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Characteristics of Women Receiving Emergency Caesarean Section: A Cross-Sectional Analysis from Ghana and Dominican Republic

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Abstract

Background Significant inequalities still exist between low- and high-income countries regarding access to optimum emergency obstetric care including life-saving emergency caesarean section. These relationships are considerably stronger between population-based caesarean section rates and socio-economic characteristics with poorest households experiencing significant unmet needs persistently.

Objective To explore the characteristics of women receiving emergency C-section using a new, validated definition in Ghana and the Dominican Republic.

Materials and Methods This was a cross-sectional study conducted in Ghana and the Dominican Republic. Multivariable logistic regression analysis was used to determine women's characteristics associated with emergency C-section.

Results This analysis included 2166 women who had recently delivered via C-section comprising 653 and 1513 participants from Accra and Santo Domingo, DR, respectively. Multivariable analyses showed that women, both in Ghana and the DR, were more likely to have an emergency C-section if they did not have a previous C-Section (adjusted Odds Ratio (aOR): 2.45, 95% CI [1.57–3.81]; and aOR: 15.5, 95% CI [10.5–22.90], respectively) and if they were having their first childbirth, compared to women with previous childbirth (aOR: 1.77, 95%CI [1.13–2.79]; and aOR: 1.46, 95%CI [1.04–2.04], respectively). Also, preterm birth was associated with significantly decreased likelihood of emergency C-section compared with childbirth occurring at term in both Ghana and the DR (aOR: 0.31, 95%CI [0.20–0.48]; and aOR: 0.43, 95%CI [0.32–0.58], respectively). Among the Ghanaian participants, having an emergency C-section was positively associated with being referred and negatively associated with being older than 35 years of age. Characteristics such as education, religion, marital status, and residence did not differ between women's emergency versus non-emergency C-section status.

Conclusion Emergency C-section was found to be significantly higher in women with no prior C-section or those having their first births but lower in those with preterm birth in both Ghana and the DR. Data from additional countries are needed to confirm the relationship between emergency C-section status and socio-economic and obstetric characteristics, given that the types of interventions required to assure equitable access to potentially life-saving C-section will be determined by how and when access to care is being denied or not available.

Keywords Emergency · Access · Caesarean section · Ghana · Dominican Republic

Abbreviations

aOR	Adjusted Odds Ratio
CI	Confidence interval
C-section	Caesarean section
DR	Dominican Republic
WHO	World Health Organization

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Significance Statement

Globally, there are substantial variations in access to emergency maternity care services including life-saving emergency operation during childbirth in both low- and high-income countries. These associations are noticeably stronger at the community level such that women from the poorest households do not usually receive this life-saving operation when they really need it. We studied the characteristics of women who received emergency cesarean birth using a newly endorsed definition of emergency childbirth operation in Ghana and the Dominican Republic (DR). Our study included 2166 women who had recently delivered through cesarean birth, comprising 653 and 1513 participants from Accra and Santo Domingo, DR, respectively. Our analysis indicated that women in both Ghana and the DR were more likely to have an emergency cesarean operation if they did not have a prior history of the operation and if they were having their first childbirth, compared to women with previous childbirth. Also, women whose delivery occurred sooner than expected had significantly decreased likelihood of undergoing an emergency operation during childbirth. Among the Ghanaian women, having an emergency operation was positively associated with being referred from another health center and negatively associated with being older than 35 years of age. Characteristics such as education, religion, marital status, and residence did not affect the relationship. In conclusion, there is the need for more research from other countries to confirm the relationship between the characteristics of women and the occurrence of emergency childbirth operation to provide relevant information on equitable access to maternity care services.

Introduction

Health facility-based birth rates in low- and middle-income countries (LMICS) are positively associated with socio-economic characteristics of women (Houweling et al., 2007). Such inequalities in provision of maternity care health services are a global problem which is positively skewed in favour of the rich in most regions although the greatest burden occurs in LMICs (Houweling et al., 2007). These relationships are dramatically stronger between population-based caesarean section (C-section) rates and socio-economic characteristics: women in the wealthiest households often have C-section rates above 20%, whereas among the poorest households in many countries C-section rates are less than 1% (Ronsmans et al., 2006). Generally, these insupportable inequities in access to life-saving emergency cesarean birth are usually masked by the overall national cesarean rates and evaluation using *socioeconomic position* has been recommended to better appraise the quality of providing maternity care services (Ronsmans et al., 2006).

Recently, the World Health Organization (WHO) stated that at the population level, C-section rates higher than 10% are not associated with reductions in maternal and newborn mortality rates and moreover, that "every effort should be made to provide cesarean sections to women in need, rather than striving to achieve a specific caesarean rate" (Betran et al., 2016). Although there is a global concern regarding the progressively rising cesarean section rates, access to cesarean section is problematic in the deprived regions including sub-Saharan Africa (Houweling et al., 2007). Conversely, there is evidence that significant proportion of cesarean sections performed in some countries are considered unnecessary with a call for global effort in addressing the inequities in access to maternal health care (Betran et al., 2016; Houweling et al., 2007).

Population-based surveys incorporate questions that go beyond mode of delivery and the need for an indicator for emergency C-section (CHERG MA#13, 2010). In response, a validation study among women delivering in two hospitals in Ghana and the Dominican Republic (DR) showed promising results based on survey questions which defined emergency C-section as a caesarean delivery for which the decision to operate was made after as opposed to before the onset of labour (Tunçalp et al., 2013). In the validation study, the sensitivity of 79% and 50% for emergency cesarean section (defined by decision time) were determined in Ghana and DR respectively (Tunçalp et al., 2013).

In Ghana, skilled birth attendance and caesarean section rates increased from 54% to 79% and 7% to 13%, respectively, from 2007 to 2017 (Ghana Statistical Service, 2018; Ghana Statistical Service (GSS), Ghana Health Service (GHS), 2007). The estimated maternal mortality ratio according to the WHO decreased from 380 to 308 per 100,000 live births between 2013 and 2017 (World Health Organization (WHO), 2014, 2019). On the other hand, there was nearly a universal coverage of antenatal care and skilled birth attendance in the Dominican Republic (95%) with characteristically high C-section rate of about 42% at the time the study was conducted (Macro International, 2011). However, the maternal mortality ratio for the Dominican Republic is still high (estimated at 95 [88–102] per 100,000 live births in 2017) compared to countries of similar income although lower than that of Ghana (World Health Organization (WHO), 2014, 2019).

Using data from the validation study, the objective of this analysis is to explore the characteristics of women who had undergone emergency C-section in two hospitals

in Ghana and the DR according to the validated definition for caesarean section.

Methods

Study Design and Setting

This was a cross-sectional study conducted in Ghana from June to August 2011 and in the Dominican Republic from August to November 2011. The duration of the study was different for Ghana and DR study sites because the data collection was started and completed earlier in Ghana based on the approved study protocol and the smaller sample sized required. The study was part of a larger study that validated women's self-report of emergency caesarean sections in Ghana and the Dominican Republic and the detailed information on the methodology has been published elsewhere (Tunçalp et al., 2013). Two contrasting countries were selected for the original study in terms of maternal health statistics. The study involved hospital discharge interviews conducted with women who had undergone caesarean section in two hospitals, Korle-Bu Teaching Hospital (KBTH) in Accra, Ghana and Maternity Hospital Nuestra Señora de la Altagracia in Santo Domingo, DR. The KBTH is the largest tertiary hospital in Ghana with an annual childbirth rate of approximately 10,000 with a cesarean section rate of about 40% (Boatin et al., 2017; Seffah & Adu-Bonsaffoh, 2014). The Maternity Hospital Nuestra Señora de la Altagracia in Santo Domingo, DR, is the national referral maternity hospital and a teaching hospital with approximately 18,000 deliveries per year with a cesarean rate of 33% at the time of the study (Dirección General de Información y Estadística de Salud, 2008). Both facilities used partographs as routine practice during labour and delivery and were the highest referral centers for maternal health in Accra and Santo Domingo respectively.

Study population

All women undergoing C-section who survived to hospital discharge and provided informed consent for the exit interview were eligible to be included into the study. Specific exclusion criteria consisted of women who had C-section at a peripheral facility but later referred to the study sites, those who declined to take part in the study as well as those who left the hospital before the exit interview. Also, women who were admitted in labour but did not deliver via cesarean section were also excluded from the study.

Sample Size Calculation

In this study, the sample size was calculated based on the primary outcome of validating women's self-report of undergoing emergency cesarean section in a cohort of women who delivered by cesarean birth. An assumption of 80% sensitivity, a Type 1 error of 5% for a two-tailed test and a precision of $\pm 5\%$ were made in the calculation. Based on the assumptions, the minimum sample size required to provide the needed study power were 450 and 1,460 in Ghana and DR respectively (Tunçalp et al., 2013). In this study, emergency caesarean section was defined by the decision time in which case the decision to perform the operation is made after the onset of labor (Tunçalp et al., 2013).

Data Collection

Briefly, the data on all women who had delivered over the previous 24 h were reviewed on a daily basis and those with caesarean births were identified using the surgical register at the labor wards. The potential participants' list (logbook) was compiled comprising the names and hospital identification numbers for all women who had undergone a cesarean delivery in the last 24 h. The logbook was stored securely at the hospital during the course of the study. The women who had recently undergone C-sections (potential participant list) were traced to the respective maternity wards where they had been admitted after delivery. Selection and inclusion of study participants was undertaken using simple random sampling after identifying those with caesarean delivery. Informed consent was obtained from them individually after explaining the study protocols to them. For women who consented to participate in the study, they were assigned study identification numbers and the relevant sociodemographic and obstetric data were extracted from their medical records for purposes of the study. The study participants were followed up until discharge from the hospital and exit interviews were conducted using a structured questionnaire after they had been discharged.

Ethical Consideration

The Ethical and protocol review committee of the University of Ghana Medical School provided ethical approval for the study in Ghana (MS-Et/M.9-P.4.15/2010-11), whereas the National Council of Bioethics of the Dominican Republic and Harvard School of Public Health (20857-101) approved the study in the Dominican Republic. A written informed consent was obtained from all the women who were included in the study.

Statistical Analyses

The data was analyzed using STATA version 12 (StataCorp, College Station, TX, USA). Descriptive analyses were conducted and the results presented as percentages. Univariable and multivariable logistic regression analyses were performed to assess the association between women's characteristics and emergency C-section. In this analysis, the dependent variable was emergency cesarean section by decision time, defined as C-section for which the recommendation to perform the surgery was made after labour onset. The independent variables included in the logistic regression model included maternal age, education, religion, marital status, residence, previous cesarean section, number of previous births, gestational age, and referral status. No significant missing variables were encountered and therefore no special methods were employed to address missing data. A p-value of < 0.05 was considered as significant (Fig. 1).

Results

In this study, we included 2166 women who had recently delivered via C-section, comprising 653 and 1513 participants from Accra, Ghana and Santo Domingo, DR, respectively. In Ghana, there were 740 deliveries over the study period out of which 659 (89.1%) were interviewed. Six participants were further excluded from the analysis because of incomplete data, resulting in 653 participants (88.2%) included in the final analysis. In the DR, there were 2949 births during the study period out of which 1531 (51.9%) were interviewed. Eighteen participants were further excluded from the analysis because of incomplete data, resulting in 1513 participants (51.3%) included in the final analysis. In Ghana, 14 (2.1%) and 158 (24.2%) of the women were below 20 years and above 34 years respectively compared to 410 (27.1%) and 94 (6.2%) women in the DR respectively. Also, 218 (33.4%) and 597 (61.3%) in Ghana and the DR respectively had not given birth before besides their current childbirth. In Ghana, 133 (20.4%) of the study participants had low educational status (up to primary level) compared to 418 women (27.6%) in the DR. Tertiary level of education was recorded in 91 (13.8%) and 242 (16.0%) in Ghana and the DR participants, respectively. Among the study population, 232 (35.5%) and 586 (38.7%) of the Ghanaian and DR women had had at least a previous C-section. In terms of gestational age at childbirth, 169 (25.9%) and 399 (26.4%) women in Ghana and the DR respectively were delivered at age of 37 weeks or earlier. The socio-demographic and pregnancy-related characteristics of the study participants are shown in Table 1.

Table 2 shows the associations between the socio-demographic and pregnancy-related characteristics and emergency C-section status among the study population. In multivariable analyses, women both in Ghana and the DR were more likely to have an emergency C-section if they did not have a previous C-section (adjusted Odds Ratio (aOR): 2.45, 95% CI [1.57–3.81], $p < 0.001$; and aOR: 15.5, 95% CI [10.5–22.90], $p < 0.001$, respectively). Similarly, women with no history of previous childbirth (nulliparity) were

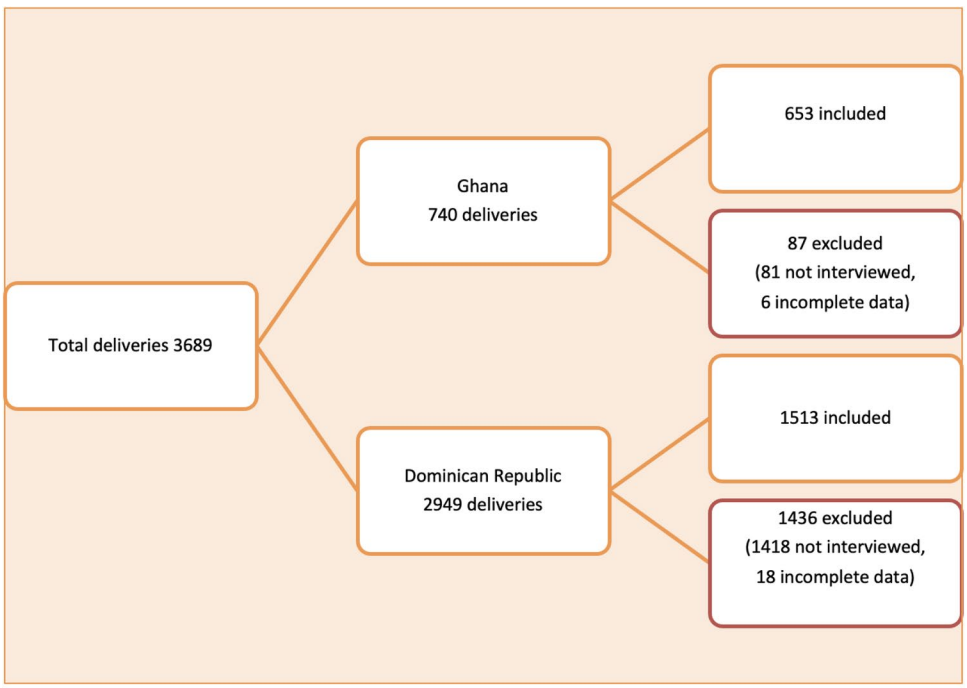

Fig. 1 Flow chart of recruitment in Ghana and the Dominican Republic

Table 1 Characteristics of women who had emergency and non-emergency caesarean section in Ghana and the Dominican Republic

Variable	Ghana ($N=653$)			Dominican Republic ($N=1513$)		
	Emergency C-section *n*(%)	Non-emergency C-section *n*(%)	Total *N* (%)	Emergency C-section *n*(%)	Non-emergency C-section *n*(%)	Total *n N* (%)
Age						
<20	6 (2.2)	8 (2.1)	14 (2.1)	228 (38.2)	182 (19.9)	410 (27.1)
20–34	231 (83.7)	250 (66.3)	481 (73.7)	340 (56.9)	669 (73.0)	1009 (66.7)
>=35	39 (14.1)	119 (31.6)	158 (24.2)	29 (4.9)	65 (7.1)	94 (6.2)
Education						
Up to primary	64 (23.2)	69 (18.3)	133 (20.4)	159 (26.6)	259 (28.3)	418 (27.6)
Secondary	174 (63.0)	255 (67.6)	429 (65.7)	348 (58.3)	505 (55.1)	853 (56.4)
Above secondary	38 (13.8)	53 (14.1)	91 (13.9)	90 (15.1)	152 (16.6)	242 (16.0)
Religion						
Christian/Catholic	235 (85.1)	328 (87.2)	563 (86.2)	399 (66.8)	657 (71.7)	1056 (69.8)
Muslim	41 (14.9)	48 (12.8)	89 (13.6)	0 (0)	0 (0)	0 (0)
No religion	0 (0)	0(0)	n/a	191 (32.0)	247 (27.0)	438 (29.0)
Other	–	–	1 (0.2)	–	–	19 (1.3)
Marital status						
With a partner	223 (80.8)	330 (87.5)	553 (84.7)	490 (82.1)	785 (85.7)	1275 (84.3)
Without a partner	53 (19.2)	47 (12.5)	100 (15.3)	107 (17.9)	131 (14.3)	238 (15.7)
Residence						
Urban	212 (77.7)	305 (80.9)	517 (79.2)	549 (92.3)	832 (90.9)	1381 (91.3)
Rural	61 (22.3)	72 (19.1)	133 (20.4)	46 (7.7)	83 (9.1)	129 (8.5)
Missing data	–	–	3 (0.4)	–	–	3 (0.2)
Previous C-section						
No	220 (79.7)	201 (53.3)	421 (64.5)	552 (92.5)	375 (40.9)	927 (61.3)
Yes	56 (20.3)	176 (46.7)	232 (35.5)	45 (7.5)	541 (59.1)	586 (38.7)
Number of previous births[a]						
None	129 (46.7)	89 (23.6)	218 (33.4)	384 (64.3)	213 (23.2)	597 (39.5)
1–2 births	107 (38.8)	213 (56.5)	320 (49.0)	157 (26.3)	583 (63.6)	740 (48.9)
>2 births	40 (14.5)	75 (19.9)	115 (16.6)	56 (9.4)	120 (13.1)	176 (11.6)
Gestational age at birth						
<=37 weeks	42 (15.5)	127 (33.7)	169 (25.9)	125 (20.9)	274 (29.9)	399 (26.4)
>37 weeks	229 (84.5)	250 (66.3)	479 (73.3)	472 (79.1)	642 (70.1)	1114 (73.6)
Missing data	–	–	5 (0.8)	–	–	0 (0)
Referral status						
No	30 (10.9)	120 (31.8)	150 (23.0)	441 (73.9)	682 (74.4)	1123 (74.2)
Yes	246 (89.1)	257 (68.2)	503 (77.00	156 (26.1)	234 (25.6)	390 (25.8)

[a]Number of births excluding the current pregnancy

more likely to deliver via an emergency caesarean section among the participants in both Ghana (aOR: 1.77, 95% CI [1.13–2.79], $p<0.05$) and the DR (aOR: 1.46, 95% CI [1.04–2.04], $p<0.05$). In Ghana, women with advanced maternal age (≥ 35 years) were less likely to undergo emergency caesarean section (aOR: 0.38, 95% CI [0.23–0.66], $p<0.05$) but there was no association in the DR study participants. Also, women with gestational age at delivery of <37 weeks (preterm birth) were less likely to deliver by an emergency C-section in both Ghana (aOR: 0.31, 95% CI [0.20–0.48], $p<0.001$) and the DR (aOR: 0.43, 95% CI [0.32–0.58], $p<0.001$) compared to those with a gestational age of 37 weeks and above.

Discussion

In this study, we sought to examine and compare the characteristics of women who had emergency versus non-emergency C-sections in two hospitals in Ghana and the DR. Our results show that previous C-section is associated with lower likelihood of emergency C-section in subsequent deliveries

Table 2 Associations between characteristics and emergency C-section status among women in Ghana and the Dominican Republic

Variable	Ghana ($N=653$)				Dominican Republic ($N=1513$)			
	Crude OR (95% CI)	*P* value	Adjusted OR (95% CI)	*P* value	Crude OR (95% CI)	*P* value	Adjusted OR (95% CI)	*P* value
Age								
<20	0.81 (0.28–2.37)	NS	0.53 (0.16–1.81)	NS	2.46 (1.95–3.12)	<0.001	1.31 (0.95–1.79)	NS
20–34	1.00		1.00		1.00		1.00	
>=35	0.35(0.24–0.53)	<0.001	0.38 (0.23–0.66)	<0.01	0.88 (0.56–1.39)	NS	1.02 (0.59–1.76)	NS
Education								
Up to primary	1.36 (0.91–2.01)	NS	1.21 (0.76–1.93)	NS	0.89 (0.70–1.13)	NS	0.90 (0.67–1.22)	NS
Secondary	1.00		1.00		1.00		1.00	
Above secondary	1.05 (0.66–1.66)	NS	1.03 (0.60–1.77)	NS	0.86 (0.64–1.15)	NS	0.88 (0.61–1.27)	NS
Religion								
Christian/Catholic	1.00		1.00		1.00		1.00	
Muslim	1.19 (0.76–1.87)	NS	1.28 (0.76–2.16)	NS	n/a		n/a	
No religion	n/a		n/a		1.27 (1.01–1.60)	<0.05	1.33 (1.00–1.76)	NS
Marital status								
With a partner	1.00		1.00		1.00		1.00	
Without a partner	1.67 (1.09–2.56)	<0.05	1.18 (0.72–1.95)	NS	1.31 (0.99–1.73)	NS	0.99 (0.72–1.40)	NS
Residence								
Urban	1.00		1.00		1.00		1.00	
Rural	1.22 (0.83–1.79)	NS	1.02 (0.66–1.58)	NS	0.84 (0.58–1.22)	NS	0.82 (0.52–1.28)	NS
Previous C-section								
No	3.43(2.41–4.91)	<0.001	2.45(1.57–3.81)	<0.001	17.7 (12.71–24.64)	<0.001	15.5 (10.5–22.9)	<0.001
Yes	1.00		1.00		1.00		1.00	
Number of previous births[a]								
None	2.88 (2.02–4.12)	<0.001	1.77 (1.13–2.79)	<0.05	6.69 (5.23–8.54)	<0.001	1.46 (1.04–2.04)	<0.05
1–2 births	1.00		1.00		1.00		1.00	
>2 births	1.06 (0.68–1.66)	NS	1.20 (0.71–2.04)	NS	1.73 (1.20–2.49)	0.01	1.08 (0.70–1.68)	NS
Gestational age at birth								
<=37 weeks	0.36 (0.24–0.53)	<0.001	0.31 (0.20–0.48)	<0.001	0.62 (0.47–0.79)	<0.001	0.43 (0.32–0.58)	<0.001
>37 weeks	1.00		1.00		1.00		1.00	
Referral status								
No	1.00		1.00		1.00		1.00	
Yes	3.83 (2.47–5.92)	<0.001	3.59 (2.19–5.91)	<0.001	1.03 (0.81–1.30)	NS	0.93 (0.70–1.25)	NS

NS Non significant (p value > 0.05); [a]Number of births excluding the current pregnancy, *OR* Odds ratio, *CI* Confidence interval

in both countries compared to women with no history of previous caesarean birth. This may be attributable to the fact that a higher proportion of women with a previous C-section were scheduled for repeat cesarean birth prior to the onset of labor. This is an interesting finding which buttresses the fact that previous C-section represents a major risk factor for subsequent caesarean delivery because of the potentially serious complications associated with trial of vaginal birth including uterine rupture (Boatin et al., 2017; Seffah & Adu-Bonsaffoh, 2014). Globally, cesarean section rates have been increasing progressively in both low- and high-income countries with differential negative effects across different regions including severe maternal morbidities (Betran et al., 2016).

More recently, the WHO has recommended specific non-clinical interventions to reduce unnecessary cesarean deliveries because of the potentially serious complications associated with the procedure (World Health Organization, 2018).

Similarly, other international organizations have instituted evidence-based measures to reduce the global epidemic of high cesarean births (Caughey et al., 2014; Visser et al., 2018). Recent estimates indicate a global cesarean section rate of 21% with approximately 5% in Sub-Saharan Africa to about 43% in Latin America and the Caribbean. Based on the current estimates, the worldwide cesarean section rate is projected to be approximately 28.5% by the year 2030, representing 38 million cesarean births (Betran et al., 2021). The progressively rising rates of cesarean section is alarming and require a concerted global approach in addressing the situation. There is the need to explore evidence-based measures to reducing the global caesarean rates including vaginal birth after previous cesarean section as well as prevention of unindicated primary caesarean births.

Moreover, women in both countries were more likely to have an emergency C-section if this was their first birth, compared to women who had delivered before (aOR: 1.77, 95%CI [1.13–2.79], $p < 0.05$; and aOR: 1.46, 95%CI [1.04–2.04], $p < 0.05$, respectively). In this study, emergency C-section was defined based on the time of decision to perform the C-section with the onset of labor being the reference point. Tebeu et al. reported a similar increase in cesarean section rate in nulliparous women in Cameroun, although there was no distinction between emergency and non-emergency cesarean births in their study (Tebeu et al., 2011). Also, preterm birth was associated with significantly decreased likelihood of emergency C-section compared with childbirth occurring at term in both countries (aOR: 0.31, 95%CI [0.20–0.48], $p < 0.001$; and aOR: 0.43, 95%CI [0.32–0.58], $p < 0.001$, respectively). This might be attributed to some obstetric emergencies or complications which necessitate delivery prior to the onset of labour and these include severe preeclampsia/eclampsia and antepartum hemorrhage.

In Ghana only, multivariable analyses showed that having an emergency C-section was positively associated with being referred to the facility and negatively associated with being older than 35 years of age compared to women who had a non-emergency C-section. Generally, most uncomplicated deliveries are conducted in the primary health care centres and maternity homes in Ghana and the complicated ones are referred to tertiary centres such as the study facility. It is therefore not surprising that referred cases were associated with higher frequencies of emergency C-section.

As observed in the case of Ghana among women who were referred and $>=35$ age women, overall, emergency C-section as an indicator can identify different sets of women and situations depending on the local and country setting and inform service delivery and resource allocation. Moreover, it might be used along with the recommended Robson classification (Robson, 2001), which allows a standardized way for assessing, monitoring, and comparing caesarean section rates within healthcare facilities over time (Betran et al., 2016; Vogel et al., 2015).

Intriguingly, socio-demographic characteristics such as education, religion, marital status, and residence did not differ between women's emergency versus non-emergency C-section status among women who delivered by C-section. This possibly suggests that the stark socio-economic inequalities in population-based health facility delivery and C-section rates shown across low-resource settings dissipate by the time the emergency versus non-emergency status of C-section is determined. A recent study from Ethiopia showed that C-section rates were significantly higher in women with secondary or higher levels of education compared with those with primary or no education (Gebremedhin, 2014). However, there was no distinction between the emergency and non-emergency status of the C-section in their report unlike the current study, which looked at the emergency C-section and socioeconomic and obstetric characteristics. Data from additional countries are needed to confirm the relationship between emergency C-section status and socio-economic characteristics, given that the types of interventions required to assure equitable access to potentially life-saving C-section will be determined by how and when access to care is being denied or not available. The application of the validated definition for caesarean section based on data from the validation study is considered a strength of the study.

In terms of limitations, information on a range of other socio-economic variables such as the income level and occupation were not obtained as part of this study and may have influenced our results. Also, our analysis did not control for obstetric complications such as antepartum hemorrhage and severe hypertensive emergencies, as these morbidities may contribute to the need for immediate delivery prior to the onset of labor. However, the findings of this study represent a valuable evidence-based information with significant potential of improving the quality of maternal health care in contemporary clinical practice.

Conclusion

Our study explored the characteristics of women who underwent emergency C-section in Accra, Ghana and Santo Domingo, DR. Emergency C-section was found to be significantly higher in women with no prior C-section or those having their first births but lower in those with preterm birth in both countries. Data from additional countries are needed to confirm the relationship between emergency C-section status and socio-economic and obstetric characteristics, given that the types of interventions required to ensure equitable

access to potentially life-saving C-section will be determined by how and when access to care is being denied and/or not available.

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Author Contributions OT, AC and KAB conceived and designed the study. KAB, OT and AC conducted the study. OT and KAB analyzed the data. KAB wrote the manuscript and OT and AC provided input to the manuscript. All authors read and approved the final manuscript.

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Data Availability The datasets for the current study available from the corresponding author on reasonable request.

Declarations

Conflict of Interest The authors declare no competing interests.

Ethical Approval The Ethical and protocol review committee of the University of Ghana Medical School provided ethical approval for the study in Ghana (MS-Et/M.9-P.4.15/2010-11) whereas the National Council of Bioethics of the Dominican Republic and Harvard School of Public Health (20857-101) approved the study in the Dominican Republic. AC was at Harvard Medical School at the time the study took place.

Consent to Participate A written informed consent was obtained from all the women who were included in the study.

Consent for Publication Not applicable.

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