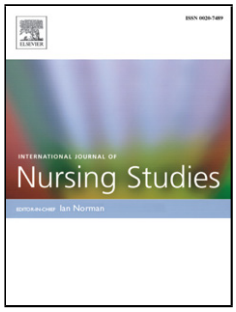
Accepted Manuscript



Title: Perineal injury associated with hands on/hands poised and directed/undirected pushing: A retrospective cross-sectional study of non-operative vaginal births, 2011 to 2016

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Manuscript Title: Perineal injury associated with hands on/hands poised and directed/undirected pushing: A retrospective cross-sectional study of non-operative vaginal births, 2011 to 2016

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Background: Clinicians hand position and advised pushing techniques may impact on rates of perineal injury

Objective: To assess the association of four techniques used in management of second stage with risk of moderate and severe perineal injury

Design: Retrospective cross-sectional study

Setting: A metropolitan maternity hospital and a private maternity hospital in Brisbane, Australia

Participants: Term women with singleton, cephalic presentation experiencing a non-operative vaginal birth from January 2011 to December 2016

Methods: The research sites perinatal database recorded data on clinicians approach to instructing women during second stage and hand position at birth. Women were identified from matching the inclusion criteria (n=26,393) then grouped based on combinations of hands-on, hand- poised, directed and undirected pushing. The associations with perineal injury were estimated using odds ratios obtained by multivariate analysis. Primary outcomes were the risk of moderate and severe perineal injury. The significance was set at 0.001.

Results: In Nulliparous women there was no difference in the risk of moderate or severe perineal injury between the different techniques. In multiparous women the use of a hands-on/directed approach was associated with a significant increase in the risk of moderate (AOR 1.18, 95% CI 1.10-

1.27, p<0.001) and sever perineal injury (AOR 1.50, 95% CI 1.20-1.88, p<0.001) compared to hands-poised/undirected .

Conclusions: a hands poised / undirected approach could be utilised in strategies for the prevention of moderate and severe perineal injury.

Keywords: Hands off, Hands-poised, Hands-on, Obstetric anal sphincter injury, Perineal support, Perineal injury, Vaginal birth,

Contribution of the paper

What is already known about the subject:

- Evidence regarding the effectiveness of either a hands-on the perineum/vertex or a hands-poised technique remains contradictory
- Cochrane systematic reviews of randomised controlled trials of effects either hand position or directed / undirected pushing have not demonstrated any benefit of one technique over the other in terms of preventing perineal injury
- Some non-randomised trials report reductions in severe perineal injury when a package of care including a hands-on approach is used.

What this paper adds

- In nulliparous women differences hand position and pushing technique at birth are not associated with any difference in rates of perineal injury.
- In multiparous women a hands-poised approach combined with undirected pushing may be associated with a lower risk of perineal injury and episiotomy use compared to other technique combinations.
- The hands-on component of care packages designed to reduce severe perineal injury may not be a major contributing factor in reducing risk of severe perineal injury

1 Introduction

In countries such as Australia and the United Kingdom some degree of perineal trauma occurs in up to 85% of all vaginal births (Australian Institue of Health and Welfare, 2015, Smith et al., 2013). The majority of these tears occur spontaneously involving the vaginal tissue, underlying perineal muscles and skin (2nd degree) or as episiotomies involving the same anatomical structures (Hauck et al., 2015). Severe perineal injury involving the anal sphincter (3rd degree) or anal epithelium (4th degree), occurs in up to 6% of all vaginal births (Ampt et al., 2015, Ismail and Puyk, 2014) with approximately half resulting in medium to long term health implications such as bowel incontinence (Smith et al., 2013, Suto et al., 2015). Various strategies that can be used by clinicians to reduce the incidence of perineal trauma have been debated in the literature since the 19th century (Goodell, 1871).

A frequently discussed aspect of perineal management is whether pressure should be applied to the advancing vertex and/or the stretching perineum (hands-on) or no/minimal touch unless it is assessed that rapid birth of the head may occur (hands-poised). Systematic reviews of trials comparing a hands-on to a hands-poised approach have reported either no effect (Aasheim et al., 2017) or favoured the hands-on approach (Bulchandani et al., 2015) however, in the latter the effect was only present in the reported non-randomised trials. Other approaches used during birth that may impact on perineal outcomes include either verbally instructing the woman to push with each contraction with or without Valsalva (directed) or allowing the woman to respond to her own expulsive urges (undirected). Again systematic reviews have either reported no effect,(de Tayrac and Letouzey, 2016, Lemos et al., 2017) or favoured the undirected approach (Prins et al., 2011). Complicating factors in randomized controlled trials exploring these separate techniques are that each approach is unlikely to occur in isolation, with combinations of methods used and high rates of crossover between groups, due to strong clinician preference for one method over the other (Hamilton, 2016, McCandlish et al., 1998). This lack of trial fidelity in either or both the treatment and control arms may lead to confounding and threaten the reliability of results (Bannister-Tyrrell et al., 2015). Observational studies may provide useful data when in randomized controlled trials are likely to be affected by high rates of confounding resulting from entrenched practice (Hirayama et al., 2012).

1.1 Aim

The aim of this study was to examine the effects of combinations of second stage techniques (hands-on/hands-poised and directed/undirected pushing) on rates of moderate (2nd degree) perineal injury and severe (3rd and 4th degree) perineal injury using data from 63,539 women giving birth between 2011 and 2016.

2. Methods

A retrospective study design was used to determine rates of moderate and severe perineal trauma associated with clinicians hand position and expulsive directions given to the labouring woman during second stage labour and birth.

2.1 Participants and setting

The study population is comprised of women who had vaginal births at two maternity hospitals in Brisbane, Australia between 2011 and 2016. One hospital is a major referral centre providing maternity services to both public and privately insured women with approximately 10,000 births per year (5000 public; 5000 private). The second hospital is a private obstetric unit with approximately 400 births annually.

2.3 Data sources

Data were collected from the research sites perinatal database which contains information related to all births from both hospitals. We extracted de-identified data from January 2011 to December 2016. In 2011 a number of questions were added to the database regarding the hand position of the attending clinician during the birth of the fetal head and the directions provided to the woman with regards to pushing during the second stage. This data was self-reported by the attending midwife after the birth. These consisted of: “No/minimal touch”, where pressure was only applied to the vertex when judged to be advancing rapidly and likely to tear the perineum, referred to in this study as ‘hands-poised’. This is consistent with definitions from previous studies (Mayerhofer et al., 2002, McCandlish et al., 1998). Other options were: “hands-on controlling the head and/or promoting flexion”; “controlling the head and guarding of the perineum”; “guarding of the perineum only” collectively referred to in this

study as 'hands-on'. The descriptions of the three hands-on options are similar to those presented in a Delphi study by Ismail et al. (2015) that reported the view of a panel of expert clinicians that all three manoeuvres constitute an hands-on approach either singularly, or in combination. A similar description of the hands-on technique is provided in the Cochrane review by Aasheim et al. (2017). It may be that clinicians use one or more of the hands-on techniques whilst managing a birth and the data recorded reflects the hands-on technique mostly used during the birth. We also considered that clinicians using either of the hands-on manoeuvres were adopting a similar practice approach to managing the birth. The difference between the two groups (hands-poised versus hands -on) being that in hands-on, pressure (firm enough to promote flexion) is routinely applied to the fetal head and/or perineum whereas, with hands-poised only light pressure is applied to the vertex when considered necessary by the clinician and no pressure is applied to the perineum. Questions regarding advice in second stage were either "listen to and respond to her body's urges" (undirected pushing) or "actively encouraged each contraction but not Valsalva" and "actively encouraged each contraction and directed to Valsalva" (directed pushing). The only difference between the two directed pushing options was the verbal instruction to the woman to hold her breath during pushing (Valsalva) versus no clear instruction to breath hold. We considered that in either case it would be likely that, even though a woman may instinctively hold her breath briefly when pushing, she would hold that breath longer than normal when following instructions to push and hence we grouped these together. The data was then sorted into four categories, hands-poised /undirected, hands-poised /directed, hands-on /directed, and hands-on /undirected.

2.4 Exclusions and covariates

The final analytical sample was achieved after a series of exclusions (Figure 1). These exclusions included: caesarean section, gestation <37 weeks, twin births, malpresentations (e.g. breech, brow, face). Data regarding hands-on/hands-poised or directed/undirected was not recorded for babies born outside of the birth suite or operating theatre (e.g. homebirths) or operative (vacuum and forceps) births so these were excluded. Only data from (non-operative) vaginal births were analysed. Based on existing literature the following covariates were considered as confounders: birthweight, head

circumference, gestation, maternal age, body mass index, insurance status, Asian ethnicity, nulliparity, labour induction, oxytocic augmentation, increased second stage, episiotomy, first vaginal birth after caesarean section, shoulder dystocia, epidural and recumbent birth position.(Ampt et al., 2013, Baghestan et al., 2010, Garretto et al., 2016, Gurol-Urganci et al., 2013, Jango et al., 2014, Loewenberg-Weisband et al., 2014)

Ethnicity was grouped according to the Australian Bureau of Statistics Standard Australian Classification of Countries.(Australian Bureau of Statistics, 2016) Increased second stage was defined as lasting over two and a half hours in nulliparous women and over one hour in multiparous women in keeping with the research sites definitions of prolonged second stage. Recumbent birthing position included recumbent, supine, lateral and lithotomy.

2.5 Statistical Analysis

Statistical analyses were performed using Stata 14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP). Descriptive statistics were reported as means and standard deviations for continuous variables and percentages for categorical variables. Odds ratios and 95% confidence intervals were calculated using logistic regression. Univariate analysis were conducted with all the covariates identified from literature and statistical significance was set as $P<0.05$ for the univariate analysis. Any variable found to be statistically significant in the univariate analysis was entered into the final multivariate model (footnotes in Table 3 detail variables included in each model). Statistical significance for the multivariate analysis was set at $P<0.001$ due to the nature and size of the data set. Poisson regression was used to explore yearly trends for the primary outcomes and episiotomy rates with significance set at $P<0.05$. **3** Results

Of the 62,539 births between 2011 and 2016, 36,146 births were excluded from final analysis because they did not meet inclusion criteria (n=34,996), duplicate records (n=473) and missing primary outcomes (n=677) (Figure 1).

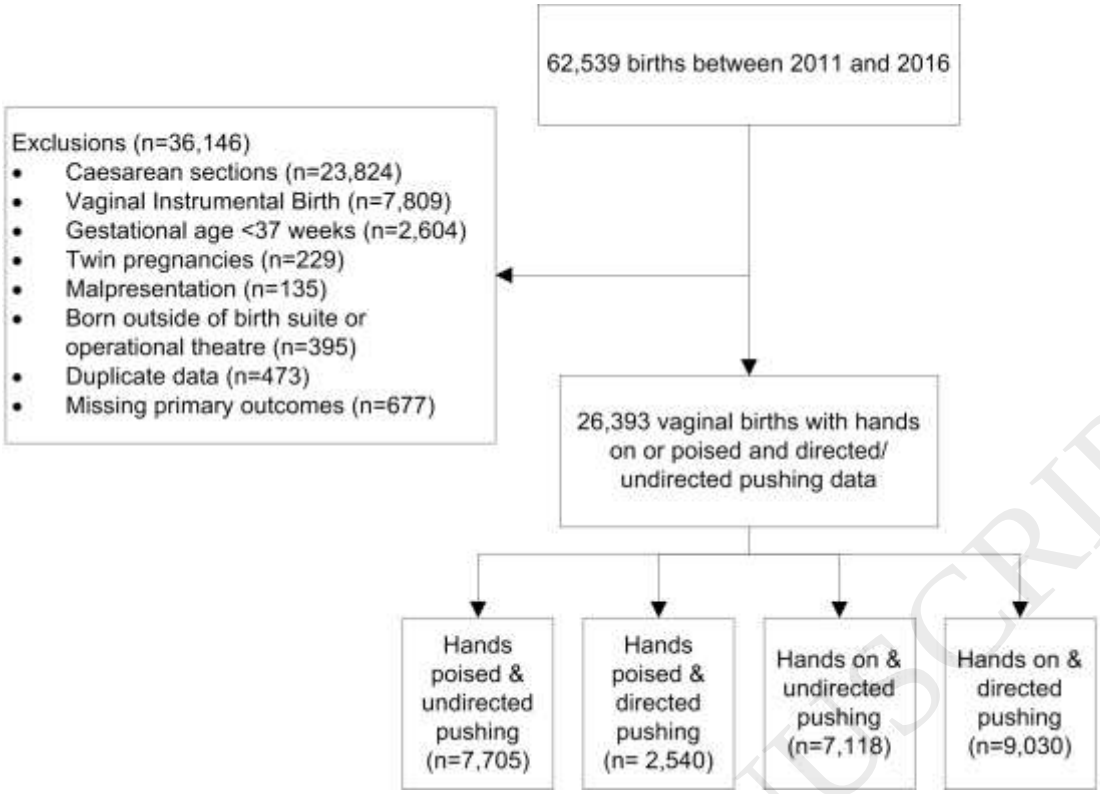

Figure 1. Flow chart of participants for final cohort.

3.1 Descriptive data

Birthweight was similar between the four groups, whilst head circumference, gestation, maternal age and body mass index were statistically, but not clinically, different. Women in the hands-on/directed pushing group were more likely to be of Asian ethnicity, be nulliparous, have their labours induced or require oxytocic augmentation, have an increased second stage of labour, have had a previous caesarean section, have an epidural or birth in a recumbent position compared to the other three primary outcome groups (Table 1).

Table 1. Characteristics of the study cohort (n=26,393)

	Hands-poised & undirected (n=7,705)	Hands-poised & directed (n=2,540)	Hands-on & undirected (n=7,118)	Hands-on & directed (n=9,030)	p-value
Continuous variables	Mean ±Standard Deviation				
Birth weight (grams)	3453.31 ±449.10	3459.47 ±447.44	3441.55 ±448.52	3454.59 ±445.92	0.1822
Head circumference (centimetres)	34.61 ±1.39	34.68 ±1.40	34.63 ±1.39	34.75 ±1.40	<0.001
Gestation	39.25 ±1.13	39.28 ±1.14	39.17±1.12	39.20 ±1.11	<0.001
Body Mass Index	23.96 ±5.68	23.66 ±5.44	23.81 ±5.43	23.45 ±4.97	<0.001
Maternal age	30.87 ±5.30	30.36 ±5.21	30.97 ±5.35	31.12 ±5.03	<0.001
Categorical variables	n (%)				
Public Patient	5,766 (74.83)	1,661 (65.39)	4,856 (68.22)	4,486 (49.68)	<0.001
Asian ethnicity	1,188 (15.43)	478 (18.89)	1,646 (23.14)	1,951 (21.62)	<0.001
Nulliparity	2,138 (27.76)	1,245 (49.04)	2,123 (29.83)	4,403 (48.78)	<0.001
Labour induction	2,170 (28.17)	1,040 (40.94)	2,289 (32.16)	4,044 (44.78)	<0.001
Oxytocin augmentation	2,222 (28.84)	1,431 (56.34)	2,400 (33.72)	5,244 (58.07)	<0.001
Increased second stage	297 (3.86)	331 (13.04)	274 (3.85)	1,068 (11.83)	<0.001
Episiotomy	312 (4.05)	315 (12.40)	543 (7.63)	1,678 (18.58)	<0.001
Vaginal birth after cesarean section	121 (1.57)	59 (2.32)	100 (1.40)	196 (2.17)	<0.001
Shoulder dystocia	220 (2.86)	131 (5.16)	292 (4.10)	511 (5.66)	<0.001
Epidural	1,321 (17.14)	1,436 (56.54)	1,219 (17.13)	4,988 (55.24)	<0.001
Recumbent birthing position	5,559 (72.15)	2,387 (93.98)	6,015 (84.50)	8,782 (97.25)	<0.001

Between 2011 and 2016 there was a significant increase in the number of clinicians using either a hands-on/directed (28.1% to 38.0%, P<0.001) or hands-on/undirected (19.2% to 33.9%, P<0.001) approach (Figure 2). Poisson regression analysis also indicated a significant increasing yearly trend in these variables between 2012 and 2016 (p=<0.001) (Table 2). Conversely there was a significant decrease in the number of clinicians using a hands-poised/undirected (36.4% to 21.8%, P<0.001) or hands-poised/directed (16.3% to 6.2%, P<0.001) approach, which was also significant in the poisson regression analysis for a decreasing yearly trend between 2012 and 2016 (p=<0.001). During the same

time period the rate of severe perineal trauma did not increase significantly in either the rate (2.1%-2.2%, P=0.815) or yearly trend. However, second degree tears and episiotomies both increased significantly between 2015 and 2016.

Table 2: Poisson regression trend analysis of hands-on/poised, directed/undirected and perineal outcomes 2011 - 2016

	RR (95% CI)	P value
Hands-on/directed		
2011	Reference	
2012	1.10 (1.01-1.19)	0.024
2013	1.29 (1.19-1.40)	<0.001
2014	1.24 (1.14-1.34)	<0.001
2015	1.28 (1.18-1.38)	<0.001
2016	1.35 (1.25-1.46)	<0.001
Hands-on/undirected		
2011	Reference	
2012	1.10 (0.99-1.21)	0.067
2013	1.41 (1.29-1.55)	<0.001
2014	1.57 (1.44-1.72)	<0.001
2015	1.53 (1.40-1.68)	<0.001
2016	1.77 (1.62-1.94)	<0.001
Hands-poised/directed		
2011	Reference	
2012	0.77 (0.69-0.87)	<0.001
2013	0.54 (0.48-0.62)	<0.001
2014	0.49 (0.43-0.56)	<0.001
2015	0.44 (0.38-0.50)	<0.001
2016	0.38 (0.33-0.44)	<0.001
Hands-poised/undirected		
2011	Reference	
2012	0.98 (0.91-1.05)	0.495
2013	0.76 (0.71-0.82)	<0.001
2014	0.74 (0.69-0.80)	<0.001
2015	0.75 (0.70-0.81)	<0.001
2016	0.60 (0.55-0.65)	<0.001
3rd and 4th degree tears		
2011	Reference	
2012	1.43 (1.08-1.89)	0.012
2013	1.02 (0.76-1.38)	0.881
2014	1.22 (0.92-1.64)	0.171
2015	1.28 (0.96-1.69)	0.094
2016	1.04 (0.76-1.41)	0.815
2nd degree tears		
2011	Reference	
2012	1.18 (1.09-1.27)	<0.001
2013	1.12 (1.04-1.21)	0.003
2014	1.13 (1.05-1.22)	0.002
2015	1.15 (1.07-1.24)	<0.001
2016	1.17 (1.09-1.27)	<0.001

Episiotomy		
2011	Reference	
2012	1.00 (0.87-1.16)	0.958
2013	1.17 (1.02-1.34)	0.030
2014	1.21 (1.05-1.39)	0.007
2015	1.29 (1.13-1.48)	<0.001
2016	1.37 (1.19-1.57)	<0.001

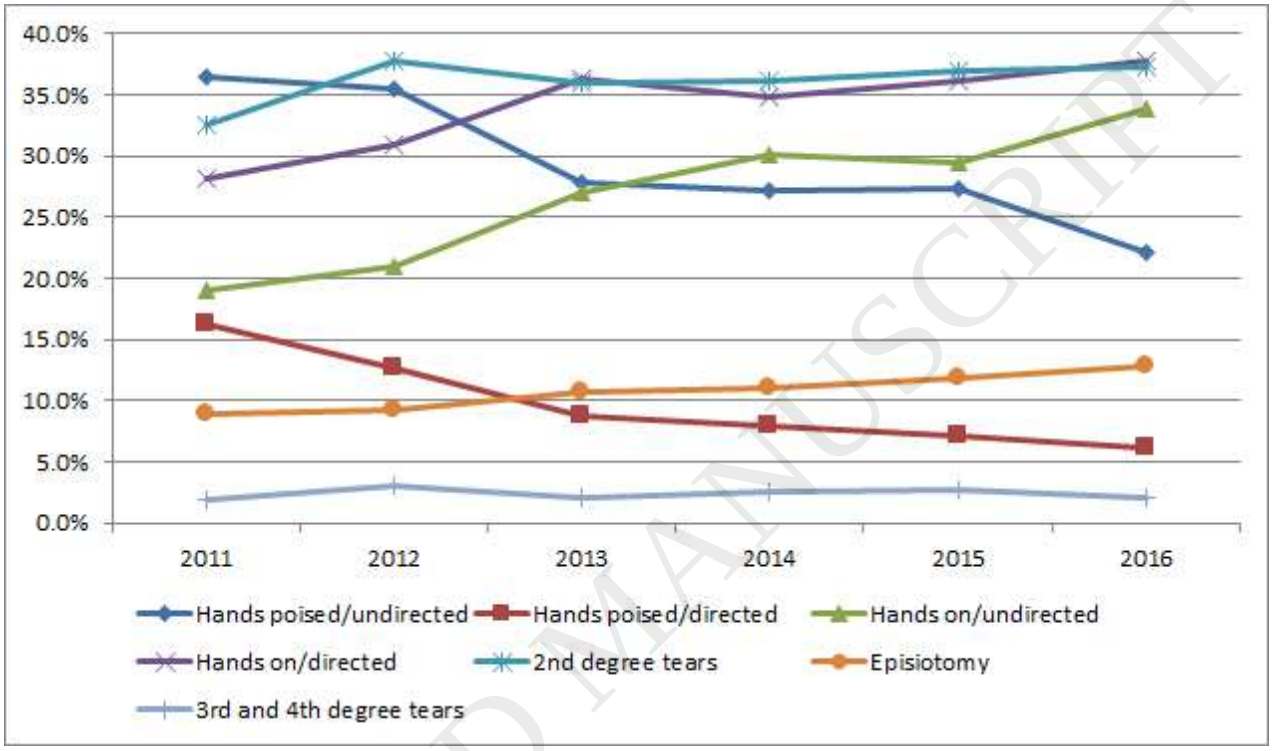

Figure 2: Rates of second stage management techniques and perineal injury between 2011 and 2016

3.2 Main results

Table 3 shows the crude odds ratios and adjusted odds ratios for the four groups by parity with regards to moderate and severe perineal trauma. For nulliparous women the risk of second, third and fourth degree tears was not significantly different regardless of the technique used. However for multiparous women the risk of second degree tears was significantly higher in hands-on groups and the risk of 3rd and 4th degree tears was higher in the hands-on and directed pushing group compared to hands-poised and undirected. Hands-on was also significantly associated with increased incidence of episiotomy in both nulliparous and multiparous women (Table 3).

Table 3: Primary and secondary outcomes for nulliparity and mulitparity

Nulliparity	N (%)	Odds ratio	Adjusted odds ratio	P value
2nd degree tears				
Hands-poised undirected	1020 (47.71)	Reference group	Reference group	
Hands-poised directed	581 (46.67)	0.96 (0.83-1.10)	0.96 (0.82-1.11)	0.547
Hands-on undirected	1025 (48.28)	1.02 (0.91-1.15)	1.06 (0.94-1.20)	0.356
Hands-on directed	1916 (43.52)	0.84 (0.76-0.94)	0.94 (0.84-1.06)	0.334
3rd and 4th degree tears				
Hands-poised undirected	93 (4.35)	Reference group	Reference group	
Hands-poised directed	52 (4.18)	0.96 (0.68-1.36)	1.06 (0.74-1.52)	0.759
Hands-on undirected	101 (4.76)	1.10 (0.82-1.47)	1.09 (0.81-1.47)	0.561
Hands-on directed	198 (4.50)	1.04 (0.80-1.33)	1.30 (0.99-1.71)	0.057
Episiotomy				
Hands-poised undirected	177 (8.28)	Reference group	Reference group	
Hands-poised directed	208 (16.71)	2.22 (1.79-2.75)	1.72 (1.38-2.15)	<0.001
Hands-on & undirected	311 (14.65)	1.90 (1.56-2.31)	1.54 (1.26-1.88)	<0.001
Hands-on & directed	1124 (25.53)	3.80 (3.21-4.49)	2.61 (2.19-3.12)	<0.001
Multiparity				
2nd degree tears				
Hands-poised undirected	1488 (26.74)	Reference group	Reference group	
Hands-poised directed	414 (31.99)	1.29 (1.13-1.47)	1.15 (1.04-1.27)	0.006
Hands-on undirected	1600 (32.04)	1.29 (1.19-1.40)	1.20 (1.12-1.29)	<0.001
Hands-on directed	1512 (32.70)	1.33 (1.22-1.45)	1.18 (1.10-1.27)	<0.001
3rd and 4th degree tears **				
Hands-poised undirected	52 (0.93)	Reference group	Reference group	
Hands-poised directed	14 (1.08)	1.16 (0.64-2.10)	1.12 (0.83-1.53)	0.460
Hands-on undirected	67 (1.34)	1.44 (1.00-2.08)	1.20 (0.95-1.51)	0.120
Hands-on directed	76 (1.64)	1.77 (1.24-2.53)	1.50 (1.20-1.88)	<0.001
Episiotomy				
Hands-poised undirected	135 (2.43)	Reference group	Reference group	
Hands-poised directed	106 (8.19)	3.59 (2.76-4.66)	2.03 (1.71-2.40)	<0.001
Hands-on & undirected	232 (4.65)	1.96 (1.58-2.43)	1.58 (1.37-1.83)	<0.001
Hands-on & directed	554 (11.98)	5.47 (4.52-6.64)	2.95 (2.58-3.37)	<0.001

Data are presented as odds ratio (95% confidence interval). ** Small sample size may impact on the width of confidence interval, a larger sample may detect statistically significant results for all groups

Any variables significant in the univariate analysis were included in the multivariate analysis.

Second degree tears model adjusted for: birthweight, head circumference, gestation, insurance, body mass index, Asian ethnicity, onset of labour, increased duration of 2nd stage, epidural, vaginal birth after cesarean section , episiotomy.
Third and fourth degree tears model adjusted for: birthweight, head circumference, gestation, body mass index, maternal age, Asian ethnicity, insurance, onset of labour, oxytocin augmentation, increased of 2nd stage, epidural, episiotomy, vaginal birth after cesarean section and shoulder dystocia.
Episiotomy model adjusted for: birthweight, gestation, maternal age, insurance, Asian ethnicity, onset of labour, increased duration of 2nd stage, epidural, oxytocin augmentation, vaginal birth after cesarean section, shoulder dystocia, recumbent birthing position.

4 Discussion

4.1 Key Findings

Our results suggest that in nulliparous women a hands-on/directed technique is not associated with a reduced risk of moderate and severe perineal injury when compared to a hands-poised/undirected approach. In multiparous women the hands-on/directed approach was associated with an increased risk of moderate and severe perineal injury when compared to a hands-poised/undirected technique. The difference in episiotomies was significant in the hands-poised/directed and hands-on/undirected groups compared to a hands-poised/undirected approach. During the study period the number of clinicians using either a hands-on/directed or hands-on/undirected approach increased significantly. Throughout this time there was increasing encouragement at the study sites for clinicians to use a hands-on approach as a strategy to reduce the incidence of severe perineal injury. Some senior clinicians, both obstetric and midwifery, raised concerns that a hands-poised approach may contribute to a rise in severe perineal injury and, although no formal campaign to change practice was undertaken, verbally supported a hands-on approach. However there was no corresponding reduction in moderate or severe perineal injury.

4.2 Strengths and limitations

To our knowledge this is the first study to examine the combined effects of a hands-on/poised and directed/undirected approach to second stage management on perineal injury. The strength of this study was the opportunity to examine effects of the combination of techniques on the risk of perineal injury. Previously studies have examined these two approaches (hands-on/hands-poised or directed/undirected) individually, however it is unlikely that in practice the two techniques occur in isolation. At the time of data input clinicians were able to select the description that best describes the techniques used during birth. The data set was of large and of high quality with less than 2% missing data and the possibility to account for important confounding factors that contributes to the generalisability of the findings. This study is subject to limitations inherent in retrospective designs. There were significant differences in participant numbers across groups and rates of variables, such as

nulliparity, known to independently contribute to perineal injuries and whilst these were controlled for within the model it is not possible to know if we have completely excluded their influence on the results. The incidence of variables such as VBAC, augmentation and prolonged second stage were similar between the hands-poised/directed and the hands-on/directed, probably related to the more common use of epidurals in these clinical situations and the need to direct pushing when the spontaneous urge is affected by regional analgesia.

Other techniques to support perineal integrity such as warm compresses may have been used in conjunction with the either of the documented techniques however, data for these was not available for the entire study period. Despite the choices available within the database to describe the techniques used by the clinician during second stage, it is conceivable that a number of differing approaches could be used during the same labour and birth, such as a combination of hands-on/poised or directed/undirected pushing, and this data could not be represented within the database. Neither were we able to verify that the descriptions chosen by the midwife accurately reflected the actual approach used. This limitation of retrospective data has been acknowledged in other studies in the field (Laine et al., 2012). It is also possible that midwives may have entered data reflecting the hands-on approach being encouraged by some senior clinicians rather than the technique actually used. However, it was not the practice within the units to use the dataset to scrutinise of individual practice

4.3 Interpretation

Our data did not show any significant change in rates of severe perineal injury despite substantial change in practice over the time period from a largely hands-poised/undirected to a hands-on/ directed approach. This may reflect the findings of a lack of benefit of one technique over the other in nulliparous women. The outcomes of our study differ from those described in a number of recent Scandinavian studies that report on the introduction of programs that involve a combination of strategies to reduce severe perineal trauma (Hals et al., 2010, Laine et al., 2012, Stedenfeldt et al., 2014). These include the use of manual perineal support, pressure applied to the fetal head to control the speed of the advancing vertex and promote flexion until the head is crowned, providing clear

direction to the birthing woman and the use of mediolateral episiotomies when clinically indicated (Hals et al., 2010, Laine et al., 2012, Stedenfeldt et al., 2014). These studies have reported a 50% reduction in severe perineal injury following introduction of the intervention program. Although these studies also included operative vaginal births a hands-on approach including perineal support was strongly emphasised. However, in the study by Laine et al (2012) which reports on the reduction of anal sphincter injuries in two time periods, before and after the implementation of a perineal injury protection training program, the rate of severe perineal injury in non-operative vaginal birth for all parities at the end of the post intervention reporting period was the same as the hands-poised/undirected group in this study (1.9%) (Laine et al., 2012). Furthermore the most significant reduction in anal sphincter injuries in the study by Laine et al (2012) occurred in the time period prior to the introduction of training related to protection of the perineum, incorporating a hands-on approach. This suggests that the reduction noted in these studies may be related to factors within the care package other than a hands-on/directed approach.

The increase in the use of a hands-on/undirected approach demonstrated in our study may indicate a trend in clinicians seeking a compromise between the expectations to change practice from a hands-poised/undirected to a hands-on/directed technique. A study from the United Kingdom describes simple tactile control without perineal guarding and allowed for spontaneous birth of the shoulders and reported a similar 50% reduction in severe perineal injury (Basu et al., 2016). The investigators stated their objective was to use a less invasive ‘hands-on’ approach than the aforementioned Norwegian studies. A complicating factor may be that there are few guidelines providing instruction on the hands-poised/undirected approach, possibly resulting in a greater variation in practice compared to hands-on/directed.

An unexpected finding was the increased risk of perineal trauma in multiparous women when a hands-on/directed approach was used. A number of authors have previously described how a hands-on approach and directed pushing individually might contribute to increased risks of moderate and severe perineal injury. Myrfield et al. (1997) state that pressure applied to the fetal head in an attempt to increase flexion forces the head down towards the stretched perineum. It may be that this is more

likely to result in perineal trauma in multiparous women with scarring from previous perineal injury. Furthermore, that flexing the head to maintain a smaller diameter is unlikely to succeed as the head must extend during birth to negotiate the curve of Carus (Myrfield et al., 1997). It has also been suggested that digital pressure to the perineal tissues may cause perineal ischemia leading to an increased risk of perineal trauma (Mayerhofer et al., 2002). It is thought that using a hands-poised technique allows the fetal head to adjust itself to the most appropriate angle allowing the smallest diameter to present whilst the perineal tissues are able to accommodate to the advancing vertex without obstruction (Myrfield et al., 1997).

The use of directed pushing has also been associated with increased pelvic floor dysfunction (Schaffer et al., 2005) and a is predictor for obstetric perineal trauma (Albers et al., 2006). Directed pushing during second stage of labour is thought to lead to perineal oedema, increasing the likelihood of perineal injury (Yildirim and Beji, 2008). It has also been suggested that directed pushing places a greater degree of control upon the clinician requiring the women to ignore her instinctive urges. This may then seem counter intuitive to women when the instruction not to push is given. Whereas with undirected pushing, where women are encouraged to respond to their normal expulsive reflexes with little instruction, the associated calm interaction with the clinician allows for more effective communication when a reduction in effort is required (Ahmadi et al., 2017, Albers et al., 2006). Our data suggests that, for multiparous women, a hands-poised/undirected approach combines the aforementioned benefits resulting in a reduced association between the techniques and incidence of perineal injury.

In this study the proportion of women giving birth in a recumbent position was high across all four groups, reaching 97.25% in the hands-on/directed pushing group. Whilst the high epidural rate (55%), where movement may be restricted, would also contribute to the rate this does suggest a strong association between a hands-on/directed pushing approach and recumbent birth position. There is evidence to suggest that maternal choice of birth position is associated with higher levels satisfaction with the birth experience (Priddis et al., 2012, Thies-Lagergren et al., 2013). None of the aforementioned Scandinavian studies reported any outcomes related to maternal choice or experience

in their post test phase. This would be an area for consideration in future studies. The percentage of women birthing in a recumbent position in the hands-poised/undirected group was also high (72.15%). A number of studies have illustrated that rates of interventions amongst otherwise low-risk women are higher in tertiary and private hospital settings than models designed specifically for low-risk women (Davis et al., 2011, Hollowell et al., 2015, Tracy et al., 2014). This may reflect a pervasive attitude towards aspects of birth management in tertiary centres to women of a higher risk, or a private obstetric hospital setting, where clinicians are more likely to expect or advise women to birth in a recumbent position (Priddis et al., 2011). Asian women were more likely to receive a hands-on approach (hands-on/undirected 23.14%; hands-on/directed 21.62%) compared to a hands-poised (hands poised/undirected 15.43%). Previous studies have highlighted higher rates of severe perineal injury amongst Asian women (Dahlen and Homer, 2008, Hopkins et al., 2005). Clinicians being aware of this increased incidence may have chosen to use a hands-on approach in the belief that this may assist in mitigating the risk of perineal trauma.

4.4 Conclusion

In summary, the use of a hands-poised/undirected approach to second stage management may be included in strategies to reduce moderate and severe perineal injury, particularly in multiparous women, however guidelines to support consistency of practice and training of staff are recommended. The hands-poised approach does not exclude the use of digital pressure to counter the speed of the advancing vertex but applies this as required, on a case-by-case basis. In the past it has been routine practice to perform episiotomies on all women in an attempt to control or reduce perineal injury, although, it is currently accepted that episiotomies should only be used when clinically indicated. The same principle could be applied to the use of hands-on/directed pushing approach. We believe that our study provides sufficient equipoise to warrant a suitably powered randomized control trial to determine which combinations of techniques are likely to the most effective in preventing severe

perineal injury. A cluster randomized control trial design would likely be the most effective in minimising the contamination experienced in previous trials.

Contribution to Authorship

NL conceived the study, prepared the protocol and ethics submission and co-wrote the manuscript. MF assisted with the data analysis and co-wrote the manuscript. YG undertook the data analysis and edited the manuscript. SK supervised interpretation of the data, writing and editing of the manuscript

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Disclosure of interest

The authors declare no conflict of interest

Details of ethics approval

We obtained ethics approval from the Mater Health Services Human Research Ethics Committee (16/MHS/56). The study was exempt of informed consent as the data was de-identified during the extraction process.

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