Factors contributing to rising cesarean section rates in South Asian countries: A systematic review

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ABSTRACT

Rising cesarean section (CS) rates are a global public health problem. The systematic review investigates key indications for performing CS and factors significantly associated with the rising rate of CS in South Asia. Primary studies in South Asia published between January 2010 and December 2018 were searched using relevant electronic databases: MEDLINE, Scopus, PubMed, Web of Science, CINAHL, NepJOL, and BanglaJOL. A narrative synthesis of the indications for performing CS and factors significantly associated with the rising CS rates was performed using content analysis. A total of 68 studies were included in this review. The most common medical indication for CS was fetal distress, followed by previous CS, antepartum hemorrhage (including placenta previa/abruption), cephalopelvic disproportion, failed induction, hypertensive disorders in pregnancy, oligohydramnios, and non-progress of labor. Maternal request was the most common non-medical indication for conducting CS. Higher maternal age was the most common significant factor associated with the rising CS rate followed by higher maternal education, urban residency, higher economic status, previous CS, pregnancy/childbirth complications, and lower parity/nulliparity. Preference for CS and increasing private number hospital were also factors contributing to the rising rate. Several key indicators and factors significantly associated with rising CS rate are revealed. These key indicators and significant factors reflect the global trend. Reduction in the use of primary CS, unless medically warranted, would help stem rates of CS. Realistic and candid explanation to pregnant women and their families regarding the benefits of vaginal birth for women and babies should form an integral part of maternity care as these are issues of public health.

Key words: Cesarean section; Indication; South Asia; Systematic review

INTRODUCTION

The rising rate of cesarean section (CS) is a global public health problem. The World Health Organization (WHO) recommended CS rates of 10–15%.[1] A CS rate >10% at the population level does not reduce maternal and new-born mortality rates.[2] Globally, the CS rate nearly doubled between 2000 (12.1%) and 2015 (21.1%).[3] In the light of this, there is an emphasis on the optimum use of CS for medically indicated reasons to avoid unnecessary interventions in low-risk pregnancies.[4,5] However, it is apparent that CS is often performed without medical

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indication, and this is associated with an increased risk of severe maternal outcomes.[6] CS is associated with many short and long-term maternal and infant health problems and can also adversely affect subsequent pregnancies.[7] The risk of serious maternal morbidity rises with each repeat CS.[8] In addition, unnecessary CS is costly for families and health systems.[9] Thus, CS should only be performed when medically necessary and where its benefits compensate for the associated costs and risks.[10]

In the South Asia, the CS rate almost tripled between 2000 (7.2%) and 2015 (18.1%),[3] and the highest CS rates are in cities.[11] In Bangladesh, CS rates increased over fivefold from 2004 (3.5%) to 2014 (23%).[12] A higher prevalence of CS was reported in urban areas (62.88%).[13] In India, the estimated overall CS rate 2010–2016 was17.2%[14] with high CS rates reported in urban (27.20%)[13] and in private health facilities (29.5%).[15] Furthermore, the disparity in CS rate between private and public hospitals has increased over the years in India.[16] In Nepal, the overall CS rate is 12.21%,[13] but the CS rates are rising in urban areas.[17] CS rates in private hospitals increased three-fold from 1996 (8.9%) to 2016 (26.3%).[18] In Pakistan, the overall CS rate increased about five-fold from 1991–1992 (2.7%) to 2012–2013 (15.8%) and higher in urban (27.79%).[19] In Sri Lanka, a study reported an increased CS rates (from 29.6% in 2008 to 33.6% in 2010).[20] Similarly, in the Maldives, the CS rate is reported to be high in urban areas (30.18%).[13] The utilization of CS is still low (3.4%) in Afghanistan.[21] A hospital-based study showed that the CS rate was 18.7% in Bhutan.[22] The rising rates of CS in South Asia raise questions about performing CS for unnecessary reasons. A study conducted in Nepal also revealed that CSs are performed for suboptimal indications in relation to fetal distress and prolonged labor, because fetal heart rate monitoring was poor for the diagnosis of fetal distress and use of partograph was also poor to diagnose prolong labor proceeding the decision for the emergency CSs.[23] Hence, there is a need to explore the key indications and factors underlying the rising CS rates not only to address the CS rate itself but also to avoid over medicalization of childbirth in South Asia. By considering the range of key indications for CS, and factors associated with, rising CS in South Asian countries, this systematic review aims to answer the question: What are the factors contributing to the rising CS rates in South Asian countries?

Aims and objectives
Aim: To assess factors contributing to rising cesarean section rates in South Asian countries.

Objectives: To investigates key indications for performing CS and factors significantly associated with the rising rate of CS in South Asia.

MATERIALS AND METHODS

This systematic review included studies according to the protocol registered in PROSPERO in 2019 (ID: CRD42019131237).

Inclusion and exclusion criteria
Primary quantitative cross-sectional and cohort studies which focussed on the indications/factors/determinants for CS from 2010 to 2018 in South Asia and written in English were included in this review. For mixed-methods studies, only quantitative data were included. In addition, studies accessible online database until 30 May 2019 were included. All case control studies, interventional studies, studies using only secondary data and studies with critical appraisal skills program (CASP) scoring <20 were excluded.

Search strategy
The systematic review used the following electronic databases: MEDLINE, Scopus, PubMed, Web of Science, CINAHL, NepJOL, and BanglaJOL. Databases were searched for articles published from 1st January 2010 to 30th December 2018 reporting factors, reasons, causes, determinants, and indications for CS. Medical subject headings terms and key words for "cesarean;" "cesarean," "C-section," were combined with countries (Nepal, India, Pakistan, Bangladesh, Afghanistan, Sri Lanka, Maldives, Bhutan) using Boolean operators. Titles and abstracts were screened for the reasons, factors, indications and determinants of CS. The search strategy also included hand searching of journals and reference lists of included articles. Key articles cited by multiple authors were checked on Google Scholar, and authors of relevant published protocols were contacted if necessary (Supplementary Table 1).

Data extraction and study outcome
All extracted articles were assessed for inclusion eligibility by the first author (SD). Titles and abstracts comprising factors/causes/indications/reasons for CS were included, after which the full text of each article was considered. The data extraction form was developed by the research team. Data extraction included: Author, Published Year, Country/Setting, Study design/method, Study population/ Sample size, Key findings (Supplementary Tables 2 and 3). Extracted data were checked for accuracy by other authors (EvT, JW, PR, GD, KBD). Any discrepancies/disagreement over eligibility of studies were discussed with reviewers and resolved based on consensus.

Risk of bias (quality) assessment
All selected eligible articles were reviewed independently by two reviewers (SD and EvT or another one reviewer). CASP checklists were used to assess the quality of studies.[24]

Any disagreements between reviewers were discussed and resolved with a third reviewer. The selected studies were appraised for strengths and weaknesses. The quality of evidence was assessed for each study. Studies with CASP score of more than 20 out of 33 were included in this review (Supplementary Table 4).

Data synthesis

A narrative synthesis was applied to the findings from the different studies included in this review. First, data were summarized and presented in a tabular form and discussed within the research team to ensure they were relevant. The narrative synthesis of the indications for CS and significant factors associated with CS was divided into the distinct categories using content analysis.[25] The indications for CS and significant factors associated with CS was divided into medical/obstetrical and non-medical indications. Likewise, significant factors associated with

CS were classified into sociodemographic, medical/obstetrical, and non-medical factors. Overview tables (Tables 1 and 2) were created to summarize the findings on indications and significant factors associated with CS in each category. Two researchers (SD and EvT/another co-author) conducted the data synthesis. Lack of homogeneity and the amount of data meant that a meta-analysis was not feasible.

RESULTS

We identified a total of 1543 studies, of which 524 duplicates were removed using EndNote. Of 1019 studies, 925 studies were excluded after initial screening and a further 23 were removed after assessing the full text, leaving 71 which were assessed for quality. Three studies were excluded after the quality assessment (CASP score <20). We included 68 studies (Figure 1); 63 were cross-sectional

Table 1: Indications for overall CS reported by studies in South Asia

Indications for CS	%	References
1. Medical and obstetrics Indications		
Foetal Clinical Characteristics		
Foetal distress	1.3–46%	27-54,56,58-76,78
Breech presentation	2.38–16.8%	28,30,31,35,37-40,42,44,45,50,54,56,58-61,65,66,69,70,75,76
Malpresentation	0.53–34.3%	27,29-34,36,38,40,44,46,49,51-53,55,58,60,63,64,67-70,72-74,77
Transverse/abnormal lie	1.04–25.3%	31,37,39,48,54,61,62,77
IUGR	0.52–9.31 %	28,30,31,33,42,44,48,49-54,56,58,61,63,65,68,69
Post-term	0.63–13%	29,34,48,51,56,58,68,70,76
Pre-term	0.11–5.6%	29,38,46,53,68
Oligohydramnios	0.1–27.9%	27-31,33,35,36,38-40,44,48-52,54,58,59-62,64-70,75-77
Meconium stained liquor	9.6–32.4%	37,40,59,71,75,77
Multiple gestation/pregnancy	0.32–3.5%	29,30,31,32,35-39,42,44,46,48-51,54,55,58,59,61,63,65,66,68,69,70,73-75
PROM	1.1–6%	28,29,46,50,51,58,62,68,70,76,77
Cord presentation/prolapse	0.1–4.2%	30,31,36,37,44,47-49,53,60,66
Maternal indications		
• CPD	0.9–30.9%	27,28,30-33,35,36-39,41,44,46,48-56,58-61,63-66,68-70,72,73,75,77
• HDP	0.21–15.8%	27,28,34,37-40,42-44,46,48-52,54,56,58,60,61,63,65-68,70,72-76,78
• APH/Placenta praevia/abruptio	0.2–7.05%	27,29-31,33,35-40,42,44,48-54,56,58-66,68-70,72-77
• Scar tenderness	1.5–31.22%	38,42,41,54,69
• Previous hysterotomy/myomectomy	0.3%	42,50,53,69
• Medical disorders/ conditions	0.2–5.8%	29,30,31,38,39,42,44,49-51,53,58,60,61,63,67-70,73
Obstetrics history		
• Previous CS 1 or more	2.9–48%	27,28-48,50-52,54,56,58,59-70,72-77,78
• Refuse of after CS (VBAC)	2.85–22.4%	38,41,42,69
• History of subfertility/Infertility	0.78–4.99%	28.29,48,63
• BOH	0.29–5%	29,31,33,37,38,42,44,46,48-50,52,60,63-65,67,68,70
Labor abnormalities		
• Obstructed Labor	0.4–3.9%	30,31,34,36,37,39,40,47,48,50,54,58,61,64,66,69,70,76
• Prolonged Labour	0.8–33.2%	29,33,34,47,50,56,64,70,73,76
• NPOL	0.7–29%	27,28,30,32,33,35-37,40,42,43,45,46,48,49,52-54,58-61,66-69,72,75,77,78
• Failed induction	0.40–15.7%	27,28,30-33,36,37,39,40,43,44,46-53,56,58-60,63-66,68-71,75,77,78
• Others	0.5–36.2%	34,35,37,39,40,47,52,60,75,76
2. Non-medical indications		
Maternal request/demand	0.1–3.97%	29,37,42,56,66,67
Labour pain	0.2%	70
Previous traumatic birth experience	2.2%	62
Precious pregnancy	0.47–3.96%	36,42,50,63,68
No indication recorded	0.6–8.9%	68,70,73,76

IUGR: Intrauterine growth retardation, APH: Antepartum haemorrhage, CPD: Cephalopelvic disproportion, HPD: Hypertensive disorders of pregnancy, VBAC: vaginal birth after CS, BOH: Bad obstetric history, PROM: Premature rupture of membrane, NPOL: Non-progress of labor, CS: Caesarean section

Table 2: Factors significantly associated with rising CS rates reported by studies in South Asia

Category of factors	Significant associated factors	Total number of studies	References
Socio-demographic factors	Higher age of mother	8	34,39,88-93
	Higher education of mother	7	34,39,88,90,92-94
	Urban residency	3	88,92,94
	Higher socioeconomic status	3	34,81,90
	Higher number of ANC visits	3	34,39,90
	Place of birth: Private hospitals	3	81,90
	Obesity of mother	2	91,92
	Birth weight: >4 kilograms	2	71,89
	Low nutritional food intake during the pregnancy	2	92,93
	Lower birth order	2	34,93
	Not using contraceptive method	1	93
	Length of baby >45 centimeters	1	93
	Distance to health facility	1	39
Medical and obstetric factors	Previous CS	3	39,92,93
	Complications in pregnancy and childbirth	3	88,90,93
	Lower parity: Nullipara or primipara	3	39,89,94
	Gestational week (pre or post)	2	81,89
	Prolong labour	2	71,93
	Multiple pregnancy/birth	1	90
	Bishop's score 5 or less	1	71
	Abnormal foetal presentation	1	89
	Bad obstetric history (Foetus loss)	1	34
	Umbilical cord prolapse	1	91
	Three doses misoprostol in labour induction	1	71
Non-medical factors	Patient's preference	1	91
	Increasing number of private hospitals	1	91
	Poor condition of public hospitals	1	91
	Unavailability of good quality health care and hospital in rural areas	1	91

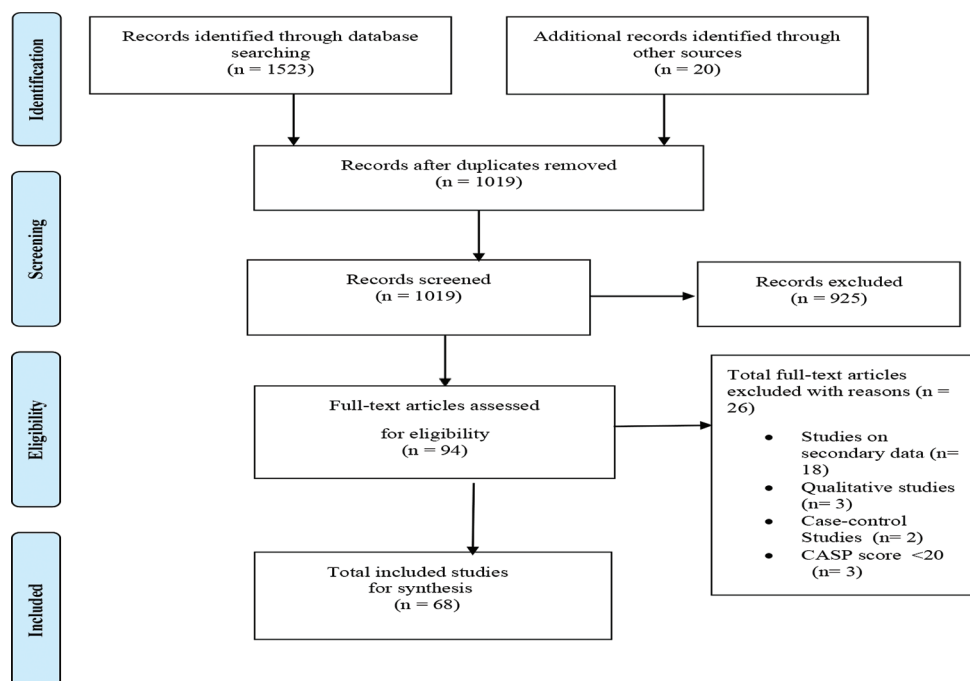ANC: Antenatal clinic, CS: Caesarean section

Figure 1: PRISMA flow diagram[26]

studies and 5 were cohort studies. Almost all included studies applied a quantitative approach (n=67) and one was a mixed methods study.

A total 61 studies illustrated the indications for CS, and 11 described factors which were significantly associated with rising CS (4 out of 11 studies reported both indications and

significant associated factors). Figure 1 shows the Preferred Reporting Items for Systematic Reviews and Meta-analysis flow diagram[26] of the progress.

Indications for CS in South Asia

We divided indications for CS into two categories: medical/obstetrical and non-medical. The medical/obstetrical indications were further divided into fetal clinical characteristics, maternal clinical characteristics, obstetric history, labor abnormalities and other.

Key indications for overall CS

A total 51 studies[27-78] reported the overall indications for CS (Table 1). More details are given in Supplementary Tables 2 and 5.

Medical and obstetric indications

Fetal distress is the most common key indicator for CS followed by previous CS, antepartum hemorrhage (APH) including placenta previa/placenta abruption, cephalopelvic disproportion (CPD), failed induction, oligohydramnios, hypertensive disorders of pregnancy (HDP) (pregnancy-induced hypertension, pre-eclampsia, and eclampsia), non-progress of labor (NPOL), multiple pregnancy, fetal malpresentation, breech presentation and intrauterine growth retardation (IUGR) (Table 1).

Many studies[34,35,37,39,40,47,52,60,75,76] categorized some indications to other indication/miscellaneous (0.5–36.2%). Some studies used vague terminology such as maternal indication, fetal indication, obstetric indication[32,53,55] antepartum complications.[41] Similarly, there is evidence of use of non-standardized terminology/abbreviations for some indications such as "DLOC with head floating."[31] These unspecified and vague indications are not included in the overview table.

Non-medical indications

The non-medical indications included maternal request/choice/demand,[29,37,42,56,66,67] precious pregnancy,[36,42,50,63,68] labor pain,[70] previous traumatic birth experiences.[62] CS performed without indication (0.6–8.9%) was also apparent (Table 1).

Key indications for elective CS and emergency CS

A total 16 studies[29,40,42,49,57,58,65,70,73,74,77,79-83] reported the indications for elective CS. The most common indication for elective CS was previous CS (9.4–78.72%),[29,40,42,49,57,58,65,70,73,74,77,79-82] followed by malpresentation,[40,29,49,57,58,70,73,74,77,80,82,83] CPD,[43,49,57,65,70,73,79,80-83] HDP,[29,42,44,49,57,65,70,73,74,80,83] maternal medical conditions,[29,42,43,49,58,70,73,80,82,83] APH/placenta previa/abruptio,[29,42,49,57,65,73,74,80,82] oligo/severe oligohydramnios,[49,57,65,70,77,80,82,84] breech,[40,42,49,57,58,65,70] multiple pregnancy,[29,57,58,70,80,82] IUGR[42,49,65,80,82,83] bad obstetric history (BOH),[29,43,49,57,65,70,79] and post-term.[42,58,70,78] History of

subfertility,[29,43,83,84] and elderly mother/primipara,[43,70,82] were notable indications for elective CS. Non-medical indications were maternal request,[29,57] and precious pregnancy,[80,83] in elective CS. Two studies[70,73] showed that 0.6–5.6% elective CS was performed without indication.

Similarly, a total of 16 studies[40,42,43,49,57,58,65,70,73,74,77,79-81,83,85] reported indications for emergency CS. The most common indication for emergency CS was fetal distress (7.7–61%)[40,42,43,49,57,58,65,70,73,74,79,80,81,83,85] followed by previous CS,[42,49,57,58,65,70,73,74,77,79,80,85] PIH (Pregnancy-Induced Hypertension)/pre-eclampsia/eclampsia,[42,49,57,58,65,70,73,74,80,85] APH/Placenta previa/abruption,[49,57,58,65,70,73,74,77,80,85] malpresentation,[40,49,57,58,70,73,74,77,80,83] CPD,[49,57,58,65,70,73,80,83,85] NPOL,[40,42,43,49,57,58,77,79,81] oligohydramnios,[49,58,65,70,77,79,80,83] breech,[40,42,49,57,58,65,70] multiple pregnancy,[57,58,65,70,73,74,80] obstructed labor,[49,57,58,70,80,85] failed induction,[43,57,58,65,70,79] cord presentation,[49,57,74,70] and medical disorders,[42,70,80,85] Precious pregnancy,[80,83] and labor pain[70] were non-medical indications in emergency CS. Surprisingly, one study[73] reported that 7.9% of emergency CS were performed without indication (See more details in Supplementary Tables 2 and 6).

Key indications in terms of primary CS and repeat CS

Eight studies[50,55,67,70,80,83,84,86] illustrated the indications for primary CS. The most common indication for primary CS was fetal distress (5.58–60.8%),[50,55,67,70,80,83,86] followed by CPD,[50,55,70,80,83,84,86] malpresentation,[55,67,80,83,84] HDP,[50,67,80,84,85] NPOL,[67,70,80,84,85] obstructed labor,[50,70,80,84,85] failed induction,[70,80,84,85] APH/placenta previa/abruptio,[50,80,84,86] and oligohydramnios,[80,83,84,86] precious pregnancy,[80,83,84,86] and maternal request,[67,82] were non-medical indications for primary CS.

Similarly, a total of seven studies[44,48,50,55,70,80,83] illustrated the indications for repeat CS. The most common indications for repeat CS were previous CS (1.31–48.5%),[44,48,50,55,70,83] fetal distress,[44,48,50,55,80,83] CPD,[44,48,50,55,80,83] scar tenderness,[44,48,55,80,83] breech,[44,48,55,80,83] and multiple pregnancy,[44,48,50,55,80] oligohydramnios,[44,48,80,83] IUGR,[44,48,80,83] HDP,[44,48,50,80] APH/placenta previa/abruption,[44,48,50,80] medical disorders,[44,48,80,83] big baby,[44,48,83] and malpresentation.[44,48,50] precious pregnancy,[80,83] was given as a non-medical indication for repeat CS (See details in Supplementary Tables 2 and 7).

Key indications in terms of parity

Seven studies[43,58,62,70,82,86,87] illustrated the indications for CS in primigravidae. The most common indication for CS in primiparous women was fetal distress (8.3–53%),[43,58,62,70,82,86,87] followed by CPD,[43,58,70,82,86] oligohydramnios,[58,62,82,86] abnormal fetal lie,[62,82,86] breech,[58,82,86] IUGR,[58,82,86] HDP,[82,86,87] placenta previa/abruptio,[62,82,86] NPOL,[43,86,87] Obstructed

labor,[58,86,87] and failed induction.[43,86,87] Elderly primipara/ elderly mother[43,82] and subfertility,[43,82] were also indications for CS in primiparous women. Precious pregnancy,[86,87] and patient request[87] were non-medical indications for CS in primiparous women.

Similarly, four studies[43,58,62,86] presented the indications for CS in multigravida. Fetal distress (11.4–61%)[43,58,62,86] was the most common indication for CS in multiparous women followed by oligohydramnios,[58,62,86] failed induction,[43,63,86] breech,[58,86] abnormal fetal lie,[62,86] premature rupture of membrane (PROM),[62,86] IUGR,[58,86] CPD,[58,86] placenta previa/abruptio,[62,86] obstructed labor,[58,86] NPOL.[43,58] Traumatic experience in previous childbirth[62] was a non-medical indication in multiparous women (See more details in Supplementary Tables 2 and 8).

Factors significantly associated with rising CS rates in South Asia

Several significant factors associated with rising CS rates were reported in South Asia (Table 2). These factors are divided into three major categories: (1) sociodemographic; (2) medical and obstetric; and (3) non-medical factors. (See more details in Supplementary Table 3).

Sociodemographic factors

We found that higher maternal age,[34,39,88-93] and higher maternal education[34,39,88,90,92,93,94] were the key factors significantly associated with rising CS rate in South Asia. Other factors significantly associated CS included urban residency,[88,92,94] higher economic status,[34,81,90] and higher number of antenatal clinic (ANC) visits,[34,39,90] childbirth in a private hospital,[81,90] birthweight of baby (>4 kg),[71,89] low nutritional food intake during the pregnancy,[92,93] lower birth order,[34,93] not using contraceptive method,[93] length of baby (>45 cm)[93] and distance to health facility[39] (Tables 2).

Medical/obstetric factors

Previous CS,[39,92,93] complications in pregnancy and childbirth,[88,90,93] lower parity (nullipara),[88,90,93] gestational week (pre or post)[81,89] prolonged labor,[71,93] multiple pregnancy,[90] abnormal fetal presentation,[89] BOH (fetal loss),[34] umbilical cord prolapse,[91] and 3 doses misoprostol used in labor induction[71] were medical/obstetric factors that significantly associated with rising CS rates in South Asia (Tables 2).

Non-medical factors

Regarding non-medical factors for rising CS rates in South Asia, patients' preference for CS, increasing number of private hospitals, the poor condition of public hospitals and the unavailability of good quality health care in rural areas were reported[91] (Tables 2).

DISCUSSION

This systematic review reports various key indications for performing CS and several factors significantly associated with rising CS rates in South Asia.

Key indications for CS in South Asia

Fetal distress is found to be the major key indication for performing CS in this review as reported by other studies.[20,95-98] Fetal distress is an emergency condition; however, it was given as an indication also for performing elective CS in some studies.[42,43,49,73,79] Early and accurate diagnosis of fetal distress can reduce the risk of perinatal mortality. Fetal heart rate monitoring and partograph are fundamental to diagnose fetal distress and progress of labor, but Litorp et al.,[23] identified that fetal heart rate monitoring was only performed in one-third (36%) of total CS cases. However, the diagnosis of fetal distress is notoriously difficult. Shortage of resources such as staff (obstetricians/qualified midwives)[70] and shortage of diagnostic resources in most parts of South Asia may add to the imprecision of the diagnosis of fetal distress.

Previous CS was another key indication for CS;[95,96] for both elective[97] and repeat CS.[99] Recent studies have reported that previous CS is the key leading indication of CS.[22,100-103] The growing number of primary CS may influence the decision-making around mode of birth. The majority of pregnant women who have a history of previous CS would decline vaginal birth after CS (VBAC).[96,97,99] Although trial of VBAC is often the best option, it may be riskier than repeating CS where resources are lacking, and repeat CS may be the first choice in low-resource countries like South Asia.[104] This is because successful VBAC depends on many factors such as clinical expertise; resources; good obstetric history and positive attitude of women who are going through the VBAC; proper management of fear and providing unbiased information to women. Unfortunately, these criteria for VBAC are often scarce in most places in low-resource countries.[104]

As reported by several previous studies, our review documents many other common key indications for CS: APH/placenta previa/abruption,[22,96,101,103] CPD,[22,95,96,100,103] HDP,[22,95,96,103] failed induction,[22,96,100,103] NPOL,[95,96,100-103] oligohydramnios,[95,100,103] multiple pregnancy,[22,95,101,103] malpresentation,[95,96] breech presentation,[22,100,103] and IUGR,[95,101] Similarly, CPD is found to be a key indicator for elective CS.[95,97,98] emergency CS,[95,96,98] primary CS,[99] repeat CS[99] and CS in primigravida.[20] HDP was reported as a key indication for elective CS,[95,98] emergency CS,[95,97,98] primary CS,[99] repeat CS,[99] CS in primigravidae,[99] and multigravida.[99]

APH/placenta previa/abruptio was also a key indication for elective CS,[97,98] primary CS,[99] repeat CS,[99]

CS in primigravida,[99] and multigravida.[99,105] Similarly, oligohydramnios was common indication for elective CS,[95,98] emergency CS,[97,98] primary CS,[99] repeat CS,[96] CS in primigravida,[99] and multigravida.[99,105] Breech presentation was a common indication for elective CS,[98] emergency CS,[98] primary CS, repeat CS,[96,99] CS in primigravida and multigravida.[105] IUGR was also a common indication for elective CS,[98] emergency CS,[98] primary CS, repeat CS,[99] CS in primigravida and multigravida.[105] Similarly, other common indications were: malpresentation (elective CS,[98] emergency CS,[97,98] primary CS,[99] repeat CS,[99] fail induction (emergency CS,[95,98] primary CS,[99] multigravida,[99] multiple pregnancy (elective CS,[98] emergency CS,[99] primary CS, and repeat CS,[99]), obstructed labor[105] (emergency CS, primary CS, CS in primigravida and multigravida), NPOL (emergency CS[95] and primary CS[99] and maternal medical conditions (elective CS,[98] and emergency CS[96]), BOH[98] was key indication for elective CS and cord presentation[98] was for emergency CS. Scar tenderness[96] and large baby were also key indications for repeat CS.

Subfertility[98,99] and advanced maternal age,[20,99] were found to be notable indications for elective CS and CS in primigravidae. A history of infertility in nulliparous women can increase the risk of childbirth by CS.[106] Increasing education, empowerment, and improved socioeconomic status of women in South Asia may encourage them to consider pregnancy at an advanced age. This may also be associated with pregnancy complications and increase the risk of CS.[107]

Maternal request was a major non-medical indication for CS.[95,99,101,102] Indications for elective CS are increasingly likely to be for psychological indications.[108] Women may perceive CS as a safer and easier way of giving birth because of fear of labor pain and fear of loss of baby.[109] Schantz et al.,[110] revealed that pregnant women are not well informed in the process of giving consent for CS. Lack of knowledge on mode of childbirth may lead to wrong choices in their birth plan.[110-112] In addition, women may feel pressurized to request CS for fetal well-being, cosmetic reasons, maintain pelvic floor damage or sexual satisfaction rather than to protect their autonomy or own reproductive rights.[111]

In this review, CS performed with no stated indications (0.6–8.9%) was also apparent.[68,70,73,76] Such surgical procedures do not only affect maternal and neonatal health adversely, but also add unnecessary costs to the family and the misuse of precious health resources. Furthermore, we found some vague terminology used for indications; along with the use of non-standardized terminology/abbreviations; and indications of CS categorized as "other." These are difficult to understand/interpret thus reflect poor practice. The data highlight the necessity of adherence to

locally tailored comprehensive guidelines and evidence-based practice in obstetric care.

Factors associated with rising CS in South Asia

Higher maternal age is found to be the most common key contributing factors for rising CS rates in South Asia as reported by several studies.[12,13,18,113-116] Increased maternal age can increase the risk of assisted reproductive technology, gestational diabetes/diabetes mellitus, preeclampsia and placenta previa/placental abruption.[107] It can be argued that increasing empowerment and improving socioeconomic status of women in South Asia possibly encourage them to consider pregnancy at an advanced age. Similarly, higher education of the mother is found to be another key factor significantly associated with increasing CS rates.[12,13,18,19,21,113,115] Increasing the educational status of women has offered them independence as well as more control over their birth plan, however, better education of women may not provide them with better knowledge of the risks and benefits of CS or mode of childbirth.[112]

Place of residency (urban residency) is significantly associated with the rising CS rate.[12,13,18,19,21,116] The availability of modern obstetric care private facilities in urban areas probably encourage women to utilise modern technology for childbirth by CS.[112] This is also true of the higher economic status of women.[12,18,19,21,113,116] Richer/richest women or families have more choices of obstetric services and could afford the cost of CS. Similarly, higher number of ANC check-up (3 or more visits) is also found to be a factor significantly associated with rising CS.[12,112,114,115] Lack of adequate counselling on mode of childbirth or/and lack of information on risk versus benefits of CS perhaps encourage pregnant women to choose CS.[117] Recently, Doraiswamy and colleagues[118] reported that inadequate communication between physicians and pregnant women is one of the factors for the rising CS rate in Bangladesh. Childbirth in private hospitals/place of birth is also found to be a significantly associated with rising CS rate in South Asia as claimed by previous studies.[13,15,18,114,115,119] Private care providers perhaps motivate pregnant women by suggesting CS is an easy and safe way to give birth.[117]

History of previous CS is found to be the most common medical/obstetrics factor significantly associated with rising CS in South Asia. Previous CS is a strong predictor of repeat CS.[120] This highlights the need to avoid primary CS wherever possible and the need for antenatal education. Similarly, complications in pregnancy are also found to be common significant medical factors associated with rising CS rates. In Bangladesh, Karim et al.,[119] also found that CS was 3.6 times higher among women who reported complications during the last birth than those who did not report any complication. Adherence to evidence-based

guidelines on indications for CS is essential in considering whether these factors are sufficient reason for preforming CS in any individual case.

Maternal preference for CS is one of the most significant non-medical factors for rising CS rates. Wealthy urban women perceives CS either as a modern childbirth method or lifestyle choice as in Bangladesh.[112] Higher maternal age, education and socioeconomic status of women as well as residing in urban areas appear to be correlated with maternal preference of CS. In addition, lack of adequate knowledge about risks, benefits of mode of childbirth, and medical indications of CS[110,112,117] along with poor communication between obstetricians and women[118] possibly boost the maternal preference of CS.

Increasing numbers of private hospitals are associated with rising CS rates. Private healthcare is a fast-growing business in South Asia and may partly be to blame for the rising CS rate. A qualitative study conducted in India revealed that private providers would accept maternal request and perform more CS to be commercially successful.[121] Private health facilities contribute to rising CS rates in India,[15,16] Nepal,[18] and Bangladesh.[117,121]

Limitations of the study

The review has not included qualitative studies, case-control studies, studies based on secondary analysis and other interventional studies. Importantly, it only includes studies reported in English. Similarly, meta-analysis or other statistical analysis of data could not be performed because of heterogeneous data. There were no eligible studies from Bhutan and Maldives for this review. Further studies are needed to consider the contribution of evidence from qualitative and interventional studies.

CONCLUSION

This review reveals key indications for performing CS and their significant factors in South Asia. It concludes that fetal distress and previous CS are the most common key medical indications followed by APH/placenta previa/abruptio, CPD, HDP, failed induction, NPOL, oligohydramnios, multiple pregnancy, malpresentation, breech presentation, and IUGR. Fetal distress was a prime indication for all types of CS except elective CS. Previous CS was the chief indication for elective and repeat CS. CPD is found to be a key indicator also for elective/emergency/primary/repeat CS and CS in primigravida. HDP was reported as a key indication also for elective/emergency/primary/repeat CS, CS in primigravida and multigravida. Maternal request is the most important non-medical indication for CS. The use of imprecise terminology for indications of CS and

carrying out CS without indication were also apparent. Higher maternal age, higher maternal education, urban residency, higher economic status, higher numbers of ANC visits, previous CS, complications of pregnancy/childbirth, and lower parity are found to be the most common factors significantly associated with rising CS rates in South Asia. Maternal preference for CS and rising numbers of private hospitals are found to be the most important non-medical factors significantly associated factors for rising CS rates in South Asia. These key indicators and significant factors reflect global trends of CS and suggest that a global strategy is required to stem the rise of unnecessary CS. Realistic and candid explanations to pregnant women and their family regarding the benefits of vaginal birth for women and babies should form an integral part of maternity care as these are issues of public health. The strategies for optimizing the use of CS should include greater precision in diagnosis of fetal distress; keeping primary CS to a minimum; educating pregnant women/family on indications, risks and benefits of CS; avoiding CS for non-medical reasons; and adherence to evidence-based guidelines for CS.

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SDR, EvT, PRR, JW, GD, KBD- have contributed to design/plan, quality assessment of the studies, analysis of data and interpretation in this review. **SD** performed write-up the manuscript at first and then all other authors contributed to finalize the article. All authors have read and approved the manuscript.

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SUPPLEMENTARY

Supplementary Table 1: Search Strategy

Databases	Filter	Search Term	Results
Web of Science	English language Date: 2010 – 2018	(TI = (Caesarean or Cesarean or C-section) or AB = (Caesarean or Cesarean or C-section) (TI = (Nepal or India or Bangladesh or Pakistan or Bhutan or Shri Lank or Maldives) or AB= (Nepal or India or Bangladesh or Pakistan or Bhutan or Shri Lank or Maldives)	465
Scopus	English language Date: 2010 – 2018	(TITLE-ABS-KEY (caesarean OR cesarean OR c-section) AND TITLE-ABS-KEY (nepal* OR india* OR pakistan* OR bhutan* OR bangladesh* OR afghanistan* OR "SRI LANKA" * OR sri-lanka* OR maldives*)	67
PubMed	English language Date: 2010 – 2018	(("Caesarean" OR "caesarean" OR "C-section") ("Caesarean" AND "caesarean" AND "C-section"))	180
CINAHL Compete – CINAHL Headings	English language Date: 2010– 2018	(Caesarean or Cesarean or C-Section) AND (Nepal* or India* OR Bangladesh* OR Afghanistan* OR "Sri Lanka"* OR Maldives* OR Bhutan*	185
Medline Complete – MeSH Headings	English language Date: 2010 – 2018	TI (Caesarean* OR Cesarean* OR "C-Section"*) OR AB (Caesarean* OR Cesarean* OR "C-Section"*) TI (Nepal* OR India* OR Pakistan* OR "Sri Lanka"* OR Bangladesh* OR Maldives* OR Bhutan* OR Afghanistan*) OR AB (Nepal* OR India* OR Pakistan* OR "Sri Lanka"* OR Bangladesh* OR Maldives* OR Bhutan*)	365
NepJOL	English language Date: 2010 – 2018	Caesarean or caesarean or C-section	218
BanglaJOL	English language Date: 2010 – 2018	Caesarean or caesarean or C-section	43
Hand Search	English language Date: 2010 – 2018	Additional records through other sources	20
Total			1,543

Supplementary Table 2: Summary of indications of CS in South Asia

Authors and Year	CS rates	Location of study/ Settings	Study design	Study population/ Sample size	Indications of CS
Nazneen et al., (2011)	70.5%	Bangladesh	Retrospective Observational Longitudinal study	21149 Women	Repeat C/S (17.2–31.4%), Pre-eclampsia (7.3–21.7%), Foetal distress (6.5–17.9%), Prolong labour (2.2–6%), Breech (1.7–8.1%), Failed induction (1–6.7%), Cervical dystocia (1–17.1%), PROM (0.7–2.6%), IUGR (1.5–4.1%), Obstructed Labour (0.2–4.6%), Eclampsia (0.3–1.6%), APH (1–2.6%), CPD (4.0–7.7%), Post-term (1.2–3%), Maternal choice (0.4–0.8%)
Aminu et al., (2014)	38.2%	Bangladesh	Cross-sectional Mixed Method Study	530 Women	Previous CS (29.4%), Foetal distress (15.5 %), CPD (10.2%), Prolonged labour/Obstructed labour (8.3%), Post-term (7%), HDP (4.5%, Rupture of membrane (4.2%), Breech (4%), Fail Induction (3.6%), Oligohydramnios (2.8%),POH (2.5%), Malpresentation (2.1%), APH (1.1%), Reduced foetal Movement (1.1%), Unfavourable cervix (0.9%), Multiple gestation (0.6%), Maternal distress (0.4%), Older primipara (0.4%), Rhesus incompatibility (0.2%), Anaemia (0.2%), Recurrent UTI (0.2%), Labour pain (0.2%), No indication recorded (0.6%) Elective CS: Previous CS (51.8%), CPD (6.8%),Post-term (4.1%), HDP (4.5%, Breech (3%), Oligohydramnios (6%), POH (7.3%), Malpresentation (0.6%), Reduced foetal movement (1.2%), Unfavourable cervix (1.2%), Multiple gestation (1.2%), Older primipara (1.2%), Rhesus incompatibility (0.6%), Recurrent UTI (0.6%), No indication recorded (0.6%) Emergency CS: Previous CS (19.2%), Foetal distress (22.8%), CPD (12.2%), Prolonged labour/Obstructed labour (12.2%), Post-term (2.5%), HDP (5%), Rupture of membrane (6.1%), Breech (4.2%), Fail Induction (5.3%), Oligohydramnios (2.5%), POH (0.3%), Malpresentation (2.8%), APH (1.7%), Reduced foetal Movement (1.1%), Unfavourable cervix (0.8%), Multiple gestation (0.3%), Maternal distress (0.6%), Anaemia (0.3%), Labour pain (0.3%), Unfavourable cervix (0.9%) Primary CS: Foetal distress, CPD, Post-term, Obstructed labour, Breech, Rupture of membrane, Fail induction Repeat CS: Previous CS Primigravida: Post-term (19%), CPD (9.3%), Foetal distress (8.3%)
Sultan et al., (2017)	25%	Bangladesh	Cross-sectional Prospective Study	100 Women	Emergency CS: Previous caesarean section (25.0%), Foetal distress (18.0 %), Obstructed labour (11.0%), Placenta Previa (7.0 %), Abruptio Placentae (1.0 %), Preeclamptic toxaemia (7.0%), Eclampsia (5.0%), PIH (1.0 % Malpresentation (7.0 %), Prolonged labour (6.0%), CPD (4.0%), Failed trial labour (4.0 %), Bad obstetric history (2.0%), Cord prolapse (1.0%), Diabetes Mellites (1.0%)
Ara et al., (2017)	78.7%	Bangladesh	Cross-sectional Prospective study	1253 Women	Previous CS (42.45%), History of subfertility (4.99%). HDP (9.76%), Diabetes mellitus (4.31%), Patient's desire (3.97%), BOH (2.61%), Prolonged labour and cervical dystocia (7.7%), Post-dated pregnancy with oligohydramnios (5.6%), Malpresentation (5.7%),PROM and oligohydramnios (3.2%), Foetal distress (5.1%), Placenta praevia (1.5%), Multiple pregnancy (1.9%), APH (1.3%) Elective CS: Previous caesarean section (55.7%), History of subfertility (6.3%), HDP (12.4%), Malpresentation (7.2%), Diabetes mellitus (5.5%), Patient's desire (5.1%), Placenta praevia (1.9%), BOH (3.3%), Multiple pregnancy (2.5%)
Begum et al., (2017)	35%	Bangladesh	Retrospective Cross-sectional Study	2549 Women	Previous CS (24%), Foetal distress (21%), Prolonged labour and obstructed labour (16%), Amniotic fluid disorder (14%), Post-term (13%), Malpresentation (3%), HDP (3%), Other (6%)

(Contd...)

Supplementary Table 2: (*Continued*)					
Authors and Year	CS rates	Location of study/ Settings	Study design	Study population/ Sample size	Indications of CS
Islam and Yoshimura, (2015)	32%	Bangladesh	Retrospective Cross-sectional Study	1075 Women	Previous CS (24.1%), Foetal distress (21.9%), Obstructed/prolonged labour (20.5%), Post-term (11.1%), Oligohydramnios (6.1%), Breech (3.7%), Pre-eclampsia and eclampsia (3.2%), PROM/leaking (2.4%), APH or placenta previa (1.4%), No indication recorded (1.2%), Others (4.3%)
Das et al., (2018)	35.45%	India	Retrospective Cross-section Study	1619 Women	Foetal distress (32.38%), Scar tenderness (20%), CPD (15.74%), Previous CS 1 or more (12.38%), PIH (2.85%), Refusal of vaginal delivery (2.85%), Oligohydramnios/IUGR (2.38%), Breech (2.38%), Big baby-3.5 kg or more (1.42%), Multifetal gestation (1.42%), Malpresentation (1.42%), APH (1.42%), Prematurity (1.42%), Medical disorder (0.95%), BOH (0.95%)
Jain U., (2018)	17.49%	India	Retrospective Cross-sectional Study	768 Women	Previous CS (30.98%), CPD (16.92%), NPOL (7.55%), Fail induction (7.42%), PIH (5.07%), Obstructed Labour (1.30%), Placenta previa (1.04%),Prolong Infertility (0.78%), Abruption (0.52%), BOH (0.52%), Advanced age (0.52%), Foetal distress (7.05%), Breech (5.98%), Severe oligohydramnios (5.46%), Post-term (3.25%), Twin (1.43%), Transverse lie (1.04%), Malposition (1.04%), Large baby (1.04%), Severe IUGR (0.52%), Cord prolapsed (0.52%) Repeat CS: CPD (30.25%), Foetal distress (15.96%), Scar tenderness (14.7%),PIH (10.08%), Oligohydramnios (8.4%), Breech (6.78%), BOH (2.52%), Twin (2.1%), Malpresentation (2.1%), Big baby (1.68%), Previous 2 LSCS (1.68%), IUGR (1.68%), APH (0.84%), Prematurity (0.84%), Medical disorder (0.42%)
Bade et al., (2014)	23.97%	India	Retrospective Cross-sectional Study	2136 Women	Previous CS (24.8%), CPD (17.6%), Failure to progress (16.6%), Threatened rupture (20%), HIV/ Genital lesion (1.2%), APH (2.1%), Obstructed labour (3.1%), Fail induction (2.1%), Foetal distress (11.7%), Malpresentation (3.9%), Multiple gestation (2.9%), Breech (2.9%), IUGR (2.0%), Cord prolapsed (1.2%), Oligohydramnios (2.0%), Other (3.1%)
Subhashini R and Uma N., (2015)	25.66%	India	Retrospective Cross-sectional Study	8121 Women	Primary Emergency CS: Foetal distress (32.03%), CPD + Medical disorders (22.54%), Big baby–3.5 kg or more (11.22%), Pelvic abnormality (4.74%), Precious Pregnancy (4.85%), Malpresentation (3.88%), IUGR (4.31%), Oligoamnios (8.52%) Primary Elective CS: Foetal distress (5.58%), CPD + Medical disorders (26.56%), Big baby (5.58%), Pelvic abnormality (8.4%), Precious Pregnancy (2.92%), Malpresentation (7.88%), IUGR (5.05%) Repeat Emergency CS: Scar tenderness (13.13%), Foetal distress (10.39%), CPD + Medical disorders (6.02%), Big baby (4.14%), Pelvic abnormality (5.52%), Precious Pregnancy (2.53%), Malpresentation (6.91%), IUGR (7.37%) Repeat Elective CS: CPD + Medical disorders (39.81%), Big baby (9.54%), Pelvic abnormality (9.35%), Precious Pregnancy (4.40%), Malpresentation (3,31%), IUGR (7.70%), Oligoamnios (4.58%)
Dayanand R. D., (2015)	25.7%	India	Retrospective Cross-sectional Study	873 Women	Previous CS 1 or mote (45.77%), Foetal distress (14.97%), PIH (8.86%), Malpresentation (6.11%), Failure of Induction (5.06 %), CPD (4.64%), Labour abnormalities (4.43%), APH (3.53%), Multiple pregnancies (2.11%), Oligohydramnios (1.89%), PROM (1.89 %), IUGR (0.63%, Post-terms (0.63%), Medical disorders (0.42%), BOH (1%), Cord prolapse (0.5%), Hand prolapse (0.25%)

(Contd...)

Supplementary Table 2: (*Continued*)

Authors and Year	CS rates	Location of study/ Settings	Study design	Study population/ Sample size	Indications of CS
Bala et al., (2017)	39.6%	India	Retrospective Cross-sectional Study	11477 Women	Previous CS 1 or more (43.07%), Foetal distress (11.15%), Oligohydramnios +_IUGR (9.31%), Breech (7.5%), CPD (5.94%), Arrest of labour (4.61%), PIH+_APE (4.40%), Fail induction (3.67%), APH (2.96%), Obstructed labour (2.59%, DLOC with head floating (2.45%), Malpresentation or abnormal lie (1.06%), Multiple pregnancy (0.48%), Others (medical diseases, BOH, cord prolapse etc.: 0.8%)
Nikhill et al., (2015)	25.18%	India	Retrospective Cross-sectional Study	1632 Women	Previous 1 or more CS (48.90%), Foetal distress (10.94%), NPOL+ fail induction (10.94%), Breech (6.32%), CPD (6.32%), Oligoaminos and/or IUGR (3.89%), APH (2.43%), Pre-eclampsia/PIH (1-94%), Malpresentation (1.94%), Obstructed labour (1.45%), Twins (1.70%), Other (HIV, PROM, Uterus rupture, ovarian cyst, post-term, fibroid, 4 previous CS (3.16%) Elective CS: Previous CS 1 more (78.72%), Previous CS + post-term (1.51%), Previous CS + HIV (3.02%), Breech (9.06%), Fibroid uterus (3.02%), PLHA (1.51%), Ovarian cyst (1.51%), Twin + traverse lie (1.51%) Emergency CS: Previous CS (40.28%), Foetal distress (13.04%), NPOL + fail induction (13.04%), CPD (7.53%), Breech (5.79%), Oligoamines +/or IUGR (4.63%), Obstructed labour (1.45%), Malpresentation (1.94%), Pre-eclampsia/PIH (1.94%), APH (2.89%), Twins (1.70%), Others (4.34%). Primigravida: NPOL (30%), Foetal distress (33%), Breech (20%), CPD (23%), Malpresentation (1%), Obstructed labour (4%), Oligohydramnios/IUGR (15%) Multigravida: NPOL (15%), Foetal distress (12%), Breech (6%), CPD (3%), Malpresentation (7%), Obstructed labour (2%), Oligohydramnios/IUGR (1%)
Sarma et al., (2016)	27.60%	India	Observational Study	2278 Women	Foetal distress (30.99%), Repeat C/S (23.00%, Induction failure (14.00%), PIH (12.99%), Oligohydramnios (5.0%), CPD (2.02%), Malpresentation (3.03%), Obstructed labour (2.94%), APH (2.02%), Prolonged labour (2.99%), BOH (1.01%)
Patil et al., (2017)	48.18%	India	Retrospective Cross-sectional Longitudinal Study	1143 Women	Primary CS: Foetal distress (34.3%), CPD (18.1%), Malpresentation (9.7%), Oligohydramnios with IUGR (8%), APH (1.3%), Severe pre-eclampsia/eclampsia (2.3%), Multiple pregnancy (2.9%), NPOL (12.6%), Fail induction (4.2%), Precious pregnancy (3.2%), Obstructed labour (1.3%) Primary Elective: Malpresentation (22.2%), CPD (20%), Precious Pregnancy (13.3%), Placenta previa/APH (4.4%), IURG with oligo hydramnios (24.4%), Multiple pregnancy (15.5%) Primary Emergency: Foetal distress (40.2%), NPOL (14.8%), Malpresentation (7.6%), CPD (17.8%), Precious Pregnancy (1.5%), APH (0.8%), Severe oligohydramnios (7.6%), Multiple pregnancy (0.8%), Severe pre-eclampsia/eclampsia (2.7%), Obstructed labour (1.5%) Repeat CS: Scar tenderness (21%), Foetal distress (7.7%), Malpresentation (11.2%), Severe oligo (8.4%), Severe pre-eclampsia/Eclampsia (0.7%), Post-term (0.7%), CPD (8.4%), PROM (5.6%), Precious pregnancy (8.4%), Previous CS (26.5%), Others: Cord around neck, APH (1.4%) Repeat Emergency CS: Scar tenderness (21%), Foetal distress (7.7%), Malpresentation (11.2%), Severe oligohydramnios (8.4%), Severe pre-eclampsia/Eclampsia (0.7%), PROM (0.7%), CPD (8.4%), PROM (5.6%), Precious pregnancy (8.4%), Previous CS (9.9%), Others: Multiple pregnancy, RHD, APH (1.4%)

(Contd...)

Supplementary Table 2: (*Continued*)					
Authors and Year	**CS rates**	**Location of study/ Settings**	**Study design**	**Study population/ Sample size**	**Indications of CS**
Desai et al., (2017)	9.5% and 15.6%	India	Retrospective Cress-sectional Longitudinal Study	19923 Women	Repeat Elective CS: Post-term (1.6%), Malpresentation (16.1%), Severe oligohydramnios with IUGR (16.1%), Severe pre-eclampsia/Eclampsia (1.6%), CPD (16.1%), Precious pregnancy (9.7%), Previous CS (48.5%), Others: Multiple pregnancy, RHD, APH (1.4%) Tribal mother: Foetal distress (31.2%), Previous Caesarean sections (23.2%), Prolonged Labour (11.2%), Breech (16.0%), Transverse lie (5.2%), Obstructed Labour (2.5%), Placenta previa (2.7%), Multiple births (2.0%), CPD (1.8%), Placental abruption (1.3%), Failed induction of labour (0.7%), PIH (15.8%), Eclampsia (4.8%), Sickle Cell disease (2.8%), Anaemia (5.8%), Oligohydramnios (1.5%), Other (7.7%) Non-Tribal mother: Foetal distress (30.6%), Previous Caesarean sections (12%), Prolonged Labour (33.2%), Breech (12,2%), Transverse lie (2.8), Obstructed Labour (1,7%), Placenta previa (1,6%), Multiple births (1,3%), CPD (1.2%), Placental abruption (1.2%), Failed induction of labour (0.7%), PIH (15.4%), Eclampsia (4.8%), Anaemia (5.8%), Oligohydramnios (1.5%), 0ther (8,4%)
Birla et al., (2016)	31.61%	India	Prospective Cross-sectional Study	4,981 Women	Primary CS/Primigravida: Foetal distress (32.21%), CPD (13.4 %), Breech (12.63%), Failed progress (10.7%), PIH (9.26%), Obstructed labour (8.2%), Oligohydramnios (6.53%), IUGR (6.31%), Failed induction (6.10 %), APE (4.42%), Foetal hypoxia (3.16%), PROM (2.10%), Abruptio placenta (1.89%), UPI (1.68%), Precious pregnancy (1.68 %), DTA (1.47%), Transverse lie (1.26%), Brow presentation (0.84%), Cord prolapse (0.63%), Face presentation(0.21%), Impending eclampsia (0.21%) Primary CS/Multigravida: Foetal distress (17.45%), CPD (13.82%), Breech (10.18%), Failed progress (8.73%), PIH (9.09%), Obstructed labour (6.54 %), Oligohydramnios (7.64%), IUGR (4.73%,) Failed induction (3.64 %), APE (Retrospective Longitudinal Study 0.73%), Foetal hypoxia (2.18%), PROM (4.73%), Abruptio placenta (12.73 %), UPI (2.54 %), Precious pregnancy (0.73%), DTA (0.73 %), Transverse lie (5.45 %), Brow presentation (1.09 %), Cord prolapse (1.45%), Face presentation (0.73%), BOH (11.27 %), Placenta previa (8.73 %), Impending rupture (0.73 %), Vasa previa (0.36%), Cord presentation (0.36% , Medical indication (0.36%)
Jain and Patel, (2016)	18.5%	India	Retrospective Cross-sectional Study	7295 Women	Primary CS: Malpresentation (34.3%), APH/placenta abruption/praevia (5.6%), Non-reassuring foetal status (8.2%), Severe oligohydramnios (3.4%), Meconium stain liquor (22%), Obstructed labour (3.9%), NPOL (4.1%), DTA (0.7%), CPD (0.9% Absent end diastolic flow (0.4%), Failure of induction (12.7 %), Demand LSCS (0.2%), Precious pregnancy in case of infertility (0.7%), Cervical fibroid (0.2%), Cervical dystocia (0.2%), Generalized contracted pelvis (2.6%)
Jawa et al., (2016)	31.8%	India	Retrospective Cross-sectional Study	1645 Women	Previous LSCS (23.90%), Foetal distress (16.06%), Breech (6.69%), CPD (5.93%), PIH (11.66%), APH (3.25%), Obstructed labour (2.10%), Malpresentation (2.68%), Multifetal gestation (2.10%), Oligohydramnios/ IUGR (5.93%) ,Cord prolapse (0.96%), BOH (1.53%), NPOL/failed induction (13.0%), Medical disorders excluding HDP(4.21%) Emergency CS: Previous LSCS (18%), Foetal distress (22%), NPOL (18%), Breech (2.5%), CPD (7%), HDP (14%), APH (4.5%), Obstructed labour (3%), Malpresentation (2%), Oligohydramnios/IUGR (6%), Cord prolapse (0.5%), BOH (1%)

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Supplementary Table 2: (*Continued*)					
Authors and Year	CS rates	Location of study/ Settings	Study design	Study population/ Sample size	Indications of CS
Santhanalakshmi et al., (2013)	12.5%	India	Retrospective Cross-sectional Study	530 Women	Elective CS: Previous LSCS (38%), Foetal distress (2%), NPOL (5%), Breech (19%), CPD (1%), HDP (6.5%), Malpresentation (4.5%), Oligohydramnios/ IUGR (6.5%), Cord prolapse (0.5%), BOH (4.5%,), Medical disorders (13 %) Previous CS (43.3%),CPD (15.47%),Failed induction (10%), Foetal distress (6.60 %), Malpresentations (3.39 %), Multiple pregnancy (2.45 %), Precious Pregnancy: BOH, infertility (3.96%),Tumours (1.32 %), APH (1.13 %), Uterine malformations (0.18 %), Cervical dystocia (0.18 %), Severe PIH (2.45 %), IUGR (4.9 %), Medical disorders (4.3 %)
Preetkamal and Nagpal, (2017)	33.2%	India	Retrospective Cross-sectional Study	3233 Women	Repeat CS (29.9%), Placenta Previa (3.9%), Abruptio Placenta (2.6%), NPOL (5.4%), CPD (5.3%), Pre-Eclampsia (3.7%), Eclampsia (1.3%), Obstructed labour (0.7%), Fibroid (0.7%), Foetal distress (17.8%), Breech (16.8%), Transverse Lie 1.3%, IUGR (3 .9%), Severe oligohydramnios (3.5%), Twin pregnancy (3.2%)
Chavda et al., (2017)	19.9%	India	Cross sectional study	1000 Women	Previous CS (39.9%), Foetal distress (19.1%), Malpresentation (18.6%), Failed induction (7.3%), CPD (4.8%), Placenta previa (3.5%), Severe Oligo hydramnios (2.0%), Obstructed labour (1.8%), NPOL (0.9%), Cord prolapse (0.8%), Precious pregnancy (0.6%), Multifetal gestations (0.6%), Abruptio placenta (0.2%)
Dhodapkar et al., (2015)	32.6%	India	Retrospective Cross-sectional Study	1123 Women	Antepartum complication (31.2%), CPD (3.6%), Contracted pelvis (5.4%), Foetal distress (1.3%), Not willing for TOLAC (22.4%), Previous 2 LSCS (10.8%), Scar tenderness (2.2 %), Unfavourable cervix (2.0%)
Saxena et al., (2016)	32.18%	India	Retrospective Cross-sectional Study	2,707 Women	Previous CS (33%), Foetal distress (26.2%), Breech (8.8%), Refusal of VBAC (7.5%), Placenta previa (5.8%), NPOL (4.5%), Unclear indications (4.6%), Multiple gestation (3.5%), Failed induction (3.5%), Obstructed labour (3.3%), IUGR/Abnormal Doppler (1.8%), Malpresentation (1.5%), Scar tenderness (1.5%), CPD (1.5%), Previous hysterotomy (0.3%), Oligohydramnios (0.1%), Fibroid (0.1%)
Jayanthi and Ratna, (2017)	43%	India	Prospective Descriptive Study	1929 Women	Elective/Primigravida: Oligohydramnios (29.1%), PIH (11.9%), Breech (19.17%), CPD (9.5%, Short primi (7.6%), Transverse lie (2.33%), Doppler changes (2.3%), Elderly primi (2.3%), Twins (2.3%), Previous abortions (1.91%), GDM (5.4%), Triplets (0.4%), IUGR (3.3%), Fibroid in LUS (0.4%), Placenta previa (0.4%), Contracted pelvis (0.4%), Long marital life (2.3%)
Banerjee et al., (2018)	34.1%	India	Retrospective Cross-sectional Study	75685 Women	Foetal distress (32.8%), Malpresentation (7.33%), Post caesarean pregnancy (26.76%), Failed induction (3.67%, Failed progression (10.5%), CPD (1.84%), Multiple pregnancy (2.7%), Maternal indication (1.9%), Obstetric indication (8.2%), Foetal indication (4.2%)
Mehta et al., (2018)	41.92%	India	Retrospective Cross-sectional Study	4785 Women	Previous 1 CS with scar tenderness (31.22%), Previous 2 CS (11.91%), Foetal distress (20.74%), NPOL (9.34%), Breech (4.67%), PIH/eclampsia (2.97%, Obstructed labour (3.08%), Severe oligohydramnios/IUGR (1.43%), CPD (9.45%), APH (1.64%), Multiple pregnancies (2.05%), Abnormal lies/ compound presentations (1.43%), More than one Indications (3.03%)
Mittal et al., (2014)	28,93%	India	Retrospective Cross-sectional Study	19,990 Women	Primary CS: Foetal distress (11.06%), Arrest of labour (2.42%), Dilatation (1.68%), Descent (0.74%), Malpresentation (3.29%), Multiple gestation (0.52%), Obstetric indication (1.45%), Maternal indication (0.17%), Foetal indication (0.77%), CPD (1.29%)

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Supplementary Table 2: (*Continued*)

Authors and Year	CS rates	Location of study/ Settings	Study design	Study population/ Sample size	Indications of CS
					Repeat CS: Foetal distress (18.67%), Arrest of labour (0.75%), Dilatation (0.65%), Descent (0.10%), Malpresentation (0.64 %), Multiple gestation (0.28%), Obstetric indication (0.19%, Maternal indication (0.04%), Foetal indication (0. 23%), CPD (1.63 %), C2 Caesarean section (1.31%), Scar tenderness (0.72%), Refusal of Vaginal Birth (0.23%)
Ajeet and Nandakishore, (2013)	40.8%	India	Cross-sectional Study	272 Women	Elective CS: Post caesarean pregnancy, Cephalopelvic disproportion Emergency CS: Foetal distress, Failure of progression of labour
Manjulatha and Sravanthi, (2015)	22.4%	India	Retrospective Cross-sectional Longitudinal Study		Post caesarean pregnancy (9.69 %), Obstetric Indications (2.61%: Placenta previa, abruptio placenta, placenta accrete, and cord prolapse), Failed Progression (1.55%), Maternal Indications (1.14%: Vesico-vaginal fistula repair, post myomectomy, complete perineal tear, and medical causes), Multiple gestation (0.32%, Foetal Indications (0. 07%: Intrauterine growth restriction, prematurity, and congenital malformations), Failed Induction (0.40%), Malpresentation (1.98%), CPD (2.66%, Foetal Distress (1.99%)
Gupta and Garg, (2017)	31.46%	India	Retrospective Cross-sectional Study	2959 Women	Previous C-Section (36.52%), Arrest of Labour (13.65%), CPD (12.03%), Foetal Distress (11.82%), Breech (7.52%), Oligohydramnios/IUGR (5.16%), Failed Induction (3.54%), PIH 3.54%, Obstructed labour (2.90%), APH (1.40%), BOH (0.64%), Malpresentation (0.53%), Multifetal gestation (0.32%), Medical disorders excluding HDP (0.21%), Cord prolapse (0.11%), Prematurity (0.11%) Repeat CS: Foetal distress (32.65%), Scar tenderness (20.87%), CPD (15.88%), ≥2 CS (12.65%), PIH (3.24%), Refusal of vaginal birth (3.24%), Breech (2.94%), Oligohydramnios/IUGR (2.94%), Big baby 3.5 kg and more (1.47%), Multifetal gestation (1.18%), Malpresentation (0.88 %), APH (0.59 %), Prematurity (0.59%), Medical disorders excluding HDP (0.59%), BOH (0.29%)
Chhetri and Singh, (2011)	33.7%	Nepal	Prospective Cross-sectional Study	11,964 Women	Meconium stained liquor (22.7%), Previous CS (15.6%), Breech (12.1%), Foetal distress (10.7%), NPOL (16.5%), CPD (5.3%), Placenta previa (5%), Abruptio placenta (0.4%), Failed induction (3.2%), Twin pregnancy (2.1%), Pre-eclampsia (2.1%), Eclampsia (2.1%), Transverse lie (1.9%), Obstructed labour (1.2%), Cord prolapse (0.9%), Deep transverse arrest (1.3%), Bad obstetric history (0.7%), Previous 2 CS (0.9%), Others (4.6%), On request (0.3%)
Subedi S., (2012)	19.89%	Nepal	Retrospective cross-sectional Study	2011 Women	Foetal distress (6.25%), Previous CS (21.25%), Failed induction (11.25%, NPOL (10%), Breech (10%), CPD (4%), Preeclampsia and eclampsia (3.75%), APH (3.25%), Severe Oligohydramnios (2.5%), Multiple pregnancy (2.5%), Obstructed labour (1.5%), Uterine rupture (1.25%), Cord prolapse (1.25%), CS on Demand (1.25%)
Pradhan et al., (2014)	50.9%	Nepal	Retrospective cross-sectional Study	1295 Women	Foetal distress (40.2%), Previous CS (13.5%), Oligohydramnios (8.9%), NPOL (7.8%), Failed induction (5.9%), Breech (5.3%), Cord round neck (4.2%), CPD (2.8%), PIH/preeclampsia (2.7%), BOH (1.5%), Malpresentation (2.8%), APH (1.2%), Maternal request (1.0%), Intrahepatic cholestasis (0.7%), Others (1.45%)
Gurung et al., (2016)	41.26%	Nepal	Retrospective Cross-sectional Study	2627 Women	CPD (28%), Foetal distress (25%), Previous CS (14%), Malpresentation (7%), PROM (6%), Preeclampsia (6%), Failed induction (5%), NPOL (5%), BOH (2%), Twins (1%), APH (1%)

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Supplementary Table 2: (*Continued*)

Authors and Year	CS rates	Location of study/ Settings	Study design	Study population/ Sample size	Indications of CS
Acharya S. and Raut B., (2017)	17.34%	Nepal	Retrospective cross-sectional Study	1367 Women	Previous CS (20.89%), NPOL (17.9%), CPD (16.2%), Failed induction (15.7%), Malpresentation (7.75%), Foetal distress (5.1%), Severe oligohydramnious with unfavourable cervix (6.9%), Gestational hypertension and eclampsia (4.4%), Placenta previa and APH (1.8%)
Dhakal et al., (2018)	18.8%	Nepal	Retrospective cross-sectional Study	3,694 Women	Foetal distress (20.1%), Previous CS (17.8 %), Meconium stained liquor (17.7%), NPOL (17.1%), Breech/malpresentation (15.8%), Failed vacuum/ instrumental (2.3%), Obstructed labour (2.2%), Eclampsia (2.0%), APH/placenta previa (2%), Failed induction (1.7%), Oligohydramnios (0 .1%), Other (1.0%) Emergency CS: Foetal distress (24.3%), Meconium stained liquor (21.3%), NPOL (20.6%), Breech/malpresentation (13.3%) Elective CS: Previous CS (61.9%), Breech/malpresentation (28.0%)
Singh et al., (2017)	25%	Nepal	Retrospective cross-sectional Study	2250 Births	CPD (32.21%), Previous CS (21.88%), Foetal Distress (13.87%), PIH (2.30%), Oligohydramnios (9.6%), Breech (6.76%), IUGR (0.71%), Fail Induction (8.18%), Polyhydramnios (0.17 %), BOH (0.93%), Twin (0.93%), APH (2.49%) Elective CS: CPD (35.23%), Previous CS (38.64%), PIH (2.27%), Oligohydramnios (4.55%), Breech (5.52%), IUGR (2.27%), Fail Induction (5.68%), BOH (2.84 %), APH (3.41%) Emergency CS: CPD (30.83%), Previous CS (24.25%), Foetal Distress (20.21%), PIH (2.33%), Oligohydramnios (11.92%), Breech (7.52%), Fail Induction (9.33%), Polyhydramnios (0.26%), Twin (1.30%), APH (2.07%)
Mall et al., (2018)	22.57%	Nepal	Retrospective Cross-sectional Longitudinal Study	4892 Women	Previous CS (28.7%), Foetal distress (18.8%), Abnormal presentation (12.0%), CPD (11.9%), Oligohydramnios (6.3%), Fail induction (5.1%), NPOL (4.2%), PIH (3.8%), APH (3.2%), IUGR (2.6%), Subfertility (2.23%), Others (7.4%)
Poudyal et al., (2014)	39.23%	Nepal	Retrospective Cross-sectional Longitudinal Study	38,770 Women	Emergency CS: Foetal distress (41.9%), Oligohydramnios (9.69%), Previous CS (5.57%), NPOL (5.45%), Failed induction (4.03%) Elective CS: Previous CS (9.4%), Breech (1.9%), Subfertility (1.24%), BOH (1.21%), CPD (0.98%)
Bhandari B.R., (2015)41	42.6%	Nepal	Cross-sectional Study	327 Women	Foetal distress (42.6%), Failed induction (15%), Abnormal presentation (14.6%), Severe oligohydramnios (8%), BOH (5%), NPOL (5%), CPD (3.6%), Prolonged second stage of labour (3%), APH (2%), IUGR (1.2%)
Chaudhary et al., (2018)	63.27%	Nepal	Retrospective Cross-sectional Study	275 Women	Oligohydramnios (41%), CPD (34%), NPOL (29%), Previous CS (25%), Foetal distress (21%), Breech (10%), Twins (2%), APH (2%), Triplets (1%), Others (9%)
Prasad et al., (2017)	45.81%	Nepal	Retrospective Cross-sectional Study	1172 Women	Failed induction (7.3%), Foetal distress (19.55%), Previous LSCS (11.5%), Pervious LSCS with other risk factors (9.8%), CPD (10.8%), Meconium stained liquor (9.6 %), Breech/Malpresentation (8.5%), HDP (2.7%), Oligohydramnios (2.22%), Multiple pregnancy (2.04%), APH (2%), NPOL (0.7%), DTA (0.3%), Others (0.9%)
Rijal P., (2014)	-	Nepal	Prospective Observational Study	348 Women	Failed induction (24.7%), Foetal distress (46.0%), Meconium stained liquor (15.5%), Dystocia (13.8%)
Amatya et al., (2013)	25.4%	Nepal	Retrospective Cross-sectional Study	5907 Women	Foetal distress (33.9%), PROM (1.8%), CPD (3.5%), Previous CS (14.7%), Impending Eclampsia (2.1%), IUGR (2.1%), NPOL (6.7%), Failed induction (4.2%), Infertility (1.8%), Primi breech (5.1%), Oligoamines (7.5%), PIH (2.0%), DTA (0.9%), Others (13.5%)

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Supplementary Table 2: (*Continued*)

Authors and Year	CS rates	Location of study/ Settings	Study design	Study population/ Sample size	Indications of CS
Samdal et al., (2016)	9.5%	Nepal	Cross-sectional Prospective Study	864 Women	Prolonged labour/failed induction (26.4%), Abnormal foetal lie (25.3%), Foetal distress (19.8%), Pelvic anatomy (13.2%), Previous CS (7.7%), Previous traumatic delivery (2.2%), PROM (2.9%), Severe oligohydramnios (3.3%) Primigravida: Prolonged labour/failed induction (33.3%), Abnormal foetal lie (27.8%), Foetal distress (24.1%), Pelvic anatomy (11.1%), Previous traumatic delivery (5.7%), PROM (1.1%), Placenta abruption (1.9%), Severe oligohydramnios (1.9%) Multigravida: Prolonged labour/failed induction (17.1%), Abnormal foetal lie (22.9%), Foetal distress (11.4%), Pelvic anatomy (14.3%), Previous CS (20.0%), Previous traumatic delivery (2.2%), PROM (1.1%), Placenta abruption (1.1%), Severe oligohydramnios (5.7%)
Amatya YR and Sapkota D, (2014)	18.5%	Nepal	Retrospective Cross-sectional Study	369 Women	Oligohydramnios (27.9%), CPD (30.9%), Placenta Previa (1.5%), NPOL (10.3%), Failed induction (2.9 %), Maternal distress (1.5%), Previous CS (2.9%), PROM (1.5%), Malpresentation/Malposition (11.8%), Meconium stained Liquor (32.4%) Elective CS: Oligohydramnios (26.5%), CPD (2.9%), Failed induction (2.9%), Previous CS (1.5%), PROM (1.5%, Malpresentation/Malposition (4.4%) Emergency CS: Oligohydramnios (1.5%), CPD (27.9%), Placenta Previa (1.5%), NPOL (10.4%), Maternal distress (1.5%), Previous CS (1.5%), Malpresentation/Malposition (7.5%), Meconium stained Liquor (32.5%)
Pradhan et al., (2015)	41.9%	Nepal	Retrospective Cross-sectional Longitudinal Study	44713 Women	CPD (19.9%), Previous CS (16.5%), Foetal distress (14.3%), Meconium stained liquor (12.3%), Failed induction (9.8%), NPOL (8.9%), Breech (4.9%), Severe oligohydramnios (4.5%), APH (2.7%), Twin pregnancy (1.9%)
Latif et al., (2017)	81%	Pakistan	Retrospective Cross-sectional Study	1354 Women	Primigravida: Failure progression (31%), Foetal distress (22%), Fail induction (14%), Malpresentation (14%), PIH (8.3%), Patients' request (2.87%), Chorioamnionitis (2.1%), Precious pregnancy (1.67%), Obstructed Labour (0.47%)
Jabeen et al., (2013)	56%	Pakistan	Cross-sectional Study	3049 Women	Previous scar (40.37%), Failed induction (13.58%), Foetal distress (11.23%), Malpresentation (6.73%), Failure to progress (4.39%), CPD (3.22%), Polyhydramnios (0.47%), Oligohydramnios (4.68%), PIH (3.92%), IUD (0.29%), Preterm (0.70%), APH (1.64%), IUGR (2.05%), Twins (0.53%), Post-term (0.53%), Decreased Foetal movements (0.99%), Poor Bishop (1.05%), PROM (0.76%), BOH (0.29 %), GDM (1.05%), SROM (0.29%), Precious pregnancy (0.47%), Unspecified (0.76%)
Karim et al., (2013)	27.94%	Pakistan	Cross-sectional Descriptive Case Series Method	778 Women	Previous cs (47.17%), Prolonged Labour (6.2%), Obstructive Labour (3.9%), Breech (9.8 %), Foetal Distress (9.2 %), CPD (9.1 %), Pre-eclampsia (5.3%), Eclampsia (1.02%), APH (5%), Abruptio placenta (2.4%), Placenta previa (2.6%), Twins (2.3 %), Miscellaneous - 13.8 %: PROM (2.6%), Bad obstetrical history (2.6%), Medical disorders including GDM (2.2%), Failed induction (2%), IUGR/Scanty Liquor (1.8%), Precious pregnancy (1.3%), Chorioamnionitis (0.9%), H/O Myomectomy (0.5%)} Primary CS: Prolonged Labour (9.5%), Obstructive Labour (7.1%), Breech (15.8%), Foetal Distress (15.1%), CPD (9.9%), Pre-eclampsia (9.5%), Eclampsia (1.5%), Abruptio placenta (4.1%), Placenta previa (3.2%), Twins (3.2%), Miscellaneous (18.2%)

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Supplementary Table 2: (*Continued*)

Authors and Year	CS rates	Location of study/ Settings	Study design	Study population/ Sample size	Indications of CS
					Repeat CS: Previous cs (47.17%), Prolonged Labour (7.5%), Obstructive Labour (0.8%), Breech (10%), Foetal Distress (8.3%), CPD (25%), Pre-eclampsia (1.7%), Eclampsia (1.7%), Abruptio placenta (1.7%), Placenta previa (5,8%), Twins (4.2%), Miscellaneous (27.5%)
Ehtisham et al., (2014)	44.8%	Pakistan	Retrospective Cress-sectional Study	1491 Women	Repeat Caesarean section (30.9%), Previous scar in labour (5.7%), Foetal distress (15.2%), NPOL (13.9%), Breech presentation (6.6%), Pre-eclampsia/Eclampsia (3.9%), Placental abruption (3.1%), Placenta previa (2.8%), Refusal of labour trial (2.7%), IUGR (2.4%), Good size baby (0.6%), GDM/Uncontrolled Diabetes (0.6%), Miscellaneous (11.5%: Twins pregnancy (1.49%), Precious pregnancy /BOH - 2.09%, Scar tenderness (1.57%), Decreased foetal movements (1.2%), Patient wish (1.04%), Maternal medical disorders (2.1%) {*includes medical disorders like epilepsy, cardiac disease, Renal disease, liver disease, obstetric cholestatic and ITP}, Foetal anomalies –0.6% (includes diaphragmatic hernia, hydrocephalus), Fibroids/history of myomectomy (0.4%), Perineal tear (0.29%)
					Emergency CS: Repeat Caesarean section (1.04%), Previous scar in labour (5.6%), Foetal distress (15.2%), NPOL (13.9%), Breech (3.7%), Pre-eclampsia/Eclampsia (3.2%), Placental abruption (3.1%), Placenta previa (2.24%), Refusal of labour trial (2.24%), IUGR (1.04%), Good size baby (0.14%), GDM/Uncontrolled Diabetes (0.14%), Miscellaneous (6.72%)
					Elective CS: Repeat Caesarean section (29.89%), Breech (2.8%), Pre-eclampsia/Eclampsia (0.59%), Placenta previa (0.59%), Refusal of labour trial (0.44%), IUGR (1.3%), Good size baby (0.44%), GDM/ Uncontrolled Diabetes (0.44%), Miscellaneous (4.7%)
Tahir et al., (2018)	46.7%	Pakistan	Cross-sectional Study	1,093 Women	Previous CS (59.4%), Foetal distress (26.9%), NPOL (32.2%), Malpresentation (7.7%), PIH (6.0%), BOH (2.2%), Abnormalities of placenta (1.8%), GDM (1.2%), Haemorrhagic disorders (0.5%), Maternal request (0.1%), Other (0.5%)
					Primary CS: Foetal distress (60.8%), NPOL (36.6%), Malpresentation (14.1%), PIH (8.2%), BOH (4.0%), Abnormalities of placenta (2.3%), GDM (1.4%), Haemorrhagic disorders (0.9%), Maternal request (0.2%), Other (0.9%)
Ishaq et al,, (2017)	13.1%	Pakistan	Retrospective Cross-sectional Study	1192 Women	Previous CS (39.1%), Obstructed labour (12.9%), Long labour (0.8%), Fail induction (3.1%), Breech (4.1%), Foetal distress (2.4%), Cord prolapse (1.4%), Others (36.2%)
Rafique and Raana, (2012)	55%	Pakistan	Retrospective Cross-sectional Study	1115 Women	Previous CS (56.3%), Foetal distress (17.5%); Failure to progress (14.3%), malpresentation (3.2%), PIH (3.2%), Placenta praevia (2.93%), Placental abruption in 6 (0.9%), Twin in 8 (1.3%)
					Elective CS: Previous CS (23%), malpresentation (2.6%), PIH (3.2%), Placenta praevia (2.6%), Placental abruption (2.6%), Twin in 8 (0.98%)
					Emergency CS: Previous CS (33.2%), Foetal distress (17.5%); Failure to progress (14.3%), malpresentation (0.65%), PIH (0.98%), Placenta praevia (0.3%), Placental abruption in 6 (0.98%), Twin (0.3%)
Baig et al., (2016)	41.96%	Pakistan	Cross-sectional Study	2874 Women	Previous CS (30.51%), CPD and malpresentation (20.14%), Failed progress of labour (19.0%), Foetal distress (16.08%), Eclampsia/Pre-eclampsia (7.22%), APH (7.05%)

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Authors and Year	CS rates	Location of study/ Settings	Study design	Study population/ Sample size	Indications of CS
					Supplementary Table 2: (*Continued*)
Hafeez et al., (2016)	21.40%	Pakistan	Cross-sectional Study	1149 Women	Previous CS (22.26%), Failed progress of labour (18.29%), Foetal distress (15.44%), Breech (14.25%)
Naeem et al., (2015)	21.7%	Pakistan	Cross-sectional Descriptive Study	966 Women	Elective CS: Previous CSs (34.0%), Marked Oligohydramnios (13.0%), CPD (13.0%), PIH (10.8%), Breech (8.6%, Twins with some complication (8.6%), BOH (8.6%), Maternal Wish with bilateral tubal ligation (4.3%), Placenta Praevia (4.3%), Miscellaneous (6.5%) Emergency CS: Foetal Distress (21.9%), Obstructed Labour/Failure to progress (20.7%), Previous (9.7%), Breech (9.7%), Failed Induction (7.3%), APH (6.7%), Primary Dysfunctional Labour (6.4%), Transverse lie (5.5%), CPD (4.3%), PIH/eclampsia (4.3%), Cord Prolapse (2.4%), Twin and first breech (2.4%), Miscellaneous (5.5%)
Goonewardene et al., (2012)	31/8% in 2010	Sri Lanka	Retrospective Longitudinal Study	4689 Women	Previous CS (35.6%), Foetal distress (22.3%), Failure to progress (10.8%), Fail induction (2.5%), Severe preeclampsia (6.6%), Cervix unfavourable for IOL (7%), Primigravida: Elective CS: Foetal distress (23%), Primary Subfertility (14%, Elderly mother (9%), CPD (7%), Cervix unfavourable for IOL (7%) Emergency CS: Foetal distress (46-53%), Fail induction (18%), Fail progression of Labour (29-41%) Multigravida: Emergency CS: Foetal distress (54-61%), Fail induction /fail progression (30-39%) Elective CS: Foetal distress (17%), Vaginal varices (22%), BOH (11%)
Goonewardene et al., (2016)	31.4%	Sri Lanka	Retrospective Longitudinal Study	3174 Women	Previous CS (36.2%), Foetal distress (21.2%), Failure to progress in labour (3.9%), Fail induction (1.9%), Severe preeclampsia (3.8%)
Kim et al., (2012)	Varied <2–28%	Afghanistan	Cross-sectional Study	173 Women	Placenta praevia/abruption (17.7%), Maternal distress (2.4%), Previous scar (8.9%), Eclampsia/ severe pre-eclampsia (4.1%), CPD/prolonged labour (27.2%), Vesico-vaginal fistula (0.6%), Cord prolapse/presentation (3%), Foetal distress (12.4%), Malpresentation (14.2%), Multiple gestation (0.6%), No information (8.9%) Emergency CS: Placenta praevia/abruption (19.2%), Maternal distress (2%), Previous scar (7.3%), Eclampsia/severe pre-eclampsia (4%), CPD/prolonged labour (27.8%), Cord prolapse/presentation (3.3%), Foetal distress (13.2%), Malpresentation (14.6%), Multiple gestation (0.7%), No information (7.9%) Elective CS: Placenta praevia/abruption (5.6%), Maternal distress (5.6%), Previous scar (22.2%), Eclampsia/severe pre-eclampsia (5.6%), CPD/ prolonged labour (22.2%), Vesico-vaginal fistula (5.6%), Foetal distress (5.6%), Malpresentation (22.2%), No information (5.6%)

Supplementary Table 3: Summary of significant factors associated with rising CS rates in South Asia

Authors and Year	Study setting	Study design	Sample Size	Major findings: Statistically significant factors associated with rising CS rates
Khanal et al., 2016	Nepal	Community-based Cohort Study	735 women having an infant <1 year	Urban women (AOR: 3.41, 95% CI: 2.01–5.78. P<0.001) Women education secondary and above (AOR: 2.56, 95% CI: 1.28–5.14, <0.001) Parity: Primiparous (AOR: 1.85, 95% CI: 1.16–2.95, P<0.010)
Karkee et al., 2014	Nepal	Prospective Community-based Cohort	658 women/ births	Higher age (OR: 1.08, 95% CI:1.02–1.15, P< 0.004) Higher education: • Primary (OR:1.65, 95% CI:0.52–5.21) • Secondary (OR: 2.12, 95% CI: 0.70–6.3) • College (OR: 3.43, 95% CI: 1.17–10.07, P< 0.040) Residential location: Urban (OR: 2.94, 95%CI:1.68–5.15, P< 0.001) Intrapartum complications (severe bleeding, prolong labour, swollen hand/body etc.): Yes (OR: 4.15, 95% CI: 2.49–6.9, P< 0.001)
Rijal et al., 2014	Nepal	Hospital-based Prospective Cohort Study	348 pregnant women induced during labour	3 doses of misoprostol (OR: 6.027, 95% CI: 1.832–19.839, P 0.003) Prolonged latent phase of labour (OR: 16.039, 95% CI: 3.985–64.551, P<0.000) Prolonged active phase of labour (OR: 9.627, 95% CI: 3.914–23.684, P<0.000) Birth weight <4kg (OR: 4.384, 95% CI: 1.702–11.109, P<0.002) Bishop's score 5 or more (OR: 1, 95% CI: O.13-0.816, P<0.034)
Neuman et al., 2014	Bangladesh (rural), India (rural and urban) and Nepal Rural)	Cross-sectional Study	45327 births (21 560 in rural Bangladesh, 8541 in rural India, 10 236 in urban India and 4931 in rural Nepal).	Place of birth: Private hospitals • Bangladesh (OR:6.82, 95% CI: 5.96–7.81 and AOR: 5.91,95% CI: 5.15–6.78) • Nepal (OR: 2.42, 95% CI: 1.48–3.94, and AOR: 2.37, 95% CI: 1.62–3.44) • Urban India (OR: 1.36, 95% CI: 1.21–1.52 and AOR: 1.22, 95% CI: 1.09–1.38) ANC 4 visits +: • Bangladesh (AOR: 1.46, 95% CI: 1.26–1.69) • Nepal (AOR: 1.92,95% CI: 1.43–2.58) Serious complications in pregnancy/delivery: symptoms of eclampsia • Rural India (AOR: 1.77, 95% CI: 1.17–2.67) • Urban India (AOR:1.71, 95% CI:1.39–2.11) • Nepal (AOR: 4.87, 95% CI: 2.51–9.47) Multiple birth: • Urban India (AOR: 3.01, 95% CI: 2.14–4.23) • Nepal (AOR: 3.42, 95% CI:1.77–6.61) Higher maternal age: Urban India (AOR: 1.79, 95% CI: 1.27–2.53) Wealth quintile: Richest women • Bangladesh: (AOR: 1.36, 95% CI: 1.09–1.70) • Rural India (AOR: 2.16, 95% CI: 0.87–5.33) • Urban India (AOR: 1.50,95% CI: 1.2–-1.78) Education of women: • Bangladesh: Secondary (AOR 1.44, 95% CI 1.13 to 1.84) and bachelor's or higher (AOR 2.44, 95% CI 1.52 to 3.92) • Urban India: Secondary (AOR 1.22, 95% CI 1.04 to 1.42) and bachelor's or higher 1.62, 95% CI 1.30 to 2.02, P<0.001)
Desai et al., 2017	India	Cross-sectional Longitudinal Study	19923 births	Higher age of women: • Tribal mother: 25–29 (AOR: 1.9, 95% CI: 1.40–2.8, P<0.000), 30 and above (AOR: 3.32, 95% CI: 2.19–5.03, P<0.000) Higher education: • Non-tribal women: 8–12 years (AOR: 1.45, 95% CI: 1.07–1.98, P<0.018), 12 years and more (AOR: 0.73, 95% CI: 0.54–0.98, P<0.039) Low Parity: Primiparous Tribal women and Non-tribal women (P< 0.000) History of previous CS: • Tribal women (AOR: 44.7, 95% CI: 34.74–57.51, P<0.000) and Non-tribal (AOR: 57.51, 95% CI: 41.97–78.82, P<0.00). ANC visits 3 or more: • Non-tribal (AOR: 1.67, 95% CI: 1.16–2.41, P<0.006) Distance from the health facility 26–50 Kilometres: • Tribal (AOR: 1.31, 95% CI: 1.07–1.59, P<0.007)

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Supplementary Table 3: (*Continued*)

Authors and Year	Study setting	Study design	Sample Size	Major findings: Statistically significant factors associated with rising CS rates
Begum et al., 2017	Bangladesh	Retrospective Cross-sectional Study	2549 Births	Higher age of mother: • 30–34 years (AOR: 2.15, 95% CI: 1.48–3.29, P<0.005) and 35 years or more (AOR: 2.00, 95% CI: 1.18–3.40, P<0.005) Higher education: • Higher secondary and above (AOR: 2.06, 95% CI: 1.24–3.25, P<0.005) Birth order: • 1 (AOR:1), 2 (AOR: 0.56, 95% CI: 0.46–0.76, P<0.005) and 3 or more (AOR:0.32, 95% CI: 0.23–0.44, P<0.005) Wealth Quintiles: • Rich (AOR: 1.90, 95% CI: 1.37–2.58, P<0.005) and Richest (AOR: 2.47, 95% CI: 1.78–3.34, P<0.005) Number of ANC visits: • 3 (AOR:1.40, 95% CI: 1.11–1.76, P<0.005) and >3 (AOR: 2.19, 95% CI: 1.67–2.82, P< 0.005) History of foetal loss (AOR: 1.38, 95% CI: 1.10–1.73, P<0.005)
Ajeet and Nandkishore, 2013	India	Cross-sectional Study House to house survey	272 Women who had a child under five years	Place of delivery: Private/nursing home (AOR: 2.73, 95% CI: 1.51–4.94, P<0.05) Pregnancy duration: Pre/post-term (AOR: 1.85, 95% CI: 1.01–3.39, P<0.05) Socioeconomic status: Rich (Class I, II, and III) (AOR: 2 .53, 95% CI: 1.45–4.40, P<0.05)
Yadav et al., 2015	India	Cross-sectional Longitudinal Study	40,086 births	Birth weight >4 Kg (Coefficient: - −0.09257, P<0.0001) Abnormal foetal presentation (Coefficient: 0.7302, P<0.0001) Increasing gestational age (>37 weeks) (Coefficient: −0.4523, P<0.001) Increasing maternal age (>35 years) (Coefficient: 0.01187, P<0.0001) Parity: Nulliparous (Coefficient: −0.1158, P<0.0001)
Ali et al., 2018	Pakistan	Questionnaire Survey using DEMATEL method	Gynaecologists working in either public or private hospitals	Medical factors: • Obesity (Matrices value: r_i+c_i = −45.35909106, $r_i−c_i$ = 1.748565604) • Age of mother (Matrices value: r_i+c_i = −31.8434601, $r_i−c_i$ = 2.172376183) • Umbilical cord prolapse (Matrices value: r_i+c_i = −31.54166732, $r_i−c_i$ = 0.630270284) Non-medical factors: • Patient's preference towards CS (Matrices value: r_i+c_i = 85.76431003, $r_i−c_i$ = 7.654406112) • Increasing number of private hospitals (Matrices value: r_i+c_i = 86.36295414, $r_i−c_i$ = 7.836383342) • The poor condition of public hospitals (Matrices value: r_i+c_i = 78.90532342, $r_i−c_i$ = 0.32802823) • The unavailability of good quality health care and hospital in rural areas (Matrices value: r_i+c_i = 77.82678084, $r_i−c_i$ = 0.709594802)
Hasan et al., 2015	Bangladesh	Cross-sectional Study	194 Women interviewed within 24–48 h after giving birth	Overweight of mother (P<0.01); underweight (OR: 0.021, 95% CI: 0.002–0.196, P<0.01) and normal weight women (OR: 0.048, 95% CI: 0.013–0.176, P<0.01) Higher age of mother: 25 year and above (P<0.01); 15–20 years (OR: 0.050, 95% CI: 0.010–0.248, P<0.01) and 20-25 years (OR: 0.140, 95% CI: 0.410–0.479). Higher education of mother's education (P<0.05); primary educated women (OR: 0.192, 95% CI: 0.045–0.818, P<0.05). Using contraceptive method (P<0.01); Women using contraceptive Devices (OR: 0.229, 95% CI: 0.076–0.687, P<0.01) History of previous CS (P<0.01); Women who did not have history of CS (OR: 0.008, 95% CI: 0.023–0.414, P<0.01). • Mother's weight: Underweight (OR: 0.021, 95% CI: 0.002-0.196, P<0.01) and normal weight women (OR: 0.048, 95% CI: 0.013-0.176, P<0.01) were very less likely having a CS than overweight women. • Previous CS: Women who did not have history of CS (OR: 0.008, 95% CI: 0.023–0.414, P<0.01) were very less chances having a CS than women who had a previous CS.

(Contd...)

Supplementary Table 3: (*Continued*)

Authors and Year	Study setting	Study design	Sample Size	Major findings: Statistically significant factors associated with rising CS rates
Rahman et al., 2014	Bangladesh	Cross-sectional Study Interview	1142 women admitted in hospitals for giving birth	History of previous CS (OR: 20.184, 95% CI: 10.464–25.582, P<0.01) Pregnancy-induced swollen Leg (OR: 1.334, 95% CI: 0.994–1.790, P<0.05) Prolonged labour (OR: 0.172, 95% CI: 0.127–0.235, P<0.01) Mother's education: Secondary (OR: 2.199, 95% CI: 1.551–3.118, P<0.01) and higher (OR: 2.687, 95% CI: 1.588–4.549, P<0.01) Mother's Age: 25-29 (OR: 2.740, 95% CI: 1.588–4.729, P<0.01) and 30+ (OR: 5.078, 95% CI: 2.319–11.123, P<0.01) Duration of taking balanced diet: Rarely (OR: 1.870, 95% CI: 1.244-2.818, P<0.05) and once a week (OR: 1.457; 95% CI: 0.953–2.229, P<0.01) Length of baby >45 cm (OR: 1.456, 95% CI: 1.048–2.023, P<0.05), Order of Bi • rth: 1 (OR: 1), 2 (OR: 0.744, 95% CI: 0.493–1.125, P<0.01)

Supplementary Table 4: Summary of Quality Assessment of included Studies using CASP check lists (CASP Scores)

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total score
Acharya et al., 2017[27]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Amatya et al., 2013[28]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Ara et al., 2018[29]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Bade et al., 2014[30]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Bala et al., 2017[31]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Banerjee et al., 2018[32]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Bhandari et al., 2017[33]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Begum et al., 2017[34]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Chaudhary et al., 2018[35]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Chavda et al., 2017[36]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Chhetri et al., 2011[37]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Das et al., 2018[38]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Desai et al., 2017[39]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Dhakal et al., 2018[40]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Dhodapkar et al., 2015[41]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Ehtisham et al., 2014[42]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Goonewardene et al., 2012[43]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Gupta et al., 2017[44]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Hafeez et al., 2014[45]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Gurung et al., 2016[46]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Ishaq et al., 2017[47]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Jain et al., 2018[49]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Jawa et al., 2016[49]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Karim et al., 2011[50]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Dayanada et al., 2015[51]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Malla et al., 2018[52]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Manjulatha et al., 2015[53]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Mehta et al., 2018[54]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Mittal et al., 2014[55]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Nazneen et al., 2011[56]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Naeem et al., 2015[57]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Nikhil et al., 2015[58]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Pradhan et al., 2014[59]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Pradhan et al., 2014[60]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Preetkamal et al., 2017[61]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Samdal et al., 2016[62]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Santhanalakshmi et al., 2016[63]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Sarma et al., 2016[64]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Singh et al., 2018[65]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Subedi et al., 2018[66]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Tahir et al., 2018[67]	3	3	3	3	3	NA	3	3	3	3	3	3	33

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Supplementary Table 4: (*Continued*)												
Studies	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Total score**
Jabeen et al., 2013[68]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Saxena et al., 2016[69]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Aminu et al., 2014[70]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Rijal et al., 2014[71]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Baig et al., 2016[72]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Kim et al., 2012[74]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Rafique et al., 2012[75]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Prasad et al., 2017[76]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Islam et al., 2015[77]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Amatya et al., 2014[78]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Patil et al., 2017[79]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Subhashini et al., 2015[80]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Sultana et al., 2017[81]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Birla et al., 2016[82]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Jain et al., 2016[83]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Jayanthi et al., 2017[85]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Latif et al.,2017[86]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Paudyal et al., 2014[84]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Goonewardene et al., 2016[86]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Ajeet et al., 2013[84]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Khanal et al., 2016[87]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Karkee et al., 2014[94]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Yadav et al., 2016[88]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Neuman et al., 2014[89]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Ali et al., 2018[91]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Hasan et al., 2015[92]	3	3	3	3	3	NA	3	3	3	3	3	3	33
Rahman et al., 2014[93]	3	3	3	3	3	NA	3	3	3	3	3	3	33

Studies	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Total score**
Sultana et al., 2017	2	1	1	1	1	NA	1	2	2	2	2	2	17
Gurung et al., 2017	2	2	1	1	1	NA	1	2	2	2	2	2	18
Suwal et al., 2013	2	2	1	1	2	NA	1	2	2	2	2	2	19

Supplementary Table 5: Indications for CS reported by studies in South Asia

Indications for CS	%	References
1. Medical and obstetrical Indications		
Foetal Clinical Characteristics		
Foetal distress	1.3–46%	27-54,56,58-76,78
Reduced foetal Movement	0.99–1.1%	42,68,70
Breech/Primiparous breech	2.38–16.8%	28,30,31,35,37-40,42,44,45,50,54,56,58-61,65,66,69,70,75,77
Malpresentation/Abnormal presentation	0.53–34.3%	27,29-34,36,38,40,44,46,49,51-53,55,58,60,63,64,67-70,72-74
Malposition	1.04%	31,48,54
Transverse lie/Abnormal lie	1.04–25.3%	31,37,39,48,54,61,62,77,83
Deep Transverse Arrest (DTA)	0.3–1.3%	28,37,75
Intra-uterine growth retardation (IUGR)	0.52–9.31 %	28,30,31,33,42,44,48,49-54,56,58,61,63,65,68,69
Abnormal Doppler	1.8%	69
Intra-uterine Death (IUD)	0.29%	68
Foetal anomalies/malformation	0.6%	42,53
Big baby - 3.5 kg or more	0.59–1.42%	38,42,48
Post-term	0.63–13%	29,34,48,51,56,58,68,70,76
Pre-term/Prematurity	0.11–5.6%	29,38,46,53,68
Oligohydramnios/Severe oligohydramnios	0 .1–27.9%	27-31,33,35,36,38-40,44,48-52,54,58,59-62,64-70,75-77
Polyhydramnios	0.17%	77
Amniotic fluid disorder	14%	65,68
Meconium stained liquor	9.6–32.4%	34
Multiple gestation/pregnancy (Twins/Triplets)	0.32–3.5%	37,40,59,71,75,77 29,30,31,32,35-39,42,44,46,48-51,54,55,58,59,61,63,65,66,68,69,70,73-75
Premature Rupture of Membrane (PROM)	1.1–6%	28,29,46,50,51,58,62,68,70,76,77
Spontaneous rupture of membrane (SROM)	0.29%	68
Chorioamnionitis/leaking	0.59–0.9%	42,50
Cord prolapse/Presentation/round neck	0.1–4.2%	30,31,36,37,44,47-49,53,60,66
Maternal Clinical Characteristics		
Cephalo-pelvic disproportion (CPD)	0.9–30.9%	27,28,30-33,35,36-39,41,44,46,48-56,58-61,63-66,68-70,72,73,75,77
Contracted pelvis/pelvic anatomy	2.6–5.4%	41,62
PIH/Pre-eclampsia/Eclampsia/HDP	0.21–15.8%	27,28,34,37-40,42-44,46,48-52,54,56,58,60,61,63,65-68,70,72-78
APH/Placenta praevia/Abruptio placenta	0.2–7.05%	27,29-31,33,35-40,42,44,48-54,56,58-66,68-70,72-77
Abnormalities of placenta	1.8%	67
Maternal distress	0.4%	70,73,77
Scar tenderness	1.5–31.22%	38,42,41,54,69
Perineal tear	0.29%	42,53,70
Advanced age /Older primipara	0.4–0.52%	42,48
Uterine malformations	0.18	63
Threatened rupture/uterine rupture	1.25–20%	30,66
Previous hysterotomy/myomectomy	0.3%	42,50,53,69
Medical disorders/conditions (Cervical fibroid/Fibroid Gestational diabetes mellitus/Diabetes mellitus, Rhesus incompatibility, Anaemia, Sickle Cell disease, Recurrent Urinary Tract Infection, Vesico-vaginal fistula, HIV/Genital lesion, Tumours, Intrahepatic cholestasis, Haemorrhagic disorders)	0.2–5.8%	29,30,31,38,39,42,44,49-51,53,58,60,61,63,67-70,73
Obstetrics history		
Previous CS 1 or more	2.9–48%	27,28-48,50-52,54,56,58,59-70,72-78
Refusal of Vaginal Birth After Caesarean Section (VBAC)	2.85–22.4%	38,41,42,69
History of subfertility/Infertility	0.78–4.99%	28.29,48,63
Bad Obstetrics History (BOH)	0.29–5%	29,31,33,37,38,42,44,46,48-50,52,60,63-65,67,68,70
Labour abnormalities		
Obstructed Labour	0.4–3.9%	30,31,34,36,37,39,40,47,48,50,54,58,61,64,66,69,70 ,76
Prolonged Labour	0.8–33.2%	29,33,34,47,50,56,64,70,73,76
Labour abnormalities	4.43%	51
Arrest of labour/Dilatation/Descent	0.74–13.65%	31,44,55
Non-progress/Failure to progress (NPOL)	0.7–29%	27,28,30,32,33,35-37,40,42,43,45,46,48,49,52-54,58-61,66-69,72,75,77,78

(Contd...)

Supplementary Table 5: (*Continued*)

Indications for CS	%	References
Failed induction	0.40–15.7%	27,28,30-33,36,37,39,40,43,44,46-53,56,58-60,63-66,68-71,75,77,78
Dystocia	13.8%	71
Failed vacuum/instrumental	2.3%	40
Poor Bishop	1.05%	68
Cervical dystocia	0.2–7.7%	29,56,63
Unfavourable cervix	0.9–6.9%	27,41,70
Others	0.5–36.2%	34,35,37,39,40,47,52,60,75,76
2. Non-medical indications27		
Maternal choice/Request/Demand	0.1–3.97%	29,37,42,56,66,67
Labour pain	0.2 %	70
Previous traumatic birth experience	2.2%	62
Precious pregnancy	0.47–3.96%	36,42,50,63,68
No indication recorded/Unspecified	0.6–8.9%	68.70,73,76

Supplementary Table 6: Indications for elective CS and emergency CS

Indications	Elective CS		Emergency CS	
1. Medical and Obstetric Indications	%	References	%	References
Foetal Clinical Characteristics				
Foetal distress	2–23%	42,43,49,73,83	7.7–61%	40,42,43,49,57,58,65,70,73,7 4,79,80,81,83,85
Reduced foetal Movement	1.2%	70	1.1%	70
Breech	1.9–19.17%	40,42,57,58,65,70,79,82	2.5–9.7%	40,42,49,57,58,65,70
Malpresentation	0.6–22.2%	40,29,49,57,58,70,73,74,77,80,8 2,83	1.94–14.6%	40,49,57,58,70,73,74,77,80,83
Oligohydramnios/Sever oligohydramnios	4.58–29.1%	49,57,65,70,77,80,82,84	7.6–11.92%	49,58,65,70,77,79,80,83
Polyhydramnios	-	-	0.26%	65
Meconium stained liquor	-	-	21.3-32.5%	40,77
Intrauterine Growth Retardation (IUGR)	1.3–24.4%	42,49,65,80,82.83	1.04–7.37%	42,49,58,83
Doppler changes	2.3%	83	-	-
Multiple pregnancy/Twins/ Triplets	0.4–15.5%	29,57,58,70,80,82	0.30–1.70%	57,58,65,70,73,74,80
Big baby–3.5 kg or more	0.44–9.54%	42,83	0.14–11.22%	42,83
Post-term	1.6–4.1%	42,58,70,80	2.5%	70
Cord prolapse/presentation	0.5%	49	0.5–3.3%	49,57,74,70
Premature Rupture of Membrane (PROM)	1.5%	77	0.7–9.9%	70,80
Hydrocephalus	2.3%	80	-	-
Maternal Clinical Characteristics				
Cephalopelvic disproportion (CPD)	0.98-39.81%	43,49,57,65,70,73,79,80-83	2.5–39.89%	49,57,58,65,70,73,80,83,85
Contracted pelvis/Pelvic abnormality	0.4–9.35%	80,82	4.74–5.52%	80
PIH/HDP/Pre-eclampsia/ Eclampsia	0.59–12.4%	29,42,49,57,65,83,70,73,74,80	0.7–14%	42,49,57,58,65,70,73,74,80,85
APH/Placenta praevia/abruption	0.4–5.6%	29,42,49,57,65,73,74,80,82	0.8–6.7%	49,57,58,65,70,73,74,77,80,85
Short stature primipara	7.6%	82	-	-
Maternal distress	5.6%	73	0.6–2%	70,73,77
Elderly mother/Elderly primipara	1.2–9%	43,70,82	-	-
Scar tenderness	-	-	13.13–37%	82,85
History of subfertility	1.24–14%	29,43,83,84	-	-
Medical disorders (GDM/ Uncontrolled mellitus, Fibroid, PLHA/HIV, Ovarian cyst Vaginal varices, Vesico-vaginal fistula, Rhesus incompatibility, Recurrent UTI, RHD, Anaemia etc.)	0.4–39.81%	29,42,43,49,58,70,73,80,82,83	0.14–22.54%	42,70,80,85
Obstetrics history				
Previous CS 1 or more	9.4–78.72%	29,40,42,49,57,58,65,70,73,74,77,79-82	1.04–40.28%	42,49,57,58,65,70,73,74,77, 79,80,85
Refusal of vaginal birth after CS (VBAC)	0.44%	42	2.24%	42
Bad obstetric history (BOH)	1.21–11%	29,43,49,57,65,70,79	0.3–2.0%	49,70,85
Previous abortions	1.91%	82	-	-
Labour abnormalities				
Non-progress/failure of labour (NPOL)	0.5 %	49	5.45–41%	40,42,43,49,57,58,77,79,81
Obstructed labour	-	-	1.5–20.7%	49,57,58,70,80,85
Prolong labour	2.3%	73	6.0%	70,84
Unfavourable cervix	1.2–7%	43,70	0.8–0.9%	70
Failed Induction	2.9-5.68%	65,77	4.03–18%	43,57,58,65,70,79
Failed trial labour	-	-	4.0%	79
Others	4.7–6.5%	42,57	4.34–6.72%	42,57,58
2. Non-medical Indications				
Maternal request	4.3–5.1%	29,57	-	-
Precious pregnancy	2.92–13.3%	80,83	1.5–8.4%	80,83
Labour pain	-	-	0.3%	70
No indication/information	0.6–5.6%	70,73	7.9%	73

Supplementary Table 7: Indications for primary CS and repeat CS

Indications	Primary CS		Repeat CS	
1. Medical and Obstetric Indications	%	References	%	References
Foetal Clinical Characteristics				
Foetal distress	5.58–60.8%	50,55,67,70,89,83,86	5.96–32.65%	44,48,50,55,80,83
Non-reassuring foetal status	8.2%	84	-	-
Foetal hypoxia	3.16%	86	-	-
Absent end diastolic flow	0.4%	84	-	-
Malpresentation,	3.29–34.3%	55,67,80,83,84	2.94–10%	44,48,50
Breech	15.8–19.17	50,70,86	0.64–16.1%	44,48,55,80,83
Deep transverse arrest (DTA)	0.7–1.47%	84,86	-	-
Transverse lie	1.26%	86	-	-
Brow presentation	0.84%	86	-	-
Face presentation	0.21%	86	-	-
Multiple gestation/pregnancy (Twins/Triplets)	0.4–15.5%	50,55,80	0.28–4.2%	44,48,50,55,80
Severe Oligohydramnios/Oligohydramnios	3.4–29.1%	80,83,84,86	4.58–8.4%	44,48,80,83
Meconium stain liquor	22%	84	-	-
Intrauterine Growth Retardation (IUGR)	3.3–6.31%	80,83,86	1.68–7.70%	44,48,80,83
Premature Rupture of Membrane (PROM)	2.10%	70,86	0.7–5.6%	80
Cord prolapse /cord round neck	0.63%	86	1.4%	80
Big baby–3.5 kg or more	5.58–11.22%	83	1.68%	44,48,83
Prematurity	-	-	0.59–0.84%	44,48
Post-term	-	-	0.7–1.6%	80
Hydrocephalus	-	-	2.3%	80
Maternal Clinical Characteristics				
Cephalopelvic disproportion (CPD)	0.9–20%	50,55,70,80,83,84,86	1.63–30.25%	44,48,50,55,80,83
Pelvic abnormality/Contracted pelvis	0.4–8.4%	84,85	5.52–9.35%	80
APH/Placenta previa/Abruptio placenta	0.4–5.6%	50,80,84,86	0.59–5.8%	44,48,50,80
Abnormalities of placenta	2.3%	67		
Uteroplacental insufficiency (UPI)	1.68%	86		
PIH/Severe pre-eclampsia/eclampsia	2.3–11.9%	50,67,80,84,86	0.7–10.08%	44,48,50,80
Scar tenderness		-	0.72–21%	44,48,55,80,83
Medical disorders (RHD, Cervical fibroid, GDM, Haemorrhagic disorders)	0.4–5.4%	67,84	0.42–2.3%	44,48,80,83
Obstetric history				
Bad obstetrics history (BOH)	4.0%	67	0.29–2.52%	44,48
Previous CS 1 or more	-	-	1.31–48.5%	44,48,50,55,70,83
Refusal of Vaginal Birth	-	-	0.23–0.23	44,55
Labour abnormalities				
Obstructed labour	1.3–8.2%	50,70,80,84,86	7.5%	50
Prolonged Labour	9.5%	50	0.8%	50
Non/fail progression of labour (NPOL)	12.6–36.6%	67,70,80,84,86	-	-
Cervical dystocia	2.42%	55,84	-	-
Arrest of labour/Dilatation/Descent	0.2–1.68%	55	0.10–0.75%	55
Fail induction	4.2–12.7%	70,80,84,86	-	-
Others	0.9–18.2%	50,67	0.10–0.75%	55
2. Non-medical indications				
Maternal request	0.2%	67,82	-	-
Precious Pregnancy	1.5–13.3%	80,83,84,86	2.53–9.7%	80,83

Supplementary Table 8: Indications for CS in terms of parity

Indications of CS	Primigravida		Multigravida	
1. Medical & Obstetric Indications	%	References	%	References
Foetal Clinical Characteristics				
Foetal distress	8.3–53%	43,58,62,70,86,87,	11.4–61%	43,58,62,86
Foetal hypoxia	3.16%	86	2.18%	86
Malpresentation	1–14%	58,87	7%	58
Breech	12.63%	58,82,86	6–10.18%	58,86
Brow presentation	0.84%	86	0.73%	86
Face presentation	0.21%	86	1.09%	86
Abnormal foetal lie/Transverse lie	1.26–27.8%	62,82,86	5.45–22.9%	62,86
Deep Transverse Arrest (DTA)	1.47%	86	0.73 %	86
Oligohydramnios/Severe oligohydramnios	1.9–29.1%	58,62,82,86	1–7.64%	58,62,86
Chorioamnionitis	2.1%	86	-	-
Premature Rupture of Membrane (PROM)	2.10%	86	1.1–4.73%	62,86
Intra-uterine Growth Retardation (IUGR)	3.3–6.31%	58,82,86	1–4.73%	58,86
Doppler changes	2.3%	82	-	-
Multiple pregnancy (Twins /Triplets)	0.4–2.3%	82	-	-
Post-term	19%	70	-	-
Cord prolapse/Cord presentation	0.63%	86	0.36–1.45%	86
Vasa previa	-	-	0.36%	86
Maternal Clinical Characteristics				
Cephalo-pelvic Disproportion (CPD)	7%–23%	43,58,70,82,86	3–13.82%	58,86
Contracted pelvis/Pelvic anatomy	0.4–11.1%	62,82	14.3%	62
PIH\Eclampsia/HDP	0.21–11.9%	82,86,87	9.09%	85
Elderly primipara /Elderly mother	2.3–9%	43,82	-	-
Short stature primipara	7.6%	82	-	-
Placenta previa/Placenta abruption	0.4–1.9%	62,82,86	1.1–12.73%	62,86
Uteroplacental insufficiency (UPI)	1.68%	85	2.54 %	86
Medical disorders (GDM, Fibroid in uterus,	0.4–5.4%	82	-	-
Vaginal varices)	-	-	22%	43
Obstetric history				
Primary Subfertility/Long marital life	2.3–14%	43,82	-	-
Previous abortions/Bad obstetric history (BOH)	1.91%	82	11–11.27 %	43
Previous CS	-	-	20%	62
Labour abnormalities				
Obstructed labour	0.47–8.2%	58,85,87	2–6.54 %	58,86
Prolonged labour	33.3%	62	17.1%	63
Non/Failed progress of Labour (NPOL)	10.7–41%	43,86,87	8.73–15%	43,58
Failed induction	6.10–33.3%	43,86,87	3.64–39 %	43,63,86
Unfavourable cervix	7%	43	-	-
2. Non-medical Indications				
Patients' request	2.87%	87	-	-
Precious pregnancy	1.67–1.68%	89,87	-	-
Previous traumatic birth experience	-	-	5.7%	62