



Cornthwaite, K., Bahl, R., Lenguerrand, E., Winter, C., Kingdom, J., & Draycott, T. (2020). Impacted fetal head at caesarean section: a national survey of practice and training. *Obstetrics and Gynecology*, 41(3), 360-366. <https://doi.org/10.1080/01443615.2020.1780422>

Peer reviewed version

Link to published version (if available):
[10.1080/01443615.2020.1780422](https://doi.org/10.1080/01443615.2020.1780422)

[Link to publication record in Explore Bristol Research](#)
PDF-document

This is the author accepted manuscript (AAM). The final published version (version of record) is available online via Taylor & Francis at <https://www.tandfonline.com/doi/abs/10.1080/01443615.2020.1780422?journalCode=ijog20> . Please refer to any applicable terms of use of the publisher.

University of Bristol - Explore Bristol Research

General rights

This document is made available in accordance with publisher policies. Please cite only the published version using the reference above. Full terms of use are available: <http://www.bristol.ac.uk/red/research-policy/pure/user-guides/ebr-terms/>

Impacted fetal head at caesarean section: a national survey of practice and training

Katie Cornthwaite, MRCOG ^{1,2}, Rachna Bahl, MD, MRCOG ³, Erik

Lenguerrand, PhD ², Cathy Winter, RM ¹, John Kingdom, MD, FRCSC ⁴, Tim

Draycott, MD, FRCOG ¹

¹ *Women's Health Department, North Bristol NHS Trust, UK*

² *Translational Health Sciences, University of Bristol, UK*

³ *Women's Health Department, University Hospital Bristol, UK*

⁴ *Department of Obstetrics & Gynaecology, Mount Sinai Hospital, Toronto, Canada*

Corresponding author

Dr Katie Cornthwaite

The Chilterns

North Bristol NHS Trust

Westbury-on-Trym

Bristol

BS10 5NB

Tel: 07834597324

Email: kc17995@bristol.ac.uk

Word count: 2,640 (excluding reference citations)

Impacted fetal head at caesarean section: a national survey of practice and training

Abstract

This is a national survey of UK obstetric trainees and consultant labour ward leads designed to investigate current practice and training for impacted fetal head (IFH) at caesarean section (CS). An anonymous, on-line survey was disseminated to trainees via Postgraduate Schools and RCOG trainee representatives, and to labour ward leads via their national network. 345 obstetric trainees and consultants responded. The results show that IFH is variably defined and encountered by most UK obstetricians (98% had encountered IFH and 76% had experienced it before full cervical dilatation). There is significant variation in management strategies, although most respondents would use a vaginal push up to assist delivery prior to reverse breech extraction. Responses revealed a paucity of training and lack of confidence in disimpaction techniques: over one in ten respondents had not received any training for IFH and less than half had received instruction in reverse breech extraction.

Impact statement

What is already known on the subject?

IFH is an increasingly recognized, technically challenging complication of intrapartum CS. A recent report suggested that birth injuries associated with IFH are now as common as with shoulder dystocia. However, there is no consensus nor guidelines regarding best practice for management or training.

What do the results of this study add?

This study demonstrates that IFH is poorly defined and commonly encountered by UK obstetricians. It highlights that IFH is not restricted to CS at full dilatation and reveals the ubiquity of the vaginal push method in UK practice. We found evidence that UK obstetricians

are using techniques which have not been investigated and are not recommended for managing an IFH. Moreover, this survey is an eye-opener as to the paucity of training, highlighting that UK obstetric trainees are not adequately prepared to manage this emergency.

What are the implications of these findings for clinical practice and further research?

There is a pressing need to standardize the definition, guidance and training for IFH at CS. Further research should clarify appropriate techniques for IFH and establish consensus for best practice. An evidence-based simulation training package, which allows clinicians to learn and practice recognized disimpaction techniques is urgently required.

Keywords: Impacted fetal head, caesarean section, training

Introduction

Over one-quarter of pregnant women in the UK have a caesarean section (CS)(Swinton 2018) and increasingly, these are performed in the second stage of labour. In the UK and Ireland, CS at full dilatation accounts for 2-5% of all CS(Loudon *et al.* 2010, Unterscheider *et al.* 2011, Corry *et al.* 2018) and up to 15% of intrapartum CS.(Rice *et al.* 2019) Rising rates of second stage CS are a global trend, with similar rates reported internationally.(Radha *et al.* 2012, Davis *et al.* 2015) Underlying reasons for this are likely multifactorial, but reduced levels of experience with operative vaginal birth techniques is undoubtedly an important contributor.(Merriam *et al.* 2017)

Impacted fetal head (IFH) is commonly considered to be a complication of CS at full cervical dilatation.(Jevc *et al.* 2015, Manning *et al.* 2015) Second stage CS can be technically challenging with increased maternal risks of haemorrhage, bladder and other visceral injury(Asıcıoglu *et al.* 2014, Manning *et al.* 2015) as well as long-term consequences such as preterm birth.(Berghella *et al.* 2017) Furthermore, the operator may encounter considerable

difficulty disimpacting an IFH. Reduced space between the fetal head and maternal pubic symphysis can make it difficult for the operator to insert their hand to dislodge the head (Jeve *et al.* 2015). Failure to disimpact the head uneventfully places the fetus at risk of asphyxia and/or head trauma, including skull fractures, sub-galeal and intra-cranial bleeding that may result in severe neonatal morbidity or death. (Asıcıoğlu *et al.* 2014, Steer 2016, Resolution 2019) A range of techniques and strategies are described to overcome these difficulties including tocolysis, vaginal push up, reverse breech extraction and Patwardhan technique (modification of reverse breech for the occipito-anterior fetus, whereby the shoulders are delivered first). (Jeve *et al.* 2015, Waterfall *et al.* 2016)

However, there are notable gaps in the existing literature. Firstly, there is no current consensus definition for IFH. Accordingly, there are very few data to allow estimation of the incidence of IFH in current UK practice. (Rice *et al.* 2019) Moreover, there is a paucity of research addressing the utility of the various techniques suggested to facilitate delivery of an IFH. Finally, obstetricians may lack the training, confidence and skills to execute the recommended techniques when required. (Sethuram *et al.* 2010) We therefore undertook an online national survey to explore potential definitions, and investigate current practice and training for the management of IFH at CS amongst UK obstetric trainees and consultant labour ward leads.

Materials and methods

UK practice and training for impacted fetal head

An anonymous, online survey exploring experience, management and training for IFH at CS was developed using SurveyMonkey™. A pilot version was iteratively revised after feedback from consultant obstetricians and trainees at North Bristol NHS Trust, UK.

The survey was emailed to all UK Obstetrics and Gynaecology Postgraduate Medical Education administrators and the chair of the Royal College of Obstetricians and Gynaecologists (RCOG) trainees' committee for dissemination to UK Obstetrics and Gynaecology trainees. The National Labour Ward Leads' group (now British Intrapartum Care Society) facilitated dissemination to UK consultant labour ward leads. The survey was open for four months (1st May 2017 - 31st August 2017). A final reminder email was sent one month before the survey closed.

The survey consisted of a series of closed answer questions with additional space for open-ended responses where appropriate. Demographic questions asked about the respondent's region of practice and level of experience. Further questions explored potential diagnostic criteria to define IFH, the number of times respondents had experienced IFH at CS, techniques witnessed and used to disimpact an IFH, training, confidence and consultant presence. The survey was anonymous, took approximately 4 minutes to complete and participation was voluntary.

Statistical analyses

The number of UK trainees, estimated from RCOG recruitment administrators, and number of consultant labour ward leads, calculated from the total number of UK obstetric units, were used to estimate denominators for response rates. Data were analysed using descriptive statistics.

For questions relating to training, sub-group analyses using Poisson regression were performed to assess if there were differences in response according to years of experience. Median and interquartile ranges were used to analyse Likert scale questions. Sub-group analyses using Chi-square test or Fisher's exact tests (where numbers were small) were employed to compare results according to years of experience.

Analyses were performed using Stata version 14.2.

Ethical approval

This survey involved anonymous responses from healthcare practitioners only. Research Ethics Committee approval was not required as per the NHS Health Research Authority.

Results

Demographics of respondents

345 obstetricians responded to the survey (response rate=18%), of which 312 (90%) were Obstetrics and Gynaecology trainees (response rate=17% (312/1791)) and 33 (10%) were consultant labour ward leads (response rate=20% (33/165)). Respondents were widely distributed (Table 1) with the majority working in North West England. Most respondents were in Specialty Trainee Years 3 to 5 (47%) with almost half (46%) reporting less than 5 years' experience.

Diagnosis of impacted fetal head

We asked respondents (n=345) about the criteria they would use to diagnose or define IFH at CS. Most (95%) would use "difficulty" (73%) and/or "failure" (57%) "to disengage and deliver the head with standard manoeuvres" at CS. 30% would use "insufficient space

between the fetal head and symphysis pubis to permit delivery with standard manoeuvres” as an additional criterion. Only 15 (4%) respondents stated that “caesarean section performed at full dilatation” was a sufficient diagnostic criterion. Alternative suggestions by individual respondents included: “presence of Bandl’s ring”, “more than two-minute delay from uterine incision to delivery of head” and “caesarean after failed instrumental birth”. In free-text comments, respondents highlighted concerns about the medico-legal implications of describing a fetal head as “impacted”: “Trainees are uncertain if and what should be documented about deeply impacted head”.

Frequency of impacted fetal head at caesarean section

Almost all respondents (98%) had encountered an IFH at CS at least once. More than 1 in 5 (22%) had encountered it over twenty times and the incidence increased with duration in obstetrics (Figure S1). Of those with experience of IFH, 76% had encountered it during a caesarean performed in the first stage of labour, and 11% had experienced IFH before full cervical dilatation at least ten times.

Current practice

Techniques seen to deliver an impacted fetal head (Table S1)

The most common strategy seen to assist delivery of an IFH was lowering of the operating table / use of a stool for the surgeon to stand on (95%). More respondents (94%) had seen the ‘push’ method (assistance to push up vaginally) employed than the ‘pull’ method (reverse breech extraction) (65%), and 38% had seen a fetal pillow being used. The Patwardhan method had only been observed by 7% of respondents, whereas 17% had seen forceps employed abdominally for IFH. Respondents were invited to record any other techniques

they had seen that were not listed. Of these, the most common response was swapping side of the operating table (1%).

Techniques employed to manage an impacted fetal head (Figure 1)

We asked respondents (n=307) to rank the techniques they would normally use to deliver an infant with IFH, in the order they would use them. Respondents could rank their choices 1 to 11 (1 being the first choice and 11 the least likely), or not applicable. Most respondents would first lower the operating table (71%) and then swap hands (41%) to aid disimpaction. Subsequent steps were more variable with obstetricians employing head down tilt, vaginal push up or tocolysis next to assist disimpaction. The data suggest that respondents would attempt a reverse breech extraction later in their management, and typically after extending the uterine incision.

One in five respondents would use the fetal pillow prior to skin incision to assist disimpaction and the device was described as “useful” in free-text comments. However, half of all respondents reported the device as not applicable and difficulties were reported despite its use (“fetal pillow used but still difficult, 2 consultants involved”). Over three quarters of respondents (77%) deemed the Patwardhan method not applicable; an equivalent proportion viewed bladder filling (76%) and use of forceps for IFH (69%) as inappropriate techniques.

Training (Table 2)

Overall, 87% of respondents had received some form of training for IFH at CS, most of which was hands-on / clinical (70%). Less experienced respondents (<5 years’ experience) were less likely to have had hands-on training than more experienced respondents (>10 years’

experience) (RR 0.80, CI; 0.66 to 0.97, $p=0.03$). Only 36% of respondents had received simulation training and this did not vary by experience.

More respondents had received clinical training in the 'push' method (63%) than the 'pull' method (42%). Only a quarter of respondents had received simulation training in advanced disimpaction techniques. Respondents with under 5 years' experience were less likely to have received real life training in both the 'push' (RR 0.75, CI; 0.61 to 0.91, $p=0.003$) and 'pull' methods (RR 0.65, CI; 0.47 to 0.89, $p=0.007$) than those with 6 to 10 years' experience. In contrast, less experienced respondents were more than twice as likely to have received simulation training in the 'pull' method (compared with respondents with 6-10 years' experience: RR 2.02, CI; 1.25 to 3.29, $p=0.004$). Very few respondents had received real-life (6%) or simulation training (5%) in the Patwardhan method, regardless of years of experience.

Consultant presence

Respondents were asked, in their current unit, to estimate the proportion of CS at full cervical dilatation where a consultant would attend: 40% (124/307) reported that consultants were usually or always present and 20% (62/307) that they were rarely or never present.

Satisfaction and Confidence (Table 3)

Most respondents were in equipoise about the quality of training they had received, being neither satisfied nor dissatisfied. Over 90% of respondents with at least 5 years' experience were confident managing an IFH, although only 77% of registrars (grades ST3-7) were confident. Despite this, 25% of those with 6 to 10 years' experience would not feel confident performing a reverse breech extraction. Notably, only 85% of consultant labour ward leads

had this expertise. Only 5% of respondents would feel confident performing Patwardhan's technique. More experienced obstetricians were more satisfied with their training and confident performing disimpaction techniques.

In free-text comments, respondents expressed a desire for an algorithm or guideline that set out a stepwise approach for management: "which manoeuvres to try in which order", "like for shoulder dystocia". Many expressed a wish for "simulation training" as "part of departmental" or "regional training".

Discussion

This is the first national study to investigate current practice and training for IFH at CS. It shows that IFH is well recognised by UK obstetricians and not confined to CS at full dilatation. It highlights the lack of consensus definition and variable management for IFH. It suggests that UK obstetricians have a preference for 'push' methods over 'pull' methods and reveals a concerning use of unvalidated techniques. Importantly, it shines a light on the paucity of training and lack of confidence amongst obstetric trainees managing IFH.

This study has several strengths. It is novel in highlighting the extent of the problem in a high-income setting: thus far, most research into IFH has taken place in low-income countries,(Jeve *et al.* 2015, Waterfall *et al.* 2016) where difficulties with obstructed labour are more common, and obstetricians are more familiar with 'pull' methods. The survey was conducted anonymously, promoting participation. We intentionally surveyed predominantly obstetric trainees to establish their training needs for IFH. We acknowledge that, by not surveying all consultant obstetricians, we may have under-estimated confidence. However, we included an expert group of consultant labour ward leads to contextualise our findings.

The survey benefits from having a large number of respondents representative of UK obstetric trainees and labour ward leads. Whilst we recognise that the response rate is low, it is similar to that of other surveys of health care practitioners.(Johnson and Wislar 2012) The denominator for the response rate may be overestimated since we were unable to precisely determine how many potential participants received the survey link and regional dissemination was variable.

Our survey highlights the lack of agreed definition and possible reluctance amongst trainees to diagnose and document an IFH. We propose a definition for IFH as: “a caesarean cephalic delivery requiring additional techniques to disimpact the fetal head after standard delivery manoeuvres have failed”. Defining a condition by the manoeuvres required to manage it seems circular, but a similar principle is accepted for shoulder dystocia.(Crofts *et al.* 2012)

The exact UK incidence of IFH is unknown, at least partly because there is no standard definition.(Rice *et al.* 2019) Rates of CS at full cervical dilatation have risen over recent years(Unterscheider *et al.* 2011, Corry *et al.* 2018) and it is likely that rates of IFH have increased accordingly. However, our respondents report that IFH is not confined to second stage CS and although this has been reported previously, there are very few data.(Rice *et al.* 2019)

We identified a wide variation in the techniques used to manage IFH and lack of a standardised approach in UK practice. Some initial actions were common, while subsequent steps and their sequence varied considerably. ‘Push’ methods appear to be more commonly used by UK obstetricians, despite increasing evidence that ‘pull’ methods may be safer, at

least for mothers.(Jeve *et al.* 2015, Waterfall *et al.* 2016) This echoes previous research, which highlighted the diversity of techniques for second stage CS and ubiquity of the ‘push’ method in UK practice.(Vousden *et al.* 2015) It is likely that respondents deemed the Patwardhan technique as not applicable due to lack of awareness, since it is relatively new to UK practice, although used widely elsewhere.(Anish *et al.* 2019)

UK obstetric trainees seem to favour less technical interventions such as tocolysis and head down tilt, both of which have been proposed in an algorithm for IFH management(Manning *et al.* 2015) even though there is no evidence of benefit(Waterfall *et al.* 2016). There are conflicting reports regarding the need to extend the uterine incision prior to reverse breech extraction(Manning *et al.* 2015) and this uncertainty is reflected in this survey.

Use of techniques that have not been validated in clinical studies is concerning. Forceps, for example, may aid delivery of a high, mobile fetal head(Waterfall *et al.* 2016) but their use is inconsistent with the mechanics of disimpacting a head deep in the pelvis. Specifically designed obstetric spoons, which look similar to a single blade of an obstetric forceps, are described to deliver an IFH.(Greenberg *et al.* 2018) However, there is little evidence for their use and inappropriate use can lead to maternal visceral injury.(Greenberg *et al.* 2018) Respondents also reported bladder filling as a technique for IFH even though it is not validated and may be unsafe for this purpose.

Our survey identifies an increasing trend in the prophylactic use of fetal pillow, despite not currently being recommended by The National Institute for Health and Care Excellence.(Tabiri-Essuman 2014) Existing research(Seal *et al.* 2016) suggests that the fetal pillow may improve the management of IFH; results echoed by open-ended responses to this

survey. However, studies to date are at risk of selection bias, have inadequate outcome data and do not report cost effectiveness. Moreover, IFH can occur in spite of its use and in CS prior to full dilatation.

This study highlights significant deficiencies in training and confidence for managing IFH. A survey conducted over ten years ago demonstrated the need for training for IFH,(Sethuram *et al.* 2010) yet UK obstetric trainees continue to feel inadequately prepared to deal with it. This may reflect a lack of consensus regarding best practice. Ideally, training should be based on a standardised algorithm, analogous to the management ladder of shoulder dystocia and involve the whole maternity team. However, there are no existing guidelines for managing an IFH and local algorithms have not been widely adopted.(Manning *et al.* 2015, O'Brien *et al.* 2015)

Furthermore, hands-on clinical training may not always be feasible since IFH is unpredictable and consultant presence variable. It also appears that low confidence in performing disimpaction methods is not restricted to trainees, underscoring the importance of advanced training for all levels of experience. Whilst simulation is likely to provide an effective and safe form of training(Crofts *et al.* 2015) existing models do not realistically permit rehearsal of advanced disimpaction techniques.(Vousden *et al.* 2015)

In conclusion, IFH is a heterogeneous and poorly defined complication of CS, increasingly encountered by UK obstetricians. There is a pressing need to standardize its definition, management, and training. Future research should identify the defining techniques for IFH, investigate potential mechanisms of injury and establish consensus for best practice.

Evidence-based simulation training, which allows rehearsal of recognized disimpaction

techniques is urgently required. In the meantime, we would advocate that practitioners refrain from using techniques such as bladder filling, forceps and head down tilt, except in the context of research.

Acknowledgements

The authors would like to thank all the survey respondents who took the time to thoughtfully respond to the survey questions.

Funding

KC is the recipient of a David Telling Charitable Fellowship, Health Education England South West Simulation Network Fellowship and Limbs & Things Fellowship. Additional funding was provided by the Springboard North Bristol NHS Trust Charitable Fund. The funding sources have no direct role in the study design; collection, analysis or interpretation of the data; writing of the report or decision to submit.

Disclosure of interest

The authors report no conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author contributions

KC and TD conceived the idea. KC designed the study, conducted the data collection, analysis and wrote the manuscript, supervised by EL, TD and RB. EL, RB, CW, TD and JK edited and approved the manuscript.

References

Anish, K., Nafeez, S., Kubera, N., Adhisivam, B., and Maurya, D.K., 2019. Comparison of 'push method' with 'Patwardhan's method' on maternal and perinatal outcomes in women undergoing caesarean section in second stage. *Journal of Obstetrics & Gynaecology*, 0 (0), 1–6.

Asıcioglu, O., Güngördük, K., Yildirim, G., Asıcioglu, B.B., Güngördük, Ö., Ark, C., Günay, T., and Yenigül, N., 2014. Second-stage vs first-stage caesarean delivery: Comparison of maternal and perinatal outcomes. *Journal of Obstetrics & Gynaecology*, 34 (7), 598–604.

Berghella, V., Gimovsky, A.C., Levine, L.D., and Vink, J., 2017. Cesarean in the second stage: a possible risk factor for subsequent spontaneous preterm birth. *American Journal of Obstetrics and Gynaecology*, 217 (1), 1–3.

Corry, E.M., Ramphul, M., Rowan, A.M., Segurado, R., Mahony, R.M., and Keane, D.P., 2018. Exploring full cervical dilatation caesarean sections—A retrospective cohort study. *European Journal of Obstetrics & Gynaecology and Reproductive Biology*, 224, 188–191.

Crofts, J., Fox, R., Montague, I., and Draycott, T., 2012. Shoulder Dystocia^[66], 1–18.

Crofts, J., Lenguerrand, E., Bentham, G., Tawfik, S., Claireaux, H., Odd, D., Fox, R., and Draycott, T., 2015. Prevention of brachial plexus injury-12 years of shoulder dystocia training: an interrupted time-series study. *BJOG: An International Journal of Obstetrics & Gynaecology*, 123 (1), 111–118.

Davis, G., Fleming, T., Ford, K., Mouawad, M., and Ludlow, J., 2015. Caesarean section at full cervical dilatation. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, 55 (6), 565–571.

Greenberg, J., Ramin, S., and Barss, V., 2018. Management of deeply engaged and floating fetal presentations at cesarean delivery. *uptodate*.

Jeve, Y., Navti, O., and Konje, J., 2015. Comparison of techniques used to deliver a deeply impacted fetal head at full dilation: a systematic review and meta-analysis. *BJOG: An International Journal of Obstetrics & Gynaecology*, 123 (3), 337–345.

Johnson, T.P. and Wislar, J.S., 2012. Response Rates and Nonresponse Errors in Surveys. *JAMA*, 307 (17), 1805–1806.

Loudon, J., Groom, K., Hinkson, L., Harrington, D., and Paterson-Brown, S., 2010. Changing trends in operative delivery performed at full dilatation over a 10-year period. *Journal of Obstetrics & Gynaecology*, 30 (4), 370–375.

Manning, J.B., Tolcher, M., Chandraharan, E., and Rose, C.H., 2015. Delivery of an Impacted Fetal Head During Cesarean: A Literature Review and Proposed Management Algorithm. *Obstetrical & Gynecological Survey*, 70 (11), 719–724.

Merriam, A., Ananth, C., Wright, J., Siddiq, Z., D'Alton, M., and Friedman, A., 2017. Trends in operative vaginal delivery, 2005-2013: a population-based study. *BJOG: An International Journal of Obstetrics & Gynaecology*, 124 (9), 1365–1372.

O'Brien, S., Sharma, K., Simpson, A., Kingdom, J., Windrim, R., McAuliffe, F.M., and Higgins, M., 2015. Learning From Experience: Development of a Cognitive Task List to Perform a Caesarean Section in the Second Stage of Labour. *Journal of Obstetrics and Gynaecology Canada*, 37 (12), 1063–1071.

Radha, P., Tagore, S., Rahman, M., and Tee, J., 2012. Maternal and perinatal morbidity after Caesarean delivery at full cervical dilatation. *Singapore Medical Journal*, 53 (10), 655–658.

Resolution, N., 2019. The Early Notification scheme progress report: collaboration and improved experience for families, 1–70.

Rice, A., Tydeman, G., Briley, A., and Seed, P.T., 2019. The impacted foetal head at caesarean section: incidence and techniques used in a single UK institution. *Journal of Obstetrics & Gynaecology*, 10, 1–4.

Seal, S.L., Dey, A., Barman, S.C., Kamilya, G., Mukherji, J., and Onwude, J.L., 2016. Randomized controlled trial of elevation of the fetal head with a fetal pillow during cesarean delivery at full cervical dilatation. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*, 133 (2), 178–182.

Sethuram, R., Jamjute, P., and Kevelighan, E., 2010. Delivery of the deeply engaged head: a lacuna in training. *Journal of Obstetrics and Gynaecology*, 30 (6), 545–549.

Steer, P.J., 2016. Is a fractured skull discovered in the neonate after caesarean section delivery always evidence of negligence? *BJOG: An International Journal of Obstetrics & Gynaecology*, 123 (3), 336–336.

Swinton, G., 2018. NHS Maternity Statistics, 1–29.

Tabiri-Essuman, J., 2014. NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE, 1–15.

Unterscheider, J., McMenamin, M., and Cullinane, F., 2011. Rising rates of caesarean deliveries at full cervical dilatation: a concerning trend. *European Journal of Obstetrics & Gynaecology and Reproductive Biology*, 157 (2), 141–144.

Vousden, N., Hamakarim, Z., Briley, A., Girling, J., Seed, P.T., Tydeman, G., and Shennan, A.H., 2015. Assessment of a Full Dilatation Cesarean Delivery Simulator. *Obstetrics & Gynaecology*, 125 (2), 369.

Waterfall, H., Grivell, R.M., and dd, J., 2016. Techniques for assisting difficult delivery at caesarean section. *The Cochrane database of systematic reviews*, (1), CD004944.

Tables

Table 1 Demographics of respondents

Demographic factor	n	(%)
Region		
East Midlands	2	(0.6)
East of England	21	(6.1)
Kent, Surrey, Sussex	37	(10.7)
London	39	(11.3)
North East	28	(8.1)
North West	80	(23.2)
Oxford	1	(0.3)
Scotland	4	(1.2)
Severn	34	(9.9)
South West Peninsula	5	(1.4)
Wales	13	(3.8)
Wessex	33	(9.6)
West Midlands	11	(3.2)
Yorkshire and the Humber	37	(10.7)
Grade		
ST1 – 2	49	(14.2)
ST3 – 5	163	(47.2)
ST6 – 7 / Associate Specialist	100	(29.0)
Consultant	33	(9.6)
Years of experience		
Less than 5 years	160	(46.4)
6 to 10 years	135	(39.1)
More than 10 years	50	(14.5)

Table 2 Type of training respondents had received for managing impacted fetal head at caesarean section

Type of training	Years of experience			Comparisons according to years of experience					
	< 5yr n=130 (44%)	6-10yr n=122 (41%)	> 10yr n=46 (15%)	>10yr vs <5yr		>10yr vs 6-10yr		6-10yr vs <5yr	
				RR (95%CI)	p value	RR (95%CI)	p value	RR (95%CI)	p value
None	21 (16.2)	11 (9.0)	6 (13.0)	1.24 (0.53-2.88)	0.62	0.69 (0.27-1.76)	0.44	1.79 (0.90-3.56)	0.10
Hands-on / clinical	84 (64.6)	89 (73.0)	37 (80.4)	0.80 (0.66-0.97)	0.03	0.91 (0.76-1.08)	0.29	0.89 (0.75-1.05)	0.16
Push method	70 (53.9)	88 (72.1)	31 (67.4)	0.80 (0.62-1.03)	0.09	1.07 (0.85-1.35)	0.56	0.75 (0.61-0.91)	0.003
Pull method	40 (30.8)	58 (47.5)	26 (56.5)	0.54 (0.38-0.78)	0.001	0.84 (0.61-1.15)	0.28	0.65 (0.47-0.89)	0.007
Patwardhan method	6 (4.6)	7 (5.7)	5 (10.9)	0.42 (0.14-1.33)	0.14	0.53 (0.18-1.58)	0.25	0.80 (0.28-2.33)	0.69
Simulation	54 (41.5)	39 (32.0)	15 (32.6)	1.27 (0.80-2.03)	0.31	0.98 (0.60-1.60)	0.94	1.30 (0.93-1.80)	0.12
Push method	49 (37.7)	20 (16.4)	8 (17.4)	2.17 (1.11-4.23)	0.02	0.94 (0.45-1.99)	0.88	2.30 (1.45-3.64)	<0.001
Pull method	41 (31.5)	19 (15.6)	11 (23.9)	1.32 (0.74-2.34)	0.35	0.65 (0.34-1.26)	0.20	2.02 (1.25-3.29)	0.004
Patwardhan method	8 (6.2)	5 (4.1)	2 (4.4)	1.42 (0.31-6.44)	0.65	0.94 (0.19-4.70)	0.94	1.50 (0.50-4.47)	0.47
Small group	31 (23.9)	31 (25.4)	14 (30.4)	0.78 (0.46-1.34)	0.37	0.83 (0.49-1.42)	0.51	0.94 (0.61-1.45)	0.77
Lecture based	19 (14.6)	19 (15.6)	11 (23.9)	0.61 (0.31-1.19)	0.15	0.65 (0.34-1.26)	0.20	0.94 (0.52-1.69)	0.83

Table 3 Satisfaction and confidence amongst respondents for managing impacted fetal head at caesarean section

Question	Years of experience						p value
	< 5yr		6-10yr		> 10yr		
	Median Rank* (IQR)	Agree n (%)	Median Rank* (IQR)	Agree n (%)	Median Rank* (IQR)	Agree n (%)	
I am satisfied with the training I have received for managing an impacted fetal head	3 (2-4)	34 (39.1)	3 (3-4)	60 (75.0)	4 (3-4)	29 (82.9)	<0.001
I feel confident managing cases of impacted fetal head	3 (2-4)	35 (35.4)	4 (4-4)	92 (91.1)	4 (4-5)	43 (97.7)	<0.001
I would feel confident performing a reverse breech extraction if the need arose	2 (2-3)	21 (20.2)	4 (3-4)	74 (75.5)	4 (4-5)	35 (85.4)	<0.001
I would feel confident performing Patwardhan's technique if the need arose	1 (1-2)	2 (1.6)	1 (1-2)	5 (4.4)	2 (1-3)	8 (19.5)	<0.001

*Median Rank: 1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree

Figure captions

Figure 1 Order in which respondents would use techniques to assist delivery of an impacted fetal head at caesarean section

Supporting tables and figures captions

Figure S1 Proportion of respondents who had encountered impacted fetal head at various frequencies, according to years of experience.

Table S1 Techniques respondents had seen being used to manage an impacted fetal head at caesarean section