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CLINICAL ARTICLE

Q1 A cross-sectional study of indications for cesarean deliveries in Médecins
 3 Sans Frontières facilities across 17 countries

Q2 Reinou S. Groen^{a,b,*}, Miguel Trelles^c, Severine Caluwaerts^c, Jessica Papillon-Smith^d, Saiqa Noor^e,
 5 Burhani Qudsia^f, Brigitte Ndelema^g, Kalla M. Kondo^h, Evan Wong^{a,i}, Hiten D. Patel^j, Adam L. Kushner^{a,k}

^a Surgeons OverSeas, New York, NY, USA^b Department of Gynecology and Obstetrics, Johns Hopkins Hospital, Baltimore, MD, USA^c Surgery, Anesthesia, Gynecology, and Emergency Medicine Unit, Médecins Sans Frontières (MSF), Operational Centre Brussels, Brussels, Belgium^d Department of Obstetrics and Gynecology, McGill University, Montreal, QC, Canada^e MSF District Headquarters Hospital, Timegara, Pakistan^f MSF Ahmad Shah Baba General Hospital, Kabul, Afghanistan^g MSF Obstetric Emergency Centre of Kabezi, Kabezi, Rural Bujumbura Province, Burundi^h MSF Referral General Hospital, Dakoro, Nigerⁱ Centre for Global Surgery, McGill University Health Centre, Montreal, QC, Canada^j James Buchanan Brady Urological Institute, Johns Hopkins Medical Institutions, Baltimore, MD, USA^k Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

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ABSTRACT

Objective: To review the major indications for cesareans performed by Médecins Sans Frontières (MSF) personnel from the Operational Center Brussels. **Methods:** A retrospective study was undertaken of all singleton cesarean deliveries from 2008–2012 for which indications were recorded. Location of project, age of patient, type of anesthesia, and duration of operation were also recorded. **Results:** A total of 14 151 singleton cesarean deliveries were identified from 17 countries. Among the 15 905 indications recorded, the most common was failure to progress or cephalopelvic disproportion (4822 [30.3%]), followed by previous uterine scar (2504 [15.7%]), non-reassuring fetal status (2306 [14.5%]), and fetal malpresentation (1746 [11.0%]). Other indications were placenta or vasa previa (794 [5.0%]), uterine rupture (676 [4.3%]), hypertensive disorders (659 [4.1%]), placental abruption (520 [3.3%]), pre-rupture (450 [2.8%]), and cord prolapse (365 [2.3%]). **Conclusion:** Indications for cesareans in MSF settings differ from those in higher-income countries. Further investigation is needed for adequate emergency obstetric care coverage.

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1. Introduction

It is estimated that 287 000 women died of complications related to pregnancy and parturition worldwide in 2010 [1]. Of these maternal deaths, 99% occurred in low-income countries, where access to emergency obstetric care is limited; maternal mortality is the health indicator with the most significant gap between high- and low-income countries [1–3].

In an effort to highlight major deficiencies experienced by low- and middle-income countries (LMICs), the UN established the Millennium Development Goals (MDGs) in 2000. One of these goals was dedicated to improving maternal health, aiming for a 75% reduction in the

worldwide maternal mortality ratio between 1990 and 2015 [3]. However, Ameh et al. [4] evaluated access to emergency obstetric services in six low-income countries approximately 5 years before the MDG target and established that lifesaving interventions for obstetric complications remained unavailable to most women.

Cesarean deliveries should be available to all laboring women in case a maternal or neonatal emergency arises. The proportion of deliveries that occur by cesarean is a quality indicator for adequate coverage of obstetrical services, and WHO have stated that the minimum proportion of deliveries that should occur by cesarean is 5% [2]. Although reports from Tanzania [5] and Bangladesh [6] document increasing numbers of cesarean deliveries in LMICs, most epidemiological analyses reveal that access to this emergency obstetric service remains inadequate, with only 1%–2% of deliveries occurring by cesarean in many African countries [4,7,8].

Interest in global health work is increasing amongst gynecologists from high-income countries [9,10]. However, a good understanding of the complexities involved in working in LMICs is needed to work or assist

* Corresponding author at: Department of Gynecology and Obstetrics, Johns Hopkins Hospital, 600 North Wolfe Street, Phipps 279, Baltimore, MD 21287, USA. Tel.: +1 410 955 6710; fax: +1 410 502 6683.

E-mail addresses: rsgroen@hotmail.com, rgroen1@jhmi.edu (R.S. Groen).

in such settings. Notably, the surgical indications can differ, and good operative skills are required to practice in areas with limited resources.

Médecins Sans Frontières (MSF), also known as Doctors without Borders, is a medical organization which operates in over 70 countries and is dedicated to providing quality medical care to populations in crisis [11]. As such, MSF is uniquely positioned to shed light on what skills are required in low-resource settings. Therefore, the primary goal of the present study was to review the major indications for singleton cesarean deliveries performed by MSF personnel from the Operational Center Brussels (OCB) in disaster and conflict settings. Secondly, other gynecologic procedures performed were also examined to better prepare gynecologists aspiring to work in low-resource settings.

2. Materials and methods

In a retrospective study, data obtained through standard evaluation and monitoring of surgical procedures performed by OCB personnel in 2008–2012 were assessed. Because the database was de-identified, consent was not needed. The present study satisfied the criteria for ethics exemption from the MSF Ethical Review Board.

Data for surgical procedures performed by OCB personnel are aggregated at the MSF OCB headquarters in Brussels, Belgium. They are independently verified for completeness and accuracy by the director of the Surgical, Anesthesia, Gynecology and Emergency Medicine unit (M.T.). Any identified discrepancies are clarified immediately by contacting the personnel in the projects who initially entered the data.

For the present study, all project databases from 2008–2012 were combined into one electronic database in Excel 2007 (Microsoft, Redmond, WA, USA). Procedures and indications were initially classified into broad categories, including wound-related, visceral, orthopedic, gynecologic, and obstetric (with urology), as previously described [12]. All cesareans in the obstetric categories were included in the present analysis. Additional comments and notes recorded at data entry were individually reviewed for indications of singleton cesareans, which were divided into categories per Timofeev et al. [13] (Box 1) by a researcher (R.S.G.) proficient in English and French. Any indication that was unclear (e.g. an unknown abbreviation) was discussed with two other bilingual authors (J.P.-S. and E.W.) until a group consensus was achieved. One procedure could have a maximum of two indications; if more indications were recorded, only the two most emergent indications were noted. Any cesarean without an indication was recorded as missing data. Location of project, age of patient, type of anesthesia, indication for cesarean, and duration of operation were also recorded.

To give a full outline of activities a gynecologist can encounter while working with MSF, information about conditions and types of operation other than cesareans was also assessed.

Initially, descriptive statistics were used. Prevalence ratios were calculated to elucidate differences in the likelihood of common cesarean indications between age groups. Statistical analyses were conducted with Stata version 12.0 (StataCorp, College Station, TX, USA).

Box 1

Categories used as indications for cesarean deliveries.

Failure to progress in labor or cephalic disproportion; malpresentation; chorioamnionitis; failed induction; failed trial of forceps or vacuum; failed vaginal birth after cesarean delivery; non-reassuring fetal heart status; fetal anomaly; macrosomia; active infection of HIV, herpes simplex virus, or excessive condylomata; placental abruption; placenta previa or vasa previa; maternal hypertensive disease (pre-eclampsia or eclampsia); previous uterine scar; shoulder dystocia; elective; uterine rupture; (suspicion of) uterine pre-rupture; cord prolapse, or other.

3. Results

A total of 24 182 cesarean deliveries were initially identified by the standard coding system [12]. However, only 14 506 (60.0%) had a specific indication recorded in the supplementary notes. An additional 137 cesarean deliveries that were initially miscoded were included in the present analysis. Therefore, 14 643 cesarean deliveries performed in 17 countries were included (Table 1).

The median age of the women undergoing cesarean was 25 years, and 6180 (42.2%) were younger than 25 years at the time of their cesarean (Table 2). Most procedures were performed with a spinal anesthetic, and 6514 (44.5%) lasted 60 minutes or fewer (Table 2).

Among the 14 643 cesareans, 483 (3.3%) were done for twins and 9 (0.1%) for triplets. Among the 14 151 singleton cesarean deliveries, 1754 (12.4%) had two documented indications. Therefore, there were 15 905 indications for singleton cesareans.

The most common indication for a cesarean delivery of a singleton in an MSF setting was failure to progress or cephalopelvic disproportion, followed by previous uterine scar, non-reassuring fetal status, and fetal malpresentation (Table 3). Only 3 (0.1%) recorded indications were related to infectious disease (one for HIV, one for excessive genital condylomata acuminata, and one for active genital herpes simplex virus).

Failure to progress or cephalopelvic disproportion was significantly more common as an indication for a singleton cesarean delivery in women younger than 25 years than in those aged at least 25 years ($P < 0.001$) (Table 4). However, a previous uterine scar was more likely to be the indication in women aged at least 20 years than in those younger than 20 years, and uterine rupture was more prevalent in women aged at least 30 years than among those aged younger than 30 years ($P < 0.001$ for both) (Table 4). Among the 676 documented uterine ruptures, a previous uterine scar was noted as a second indication for 16 (2.4%).

As previously mentioned by Wong et al. [12], 9277 other gynecologic procedures were performed. These included 2462 curettages, 3002 complex deliveries (including laceration repairs and retained placentas), 2228 major gynecologic surgeries (including hysterectomies, oophorectomies, and pelvic tumor resections), and 1585 obstetric fistula repairs. Of the 641 documented hysterectomies that had additional notes, 189 (29.5%) specifically mentioned that the hysterectomy was performed in the peripartum context or in the setting of a uterine rupture, alluding to a cesarean hysterectomy. The detailed notes showed

Table 1
Cesarean deliveries with specific indications listed (n = 14 643).^a

Country	No. (%)	
Afghanistan	106 (0.7)	t1.1
Burundi	3872 (26.4)	t1.2
Central African Republic	97 (0.7)	t1.3
Chad	0	t1.4
Côte d'Ivoire	170 (1.2)	t1.5
Democratic Republic of the Congo	4326 (29.5)	t1.6
Haiti	403 (2.8)	t1.7
India	15 (0.1)	t1.8
Indonesia	0	t1.9
Iraq	253 (1.7)	t1.10
Kenya	0	t1.11
Lesotho	31 (0.2)	t1.12
Libya	0	t1.13
Mali	2 (<0.1)	t1.14
Niger	1204 (8.2)	t1.15
Pakistan	1464 (10.0)	t1.16
Sierra Leone	1921 (13.1)	t1.17
Somalia	696 (4.8)	t1.18
South Sudan	43 (0.3)	t1.19
Sudan	39 (0.3)	t1.20
Syria	1 (<0.1)	t1.21

^a Singleton and multiple deliveries included.

Table 2
Maternal characteristics.^a

Characteristics	Cesarean deliveries with indication recorded (n = 14 643)
Age, y	26.5 ± 6.9 (25)
<15	31 (0.2)
15–19	2253 (15.4)
20–24	3896 (26.6)
25–29	3469 (23.7)
30–34	2459 (16.8)
≥35	2535 (17.3)
Type of anesthesia	
Spinal	11 207 (76.5)
General (ketamine) without intubation	1854 (12.7)
General (ketamine) with intubation	753 (5.1)
Combination	562 (3.8)
Other	12 (0.1)
Missing	255 (1.7)
Time in operating room, min	69.9 ± 24.1 (65)
≤30	41 (0.3)
31–60	6473 (44.2)
61–90	6606 (45.1)
>90	1265 (8.6)
Missing	258 (1.8)

^a Values are given as mean ± SD (median) or number (percentage).

that 45 craniotomies were performed and 107 molar pregnancies were identified and surgically treated.

4. Discussion

In the present study, the most common indication for a singleton cesarean delivery in disaster and conflict settings was failure to progress or cephalopelvic disproportion. This indication was more common in women aged younger than 25 years than among those aged at least 25 years. Additionally, uterine rupture was more common among women aged at least 30 years, and few ruptures occurred among women with a previous uterine scar.

The existing literature on this topic—although scant—lends support to the present findings. In a systematic review of the indications for cesarean in Sub-Saharan Africa, Dumont et al. [14] noted that the six most frequent indications were protracted labor, placental abruption, previous cesarean, eclampsia, placenta previa, and fetal malpresentation. In a large study conducted by Festin et al. in 2009 [15], the indications

Table 4
Indications by age.

	Proportion ^a	Prevalence ratio	P value	% difference (95% CI)
Cephalopelvic disproportion and failure to progress				
<25 y	2650/6755	1.65	<0.001	15.5 (14.0–16.9)
≥25 y	2172/9150	Ref.		
Uterine rupture				
<30 y	309/10 459	Ref.		
≥30 y	367/5446	2.28	<0.001	3.8 (3.0–4.6)
Previous uterine scar				
<20 y	149/2513	Ref.		
≥20 y	2355/13 392	2.97	<0.001	11.7 (10.5–12.8)

^a Values are given as number of cesarean deliveries with the indication in the age group/total number of cesarean deliveries in the age group.

for cesarean were assessed in four Southeast Asian countries: the most common were repeat cesarean, obstructed labor, and malpresentation. Likewise, Chu et al. [7] prospectively evaluated the most common indications for cesarean in a subset of countries where MSF OCB operates and concluded that obstructed labor was the most common indication, followed by malpresentation. They also noted a 9.2% rate of uterine rupture [7]. Although the data from the Sub-Saharan African countries studied by Chu et al. are included in the database used in the present study, their differing results can be partly explained by the fact that only one indication was noted per cesarean and that multiple gestations were included in their analysis. Overall, most studies show that cephalopelvic disproportion and failure to progress is the main indication for cesareans in low-resource settings.

In the USA, cesarean remains the most frequently performed operating room procedure [16]. As in other high-income countries, the most common indication is a history of cesarean delivery [13,17,18]. In fact, Timofeev et al. [13] revealed that repeat cesarean or a history of uterine scar accounted for nearly 37% of all cesareans performed in women older than 25 years in the USA. It would be beneficial to know how often full dilation was achieved in Timofeev et al.'s study [13] as well as in the present analysis, because the frequency might differ between high-income countries and LMICs.

Differences in cephalopelvic disproportion versus failure to progress between high- and low-resource settings may be present secondary to the lack of tocodynamometers, intrauterine pressure monitors, and automated flow rates for oxytocin titration in low-income countries.

Table 3
Indications for singleton cesareans (n = 15 905).^{a,b}

Indications	Overall (n = 15 905)	<15 y (n = 33)	15–19 y (n = 2480)	20–24 y (n = 4242)	25–29 y (n = 3704)	30–34 y (n = 2651)	≥35 y (n = 2795)
Failure to progress or cephalopelvic disproportion	4822 (30.3)	15 (45.5)	1113 (44.9)	1522 (35.9)	1009 (27.2)	590 (22.3)	573 (20.5)
Previous uterine scar	2504 (15.7)	2 (6.1)	147 (5.9)	740 (17.4)	800 (21.6)	470 (17.7)	345 (12.3)
Non-reassuring fetal status/fetal heart tracing	2306 (14.5)	6 (18.2)	452 (18.2)	686 (16.2)	491 (13.3)	361 (13.6)	310 (11.1)
Malpresentation	1746 (11.0)	1 (3.0)	247 (10.0)	405 (9.5)	399 (10.8)	341 (12.9)	353 (12.6)
Placenta or vasa previa	794 (5.0)	2 (6.1)	56 (2.3)	123 (2.9)	176 (4.8)	203 (7.7)	234 (8.4)
Uterine rupture	676 (4.3)	1 (3.0)	25 (1.0)	113 (2.7)	170 (4.6)	161 (6.1)	206 (7.4)
Hypertensive disorders	659 (4.1)	2 (6.1)	219 (8.8)	132 (3.1)	122 (3.3)	90 (3.4)	94 (3.4)
Other	601 (3.8)	1 (3.0)	23 (0.9)	81 (1.9)	125 (3.4)	115 (4.3)	256 (9.2)
Placental abruption	520 (3.3)	1 (3.0)	47 (1.9)	73 (1.7)	92 (2.5)	109 (4.1)	198 (7.1)
Pre-rupture	450 (2.8)	2 (6.1)	56 (2.3)	134 (3.2)	118 (3.2)	75 (2.8)	65 (2.3)
Cord prolapsed	365 (2.3)	0	37 (1.5)	92 (2.2)	89 (2.4)	68 (2.6)	79 (2.8)
Failed vaginal birth after cesarean	175 (1.1)	0	12 (0.5)	63 (1.5)	51 (1.4)	24 (0.9)	25 (0.9)
Failed induction	68 (0.4)	0	4 (0.2)	23 (0.5)	12 (0.3)	11 (0.4)	18 (0.6)
Macrosomia	63 (0.4)	0	6 (0.2)	19 (0.4)	11 (0.3)	12 (0.5)	15 (0.5)
Failed trial of forceps or vacuum	58 (0.4)	0	18 (0.7)	20 (0.5)	12 (0.3)	5 (0.2)	3 (0.1)
Fetal indication or anomaly	38 (0.2)	0	6 (0.2)	4 (0.1)	11 (0.3)	7 (0.3)	10 (0.4)
Chorioamnionitis	32 (0.2)	0	7 (0.3)	7 (0.2)	8 (0.2)	5 (0.2)	5 (0.2)
Elective	24 (0.2)	0	5 (0.2)	4 (0.1)	7 (0.2)	4 (0.2)	4 (0.1)
Infectious disease	3 (<0.1)	0	0	1 (<0.1)	0	0	2 (0.1)
Shoulder dystocia	1 (<0.1)	0	0	0	1 (<0.1)	0	0

^a Values are given as number (percentage).

^b 1754 of the 14 151 singleton cesarean deliveries had two documented indications.

Therefore, identification of abnormal labor patterns is difficult. In the setting of difficulty with monitoring contraction patterns and oxytocin administration, errors and misuse are not uncommon.

More than 15% of women in the present sample were younger than 20 years, and 31 patients were younger than 15 years. Such young ages are, in themselves, a risk factor for pregnancy-related complications [19].

Some indications for cesarean merit further clarification. For example, HIV was only mentioned once in the MSF database as an indication, which could be because some MSF projects do not routinely verify HIV status or that HIV status was not noted in the operating-room logbook for reasons of confidentiality. Malpresentation was a common indication for cesarean in Timofeev et al.'s analysis in the USA [13], and it is unlikely that malpresentation is less common in the settings where MSF operates than in stable or high-resource settings. On the contrary, malpresentation could be expected to be more common given the higher rates of grand multiparas, as well as limited antenatal care and thereby access to external cephalic version. The decreased number of cesareans for malpresentation could be better explained by the fact that vaginal breech deliveries are more commonly practiced in low-resource settings [20,21].

Forty-five craniotomies were recorded. Although these destructive operative deliveries are rarely performed in high-income countries, clear indications exist for such procedures and a cesarean can be avoided in cases of prolonged, neglected labor with full dilation and an intrauterine fetal demise, or an attempted breech delivery with hydrocephalus [22]. Arguably, craniotomy is also indicated in high-income countries for macrosomia and sudden intrauterine demise [23].

The number of ruptured and pre-ruptured uteruses is high in the MSF setting. Although some (2.4%) were noted to be related to the presence of a previous uterine scar, most are probably related to prolonged, obstructed labor in older grandmultiparas women. Where uterine ruptures are frequently diagnosed, it is almost certain that many women fail to reach the hospital in time and do not survive. As known from a country-wide population survey in Sierra Leone [8], only 45% of maternal deaths will happen in hospitals, indicating that the obstetric complications seen in hospitals are only partially describing what happens to women at home. Nevertheless, a report from a maternal morbidity and mortality review in a rural Tanzanian hospital [24] demonstrated that 60% of the uterine ruptures occurred in the hospital, meaning that 40% of women with a uterine rupture in the hospital arrive after uterine rupture occurred at home or en route. A Nigerian report [25] mentioned that injudicious use of oxytocin was responsible for most cases of uterine rupture (38.7%) occurring in the hospital, followed by the presence of a uterine scar (28.0%). As mentioned previously, oxytocin use in low-resource settings without tocodynamometers, intrauterine pressure monitors, and automated flow-rates for oxytocin titration is tedious and labor-intensive and should be used with care, particularly in patients with a uterine scar.

Another remarkable finding of the present study was that cord prolapse was frequently noted in the MSF logbooks as an indication for cesarean, although it is not often cited in higher-income settings [13,26]. This finding could be because rupture of membranes in LMICs often occurs at home or in an otherwise non-medical setting in the presence of advanced cervical dilatation. Alternatively, it could be related to undiagnosed fetal malpresentation, which is an inherent risk for prolapsed cord [27].

One of the major strengths of the present study was the large number of cases from different settings. Another key asset was the quality of the database used for analysis. Generally, data on indications for cesareans might exist in individual facilities in LMICs, but they are rarely reported in large-scale health information systems [26]. However, there are limitations to the present study. Through care for populations in distress and victims of natural or manmade disasters and of armed conflict, MSF's practice is diverse [12]. However, MSF works in very specific situations, which cannot necessarily be generalized to LMICs. Indeed, it is likely that the healthcare-seeking behaviors of pregnant

women vary in times of peace and times of conflict or natural disasters. Furthermore, certain indications might not have been noted—e.g. in the setting of a uterine rupture, a previous scar might not have been reported because it was not the primary reason for the surgery. Similarly, operative indications were not noted for many cesareans; whether or not the probability of missing data is related to certain indications is unclear but could represent a source of bias. Another limitation is that the database did not have detailed information on maternal characteristics and prenatal care or outcome data. Nevertheless, the present large study provides a review of cesarean indications across exceptionally diverse settings in LMICs.

For gynecologists who have worked with organizations such as MSF, it is not surprising that the prevalence of indications for cesareans in LMICs differ from those in high-income countries. The present study has highlighted the distinctive clinical context prevailing in LMICs and provides insight into the current need for obstetric care. Furthermore, it provides further evidence that obstetric care is not homogeneous across the world and that standard obstetric training in higher-income settings might not adequately prepare clinicians for low-resourced settings.

Conflict of interest

The authors have no conflicts of interest.

References

- [1] World Health Organization, United Nations Children's Fund, United Nations Population Fund, The World Bank. Trends in Maternal Mortality: 1990 to 2010. http://whqlibdoc.who.int/publications/2012/9789241503631_eng.pdf. Published 2012. Accessed February 15, 2015.
- [2] World Health Organization, United Nations Population Fund, United Nations Children's Fund, Averting Maternal Death and Disability. Monitoring emergency obstetric care: a handbook. http://whqlibdoc.who.int/publications/2009/9789241547734_eng.pdf?ua=1. Published 2009. Accessed February 15, 2015.
- [3] World Health Organization, United Nations Children's Fund. Countdown to 2015 decade report (2000–2010) with country profiles: taking stock of maternal, newborn and child survival. http://whqlibdoc.who.int/publications/2010/9789241599573_eng.pdf. Published 2010. Accessed February 15, 2015.
- [4] Ameh C, Msuya S, Hofman J, Raven J, Mathai M, van den Broek N. Status of emergency obstetric care in six developing countries five years before the MDG targets for maternal and newborn health. *PLoS One* 2012;7(12):e49938.
- [5] Litorp H, Kidanto HL, Nystrom L, Darj E, Essén B. Increasing caesarean section rates among low-risk groups: a panel study classifying deliveries according to Robson at a university hospital in Tanzania. *BMC Pregnancy Childbirth* 2013;13:107.
- [6] Khan A, Ghani T, Rahim A, Rahman MM. Changing trends in incidence and indications of caesarean section. *Mymensingh Med J* 2014;23(1):52–5.
- [7] Chu K, Cortier H, Maldonado F, Mashant T, Ford N, Trelles M. Caesarean section rates and indications in sub-Saharan Africa: a multi-country study from Medecins sans Frontieres. *PLoS One* 2012;7(9):e44484.
- [8] Groen RS, Solomon J, Samai M, Kamara TB, Cassidy LD, Blok L, et al. Female health and family planning in Sierra Leone. *Obstet Gynecol* 2013;122(3):525–31.
- [9] Nour NM. Preparing for Global Women's Health Work. *Rev Obstet Gynecol* 2013;6(2):89–92.
- [10] Committee opinion no. 466: ethical considerations for performing gynecologic surgery in low-resource settings abroad. *Obstet Gynecol* 2010;116(3):793–9.
- [11] Chu K, Rosseel P, Trelles M, Gielis P. Surgeons without borders: a brief history of surgery at Médecins Sans Frontières. *World J Surg* 2010;34(3):411–4.
- [12] Wong EG, Trelles M, Dominguez L, Gupta S, Burnham G, Kushner AL. Surgical skills needed for humanitarian missions in resource-limited settings: common operative procedures performed at Médecins Sans Frontières facilities. *Surgery* 2014;156(3):642–9.
- [13] Timofeev J, Reddy UM, Huang CC, Driggers RW, Landy HJ, Laughon SK. Obstetric complications, neonatal morbidity, and indications for cesarean delivery by maternal age. *Obstet Gynecol* 2013;122(6):1184–95.
- [14] Dumont A, de Bernis L, Bouvier-olle MH, Bréart G, the MOMA study group. Caesarean section rate for maternal indication in sub-Saharan Africa: a systematic review. *Lancet* 2001;358(9290):1328–33.
- [15] Festin MR, Laopaiboon M, Pattanittum P, Ewens MR, Henderson-Smart DJ, Crowther CA, et al. Caesarean section in four South East Asian countries: reasons for, rates, associated care practices and health outcomes. *BMC Pregnancy Childbirth* 2009;9:17.
- [16] Menacker F, Declercq E, Maccormack MF. Caesarean delivery: background, trends, and epidemiology. *Semin Perinatol* 2006;30(5):235–41.
- [17] Simsek Y, Celen S, Ertas E, Danisman N, Mollamahmutoglu L. Alarming rise of caesarean births: a single center experience. *Eur Rev Med Pharmacol Sci* 2012;16(8):1102–6.
- [18] Wang CP, Tan WC, Kanagalingam D, Tan HK. Why we do caesars: a comparison of the trends in caesarean section delivery over a decade. *Ann Acad Med Singapore* 2013;42(8):408–12.

- 347 [19] Okonofua F. Prevention of child marriage and teenage pregnancy in Africa: need for
348 more research and innovation. *Afr J Reprod Health* 2013;17(4):9–13.
- 349 [20] Nkwabong E, Fomulu JN, Kouam L, Ngassa PC. Outcome of breech deliveries in
350 Cameroonian nulliparous women. *J Obstet Gynaecol India* 2012;62(5):531–5.
- 351 [21] Vistad I, Cvancarova M, Hustad BL, Henriksen T. Vaginal breech delivery: results of a
352 prospective registration study. *BMC Pregnancy Childbirth* 2013;13:153.
- 353 [22] Sikka P, Chopra S, Kalpdev A, Jain V, Dhaliwal L. Destructive operations—a vanishing
354 art in modern obstetrics: 25 year experience at a tertiary care center in India. *Arch*
355 *Gynecol Obstet* 2011;283(5):929–33.
- 356 [23] Steel A, Fakokunde A, Yoong W. Management of complicated second stage of labour
357 in stillbirths: a review of the literature and lessons learnt from two cases in the UK.
358 *J Obstet Gynaecol* 2009;29(6):464–6.
- 359 [24] Nelissen EJ, Mduma E, Ersdal HL, Evjen-Olsen B, van Roosmalen JJ, Stekelenburg J.
360 Maternal near miss and mortality in a rural referral hospital in northern Tanzania:
361 a cross-sectional study. *BMC Pregnancy Childbirth* 2013;13:141.
- 362 [25] Akaba GO, Onafowokan O, Offiong RA, Omonua K, Ekele BA. Uterine rupture: trends
363 and feto-maternal outcome in a Nigerian teaching hospital. *Niger J Med* 2013;22(4):
364 304–8.
- 365 [26] Stanton C, Ronsmans C. Caesarean birth as a component of surgical services in low-
366 and middle-income countries. *Bull World Health Organ* 2008;86(12) A.
- 367 [27] Kalu CA, Umeora OU. Risk factors and perinatal outcome of umbilical cord prolapse
368 in Ebonyi State University Teaching Hospital, Abakaliki, Nigeria. *Niger J Clin Pract*
369 2011;14(4):413–7.

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