Exploring the Impact of Indication on Differences in Rates of Emergency Caesarean Section in Six Palestinian Hospitals: a Prospective Cohort Study

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Research Article

Keywords: Caesarean section, emergency, Gaza, indications, odds, Palestine, West Bank

Posted Date: March 8th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1302359/v1

Abstract

Background

Caesarean section rates are rising globally. No specific caesarian section rate at either country-level or hospital-level was recommended. In Palestinian government hospitals, nearly one-fourth of all births were caesarean sections, ranging from 14.5% to 35.6%. Our aim was to assess whether differences in odds for emergency caesarean section in six Palestinian government hospitals can be explained by differences in indications.

Methods

Data on maternal and fetal health was collected prospectively for all women scheduled for vaginal delivery during the period from 1st March 2015 to 30th November 2016 in six government hospitals in Palestine. Comparisons of proportions in sociodemographic, antenatal obstetric characteristics and indications by hospital were tested by $\chi 2$ test and differences in means by one-way ANOVA analysis. The odds for emergency caesarean section were estimated by logistic regression. The amount of explained variance was estimated by Nagelkerke R square.

Results

Out of 51,041 women, 4724 (9.3%) underwent emergency caesarean section. The prevalence of emergency caesarean section varied across hospitals; from 7.6% to 22.1% in primiparous, and from 5.8% to 14.1% among parous women. The most common indications were fetal distress and failure to progress in primiparous, and previous caesarean section in parous women. Adjusted ORs for emergency caesarean section among primiparous women ranged from 0.42 (95% CI 0.31 to 0.57) to 2.41 (95% CI 1.70 to 3.40) compared to the reference hospital, and from 0.50 (95% CI 0.40-0.63) to 2.07 (95% CI 1.61 to 2.67) among parous women. Indications explained 58% and 66% of the variation in emergency caesarean section among primiparous and parous women, respectively.

Conclusion

The differences in odds for emergency caesarean section among hospitals could not be fully explained by differences in indications. Further investigations on provider related factors as well as maternal and fetal outcomes in different hospitals are necessary.

Background

Worldwide, caesarean section rates are rising [1]. On one hand the caesarean section rates among healthy primiparous women with singleton pregnancies at term, who have a low risk of caesarean section, have been constantly rising [2]. On the other hand, there is a need for better caesarean section availability, particularly in low and middle income countries, which is an essential component of comprehensive emergency obstetric and neonatal care (CEmONC) [3]. In the WHO report on caesarean

section from 2015, no specific caesarian section rate at either country-level or hospital-level was recommended [4]. However, caesarean section was recommended only to be performed with an appropriate indication [4].

In Palestine, obstetric care and delivery services are offered in government as well as private maternity hospitals. Government hospitals are available in all geographic areas and offer services at very low cost [5]. Therefore, all Palestinian women have access to similar affordable emergency obstetric services, regardless of place of residence. Only 0.1% of deliveries occur at home [5]. In Gaza, 77.4% of births take place in government hospitals, compared to 51.2% in the West Bank [5, 6]. The annual birth rate in Palestine was 31.9 per 1000 in 2015. The high fertility rate, leads to a large workload on labour wards, which are generally poorly equipped and do not offer single rooms, except for complicated cases [5, 6]. Staff numbers are low compared with the current workload [6]. Furthermore, the staffing with consultants, specialists and general practitioners varies between government hospitals, which has been described by Hassan et al [5]. One-to-one care, which is an important intervention to prevent caesarean section, is not available on the labour wards of government hospitals in Palestine [6]. In 2015 nearly one-fourth of all births were caesarean sections, ranging from 14.5–35.6% in West Bank hospitals and from 16.6–26.0% in Gaza hospitals [5]. In order to appropriately address the rising caesarean section rates, the causes for these large variations between government hospitals need to be understood. Reasons for the wide variation in caesarean section rates across different countries are still unknown, but it has been suggested that social, cultural, unequal accessibility to health services and clinical practice patterns might be major contributing factors [7–9]. Moreover, it has been shown that these variations are mainly due to differences in emergency caesarean section rates [10]. A previous study showed that differences in sociodemographic and obstetric characteristics of the population in six study hospitals did not explain variation in emergency caesarean section rates in these hospitals [11]. However, indications for emergency caesarean section, as one possible reason for varying rates, have not so far been studied in Palestine. Information on the emergency caesarean section indications will be useful for physicians and public health providers to assess the practice and improve maternal health outcomes in Palestine [9, 12].

This study aims to investigate differences in odds for emergency caesarean section between government hospitals in Palestine and explore whether potential differences can be explained by differences in indications.

Methods

The data were obtained from The Palestinian Perineum and Birth Complications Study, a prospective cohort study comprising six Palestinian government hospitals. All women scheduled for vaginal delivery in the period from 1 March 2015 until 30 November 2016 were included in the study. Women with multiple gestations, with two or more previous caesarean deliveries, those planned for elective caesarean delivery and women with missing information about mode of delivery were excluded (Fig. 1). The study hospitals present the majority of deliveries in government hospitals and are considered representative of obstetric practice in Palestine [5]. Three of the selected hospitals were in Gaza and three in the West

Bank. The hospitals were public teaching as well as referral hospitals, except for Hospital 2 which was not a referral hospital, and Hospital 3 which was not a teaching hospital.

Data collection and entry

Data on maternal sociodemographic and obstetric characteristics, mode of delivery and caesarean delivery indications were collected prospectively using case registration forms developed by Palestinian and Norwegian obstetricians and midwives [5]. The case registration forms were filled in by midwives or doctors attending the births. Data on indications for emergency caesarean delivery were registered according to the decision makers, with multiple indications or only one indication. Then all data were entered into special software (DHIS 2) and saved in the Service for Sensitive Data (TSD) platform [5].

Risk factors

Sociodemographic characteristics included maternal age, education and pre-pregnancy body mass index (BMI, kg/m^2). While obstetric characteristics were average number of children alive, history of previous caesarean section and in vitro fertilisation treatment (IVF). Data on maternal pre-pregnancy weight and height was obtained from the antenatal mother and child health handbook or by verbal inquiry from the woman if the booklet was unavailable. Mode of delivery was dichotomised into vaginal delivery and emergency caesarean section. The criteria for emergency caesarean section in the studied hospitals reflect Lucas urgency classification one, two, or three [13].

Indications for emergency caesarean section were grouped into six diagnostic categories: 1- Fetal distress, diagnosed as pathologic findings by cardiotocography and/or meconium stained amniotic fluid. 2- Failure to progress included cephalopelvic disproportion, ineffective contractions, failed forceps/vacuum, maternal exhaustion and fetal malpresentation. 3- Breech presentation. 4- Previous caesarean section. 5- Hypertensive disorder included chronic hypertension, gestational hypertension, preeclampsia and eclampsia. 6- Others, included antepartum bleeding and any other indications necessitating emergency caesarean section.

Outcomes

The primary outcome was the adjusted OR of emergency caesarean section among singleton pregnancies for five Palestinian hospitals as compared to the reference (Hospital 1). The secondary outcome was the commonest indications for emergency caesarean section among primiparous and parous women with singleton pregnancies.

Statistical analyses

Statistical analysis was performed by using descriptive statistics for the sociodemographic and obstetric characteristics of the women, presented as frequencies and proportions, and as means with standard deviations (SD) by hospital. Comparison of proportions was tested by $\chi 2$ test and differences in means by one-way ANOVA analysis. $P < 0.05$ was considered statistically significant.

Logistic regression was used to estimate the association between hospital, sociodemographic, obstetric characteristics and indications for the odds of emergency caesarean section. The strength of association was estimated by crude and adjusted odds ratios (ORs) with 95% confidence intervals (CIs). Hospital 1, which had the highest volume of deliveries, was used as reference. To investigate whether differences in indications could explain differences in odds of emergency caesarean section between hospitals, two models were tested. Model 1 adjusted for sociodemographic characteristics (maternal age, education and pre-pregnancy BMI) and obstetric characteristics (average number of children alive, history of previous caesarean section and IVF), while Model 2 additionally adjusted for indications for emergency caesarean section. The amount of explained variance by the model was given by Nagelkerke R square. The difference in R^2 between model 1 and model 2 was considered as the fraction of the variation in emergency caesarean section that can be explained by the indications. Data were analysed in the different strata according to whether the women were primiparous or parous. No multicollinearity was found among both groups. Interaction between hospital and the adjusting variables were explored by entering product terms, one at a time, into the model. Interactions with $p < 0.001$ were reported in the text. All statistical analyses were performed using SPSS 22 (version 22.0, Chicago, IL, USA).

Results

From the total of 61 678 women planned for vaginal birth during the study period, 10 637 women were excluded (Fig. 1). Among the remaining 51 041 singleton pregnant women, 4724 (9.3%) women had an emergency caesarean section.

Table 1 describes the differences in sociodemographic and obstetric characteristics between the study hospitals. The overall mean age for all women in the study was 26.5 years (SD 5.7). The majority of women had 10–12 years of education (Table 1). Information about BMI were available for > 96% of the women in four of the hospitals, while the information in the remaining two hospitals was less complete (10% and 25% missing). More than 50% of women had BMI < 25 in all hospitals except in Hospital 1, in which more than 70% of women had a BMI > 25. Less than one percent of women had undergone IVF across all hospitals.

Table 1

Maternal characteristics of the study population (N=51 041)

	Hospital 1 (n=17,314) N (%)	**Hospital 2 (n=7557) N (%)**	**Hospital 3 (n=7397) N (%)**	**Hospital 4 (n=7898) N (%)**	**Hospital 5 (n=6152) N (%)**	**Hospital 6 (n=4723) N (%)**	**P value**
	Gaza			**West Bank**			
Age (years)*	25.6±5.6	26.8±5.7	27.5±5.7	26.7±6.0	26.6±5.5	26.4±5.5	<0.001
Education (years)							
≤9	777 (4.5)	764 (10.1)	274 (3.7)	1172 (14.8)	838 (13.6)	1505 (31.9)	<0.001
10-12	11,229 (64.9)	4724 (62.5)	4118 (55.7)	4413 (55.9)	3032 (49.3)	1817 (38.5)	
≥13	5308 (30.7)	2069 (27.4)	3005 (40.6)	2313 (29.3)	2282 (37.1)	1401 (29.7)	
Missing	0	0	0	0	0	0	
BMI (kg/m^2)							
≤18.5	204 (1.2)	37 (0.5)	89 (1.3)	424 (5.5)	339 (5.6)	189 (5.4)	<0.001
18.5–24.9	4511 (26.4)	4012 (59.2)	3473 (48.9)	4525 (58.8)	3635 (60.4)	2245 (63.6)	
25–29.9	9070 (53.1)	2387 (35.2)	2997 (42.2)	2138 (27.8)	1539 (25.6)	888 (25.1)	
≥ 30	3293 (19.3)	341 (5.0)	547 (7.7)	613 (8.0)	510 (8.5)	209 (5.9)	
Missing	236	780	291	198	129	1192	
Parity							
Primiparous	5361 (31.0)	1949 (25.8)	1977 (26.7)	1859 (23.5)	1840 (29.9)	1391 (29.5)	<0.001
Parous	11 953	5608	5420	6039	4312	3332	

	(69.0)	(74.2)	(73.3)	(76.5)	(70.1)	(70.5)	
Number of children alive†							
0–1	3744 (31.3)	1353 (24.1)	1495 (27.6)	1656 (27.4)	1532 (35.5)	1156 (34.7)	<0.001
≥2	8209 (68.7)	4255 (75.9)	3925 (72.4)	4383 (72.6)	2780 (64.5)	2176 (65.3)	
Previous caesarean section**							
0	10 641 (89.0)	5286 (94.3)	4965 (91.6)	5170 (85.6)	3749 (86.9)	3037 (91.1)	<0.001
1	1312 (11.0)	322 (5.7)	455 (8.4)	869 (14.4)	563 (13.1)	295 (8.9)	
IVF							
Yes	56 (0.3)	45 (0.6)	16 (0.2)	41 (0.5)	36 (0.6)	26 (0.6)	<0.001
No	16 882 (99.7)	7295 (99.4)	7263 (99.8)	7835 (99.5)	6101 (99.4)	4655 (99.4)	
Missing	376	217	118	22	15	42	

BMI, body mass index; IVF, in vitro fertilisation treatment

*Data presented as mean ± SD

**Among parous women

The prevalence of emergency caesarean section varied significantly between hospitals (Table 2); from 7.6% in Hospital 2 to 22.1% in Hospital 6 for primiparous women, and from 5.8% in Hospital 2 to 14.4% in Hospital 6 among parous women.

Table 2
Prevalence of emergency caesarean section in the study hospitals (N = 51 041)

	Hospital 1 N (%)	Hospital 2 N (%)	Hospital 3 N (%)	Hospital 4 N (%)	Hospital 5 N (%)	Hospital 6 N (%)
	Gaza			**West Bank**		
Primiparous	613/5361 (11.4)	149/1949 (7.6)	234/1977 (11.8)	180/1859 (9.7)	256/1840 (13.9)	307/1391 (22.1)
Parous	925/11 953 (7.7)	326/5608 (5.8)	420/5420 (7.7)	384/6039 (6.4)	450/4312 (10.4)	480/3332 (14.4)
Total	1538/17 314 (8.9)	475/7557 (6.3)	654/7397 (8.8)	564/7898 (7.1)	706/6152 (11.5)	787/4723 (16.7)

Data presented as number of women who had caesarean section in the group/total number of women in the group (percentage)

Indication was given for the majority (88.3%) of the women with emergency caesarean section, ranging from 72.8% in Hospital 2 to 97.3% in Hospital 4 (Table 3). The mean number of indications per women was 1.21 (5033/4169), ranging from 1.06 in Hospital 6 to 1.31 in Hospital 5. Among women with vaginal deliveries, 1022 women had one or two indications, where 380 women were primiparous and 642 were parous. The most common indications among primiparous women were failure to progress in Hospitals 1, 2 and 3 and fetal distress in Hospitals 4, 5 and 6 (Table 3). Hospital 2 had the highest prevalence for hypertensive disorder as an indication in 14.4%. For parous women, the commonest indication in Hospitals 3, 5 and 6 was previous caesarean section, while this was failure to progress in Hospital 1, breech presentation in Hospital 2 (after ‘missing’ indications) and fetal distress in Hospital 4 (Table 3, Fig. 2a, 2b, 2c).

Table 3
Indications for emergency caesarean section in the study hospitals (n = 4724)

	Hospital 1 (n = 1538) N (%)	**Hospital 2 (n = 475) N (%)**	**Hospital 3 (n = 654) N (%)**	**Hospital 4 (n = 564) N (%)**	**Hospital 5 (n = 706) N (%)**	**Hospital 6 (n = 787) N (%)**
	Gaza			**West Bank**		
Primiparous (n = 1739)	(n = 613)	(n = 149)	(n = 234)	(n = 180)	(n = 256)	(n = 307)
Fetal distress	161 (26.3)	10 (6.7)	91 (38.9)	90 (50.0)	74 (28.9)	89 (29.0)
Failure to progress	256 (41.8)	35 (23.5)	92 (39.3)	36 (20.0)	68 (26.6)	74 (24.1)
Breech	83 (13.5)	30 (20.1)	38 (16.2)	41 (22.8)	31 (12.1)	28 (9.1)
Hypertension disorder	30 (4.9)	22 (14.8)	11 (4.7)	9 (5.0)	15 (5.9)	28 (9.1)
Others	118 (19.2)	21 (14.1)	31 (13.2)	10 (5.6)	53 (20.7)	72 (23.5)
Missing	75 (12.2)	37 (24.8)	21 (9.0)	8 (4.4)	54 (21.1)	26 (8.5)
Parous (n = 2985)	(n = 925)	(n = 326)	(n = 420)	(n = 384)	(n = 450)	(n = 480)
Fetal distress	224 (24.2)	21 (6.4)	83 (19.8)	151 (39.3)	52 (11.6)	67 (14.0)
Failure to progress	309 (33.4)	64 (19.6)	124 (29.5)	67 (17.4)	95 (21.1)	35 (7.3)
Breech	122 (13.2)	66 (20.2)	80 (19.0)	105 (27.3)	50 (11.1)	69 (14.4)
Previous caesarean section	165 (17.8)	47 (14.4)	152 (36.2)	54 (14.1)	160 (35.6)	204 (42.5)
Hypertension disorder	46 (5.0)	34 (10.4)	28 (6.7)	23 (6.0)	37 (8.2)	27 (5.6)
Others	161 (17.4)	30 (9.2)	68 (16.2)	59 (15.4)	118 (26.2)	89 (18.5)
Missing	94 (10.2)	92 (28.2)	38 (9.0)	7 (1.8)	77 (17.1)	26 (5.4)

Data presented as number (percentage)

The percentage of emergency caesarean section equal more than 100% due to 806 women (19.3%) having more than one indication

Table 4 shows crude and adjusted ORs for emergency caesarean section stratified by parity. Among primiparous women the crude ORs for emergency caesarean section differed by hospital. Compared to Hospital 1, the largest difference was found for Hospital 6 (crude OR 2.19, CI 1.88 to 2.55) and the lowest was found for Hospital 2 (crude OR 0.64, CI 0.53 to 0.77). Adjustment for sociodemographic and obstetric characteristics slightly influenced the results. Moreover, after additional adjustment for indications, still some differences in odds for emergency caesarean section were observed (Table 4, model 2). The amount of explained variance increased from 5.0% in model 1 to 63.3% in model 2, thus indication explained 58.4% of the variability in emergency caesarean section.

Table 4
Crude and adjusted odds ratios (ORs) with 95% confidence intervals (CIs) of emergency caesarean section across study hospitals

Hospitals	**Crude OR (95% CI)**	**Model 1* OR (95% CI)**	**Model 2** OR (95% CI)**
Primiparous			
Hospital 1	ref.	ref.	ref.
Hospital 2	0.64 (0.53 to 0.77)	0.60 (0.49 to 0.74)	1.12 (0.79 to 1.58)
Hospital 3	1.04 (0.89 to 1.22)	0.88 (0.74 to 1.04)	1.06 (0.77 to 1.45)
Hospital 4	0.83 (0.70 to 0.99)	0.84 (0.69 to 1.02)	0.42 (0.31 to 0.57)
Hospital 5	1.25 (1.07 to 1.46)	1.18 (0.99 to 1.41)	2.18 (1.61 to 2.96)
Hospital 6	2.19 (1.88 to 2.55)	1.88 (1.54 to 2.28)	2.41 (1.70 to 3.40)
Parous			
Hospital 1	ref.	ref.	ref.
Hospital 2	0.74 (0.65 to 0.84)	0.73 (0.64 to 0.85)	1.94 (1.51 to 2.50)
Hospital 3	1.00 (0.89 to 1.13)	0.94 (0.83 to 1.06)	0.90 (0.70 to 1.16)
Hospital 4	0.81 (0.72 to 0.92)	0.78 (0.68 to 0.88)	0.50 (0.40 to 0.63)
Hospital 5	1.39 (1.23 to 1.56)	1.35 (1.19 to 1.53)	2.07 (1.61 to 2.67)
Hospital 6	2.01 (1.78 to 2.26)	1.80 (1.56 to 2.08)	1.77 (1.33 to 2.35)

*Adjusted for sociodemographic (maternal age, education and pre-pregnancy body mass index) and obstetric characteristics (average number of children alive, history of previous caesarean section and in vitro fertilization treatment).

**Adjusted for sociodemographic (maternal age, education and pre-pregnancy body mass index) and obstetric characteristics (average number of children alive, history of previous caesarean section and in vitro fertilisation treatment) and emergency caesarean section indications (Fetal distress, failure to progress, breech, previous caesarean section, hypertension disorder and others).

Table 5
Interaction terms between hospitals and BMI, fetal distress and breech presentation

	Interaction by hospital and BMI	Interaction by hospital and fetal distress	Interaction by hospital and breech presentation
Hospital 1	ref.	ref.	ref.
Hospital 2	0.89 (0.83–0.96)	0.25 (0.11–0.59)	3.46 (1.55–7.71)
Hospital 3	0.87 (0.81–0.94)	0.97 (0.47–2.01)	5.84 (2.65–12.89)
Hospital 4	0.95 (0.90-1.00)	0.88 (0-55-1.42)	2.34 (1.37–3.99)
Hospital 5	1.04 (0.98–1.10)	0.22 (0.12–0.41)	2.97 (1.18–7.45)
Hospital 6	1.03 (0.96–1.11)	0.37 (0.19–0.72)	9.05 (2.56-32.0)
BMI Body mass index			
Adjusted for sociodemographic (maternal age, education and pre-pregnancy body mass index) and obstetric characteristics (average number of children alive, history of previous caesarean section and in vitro fertilization treatment) and emergency caesarean section indications (fetal distress, failure to progress, breech, previous caesarean section, hypertension disorder and others)			

An interaction was observed between the indication of fetal distress and hospital; the OR for emergency caesarean section increased 5.6-fold in Hospital 3, whereas the remaining hospitals showed no statistically significant differences, when compared to Hospital 1.

Among parous women, the crude ORs were similar to that of primiparous women. Adjustment for sociodemographic and obstetric characteristics influenced the ORs for all hospitals only to a small degree. When indication was included in the model, the OR of emergency caesarean section almost doubled in Hospitals 2, 5 and 6 compared to Hospital 1 and nearly halved in Hospital 4 while no difference was observed for Hospital 3 (Table 4). Among parous women the amount of explained variance attributed to indications was 66.4% (Nagelkerke R^2 increased from 2.0% in model 1 to 68.4% in model 2).

Interactions by hospitals were observed for BMI, fetal distress and breech presentation among parous women. The ORs for emergency caesarean section decreased with increasing BMI in Hospitals 2 and 3, whereas in the remaining hospitals' ORs increased with higher BMI. For fetal distress, Hospitals 2, 5 and 6 had 63–78% lower ORs for emergency caesarean section, while Hospitals 3 and 4 showed no difference

when compared to Hospital 1. The ORs of breech presentation were increased in all hospitals compared to Hospital 1 (Table 1).

Discussion

Large variations in emergency caesarean section rates were observed between hospitals among singleton pregnancies both in primiparous and parous women. The differences in odds for emergency caesarean section could not be fully explained by differences in indications, although for primiparous women 58% of the variability in emergency caesarean section could be explained by variation in indications; the corresponding percentage for parous women was 66%, respectively.

As the study hospitals were public government, they had similar work environments and available tools. However, the rates of emergency caesarean section varied significantly between the study hospitals with the lowest rate in Hospital 2 and the highest in Hospital 6. Hospital 2, not a referral hospital, transferred the high risk patients to hospitals with intensive care facilities. This factor may contribute to its emergency caesarean section rate to be the lowest. The high caesarean section rate in Hospital 6 could not be explained by maternal factors, therefore, obstetric practice and decision makers may play an important role [14, 15]. Variations in staff working schedules, clinical experience and level of knowledge of those who decide to conduct caesarean section may also contribute to explain the differences in risks for emergency caesarean section between the study hospitals [16].

In concordance with previous studies [17], the most common reasons for caesarean section among primiparous women in this study were fetal distress and failure to progress with wide variations between hospitals. Electronic fetal monitoring, which was routinely used in the study hospitals, is associated with an increased likelihood of caesarean section [16]. Furthermore, the lack of fetal scalp sampling might cause over-diagnosis [18]. Moreover, non-judicious use of oxytocin augmentation to manage large numbers of deliveries might increase the risk of fetal distress [19].

Previous caesarean section was the commonest indication among parous women with large variations between hospitals. The fear of litigation related to uterine rupture and associated risks to the mother and the fetus, might explain some variations [20, 21]. In Palestine, no medico-legal framework or indemnity for doctors exists in case of maternal or fetal complications occurring during obstetric care and procedures. Moreover, increased awareness of potential complications of vaginal delivery resulted in obstetricians having a lower threshold for advising delivery by caesarean section [22].

The indications influenced the odds of emergency caesarean section differently in each study hospital. Among primiparous women fetal distress increased the odds of emergency caesarean section to a larger extent in Hospital 3 than in the remaining hospitals. Among parous women, fetal distress increased the odds of emergency caesarean section to a larger extent in Hospitals 1, 3 and 4 than in Hospitals 2, 5 and 6. This may demonstrate a wide range in obstetric care practice between the hospitals as well as wide variations in physicians' subjective diagnosis that make the distribution of the commonest indications vary between hospitals [9, 10, 17, 23–25]. Therefore some variations might be due to varying hospital

culture emphasizing on different indications [23, 24], which became apparent when some hospitals, such as Hospital 6, mainly had one indication per woman, whereas others, such as Hospital 5, reported multiple indications in a larger proportion of women. Furthermore, physicians' may differ in their choice of indication, when multiple indications may apply, reflecting differing clinical practices rather than differing medical situations [9]. Accordingly, similar trends were observed in two study hospitals located in the Gaza-Strip, and may reflect shared beliefs and work environments. Interestingly, in the hospital with the highest emergency caesarean section rate, indications did not influence the rate, suggesting an overall lower threshold for decision towards emergency caesarean section irrespective of indication.

Several studies have reported significant variation in caesarean section rates between hospitals. Gillian studied rates of primary caesarean section in 16 health service delivery areas in British Columbia and found caesarean section rates ranging from 16.1–27.5% between areas [24]. This variation could not be explained by patient illness or indications of caesarean section, but reflected differing medical decision making. However, these results contrast those from a study in Nova Scotia, which explained high caesarean section rates by maternal characteristics [26].

Another large study from England, comparing 146 National Health Service trusts, showed large variation in rates of emergency caesarean section singleton pregnancies in different trusts [10]. Likewise, two studies from the USA showed wide variations in caesarean section rates among different facilities [8, 27]. The authors suggested that these variations were due to lack of precise criteria for indications. Our study showed similar findings which may suggest lack of guidance for clinical decision making across the study hospitals, and implies a wide range in obstetric care practice patterns and work culture [27]. The recently updated Palestinian national guidelines for standardised labour management may contribute to harmonise clinical practice [28].

Therefore, reduction of hospital variations in caesarean section prevalence and indications is essential and has to be achieved by a multimodal approach including continuous staff training and increased instrumental deliveries among low-risk groups. One further aspect is to increase evidence based practice among Palestinian obstetricians and midwives, as lack of such might be one of the reasons for the variations in frequency of common indications. Furthermore, this study as well as ongoing local audits might have practical implications for health service planners to focus on the commonest caesarean section indications and the decision makers in order to standardize maternity care and improve quality of care and maternal health outcomes.

Strengths and limitations

The data were collected for research purposes in a prospective manner. All women aiming to give birth vaginally during the study period were included, reducing the risk for selection bias. Also, indications for emergency caesarean section were registered by attending medical teams and thus reducing time related bias.

The main limitation of this study was the missing data, where almost 10% of the potential population was excluded because of missing information on mode of delivery as well as missing values on indications. The missing values were considered to be random and should therefore not influence the effect estimates. Also data did not contain specific definitions or details about diagnostic criteria for registered indications. Some of the studied indications were diagnosed subjectively depending on decision makers, with some women having more than one indication. This may affect prioritisation of the prime indication to varying degrees in different hospitals and by different decision makers. This study did not include private hospitals because most deliveries in Palestine take place in the government hospitals.

Conclusion

Large differences in rates and indications for emergency caesarean section were observed between the six government Palestinian hospitals. These could not be explained by differences in the indications for emergency caesarean section, suggesting additional factors may influence clinical practice. These findings may imply that a wide range in obstetric care practice patterns, different strategies and varying work culture played an important role in the decision to deliver by emergency caesarean section. A need for change exists in the healthcare system with greater emphasis on resources, education, continuing professional development and clinical governance. Further investigation on provider related factors as well as maternal and fetal outcomes in different hospitals, is necessary.

Abbreviations

CEmONC: comprehensive emergency obstetric and neonatal care; WHO: World Health Organization; IVF: in vitro fertilisation treatment; TSD: Service for Sensitive Data; DHIS2: District Health Information Software 2; BMI: body mass index; SD: standard deviation; OR: odds ratios; CI: confidence interval

Declarations

Ethical approval and consent to participate

This study was approved from the Helsinki Committee for Ethical Approval in Gaza (PHRC/HC/13/15), the Norwegian Data Inspectorate (17/00082-2/GRA) and the Regional Committee for Medical and Health Research Ethics in South-Eastern Norway and was considered as health quality research (REK 2014/1727). The Norwegian Data Inspectorate and the Palestinian Ministry of Health Ethics Committee accepted that no consent was needed on the premises that all women giving birth in the time period were included, all data was kept anonymously in the sensitive data platform and the women’s management was not affected.

Consent for publication

The manuscript does not include any individual person’s data; hence consent to publish is not applicable.

Availability of data and material

The dataset used in this audit is available on reasonable request from the first author's (SH), but cannot be publically shared to maintain women's confidentiality.

Competing interests

The authors declare that they have no competing interest.

Funding

Norwegian Research Council (project number 234452/14)

Authors' contributions

MWZ: in charge of data collection, participated in staff training on data registration and entry, statistical analysis for the data set; he participated in interpretation of the results and he drafted the manuscript. KL: study design, protocol and research tool development, she participated in staff training on data registration and entry and commented on the manuscript. SH: study design, she collaborated in the preparation of the protocol and research tool development, data collection, participated in staff training on data registration and entry and commented on the manuscript. EF: study design, protocol development and commented on the manuscript. ML: commented on the manuscript. KZ and HA-M: data collection, participated in staff training on data registration and entry and commented on the manuscript. BB: participated in interpretation of the results, revised the medical English language and commented on the manuscript. RSF: statistical analysis for the data set, participated in interpretation of the results and commented on the manuscript. AV: study design, protocol and research tool development and participated in staff training on data registration and entry, participated in interpretation of the results and commented on the manuscript.

All authors revised, comments, and approved the final version.

Acknowledgements

We thank the Norwegian Research Council for funding this study through Oslo University Hospital (grant number: 234452/14), and we thank the Palestinian Ministry of Health for supporting the study. We also thank the heads of obstetrics departments for facilitating and assisting before and during data collection. We also are grateful for having competent research teams at each hospital registering the data day and night.

Conflict of interest

The authors declare that they have no competing interest.

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Figures

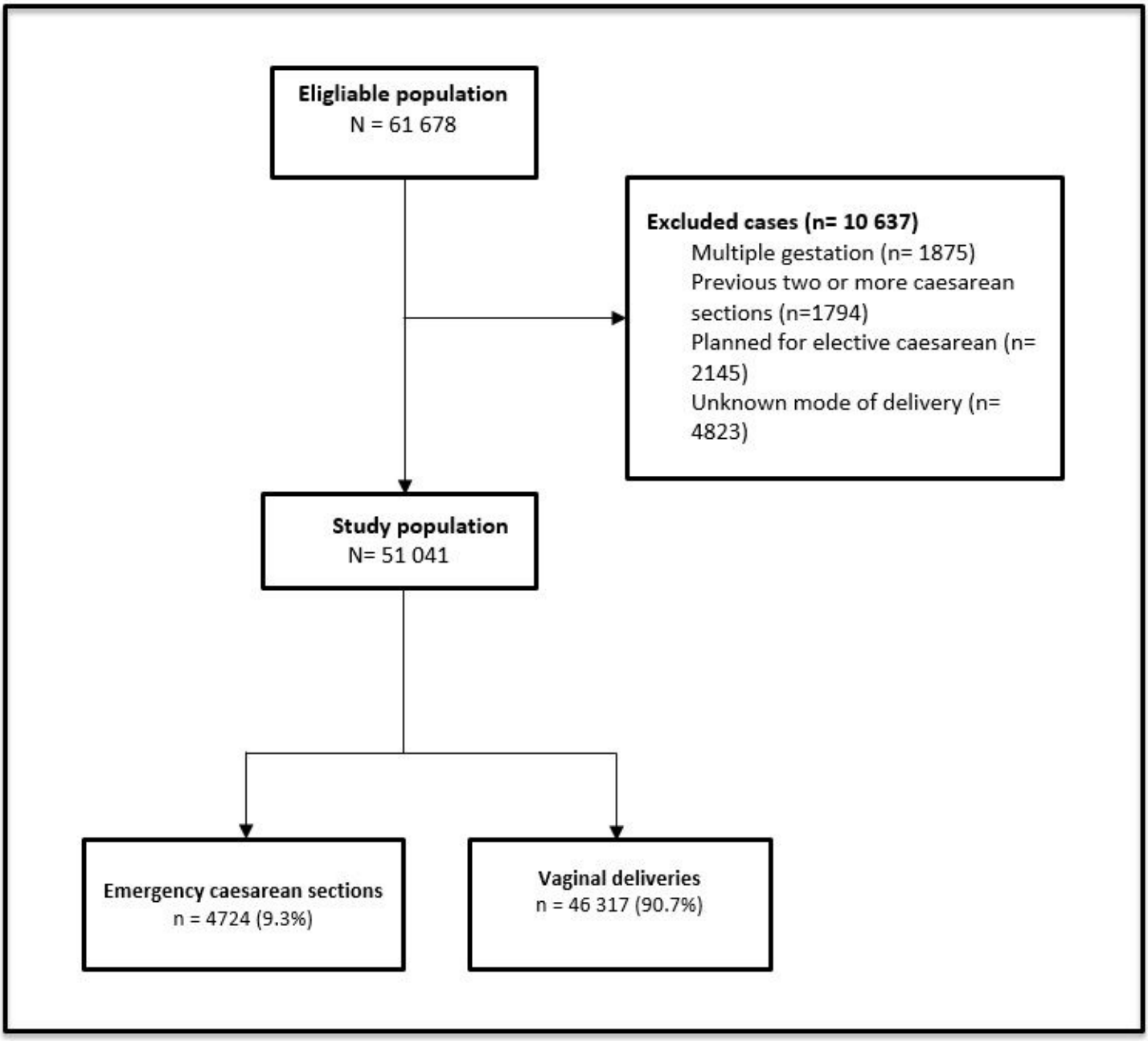

Figure 1

Flow chart of the selected study population, multicenter study from Palestine

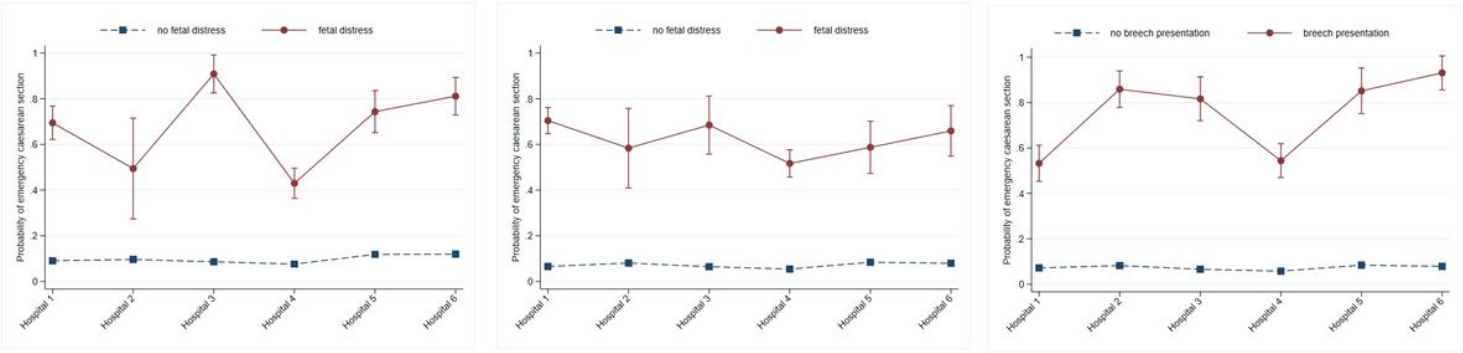

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Figure 2

Legend not included with this version.