

VU Research Portal

Reintroduction of vacuum extraction in a tertiary referral hospital in Uganda

Nolens-van der Horst, B.J.

2019

document version

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

citation for published version (APA)

Nolens-van der Horst, B. J. (2019). *Reintroduction of vacuum extraction in a tertiary referral hospital in Uganda*. [PhD-Thesis - Research and graduation internal, Vrije Universiteit Amsterdam].

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

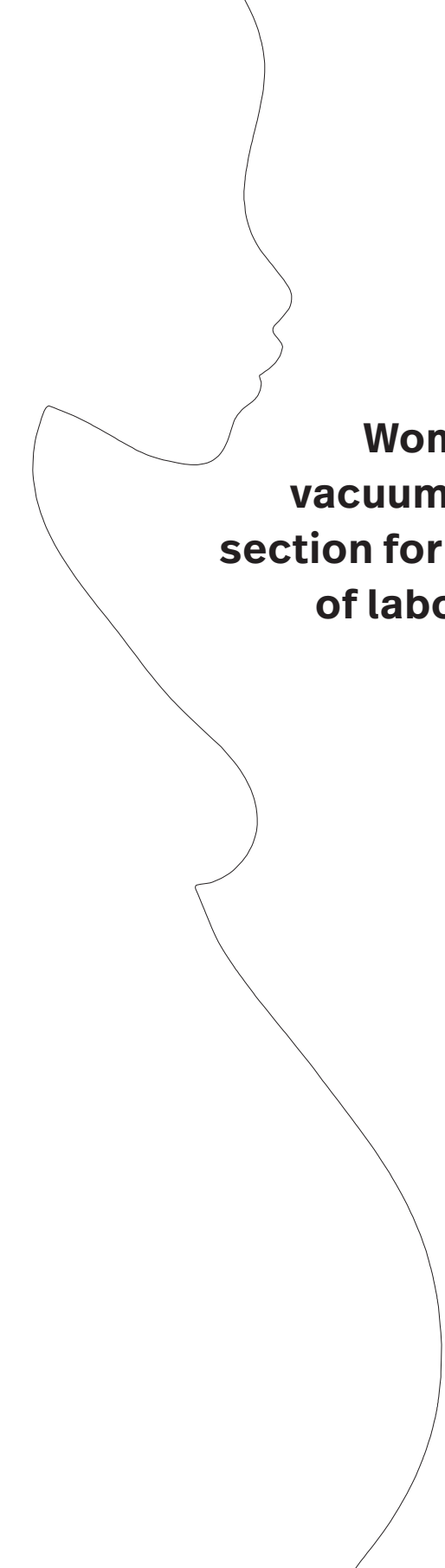
- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

E-mail address:

vuresearchportal.ub@vu.nl



**Women's recommendations:
vacuum extraction or caesarean
section for prolonged second stage
of labour, a prospective cohort
study in Uganda**

**Barbara Nolens
Thomas van den Akker
John Lule
Sulphine Twinomuhangi
Jos van Roosmalen
Josaphat Byamugisha**

Abstract

Objectives

To investigate what women who have experienced vacuum extraction or second-stage caesarean section would recommend as mode of birth in case of prolonged second stage of labour.

Methods

A prospective cohort study was conducted in a tertiary referral hospital in Uganda. Between November 2014 and July 2015, women with a term singleton in vertex presentation who had undergone vacuum extraction or second-stage caesarean section were included. The first day and six months after birth women were asked what they would recommend to a friend: vacuum extraction or caesarean section and why. Outcome measures were: proportions of women choosing vacuum extraction versus caesarean section and reasons for choosing this mode of birth.

Results

The first day after birth, 293/318 (92.1%) women who had undergone vacuum extraction and 176/409 (43.0%) women who had undergone caesarean section recommended vacuum extraction. Of women who had given birth by caesarean section in a previous pregnancy and had vacuum extraction this time, 31/32 (96.9%) recommended vacuum extraction. Six months after birth findings were comparable. Less pain, shorter recovery period, avoiding surgery and the presumed relative safety of vacuum extraction to the mother were the main reasons for preferring vacuum extraction. Main reasons to opt for caesarean section were having experienced caesarean section without problems, caesarean section presumed as being safer for the neonate, caesarean section being the only option the woman was aware of, as well as the concern that vacuum extraction would fail.

Conclusion

Most women would recommend vacuum extraction over caesarean section in case of prolonged second stage of labour.

Introduction

Prolonged second stage of labour is an important cause of maternal and perinatal morbidity and mortality in low- and middle-income countries (LMIC).¹⁻⁶ Interventions aiming to end prolonged second stage of labour are assisted vaginal birth (vacuum extraction and forceps) and caesarean section.^{1,7-9} Although caesarean section can be a lifesaving procedure and must be available when indicated, the operation may also cause maternal and perinatal morbidity and mortality. Performing caesarean section without strict indication is therefore a major cause of concern.^{3,10,11} Assisted vaginal birth has many advantages over caesarean section, especially in LMIC, where the risks of surgery are substantial.^{10,12} Performing assisted vaginal birth avoids the risks related to anaesthesia and reduces risk of surgery-related bleeding and infection.¹³⁻¹⁵ In addition, delay between decision and birth may be reduced and thereby the risk of uterine rupture or intrauterine fetal death during waiting time.¹⁵ Furthermore, the procedure does not result in a uterine scar, with an increased risk of uterine rupture, placenta previa or abnormal invasive placenta in a next pregnancy. This is a particular advantage in settings where many women give birth outside hospital and where these complications are truly life-threatening.¹⁶ The fertility rate in LMIC is often high (5.8 per woman in Uganda during the study period) meaning that, when the first birth is by caesarean section, many 'trials of labour' or repeat caesarean sections are likely to follow. Other long-term complications of caesarean section, or complications causing long-term morbidity, are increased risk of preterm birth in subsequent pregnancies and iatrogenic obstetric fistula.^{17,18} Recovery time after assisted vaginal birth is substantially shorter compared to caesarean section and assisted vaginal birth is less costly.^{10,19} Therefore, assisted vaginal birth was included as one of the seven signal functions of basic emergency obstetric care and one of the nine signal functions of comprehensive emergency obstetric care (together with caesarean section). Vacuum extraction is recommended as an important management option for prolonged second stage of labour to avoid caesarean section and associated maternal and perinatal morbidity and mortality.^{15,20-22}

Despite its advantages, assisted vaginal birth is hardly used in many LMIC (<1% of institutional births), which is very different from many high-income European countries that often have frequencies above 15%.²³⁻²⁶ A cross-sectional health facility assessment in 40 countries in Latin America, sub-Saharan Africa and Asia revealed that reasons for not using assisted vaginal birth were equipment related; lack of staff training; issues with authorisation of human resources and the perception amongst staff that no women with an indication for assisted vaginal birth had presented to the health facility.²³ Failing to resort to assisted vaginal birth could be a major impediment to the reduction of medically non-indicated caesarean sections and maternal and perinatal morbidity and mortality in LMIC.^{3,22} Authorities have declared vacuum extraction the method of choice in modern obstetrics because of its safety for woman and fetus.^{9,23} Several projects have been implemented intending to increase the use of vacuum extraction in LMIC, with promising results.²⁷⁻³⁰ It is not known, however, whether women find vacuum

extraction an acceptable mode of birth, especially in settings where the procedure is uncommon. Studies about women's preferences for mode of birth have only investigated whether women preferred (elective) caesarean section or spontaneous vaginal birth. In those studies, most women preferred vaginal birth above caesarean section.³¹⁻³⁵ The preference of women in case of prolonged second stage of labour has not been studied.

The objective of this study was to investigate what women, who have undergone vacuum extraction or second-stage caesarean section, would recommend to their friends in case of prolonged second stage of labour and why.

Methods

Study design

A prospective cohort study, consisting of interviews with women who gave birth by vacuum extraction or second-stage caesarean section. Interviews were conducted on the first day and six months after birth. This study was part of a larger study on clinical and woman-centred outcomes of vacuum extraction and second-stage caesarean section in Mulago hospital, Uganda. Detailed methods and outcomes were described elsewhere.^{15,19}

Setting

Mulago hospital is the national referral and main teaching hospital of Uganda, situated in the capital city, Kampala. It is a government hospital with 2700 beds and more than 31 000 births annually. The study was conducted in the main labour ward. Medical care in this ward is free of charge. However, due to shortages women sometimes have to buy medical items outside the hospital (e.g. drugs and urinary catheters). During the study period, the vacuum extraction rate in this ward was 2.6% and the caesarean section rate 31.7%. Caesarean section during the second stage of labour in a term singleton pregnancy in vertex presentation occurred to 3.3% of all women. Of women with a term cephalic singleton who had a second stage intervention, 42% had vacuum extraction, 4% had failed vacuum extraction followed by caesarean section and 54% had caesarean section without trial of vacuum extraction.¹⁵

Participants and period of recruitment

Between 25 November 2014 and 8 July 2015, women with a term, singleton in vertex presentation who had undergone vacuum extraction or caesarean section in the second stage of labour were included, after providing a written informed consent.

Outcome measures and method of assessment

Outcome measures were: proportions of women recommending vacuum extraction and caesarean section on the first day and six months after birth, stratified by mode of birth (vacuum extraction, failed vacuum extraction followed by caesarean section or second-stage caesarean section without trial of vacuum extraction).

Since unfavourable clinical outcome could influence women's preferences, outcome measures were calculated for all women and also after exclusion of women with unfavourable maternal or perinatal outcome at the moment of interview, defined as: neonate had died before interview, severe maternal complications (re-laparotomy, hysterectomy and obstetric fistula). Additional outcome measures were reasons for choosing vacuum extraction or caesarean section and frequencies (in percentages), in which those reasons were mentioned, stratified by mode of birth. For reasons of interpretation, clinical information is described when relevant. Method of data collection of clinical outcomes was described elsewhere.¹⁵

On the first day after birth, women were asked what they would recommend to a friend who would need an intervention for prolonged second stage of labour: vacuum extraction or caesarean section (closed question). During a six months follow-up visit or phone call, women were asked what they would recommend to a friend, as well as why they would recommend the chosen mode of birth (open question). Interviews were conducted by trained research assistants who were not performing vacuum extraction or caesarean section themselves. The answers to the open question about why they would recommend the chosen mode of birth were literally recorded into a database by the research assistants.

More than one reason per woman was possible. During analysis, reasons given by the women were categorised into 'main reasons' (mentioned 15 times or more) and 'other reasons' (mentioned less than 15 times). This resulted in five main reasons for choosing vacuum extraction and five main reasons for choosing caesarean section.

Statistical methods

Baseline characteristics are reported in counts and percentages with P-values comparing vacuum extraction to caesarean section without trial of vacuum extraction. Outcome parameters are reported as counts with percentages. P-values were calculated with two-sided chi-square. Data were entered in Microsoft Excel and SPSS version 24 was used for data analysis. $P < 0.05$ was considered statistically significant.

Study size

A convenience sample was used, since this study was part of a larger study including clinical and woman-centred outcome after vacuum extraction and second-stage caesarean section.¹⁵ Sample size for that study was based on expected differences in perinatal death per mode of birth. Missing data per baseline characteristic or outcome parameter varied from 0% to 3.1% and are shown in the tables. Loss to follow-up is described in Results section.

Ethical permission

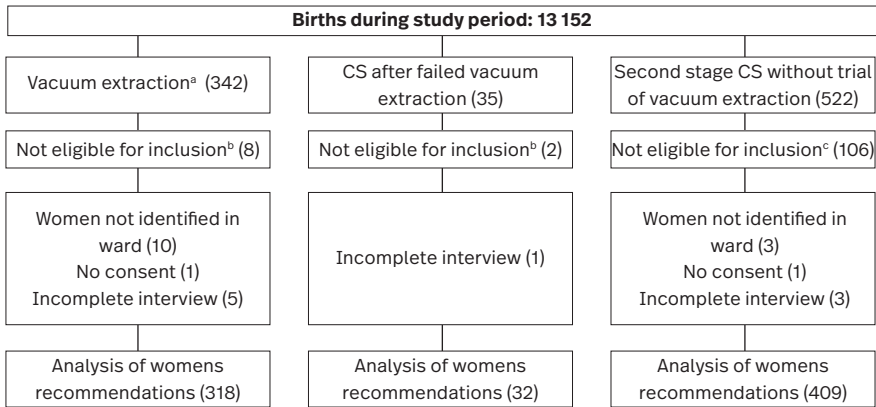
Ethical permission to conduct this study was obtained from the Mulago hospital Research and Ethics Committee (refnr: MREC 489) and the Uganda National Council for Science and Technology (ref HS1752).

Results

Of 783 eligible women, 759 (96.9%) participated in the study. Three hundred and eighteen women had vacuum extraction, 32 women had caesarean section after failed vacuum extraction and 409 women had second-stage caesarean section without trial of vacuum extraction (Figure 1). One day after birth, 317 (99.7%) women after vacuum extraction, 401 (98.0%) women after second-stage caesarean section without trial of vacuum extraction and 32 (100%) women after failed vacuum extraction and subsequent caesarean section had a complete intake interview. Six months after birth, 178 (56.0%) women after vacuum extraction, 226 (55.3%) women after caesarean section without trial of vacuum extraction and 22 (68.8%) women after failed vacuum extraction and subsequent caesarean section could be interviewed.

Table 1 shows socio-demographic characteristics. Ninety-nine of 409 (24.2%) women who had caesarean section without trial of vacuum extraction had a previous caesarean section versus 32/318 (10.1%) women who had vacuum extraction ($P < 0.001$). Other characteristics were not statistically different between the groups. During the interview on the first day after birth, the majority of women who had vacuum extraction (293/318; 92.1%) would recommend this procedure. Almost half of women who had caesarean section (176/409; 43.0%) would recommend vacuum extraction rather than caesarean section (Table 2).

When women with unfavourable outcome were excluded, these figures did not change (Table S1). Of 32 women who had experienced caesarean section in a previous pregnancy and vacuum extraction during this study, 31 women (96.9%) would recommend vacuum extraction to a friend rather than caesarean section. During the follow-up interview at six months after birth, the answers were similar to those on the first day after birth (Table 2).

**Figure 1** | Inclusion process

CS, caesarean section

^a One woman had failed vacuum extraction and subsequent forceps delivery (analysed in vacuum extraction group).^b One of the following exclusion criteria (more than one could apply): Uterine rupture (2), twin and/or preterm birth (8).^c One of the following exclusion criteria (more than one could apply): Maternal death (6), uterine rupture (13), twin, preterm and/or non-vertex presentation (88).**Table 1** | Characteristics of participants

Mode of birth	Vacuum extraction (318)	CS without trial of vacuum extraction (409)	CS after failed vacuum extraction (32)
Parity	n (%)	n (%)	n (%)
Nulliparous	175 (55.0)	207 (50.6)	22 (68.8)
Parous	137 (43.1)	202 (49.4)	10 (31.3)
Missing data	6 (1.9)	0 (0)	0 (0)
Previous CS			
Yes	32 (10.1)	99 (24.2)	5 (15.6)
No	279 (87.7)	310 (75.8)	27 (84.4)
Missing data	7 (2.2)	0 (0)	0 (0)
Education			
None	3 (0.9)	9 (2.2)	1 (3.1)
1-6 years	76 (23.9)	91 (22.2)	5 (15.6)
7-12 years	209 (65.7)	271 (66.3)	22 (68.8)
>12 years	25 (7.9)	32 (7.8)	4 (12.5)
Missing data	5 (1.6)	6 (1.5)	0 (0)
Occupation			
Employed	117 (36.8)	170 (41.6)	15 (46.9)
Student	3 (0.9)	5 (1.2)	0 (0)
Unemployed	191 (60.1)	228 (55.7)	16 (50.0)
Missing data	7 (2.2)	6 (1.5)	1 (3.1)
Age			
Mean age	23.3 (SD 5.2)	23.9 (SD 5.3)	23.4 (SD 5.3)
<20 years	78 (24.5)	88 (21.5)	5 (15.6)
≥20 years	235 (73.9)	320 (78.2)	27 (84.4)
Missing data	5 (1.6)	1 (0.2)	0 (0)

CS: Caesarean section

Table 2 | Women's recommendations in case of second stage intervention

Mode of birth	Vacuum extraction	CS without trial of vacuum extraction	CS after failed vacuum extraction
Recommendation on first day after birth	n (318) (%)	n (409) (%)	n (32) (%)
Vacuum extraction	293 (92.1)	176 (43.0)	14 (43.8)
Caesarean section	24 (7.5)	225 (55.0)	18 (56.3)
Missing data	1 (0.3)	8 (2.0)	0 (0)
Recommendation at six months after birth	n (178) (%)	n (226) (%)	n (22) (%)
Vacuum extraction	160 (89.9)	100 (44.2)	9 (40.9)
Caesarean section	14 (7.9)	123 (54.4)	13 (59.1)
No preference	4 (2.2)	3 (1.3)	0 (0)

CS: caesarean section

Main reasons for recommending vacuum extraction

Reasons why women would recommend vacuum extraction are shown in Table 3. Less pain was the most important reason for recommending vacuum extraction, especially in women who had experienced caesarean section and would recommend vacuum extraction. A short recovery period, avoiding surgery, the presumption that vacuum extraction is safer for the mother and having experienced vacuum extraction without problems were other frequently mentioned reasons.

Table 3 | Reasons for recommending vacuum extraction or caesarean section at six months after birth

Mode of birth	Vacuum extraction (178)		CS without trial of vacuum extraction (226)		CS after failed vacuum extraction (22)		All women (426)	
	n(160)	(%) ^a	n (100)	(%) ^a	n(9)	(%) ^a	n(269)	(%) ^a
Women who recommended vacuum extraction								
Reasons for recommending vacuum extraction								
Less pain during/after vacuum extraction	50	(31.3)	54	(54.0)	6	(66.7)	110	(40.9)
Short recovery, no limitations	28	(17.5)	14	(14.0)	3	(33.3)	45	(16.7)
Vacuum extraction is like normal delivery/no operation or scar	27	(16.9)	13	(13.0)	0	(0.0)	40	(14.9)
Vacuum extraction is safer for mother	20	(12.5)	17	(17.0)	0	(0.0)	37	(13.8)
I had no problems with vacuum extraction	28	(17.5)	0	(0.0)	0	(0.0)	28	(10.4)
Other reason	28	(17.5)	8	(8.0)	0	(0.0)	36	(13.4)
Women who recommended CS	n(14)	(%)^a	n(123)	(%)^a	n(13)	(%)^a	n(150)	(%)^a
Reasons for recommending CS								
I had no problems with CS	0	(0.0)	44	(35.8)	2	(15.4)	46	(30.7)
CS is safer for baby	8	(57.1)	30	(24.4)	2	(15.4)	40	(26.7)
CS is the only option I know	0	(0.0)	21	(17.1)	0	(0.0)	21	(14.0)
Vacuum extraction may fail	0	(0.0)	12	(9.8)	9	(69.2)	21	(14.0)
CS is safer for mother	2	(14.3)	18	(14.6)	0	(0.0)	20	(13.3)
Other reason ^b	9	(64.3)	20	(16.3)	2	(15.4)	31	(20.7)
Women who did not make a choice	4/178	(2.2)^c	3/226	(1.3)^c	0/22	(0.0)^c	7/426	(1.6)^c

CS: caesarean section

^a women who gave this reason as percentage of women who recommended this mode of birth per mode of birth group (more than one reason per woman possible).^b Other reasons for recommending vacuum extraction: vacuum extraction is easier/ less complicated (12); CS is scary (10); vacuum extraction saves lives (5); vacuum delivery is faster (4); vacuum extraction is safer for baby (3); I've heard bad stories about CS (1); concern about sexual activity after CS (1). Other reasons for recommending CS: CS saves lives (11); vacuum extraction is scary (8); CS is faster (5); less pain during/after CS (3); good care after CS (2); the ones helping you have no experience in vacuum extraction (1)^c percentage of women who did not make a choice per mode of birth group

Quotes that illustrate reasons for recommending vacuum extraction are shown below:

“I would advise vacuum extraction to a friend, because I have experienced both and caesarean section was too painful compared to vacuum. I had caesarean section on my first born and it was terrible. But now (after vacuum extraction) I am very OK.”

23-year-old housewife, now P2, gave birth to 3.1 kg girl by vacuum extraction.

“After vacuum extraction you can work. After caesarean section it may take six months.”

19-year-old businesswoman, now P1, gave birth to 3.1 kg boy by vacuum extraction.

“I would recommend vacuum extraction because I recovered so fast compared to my friends who were cut.”

19-year-old businesswoman, now P1, gave birth to 3.1 kg girl by vacuum extraction.

“Vacuum extraction seems normal, while with caesarean section one is cut open.”

17-year-old bar attendant, now P1, gave birth to 2.5 kg girl by vacuum extraction.

“Vacuum extraction prevents operation and is not so painful.”

30-year-old restaurant attendant, now P3, gave birth to 3.7 kg girl by caesarean section.

“One does not have to go through the trauma of (operating) theatre.”

22-year-old housewife, now P1, gave birth to 3.5 kg girl by vacuum extraction.

“Caesarean section is total deformity.”

19-year-old hairdresser, now P1, gave birth to 3.0 kg boy by caesarean section.

“Vacuum extraction saved me and my baby. Some people die during caesarean section.”

30-year-old housewife, now P4, gave birth to 4.0 kg boy by vacuum extraction.

Main reasons for recommending caesarean section

The most frequently mentioned reasons for choosing caesarean section were: having experienced caesarean section without problems; caesarean section presumed as being safer for the neonate; caesarean section being the only option the woman was aware of, concern that vacuum extraction may fail and caesarean section presumed as being safer for the mother:

“I would recommend caesarean section, because I don't know vacuum extraction.”

20-year-old hairdresser, now P1, gave birth to 2.9 kg girl by caesarean section.

“I don't know vacuum extraction; the baby might get damage to the head.”

Housewife, now P1, gave birth to 3.7 kg boy by caesarean section.

“Vacuum extraction may fail and when they take you to (operating) theatre it’s too late.”
18-year-old businesswoman, now P1, gave birth to 3.1 kg boy by caesarean section.

“I had failed vacuum and it was very painful.”
20-year-old hairdresser, now P2, gave birth to 3.6 kg boy by caesarean section after failed trial of vacuum extraction. Neonate was in neonatology unit for 11 days for suspected birth asphyxia, but showed normal development at six months after birth.

“Caesarean section can save baby and mother. In the process of vacuum extraction, one can die, mother or baby.”
34-year-old hairdresser, now P3, gave birth to 4.2 kg girl by caesarean section.

Other reasons for recommending vacuum extraction or caesarean section

Some women recommended vacuum extraction but were concerned about trauma to the neonate as well. Other women were rather concerned about perinatal outcome after caesarean section:

“I would recommend vacuum extraction, but only if there is an assurance that the baby’s brain will not be damaged.”
20-year-old trader, now P2, had one previous caesarean section and gave birth to 3.0 kg boy by vacuum extraction. Neonate had no signs of brain damage at birth (Apgar score 8-9) or at six months follow-up.

“Maybe vacuum extraction saves babies’ lives, since it is faster.”
34-year-old businesswoman, now P4, had one previous caesarean section. Gave birth to a stillborn 3.0 kg boy by (repeat) caesarean section. Intrauterine fetal death occurred during waiting time for caesarean section.

“When babies are born vaginally, they breathe better.”
30-year-old housewife, now P5, gave birth to 4.0 kg boy by caesarean section.

Vacuum extraction perceived as being scary was mentioned by eight women:

“I witnessed vacuum extraction and it was horrible.”
19-year-old housewife, now P1, gave birth to 2.7 kg boy by caesarean section.

One woman mentioned:

“The ones helping you have no experience in vacuum extraction.”
35-year-old housewife, now P2, had one previous caesarean section, gave birth to 2.8 kg boy by (repeat) caesarean section.

The (higher) costs of caesarean section were mentioned by one woman:

“If financially stable they can do caesarean section, but if not, they should do vacuum.”

26-year-old housewife, now P3, gave birth to 3.2 kg girl by vacuum extraction.

Six months after birth, only eight out of 161 (5.0%) women who had given birth by vacuum extraction with good outcome (neonate alive and no severe maternal complications) recommended caesarean section, while 78 out of 193 (40.4%) women who had undergone caesarean section with good outcome would recommend vacuum extraction to a friend. Reasons for recommending caesarean section after having experienced vacuum extraction with good outcome were (with number of women who mentioned this reason in brackets) pain during vacuum extraction (2); ‘My baby had to go to neonatology unit’ (1) (The neonate was in the neonatology unit for suspected birth asphyxia and showed normal development at six months after birth.); ‘It felt bad to see my baby’s head swollen’ (1) (Subgaleal haemorrhage was suspected. The neonate had phototherapy and showed normal development at six months after birth.); Vacuum extraction was scary (2); Complications after vacuum extraction (1) (Mother and neonate went home after 1 day, no complications noted at discharge and at six months follow-up.)

Discussion

The vast majority of women who had experienced vacuum extraction would recommend this mode of birth above caesarean section in case of prolonged labour. Nearly half of the women who experienced caesarean section would also recommend vacuum extraction. Main reasons for choosing vacuum extraction were experiencing less pain, having a shorter recovery period, avoiding surgery and vacuum extraction being presumed as being safer for the mother. Main reasons for recommending caesarean section were having experienced caesarean section without problems, caesarean section presumed as being safer for the neonate, caesarean section being the only option the woman was aware of and concern that vacuum extraction may fail.

These results show that most women perceive vacuum extraction as an acceptable intervention for prolonged second stage of labour. In case they had experienced the procedure, they clearly preferred this intervention above caesarean section. These results are in line with previous findings from the same setting: 91% of the women after vacuum extraction were satisfied about their birthing experience.¹⁹ A study from Argentina found that only 6% of the healthy pregnant nulliparous women (without indication for caesarean section) in the public sector preferred caesarean section above vaginal birth.³³ In a study from Italy, 94% of the parous women without previous caesarean section would prefer to have a vaginal birth in a next pregnancy compared to 60% of the parous women with a previous caesarean section.³⁴ Reasons for preferring

vaginal birth in that study were not wanting to be separated from the neonate, shorter hospital stay and faster postpartum recovery.

Reasons for choosing vacuum extraction in our study are supported by results of studies in the same setting: after vacuum extraction, compared to after caesarean section, pain scores were lower up to six weeks after birth and more women were able to work at six weeks after birth.¹⁹ Vacuum extraction was indeed safer for the mother: risk of severe maternal complications (maternal death, uterine rupture while waiting for procedure, hysterectomy and re-laparotomy) was 0.8% (3/358) in women who had had (trial of) vacuum extraction as compared to 4.2% (18/425) in women who had undergone second-stage caesarean section. During or after caesarean section 5/425 (1.2%) of women died, none (0/358) after (trial of) vacuum extraction.¹⁵

'Vacuum extraction is like normal birth' or 'I do not want an operation or scar' were important reasons to choose vacuum extraction. This might be of particular importance to women in countries where having had caesarean section is seen as abnormal, 'a significant subtraction from womanhood' or even as 'the devil's work' or 'a sign of marital infidelity'.^{31,36}

An important reason for recommending caesarean section is the belief that caesarean section is safer for the neonate. However, this is not supported by publications from Uganda and the United States.^{15,37} In our setting (Uganda), a study of clinical outcome of 757 neonates after either second-stage caesarean section or (trial of) vacuum extraction showed that perinatal outcome and outcome at six months after birth was comparable. Occurrence of perinatal death was 45/410 (11.0%) in the caesarean section group and 29/347 (8.4%) in the vacuum extraction group ($P=0.227$). Occurrence of intra uterine fetal death during waiting time for caesarean section was 18/410 (4.4%) and for vacuum extraction 3/347 (0.9%, $P=0.003$).¹⁵

It is clear that many women are not aware of the risks and benefits of vacuum extraction versus caesarean section. This is an important knowledge gap for pregnant women and possibly for health care providers in this setting. In the situation of prolonged second stage with a clear indication for a vacuum extraction, this option should be promoted as the option of first choice. Women will have to be explained risks and benefits of vacuum extraction, also in relation to caesarean section, and should be asked to provide consent.

Other reported reasons for choosing caesarean section, such as having experienced caesarean section without problems and caesarean section being the only option a woman was aware of, would probably be mentioned less often if women had been better informed.

The reason 'Vacuum extraction may fail' is indeed a realistic concern. In this cohort the failure rate was 9.1% (32/350, Figure 1), comparable to failure rates elsewhere.⁹

Interestingly, 14/32 (43.8%) of the women after failed vacuum extraction would still recommend vacuum extraction. Training and adhering to clinical guidelines are important in keeping failure rates as low as possible.

Although most women in our study would recommend vacuum extraction above caesarean section, vacuum extraction is not always a realistic management option. In some areas, neither caesarean section nor vacuum extraction is available, while in other areas vacuum extraction is not available and caesarean section rates are alarmingly high.^{11,23,25} Such situations clearly represent a missed opportunity. Inexperience or inadequate skills in performing vacuum extraction have been associated with greater frequency of caesarean section use.²² Implementation programmes aiming at increasing the use of vacuum extraction by training of staff, supply of equipment, development of guidelines, audit of indications for caesarean section and vacuum extraction have shown to be effective.^{21,27-30} More such programmes are needed to ensure that women who have an indication for vacuum extraction benefit from the procedure.

Strengths and limitations

A strength of this study is that it addresses an important knowledge gap. Nearly all eligible women accepted to be included, minimising selection bias. An additional strength is that not only women who had experienced vacuum extraction, but also women who had undergone second-stage caesarean section or who had had a failed trial of vacuum extraction were interviewed. Some women in this study may have felt that they should give a response in favour of the care option they received, although 44% of the women after caesarean section recommended vacuum extraction. Only interviewing women after vacuum extraction would give results that would be difficult to interpret.

Eventual bias is expected to be in the same direction for the different groups and is not expected to change the conclusions of the study. The observational design comes with obvious limitations. The baseline characteristic 'previous caesarean section' was more frequent in women who had given birth by caesarean section, and this might have introduced bias. Losses to follow-up at six months are a limitation and could have introduced additional bias, although losses to follow-up were comparable between the different groups. Although participants were from different socioeconomic backgrounds and educational levels, the study was performed in a single health facility in an urban setting. Findings may be generalisable to similar settings, but repetition of our study in other similar and different settings must be encouraged.

In conclusion, the majority of women in this tertiary referral centre in Uganda, would recommend vacuum extraction over caesarean section in case of prolonged second stage of labour.

These findings are in line with literature that vacuum extraction should be the procedure of choice in prolonged second stage of labour to avoid caesarean section, unless a clear contraindication is present. Implementation programmes are much needed to make vacuum extraction a realistic management option for all women requiring this procedure.

References

- 1 Hofmeyr GJ. Obstructed labour: using better technologies to reduce mortality. *Int J Gynaecol Obstet* 2004; 85: 62–72.
- 2 Harrison MS, Ali S, Pasha O et al. A prospective population-based study of maternal, fetal, and neonatal outcomes in the setting of prolonged labor, obstructed labor and failure to progress in low-and middle-income countries. *Reprod Health* 2015; 12: S9.
- 3 Pattinson RC, Vannevel V, Barnard D et al. Failure to perform assisted deliveries is resulting in an increased neonatal and maternal morbidity and mortality: an expert opinion. *S Afr Med J* 2018; 108: 75–78.
- 4 Maaløe N, Sorensen BL, Onesmo R, Secher NJ, Bygbjerg IC. Prolonged labour as indication for emergency caesarean section: a quality assurance analysis by criterion-based audit at two Tanzanian rural hospitals. *BJOG* 2012; 119: 605–613.
- 5 Kayiga H, Ajeani J, Kiondo P, Kaye D. Improving the quality of obstetric care for women with obstructed labour in the national referral hospital in Uganda: lessons learnt from criteria based audit. *BMC Pregnancy Childbirth* 2016; 16: 152.
- 6 Kabakyenga JK, Ostergren PO, Turyakira E, Mukasa PK, Odberg Petterson K. Individual and health facility factors and the risk for obstructed labour and its adverse outcomes in south-western Uganda. *BMC Pregnancy Childbirth* 2011; 11: 73.
- 7 Bailit JL, Grobman WA, Rice MM et al. Evaluation of delivery options for second-stage events. *Am J Obstet Gynecol* 2016; 214: 638. e1–10
- 8 Committee on Practice Bulletins-Obstetrics ACOG Practice Bulletin No. 154: Operative Vaginal Delivery. *Obstet Gynecol* 2015; 126: e56–e65.
- 9 O’Mahony F, Hofmeyr GJ, Menon V. Choice of instruments for assisted vaginal delivery. *Cochrane Database Syst Rev* 2010; 11: CD005455.
- 10 Sandall J, Tribe RM, Avery L et al. Short-term and long- term effects of caesarean section on the health of women and children. *Lancet* 2018; 392: 1349–1357.
- 11 Boerma T, Ronsmans C, Melesse DY et al. Global epidemiology of use of and disparities in caesarean sections. *Lancet* 2018; 392: 1341–1348.
- 12 Biccard BM, Madiba TE, Kluyts HL et al. Perioperative patient outcomes in the African Surgical Outcomes Study: a 7-day prospective observational cohort study. *Lancet* 2018; 391: 1589–1598.
- 13 Epiu I, Tindimwebwa JV, Mijumbi C et al. Challenges of anesthesia in low-and middle-income countries: a cross-sectional survey of access to safe obstetric anesthesia in East Africa. *Anesth Analg* 2017; 124: 290–299.
- 14 Fawcus S, Pattinson RC, Moodley J et al. Maternal deaths from bleeding associated with caesarean delivery: a national emergency. *S Afr Med J* 2016; 106: 53–57.
- 15 Nolens B, Namiro F, Lule J, Van den Akker T, Van Roosmalen J, Byamugisha J. Prospective cohort study comparing outcomes between vacuum extraction and second-stage cesarean delivery at a Ugandan tertiary referral hospital. *Int J Gynaecol Obstet* 2018; 142: 28–36.
- 16 Yang Q, Wen S, Oppenheimer L et al. Association of caesarean delivery for first birth with placenta praevia and placental abruption in second pregnancy. *BJOG* 2007; 114: 609–613.
- 17 Wood L, Tang S, Crawford S. Cesarean delivery in the second stage of labor and the risk of subsequent premature birth. *Am J Obstet Gynecol* 2017; 217: 63. e1–10
- 18 Raassen TJ, Ngongo CJ, Mahendeka MM. Iatrogenic genitourinary fistula: an 18-year retrospective review of 805 injuries. *Int Urogynecol J* 2014; 25: 1699–1706.
- 19 Nolens B, van den Akker T, Lule J, Twinomuhangi S, van Roosmalen J, Byamugisha J. Birthing experience and quality of life after vacuum delivery and second-stage caesarean section: a prospective cohort study in Uganda. *Trop Med Int Health* 2018; 23: 914.

- 20 World Health Organization. *Monitoring Emergency Obstetric Care: A Handbook*. Geneva: WHO; 2009.
- 21 Mola GDL, Unger HW. Strategies to reduce and maintain low perinatal mortality in resource-poor settings – Findings from a four-decade observational study of birth records from a large public maternity hospital in Papua New Guinea. *Aust N Z J Obstet Gynaecol* 2019; 59: 394–402.
- 22 Betran AP, Temmerman M, Kingdon C et al. Interventions to reduce unnecessary caesarean sections in healthy women and babies. *Lancet* 2018; 392: 1358–1368.
- 23 Bailey PE, van Roosmalen J, Mola G, Evans C, de Bernis L, Dao B. Assisted vaginal delivery in low and middle income countries: an overview. *BJOG* 2017; 124: 1335–1344.
- 24 Macfarlane AJ, Blondel B, Mohangoo AD et al. Wide differences in mode of delivery within Europe: risk-stratified analyses of aggregated routine data from the Euro-peristat study. *BJOG* 2016; 123: 559–568.
- 25 Harrison MS, Saleem S, Ali S et al. A prospective, population-based study of trends in operative vaginal delivery compared to cesarean delivery rates in low-and middle-income countries, 2010-2016. *Am J Perinatol* 2019; 36: 730–736
- 26 Bernitz S, Dalbye R, Zhang J et al. The frequency of intra-partum caesarean section use with the WHO partograph versus Zhang’s guideline in the Labour Progression Study (LaPS): a multicentre, cluster-randomised controlled trial. *Lancet* 2019; 393: 340–348.
- 27 Geelhoed D, de Deus V, Siteo M et al. Improving emergency obstetric care and reversing the underutilisation of vacuum extraction: a qualitative study of implementation in Tete Province, Mozambique. *BMC Pregnancy Childbirth* 2018; 18: 266.
- 28 Dominico S, Bailey PE, Mwakatundu N, Kasanga M, van Roosmalen J. Reintroducing vacuum extraction in primary health care facilities: a case study from Tanzania. *BMC Pregnancy Childbirth* 2018; 18: 248.
- 29 Chang X, Chedraui P, Ross MG, Hidalgo L, Penafiel J. Vacuum assisted delivery in Ecuador for prolonged second stage of labor: maternal-neonatal outcome. *J Matern Fetal Neonat Med* 2007; 20: 381–384.
- 30 Nolens B, Lule J, Namiro F, van Roosmalen J, Byamugisha J. Audit of a program to increase the use of vacuum extraction in Mulago hospital, Uganda. *BMC Pregnancy Childbirth* 2016; 16: 258.
- 31 Ezeome IV, Ezugworie JO, Udealor PC. Beliefs, perceptions, and views of pregnant women about cesarean section and reproductive decision-making in a specialist health facility in Enugu, Southeast Nigeria. *Niger J Clin Pract* 2018; 21: 423–428.
- 32 Mazzoni A, Althabe F, Liu NH et al. Women’s preference for caesarean section: a systematic review and meta-analysis of observational studies. *BJOG* 2011; 118: 391–399.
- 33 Mazzoni A, Althabe F, Gutierrez L et al. Women’s preferences and mode of delivery in public and private hospitals: a prospective cohort study. *BMC Pregnancy Childbirth* 2016; 16: 34.
- 34 Tortoni MR, betran AP, Montilla P et al. Do Italian women prefer cesarean section? Results from a survey on mode of delivery preferences. *BMC Pregnancy Childbirth* 2013; 13: 78.
- 35 Dweik D, Girasek E, Toreki A, Meszaros G, Pal A. Women’s antenatal preferences for delivery route in a setting with high cesarean section rates and a medically dominated maternity system. *Acta Obstet Gynecol Scand* 2014; 93: 408–415.
- 36 Orji EO, Ogunniyi SO, Onwudiegwu U. Beliefs and perception of pregnant women at Ilesha about caesarean section. *Trop J Obstet Gynecol* 2003; 20: 141–143.
- 37 Towner D, Castro MA, Eby-Wilkens E, Gilbert WM. Effect of mode of delivery in nulliparous women on neonatal intracranial injury. *N Engl J Med* 1999; 341: 1709.

Supporting information

Additional supporting information can be found below:

Table S1 | Women's recommendations in case of second stage intervention, selection: good maternal and perinatal outcome^a

Mode of birth	Vacuum extraction (289)	CS without trial of vacuum extraction (362)	CS after failed vacuum extraction (28)
Recommendation on first day after birth	n=289 (%)	n=362 (%)	n=28 (%)
Vacuum extraction	271 (93.8)	154 (42.5)	13 (46.4)
Caesarean section	17 (5.9)	201 (55.5)	15 (53.6)
Missing data	1 (0.3)	7 (1.9)	0 (0.0)
Recommendation at six months after birth	n=161	n=193	n=17
Vacuum extraction	151 (93.8)	78 (40.4)	8 (47.1)
Caesarean section	8 (5.0)	112 (58.0)	9 (52.9)
No preference	2 (1.2)	3 (1.6)	0 (0.0)

^a Women with unfavourable outcome were excluded. This was defined as neonate had died before interview, severe maternal complications (re-laparotomy, hysterectomy, obstetric fistula)

When outcome in Table 2 is compared to outcome in this table, using P-values, all P-values are ≥ 0.05