanish Instagram, where intensive mothering was promoted, encouraging women to make choices deemed “best for the baby”, with limited consideration for the woman herself [15]. Aligned with the consumerism societal model, we observed no posts were posted by public health facilities or providers working in the public sector in relation to CS, which is similar to previous study on Spanish Instagram that demonstrates the absence of information surrounding maternity from governmental organisations [15]. This could be due to the need to generate profit in the private but not public sector [51]. Health information dissemination from government organisations may be essential to counteract informational biases favouring CS over vaginal birth.

It is important to note that we identified many posts with CS #Hashtags, yet were unrelated to CS. Although these posts are not related CS, CS #Hashtags were used possibly to gain a wider audience, especially women in their reproductive age regardless of pregnancy status – a common phenomenon called #Hashtags hijacking [52]. This suggests that CS-related #Hashtags may be a popular #hashtag searched among women, which may prompt sellers and advertisers to use CS #Hashtags in their posts, as an effective broadcast strategy. We also observed that CS 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 CS and were not considered a “complete” mother because they did not experience labour. The existence of stigma attribute to CS and increasing CS seems paradoxical, however, this was similarly observed in Mexico in which CS was reported to be over 45% [20]. In Mexican media Facebook pages, users commonly used derogatory terms to describe women who had CS and considered women who underwent vaginal birth as braver and stronger [20]. In Indonesia, socio-cultural and religious beliefs may influence societal norms to glorify natural birthing [53]. These beliefs and norms, coupled with the recent rise of CS in Indonesia [7], may result in stigmatisation of women with CS. Through this stigmatisation, women reported to feel inadequate, disconnected, and powerless during childbirth when they fail to meet societal expectations of a drug-free vaginal birth [16]. However, we identified increasing posts that aimed to debunk stigma placed on women who underwent CS, indicating that there seems to be a shift on how society perceived CS in recent years. Messages, however, need to be evidence-informed, and include risks and benefits of different modes of birth, to ensure that CS is not unintentionally promoted as superior to vaginal birth. Furthermore, any health promotion should carefully consider terms or phrases that may contribute to further stigmatisation of women, based on their mode of birth.

Strengths and limitations

To our knowledge, this is the first study exploring the portrayal of CS in Indonesia through Instagram. It uses modern machine learning approaches which enables to us to analyse large quantities of data, and adopted a mixed-methods approach which enable 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 region with the highest gross domestic product in the country, where most business activities happen, and economic agglomeration occurred [54], and makes it more difficult to generalise if portrayal and discourse about CS is similar on other parts of Indonesia. 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.

Implications for future research and practice

More efforts are needed to regulate services advertisements by healthcare providers and facilities in the country and mobilising its enforcement, to ensure that women receive credible and evidence-based information which are beneficial to them. There is also a need to promote and disseminate clear, transparent, factual, and unbiased information around 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 mode of birth in Indonesia. Additional studies to investigate how social media influence mode of birth uptake will be useful to identify areas of improvement on social media communication around birth.

Conclusion

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

Authors' contributions

- Conceptualised and designed the study: RIZ, MAB, MC, CHSE, APB
- Funding acquisition: RIZ, MAB, MC, CHSE, FE, OE, APB
- Data curation: RIZ, AH
- Investigation, methodology and formal analysis: all authors
- Visualisation: RIZ, MAB, MC
- Writing – original draft preparation: RIZ

- Writing – review and editing: all authors

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Availability of data and materials

The dataset on this study is publicly available and can be searched using *#Hashtags* listed on Table S1 in Multimedia Appendix 1 and date filter set to 31 August 2018 and 31 August 2021 on 4KStogram or directly in Instagram.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

API: Application Programming Interface

CS: Caesarean section

ERACS: Enhanced Recovery After Caesarean Surgery

ERAS: Enhanced Recovery After Surgery

WHO: World Health Organization

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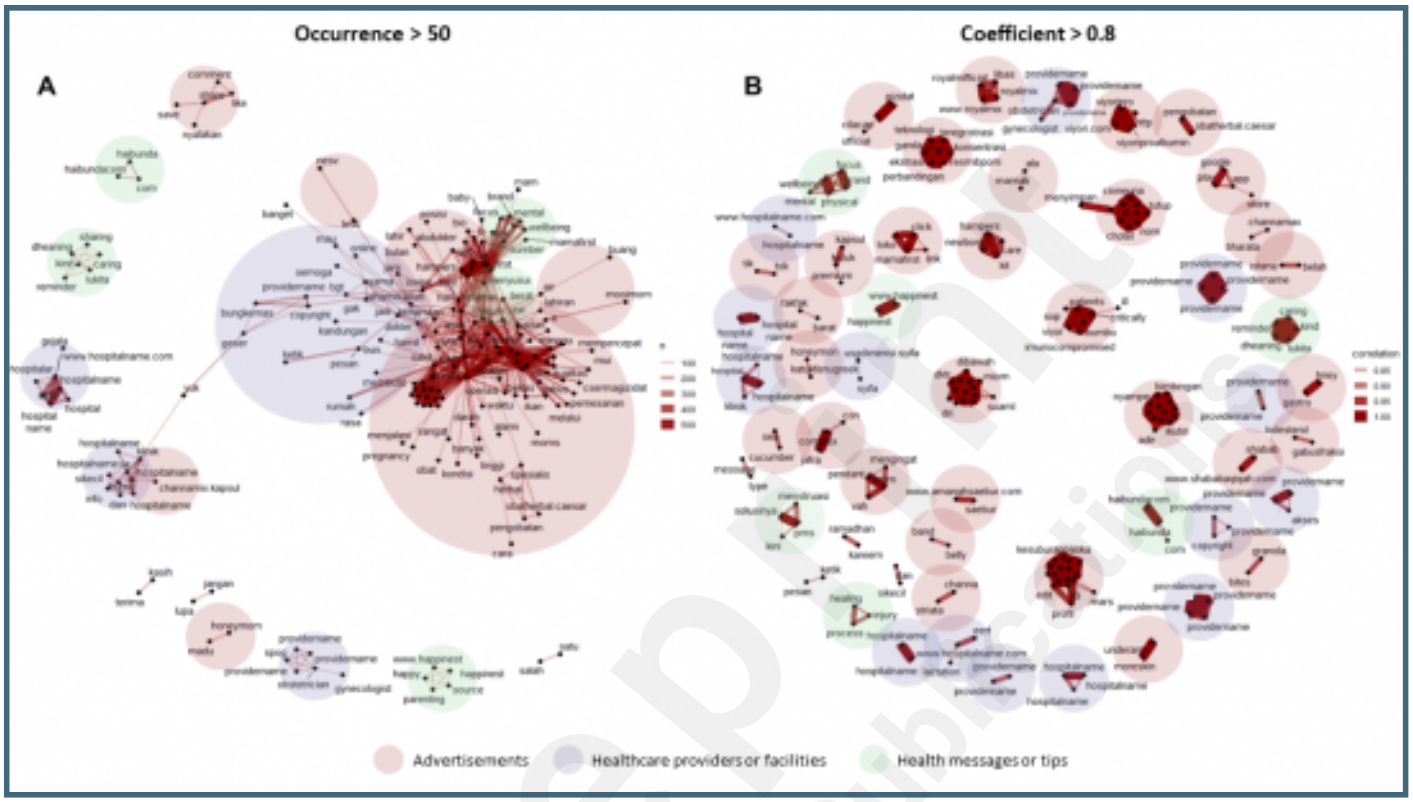
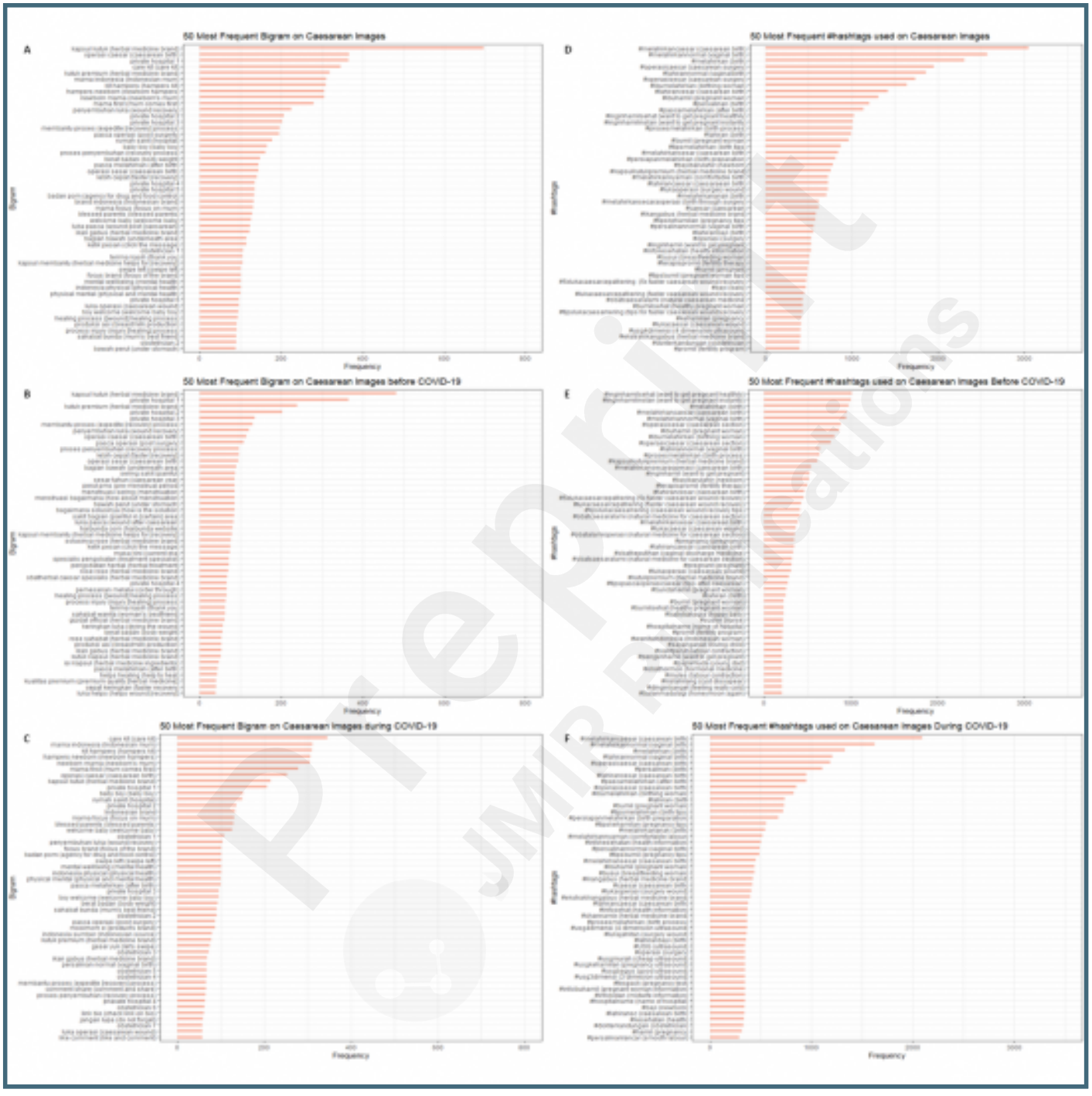
Supplementary Files

Figures

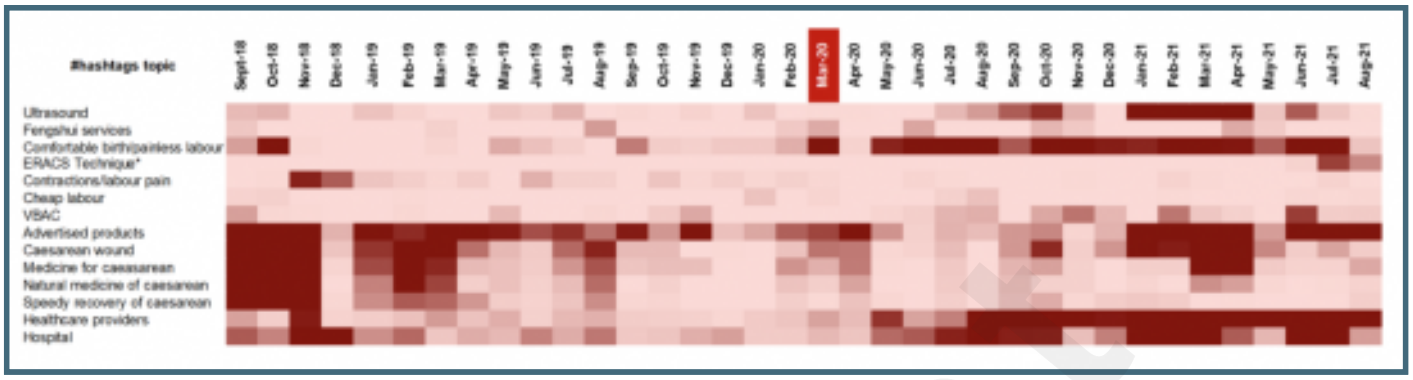
Network of words co-occurrence and correlation on CS images. Panel A is a co-occurrence network presenting word pairs that occur most often (only word pairs that occur above 50 times shown); Panel B shows words that occur more often together than with other words (we only show word pairs with coefficient > 0.8; coefficient = 1 means words always appear together).



50 most used bigram and #Hashtags on CS images (n all period = 9,978 posts, n before pandemic = 4065, n during pandemic = 5913). Panel A, B, C showed most frequent bigram appearing on CS images. Bigram is texts comprising of two words; Panel D, E, F showed most frequent #Hashtags used on CS posts.



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 [30].



Multimedia Appendixes

Additional information on list of #hashtags, coding domains, flowchart on data retrieval and sampling, most frequent objects, tags, and colour combinations, Bahasa Indonesia glossary, and type of posts and themes emerging from posts that used caesarean #hashtags yet were not relevant to caesarean.
URL: http://asset.jmir.pub/assets/70effbd723a7fe12207a25fee065b9e6.docx