International Centre for Allied Health Evidence

Evidence-Based Review

Factors Related to Perineal Tear Occurrence Through Childbirth

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Abbreviations

The following abbreviations are used in this report and are collated here for readers' convenience

Abbreviation		Abbreviation	
ACC	Accident Compensation Corporation	**MANA**	Midwives Alliance of North America
ACOG	American College of Obstetricians and Gynaecologists	**MFR**	Myofascial release
aOR	Adjusted odds ratio	**OASI**	Obstetric anal sphincter injury
ASI	Anal sphincter injury	**OASIS**	Obstetric anal sphincter injuries
AST	Anal sphincter tears	**OASR**	Obstetric Anal Sphincter Rupture
BMI	Body Mass Index	**OP**	Occiput posterior
CI	Confidence interval	**OR**	Odds ratio
CNM	Certified Nurse-Midwives	**OMT**	Osteopathic Manipulative Treatment
CPG	Clinical Practice Guidelines	**OT**	Occiput transverse
CS	Caesarean section	**OVB**	Operative Vaginal Birth
CT	Controlled trial	**PECO**	Population, exposure, comparator, outcome
eIOL	Elective induction of labour	**PFMT**	Pelvic floor muscle training
FGM	Female Genital Mutilation	**PUT**	Placebo ultrasound treatment
GDG	Guideline Development Group	**PVD**	Previous vaginal birth
GDM	Gestational diabetes mellitus	**RACGP**	The Royal Australian College of General Practitioners
GIN	Guidelines International Network	**RANZCOG**	The Royal Australian and New Zealand College of Obstetricians and Gynaecologists
IOM	Institute of Medicine	**RCM**	The Royal College of Midwives
IUFD	Intrauterine foetal death	**RCOG**	Royal College of Obstetricians and Gynecologists
IVB	Instrumental vaginal birth	**RCT**	Randomised Controlled Trial
LAM	Levator ani muscle	**rOASI**	Recurrent obstetric anal sphincter
LGA	Large for gestational age	**RR**	Risk ratio
MFR	Myofascial release	**SIGN**	Scottish Intercollegiate Guidelines Network
NHMRC	National Health and Medical Research Council	**SNHS**	Spanish National Healthcare System
NHS	National Health Service	**SR**	Systematic Review
NICE	National Institute for Health and Care Excellence	**SOL**	Stage of labour
NNT	Numbers needed to treat	**UCO**	Usual care only
NZ	New Zealand	**US**	Ultrasound
NZGG	New Zealand Guidelines Group	**VBAC**	Vaginal Birth After C-Section
MA	Meta-analysis	**VE**	Vacuum extraction
MD	Medical Doctor, Physician	**WHO**	World Health Organisation
	Quality Ratings		
AQ	Acceptable Quality	**LQ**	Low Quality
CS	Can't say	**NA**	Not Applicable
HQ	High Quality	**R**	Reject (Unacceptable Quality)
QS	Quality of Study		

Glossary

APOR B method – is an alternative method of positioning at delivery that allows women to adopt positions and alter their posture according to their comfort and clinical situation (e.g., for various fetal positions, asynclitism, altered fetal heart rate, or localization of pain). Suggested positions to be adopted include lateral, hand-knee, squatting, ventral, or dorsal positions. (Maheux-Lacroix et al 2013)
Assisted vaginal birth- vaginal delivery of a baby performed with the help of forceps or a vacuum device. Also called operative vaginal birth/delivery or instrumental vaginal birth/delivery (ACOG 2016)
Finnish intervention - is a package of care from Norway designed to prevent OASIS. It consists of: (1) good communication between the accoucheur and the delivering woman, (2) the 'Finnish manoeuvre', (3) use of a delivery position that allows visual examination of the perineum during the last minutes of delivery, and (4) mediolateral episiotomy on indication. (Poulsen et al. 2015)
Finnish manoeuvre – a manual support technique developed in Finland to prevent OASIS. The speed of crowning is controlled by exerting pressure on the occiput with one hand. Simultaneously, the thumb and index finger of the other hand are used to support the perineum while the flexed middle finger takes a grip on the baby's chin. When a good grip has been achieved, the woman is asked to stop pushing and to breathe rapidly, while the midwife slowly helps the baby's head through the vagina. When most of the head is out, the perineal ring is pushed under the baby's chin. (Pirhonen et al. 1998)
Forceps – tools which look like two large spoons inserted into the vagina and placed around the baby's head to assist the delivery of a baby. Forceps are used to apply gentle traction to help guide the baby's head out of the birth canal. (ACOG 2016)
Lithotomy – position in which patients' legs are separated from the midline into 30 to 45 degrees of abduction, with the hips flexed until the thighs are angled between 80 and 100 degrees. The patient's legs are placed into stirrups, with the knees bent such that the lower legs are parallel to the plane of the torso. (Matin & Novick 2001)
Minor perineal tears – are first and second-degree tears (Goh et al. 2018)
Obstetric anal sphincter injuries (OASIS) – term referring to third- and fourth-degree tears. (Goh et al. 2018)
Passive second stage of labour – passive second stage of labour lasting 60 minutes or more. (Gossett et al. 2016).
Perineal tears – trauma or injury to the perineum further described as first, second, third- and fourth-degree tears (Goh et al. 2018) • First-degree perineal tear – is a laceration of the vaginal mucosa or perineal skin only. • Second-degree tear – is a laceration involving the perineal muscles. • Third-degree tear – is a laceration involving the anal sphincter muscles, and further subdivided into:

- 3A (<50% of the external anal sphincter is torn)
- 3B (>50% of the external anal sphincter is torn)
- 3C (external and internal anal sphincters are both torn)

- Fourth-degree tear- is a laceration extending through the anal epithelium.

Ritgen's manoeuvre – manual support technique performed between contractions where two fingers are placed behind the anus and a forward and upward pressure is applied on the forehead through the perineum (Cunningham 2008)

Severe perineal tears – are third- and fourth-degree tears, also called major tears (Goh et al. 2018)

Spatula – tools used by French physicians which consist of two independent spoons which allow orientation of the fetal head and propel the fetus head through the maternal genital tract for instrumentally assisted vaginal delivery. (Simon-Toulza & Parant 2008)

Vacuum – a suction cup (also called the ventouse) device with a handle attached. The suction cup is applied to the top of the baby's head and used to help guide the baby out of the birth canal. (ACOG 2016)

Executive Summary

Objective of the review	The objective of this evidence-based review is to summarise the published literature regarding contributing factors to perineal tears that can occur during childbirth, and what factors may reduce the risk of tears. This review aims to answer the following research questions: Primary research questions: 1. What factors are responsible for, or contribute to a perineal tear occurring during childbirth? 2. What factors reduce the risk of a perineal tear? Secondary research questions: What is the evidence regarding the following factors in relation to occurrence of perineal tears for: a) Patient related factors including: ethnicity, BMI/obesity, age, primigravida/ multigravida women, gestational diabetes b) Birth related factors including: birth position (eg. occipito-posterior birth, birth weight, infant head circumference, shoulder dystocia, pre/post term), time in labour (eg. length of second stage of labour) c) Procedure related factors including: episiotomy, caesarean/vaginal birth, instrumentally assisted birth (eg. vacuum, forceps)
Evidence sourced	The search for all risk factors using 6 databases and 13 guideline sites yielded 9,150 articles (see Appendix 1 for search strategy). The final search was conducted on March 3, 2019. After removing duplicates from the search, 1,215 articles were identified for title and abstract screening. After scrutiny, 891 articles were excluded for failing to meet the inclusion criteria (shown in Figure 1), leaving 324 studies that fitted all inclusion criteria for the report. The main issues affecting the methodological quality of the studies include: ***Systematic reviews*** A) Very few studies addressed the potential for publication bias in reporting their reviews. B) Limited databases were often sourced during the search process. C) Excluded studies were frequently not listed. D) Studies frequently report details of the intervention, control and models of care inadequately. E) The status of publication was often not used as an inclusion criteria. F) Significant variability in birth procedures were common within the reviews. G) Not all studies screened for methodological quality using validated critiquing tools. H) Studies often combined heterogenous data.

I) Rarely do studies utilise two independent researchers to screen the search results, assess trial eligibility, assess risk of bias, and extract data from the included trials.

Primary studies

A) Power calculations were often not conducted.

B) Investigators were rarely blinded to the intervention involved.

C) Studies often were not designed with the primary aim of assessing the risk of perineal tears.

D) A number of studies failed to report the use of intention to treat analysis when reporting findings.

E) Studies often did not use valid and reliable primary outcome measures.

F) Convenience sampling was frequently used.

G) Dropouts and cause of attrition were infrequently reported.

H) Expertise of practitioners administrating the intervention was regularly not reported.

I) Common risk factors such as nulliparity, foetal position, size, and instrumental birth are often not controlled for in the analysis.

J) A number of the studies were retrospective in nature and utilised birth registers, obstetric databases or admitted patient data.

K) Studies (particularly the cohort studies) often did not check if groups being studied were from source populations that were comparable other than for the factor being investigated.

Evidence summary table

Evidence recommendations were organised in the table below to summarise and present the recommendations for risk factors, starting with those with consistent and very strong evidence, down to limited and very weak evidence. The table was based on the summary matrix and wording proforma developed to standardise data synthesis as reported in the methods section (see 2.7).

Strength and consistency	Risk factor	Relationship (with degree of trauma)
Consistent very strong evidence	➢ Induction at 39- or 40-weeks' gestation compared to no induction	➢ No increase (Severe)
Inconsistent very strong evidence	➢ Home birth compared to a hospital/conventional birth setting	➢ Decrease (Minor and severe)
	➢ Midwife led care compared to other models (obstetrician-provided care, family doctor provided care and shared model of care)	➢ Decrease to no increase (Minor and severe)
	➢ Perineal massage	➢ No increase (Minor), Decrease (Severe)
Limited very strong evidence	➢ Ritgen's manoeuvre	➢ No increase (Severe)

Consistent strong evidence	➢ Forceps use	➢ Small increase (Minor), Small to large increase (Severe)
	➢ Upright compared to supine birth position	➢ No increase (Minor and severe)
	➢ Median episiotomy	➢ Small to large increase (Severe)
	➢ Manual fundal pressure compared to no fundal pressure in spontaneous birth	➢ Large increase (Minor and severe)
	➢ Increased BMI/bodyweight	➢ No increase (Minor), No increase to decrease (Severe)
	➢ Pelvic floor muscle training	➢ No increase (Minor and severe)
	➢ Spontaneous pushing compared to directed pushing	➢ No increase (Minor and severe)
	➢ Warm pack/compress	➢ No increase (Minor), Decrease (Severe)
Inconsistent strong evidence	➢ Birth stool/squatting stool	➢ No increase (Minor), No increase to moderate increase (Severe)
	➢ Birth chair/sitting/semi sitting compared to supine birth position	➢ Small increase (Minor), No increase (Severe)
	➢ Induction at 41- or 42-weeks' gestation compared to no induction	➢ No increase (Severe)
	➢ Restrictive episiotomy compared to routine episiotomy in vaginal birth	➢ Decrease (Severe)
	➢ Hands on compared to hands off or hands poised	➢ No increase (Minor and severe)
	➢ Previous history of OASI or other perineal trauma	➢ Small increase (Severe)
	➢ Immediate pushing compared to delayed pushing	➢ No increase (Minor and severe)
	➢ Immersion in water compared to no immersion during any stage of labour	➢ No increase (Minor and severe)
Limited strong evidence	➢ Acupuncture compared with usual care for the induction of labour	➢ No increase (Minor)
	➢ Soft cup compared to metal cup vacuum birth	➢ No increase (Minor), No increase to decrease (Severe)
	➢ Hand-held compared to any ventouse vacuum birth	➢ No increase (Minor and severe)
	➢ Birth cushion compared to supine birth position	➢ Decrease (Minor), No increase (Severe)
	➢ Any upright compared to any recumbent maternal position in the second stage of labour for women with epidural anaesthesia	➢ No increase (Minor and severe)
	➢ Use of a perineal protection device compared to perineal support	➢ No increase (Minor and severe)
	➢ Restrictive episiotomy compared to routine episiotomy in anticipated operative vaginal birth	➢ No increase (Severe)

		➢ Mediolateral episiotomy in nulliparous women	➢ No increase (Severe)
		➢ Lateral episiotomy in nulliparous women	➢ Decrease (Severe)
		➢ Lateral episiotomy in multiparous women	➢ No increase (Severe)
		➢ Episiotomy in vacuum assisted birth compared to without episiotomy	➢ Decrease (Severe)
		➢ Fundal pressure by inflatable belt compared to no fundal pressure	➢ No increase (Minor), Large increase (Severe)
		➢ Hyaluronidase injection compared to control	➢ No increase (Minor and severe)
		➢ Hyaluronidase injection compared to placebo injection	➢ No increase (Minor and severe)
		➢ Hyaluronidase injection compared to no intervention	➢ No increase (Minor and severe)
		➢ Finnish intervention	➢ Decrease (Severe)
		➢ Birth of anterior shoulder compared to birth of posterior shoulder	➢ No increase (Minor and severe)
		➢ Metformin	➢ No increase (Severe)
		➢ Prenatal exercise	➢ No increase (Minor and severe)
		➢ Previous history of OASI and forceps birth	➢ Large increase (Severe)
		➢ Previous history of OASI and vacuum birth	➢ Moderate increase (Severe)
		➢ Previous history of OASI + birthweight greater than 4kg	➢ Moderate increase (Severe)
		➢ Previous history of OASI and an advanced maternal age greater than 35 years	➢ Small increase (Severe)
		➢ Previous history of OASI and occiput-posterior position	➢ Small increase (Severe)
		➢ Previous history of OASI and Asian ethnicity	➢ No increase (Severe)
		➢ Previous history of OASI and induction of labour	➢ No increase (Severe)
		➢ Previous history of OASI and the gender of child	➢ No increase (Severe)
		➢ Previous history of OASI and time between pregnancies	➢ No increase (Severe)
		➢ Previous history of OASI and maternal BMI	➢ No increase (Severe)
		➢ Previous history of OASI and epidural analgesia	➢ No increase (Severe)
		➢ Previous history of OASI and third pregnancy	➢ Large increase (Severe)
		➢ Previous history of OASI and shoulder dystocia	➢ Large increase (Severe)
		➢ Immersion in water compared to no immersion in the first stage of labour	➢ No increase (Minor and severe)
		➢ Immersion in water compared to no immersion in the second stage of labour	➢ No increase (Minor)

	➢ Wax/oil	➢ No increase (Minor)
Consistent moderate evidence	➢ Increased maternal age	➢ Small to moderate increase (Minor and severe)
	➢ Assisted vaginal birth	➢ Moderate to large increase (Severe)
	➢ Forceps compared to vacuum	➢ Small increase (Severe)
	➢ Increase in birthweight	➢ Small to large increase (Minor and severe)
	➢ Prolonged second stage of labour	➢ Small to large increase (Severe)
	➢ Episiotomy (all types combined, or no type mentioned) compared to no episiotomy	➢ Small to large increase (Severe)
	➢ Nulliparous women compared to multiparous women	➢ Moderate to large increase (Severe)
Inconsistent moderate evidence	➢ Epidural analgesia	➢ No increase (Minor and severe)
	➢ Vacuum birth	➢ No increase to large increase (Severe)
	➢ Mediolateral episiotomy	➢ Decrease (Severe)
	➢ Prolonged pregnancy greater than 39 weeks gestation	➢ Small increase (Severe)
	➢ Out of hours and weekend deliveries	➢ No increase to decrease (Severe)
	➢ Short perineal body length	➢ No increase to increase (Severe)
	➢ Vaginal birth after caesarean	➢ Small increase (Severe)
Limited moderate evidence	➢ Use of birth balls compared with usual care	➢ No increase (Severe)
	➢ Use of Epi-No birth trainer	➢ No increase (Minor and severe)
	➢ Mediolateral episiotomy in multiparous women	➢ Small increase (Severe)
Consistent weak evidence	➢ Assisted vaginal birth complicated by shoulder dystocia	➢ Moderate to large increase (Severe)
	➢ Non supine (kneeling/hands and knees, sitting and/or squatting) compared to supine positions	➢ Decrease (Minor and severe)
	➢ Induction of labour (no timeframe given) compared to no induction	➢ Small increase (Severe)
	➢ Occiput posterior position compared to occiput anterior position	➢ Small to moderate increase (Severe)
	➢ Increasing gestational age	➢ Small increase (Minor and severe)
	➢ Macrosomia	➢ Decrease (Minor), Moderate to large (Severe)
	➢ Oxytocin	➢ No increase (Severe)
	➢ Shoulder dystocia	➢ Moderate to large increase (Severe)
	➢ Shoulder dystocia management	➢ Small to large increase (Severe)
	➢ Smoking	➢ Decrease (Severe)
Inconsistent weak evidence	➢ Teenage/adolescent mothers	➢ No increase to decrease (Minor and severe)

		➢ Foetal head circumference	➢ Small to no increase (Minor and severe)
		➢ Kneeling/all fours birth position	➢ Decrease (Minor), No increase (Severe)
		➢ Prolonged second stage of labour in nulliparous women	➢ Small increase (Severe)
		➢ Episiotomy in nulliparous women who undergo assisted vaginal birth	➢ Moderate to large increase (Severe)
		➢ Resident doctors compared to obstetricians in assisted vaginal birth	➢ No increase to large increase (Severe)
		➢ Family physician or general practitioner compared to an obstetrician	➢ Small increase (Minor), No increase to small increase (Severe)
		➢ Couder's manoeuvre during vacuum birth	➢ Decrease to increase (Minor), No increase (Severe)
		➢ Staff training	➢ No increase to decrease (Severe)
		➢ High volume compared to low volume delivery units	➢ No increase (Severe)
	Limited weak evidence	➢ Assisted vaginal birth in a teenage population	➢ Moderate increase (Severe)
		➢ Episiotomy in a teenage population	➢ Large increase (Severe)
		➢ Increased birthweight in a teenage population	➢ Moderate increase (Severe)
		➢ Gestational diabetes requiring insulin for glucose control in a teenage population	➢ Large increase (Severe)
		➢ Suboptimal analgesia during second stage initial pain control	➢ Small increase (Severe)
		➢ Inability to sustain optimal epidural analgesia during the second stage of labour	➢ Small increase (Severe)
		➢ Subpubic arch angle	➢ No increase (Minor and severe)
		➢ Combined forceps and vacuum use compared to either forceps or vacuum alone	➢ Small to moderate increase (Severe)
		➢ Assisted vaginal birth in nulliparous compared to multiparous women	➢ Increase (Severe)
		➢ Assisted vaginal birth during 1-3 hours of second stage compared to spontaneous vaginal birth >3 hours of second stage	➢ Small increase (Severe)
		➢ Type of forceps birth	➢ No increase (Minor and severe)
		➢ Obstetric forceps volume	➢ No increase (Severe)
		➢ Vacuum birth obstetrician experience	➢ No increase (Severe)
		➢ Large for gestational age infants - induction of labour at greater than 38 weeks compared to expectant management	➢ No increase (Severe)
		➢ Sonographically estimated foetal weight in temporal proximity to birth	➢ No increase (Minor and severe)

	in neonates weighing greater than 3500g	
	➢ Standing compared to sitting birth position	➢ No increase (Severe)
	➢ Lithotomy compared to other birth positions	➢ No increase to moderate increase (Minor and severe)
	➢ Lateral (sidelying) compared to other birth positions	➢ No increase (Severe)
	➢ APOR B method compared to supine birth position	➢ Decrease (Minor), No increase (Severe)
	➢ Public hospital compared to private hospital birth setting	➢ Small to moderate increase (Minor and severe)
	➢ Birth centre compared to hospital birth setting	➢ No increase to decrease (Severe)
	➢ Rural compared to non-rural community birth	➢ No increase (Severe)
	➢ Diabetes mellitus	➢ No increase (Minor and severe)
	➢ Gestational diabetes mellitus and a macrosomic baby during assisted vaginal birth	➢ Small increase (Severe)
	➢ Prolonged second stage of labour in multiparous women	➢ Moderate to large increase (Severe)
	➢ Prolonged second stage of labour in women who undergo assisted vaginal birth	➢ Small increase (Severe)
	➢ Induction at 37- or 38-weeks' gestation compared to no induction	➢ Decrease (Severe)
	➢ Induction of labour for women with a large for gestation age fetus	➢ No increase (Minor and severe)
	➢ Episiotomy performed before crowning compared to at crowning in nulliparous women	➢ No increase (Severe)
	➢ Second vaginal birth following episiotomy at first vaginal birth	➢ Large increase (Minor and severe)
	➢ Episiotomy in women with birth complicated by shoulder dystocia	➢ Decrease (Severe)
	➢ Occiput posterior position compared to occiput anterior position for forceps birth	➢ Moderate to large increase (Severe)
	➢ Manual rotation compared to no rotation attempt for occiput posterior/transverse positions	➢ Decrease (Severe)
	➢ Assisted rotation using forceps or vacuum compared to manual rotation	➢ No increase (Minor and severe)
	➢ Manual rotation plus assisted vaginal birth compared to assisted vaginal birth with no manual rotation attempt	➢ Decrease (Severe)
	➢ Sonographic (US) diagnosis of the foetal spine position during manual rotation of the foetal occiput	➢ No increase (Severe)
	➢ In vaginal birth in occiput posterior position following a failed manual rotation attempt, no forceps rotation	➢ Large increase (Severe)

		attempt compared to a forceps rotation attempt	
		➢ Female genital mutilation	➢ Increase (Severe)
		➢ Manual fundal pressure compared to no fundal pressure in assisted vaginal birth	➢ No increase (Severe)
		➢ Gender of the delivering physician	➢ No increase (Severe)
		➢ Methods used by midwives during second stage of labour (directed pushing, toweltrick, levator pressure, pressure to spinae ischiadica, manipulation of symphysis bone and digital stretching of the perineum)	➢ No increase (Minor and severe)
		➢ Assisted vaginal birth training	➢ Decrease (Severe)
		➢ Complementary therapies program	➢ No increase (Severe)
		➢ Osteopathic manipulative treatment and usual care compared to usual care or placebo ultrasound treatment	➢ No increase (Minor)
		➢ Dietary and lifestyle counselling program	➢ No increase (Minor)
		➢ Excessive weight gain during pregnancy	➢ No increase (Severe)
		➢ Low maternal weight	➢ Small increase (Minor and severe)
		➢ Obstetric gel in vaginal births without interventions	➢ Decrease (Minor and severe)
		➢ Vaginal resting pressure	➢ No increase (Severe)
		➢ Pelvic floor muscle strength/endurance	➢ No increase (Severe)
		➢ Perineal body stretch	➢ No increase (Minor)
		➢ Pushing performed at crowning compared to breathing the head out	➢ Large increase (Severe)
		➢ Asian ethnicity for women living in Western countries	➢ Increase (Minor and severe)
		➢ Asian ethnicity for women living in Asia	➢ No increase (Minor and severe)
		➢ Asian ethnicity when the living location is not referred to	➢ Small to large increase (Severe)
		➢ Shoulder dystocia in nulliparous compared to multiparous women	➢ Moderate to large increase (Severe)
		➢ White collar workers compared to blue collar workers	➢ Small increase (Severe)
		➢ Twin pregnancy	➢ No increase (Severe)
		Twin pregnancies in nulliparous women	➢ Large increase (Severe)
		➢ Twin pregnancies whereby at least one twin is in occiput-posterior position	➢ Moderate increase (Severe)
		➢ Twin pregnancies whereby at least one twin has increased birthweight	➢ Small increase (Severe)
		➢ Twin pregnancies whereby at least one twin has an assisted vaginal birth	➢ Large increase (Severe)
		➢ Foetal abdominal circumference	➢ No increase (Severe)

	Limited very weak evidence	➢ Increased rate of cervical dilatation and head descent	➢ Increase (Minor and severe)
		➢ Vacuum birth + birthweight greater than 4000g	➢ Small increase (Severe)
		➢ Second birth after first birth of a macrosomic infant	➢ Increase (Severe)
		➢ Flexible sacrum positions (kneeling, standing, all-fours, lateral position, squatting and giving birth on the birth seat) compared to non-flexible sacrum positions (supine and sitting)	➢ No increase (Severe)
		➢ Horizontal/upright birth positions during second stage and supine at birth compared to horizontal during second stage and supine at birth	➢ No increase (Minor and severe)
		➢ Use of Relaxbirth® for upright positioning	➢ No increase (Minor and severe)
		➢ Shoulder dystocia in diabetic compared to non-diabetic women	➢ Increase (Minor)
		➢ Induction with prostaglandins	➢ Increase (Minor and severe)
		➢ Length of induction of labour	➢ No increase (Severe)
		➢ Mediolateral episiotomy in women undergoing assisted vaginal birth	➢ Decrease (Minor and severe)
		➢ Intrauterine foetal death compared to live births	➢ Decrease (Minor and severe)
		➢ Occiput transverse position compared to occiput anterior position	➢ Increase (Severe)
		➢ Occiput posterior position compared to occiput anterior position in vacuum birth	➢ Moderate to large increase (Severe)
		➢ Persistent occiput posterior position vaginal birth - forceps assisted rotation	➢ No increase (Severe)
		➢ Night float call schedule compared to traditional call schedule	➢ Decrease (Severe)
		➢ Passive second stage of labour	➢ No increase (Minor and severe)

Evidence statements

Evidence statements were developed from the key criteria detailed in the Methods section of this report (see 2.7) and are presented in summary in this section per risk factor.

Acunpuncture

1. ***There is limited strong evidence that the use of Acupuncture compared with usual care for the induction of labour is associated with no increase in risk for minor perineal tears.*** *Based on 1 HQ SR.*

Age

2. ***There is consistent moderate evidence that increased maternal age is associated with a small to moderate increase in odds/prevalence/risk for minor and severe perineal tears.*** *Based on 13 AQ cohort studies and 5 LQ cohort studies.*

3. ***There is inconsistent weak evidence that being a teenage/adolescent mother is associated with no increase to decrease in odds for minor and severe perineal tears.*** *Based on 3 AQ cohort studies.*
4. ***There is limited weak evidence that assisted vaginal birth in a teenage population is associated with a moderate increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
5. ***There is limited weak evidence that episiotomy in a teenage population is associated with a large increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
6. ***There is limited weak evidence that increased birthweight in a teenage population is associated with a moderate increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
7. ***There is limited weak evidence that gestational diabetes requiring insulin for glucose control in a teenage population is associated with a large increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

Analgesia

8. ***There is inconsistent moderate evidence that epidural analgesia is associated with no increase in odds/prevalence/risk for minor and severe perineal tears.*** *Based on 1 AQ SR, 2 HQ Cohort studies, 11 AQ cohort studies and 3 LQ cohort studies.*
9. ***There is limited weak evidence that suboptimal analgesia during second stage initial pain control is associated with a small increase in odds for severe perineal tears.*** *Based on 1 HQ cohort study.*
10. ***There is limited weak evidence that the inability to sustain optimal epidural analgesia during the second stage of labour is associated with a small increase in odds for severe perineal tears.*** *Based on 1 HQ cohort study.*

Anatomical risk factors

11. ***There is limited very weak evidence that foetal abdominal circumference is associated with no increase in prevalence for severe perineal tears.*** *Based on 1 LQ cohort study.*
12. ***There is limited weak evidence that subpubic arch angle is associated with no increase in odds for minor and severe perineal tears.*** *Based on 1 AQ cohort study.*
13. ***There is limited very weak evidence that the increased rate of cervical dilatation and head descent is associated with an increase in prevalence for severe perineal tears.*** *Based on 1 AQ case control study.*
14. ***There is inconsistent weak evidence that foetal head circumference is associated with a small to no increase in odds for minor and severe perineal tears.*** *Based on 3 LQ cohort studies.*

Assisted vaginal birth

15. ***There is consistent moderate evidence that assisted vaginal birth is associated with a moderate to large increase in odds for severe perineal tears.*** *Based on 1 AQ SR, 3 AQ cohort studies and 2 LQ cohort studies.*
16. ***There is consistent moderate evidence that the use of forceps compared to vacuum is associated with a small increase in odds/prevalence/risk for severe perineal tears.*** *Based on 1 LQ SR and 6 AQ cohort studies.*
17. ***There is limited weak evidence that combined forceps and vacuum use compared to either forceps or vacuum alone is associated with a small to moderate increase in odds/risk for severe perineal tears.*** *Based on 2 AQ cohort studies.*
18. ***There is limited weak evidence that assisted vaginal birth in nulliparous compared to multiparous women is associated with an increase in prevalence for severe perineal tears.*** *Based on 1 AQ cohort study.*
19. ***There is limited weak evidence that assisted vaginal birth during 1-3 hours of second stage compared to spontaneous vaginal birth >3 hours of second stage is associated with a small increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
20. ***There is consistent weak evidence that assisted vaginal birth complicated by shoulder dystocia is associated with a moderate to large increase in odds/prevalence for severe perineal tears.*** *Based on 3 AQ cohort studies.*

Forceps

21. ***There is consistent strong evidence that the use of forceps is associated with a small increase in risk of minor perineal tears and a small to large increase in risk/odds/prevalence for severe perineal tears.*** *Based on 1 HQ SR, 1 LQ SR, 1 HQ cohort study, 9 AQ cohort studies and 9 LQ cohort studies.*
22. ***There is limited weak evidence that the type of forceps birth is associated with no increase in risk for minor and severe perineal tears.*** *Based on 1 AQ cohort study.*
23. ***There is limited weak evidence that obstetric forceps volume is associated with no increase in prevalence for severe perineal tears.*** *Based on 1 AQ cohort study and 1 LQ cohort study.*

Vacuum

24. ***There is inconsistent moderate evidence that vacuum birth is associated with no increase to large increase in odds/prevalence/risk for severe perineal tears.*** *Based on 9 AQ cohort studies and 8 LQ cohort study.*
25. ***There is limited strong evidence that soft cup compared to metal cup vacuum birth is associated with no increase in risk for minor perineal tears and no increase to decreased risk/prevalence for severe perineal tears.*** *Based on 1 HQ SR and 1 HQ CT.*
26. ***There is limited strong evidence that hand-held compared to any ventouse vacuum birth is associated with no increase in risk for minor and severe perineal tears.*** *Based on 1 HQ SR.*

27. ***There is limited weak evidence that in vacuum birth, obstetrician experience is associated with no increase in risk/odds for severe perineal tears.*** *Based on 1 AQ cohort study and 1 LQ cohort study.*
28. ***There is limited very weak evidence that in vacuum birth, birthweight greater than 4000g is associated with a small increase in prevalence for severe perineal tears.*** *Based on 1 LQ cohort study.*

Birthweight

29. ***There is consistent moderate evidence that an increase in birthweight is associated with a small to large increase in odds/prevalence/risk for minor and severe perineal tears.*** *Based on 1 AQ SR, 16 AQ cohort studies and 7 LQ cohort studies.*
30. ***There is limited weak evidence that in large for gestational age infants, induction of labour at greater than 38 weeks compared to expectant management is associated with no increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
31. ***There is limited weak evidence that sonographically estimated foetal weight in temporal proximity to birth in neonates weighing greater than 3500g is associated with no increase in prevalence for minor and severe perineal tears.*** *Based on 1 AQ cohort study.*
32. ***There is limited very weak evidence that second birth after first birth of a macrosomic infant is associated with an increase in prevalence for severe perineal tears.*** *Based on 1 LQ cohort study.*

Birth position

33. ***There is consistent strong evidence that upright compared to supine birth position is associated with no increase in risk/odds/prevalence for minor and severe perineal tears.*** *Based on 1 HQ SR, 1 LQ SR, AQ cohort study and 2 LQ cohort studies.*
34. ***There is consistent weak evidence that non supine (kneeling/hands and knees, sitting and/or squatting) compared to supine positions are associated with decreased risk/odds/prevalence for minor and severe perineal tears.*** *Based on 1 LQ CT and 2 AQ cohort studies.*
35. ***There is limited very weak evidence that flexible sacrum positions (kneeling, standing, all-fours, lateral position, squatting and giving birth on the birth seat) compared to non-flexible sacrum positions (supine and sitting) are associated with no increase in prevalence for severe perineal tears.*** *Based on 1 LQ cohort study.*
36. ***There is inconsistent strong evidence that birth stool/squatting stool is associated with no increase in risk for minor perineal tears and no increase to moderate increase in odds/risk for severe perineal tears.*** *Based on 1 HQ SR, 1 LQ SR and 3 AQ cohort studies.*

37. ***There is inconsistent weak evidence that kneeling/all fours birth position is associated with a decrease in rate for minor perineal tears and no increase in odds for severe perineal tears.*** *Based on 1 LQ SR and 3 LQ cohort studies.*
38. ***There is limited strong evidence that birth cushion compared to supine birth position is associated with a decreased risk for minor perineal tears and no increase in risk for severe perineal tears.*** *Based on 1 HQ SR.*
39. ***There is inconsistent strong evidence that birth chair/sitting/semi sitting compared to supine birth position is associated with a small increase in risk/odds for minor perineal tears and no increase in risk/odds for severe perineal tears.*** *Based on 1 HQ SR, 1 LQ SR, 1 LQ CT, 2 AQ cohort studies and 2 LQ cohort studies.*
40. ***There is limited weak evidence that standing compared to sitting birth position is associated with no increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
41. ***There is inconsistent weak evidence that lithotomy compared to other birth positions is associated with no increase to moderate increase in odds/prevalence for minor and severe perineal tears.*** *Based on 1 AQ CT, 2 AQ cohort studies and 1 LQ cohort studies.*
42. ***There is inconsistent weak evidence that lateral (side-lying) compared to other birth positions is associated with no increase in odds/prevalence for severe perineal tears.*** *Based on 1 AQ cohort study and 2 LQ cohort studies.*
43. ***There is inconsistent weak evidence that APOR B method compared to supine birth position is associated with a decrease in odds for minor perineal tears and no increase in odds for severe perineal tears.*** *Based on 2 AQ cohort studies.*
44. ***There is limited strong evidence that any upright compared to any recumbent maternal position in the second stage of labour for women with epidural anaesthesia is associated with no increase in risk for minor and severe perineal tears.*** *Based on 1 HQ SR.*
45. ***There is limited very weak evidence that horizontal/upright birth positions during second stage and supine at birth compared to horizontal during second stage and supine at birth are associated with no increase in prevalence for minor and severe perineal tears.*** *Based on 1 LQ cohort study.*

Birth setting

46. ***There is inconsistent very strong evidence that home birth compared to a hospital/conventional birth setting is associated with a decrease in odds/prevalence/risk for minor and severe perineal tears.*** *Based on 2 HQ SRs, 3 LQ SRs and 2 LQ SRs.*
47. ***There is limited weak evidence that public hospital compared to private hospital birth setting is associated with a small to moderate increase in the odds for minor and severe perineal tears.*** *Based on 1 AQ cohort study.*

48. ***There is limited weak evidence that birth centre compared to hospital birth setting is associated with no increase to decrease in the odds for severe perineal tears.*** *Based on 1 LQ SR and 1 AQ cohort study.*
49. ***There is limited weak evidence that rural compared to non-rural community birth is associated with no increase in the odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

Devices

50. ***There is limited moderate evidence that the use of birth balls compared with usual care is associated with no increase in the risk for severe perineal tears.*** *Based on 1 AQ SR.*
51. ***There is limited moderate evidence that the use of Epi-No birth trainer is associated with no increase in the risk for minor and severe perineal tears.*** *Based on 1 LQ SR and 1 HQ CT.*
52. ***There is limited very weak evidence that the use of Relaxbirth® for upright positioning is associated with no increase in prevalence for minor and severe perineal tears.*** *Based on 1 AQ case control study.*
53. ***There is limited strong evidence that the use of a perineal protection device compared to perineal support is associated with no increase in the risk for minor and severe perineal tears.*** *Based on 1 HQ SR.*

Diabetes

54. ***There is limited weak evidence that diabetes mellitus is associated with no increase in prevalence for minor and severe perineal tears.*** *Based on 1 AQ cohort study.*
55. ***There is limited weak evidence that gestational diabetes mellitus and a macrosomic baby during assisted vaginal birth is associated with a small increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
56. ***There is limited very weak evidence that shoulder dystocia in diabetic compared to non-diabetic women is associated with an increase in prevalence for minor perineal tears.*** *Based on 1 LQ cohort study.*

Duration of second stage labour

57. ***There is consistent moderate evidence that a prolonged second stage of labour is associated with a small to large increase in the odds/prevalence/risk for severe perineal tears.*** *Based on LQ SR, 1 HQ cohort study, 10 AQ cohort studies and 3 LQ cohort studies.*
58. ***There is inconsistent weak evidence that a prolonged second stage of labour in nulliparous women is associated with a small increase in the odds for severe perineal tears.*** *Based on 1 HQ cohort study and 2 AQ cohort studies.*
59. ***There is limited weak evidence that a prolonged second stage of labour in multiparous women is associated with a moderate to large increase in the odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

60. ***There is limited weak evidence that a prolonged second stage of labour in women who undergo assisted vaginal birth is associated with a small increase in the odds of severe perineal tears.*** *Based on 1 AQ cohort study.*

Elective induction of labour

61. ***There is limited weak evidence that induction at 37- or 38-weeks' gestation compared to no induction is associated with a decrease in the odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
62. ***There is consistent very strong evidence that induction at 39- or 40-weeks' gestation compared to no induction is associated with no increase in the risk/prevalence/odds for severe perineal tears.*** *Based on 2 HQ SRs and 4 AQ cohort studies.*
63. ***There is inconsistent strong evidence that induction at 41- or 42-weeks' gestation compared to no induction is associated with no increase in risk/prevalence for severe perineal tears.*** *Based on 1 HQ SR and 2 AQ cohort studies.*
64. ***There is limited moderate evidence that induction of labour (no timeframe given) compared to no induction is associated with a small increase in odds for severe perineal tears.*** *Based on 1 AQ SR and 1 AQ cohort study.*
65. ***There is limited very weak evidence that induction with prostaglandins is associated with an increase in prevalence for minor and severe perineal tears.*** *Based on 1 LQ cohort study.*
66. ***There is limited weak evidence that induction of labour for women with a large for gestation age fetus is associated with no increase in the risk for minor and severe perineal tears.*** *Based on 1 AQ cohort study.*
67. ***There is limited very weak evidence that length of induction of labour is associated with no increase in prevalence for severe perineal tears.*** *Based on 1 LQ cohort study.*

Episiotomy

68. ***There is inconsistent strong evidence that restrictive episiotomy compared to routine episiotomy in vaginal birth is associated with a decreased risk/prevalence for severe perineal tears.*** *Based on 1 HQ SR, 2 LQ SRs, 1 AQ CT, 1 AQ cohort and 2 LQ cohort studies.*
69. ***There is limited strong evidence that restrictive episiotomy compared to routine episiotomy in anticipated operative vaginal birth is associated with no increase in risk for severe perineal tears.*** *Based on 1 HQ SR.*
70. ***There is consistent moderate evidence that mediolateral episiotomy is associated with a decrease in risk/prevalence/odds for severe perineal tears.*** *Based on 1 AQ SR, 2 AQ cohort studies and 3 LQ cohort studies.*
71. ***There is limited strong evidence that mediolateral episiotomy in nulliparous women is associated with no increase in risk/odds of severe perineal tears.*** *Based on 1 HQ SR and 1 AQ SR.*

72. ***There is limited moderate evidence that mediolateral episiotomy in multiparous women is associated with a small increase in risk of severe perineal tears.*** *Based on 1 HQ SR.*
73. ***There is consistent strong evidence that median episiotomy is associated with a small to large increase in odds/risk for severe perineal tears.*** *Based on 1 HQ SR, 1 AQ SR, 4 AQ cohort studies and 1 LQ cohort study.*
74. ***There is limited very weak evidence that mediolateral episiotomy in women undergoing assisted vaginal birth is associated with a decrease in odds for minor and severe perineal tears.*** *1 LQ cohort study.*
75. ***There is limited strong evidence that lateral episiotomy in nulliparous women is associated with a decrease in odds for severe perineal tears.*** *Based on 1 HQ SR and 1 AQ cohort study.*
76. ***There is limited strong evidence that lateral episiotomy in multiparous women is associated with no increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*
77. ***There is consistent moderate evidence that episiotomy (all types combined, or no type mentioned) compared to no episiotomy is associated with a small to large increase in risk/prevalence/odds for severe perineal tears.*** *Based on 1 AQ SR, 1 LQ SR, 10 AQ cohort studies and 6 LQ cohort studies.*
78. ***There is inconsistent weak evidence that episiotomy in nulliparous women who undergo assisted vaginal birth is associated with a moderate to large increase in odds/prevalence for severe perineal tears.*** *Based on 2 AQ cohort studies and 2 LQ cohort studies.*
79. ***There is limited weak evidence that episiotomy performed before crowning compared to at crowning in nulliparous women is associated with no increase in prevalence for severe perineal tears.*** *Based on 1 AQ cohort study.*
80. ***There is limited weak evidence that second vaginal birth following episiotomy at first vaginal birth is associated with a large increase in risk/odds for minor and severe perineal tears.*** *Based on 1 AQ cohort study and 1 LQ cohort study.*
81. ***There is limited weak evidence that episiotomy in women with birth complicated by shoulder dystocia is associated with a decrease in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

Episiotomy in vacuum assisted birth versus without episiotomy

82. ***There is limited strong evidence that episiotomy in vacuum assisted birth compared to without episiotomy is associated with a decrease in odds for severe perineal tears.*** *Based on 1 HQ SR.*

Foetal death

83. ***There is limited very weak evidence that intrauterine foetal death compared to live births is associated with a decrease in risk for minor and severe perineal tears.*** *Based on 1 HQ case control study.*

Foetal position

84. ***There is consistent weak evidence that occiput posterior position compared to occiput anterior position is associated with a small to moderate increase in odds/prevalence/risk for severe perineal tears.*** *Based on 4 AQ cohort studies and 1 LQ cohort study.*
85. ***There is limited very weak evidence that occiput transverse position compared to occiput anterior position is associated with an increase in prevalence for severe perineal tears.*** *Based on 1 LQ cohort study.*
86. ***There is limited weak evidence that occiput posterior position compared to occiput anterior position for forceps birth is associated with a moderate to large increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
87. ***There is limited very weak evidence that occiput posterior position compared to occiput anterior position in vacuum birth is associated with a moderate to large increase in odds for severe perineal tears.*** *Based on 1 LQ cohort study.*

Foetal rotation

88. ***There is limited weak evidence that manual rotation compared to no rotation attempt for occiput posterior/transverse positions is associated with a decrease in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
89. ***There is limited very weak evidence that in persistent occiput posterior position vaginal birth, forceps assisted rotation is associated with no increase in prevalence for severe perineal tears.*** *Based on 1 LQ cohort study.*
90. ***There is limited weak evidence that assisted rotation using forceps or vacuum compared to manual rotation is associated with no increase in odds for minor and severe perineal tears.*** *Based on 1 HQ cohort study.*
91. ***There is limited weak evidence that manual rotation plus assisted vaginal birth compared to assisted vaginal birth with no manual rotation attempt is associated with a decrease in odds/prevalence for severe perineal tears.*** *Based on 1 AQ cohort study and 1 LQ cohort study.*
92. ***There is limited weak evidence that sonographic (US) diagnosis of the foetal spine position during manual rotation of the foetal occiput is associated with no increase in prevalence for severe perineal tears.*** *Based on 1 LQ CT.*
93. ***There is limited weak evidence that, in a vaginal birth in occiput posterior position following a failed manual rotation attempt, no forceps rotation attempt compared to a forceps rotation attempt is associated with a large increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

Female genital mutilation

94. ***There is limited weak evidence that female genital mutilation is associated with an increase in odds/prevalence for severe perineal tears.*** *Based on 1 HQ cohort study.*

Fundal pressure

95. ***There is consistent strong evidence that manual fundal pressure compared to no fundal pressure in spontaneous birth is associated with a large increase in odds/risk for minor and severe perineal tears.*** *Based on 1 HQ SR, 1 AQ cohort study and 1 LQ cohort study.*
96. ***There is limited weak evidence that manual fundal pressure compared to no fundal pressure in assisted vaginal birth is associated with no increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
97. ***There is limited strong evidence that fundal pressure by inflatable belt compared to no fundal pressure is associated with no increase in risk for minor perineal tears and a large increase in risk for severe perineal tears.*** *Based on 1 HQ SR.*

Gestational age

98. ***There is inconsistent moderate evidence that prolonged pregnancy greater than 39 weeks gestation is associated with a small increase in odds/risk/prevalence for severe perineal tears.*** *Based on 5 AQ cohort studies and 2 LQ cohort studies.*
99. ***There is consistent weak evidence that increasing gestational age is associated with a small increase in odds/prevalence for minor and severe perineal tears.*** *Based on 2 AQ cohort studies and 3 LQ cohort studies.*

Hands on versus hands off (or poised)

100. ***There is inconsistent strong evidence that hands on compared to hands off or hands poised is associated with no increase in odds/prevalence/risk for minor and severe perineal tears.*** *Based on 1 HQ SR, 2 AQ SRs, 2 AQ cohort studies and 1 LQ cohort study.*

Health professionals

101. ***There is inconsistent very strong evidence that midwife led care compared to other models (obstetrician-provided care, family doctor provided care and shared model of care) is associated with a decrease to no increase in odds/prevalence/risk for minor and severe perineal tears.*** *Based on 2 HQ SRs, 3 AQ cohort studies and 4 LQ cohort studies.*
102. ***There is inconsistent weak evidence that resident doctors compared to obstetricians in assisted vaginal birth is associated with no increase to large increase in odds/prevalence for severe perineal tears.*** *Based on 2 AQ cohort studies and 1 LQ cohort study.*
103. ***There is inconsistent weak evidence that a family physician or general practitioner compared to an obstetrician is associated with a small increase in odds for minor perineal tears and no increase to small increase in odds/risk for severe perineal tears.*** *Based on 3 AQ cohort studies.*
104. ***There is limited weak evidence that the gender of the delivering physician is associated with no increase in odds for severe perineal tears.*** *Based on 3 AQ cohort studies.*
105. ***There is limited weak evidence that methods used by midwives during second stage of labour (directed pushing, toweltrick, levator pressure, pressure to spinae***

ischiadica, manipulation of symphysis bone and digital stretching of the perineum) are associated with no increase in odds for minor and severe perineal tears. *Based on 1 AQ cohort study.*

106. ***There is inconsistent moderate evidence that out of hours and weekend deliveries are associated with no increase to decrease in odds/prevalence for severe perineal tears.*** *Based on 5 AQ cohort studies.*
107. ***There is limited weak evidence that assisted vaginal birth training is associated with a decrease in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*
108. ***There is limited very weak evidence that night float call schedule compared to traditional call schedule is associated with a decrease in prevalence for severe perineal tears.*** *Based on 1 LQ cohort study.*

Hyaluronidase

109. ***There is limited strong evidence that Hyaluronidase injection compared to control is associated with no increase in risk for minor and severe perineal tears.*** *Based on 1 HQ SR.*
110. ***There is limited strong evidence that Hyaluronidase injection compared to placebo injection is associated with no increase in risk for minor and severe perineal tears.*** *Based on 1 HQ SR.*
111. ***There is limited strong evidence that Hyaluronidase injection compared to no intervention is associated with no increase in risk for minor perineal tears.*** *Based on 1 HQ SR.*

Intervention programs

112. ***There is limited strong evidence that the Finnish intervention is associated with a decrease in prevalence for severe perineal tears.*** *Based on 1 HQ SR.*
113. ***There is limited weak evidence that a complementary therapies program is associated with no increase in risk for severe perineal tears.*** *Based on 1 HQ CT.*
114. ***There is limited weak evidence that osteopathic manipulative treatment and usual care compared to usual care or placebo ultrasound treatment is associated with no increase in prevalence for minor perineal tears.*** *Based on 1 LQ CT.*
115. ***There is limited weak evidence that a dietary and lifestyle counselling program is associated with no increase in minor perineal tears.*** *Based on 1 AQ CT.*

Macrosomia

116. ***There is consistent weak evidence that macrosomia is associated with a decrease in prevalence for minor perineal tears and a moderate to large increase in odds/prevalence for severe perineal tears.*** *Based on 4 AQ cohort studies.*

Manoeuvres for Shoulder Delivery

117. ***There is limited strong evidence that birth of anterior shoulder compared to birth of posterior shoulder is associated with no increase in odds for minor and severe perineal tears.*** *Based on 1 HQ SR and 1 HQ CT.*

118. ***There is inconsistent weak evidence that Couder's manoeuvre during vacuum birth is associated with a decreased to increased prevalence for minor perineal tears and no increase in prevalence for severe perineal tears.*** *Based on 1 AQ cohort study and 1 LQ cohort study.*

Metformin

119. ***There is limited strong evidence that Metformin is associated with no increase in risk for severe perineal tears.*** *Based on 1 HQ SR.*

Obesity/BMI

120. ***There is consistent strong evidence that increased BMI/bodyweight is associated with no increase in odds/prevalence for minor perineal tears and no increase to decrease in odds/prevalence for severe perineal tears.*** *Based on 2 HQ cohort studies, 13 AQ cohort studies and 2 LQ cohort studies.*
121. ***There is limited weak evidence that excessive weight gain during pregnancy is associated with no increase in prevalence for severe perineal tears.*** *Based on 1 AQ cohort study and 1 LQ cohort study.*
122. ***There is limited weak evidence that low maternal weight is associated with a small increase in risk for minor and severe perineal tears.*** *Based on 1 AQ cohort study.*

Obstetric gel

123. ***There is limited weak evidence that obstetric gel in vaginal births without interventions is associated with a decrease in prevalence for minor and severe perineal tears.*** *Based on 1 AQ CT.*

Oxytocin

124. ***There is consistent weak evidence that oxytocin is associated with no increase in odds/prevalence for severe perineal tears.*** *Based on 1 AQ CT, 3 AQ cohort studies and 3 LQ cohort studies.*

Parity

125. ***There is consistent moderate evidence that nulliparous women compared to multiparous women are associated with a moderate to large increase in the risk/prevalence/odds for severe perineal tears.*** *Based on 9 AQ cohort studies and 11 LQ cohort studies.*

Passive second stage of labour

126. ***There is limited very weak to weak evidence that passive second stage of labour is associated with no increase in prevalence for minor and severe perineal tears.*** *Based on 1 AQ case control study.*

Pelvic floor muscle function & exercise

127. ***There is consistent strong evidence that pelvic floor muscle training is associated with no increase in the odds for minor and severe perineal tears.*** *Based on 1 HQ SR, 1 AQ CT, 1 HQ cohort study and 1 LQ cohort study.*

128. ***There is limited weak evidence that vaginal resting pressure is associated with no increase in the prevalence for severe perineal tears.*** *Based on 1 HQ cohort study.*

129. ***There is limited weak evidence that pelvic floor muscle strength/endurance is associated with no increase in prevalence for severe perineal tears.*** *Based on 1 HQ cohort study.*

Perineal length

130. ***There is inconsistent moderate evidence that short perineal body length is associated with no increase to increase in odds/prevalence for severe perineal tears.*** *Based on 1 HQ cohort study, 3 AQ cohort studies and 3 LQ cohort studies.*

131. ***There is limited weak evidence that perineal body stretch is associated with no increase in prevalence for minor perineal tears.*** *Based on 1 AQ cohort study.*

Perineal massage

132. ***There is inconsistent very strong evidence that perineal massage is associated with no increase in risk for minor perineal tears and a decrease in risk/prevalence for severe perineal tears.*** *Based on 3 HQ SRs, 1 HQ SR and 1 LQ SR.*

Prenatal exercise

133. ***There is limited strong evidence that prenatal exercise is associated with no increase in minor and severe perineal tears.*** *Based on 1 HQ SR.*

Previous caesarean section – Vaginal birth after caesarean (VBAC)

134. ***There is inconsistent moderate evidence that vaginal birth after caesarean is associated with a small increase in odds/prevalence/risk for severe perineal tears.*** *Based on 5 AQ cohort studies and 4 LQ cohort studies.*

Previous history of OASI or other perineal trauma

135. ***There is inconsistent strong evidence that a previous history of OASI or other perineal trauma is associated with a small increase in odds for severe perineal tears.*** *Based on 1 HQ SR, 3 AQ cohort studies and 1 LQ cohort studies.*

136. ***There is limited strong evidence that a previous history of OASI and forceps birth is associated with a large increase in odds for severe perineal tears.*** *Based on 1 HQ SR and 1 AQ cohort study.*

137. ***There is limited strong evidence that a previous history of OASI and vacuum birth is associated with a moderate increase in odds for severe perineal tears.*** *Based on 1 HQ SR and 1 AQ cohort study.*

138. ***There is limited strong evidence that a previous history of OASI and birthweight greater than 4kg is associated with a moderate increase in odds for severe perineal tears.*** *Based on 1 HQ SR and 1 AQ cohort study.*

139. ***There is limited strong evidence that a previous history of OASI and an advanced maternal age greater than 35 years is associated with a small increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*
140. ***There is limited strong evidence that a previous history of OASI and occiput-posterior position is associated with a small increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*
141. ***There is limited strong evidence that a previous history of OASI and Asian ethnicity is associated with no increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*
142. ***There is limited strong evidence that a previous history of OASI and induction of labour is associated with no increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*
143. ***There is limited strong evidence that a previous history of OASI and the gender of child is associated with no increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*
144. ***There is limited strong evidence that a previous history of OASI and time between pregnancies is associated with no increase in odds for severe perineal tears.*** *Based on 1 HQ SR and 1 AQ cohort study.*
145. ***There is limited strong evidence that a previous history of OASI and maternal BMI is associated with no increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*
146. ***There is limited strong evidence that a previous history of OASI and epidural analgesia is associated with no increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*
147. ***There is limited strong evidence that a previous history of OASI and third pregnancy is associated with a large increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*
148. ***There is limited strong evidence that a previous history of OASI and shoulder dystocia is associated with a large increase in odds for severe perineal tears.*** *Based on 1 HQ SR.*

Pushing technique

149. ***There is consistent strong evidence that spontaneous pushing compared to directed pushing is associated with no increase in risk/odds for minor and severe perineal tears.*** *Based on 1 HQ SR and 1 AQ cohort study.*
150. ***There is inconsistent strong evidence that immediate pushing compared to delayed pushing is associated with no increase in risk/prevalence for minor and severe perineal tears.*** *Based on 1 HQ SR, 1 LQ SR, 2 HQ CT and 1 AQ CT.*
151. ***There is limited weak evidence that pushing performed at crowning compared to breathing the head out is associated with a large increase in odds for severe perineal tears.*** *Based on 1 AQ cohort studies.*

Race/Ethnicity

152. ***There is limited weak evidence that Asian ethnicity for women living in Western countries is associated with an increase in prevalence for minor and severe perineal tears.*** *Based on 1 LQ SR.*

153. ***There is limited weak evidence that Asian ethnicity for women living in Asia is associated with no increase in prevalence for minor and severe perineal tears.*** *Based on 1 LQ SR.*

154. ***There is consistent weak evidence that Asian ethnicity when the living location is not referred to is associated with a small to large increase in odds for severe perineal tears.*** *Based on 4 AQ cohort studies and 3 LQ cohort studies.*

Ritgen's Manoeuvre

155. ***There is limited very strength evidence that Ritgen's manoeuvre is associated with no increase in risk for severe perineal tears.*** *Based on 2 HQ SRs.*

Shoulder dystocia

156. ***There is consistent weak evidence that shoulder dystocia is associated with a moderate to large increase in odds for severe perineal tears.*** *Based on 2 AQ cohort studies and 1 LQ cohort study.*

157. ***There is limited weak evidence that shoulder dystocia in nulliparous compared to multiparous women is associated with a moderate to large increase in odds for severe perineal tears.*** *Based on 2 AQ cohort studies.*

Shoulder dystocia management

158. ***There is consistent weak evidence that shoulder dystocia management is associated with a small to large increase in odds/prevalence for severe perineal tears.*** *Based on 3 AQ cohort studies and 2 LQ cohort studies.*

Smoking

159. ***There is consistent weak evidence that smoking is associated with a decrease in odds/prevalence for severe perineal tears.*** *Based on 2 AQ cohort studies and 1 LQ cohort study.*

Socioeconomic status

160. ***There is limited weak evidence that white collar workers compared to blue collar workers are associated with a small increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

Staff training

161. ***There is inconsistent weak evidence that staff training is associated with no increase to decrease in prevalence/odds for severe perineal tears.*** *Based on 3 LQ cohort studies.*

Twin pregnancy

162. ***There is limited weak evidence that twin pregnancy is associated with no increase in odds/risk for severe perineal tears.*** *Based on 2 AQ cohort studies.*

163. ***There is limited weak evidence that twin pregnancies in nulliparous women are associated with a large increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

164. ***There is limited weak evidence that twin pregnancies whereby at least one twin is in occiput-posterior position are associated with a moderate increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

165. ***There is limited weak evidence that twin pregnancies whereby at least one twin has increased birthweight are associated with a small increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

166. ***There is limited weak evidence that twin pregnancies whereby at least one twin has an assisted vaginal birth are associated with a large increase in odds for severe perineal tears.*** *Based on 1 AQ cohort study.*

Volume of delivery unit

167. ***There is inconsistent weak evidence that high volume compared to low volume delivery units are associated with no increase in odds for severe perineal tears.*** *Based on 2 AQ cohort studies and 2 LQ cohort studies.*

Warm pack/compress

168. ***There is consistent strong evidence that the use of warm pack/compress is associated with no increase in risk/prevalence for minor perineal tears and a decrease in risk/prevalence/odds for severe perineal tears.*** *Based on 1 HQ SR, 1 HQ CT and 1 LQ cohort study.*

Water birth

169. ***There is inconsistent strong evidence that immersion compared to no immersion during any stage of labour is associated with no increase in risk/prevalence/odds for minor and severe perineal tears.*** *Based on 1 HQ SR, 2 LQ SRs, 5 AQ cohort studies and 3 LQ cohort studies.*

170. ***There is limited strong evidence that immersion compared to no immersion in the first stage of labour is associated with no increase in risk for minor and severe perineal tears.*** *Based on 1 HQ SR.*

171. ***There is limited strong evidence that immersion compared to no immersion in the second stage of labour is associated with no increase in risk for minor perineal tears.*** *Based on 1 HQ SR.*

Wax/Oil

172. ***There is limited strong evidence that wax/oil is associated with no increase in risk for minor perineal tears.*** *Based on 1 HQ SR.*

1. Background

1.1 Objective of this review

The objective of this evidence-based review is to summarise the published literature regarding contributing factors to perineal tears that can occur during childbirth, and what factors may reduce the risk of tears. This review aims to answer the following research questions:

Primary research questions:

1. What factors are responsible for, or contribute to a perineal tear occurring during childbirth?
2. What factors reduce the risk of a perineal tear?

Secondary research questions:

What is the evidence regarding the following factors in relation to occurrence of perineal tears for:

a) Patient related factors including: ethnicity, BMI/obesity, age, primigravida/ multigravida women, gestational diabetes
b) Birth related factors including: birth position (eg. occipito-posterior birth, birth weight, infant head circumference, shoulder dystocia, pre/post term), time in labour (eg. length of second stage of labour)
c) Procedure related factors including: episiotomy, caesarean/vaginal birth, instrumentally assisted birth (eg. ventouse, forceps)

1.2 Introduction

In the 2015 United Nations population report, it was noted that there were 141 million births happening in the world every year (UN Population Division, 2017). Maternal health care services aim to ensure a healthy and safe childbirth process for the mother and baby and reduce mortality and morbidity. Major causes of maternal mortality include haemorrhage, hypertensive diseases of pregnancy (mainly preeclampsia/eclampsia) maternal sepsis, abortive outcomes and other complications (Say et al. 2014; Gulmezoglu et al. 2016). Maternal morbidity has a wider range of causes which women experience during pregnancy, delivery, or post pregnancy (Gulmezoglu et al. 2016; Firoz et al 2013). One major cause of morbidity is perineal tears, in particular, severe perineal tears (Cohen et al. 2017; Lu et al. 2019; Vannevel et al. 2019). Perineal tears occur in 85% of women who undergo vaginal birth (Frolich and Kettle 2015). In New Zealand, 65% (5,912/9,086) of women had a spontaneous vaginal birth in 2017 (Ministry of Health, 2013). In this population, 4.4% sustained third- or fourth-degree tears with no episiotomy.

Perineal tears are classified based on the degree of laceration. The Royal Australian College of General Practitioners (RACGP) provides a grading system to classify the degree of perineal tears (Goh et al. 2018). A first-degree tear is a laceration of the vaginal mucosa or perineal skin only. A second-degree tear is a laceration involving the perineal muscles. A third-degree tear is a laceration involving the anal sphincter muscles, and further subdivided into 3A (<50% of the external anal sphincter is torn), 3B (>50% of the external anal sphincter is torn) and 3C (external and internal anal sphincters are both torn). A fourth-degree tear is laceration extending through the anal epithelium. First and second-degree tears are considered minor tears such that first-degree tears may not require suturing and second-degree tears may require suturing. Third- and fourth-degree tears are major or severe tears (collectively known as obstetric anal sphincter

injuries (OASIS)) and repair by a qualified and trained health practitioner is required as soon as possible (Goh et al. 2018).

Sustaining perineal tears is extremely debilitating. Short term outcomes include perineal pain and urinary retention and defecation problems in initial postpartum period (Harvey et al. 2015). Long term outcomes, which are more severe, include abscess formation, rectovaginal fistulae, anal incontinence and psychological burden to the woman (Leeman et al. 2012). As these outcomes related to perineal tears will have seriously incapacitating impact on the mother, it is critical to determine what causes perineal tears. Thus, we conducted an evidence-based review, and searched, assessed and synthesised the existing body of evidence regarding the risk factors associated with, as well as factors preventing, perineal tears, among mothers giving birth.

Findings from the systematic review will be presented and discussed within an Expert Reference Group forum consisting of clinical specialists from around New Zealand, ACC Treatment Safety and ACC Research. Within this forum, the academic literature from the review, along with clinical expertise, will be used to form the guidance on assessing treatment injury claims regarding perineal tears. The guidance will inform decision making on whether a perineal tear was caused by an underlying health condition or common risk factors, or as an ordinary consequence of treatment provided by a registered health professional.

2. Methodology

2.1 Review question

What factors are responsible for, or contribute to, a perineal tear occurring during childbirth, and what factors may reduce the risk of a perineal tear?

2.2 Methods

A review of published research literature was undertaken to provide a synthesis of the currently available research evidence regarding contributing factors to perineal tears that can occur during childbirth, and what factors may reduce the risk of tears. A systematic and rigorous search strategy was developed to locate all published and accessible research evidence from January 2000 to March 2019. The evidence base for this review included research evidence from existing systematic reviews, meta-analyses, and high-level primary research. Where high level primary research was not identified for a risk factor, cohort studies and case control studies were reviewed. This review took a pragmatic approach to the presentation of the literature, sub-dividing the studies into the most common risk factors reported in the literature. Where SRs reported studies involving a range of risk factors, if possible the data for each risk factor has been extracted from the individual reviews and is presented separately below.

2.3 Search strategy

The search was developed using a standard PECO structure (shown in Table 1). Only articles published in English that used human participants and were accessible in full text were included.

Table 1: Criteria for considering studies in the review

Population	**Included:** Women with perineal tears during childbirth **Excluded:** Studies investigating perineal trauma which do not define the severity of the trauma Non-human studies Participants or models of care which are not relevant to New Zealand context
Exposure	**Included:** Patient related, birth related and procedure related factors that contribute to women having perineal tears **Excluded:** Studies that investigate treatment options for perineal tears after childbirth
Comparator	**Included** No restrictions
Outcomes	**Included** Studies investigating first, second, third- and fourth-degree tears, OASI, OASIS, perineal tears, perineal lacerations **Excluded**

	Studies investigating C-Section, pelvic floor dysfunction, circumstances following tears, pain relief, imaging studies, and incontinence Studies investigating levator ani injuries or perineal injuries which are not a tear or laceration

A combination of search terms (shown in Table 2) were used to identify and retrieve articles in the following databases:

- Medline
- Emcare
- Cochrane Library
- Pre-Medline
- PubMed
- EMBASE
- JBI Library of Reviews

Table 2: Search strategy

The search strategy for the MEDLINE database search is presented below. The MeSH keyword search terms and Boolean operators were modified to accommodate each search database. The detailed search strategy can be found in Appendix 1.

Search term 1	Search terms 2	Search terms 3	Search terms 4
Perineum/ Anal Canal/ AND injuries.fx. "Wounds and Injuries"/ Lacerations/	Anal Anus Rectal Rectum Perine* Vagina* Fourchette Pelvic floor adj3 Tear Tears Tore Torn Teared Tearing Lacerat* Trauma* Disruption? Injur* Wound* Ruptur* Damag*	Obstetric laceration? Obstetric tear? OASI OASIS	Delivery, Obstetric/ Labor, Induced/ exp Parturition/ Labor, Obstetric/ OR Birth* Childbirth* Child-birth* Labo?r* Obstetric deliver* Parturition Delivery Intrapartum OR Episiotomy/ Episiotom* Perineal guarding Perineal protection OR

	Third degree Fourth degree Third-degree Fourth-degree "3rd degree" "4th degree"		Rectovaginal Fistula/ Vesicovaginal Fistula/ Vaginal Fistula/ OR Fistula? adj3 obstetric Fistula? adj3 recto?vaginal Fistula? adj3 ano?vaginal Fistula? adj3 vagina? Fistula? adj3 anal Fistula? adj3 anus

The titles and abstracts identified from the above search strategy were assessed for eligibility by the *iCAHE* researchers. Full-text copies of eligible articles were retrieved for full examination and assessed for eligibility by ACC. Reference lists of included full-text articles were searched for relevant literature not located through database searching.

The following sites were used to search for clinical guidelines:

- New Zealand Guidelines Group (NZGG)
- National Health and Medical Research Council (NHMRC) Australian Clinical Practice Guidelines
- The Royal Australian College of General Practitioners (RACGP)
- The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG)
- The Royal College of Midwives (RCM)
- Royal College of Obstetricians and Gynaecologists (RCOG)
- Guidelines International Network (GIN)
- Scottish Intercollegiate Guidelines Network (SIGN)
- National Health Institute for Health and Care Excellence (NICE)
- The TRIP database
- NHS evidence search
- ACOG's clinical guidance
- Canadian Clinical Practice Guidelines Infobase (CPG Infobase)
- Google

2.4 Study Selection

Inclusion Criteria

- Study types: Systematic reviews (SRs) that may include trials, observational studies including prospective observational studies and retrospective analyses of administrative datasets; clinical guidelines, particularly Australasian guidelines, that are explicitly evidence based (i.e. based on a SR of the literature), including prospective observational studies and retrospective analyses of administrative datasets
- Population of interest: Women with perineal tears during childbirth

- Exposure: Factors that contribute to women having perineal tears that can be categorised into patient related, birth related and procedure related:
    - Patient related (ie. ethnicity, BMI/obesity, age, primigravida/multigravida women, gestational diabetes)
    - Birth related (ie. occipito-posterior birth, birth weight, infant head circumference, shoulder dystocia, pre/post term time in labour)
    - Procedure related (ie. episiotomy, caesarean/vaginal birth, instrumentally assisted birth)
- Publication criteria: English, full text available, in peer reviewed journal.

Exclusion criteria

- Studies only available in abstract form, for example, conference presentations
- Grey literature
- Single case studies
- Non-human studies
- Studies that investigate treatment options for perineal tears after childbirth
- Studies which investigate populations or models of care which are not relevant to New Zealand context
- Studies investigating C-Section, pelvic floor dysfunction, circumstances following tears, pain relief, imaging studies, and incontinence
- Studies investigating levator ani injuries or perineal injuries which are not a tear or laceration

Selecting studies

A pragmatic approach was taken in regard to cut-off for study design for individual risk factors. The cut-off varied depending on the level of evidence available. If a number of high-quality SRs and RCTs (SIGN level HQ (++)) were available for a particular risk factor or set of factors, lower level studies (e.g. cohorts and case series) were not included. If limited SRs and RCTs were available, but a number of high-quality (SIGN level HQ (++)) cohort studies were available for a particular risk factor or set of factors, lower level studies (e.g. case series) were not included.

2.5 Critical Appraisal (SIGN)

SIGN (Scottish Intercollegiate Guidelines Network) design-specific checklists were used to assess the methodological quality of the included studies. The SIGN checklists ask a number of questions with 'yes', 'no', 'can't say', or 'not applicable' as responses with the appraiser giving an overall rating of quality, based on the responses to questions of either high quality (++), acceptable (+), low quality (-), or unacceptable.

Copies of the SIGN checklist are provided in Appendix 2.

The AGREE (Appraisal of Guidelines Research & Evaluation) II tool was used to assess the quality and reporting of practice guidelines. The AGREE II consists of 23 key items organised within 6

	domains followed by 2 global rating items ("Overall Assessment"). Each domain captures a unique dimension of guideline quality. Copies of the AGREE II can be found at the following link. https://www.agreetrust.org/wp-content/uploads/2017/12/AGREE-II-Users-Manual-and-23-item-Instrument-2009-Update-2017.pdf
2.6 **Data Extraction**	Data was extracted from the identified publications using a data extraction tool which was specifically developed for this review. The following information was extracted from individual studies: • Evidence source (author, date, year) • Study design • Level of evidence • Setting (country, health facility) • Risk factors addressed • Objective • Type/grade of tear • Inclusion/exclusion criteria • Number of studies/participants included • Results
2.7 **Data Synthesis**	As described, for this review each study was graded for overall methodological quality using the SIGN checklist specific to its study design. All guidelines were graded using the AGREE II tool. To standardise the strengths of recommendations from the extensive literature used for this review, a structured system was developed to incorporate a number of quality measures. Four measures were selected as important variables in assessing the strength of recommendations from the evidence base, for each risk factor. These were: a) Strength of the evidence base b) Consistency of the evidence c) Odds/Risk ratio d) Degree of trauma

A summary matrix and wording proforma that considered all key criteria was developed in order to create a standardised method to summarise the evidence.

Key Criteria	Descriptors	Wording
Strength of the evidence base	➢ ≥2 HQ SRs or ≥3 HQ controlled trials ➢ 1 HQ SR or ≥2 AQ SR or ≥ 1 HQ controlled trials and >3 AQ controlled trials/cohorts ➢ 1 AQ SR or ≥1 LQ SR and ≥1 HQ controlled trial or ≥5 AQ controlled trials/cohorts ➢ 1 LQ SR or <5 AQ or LQ controlled trials/cohorts ➢ 1 LQ cohort or ≥1 AQ case control	➢ Very strong ➢ Strong ➢ Moderate ➢ Weak ➢ Very weak
Consistency of the evidence base	➢ ≥75% agreement ➢ ≤74% agreement ➢ Less than 3 studies	➢ Consistent ➢ Inconsistent ➢ Limited
Odds/Risk ratio/P value	➢ ≥3 ➢ 2-3 ➢ 1-2 ➢ CI crosses line of no effect - 1 ➢ <1	➢ Large increase ➢ Moderate increase ➢ Small increase ➢ No increase in risk/odds/prevalence ➢ Decreased risk/odds/prevalence
Degree of trauma	➢ Severe ➢ Minor	➢ Third- and fourth-degree tears, OASI ➢ First and second-degree tears

Evidence statement proforma:

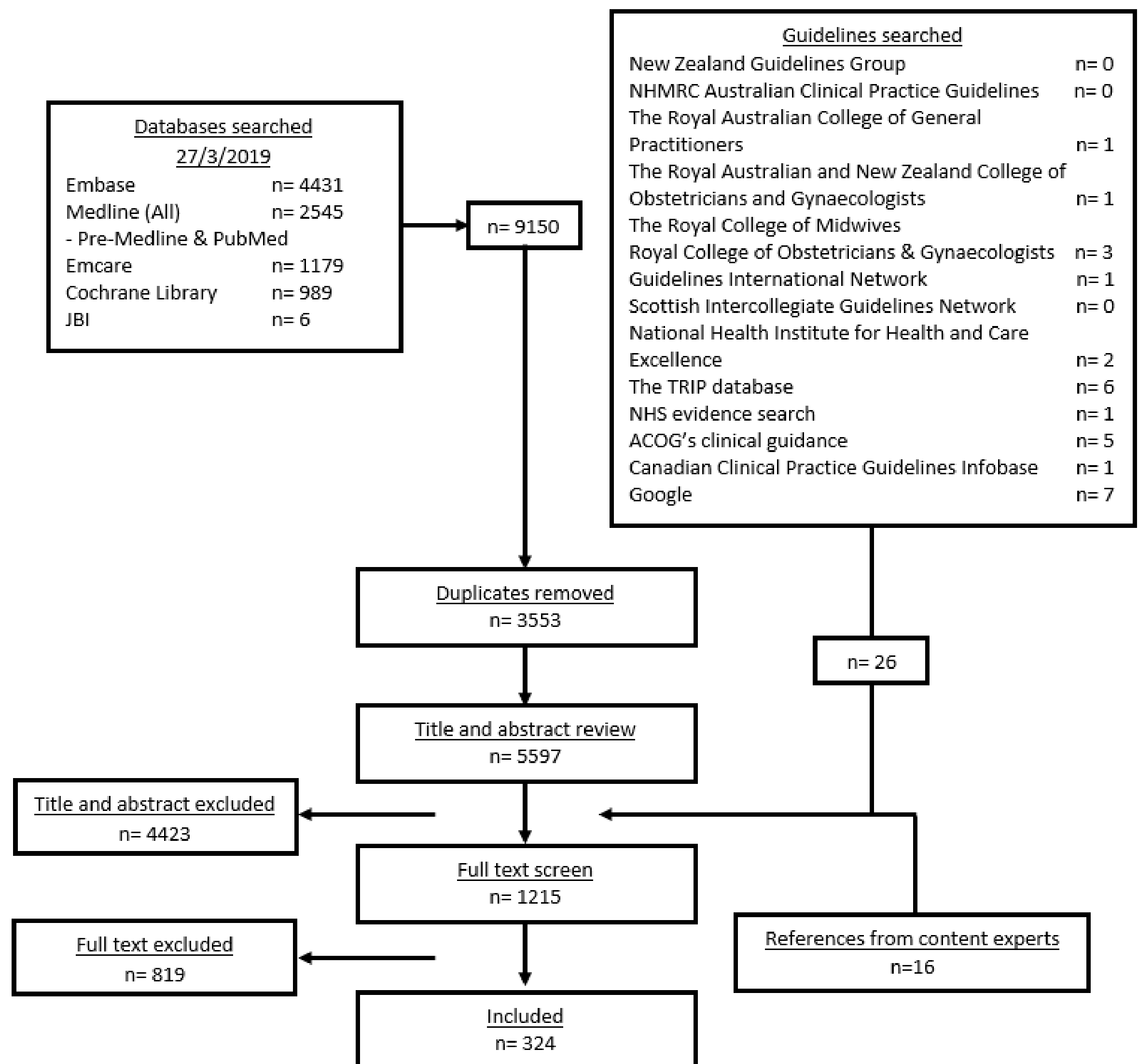
- There is [Consistency of evidence] [Strength of evidence] evidence that [Risk factor] is associated with a [Risk range] [Increase/decrease] in [Risk/odds] for [Degree of tears]

3. Results

3.1 Evidence Sources

The search for all risk factors using 6 databases and 13 guideline sites yielded 9,150 articles (see Appendix 1 for search strategy). The final search was conducted on March 3, 2019. After removing duplicates from the search, 1,215 articles were identified for title and abstract screening. After scrutiny, 891 articles were excluded for failing to meet the inclusion criteria (shown in Figure 1), leaving 324 studies that fitted all inclusion criteria for the report. Figure 1 illustrates the process involved in study selection.

Figure 1: PRISMA diagram of study identification process



3.2 Quality of the Evidence

The literature found for this report varied significantly in quality according to the SIGN Critical Appraisal checklists.

	N =	HQ (++)	AQ (+)	LQ (-/0)	R (0)
SRs	45	27	6	10	2
Controlled trials	19	7	7	5	0
Cohort studies	246	12	157	77	0
Case control studies	5	1	4	0	0
Guidelines	9	-	-	-	-

The quality of the guidelines is discussed in section 3.4. Appendix 2 presents the SIGN critical appraisal tools used in this review. Appendices 3, 4, 5, 6 and 7 present the critical appraisal scores for the Guidelines, SRs, RCTs, Cohort studies and Case control studies included in this review.

The main issues affecting the methodological quality of the studies included:

Systematic reviews

A) Very few studies addressed the potential for publication bias in reporting their reviews.
B) Limited databases were often sourced during the search process.
C) Excluded studies were frequently not listed.
D) Studies frequently reported details of the intervention, control and models of care inadequately.
E) The status of publication was often not used as an inclusion criteria.
F) Significant variability in birth procedures were common within the reviews.
G) Not all studies screened for methodological quality using validated critiquing tools.
H) Studies often combined heterogenous data.
I) Rarely do studies utilise two independent researchers to screen the search results, assess trial eligibility, assess risk of bias, and extract data from the included trials.

Primary studies

A) Power calculations were often not conducted.
B) Investigators were rarely blinded to the intervention involved.
C) Studies often were not designed with the primary aim of assessing the risk of perineal tears.
D) A number of studies failed to report the use of intention to treat analysis when reporting findings.
E) Studies often did not use valid and reliable primary outcome measures.

F) Convenience sampling was frequently used.

G) Dropouts and cause of attrition were infrequently reported.

H) Expertise of practitioners administrating the intervention was regularly not reported.

I) Common risk factors such as nulliparity, foetal position, size, and instrumental birth are often not controlled for in the analysis.

J) A number of the studies were retrospective in nature and utilised birth registers, obstetric databases or admitted patient data.

Studies (particularly the cohort studies) often did not check if groups being studied were from source populations that were comparable other than for the factor being investigated.

3.3 Findings

Guidelines

A total of 9 clinical practice guidelines (CPGs) were found in this review which had relevant information regarding risk for perineal tears. Appendix 9 presents the data extraction from the guidelines.

Systematic reviews

A total of 45 SRs was found in this review that investigated factors related to perineal tear occurrence through childbirth. These SRs appraised 369 individual relevant studies. Appendix 8 presents the studies included in these SRs. Appendix 10 presents the findings from the SRs included in this review.

Randomised controlled trials

A total of 19 relevant RCTs that were not included in the 45 SRs were identified in this review. Appendix 11 presents the data extraction from the RCTs included in this review.

Cohort studies

A total of 246 relevant cohort studies that were not included in the 45 SRs were identified in this review. Appendix 12 presents the data extraction from the cohort studies included in this review.

Case control

A total of five case control studies were included in this review which reported on risk factors which had limited high-quality SRs, RCTs and cohort studies available. Appendix 13 presents the data extraction from the case control studies included in this review.

Study selection process

The studies were sorted and selected based on risk factor being investigated. For each risk factor, the best available evidence based on the hierarchy of evidence was selected. If there were SRs, controlled trials and cohort studies, they were selected as primary source of evidence. Of note, the controlled trials and cohort studies reported in the SRs were excluded in the data extraction and synthesis to avoid double reporting. If there were no SRs, controlled trials and cohort studies, the next available evidence based on the hierarchy of evidence was selected.

3.4 Guidelines

Clinical Practice Guidelines

There were nine clinical practice guidelines (CPGs) which had relevant information regarding risk for perineal tears. Two are from the National Institute for Health and Care Excellence (NICE) in the UK (NICE 2019, NICE 2014), two are from the World Health Organisation (WHO) (WHO 2018, WHO 2014), two are from the Royal College of Obstetricians and Gynaecologists (RCOG) (RCOG 2012, RCOG 2011), one from the French National College of Obstetricians and Gynaecologists (Ducarme et al 2018), one from the Society of Obstetricians and Gynaecologists of Canada (SOGC) (Harvey et al 2015) and one from the Spanish Ministry of Health (Spanish Ministry 2011). Of note, these guidelines were developed based on evidence available from all countries and settings and not only from settings similar to the New Zealand context (the focus of the current review). These guidelines used different grading methods to develop their recommendations and different context considerations to develop their consensus recommendations for practice and thus we cannot directly synthesize the recommendations nor use the recommendations in the development of the evidence statements for this review. For instance, WHO used the terms 'recommended' and 'not recommended' whilst Ducarne et al 2018 used A, B, C, D to label recommendations and NICE used wordings such as "Do not' and "Should' to denote the strength of the recommendations. However, the recommendations from the guidelines can be used to corroborate the summary statements developed from this review, particularly the ones from guidelines found to have been developed using rigorous methods (based on AGREE II scoring). The year when the guidelines were released should be noted as they would have been based on evidence prior to their release and thus may not reflect the current evidence from more recent, well conducted higher level studies.

Guideline Quality

Guideline quality was reported based on AGREE II domains. The domain scores are independent and, therefore, there is no single overall score. AGREE II recommended that reviewers can prioritise domains of specific relevance to use of the guideline. As the purpose for appraising the guidelines is to assess their methodological quality, we specifically focused on scores for domains 1 (scope and purpose), domain 3 (rigour of development) and domain 6 (editorial independence). All guidelines scored 21/21 in domain 1 which reflects all guidelines had clear aims and questions to answer. For domain 3 which is the main measure of guideline development quality, all guidelines except the French National College of Obstetricians and Gynaecologists (Ducarme et al 2018) and the Society of Obstetricians and Gynaecologists of Canada (SOGC) (Harvey et al 2015), scored 56/56 in domain 3. This means that seven guidelines were developed using systematic methods with clear recommendations supported by evidence and/or clinical consensus (in cases where context issues had to be considered or when there was limited to lack of evidence) whilst the other two have methodological limitations. For domain 6 which is editorial independence from biased inputs due to possibly competing interests, all except the French National College of Obstetricians and Gynaecologists and the Society of Obstetricians and Gynaecologists of Canada, scored 14/14.

AGREE domains	NICE 2019	WHO 2018	Ducarme et al 2018	Harvey et al 2015	NICE 2014	WHO 2014	RCOG 2012	RCOG 2011	Spanish Ministry Guideline 2011
Domain 1 Scope and Purpose (max possible score= 21)	**21**	**21**	**21**	**21**	**21**	**21**	**21**	**21**	**21**
Domain 2 Stakeholder Involvement (max possible score= 21)	21	21	18	8	21	21	21	21	15
Domain 3 Rigour of Development (max possible score= 56)	**56**	**56**	**48**	**20**	**56**	**56**	**56**	**56**	**56**
Domain 4 Clarity of Presentation (max possible score= 21)	21	21	20	21	21	21	21	21	21
Domain 5 Applicability (max possible score= 28)	26	28	6	4	26	23	12	12	24
Domain 6 Editorial Independence (max possible score= 14)	**14**	**14**	**9**	**8**	**14**	**14**	**14**	**14**	**14**

National Institute for Health and Care Excellence (NICE) 2019 (**Intrapartum care for women with existing medical conditions or obstetric complications and their babies)**

The NICE 2019 Guideline (AGREE II scores: domain 1=21, domain 3=56, domain 6=14) covers care during labour and birth for women who need extra support because they have a medical condition or complications in their current or previous pregnancy. The guideline also covers women who have had no antenatal care. It aims to improve experiences and outcomes for women and their babies.

Relevant risk and preventive factor and recommendation identified from the guideline:

1. *Birth weight (large for gestational age)*

NICE recommendation: Discuss with women in labour whose babies are suspected to be large for gestational age the possible benefits and risks of vaginal birth and caesarean section, including a higher chance of instrumental birth and perineal trauma with vaginal birth.

NICE noted that there was no convincing evidence for one mode of birth over another for women in labour whose babies are suspected to be large for gestational age (from Alsunnari et al 2005 and Lipscomb 1995). Therefore, the committee discussed the difficulty of estimating a baby's size when a woman is in labour and agreed that women should be provided with information so that they can make their own decisions about mode of birth when their baby may be large for gestational age.

Guideline	AGREE II domain scores	Evidence for risks for perineal tears	Evidence base	Recommendation
NICE 2019 Intrapartum care for women with existing medical conditions or obstetric complications and their babies	Domain 1 =21 Domain 3 =56 Domain 6 =14	Large for gestational age: Vaginal vs emergency caesarean section No clinically important difference in the incidence of third- or fourth-degree perineal lacerations between women who gave birth vaginally and those who had an emergency caesarean section if women were giving birth to babies suspected to be large for gestational age.	From 2 very low-quality retrospective cohort studies (Alsunnari et al 2005 and Lipscomb 1995)	Discuss with women in labour whose babies are suspected to be large for gestational age the possible benefits and risks of vaginal birth and caesarean section, including a higher chance of instrumental birth and perineal trauma with vaginal birth.

World Health Organisation (WHO) 2018 (WHO recommendations Intrapartum care for a positive childbirth experience)

The WHO 2018 Guideline (AGREE II scores: domain 1=21, domain 3=56, domain 6=14) covers a comprehensive summary of evidence on essential intrapartum care irrespective of the health care setting or level of health care.

<u>Relevant risk or preventive factors and recommendations identified from the guideline:</u>

1. *Care*

WHO recommendation: RECOMMENDED
A companion of choice is recommended for all women throughout labour and childbirth.
This recommendation is based on four trials (8120 women, RR 0.97, 95% CI 0.92–1.01) and to ensure care for the mother but makes little to no difference to perineal trauma.

2. *Techniques for preventing perineal trauma*

WHO recommendation: RECOMMENDED

Manual techniques, such as massage or application of warm packs, are recommended for healthy pregnant women requesting pain relief during labour, depending on a woman's preferences.

Of note, this recommendation was developed from three trials conducted in Iran.

3. *Birth position for women without epidural analgesia*

WHO recommendation: RECOMMENDED

For women without epidural analgesia, encouraging the adoption of a birth position of the individual woman's choice, including upright positions, is recommended.
The recommendation was based on low certainty evidence from 17 trials (6148 women, RR 0.75, 95% CI 0.61–0.92) which looked at second degree tears and 3 trials (872 women, RR 1.46, 95% CI 0.44–4.79) that looked in to third- and fourth-degree tears and suggests that an upright position may increase second-degree perineal tears but may reduce third- and fourth-degree tears.

4. *Birth position for women with epidural analgesia*

WHO recommendation: RECOMMENDED

For women with epidural analgesia, encouraging the adoption of a birth position of the individual woman's choice, including upright birth positions, is recommended.

The recommendation was based on moderate-certainty evidence from 3 trials (3266 women, RR 1.01, 95% CI 0.89–1.14) and suggests there is probably little or no difference in perineal/vaginal trauma that requires suturing.

5. *Method of pushing*

WHO recommendation: RECOMMENDED

Women in the expulsive phase of the second stage of labour should be encouraged and supported to follow their own urge to push.

The recommendation was based on moderate-certainty evidence from one trial (320 women, RR 0.87, 95% CI 0.45–1.66) and suggests there is probably little or no difference between spontaneous and directed pushing on perineal lacerations. Of note, the guideline team made a remark that *health care providers should avoid imposing directed pushing on women in the second stage of labour, as there is no evidence of any benefit with this technique.*

6. *Method of pushing with epidural analgesia*

WHO recommendation: CONTEXT-SPECIFIC RECOMMENDATION

For women with epidural analgesia in the second stage of labour, delaying pushing for one to two hours after full dilatation or until the woman regains the sensory urge to bear down is recommended in the context where resources are available for longer stay in second stage and perinatal hypoxia can be adequately assessed and managed.

The recommendation was based on moderate-certainty evidence from 7 trials (2775 women, RR 0.94, 95% CI 0.78–1.14) and episiotomy (5 trials, 2320 women, RR 0.95, 95% CI 0.87–1.04) and suggests that delaying pushing probably makes little or no difference to perineal lacerations and episiotomy. Of note, the guideline team made a remark that *health care providers should avoid imposing immediate pushing on women in the second stage of labour, as there is no evidence of any benefit with immediate pushing and the practice might lead to further medical intervention.*

7. *Techniques for preventing perineal trauma*

WHO recommendation: RECOMMENDED

For women in the second stage of labour, techniques to reduce perineal trauma and facilitate spontaneous birth (including perineal massage, warm compresses and a "hands on" guarding of the perineum) are recommended, based on a woman's preferences and available options.

Perineal techniques performed in the second stage of labour include:

- Perineal massage compared with a "hands-off" approach or usual care;
- A warm compress compared with a "hands-off" approach or no warm compress;
- A "hands-off" compared with a "hands-on" approach; and
- Ritgen's manoeuvre compared with usual practice.

Perineal massage compared with control ("hands off" approach or usual care)
There is high-certainty evidence from 5 trials (2477 women, RR 0.49, 95% CI 0.25– 0.94) that indicates that perineal massage reduces third- or fourth-degree perineal tears. Evidence on first- and second-degree tears, episiotomy and the need for perineal suturing is of very low certainty.

Guideline consideration

Perineal techniques are a low-cost intervention for which in-service training would be the main cost. If perineal massage increases the proportion of women with an intact perineum after childbirth and reduces third- and fourth-degree tears, it would logically be more cost-effective than usual care by reducing the costs associated with suturing supplies (e.g. suture materials, local anaesthetics, swabs) and health care professional time required to suture.

As the guideline noted that perineal techniques are low cost interventions and if perineal massage reduces third- and fourth-degree tears, then it is worthwhile to do training with very minimal cost and resources as shown in the table below as extracted from the guideline.

Table 3.53 Main resource requirements of perineal massage

Resource	Description
Staff	▪ Midwives/nurses/doctors
Training	▪ Pre-service and in-service training on how to perform this perineal technique
Supplies	▪ Gloves: similar to usual care ▪ Lubricant, e.g. petroleum jelly: optional
Equipment and infrastructure	▪ None
Time	▪ Performed during the second stage so time is the same as for usual care
Supervision and monitoring	▪ Same as for usual care

Warm compress compared with control (a "hands-off" approach or no warm compress)

There is moderate-certainty evidence from 4 trials (1799 women, RR 0.46, 95% CI 0.27–0.79) that indicates that warm compresses reduce the incidence of third- or fourth-degree perineal tears. The absolute effect on third- or fourth-degree tears is estimated as 24 fewer per 1000 (from 9 to 33 fewer). Evidence on first- and second-degree tears and the need for perineal suturing is of very low certainty. Resources to do warm perineal compress are shown below as extracted from the guideline.

Table 3.55 Main resource requirements of warm perineal compresses

Resource	Description
Staff	▪ Midwives/nurses/doctors
Training	▪ Pre-service and in-service training on how to perform this perineal technique
Supplies	▪ Pads and warm water
Equipment and infrastructure	▪ Ready access to clean warm water
Time	▪ Performed during the second stage so time is the same as for usual care
Supervision and monitoring	▪ Same as for usual care

"Hands-off" compared with a "hands-on" approach

There is low-certainty evidence from 2 trials (700 participants, RR 1.32, 95% CI 0.99–1.77) that suggest that the hands-off approach may increase first-degree tears compared with the hands-on approach. The absolute effect is estimated as 58 more per 1000 (from 2 fewer to 139 more). Evidence on third- and fourth-degree tears, second-degree tears and episiotomy is of very low certainty. Resources to do hands off and hands on perineal approaches are shown below as extracted from the guideline.

Table 3.57 Main resource requirements of "hands-off" and "hands-on" perineal approaches

Resource	Description
Staff	▪ Midwives/nurse/doctors
Training	▪ Pre-service and in-service training on how to perform these perineal techniques
Supplies	▪ Same as for usual care
Equipment	▪ None
Time	▪ Performed during the second stage so time is the same as for usual care
Supervision and monitoring	▪ Same as for usual care

Ritgen's manoeuvre compared with usual practice

There is low-certainty evidence from one trial (1423 participants, RR 1.24, 95% CI 0.78– 1.96) that suggests that Ritgen's manoeuvre may have little or no impact on third- and fourth-degree perineal tears. The evidence on the likelihood of having an intact perineum and other perineal outcomes is of very low certainty.

Guideline consideration:
Ritgen's manoeuvre might plausibly be less comfortable for women than other perineal techniques, such as warm compresses.

However, if there is a need to use Ritgen's manoeuvre, below is the list of resources needed as extracted from the guideline.

Table 3.59 Main resource requirements of Ritgen's manoeuvre

Resource	Description
Staff	▪ Midwives/nurses/doctors
Training	▪ Pre-service and in-service training on how to perform this perineal technique
Supplies	▪ Similar to standard practice
Equipment	▪ None
Time	▪ Performed during the second stage so time is the same as for usual care
Supervision and monitoring	▪ Probably more than with standard practice, to ensure adherence to technique and to monitor potential adverse outcomes

8. *Episiotomy*

WHO recommendation: NOT RECOMMENDED
Routine or liberal use of episiotomy is not recommended for women undergoing spontaneous vaginal birth.

The guideline team provided remarks to explain the recommendation:

- *Although the review evidence on comparative effects of episiotomy policies was presented as elective/restrictive versus routine/liberal use of episiotomy, due to the beneficial effects of selective/ restrictive compared with routine/liberal episiotomy policy, the lack of evidence on the effectiveness of episiotomy in general, and the need to discourage the excessive use of routine episiotomy across all settings, the Guideline development group (GDG) felt that it was important to emphasize that routine/liberal use of episiotomy is "not recommended", rather than recommending the selective/restrictive use of episiotomy.*
- *The GDG acknowledged that, at the present time, there is no evidence corroborating the need for any episiotomy in routine care, and an "acceptable" rate of episiotomy is difficult to determine. The role of episiotomy in obstetric emergencies, such as foetal distress requiring instrumental vaginal birth, remains to be established.*
- *If an episiotomy is performed, effective local anaesthesia and the woman's informed consent is essential. The preferred technique is a medio-lateral incision, as midline incisions are associated with a higher risk of complex OASI. A continuous suturing technique is preferred to interrupted suturing.*

There is low-certainty evidence from 11 trials (6177 women, RR 0.70, 95% CI 0.52–0.94) that suggests that a policy of selective/restrictive episiotomy may reduce severe perineal/vaginal trauma (mainly third- and fourth-degree tears) compared with routine or liberal episiotomy. When only the trials with larger than 30% difference in episiotomy rate between study arms were included (8 trials, 4877 women, RR 0.55, 95% CI 0.38–0.81), moderate certainty evidence was found, increasing the certainty and impact.

In subgroup analysis by parity, evidence suggests that the episiotomy policy might not make a difference to perineal/vaginal trauma in multigravid women, but the evidence is very uncertain.

Additional guideline considerations

The evidence on severe perineal/vaginal trauma was derived mainly from trials employing a mediolateral incision technique. Two trials involving 1143 women employed a midline episiotomy incision and statistical tests employed in the review suggest that the overall effect on perineal/vaginal trauma for this subgroup of trials is not different from medio-lateral incisions. However, the individual trials of midline incisions produced inconsistent results. In addition, severe perineal/vaginal trauma occurred more frequently in the trials of midline incisions than in trials of medio-lateral incisions (106/1143 [9%] vs 58/4834 [1%], respectively), suggesting that mediolateral incisions are safer than midline incisions.

Guideline	AGREE II domain scores	Evidence for risks for perineal tears	Evidence base	Recommendation
WHO 2018 WHO recommendations Intrapartum care for a positive childbirth experience	Domain 1 =21 Domain 3 =56 Domain 6 =14	Care throughout labour Perineal trauma: Moderate-certainty evidence suggests that companionship during labour and childbirth probably makes little or no difference to perineal trauma (episiotomy or perineal tears)	(4 trials, 8120 women, RR 0.97, 95% CI 0.92–1.01)	RECOMMENDED A companion of choice is recommended for all women throughout labour and childbirth.
		Techniques for preventing perineal trauma Three trials involving 252 women compared warm pack application with usual care. Two trials (192 women) applied the warm packs to the women's lower backs and abdomens in the first stage of labour, and to the perineum in the second stage. The other trial applied the pack to the sacral and perineal areas for at least 30 minutes; it was not clear at what stage the intervention was applied.	All three trials were conducted in hospitals in Iran and took place between 2009 and 2013	RECOMMENDED Manual techniques, such as massage or application of warm packs, are recommended for healthy pregnant women requesting pain relief during labour, depending on a woman's preferences.
		Birth position for women without epidural analgesia Second-degree perineal tears: Low-certainty evidence suggests that an upright position may reduce episiotomy and may increase second-degree perineal tears. On sensitivity analysis, whereby studies at high risk of bias were excluded, the certainty of evidence in second degree tears became high Third- or fourth degree perineal tears: Evidence on third- or fourth degree perineal tears is of very low certainty overall however, on sensitivity analysis, low-certainty	Upright position may reduce episiotomy (17 trials, 6148 women, RR 0.75, 95% CI 0.61–0.92; absolute risk difference: 101 fewer [from 32 to 158 fewer]) and may increase second-degree perineal tears (18 trials, 6715 women, RR 1.20, 95% CI 1.00–1.44; absolute risk difference: 25 more per 1000 [from 0 to 56 more]). Increase in second degree tears became high (9 trials, 2967 women, RR 1.35, 95% CI 1.10–1.67). (3 trials, 872 women, RR 1.46, 95% CI 0.44–4.79).	RECOMMENDED For women without epidural analgesia, encouraging the adoption of a birth position of the individual woman's choice, including upright positions, is recommended.

		evidence suggests that upright positions may have little or no effect on third- or fourth-degree tears		
		<u>Birth position for women with epidural analgesia</u> Perineal/vaginal trauma: Moderate-certainty evidence suggests there is probably little or no difference in perineal/vaginal trauma that requires suturing	(3 trials, 3266 women, RR 1.01, 95% CI 0.89–1.14).	RECOMMENDED For women with epidural analgesia, encouraging the adoption of a birth position of the individual woman's choice, including upright birth positions, is recommended.
		<u>Method of pushing</u> Perineal/vaginal trauma: Moderate-certainty evidence suggests there is probably little or no difference between spontaneous and directed pushing on perineal lacerations.	(1 trial, 320 women, RR 0.87, 95% CI 0.45–1.66).	RECOMMENDED Women in the expulsive phase of the second stage of labour should be encouraged and supported to follow their own urge to push.
		<u>Method of pushing with epidural analgesia</u> Moderate-certainty evidence suggests that delaying pushing probably makes little or no difference to perineal lacerations and episiotomy.	Perineal lacerations (7 trials, 2775 women, RR 0.94, 95% CI 0.78–1.14) and episiotomy (5 trials, 2320 women, RR 0.95, 95% CI 0.87–1.04).	CONTEXT-SPECIFIC RECOMMENDATION For women with epidural analgesia in the second stage of labour, delaying pushing for one to two hours after full dilatation or until the woman regains the sensory urge to bear down is recommended in the context where resources are available for longer stay in second stage and perinatal hypoxia can be adequately assessed and managed.
		<u>Techniques for preventing perineal trauma</u> <u>Perineal massage compared with a "hands-off" approach or usual care</u> Third- or fourth-degree perineal tears: High-certainty evidence indicates that perineal massage reduces third- or fourth-degree perineal Tears. The absolute effect is estimated as 5 fewer per 1000 (from 2 to 22 fewer).	(5 trials, 2477 women, RR 0.49, 95% CI 0.25– 0.94).	RECOMMENDED For women in the second stage of labour, techniques to reduce perineal trauma and facilitate spontaneous birth (including perineal massage, warm compresses and a "hands on" guarding of the perineum) are recommended, based on a woman's preferences and available options.

		First and second-degree tears: Evidence on first- and second-degree tears, episiotomy and the need for perineal suturing is of very low certainty. <u>Warm compress compared with a "hands-off" approach or no warm compress</u> Third- or fourth-degree perineal tears: High-certainty evidence indicates that warm compresses reduce the incidence of third- or fourth-degree perineal tears. The absolute effect on third- or fourth-degree tears is estimated as 24 fewer per 1000 (from 9 to 33 fewer). Episiotomy: Moderate certainty evidence suggests that warm compresses probably make little or no difference to episiotomy First- and second-degree tears: Evidence on first- and second-degree tears and the need for perineal suturing is of very low certainty. <u>"Hands-off" compared with a "hands-on" approach</u> Third- or fourth-degree perineal tears: Evidence on third- and fourth-degree tears, second-degree tears and episiotomy is of very low certainty. First- and second-degree tears: Low-certainty evidence suggests that the hands-off approach may increase first-degree tears compared with the hands-on approach, however, the estimate of effect includes the possibility of no difference. The absolute effect is estimated as 58 more per 1000 (from 2 fewer to 139 more).	(4 trials, 1799 women, RR 0.46, 95% CI 0.27–0.79). (4 trials, 1799 women, RR 0.86, 95% CI 0.60–1.23). (2 trials, 700 participants, RR 1.32, 95% CI 0.99–1.77).	

		Ritgen's manoeuvre compared with usual practice ("hands-on" approach) Third- or fourth-degree perineal tears: Low-certainty evidence suggests that Ritgen's manoeuvre may have little or no impact on third- and fourth-degree perineal tears and episiotomy. The evidence on the likelihood of having an intact perineum and other perineal outcomes is of very low certainty.	On third- and fourth-degree perineal tears (1 trial, 1423 participants, RR 1.24, 95% CI 0.78– 1.96) Episiotomy (2 trials, 1489 participants, RR 0.81, 95% CI 0.63–1.03)	
		Policy of selective/restrictive compared with routine or liberal use of episiotomy Third- and fourth-degree tears: Low-certainty evidence suggests that a policy of selective/restrictive episiotomy may reduce severe perineal/vaginal trauma (mainly third- and fourth-degree tears) compared with routine or liberal episiotomy. The impact increased when only the trials with a larger than 30% difference in episiotomy rate between study arms were included. Subgroup analysis by parity suggests that the episiotomy policy might not make a difference to perineal/vaginal trauma in multigravid women, but the evidence is very uncertain.	(11 trials, 6177 women, RR 0.70, 95% CI 0.52–0.94) (8 trials, 4877 women, RR 0.55, 95% CI 0.38–0.81; moderate certainty evidence)	NOT RECOMMENDED Routine or liberal use of episiotomy is not recommended for women undergoing spontaneous vaginal birth.

Ducarme et al 2018 (Perineal prevention and protection in obstetrics: CNGOF clinical practice guidelines)

The guideline developed by Ducarme et al 2018 (AGREE II scores: domain 1=21, domain 3=48, domain 6=9) covers all of the interventions during pregnancy and childbirth that might prevent OASIS and postnatal pelvic floor symptoms.

Relevant risk and preventive factors and recommendations identified from the guideline:

1. *Maternal risk factors*
2. *Methods in preventing perineal injury*
3. *Risks in each stage of labour*
4. *Episiotomy*
5. *Instrumental births*
6. *Continuing medical education*
7. *Secondary prevention of OASIS*

Recommendations are available in the table below.

Guideline	AGREE II domain scores	Evidence for risks for perineal tears	Evidence base	Recommendation
Ducarme et al 2018 Perineal prevention and protection in obstetrics: CNGOF clinical practice guidelines	Domain 1 =21, Domain 3 =48, Domain 6 =9	Maternal risk factors		Recommendation: C Measurement of pelvic dimensions and the subpubic angle is not recommended to predict OASIS or to choose the mode of delivery for the purpose of protecting the perineum. Recommendation: Professional consensus Models to predict the risk of OASIS cannot be used to advise or authorise one mode of delivery rather than another.
		Methods of preventing perineal injury		Recommendation: B Perineal massage during pregnancy must be encouraged among women who want it Recommendation: B The use of the Epi-No device during pregnancy is not recommended for the prevention of OASIS Recommendation: B Pelvic floor muscle training during pregnancy is not recommended for the prevention of OASIS

		First stage of labour Mobilisation and posture		Recommendation: C There is no reason to recommend one maternal posture rather than another during the first stage of labour for the purpose of reducing the risk of OASIS. Recommendation: Professional consensus Women should be allowed to choose the position most comfortable for them during the first stage of labour.
		Second stage of labour Maternal posture for the second stage of labour		Recommendation: B There is no reason to recommend one posture rather than another during the second stage of labour to reduce the risk of OASIS. Recommendation: Professional consensus Women should be allowed to choose the position most comfortable for them during this stage.
		Second stage of labour Rotation of posterior positions		Recommendation: Professional consensus For fetuses in posterior cephalic positions, no data justify a preference for manual rotation at full dilation to diminish the risk of perineal injury.
		Second stage of labour Pushing efforts		Recommendation: A When maternal and foetal status allow, the start of pushing should be delayed. Recommendation: B There is no evidence to support preferring one pushing technique rather than another to diminish the risk of OASIS.

		Second stage of labour Perineal massage or warm compresses during the second stage of labour		The group did not reach a conclusion about their use in clinical practice.
		Methods of preventing perineal injury and dysfunction when the baby reaches the outlet		Recommendation: Professional consensus Substantial stretching of the perineum is not an indication for episiotomy.
		Manual control of expulsion		Recommendation: C The crowning of the baby's head should be manually controlled, and the posterior perineum manually supported manually to reduce the risk of OASIS.
		Episiotomy		Recommendation: A The performance of an episiotomy during normal deliveries is not recommended to reduce the risk of OASIS. Recommendation: C The liberal practice of episiotomy to prevent OASIS is not recommended for women with a breech presentation, twin pregnancy, or posterior position.
		Instrumental births		Recommendation: C Episiotomy may be indicated in instrumental births to avoid OASIS. Recommendation: C In operative vaginal births when several instruments can be used, a vacuum extractor is preferentially recommended to reduce the risk of OASIS. Recommendation: Professional consensus When forceps or spatulas are used, it is preferable that they be

				withdrawn just before cephalic deflexion so that the foetal head is not "capped" with these instruments at birth
		Techniques for episiotomy		Recommendation: B A mediolateral incision is recommended for an episiotomy. Recommendation: C The angle of incision recommended for a mediolateral episiotomy is 60 degrees.
		Continuing medical education		Recommendation: B Training in perineal protection in obstetrics is recommended.
		Secondary prevention of OASIS		Recommendation: Professional consensus For women with a history of OASIS, examination of the perineum is recommended during a new pregnancy; in addition, the obstetrics professional should answer the woman's questions about the risk of recurrence and of sequelae with the new birth. Recommendation: Professional consensus The mode of a new birth must be discussed with women with a history of OASIS.

Harvey et al. 2015 (Obstetrical Anal Sphincter Injuries (OASIS): Prevention, Recognition, and Repair)

The guideline developed by Harvey et al. 2015 (AGREE II scores: domain 1=21, domain 3=20, domain 6=8) covers evidence relating to OASIS with respect to diagnosis, repair techniques and outcomes. Of note, the guideline was prepared by Urogynaecology Committee and was reviewed by the Clinical Practice–Obstetrics and the Family Physician Advisory committees and approved by Executive and Board of the Society of Obstetricians and Gynaecologists of Canada, as stated in the document.

<u>Relevant risk and preventive factors and recommendations identified from the guideline:</u>

1. *Maternal risk factors (all significant ORs)*

Primiparity, age, race, maternal diabetes and infibulation (type III FGM) are the maternal risk factors associated with OASIS as identified from 7 studies. OR for primiparity ranged from 3.5-9.8 (6 studies). OR for age (>35) is 1.1 (one study). OR for age (>27) is 1.9 (one study). OR for race ranged from 1.4 to 2.5 (two studies). OR for infibulation is 1.8 to 2.7 (one study).

2. *Birth risk factors*

Operative vaginal birth: Vacuum (1.5 to 3.5) (four studies), Forceps (2.3 to 5.6) (five studies), Vacuum + forceps (8.1) (two studies)
Episiotomy: Midline (2.3 to 5.5) (one study), Mediolateral (0.21) (two studies)
Mediolat episiotomy + instrumental (one study): Vacuum (0.11), Forceps (0.08)
Midline episiotomy + instrumental (nulliparous)(one study): Vacuum (4.5), Forceps (8.6)
Unspecified episiotomy + instrumental(one study): Vacuum (2.9), Forceps (3.9)
Epidural (1.1 to 2.2) (one study), Second stage >1 h In primiparous (1.5),Shoulder dystocia (2.7 to 3.3), VBAC (1.4 to 5.5) (two studies), Waterbirth (1.46), Oxytocin augmentation in primiparous (1.2)

3. *Infant risks factors OR*

Birth weight > 4000 gm (2.2 to 3.0) (one study), Malpresentation (2.0) (one study), Postmaturity (1.1 to 2.5) (two studies), Foetal distress (1.3) (one study)
Occiput Posterior: SVD (2.0) (one study), Instrumental (4.7) (two studies)

4. *Birth position*

Standing position (upright position without buttocks support: upright standing, squatting, kneeling) versus a sitting position (upright position but with support of the ischial tuberosities, with or without sacral support) might increase the risk of OASIS, as shown in a retrospective analysis of 814 women (650 standing, 264 sitting, any parity) in which women standing for their birth had a nearly 7-fold increase in OASIS (2.5% vs. 0.38%). (one study)

Traditional method of birth (no passive second stage, and active second stage in the dorsal lithotomy) versus “alternate” method of birth (passive second stage lasting up to strong urge or 120 min, and active second stage in the lateral “Gasquet” position – with upper hip flexed, foot on stirrup higher than knee) showed no difference in rate of OASIS. (one study).

Main recommendations are available in the table below.

Guideline	AGREE II domain scores	Evidence for risks for perineal tears	Evidence base	Recommendation
Harvey et al 2015 (Obstetrical Anal Sphincter Injuries (OASIS): Prevention, Recognition, and Repair)	Domain 1 =21, Domain 3 =20, Domain 6 =8	Diagnosis		Recommendation: (II-2B) All women should be carefully examined for perineal or vaginal tears; those with a tear that is more than superficial in depth should have a systematic rectal examination for obstetrical anal sphincter injury prior to repair.

		<u>Interventions to prevent OASIS</u> Perineal support Slowing down the delivery of the head and instructing women to not push at the delivery of the head, using thus only the uterine expulsive efforts, decreases the incidence of OASIS by 50% to 70%. A 2011 Cochrane review showed that the application of warm compresses to the perineum (OR 0.5) as well as intra-partum perineal massage (OR 0.5) both decrease the risk of OASIS	(1 Cochrane review)	Recommendation: (II-2A) In women having a spontaneous vaginal birth, the rate of obstetrical anal sphincter injury is decreased when the obstetrical care provider slows the foetal head at crowning.
		Episiotomy There is no doubt that restricted use of episiotomy, of any type, is preferable in women having a spontaneous vaginal birth	(4 studies)	Recommendation: (I-A) At the time of either a spontaneous vaginal or instrumental birth, the obstetrical care provider should follow a policy of "restricted" episiotomy (i.e., only if indicated), rather than "liberal" use (i.e. routine), for the prevention of obstetrical anal sphincter injuries.
		Most data support the use of mediolateral episiotomy to protect against OASIS in primiparous women having instrumental birth over no episiotomy When a midline episiotomy is performed concurrently with an operative vaginal birth, it acts synergistically in increasing OASIS	(2 studies)	Recommendation: (II-2B) If an episiotomy is deemed indicated, preference for a mediolateral over a midline should be considered. The optimal cutting angle appears to be no less than 45 degrees, ideally around 60 degrees.

National Institute for Health and Care Excellence (NICE) 2014 (Intrapartum care for healthy women and babies)

The NICE 2014 Guideline (AGREE II scores: domain 1=21, domain 3=56, domain 6=14) covers the care of healthy women and their babies, during labour and immediately after the birth. It

focuses on women who give birth between 37 and 42 weeks of pregnancy ('term'). The guideline helps women to make an informed choice about where to have their baby. It also aims to reduce variation in areas of care such as foetal monitoring during labour and management of the third stage of labour. All recommendations were carried over from the NICE 2007 Guidelines on the same topic. This guideline is currently being updated due to more recent published research found in their surveillance work.

Relevant risk and preventive factors and recommendations identified from the guideline:

1. *Perineal massage*

NICE RECOMMENDATION: Do not perform perineal massage in the second stage of labour. [2007]

This recommendation was based on an RCT of 1,340 women which did not find significant differences between massage and no massage for intact perineum, first-degree tear, second-degree tear, episiotomy and other variables. However, the study reported a lower incidence of third-degree tears in the massage group, 12/708 vs 23/632; RR 0.47 [CI 95%, 0.23 to 0.93]. Of note, the recommendation was formulated in consideration of all the variables and not only third-degree tears thus the NICE evidence statement was '*There is high-level evidence that intrapartum perineal massage or application of warm compresses in the second stage of labour does not improve perineal outcomes'.*

2. *Hands on/Hands off*

NICE RECOMMENDATION: Either the 'hands on' (guarding the perineum and flexing the baby's head) or the 'hands poised' (with hands off the perineum and baby's head but in readiness) technique can be used to facilitate spontaneous birth. [2007]

This recommendation was based on an RCT which found rates of second-degree trauma and third-degree trauma were similar between the two groups; second degree trauma (36.9% versus 36.6%); third-degree trauma (1.5% versus 1.2%). A quasi trial was also considered in developing the recommendation which found that the rate of first- and second-degree perineal trauma was similar for the two trial groups (hands on 29.8%; hands poised 33.7%, NS), although there was a higher rate of third-degree trauma in the hands on group (n = 16 (2.7%) versus n = 5 (0.9%)). The authors noted that the study was underpowered to detect the statistical significance of this rare event.

3. *Episiotomy*

NICE RECOMMENDATION: Do not carry out a routine episiotomy during spontaneous vaginal birth. [2007]

This recommendation was based on a SR of seven RCTs which were all underpowered to detect any differences in third- or fourth-degree tears. A RCT published after the review reported that the incidences of intact perinea and 'minor' perineal trauma (defined as intact perinea or first-degree tears) were more frequent in the restrictive policy group: intact perineum: 14/49 versus 6/60, RR 2.9 [95% CI 1.2 to 6.9]; intact perineum or first-degree tear: 19/49 versus 8/60, RR 2.9 [95% CI 1.6 to 10.5]. NICE pooled the findings from trials that had similar characteristics and noted that there is considerable high-level evidence that the routine use of episiotomy (trial mean 71.6%; range 44.9% to 93.7%) is not of benefit to women either in the short or longer term, compared with restricted use (trial mean 29.1%; range 7.6% to 53.0%).

4. *Episiotomy technique*

NICE RECOMMENDATION: If an episiotomy is performed, the recommended technique is a mediolateral episiotomy originating at the vaginal fourchette and usually directed to the right side. The angle to the vertical axis should be between 45 and 60 degrees at the time of the episiotomy [2007].

This recommendation was based on a prospective study of 241 women where, 59 (25%) sustained anal sphincter injury. Multiple logistic regression identified higher birthweight (P = 0.021) and mediolateral episiotomy (OR 4.04 [range 1.71 to 9.56] as independent risk factors for sphincter injury. It was reported that episiotomies angled closer to the midline were significantly associated with anal sphincter injuries (26 versus 37 degrees, P = 0.01). No midwife and only 22% of obstetricians performed 'true' mediolateral episiotomies (defined as being at least 40 degrees from the midline).

5. *History of severe perineal trauma*

NICE RECOMMENDATION: Inform any woman with a history of severe perineal trauma that her risk of repeat severe perineal trauma is not increased in a subsequent birth, compared with women having their first baby. [2007]

NICE RECOMMENDATION: Do not offer episiotomy routinely at vaginal birth after previous third- or fourth-degree trauma. [2007]

NICE RECOMMENDATION: In order for a woman who has had previous third- or fourth-degree trauma to make an informed choice, talk with her about the future mode of birth, encompassing:

- *Current urgency or incontinence symptoms*
- *The degree of previous trauma*
- *Risk of recurrence*
- *The success of the repair undertaken*
- *The psychological effect of the previous trauma*
- *Management of her labour. [2007]*

These recommendations were based on two descriptive cohort studies that investigated the incidence of repeat third- and fourth-degree perineal tears following previous severe trauma. In both studies, there were lower rates of repeat third- and fourth-degree perineal tears following previous severe trauma; 7.31% vs 5.67% in the first study and only 27% of the cohort had repeat tears in the second study.

6. *Health professional trainings*

NICE RECOMMENDATION: All relevant healthcare professionals should attend training in perineal/genital assessment and repair and ensure that they maintain these skills. [2007]

This recommendation was based on three studies that investigated the benefits of an assessment course for midwives, junior doctors and other students (evaluation study), the effect of re-assessment of an experienced research fellow (intervention study) and the influence of an additional assessment done by a clinical research fellow. Correct classifications and improved diagnoses of tears were found in these studies.

Guideline	AGREE II domain scores	Evidence for risks for perineal tears	Evidence base	Recommendation
NICE 2014 Intrapartum care for healthy women and babies	Domain 1 =21, Domain 3 =56, Domain 6 =14	Perineal massage The RCT included a total of 1,340 women (massage group n=708) and did not find any significant differences between the two groups for intact perineum, first-degree tear, second-degree tear, episiotomy and other variables. However, the study reported a lower incidence of third-degree tears in the massage group, 12/708 vs 23/632; RR 0.47 [CI 95%, 0.23 to 0.93].	1 RCT	Do not perform perineal massage in the second stage of labour.
		Hands on/hands off The rates of second-degree trauma were similar between the two groups (36.9% versus 36.6%). The rates of third-degree trauma were similar for the two groups (1.5% versus 1.2%). The rate of first- and second-degree perineal trauma was similar for the two trial groups (hands on 29.8%; hands poised 33.7%, NS), although there was a higher rate of third-degree trauma in the hands-on group (n = 16 (2.7%) versus n = 5 (0.9%)). The study was underpowered to detect the statistical significance of this rare event.	1 RCT 1 quasi trial	Either the 'hands on' (guarding the perineum and flexing the baby's head) or the 'hands poised' (with hands off the perineum and baby's head but in readiness) technique can be used to facilitate spontaneous birth.
		Episiotomy Seven RCTs which were all underpowered to detect any differences in third- or fourth-degree tears Incidences of intact perinea and 'minor' perineal trauma (defined as intact perinea or first-degree tears) were more frequent in the restrictive policy group: intact perineum: 14/49 versus 6/60, RR 2.9 [95% CI 1.2 to 6.9]; intact perineum or first-degree tear: 19/49	1 SR 1 RCT	Do not carry out a routine episiotomy during spontaneous vaginal birth

			versus 8/60, RR 2.9 [95% CI 1.6 to 10.5		
			Episiotomy technique In 241 women, 59 (25%) sustained anal sphincter injury. Multiple logistic regression identified higher birthweight (P = 0.021) and mediolateral episiotomy (OR 4.04 [range 1.71 to 9.56] as independent risk factors for sphincter injury. Episiotomies angled closer to the midline were significantly associated with anal sphincter injuries (26 versus 37 degrees, P = 0.01). No midwife and only 22% of obstetricians performed 'true' mediolateral episiotomies (defined as being at least 40 degrees from the midline).	1 cohort study	If an episiotomy is performed, the recommended technique is a mediolateral episiotomy originating at the vaginal fourchette and usually directed to the right side. The angle to the vertical axis should be between 45 and 60 degrees at the time of the episiotomy
			History of severe perineal trauma All cases of third- and fourth-degree lacerations (termed 'severe' lacerations) for the 2-year period 1990–91 were identified (n = 18,888; 7.31% incidence rate). These women were then traced over the following 10 years, which included a further 16 152 births. Of these, 14 990 were vaginal births with an incidence rate of repeat severe laceration of 5.67% (n = 864), this being significantly lower than the original incidence rate (OR 1.29 [95% CI 1.2 to 1.4]). Note: Multivariate logistic regression was done to estimate the association of the use of forceps, vacuum extraction, episiotomy, woman's age and year of birth as independent risk factors for recurrent laceration. All were found to be significant independent risk factors 342/ 20,111 had third- and/or fourth-degree perineal lacerations. Only	1 cohort study	Inform any woman with a history of severe perineal trauma that her risk of repeat severe perineal trauma is not increased in a subsequent birth, compared with women having their first baby Do not offer episiotomy routinely at vaginal birth after previous third- or fourth-degree trauma In order for a woman who has had previous third- or fourth-degree trauma to make an informed choice, talk with her about the future mode of birth, encompassing: - Current urgency or incontinence symptoms - The degree of previous trauma

		45/342 (27%) sustained a perineal tear after the next vaginal birth again.	1 cohort study	- Risk of recurrence - The success of the repair undertaken - The psychological effect of the previous trauma management of her labour
		<u>Assessment of perineal trauma</u> Following attendance at the course, self-assessed responses showed an improvement in the correct classification of tears depending upon degree of anal sphincter injury: external anal sphincter (EAS) partially torn: 77% versus 85%, P = 0.049; EAS completely torn: 70% versus 85%, P = 0.001; internal anal sphincter (IAS) exposed but not torn: 63% versus 82%, P < 0.001; IAS torn: 45% versus 67%, P < 0.001; anal sphincter and mucosa torn: 80% versus 89%, P = 0.031. Participants were midwives, junior doctors and students. Re-examination by an experienced research fellow of nulliparous women who sustained perineal trauma. The prevalence of OASIS increased significantly from 11% to 24.5% when women were re-examined by the research fellow. Additional assessment by Clinical research fellow after assessment by obstetrician or midwife attending the birth. Comparing study data with findings for a similar group of women during the 6 months before and after the study period, the overall rates of third-degree tears were before 2.5%, during 9.3%, and after 4.6%, again suggesting that many third-degree tears go undiagnosed.	1 evaluation study 1 intervention study 1 observational study	All relevant healthcare professionals should attend training in perineal/genital assessment and repair, and ensure that they maintain these skills

World Health Organisation (WHO) 2014 (WHO recommendations for augmentation of labour)

The WHO 2014 Guideline (AGREE II scores: domain 1=21, domain 3=56, domain 6=14) is a consolidated guidance for effective interventions needed to reduce the global burden of prolonged labour and its consequences.

Relevant risk and preventive factors and recommendations identified from the guideline:

1. *Enema versus no enema*

WHO recommendation: Strong recommendation, very low quality of evidence
Administration of enema for reducing the use of labour augmentation is not recommended.

No difference was observed between women with routine enema compared with no enema in terms of perineal tears. This evidence was drawn from a Cochrane systematic review (Reveiz et al 2013) of four trials (almost 2000 women) although data were usually available from only one to two trials. Trials were from USA, Thailand, Columbia and UK.

Guideline	AGREE II domain scores	Evidence for risks for perineal tears	Evidence base	Recommendation
WHO 2014 WHO recommendations for augmentation of labour	Domain 1 =21, Domain 3 =56, Domain 6 =14	Enema versus no enema: maternal outcomes No significant differences were observed in the rates of second- or third-degree perineal trauma.	(RR 0.68, 95% CI 0.39 to 1.21).	Strong recommendation, very low quality of evidence Administration of enema for reducing the use of labour augmentation is not recommended.

Royal College of Obstetricians and Gynaecologists (RCOG) 2012 (Guidelines on Shoulder Dystocia)

The RCOG 2012 Guideline (AGREE II scores: domain 1=21, domain 3=56, domain 6=14) reviewed the evidence regarding the possible prediction, prevention and management of shoulder dystocia.

Relevant risk and preventive factors and recommendations identified from the guideline:

1. *Shoulder dystocia*

RCOG Recommendation: Good practice point ✓ *(Recommended best practice based on the clinical experience of the guideline development group)*
Birth attendants should be alert to the possibility of postpartum haemorrhage and severe perineal tears.
Shoulder dystocia was significantly associated with third- and fourth-degree perineal tears (3.8%) as found from a study (Gherman et al 1997). Other complications such as vaginal lacerations, cervical tears, bladder rupture, uterine rupture, symphyseal separation, sacroiliac joint dislocation and lateral femoral cutaneous neuropathy were found in another study (Mazouni et al 2006).

Guideline	AGREE II domain scores	Evidence for risks for perineal tears	Evidence base	Recommendation
RCOG 2012 Shoulder dystocia	Domain 1 =21, Domain 3 =56, Domain 6 =14	There is significant maternal morbidity associated with shoulder dystocia, particularly postpartum haemorrhage (11%) and third- and fourth-degree perineal tears (3.8%). Other reported complications include vaginal lacerations, cervical tears, bladder rupture, uterine rupture, symphyseal separation, sacroiliac joint dislocation and lateral femoral cutaneous neuropathy.	1 retrospective study 1 case control study	✓ Birth attendants should be alert to the possibility of postpartum haemorrhage and severe perineal tears

Royal College of Obstetricians and Gynaecologists (RCOG) 2011 (Guidelines on Operative Vaginal Birth)

The RCOG 2011 Guideline (AGREE II scores: domain 1=21, domain 3=56, domain 6=14) provides information on the use of forceps and vacuum extractor for both rotational and non-rotational operative vaginal births.

Relevant risk and preventive factors and recommendations identified from the guideline:

1. *Instruments for operative vaginal birth*

RCOG recommendation: Level A
The operator should choose the instrument most appropriate to the clinical circumstances and their level of skill. Forceps and vacuum extraction are associated with different benefits and risks. Failed birth with selected instrument is more likely with vacuum extraction.

RCOG Recommendation: Good practice point ✓ *(Recommended best practice based on the clinical experience of the guideline development group)*
The options available for rotational delivery include Kielland forceps, manual rotation followed by direct traction forceps or rotational vacuum extraction. Rotational births should be performed by experienced operators, with the choice depending on the expertise of the individual operator.

The evidence comes from a Cochrane Review (Johanson et al 199) with ten randomised controlled trials, involving 2923 primiparous and multiparous women.

RCOG Recommendation: Good practice point ✓ *(Recommended best practice based on the clinical experience of the guideline development group)*

There is insufficient evidence to favour either a rapid (over 2 minutes) or a stepwise increment in negative pressure with vacuum extraction.

This evidence comes from a Cochrane Review (Suwannachat et al 2008) with one trial of 94 women.

2. Episiotomy

RCOG recommendation: Level B

In the absence of robust evidence to support routine use of episiotomy in operative vaginal birth, restrictive use of episiotomy, using the operator's individual judgement, is supported.

This evidence comes from five studies from different countries such as the US, Netherlands and the UK (Murphy et al 2008, Robinson et al 1999, Bodner-Adler B et al 2003, de Leeuw et al 2008, Macleod et al 2008). Findings are conflicting due to differences in practice as the midline episiotomy is the preferred technique in the US and mediolateral episiotomy is the preferred technique in the UK.

Guideline	AGREE II domain scores	Evidence for risks for perineal tears	Evidence base	Recommendation
RCOG 2011 Operative Vaginal Delivery	Domain 1 =21, Domain 3 =56, Domain 6 =14	Instruments for operative vaginal birth Vacuum extraction compared with forceps is less likely to be associated with significant maternal perineal and vaginal trauma.	Cochrane review (10 trials) (OR 0.4; 95% CI 0.3–0.5).	Level A The operator should choose the instrument most appropriate to the clinical circumstances and their level of skill. Forceps and vacuum extraction are associated with different benefits and risks. Failed birth with selected instrument is more likely with vacuum extraction. ✓ The options available for rotational birth include Kielland forceps, manual rotation followed by direct traction forceps or rotational vacuum extraction. Rotational deliveries should be performed by experienced operators, with the choice depending on the expertise of the individual operator.
		There is insufficient evidence to favour either a rapid (over 2 minutes) or a stepwise increment in negative pressure with vacuum extraction.	Cochrane review (1 trial)	✓ There is insufficient evidence to favour either a rapid (over 2 minutes) or a stepwise increment in negative

				pressure with vacuum extraction.
		Episiotomy This conflict in findings between the studies which may be due to variations in practice of the threshold for episiotomy and use of different instruments in the US, Netherlands and UK.	5 studies	Level B In the absence of robust evidence to support routine use of episiotomy in operative vaginal birth, restrictive use of episiotomy, using the operator's individual judgement, is supported

Spanish Ministry for Health and Social Policy 2011 (Clinical Practice Guideline on Care in Normal Childbirth)

The Spanish Ministry for Health and Social Policy 2011 Guideline (AGREE II scores: domain 1=21, domain 3=56, domain 6=14) is a tool to accompany the Care Strategy for Normal Childbirth of the Spanish National Healthcare System (SNHS), in order to facilitate its implementation by midwives, obstetricians, paediatricians, nursing staff and other professionals involved in caring for women during labour.

Relevant risk or preventive factors and recommendations identified from the guideline:

1. *Preventing Perineal Trauma*

Recommendation: A
Perineal massage is not recommended during the second stage of labour.
This recommendation was based on NICE 2007 Guideline which reported the findings from 1 RCT. The RCT included a total of 1,340 women (massage group n=708) and did not find any significant differences between the two groups for intact perineum, first-degree tear, second-degree tear, episiotomy and other important variables. However, the study reported a lower incidence of third-degree tears in the massage group, 12/708 vs 23/632; RR 0.47 [CI 95%, 0.23 to 0.93].

Recommendation: A
The application of hot compresses should be made available during the second stage of labour.
This recommendation was based on one RCT which found that hot compress reduces the risk of third- and fourth-degree perineal lacerations. The rate of third- and fourth-degree lacerations was higher in the control group: OR 2.16 [CI 95%, 1.15 to 4.10].

Recommendation: B
The perineum should be actively protected using controlled deflection of the foetal head, asking the woman not to push.
This recommendation was based on a cohort study which found that there was a decrease in tears from 4.03% during 2002-2004 to 1.17% during 2005-2007 (p<0.001). This was also observed in both non-instrumental birth (from 16.26% to 4.90%, p<0.001) and instrumental birth (from 2.70% to 0.72%, p<0.001).

2. *Episiotomy*

Recommendation: A
Routine episiotomy should not be performed in spontaneous labour.

This recommendation was based on NICE 2007 Guideline which reported the findings from 1 SR and 1 RCT. The SR had seven RCTs which had little statistical power to detect differences in third- and fourth-degree tears between the two groups, with an incidence of 105/5,001. The RCT found that the incidence of intact perineum or minor perineal trauma (first-degree tear) was higher in the restrictive episiotomy group (14/49 vs 6/60): RR 2.9 [CI 95%, 1.2 to 6.9]; intact perineum or first-degree tear (19/49 vs 8/60): RR 2.9 [CI 95%, 1.6 to 10.5].

Recommendation: D
When episiotomy is performed, the recommended technique is mediolateral episiotomy, starting at the posterior commissure of the labia minora and usually moving towards the right side. The episiotomy should be at an angle of 45-60 degrees from the vertical.
This recommendation was based on a cohort study which found that mediolateral episiotomy: OR 4.04 [CI 95%, 1.71 to 9.56] was an independent risk factors for sphincter injury. Episiotomy oriented towards the midline was associated with a higher number of anal sphincter injuries (p=0.01). No midwives and only 22% of obstetricians performed true mediolateral episiotomies (defined as at least 40 degrees from the midline).

Recommendation: ✓ *consensus of the group*
Episiotomy should be performed if there is a clinical need, such as an instrumental labour or suspected foetal compromise.

Recommendation: ✓ *consensus of the group*
Before episiotomy an effective analgesia should be used, except in an emergency due to acute foetal compromise.

Recommendation: ✓ *consensus of the group*
Episiotomy should not be performed routinely during a vaginal birth in women with third- or fourth-degree tears from previous births.

3. *Enema*

Recommendation: A
Enemas should not be used routinely during labour.
This recommendation was based on one RCT which found no significant differences between the group with and group without enema for perineal tear without compromised anal sphincter: RR 1.11 [CI 95%, 0.65 to 1.90] and perineal tear with comprised anal sphincter: RR 0.59 [CI 95%, 0.14 to 2.42].

4. *Duration and progress of second stage of labour*

All recommendations for this risk factor are based on consensus of the group as evidence was based mostly on one cohort study only.

Recommendation: ✓
The normal duration of the passive phase of the second stage of labour in a nulliparous women is up to 2 hours with or without epidural anaesthesia.

Recommendation: ✓
The normal duration of the passive phase of the second stage of labour in a multiparous women is up to 1 hour without epidural anaesthesia and 2 hours with an epidural.

Recommendation: ✓

The normal duration of the active phase of the second stage of labour in a nulliparous women is up to 1 hour without epidural anaesthesia and 2 hours with an epidural.

Recommendation:
The normal duration of the active phase of the second stage of labour in a multiparous women is up to 1 hour with or without epidural anaesthesia.

5. *Most appropriate position during the second stage*

Recommendation: A
Women should adopt the position that is most comfortable for them during labour.
This recommendation was based on the NICE 2007 Guideline which reported on one SR, two RCTs and one cohort study that had inconsistent findings regarding different birthing positions.

6. *Directed or spontaneous pushing*

Recommendation: A
Spontaneous pushing is recommended. If there is no pushing sensation, pushing should not be directed until the passive phase of the second stage of labour has ended.
This recommendation was based on NICE 2007 Guideline which reported one SR/meta-analysis that found that women without directed pushing (spontaneous) presented a higher number of spontaneous vaginal births: RR 1.08 [CI 95%, 1.01 to 1.15], p=0.025; lower risk of instrumental birth: RR 0.07; [CI 95%, 0.71 to 0.85], p≤0.0001; and shorter pushing time: MD -0.19 hours [CI 95%, -0.27 to -0.12], p≤0.0001). However, no differences were found in the rates of caesarean sections, lacerations or episiotomies.

7. *When to push*

Recommendation: A
For women with neuraxial analgesia, pushing should be directed once the passive phase of the second stage of labour has ended.
This recommendation was based on one RCT which found that there were more perineal tears in the group with immediate pushing compared with the delayed pushing group (13 vs 5, x2=6.54, p=0.01).

Guideline	AGREE II domain scores	Evidence for risks for perineal tears	Evidence base	Recommendation
Clinical Practice Guideline on Care in Normal Childbirth	Domain 1 =21, Domain 3 =56, Domain 6 =14	Preventing Perineal Trauma Perineal massage Performing perineal massage, when compared with not doing so, did not show any significant differences in the rates of intact perineum; first- and second-degree tears.	There was a lower incidence of third-degree tears in the massage group, 12/708 vs 23/632; RR 0.47 [CI 95%, 0.23 to 0.93]. (NICE 2007- 1 RCT)	Recommendation: A Perineal massage is not recommended during the second stage of labour.
		Hot compress The application of hot compresses beginning during the second stage of labour reduces the risk of third- and fourth-degree perineal	The rate of third- and fourth-degree lacerations was higher in the control group: OR 2.16 [CI 95%, 1.15 to 4.10] (1 RCT)	Recommendation: A The application of hot compresses should be made available during

		lacerations but not the rate of perineal suturing. Deflection of the foetal head An overall reduction in anal sphincter tearing during the intervention (slow the phase of expulsion of the head using manoeuvres, controlling the deflection of the head and telling the mother not to push, in order to protect the perineum. Period was observed.	From 4.03% of tears during 2002-2004 to 1.17% during 2005-2007 (p<0.001). This trend was observed in both non-instrumental birth (from 16.26% to 4.90%, p<0.001) and instrumental birth (from 2.70% to 0.72%, p<0.001). (1 Cohort study)	the second stage of labour. Recommendation: B The perineum should be actively protected using controlled deflection of the foetal head, asking the woman not to push.
		Episiotomy The seven RCTs had little statistical power to detect differences in third- and fourth-degree tears between the two groups, with an incidence of 105/5,001. The incidence of intact perineum and minor perineal trauma (first-degree tear) was higher in the restrictive episiotomy compared with routine episiotomy. Logistic regression indicated that excess weight of the child (p=0.021) and mediolateral episiotomy: OR 4.04 [CI 95%, 1.71 to 9.56] were independent risk factors for sphincter injury. The results indicated that orientation of the episiotomy towards the midline was associated with a higher number of anal sphincter injuries (p=0.01) and that no midwives and only 22% of obstetricians performed true mediolateral episiotomies (defined as at least 40 degrees from the midline).	1 SR Restrictive episiotomy group vs routine episiotomy group (14/49 vs 6/60): RR 2.9 [CI 95%, 1.2 to 6.9]; intact perineum or first-degree tear (19/49 vs 8/60): RR 2.9 [CI 95%, 1.6 to 10.5] (1 RCT) (1 cohort study)	Recommendation: A Routine episiotomy should not be performed in spontaneous labour. Recommendation: D When episiotomy is performed, the recommended technique is mediolateral episiotomy, starting at the posterior commissure of the labia minora and usually moving towards the right side. The episiotomy should be at an angle of 45-60 degrees from the vertical. Recommendation: ✓ Episiotomy should be performed if there is a clinical need, such as an instrumental labour or suspected foetal compromise.

				Recommendation: ✓ Before episiotomy an effective analgesia should be used, except in an emergency due to acute foetal compromise. Recommendation: ✓ Episiotomy should not be performed routinely during a vaginal birth in women with third- or fourth-degree tears from previous births.
		Enema The results demonstrated that there were no significant differences between the groups (with and without enema) for perineal tear without and with compromised anal sphincter.	Perineal tear without compromised anal sphincter: RR 1.11 [CI 95%, 0.65 to 1.90]; perineal tear with comprised anal sphincter: RR 0.59 [CI 95%, 0.14 to 2.42] (1RCT)	Recommendation: A Enemas should not be used routinely during labour.
		Duration and progress of the second stage of labour There is some evidence that a second stage lasting over 120 minutes versus 1-120 minutes, and over 240 minutes versus 121- 240 minutes, is associated with various medical interventions such as episiotomy, instrumental vaginal birth and a higher frequency of perineal trauma There is an association between a prolonged second stage and low Apgar scores in the first minute, postpartum haemorrhaging, perineal tears and postpartum fever, although confounding factors were not taken into account. No association was observed between a short second stage of labour and perineal laceration, postpartum	1 cohort study 1 cohort study	Recommendation: ✓ The normal duration of the passive phase of the second stage of labour in a nulliparous women is up to 2 hours with or without epidural anaesthesia. Recommendation: ✓ The normal duration of the passive phase of the second stage of labour in a multiparous women is up to 1 hour without epidural anaesthesia and 2 hours with an epidural. Recommendation: ✓ The normal duration of the active phase of the second stage of labour in a nulliparous women is up to 1 hour without epidural anaesthesia

		haemorrhage or Apgar score <7 at 5 minutes.	1 cohort study	and 2 hours with an epidural. Recommendation: ✓ The normal duration of the active phase of the second stage of labour in a multiparous women is up to 1 hour with or without epidural anaesthesia.
		Most appropriate position during the second stage No differences were found between the two groups with respect to instrumental birth: RR 0.77 [CI 95%, 0.46 to 1.28]; or caesarean sections: RR 0.57 [CI 95%, 0.28 to 1.16]. Both studies found a significant reduction in the duration of labour for upright positions. There were insufficient data on perineal trauma. The analysis showed two measures to protect against perineal trauma, including the seated position: RR 0.68 [CI 95%, 0.50 to 0.91), which in addition to reducing the incidence of genital trauma, also provides greater comfort and autonomy for the mother during birth. The results indicated that women in a lateral position had lower rates of instrumental births, with an associated reduction in the number of episiotomies, although there were no statistically significant differences. In addition, no differences were observed in overall perineal trauma rates. The results obtained suggested that the lateral position was associated with a lower incidence of spontaneous tears in women giving birth for the first time (n=919): OR 0.6 [CI 95%, 0.2 to 1.0]. This trend was not found in women giving birth	1 SR (1 RCT, seated position: RR 0.68 [CI 95%, 0.50 to 0.91)) 1 RCT 1 cohort study (lower incidence of spontaneous tears in women giving birth for the first time (n=919): OR 0.6 [CI 95%, 0.2 to 1.0])	Recommendation: A Women should adopt the position that is most comfortable for them during labour.

		for the second or subsequent time.		
		Directed or Spontaneous Pushing The meta-analysis performed showed that women without directed pushing presented a higher number of spontaneous vaginal births: RR 1.08 [CI 95%, 1.01 to 1.15], p=0.025; lower risk of instrumental birth: RR 0.07; [CI 95%, 0.71 to 0.85], p≤0.0001; and shorter pushing time: MD -0.19 hours [CI 95%, -0.27 to -0.12], p≤0.0001). No differences were found in the rates of caesarean sections, lacerations or episiotomies.	1 SR/meta-analysis	Recommendation: A Spontaneous pushing is recommended. If there is no pushing sensation, pushing should not be directed until the passive phase of the second stage of labour has ended.
		When to push There were more perineal tears in the group with immediate pushing compared with the delayed pushing group.	(1RCT, immediate vs delayed, 13 vs 5, x2=6.54, p=0.01	Recommendation: A For women with neuraxial analgesia, pushing should be directed once the passive phase of the second stage of labour has ended.

3.5 Risk Factors

This review took a pragmatic approach to the presentation of the literature, sub-dividing the studies into the most common risk factors reported in the literature. Where SRs reported studies involving a range of risk factors, if possible, the data for each risk factor has been extracted from the individual reviews and is presented separately below. Where risk factors are not represented, no studies which met inclusion criteria were identified.

Acupuncture

One relevant SR of high quality was identified that explored the evidence related to the use of acupuncture. No RCTs or cohort studies were identified that were not included in the SR.

Systematic Review

Smith et al. 2017

Smith et al. 2017 ((QS: HQ (++)) undertook a Cochrane review to investigate the effectiveness and safety of acupuncture and acupressure for third trimester cervical ripening or induction of labour. The review identified one RCT of relevance to this review (Gaudernack et al. 2006). The RCT contained 91 women and compared the use of acupuncture to usual care. The study suggested that there was no clear difference in the outcome of first- and second-degree perineal tears when comparing acupuncture for the induction of labour to usual care (RR: 1.22 (0.95-1.56)).

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Smith et al 2017	HQ (++)	There was no clear difference in the risk of minor perineal tears in women who received acupuncture for the induction of labour compared to usual care	RR: 1.22, 95% CI 0.95 to 1.56	One RCT

Age

Twelve cohort studies were identified which investigated the association between age and perineal tears. No relevant SRs or controlled trials were identified.

Cohort Studies

Study	SIGN rating	Objective	Result	Likelihood
Shveiky et al 2019	AQ (+)	To describe prevalence and location of obstetric lacerations in adolescents	Teenage mothers were 50% less likely to have third- or fourth-degree lacerations	aOR: 0.480 95% CI: 0.320-0.720
			Teenage mothers experienced fewer perineal lacerations than the 22-34-year olds, more labial lacerations and more periurethral lacerations	17% vs 34%, P < 0.0001; 95% CI, 0.455-0.558
			There was no statistically significant difference in rate of vaginal lacerations among the age groups	-
• Appears that teenage mothers have lower rates of perineal lacerations, including severe perineal lacerations compared with adults				
Ankarcrona et al 2019	AQ (+)	To study the outcome of labour in nulliparous women ≥40 years, compared with women 25-29 years, both after spontaneous onset and induction of labour	The prevalence of obstetric anal sphincter injury was similar in both age groups after spontaneous onset and induction of labour. Obstetric anal sphincter injury was more common after operative vaginal birth	Age > 40 years OASIS risk vs 25-29 years Spontaneous onset - OR 0.79; (0.66 -0.94) Inducted labour - OR 0.97; (0.73 - 1.29)
• Appears that there is no relationship between age and prevalence of OASIS after spontaneous onset of labour • Appears that there is no relationship between age and prevalence of OASIS after induction of labour				
Waldenstrom & Ekeus 2017	AQ (+)	To investigate associations between advanced maternal age and risks of OASI in women's first, second, and third births in a large population-based cohort	Age-related risk increased from 25-29 years in first births and second births	First births - aOR 1.66; 95% CI 1.59–1.72) Second births - aOR 1.66; 95% CI 1.59–1.72)

			In all parity groups the risk was doubled at age ≥ 35 years, compared with the respective reference group of women under 25 years	-
• Appears that advanced maternal age is an independent risk factor for OASI irrespective of parity				
Daniels et al 2017	AQ (+)	To investigate obstetric and perinatal outcomes in a cohort of adolescent girls from a major Australian tertiary centre	Girls in the adolescent cohort (<20 years) were less likely to have an intact perineum and no more likely to have a third- or fourth-degree tear at the time of birth compared to controls (20-24 years)	OR: 0.73 (0.62–0.86) P < 0.001)
• Appears that adolescents (<20 years) are no more likely to have a third- or fourth-degree tear at the time of birth compared to 20-24-year olds				
Richards et al 2016	AQ (+)	To assess associations between primary caesarean birth and adverse birth outcomes with very advanced maternal age	Risk of third- or fourth-degree perineal lacerations was increased among births to women having vaginal deliveries over the age of 50 but was not associated with an elevated risk for any other age group	RR: 16.1, 95% CI 4.64 to 56.0
• Appears that there is an increased risk of third- and fourth-degree perineal lacerations in women aged over the age of 50 years				
Rahmanou et al 2016	AQ (+)	To assess the risk of pelvic floor injury relative to advancing maternal age in primiparous women after a singleton vaginal birth at term and to determine any association between maternal age and obstetric trauma, including obstetric anal sphincter injuries	Advancing maternal age at first birth carries with it a significant incremental risk of major pelvic floor trauma	OR 1.064 (1.021 – 1.108) for each increasing year of age past age 18 years (P = 0.003).
• Appears that there is a significant association between the risk of major pelvic floor injury and increasing maternal age at first birth				
Eseoghene Omih & Lindow 2015	AQ (+)	To assess the impact of maternal age on birth outcome in women that spontaneously labour at term	The over 35 years multipara were 2.5 times more likely to sustain second degree perineal trauma compared to the under 19 years	OR: 2.5 95% CI 1.85–3.34 P<0.0001
• Appears that increasing maternal age in multiparous women is an independent risk factor for sustaining second degree perineal trauma				
Kawakita et al 2016	AQ (+)	To investigate the maternal and neonatal outcomes and to explore the indication of primary caesarean birth and length of labour in adolescent pregnancy in a large contemporaneous obstetric cohort	Older adolescents had decreased risk of major perineal laceration than the comparison groups	aOR = 0.82 95% CI, 0.71-0.95
• Appears that older adolescents have a lower risk of major perineal laceration				

Blomberg et al 2014	AQ (+)	To evaluate the associations between maternal age and obstetric and neonatal outcomes in primiparous women with emphasis on teenagers and older women	Women with advancing age (≥30 years) revealed significantly increased risk of perineal lacerations, compared with women aged 25–29 years	First and second-degree perineal lacerations Age 30-34years aOR: 1.11 95% CI 1.10-1.13 Age 35-39years aOR: 1.08 95% CI 1.05-1.10 Third- and fourth-degree perineal lacerations Age 30-34years aOR: 1.16 95% CI 1.12-1.2 Age 35-39years aOR: 1.12 95% CI 1.05-1.18
• Appears that women with advancing age (≥30 years) have significantly increased odds of perineal lacerations				
Patterson & Hundley 2010	AQ (+)	To identify risk factors for severe perineal lacerations in vaginal birth in a teen population	The severe-laceration group (third/fourth degree tear) demonstrated a longer length of the second stage of labour	1.11 hours vs. 0.77 hours, (p = 0.03)
			Operative vaginal birth, episiotomy, increased infant birth weight and gestational diabetes requiring insulin for glucose control all appear to increase the risk of severe perineal laceration at the time of vaginal birth in a teenage population	Operative birth aOR: 2.3 (1.0-5.3) Episiotomy aOR: 5.7 (2.8-11.3) Insulin aOR: 6.5 (1.0-40.7) Increased infant birth weight aOR: 2.8 (1.2-6.9)
• Appears that operative vaginal birth, episiotomy, increased infant birth weight and gestational diabetes requiring insulin for glucose control all appear to increase the risk of severe perineal laceration at the time of vaginal birth in a teenage population				
Hornermann et al 2010	AQ (+)	To identify risk factors for the development of severe perineal lacerations and to give recommendations for their prevention in nulliparous women	Maternal age was significantly higher in women with higher degree laceration (29.29y ± 4.59y) compared to women with mild laceration (28.20y ± 5.30y) or women without a laceration (27.23y ± 5.77y)	$P < 0.05$
• Appears that maternal age is a risk factor for high grade perineal lacerations in nulliparous women				
Bowling et al 2009		To explore a potential relationship between maternal age and the occurrence of anal sphincter tears in	Young adolescents were not more likely to have an anal	Age >21 (reference)

	AQ (+)	three age groups of women who underwent primiparous vaginal birth	sphincter tear compared to women aged 21 or greater. Additionally, women between 17 and 20 years of age were not more likely to have an anal sphincter tear compared to women 21 years of age or greater	Age 17-20 years OR: 0.9 95% CI: 0.7—1.2 Age <16 years OR: 1.1 95% CI: 0.8—1.5
• Young adolescents were not more likely to have an anal sphincter tear compared to women aged 21 or greater				

Analgesia

Ten cohort studies were identified which investigated the association between analgesia and perineal tears. No relevant SRs or controlled trials were identified.

Cohort Studies

Study	SIGN rating	Objective	Result	Likelihood
Garcia-Lausin et al 2019	HQ (++)	To study the association between epidural analgesia and risk of severe perineal laceration, and identify additional risk factors for SPL	Epidural analgesia increased the risk of severe perineal lacerations in spontaneous births	OR: 0.47 (0.22-1.03)
			Epidural analgesia did not increase the risk of severe perineal lacerations in instrumental births	OR: 0.45 (0.09-2.11)
			32 (0.9%) women with spontaneous vaginal birth and epidural analgesia use had severe perineal lacerations and 14 (1.1%) women with spontaneous vaginal birth who did not use epidural analgesia had severe perineal lacerations	P>0.05
• Appears that epidural analgesia is not associated with severe perineal lacerations once confounding factors are included • Appears that epidural analgesia increases the risk of severe perineal lacerations in spontaneous births • Appears that epidural analgesia does not increase the risk of severe perineal lacerations in instrumental births				
Myrick & Sandri 2018	AQ (+)	To examine relationships between epidural analgesia in labouring women and vaginal lacerations at birth	Epidural anesthesia had a negative association with laceration	OR: 0.806; CI, 0.665 to 0.991
			When only second- to fourth-degree lacerations were considered, epidural anesthesia was not associated positively or negatively with occurrence of these lacerations	-

• Appears that women who receive epidural analgesia experience fewer vaginal lacerations				
Herrera-Gomez et al 2018	AQ (+)	To determine whether there is an association between the use of epidural analgesia and different aspects of labour	Women with epidural analgesia were not at an increased risk for perineal laceration	P < 0.05
• Appears that women with epidural analgesia were not at increased risk for perineal laceration				
Abenhaim et al 2008	HQ (++)	The objective of the study was to assess the effect of suboptimal second-stage pain control on the risk of difficult delivery	Suboptimal analgesia during initial pain control significantly increases the risk of third- and fourth-degree perineal tears	OR: 1.92 (1.03-3.21) P=0.04
			Improving analgesia in women with initial suboptimal analgesia did not significantly influence the risk of third- and fourth-degree tears	OR: 0.2 (0.03-1.31)
			Worsening analgesia in women with initial optimal analgesia significantly increased the risk of third- and fourth-degree tears	OR: 1.77 (1.08-2.91)
• Appears that suboptimal analgesia during initial pain control significantly increases the risk of third- and fourth-degree perineal tears • Appears the inability to sustain optimal epidural analgesia is associated with an increased risk of third- and fourth-degree tears				
Albers et al 2007	HQ (++)	To assess whether epidurals affect the rate of spontaneous obstetric lacerations in normal vaginal births	Epidural use was not found to be an independent predictor of sutured trauma	RR: 1.01 (0.73-1.39)
• Appears that epidural is not associated with a higher rate of sutured lacerations				
Poggi et al 2004	LQ (0)	To identify effect of epidural anaesthesia on clinician-applied force during vaginal birth	In the evaluation of maternal trauma, the only predictor of laceration or degree was the neonatal birth weight, and not the use of epidural analgesia or clinician-applied force	P>0.5
• Appears that epidural anaesthesia is not associated with lacerations				
Caroll et al 2002	AQ (+)	To investigate epidural analgesia and severe perineal laceration in a community-based obstetric practice	Epidural analgesia was a significant predictor of severe perineal injury	OR: 1.528, 95% CI 1.092–2.137
			When instrument use was included in the model, epidural analgesia was no longer a statistically significant independent predictor of severe perineal injury	OR: 1.287, 95% CI 0.907–1.826
• Appears that epidural analgesia is associated with an increase in severe perineal trauma as a result of an associated threefold increased risk of instrument use				

Bodner-Adler et al 2002	AQ (+)	To evaluate the effect of epidural analgesia on the occurrence of obstetric lacerations and on the neonatal outcome during spontaneous vaginal birth	No statistically significant association was found between the use of epidural analgesia and the occurrence of perineal tears, vaginal or labial trauma	Perineal tears (36.8 vs. 36.0%, p=0.83) Vaginal (5.5 vs. 7.1%, p=0.37) Labial trauma (13.9 vs. 9.9%, p=0.11)
• Appears that epidural analgesia does not influence the rate of obstetric lacerations				
Bodner-Adler et al 2001	AQ (+)	To determine if epidural analgesia is associated with increased risk of obstetric lacerations during spontaneous vaginal birth	No statistically significant association was found between the use of epidural analgesia and the occurrence of perineal tears (36.8 vs 36.0%, P=0.83), vaginal (5.5 vs 7.1%, P=0.37) or labial trauma (13.9 vs 9.9%, P=0.11)	P>0.05
• Appears that epidural analgesia does not increase the risk of obstetric lacerations during spontaneous vaginal birth				
Newman et al 2001	AQ (+)	To determine the relationship between epidural analgesia and episiotomy usage and episiotomy extension in parturients delivering vaginally	Women who received epidural analgesia had a decreased risk of first and second-degree perineal lacerations	First degree 8.9% vs. 12.4% OR 0.67, 95% CI 0.61-0.74) Second degree 11.6% vs. 14.4% OR 0.75, 95% CI 0.69–0.82
• Appears that women who receive epidural analgesia had a decreased risk of first- and second-degree perineal lacerations				

Anatomical Risk Factors

Two cohort studies and one case control were identified which investigated anatomical factors as a risk for perineal tears.

Cohort Studies

Study	SIGN rating	Objective	Result	Likelihood
Kehl et al 2011	LQ (0)	To evaluate the potential of foetal abdominal circumference measurement as predictor of perinatal complications in term newborns	No significant difference in higher grade perineal injury between foetal abdominal circumference of <36.0cm and ≥ 36.0cm	P=0.951
• Appears that foetal abdominal circumference is not associated with higher grade perineal injuries				

Frudinger et al 2002	AQ (+)	To assess the relationship between the subpubic arch angle, anal sphincter and perineal trauma, and anal incontinence after childbirth in nulliparous women	There was no significant effect of the subpubic arch angle on the incidence of sonographic trauma	OR 2.07, 95% CI 0.88–4.84
			There was no significant relationship between the subpubic arch angle and the presence or absence of sonographic trauma	OR 1.66, 95% CI 0.66– 4.17
• The subpubic arch angle was not associated with sonographic evidence of anal sphincter and perineal trauma				

Case Control

Study	SIGN rating	Objective	Result	Likelihood
Nguyen et al 2010	AQ (+)	To compare the labour curves of primigravid women with fourth degree perineal laceration with those of control subjects, and to identify characteristics of the labour curve that are associated with anal sphincter disruption	The average birth weight in the fourth-degree laceration group was 155 g greater than in the control group, which was not significantly different	P = 0.11
			Instrument delivery was more common in the fourth-degree laceration group than in the control group	65% vs. 29% P < 0.001
			The fourth-degree laceration group and the control group also differed significantly in terms of the use of episiotomy	74% vs. 24% P < 0.001
			The fourth-degree laceration group and the control group also differed significantly in terms of forceps birth	P < 0.001
• Appears that increasing rates of cervical dilatation and head descent are associated with fourth degree perineal laceration				

Assisted Vaginal Birth

There was one SR of high quality that explored the evidence related to the choice of instruments for assisted vaginal birth. One RCT and 19 cohort studies were also identified that were not included in the SR.

Systematic Reviews

O'Mahony et al. 2010

O'Mahony et al. 2010 ((QS: HQ (++)) conducted a SR/meta-analysis that investigated the choice of instruments for assisted vaginal birth, with a focus on RCTs of assisted vaginal birth using different instruments. The review focused on first, second, third- and fourth-degree tears.

It identified 19 studies published prior to 2010 (Bofill et al 1996, Dell et al 1985, Fitzpatrick et al 2003, Johanson et al 1989, Maleckiene et al 1996, Mustafa et al 2002, Vacca et al 1983, Weerasekera et al 2002, Williams et al 1991, Afifi et al 1995, Chonoy et al 1992, Cohn et al 1989, Kuit et al 1993, Lee et al 1996, Loghis et al 1992, Srisomboon et al 1998, Attilakos et al 2005, Nor Azlin et al 2008, Groom et al 2006).

The review identified that forceps were associated with higher rates of complications for the mother, including perineal tears, significantly more third- or fourth-degree tears (with or without episiotomy) and vaginal trauma. Ten studies reported on third- and fourth-degree tears and found them more likely to occur in the forceps group irrespective of whether an episiotomy had been carried out (RR 1.89, 95%CI 1.51 to 2.37; 2810 women).

When examining forms of vacuum birth, the review found there was no significant difference in perineal tears between soft cup (anterior) versus metal cup ventouse (RR 1.01, 95% CI 0.93 to 1.08; seven studies; 1237 women). There were no differences in risk of perineal tears when comparing hand-held vacuum versus any ventouse.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
O'Mahony et al 2010	HQ (++)	The result showed that forceps were associated with higher rates of perineal tears		
		<u>Forceps versus any type of vacuum</u> - Ten studies reported on third- and fourth-degree tears and found them more likely to occur in the forceps group irrespective of whether an episiotomy had been carried out	RR 1.89, 95% CI 1.51 to 2.37; 2810 women	Based on ten RCTs
		<u>Soft cup (anterior) versus metal cup</u> - There was no significant difference in perineal tears between these two groups - There was no significant difference in third- and fourth-degree perineal tears (with or without episiotomy) between the two groups	RR 1.01, 95% CI 0.93 to 1.08; 1237 women) RR 1.08, 95% CI 0.52 to 2.27; (1019 women)	Based on seven RCTs Based on five RCTs
		<u>Hand-held vacuum versus any ventouse</u> There were no significant differences in risk of first- and second-degree tears between hand held vacuum and ventouse There were no significant differences in risk of third- and fourth-degree tears between the groups	RR 1.01, 95% CI 0.88 to 1.15; (358 women) RR 0.97, 95% CI 0.47 to 1.33; (835 women)	Based on two RCTs Based on four RCTs

Controlled Trial

One RCT not included in the systematic review was identified that investigated the use of a semi-soft cup versus a metallic cup in assisting vaginal birth, on the risk for perineal tears.

Equy et al. 2015

Equy et al. (2015): (QS: HQ (++)) conducted a trial to investigate the use of iCup, a semi-soft disposable vacuum cup, compared with the traditional Drapier-Faure metallic cup on maternal and newborn outcomes. There were 668 women, singleton gestation of at least 37 weeks who required vacuum assisted birth, included in the study. There were 335 women randomly allocated to the iCup and 333 to the Drapier-Faure cup. Perineal tears were categorised into first, second, third- and fourth-degree tears.

There were more perineal tears, particularly severe types (third and fourth degree), with the Drapier-Faure metallic cup (5%) compared to the iCup semi-soft disposable cup (1.7%), p = 0.003. Authors concluded that the iCup semi-soft disposable vacuum cup had the advantage of having less perineal injuries.

Study	SIGN rating	Objective		Result
Equy et al 2015	HQ (++)	To compare maternal and new-born outcomes between a new disposable semi-soft vacuum extraction cup (iCup) and the commonly used Drapier-Faure metallic cup	Perineal tears were more frequent in the metallic cup group, especially third or fourth grade perineal tears	1.7 % versus 5.0 %, p = 0.003
• The use of semi-soft iCup disposable device resulted in fewer perineal tears, especially severe tears				

Cohort Studies

Study	SIGN rating	Objective	Result	Likelihood
Miller et al 2019	AQ (+)	To estimate the association between obstetrician experience and the incidence of severe perineal lacerations and failed vacuum attempts	Rates of severe perineal lacerations were not associated with any measure of obstetrician experience	Obstetrician experience years in practice (five-year increments) adj. OR 1.12; 0.96 -1.31
• Appears that there is no relationship between obstetrician experience and risk of severe tears during vacuum birth				
Lin et al 2019	HQ (++)	To investigate long-term association between delivery mode, LAM avulsion and obstetric anal sphincter injuries in women at least 20 years after their first birth	Those women who had at least one forceps birth had almost twice the rate of significant anal sphincter defect than those after spontaneous vaginal birth only, 21% vs 11%, respectively. However, this did not reach statistical significance	OR 2.2, 95% CI 0.87–5.59
• Appears that women who have at least one forceps birth are not at an increased risk of OASIS than those after spontaneous vaginal birth				
Wilkie et al 2018		To identify risk factors associated with higher	Forceps birth was associated with increased odds of higher	aOR: 2.09 (95% CI 1.26-3.46)

	LQ (0)	order perineal lacerations (third- or fourth-degree lacerations) after operative vaginal birth	order laceration than with vacuum birth	
			Chorioamnionitis at the time of operative birth is a significant risk factor for a higher order laceration	aOR: 2.20 (95% CI 1.09-4.44)
• Appears that forceps birth is associated with increased odds of higher order laceration than with vacuum birth				
Hamouda et al 2017	AQ (+)	To evaluate the risk of severe perineal tear following instrumental vaginal birth (IVB) performed with forceps and vacuum extraction compared to spontaneous vaginal birth	Only forceps extraction was found to significantly increase the risk of severe perineal tears	aOR: 5.8 (95% CI: 1.4—23.8)
			Vacuum extraction seemed to increase this risk, however, this impact was not found to be significant	aOR:2.7 (95% CI: 0.5—14.2)
			OP foetal birth, parity, foetal macrosomia, episiotomy, foetal extraction with the head in the deep pelvis, birth at night did not significantly increase the risk of severe perineal tears	-
• Appears that forceps birth is associated with higher odds of severe perineal tear than with spontaneous vaginal birth				
Ryman et al 2015	LQ (0)	To describe the prevalence of anal sphincter tears in relation to obstetric management and technique during vacuum extraction births	No relationship was found between technical factors such as mid high/outlet extractions, extraction time, number of pulls, experience of the operator, and the indication for vacuum extraction with the risk for anal sphincter tears	-
			Women from Africa had nearly a fourfold risk for anal sphincter tear during vacuum assisted birth compared with Swedish-born women	OR:3.82 (95% CI 1.47–9.89)
			Compared with infants with birth weight less than 4000 g, birth weight above 4000 g was associated with increased risk of anal sphincter injury	OR:1.87 (95%CI 1.06–3.28)
• Appears that there is no relationship between operator experience/extraction factors and risk of severe tears during vacuum birth				
Simo Gonzalez et al 2015	AQ (+)	To analyse the comparative risk of obstetric anal sphincter injury in relation to the method used in instrumental births	Women who had a spontaneous birth had the lowest incidence of injury (1.1%), followed by vacuum extraction (2.7%) and forceps (4.5%). The use of Thierry's spatulas (forceps) showed the highest incidence (4.9%)	
			There is a significant difference when comparing the incidence of obstetric anal sphincter injury between spontaneous and instrumental birth	*P*= < 0.01

			No significant difference was noted with vacuum extraction	OR = 2.50, 95% CI 0.876-7.189 p=0.087
			Statistically significant differences were found for forceps (OR = 4.08) and Thierry spatulas (OR = 4.80)	Forceps (OR 4.089, 95%CI 2.406-6.949, p=<0.001) Thierry's spatula (OR 4.804, 95%CI 2.406-7.792, p=<0.001)
• Appears that the use of forceps and Thierry's spatula for deliveries is associated with higher incidence of obstetric anal sphincter injury than spontaneous birth				
Gauthaman et al 2015	AQ (+)	Study aims to investigate the association between the type of forceps birth and maternal perineal trauma, and in particular to investigate if Kielland's rotational forceps birth increases OASIS	No statistically significant association between the severity of maternal perineal trauma and the type of forceps birth (failed ventouse vs Kielland's forceps, Wrigleys vs Kielland's, Andersons vs Kielland's after adjusting for age, birth weight, BMI, ethnicity and operator experience	Failed ventouse vs Kielland's forceps RR 1.52 (0.84-2.72) p=0.159 Wrigleys vs Kielland's RR 0.59 (0.24-1.43) p=0.249 Andersons vs Kielland's RR 1.16 (0.65–2.05) p=0.603
• Appears that there is no statistically significant association between the severity of maternal perineal trauma and the type of forceps birth (failed ventouse vs Kielland's forceps, Wrigleys vs Kielland's and Andersons vs Kielland's) • Appears that there is no difference in third- and fourth-degree tears following rotational Kielland's forceps birth and other non-rotational forceps births				
Miller et al 2014	AQ (+)	Study aims to estimate the association between obstetric forceps volume and severe perineal lacerations or adverse neonatal outcomes	After adjusting for confounders, the relationship between volume quartile and severe perineal lacerations became nonsignificant	P=0.91
• Appears that after controlling for patient factors, neither attending forceps volume nor physician years in practice was associated with severe perineal lacerations				
Solt et al 2011	LQ (0)	Study aims to evaluate the impact on resident forceps experience by a single proactive teacher	After appointment of the specific teaching attending, forceps births increased by 59% (8% of all births), whereas vacuum procedures decreased to 3% of births compared with the prior 2 years	P<0.0001
			Third- or fourth-degree lacerations were not associated with the labourist and prelabourist period	p>0.05
• Appears that there is no association between increasing resident forceps use and third- and fourth-degree lacerations				
Cheng et al 2011	AQ (+)	To compare perinatal outcomes in nulliparous women who had operative vaginal birth early during second stage (1–3 h) to those who delivered	Women who delivered beyond the third hour of second stage had lower odds of third- or fourth-degree perineal lacerations compared to their counterparts who had an earlier operative vaginal birth	aOR: 0.63, 95% CI 0.51–0.77

		vaginally with a prolonged second stage (>3 h)	Women who had operative vaginal birth (either during 1–3 h of second stage or 3 h of second stage) were more likely to have third- or fourth-degree perineal lacerations, postpartum haemorrhage and chorioamnionitis than those who had spontaneous vaginal birth during >3 h of second stage)	aOR: 1.35 95% CI 1.08–1.69
			Compared to women who had operative vaginal birth during 1–3 h of second stage, women who delivered later and were able to achieve spontaneous vaginal birth had lower odds of extensive perineal lacerations, postpartum haemorrhage, chorioamnionitis, and cephalohematoma for their neonates. In contrast, women who delivered later (>3 h of second stage) by operative vaginal birth, their odds of extensive perineal laceration were higher than women who had operative vaginal birth earlier (1–3 h of second stage)	
• Appears that women who deliver with forceps/vacuum or spontaneous later in second stage are less likely to have severe perineal tears • Appears that women who deliver with forceps/vacuum later in second stage (>3 hours) are more likely to have severe perineal tears than those who delivered with forceps/vacuum early in second stage (1-3 hours)				
Murphy et al 2011	AQ (+)	To establish risk factors and quantify maternal and neonatal morbidity associated with sequential use of instruments at operative vaginal birth within an entire cohort of nulliparous women delivered by forceps or vacuum extraction	Third- and fourth-degree tears more commonly occurred in women who delivered with use of sequential instruments compared to a single instrument even when adjusted for intrapartum factors	aOR: 2.1, 95% CI 1.2–3.5
			The rate of third- and fourth-degree tears was higher for sequential use of instruments compared to forceps alone	OR 1.8, 95% CI 1.1–2.9
			The rate of third- and fourth-degree tears was higher for sequential use of instruments compared to vacuum alone	OR 4.1, 95% CI 2.2–7.6
• Appears that there is an increased risk of tears with forceps and vacuum birth together compared to either alone				
Boucoiran et al 2010	AQ (+)	To assess perineal and vaginal injuries and their risk factors, neonatal complications and the success rate of the use of forceps	Nulliparity, shoulder dystocia and lack of episiotomy were significantly and independently associated with the presence of severe perineal injury during forceps birth	P<0.05

• Appears that severe perineal tears during forceps births are associated with nulliparity, shoulder dystocia and lack of episiotomy				
Minaglia et al 2009	AQ (+)	To calculate the number of caesarean births needed to prevent one case of obstetric anal sphincter laceration associated with operative vaginal birth in women	The risk of an obstetric anal sphincter laceration related to having a caesarean was lower compared to operative vaginal birth	Absolute risk reduction: 23.9% (95% CI 18.1–29.7) Number needed to treat: 4.4 (95% CI, 3.4 – 5.5)
			The rate of anal sphincter laceration among primiparous women was higher than multiparous women in the operative vaginal birth group	Rate of 3rd/4th deg tears: Primiparous: 27.8% Multiparous: 10.6% P = .019
			Women who had a vacuum-assisted birth were more likely to have a third- or fourth-degree tear than women who had forceps birth	OR: 2.5 (95% CI, 1.2–5.3)
• Appears that there is an increased risk of tears with vacuum than with forceps births • Appears that there is an increased risk of tears during forceps and vacuum birth in primiparous women				
Caughey et al 2005	AQ (+)	To compare perinatal lacerations between forceps- and vacuum-assisted births	The rate of third- or fourth-degree lacerations was higher among forceps births (36.9%) compared with vacuum assisted vaginal births (26.8%)	P < .001
• Appears that there is an increased risk of tears with forceps birth than with vacuum				
Johnson et al 2004	AQ (+)	To estimate the differences in immediate maternal and neonatal effects of forceps and vacuum-assisted births in a community-based teaching hospital with a residency program in obstetrics and gynaecology	There was a greater incidence of maternal third- and fourth-degree perineal lacerations (44.4% versus 27.9%), and vaginal lacerations (19% versus 9.7%) with the use of forceps	P < .001 P=.004
			Using multivariable logistic regression analysis and vacuum as the reference group, forceps use was independently associated with an increase in major perineal and vaginal tears	OR:1.85 (95% CI 1.27, 2.70)
• Appears that there is an increased risk of tears with forceps birth than with vacuum				
Damron & Capeless 2004	AQ (+)	Aimed to investigate the success rate of operative vaginal birth and risk of rectal sphincter injury when forceps or vacuum was used and in addition, compared the risk of third- and fourth-degree laceration with vacuum and forceps in occiput anterior and posterior positions	The use of forceps was associated with an increased risk of third- or fourth-degree lacerations when compared with the use of vacuum for both occiput anterior and posterior cases	OA Forceps vs vacuum OR: 3.25 (2.52-4.31) OP Forceps vs vacuum OR: 5.25 (3.02-9.1)
			Occiput posterior cases are at a higher risk for third- or fourth-degree laceration compared with occiput anterior, whether forceps or the vacuum was used	-

- Appears that there is an increased risk of tears with forceps birth than with vacuum for both occiput anterior and posterior cases
- Appears that there is a higher risk of tears with occiput posterior cases compared with occiput anterior presentations

Gardella et al 2001	AQ (+)	To determine the risk of neonatal and maternal disease associated with the sequential use of vacuum and forceps compared with spontaneous vaginal birth	The risk of third-degree perineal laceration among women with deliveries by vacuum extractor and forceps alone or together than women with spontaneous deliveries	Vacuum alone Nulliparous: RR 1.9 (95% CI: 1.7-2.2) Multiparous: RR 4.5 (95% CI: 3.3 -6.1) Forceps alone Nulliparous: RR 2.2 (95% CI: 1.9-2.5) Multiparous: RR 4.3 (95% CI: 3.1 -6.0) Vacuum and Forceps Nulliparous: RR 3 (95% CI: 2.7-3.4) Multiparous: RR 9.3 (95% CI: 6.9 - 12.6)
			The risk of fourth degree perineal laceration among women with deliveries by vacuum extractor and forceps alone or together than women with spontaneous deliveries	Vacuum alone Nulliparous: RR 1.6 (95% CI: 1.2-2.1) Multiparous: RR 2.7 (95% CI: 1.3 -5.5) Forceps alone Nulliparous: RR 1.5 (95% CI: 1.2-2) Multiparous: RR 3.7 (95% CI: 1.9 -7.4) Vacuum and Forceps Nulliparous: RR 2.5 (95% CI: 2-3.2) Multiparous: RR 11.4 (95% CI: 6.4 - 20.1)

- Appears that there is an increased risk of tears with forceps birth and with vacuum alone or together compared to spontaneous birth
- Appears that there is an increased risk of tears with forceps and vacuum birth together compared to either alone

Kabiru et al 2001	AQ (+)	To describe trends in operative vaginal birth rates, and second, to compare the risks of maternal complications between forceps-assisted and vacuum-assisted birth	Women who underwent forceps-assisted vaginal birth had increased risks of severe laceration (third and fourth degree)	RR: 1.9 (95% CI: 1.7—2.1)

- Appears that there is an increased risk of tears with forceps birth than with vacuum

Wen et al 2001	AQ (+)	Study aims to assess the maternal and infant outcomes associated with vacuum extraction and forceps births	Compared with birth by forceps, vacuum extraction causes fewer third-/fourth-degree perineal lacerations	aRR: 0.48 (0.45, 0.50)

- Appears that vacuum extraction compared to birth by forceps causes fewer third/fourth degree perineal lacerations

Birthweight

Eleven cohort studies investigated birthweight as a risk factor for perineal tears.

Cohort studies

Study	SIGN rating	Objective	Result	Likelihood
Turkmen et al 2018	AQ (+)	Study aims to determine the effects of birth weight on labour, foetal, maternal outcomes, and obstetric complications	Increased birth weight was associated with higher risks of perineal tear	$p < 0.05$
• Appears that an increased birth weight is significantly associated with perineal tears				
Moldeus et al 2017	AQ (+)	Aimed to compare mode of delivery, maternal and infant outcomes, of women with LGA infants who underwent induction of labour at 38 completed weeks of gestation or later, to that of expectant management	There was no significant difference between the expectant and the induction groups in regard to risk of obstetric anal sphincter injury	aOR = 0.81, 95% CI: 0.55–1.19
• Appears to be no association between OASIS and women with LGA infants who underwent induction of labour at 38 completed weeks of gestation or later, to that of expectant management				
Crosby et al 2016	LQ (0)	The objective of this study was to examine the obstetric and neonatal outcome measures in a large cohort of births with infant birthweight ≥5.0 kg	No significant difference in the adverse maternal outcome measures between both groups (1989-2000 vs 2003-2013)	p value is not significant (no exact p value given)
• Appears that there is no significant difference in third-degree tears between the two cohorts of infants with birthweight ≥5.0 kg				
Yee et al 2016	AQ (+)	Study aims to investigate, among women delivering neonates weighing greater than 3500 g, whether having had a sonographically estimated foetal weight in temporal proximity to delivery was associated with the risk of cesarean birth	No differences in rates of third- or fourth-degree perineal laceration outcomes based on sonographic status	p=0.37
			No differences in maternal outcomes, including major perineal laceration if delivered vaginally, were identified	aOR 1.12 (0.64-1.98)
• Appears that having had a sonographically estimated foetal weight in temporal proximity to delivery was not associated with perineal lacerations				
Temerinac et al 2014	AQ (+)	Study aims to provide information for better obstetric counseling by analysing the impact of foetal birth weight on foetal and maternal outcome when vaginal birth is planned in a university hospital	Severe perineal lacerations of third and fourth degree did not occur significantly	Group 2 (≥4000 – 4250 g) P value=0.441 Group 4

			higher in any group noting that in group 1 (<2500g) and group 3 (≥4250 - <4500g) no third- and fourth-degree lacerations occurred at all	≥4500g: P value=0.100
• Appears that foetal birthweight is not a significant factor for third- and fourth-degree perineal lacerations				
Jastrow et al 2010	AQ (+)	Study aims to estimate the association between neonatal birth weight and adverse obstetric outcomes in women attempting vaginal birth after cesarean	Birth weight was directly correlated with third and fourth-degree perineal laceration in women with or without previous vaginal birth	aOR: Birth weight Less than 3500g: Reference 3500-3999g: 1.41 (0.97-2.04) ≥4000g: 2.64 (1.66-4.19)
• Appears that birth weight is linked with third- and fourth-degree perineal laceration in women who undergo prior caesarean birth				
Siggelkow 2008	LQ (0)	Study aims to assess the perinatal outcome in a series of macrosomic fetuses with mothers from a general obstetric population in whom vaginal birth was planned	No relationship was observed between perineal trauma (third/fourth degree perineal laceration) and birth weight in the study population with birth weights of up to 4,500g	p>0.05
• Appears that there is no increase in the risk of third- and fourth-degree perineal lacerations in healthy women with fetuses weighing 4,000–4,500g				
Mahogany et al 2006	LQ (0)	Study aims to estimate the obstetric outcome in second pregnancies after first delivery of a macrosomic infant and the recurrence rate of foetal macrosomia in nondiabetic mothers	The overall rate of injury after second vaginal birth in the macrosomic group was 1.5%—twice the expected rate in multiparas (0.8%), but significantly less than the rate in primiparous macrosomic births (7%) and less than the overall risk in primiparous birth (2.9%)	p=0.034
• Appears that the rate of anal sphincter injury is significantly higher in second vaginal births in macrosomic infants				
Stotland et al 2004	AQ (+)	Study aims to characterize the epidemiology of macrosomia and related maternal complications including prolonged hospital stay, severe perineal lacerations, and chorioamnionitis	Women who delivered a macrosomic infant were more likely to suffer	aOR: 4000-4499g: 2.45 (2.16-2.79)

			fourth-degree perineal lacerations	4500-4999g: 4.24 (3.30-5.43) ≥5000g: 5.06 (4.01-6.37)
• Appears that women who delivered a macrosomic infant were more likely to have fourth degree perineal lacerations				
Jolly et al 2003	AQ (+)	Study aims to identify demographic risk factors for either birthweight >4 kg or over the 90th centile and to quantify the obstetric risks	Macrosomia results to an increased risk of third-degree perineal trauma	OR 2.73; CI 2.30, 3.23
• Appears that macrosomia is a significant risk factor for third degree perineal trauma				
Ehrenberg et al 2003	AQ (+)	Study aims to correlate low maternal pregravid weight, birth weight, and poor gestational weight gain with perinatal outcomes	Women with pre-gravid low maternal weight were at increased risk for perineal tears	RR: 1.8, 95% CI, 1.1-2.9
• Appears that women with pre-gravid low maternal weight are at increased risk of perineal tears				

Birth Position

Systematic Reviews

Walker et al. 2018

Walker et al. 2018 ((QS: HQ (++)) undertook a SR/MA on the evidence related to the effect of maternal position in the second stage of labour for women with epidural anaesthesia on perineal trauma. They identified three RCTs (Bumpes et al. 2017; Downe et al. 2004; Golara et al. 2002) involving 3266 subjects. The intervention of interest was maternal use of any upright position during the second stage of labour including 1. sitting (on a bed); 2. sitting (on a tilting bed more than 45° from the horizontal); 3. squatting (unaided or using squatting bars); 4. squatting (aided with a birth cushion); 5. semi-recumbent (i.e. classified as an upright position if the main axis of the body (chest and abdomen) was 45° or more from the horizontal); 6. kneeling (upright, leaning on the head of the bed, or supported by a partner); 7. walking (only for comparison of positions in the latent phase).

The authors concluded that there was no difference in the number of women who had tears requiring stitches (low-quality evidence) across the birth positions.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Walker et al 2018	HQ ++	There was no difference in any upright versus any recumbent position in the number of women who had tears requiring stitches (low-quality evidence)	RR 1.00, 95% CI 0.89 to 1.13	Three trials

Gupta et al. 2017

Gupta et al. 2017 ((QS: HQ (++)) undertook a SR/MA on the risk of perineal tears related to birthing position. The review included randomised, quasi-randomised or cluster-randomised controlled trials of any upright position assumed by pregnant women during the second stage

of labour compared with supine or lithotomy positions. The review identified 30 studies (Allahbadia & Vaidya 1992; Amiri Shirazi & Rajabalipoor 2012; Bhardwaj 1994; Bomfim-Hyppólito 1998; Calvo Aguilar, Romero & Garcia 2013; Crowley et al. 1991; De Jong et al. 1997; Gardosi, Hutson & Lynch 1989a; Gardosi Sylvester & Lynch 1989b; Gupta, Brayshaw & Lilford 1989; Hillan 1984; Jahanfar, Amini, Jamshidi 2004; Nasir, Korejo & Noorani 2007; Racinet et al. 1999, Schirmer, Fustinoni & Basile 2011; Stewart & Spiby 1989; Turner et al 1986; Zhang et al 2016).

The authors concluded that there was a tendency for more women to have perineal tears in upright positions, however, there was no difference in numbers of women with serious perineal tears between those giving birth in upright or supine positions.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Gupta et al 2017	HQ ++	Upright vs supine position *Trauma to the birth canal that required suturing: second degree perineal tear* Fewer episiotomies among women randomised to upright position groups was partly offset by a possible increase in second degree perineal tears, although the result touched the line of no effect (low quality evidence) *Trauma to the birth canal that required suturing: third- or fourth-degree tear* Upright positions were associated with no clear difference in the number of third- or fourth-degree perineal tears (very low-quality evidence)	RR 1.20, 95% CI 1.00 to 1.44 RR 0.72, 95% CI 0.32 to 1.65	18 trials Six trials
		Birth stool or squatting stool compared with supine position *Trauma to the birth canal that required suturing: second degree perineal tear* There was no clear difference in the second-degree perineal tear rate between women randomised to birthing or squatting stool versus supine position *Trauma to the birth canal that required suturing: third- and fourth-degree tear* There was no clear difference in the third- and fourth-degree tear rates between women randomised to birthing or squatting stool versus supine position	average RR 1.34, 95% CI 0.79 to 2.27 RR 0.49, 95% CI 0.16 to 1.48	Seven trials Four trials
		Birth cushion compared with supine position *Trauma to the birth canal that required suturing: second degree perineal tear* Fewer second degree perineal tears occurred in women using the birth cushion *Trauma to the birth canal that required suturing: third- and fourth-degree tear* Similar rated of third- and fourth-degree tears were identified	RR 0.72, 95% CI 0.54 to 0.97 RR 1.10, 95%CI 0.16 to 7.75	Two trials One trial
		Birth chair compared with supine position *Trauma to the birth canal that required suturing: second degree perineal tears* Rates of second-degree perineal tears were increased in the birth chair group *Trauma to the birth canal that required suturing: third- or fourth-degree tear*	RR 1.37, 95%CI 1.18 to 1.59	Five trials

		Third- or fourth-degree tear was not reported in any of the included studies		

Lodge et al. 2016

Lodge et al. 2016 ((QS: HQ (++)) undertook a SR/MA on the evidence related to the effect of maternal position at birth on perineal trauma. They explored three positions: waterbirth, all-fours and kneeling positions, and sitting, squatting and using a birth-stool. They identified seven studies (Altman et al. 2007; Cortes, Basra & Kelleher 2011; Dahlen et al. 2013; Geissbuehler Stein & Eberhar 2004; Mollamahmutoğlu et al. 2012; Shorten, Donsante & Shorten 2002; Soong & Barnes 2005).

The authors concluded that women who gave birth in water compared to positions on land had an increased risk of perineal trauma, however, women who birthed on a birth-stool had a higher rate of perineal trauma. Alternative birth positions (all-fours, kneeling, standing, squatting) did not perform better than the semi-recumbent position and the squatting position demonstrated least favourable results.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Lodge et al 2016	LQ (-)	Waterbirth position Compared to land birth, waterbirth was found to cause an increase in perineal trauma but may be protective of an intact perineum for multiparous women	Not reported	Four trials
		All-fours and kneeling positions Kneeling and all-fours positions were most protective of an intact perineum (most likely to result in an intact perineum)	Not reported	Seven trials
		Sitting, squatting and using a birth-stool Allowing for different variables, sitting, squatting and using a birth-stool caused the greatest incidence of trauma (highest rates and degrees of perineal trauma)	Not reported	Five trials

Controlled Trial

Three controlled trials not included in the SRs were found that investigated women giving birth in different positions and the risk of perineal tears. The studies varied in methodological quality. One was adequate quality (Corton et al. 2012) and the other two were low quality (Thies-Lagergren et al. 2012 and Terry et al. 2006).

Thies-Lagergren et al. 2012

Thies-Lagergren et al. (2012): (QS: LQ (-)) conducted a trial to compare the maternal labour and birth outcomes between women who gave birth on a birth seat or in any other position for vaginal birth in two labour wards. There were 950 nulliparous women who understood Swedish language, a normal pregnancy, with a singleton foetus in cephalic presentation, and spontaneous onset of labour occurring between gestational weeks 37 + 0 and 41 + 6, BMI <30, with gestational diabetes not requiring medical treatment, planning a vaginal birth after a previous caesarean section and those induced because of spontaneous rupture of membranes without spontaneous contractions for longer than twenty-four hours included in the study.

There were 253 women allocated in the birth seat group and 697 women in the control group. The control group was any other position. Perineal lacerations were defined as first, second, third- and fourth-degree tears.

There were no significant differences between the groups for any degree of laceration: First degree OR 1.06 (95%CI 0.97 - 1.15), second degree OR 1.93 (95%CI 0.68 - 1.30) and third degree OR 0.85 (95%CI 0.47 - 1.57), (p=>0.05).

Authors concluded that the results imply that women with a straightforward birth process may well benefit from giving birth on a birth seat without risk for any adverse obstetrical outcomes.

Study	SIGN rating	Objective	Result	Likelihood
Thies-Lagergren et al 2012	LQ (-)	To compare maternal labour and birth outcomes between women who gave birth on a birth seat or in any other position for vaginal birth and to study the relationship between synthetic oxytocin augmentation and maternal blood loss, in a stratified sample	There were no significant differences between the groups for any degree of lacerations	First degree OR 1.06 (95%CI 0.97 - 1.15) Second degree OR 1.93 (95%CI 0.68 - 1.30) Third degree OR 0.85 (95%CI 0.47 - 1.57) (P= >0.05)
• There was no difference in perineal outcomes between those who gave birth in a birth seat and in any other position				

Corton et al. 2012

Corton et al. (2012): (QS: AQ (+)) conducted a trial to investigate bed delivery without stirrups compared with birth in stirrup in reducing the incidence of perineal lacerations. There were 214 nulliparous women who were 16 years and older, presenting in spontaneous active labour, at a gestation of 37+0/7 weeks or longer and with singleton foetuses in cephalic presentation included in the study. There were 108 women randomly allocated to the no-stirrups group and 106 women in the stirrups group. Perineal tears were categorised into first, second, third- and fourth-degree tears.

The rates of perineal lacerations were 74% for the no-stirrup group and 80% for the stirrup group (p=0.35).

The authors concluded that the use of stirrups was not associated with increased perineal lacerations.

Study	SIGN rating	Objective	Result	Likelihood
Corton et al 2012	AQ (+)	To determine whether bed delivery without stirrups reduces the incidence of perineal lacerations compared with delivery in stirrups	Rates of perineal lacerations were 74% for the no-stirrup group and 80% for the stirrup group	P = 0.35
• The use of stirrups was not associated with increased perineal lacerations				

Terry et al. 2006

Terry et al. (2006): (QS: LQ (-)) conducted a trial to investigate giving birth in supine compared with non-supine positions on postpartum maternal and infant outcomes. There were 198 women with 37 completed weeks of gestation, spontaneous or induced singleton pregnancy,

spontaneous vaginal birth, and giving birth via cephalic presentation. There were 100 women who were allocated to the supine position and 98 in the non-supine position. The non-supine positions were kneeling/hands and knees, sitting and/or squatting. Perineal lacerations were defined as first, second, third- and fourth-degree tears.

The perineal lacerations in the non-supine group were primarily limited to first-degree tears (29 (30%)). Women in the supine group sustained more severe lacerations (67 (67%)). There were more severe lacerations in the supine group (third degree, 13 (13%), fourth degree 2(2%)) compared with the non-supine group (third degree, 2(2%), fourth degree, (0(0%)).

Authors concluded that non-supine positions during labour and birth were found to have clinical advantages without risk to mother or infant.

Study	SIGN rating	Objective	Result	Likelihood
Terry et al 2006	LQ (-)	To compare postpartum maternal and infant outcomes resulting from supine and non-supine positions maintained during the second stage of labour	Perineal lacerations in the non-supine group were limited to first-degree tears (29 [30%]), whereas women in the supine group sustained more severe lacerations (67 [67%])	-
			Women delivering in the non-supine positions had fewer second- and third-degree perineal lacerations (and no fourth-degree lacerations) compared with women who delivered in the supine position	-
• Giving birth in non-supine positions was found to have clinical advantages without risk to mother or infant				

Cohort Studies

Nine cohort studies not included in the previously reported SRs investigated birth position as a risk factor for perineal tears.

Study	SIGN rating	Objective	Result	Likelihood
Louwen et al 2017	LQ (0)	Study aims to compare breech outcomes when mothers delivering vaginally are upright, on their back, or planning caesareans	Upright deliveries did not significantly decrease serious perineal lacerations	OR: 0.34 (0.05–3.99)
• Appears that there are fewer third-and fourth-degree (serious) perineal lacerations in the upright position than in the dorsal position, but with the limited sample size it was not significant				
Warmink-Perdijik et al 2014	LQ (0)	Study aims to determine whether the episiotomy rate is higher in women who change from upright to supine position compared to women who are in horizontal position all the	Women in horizontal and upright during second stage and supine at birth compared to those in the horizontal/supine group had a non-significant difference in perineal tear rates	aOR 0.80 (0.54-1.2)

		time, and to women who give birth in sitting position * first- and second-degree tears and anal sphincter damage were combined in the variable "perineal tear"	Women in sitting position at birth compared to those in the horizontal/supine group had a non-significant difference in perineal tear rates	aOR 1.12 (0.78-1.62)
• Appears that there is no difference in minor and severe perineal tears for women in horizontal and upright positions during second stage and supine at birth compared to women with horizontal positions during the entire second stage and supine position at birth • Appears that there is no difference in minor and severe perineal tears for women that gave birth in sitting position, compared to the group with horizontal positions during the entire second stage and supine position at birth				
Serati et al 2016	AQ (+)	Study aims to evaluate the role of the maternal position at the time of birth on the onset of de novo symptoms of urinary incontinence in the post-partum period	The upright position birth group had significantly lower episiotomy rate, but a higher rate of greater than second degree perineal tears compared to the supine position group	Episiotomy: P=0.007 Second degree tear: P=0.04
• Appears that upright positions at birth are related to a lower episiotomy rate and a higher rate of greater than second degree perineal tears				
Edqvist et al 2016	LQ (0)	Study aims to describe the prevalence of perineal injuries of different severity in a low-risk population of women who planned to give birth at home and to compare the prevalence of perineal injuries, severe perineal trauma and episiotomy in different birth positions in four Nordic countries	No association between flexible sacrum positions and sutured perineal injuries was found	OR: 1.02 (0.86–1.21)
			No association between flexible sacrum positions and severe perineal trauma	OR: 0.68 (0.26–1.79)
• Appears that there are no associations between flexible sacrum positions and severe perineal trauma				
Haslinger et al 2015	AQ (+)	Study aims to analyse the association between maternal position at birth in spontaneous deliveries and the occurrence of anal sphincter tears given the lack of evidence related to the least traumatic birth position	There was a significantly higher risk for anal sphincter tears in squatting and in kneeling positions compared with the reference group on bed	Squatting OR: 2.92 (1.04-8.18) Kneeling positions OR: 2.14 (1.05-4.37)
			Adjusting for risk factors, birth in a kneeling position remained significantly associated with anal sphincter tears	aOR: 2.21 (1.07-4.54)
• Appears that birth in squatting or in kneeling position is associated with an elevated risk for anal sphincter tears • Appears that birth in water is not associated with an increased risk for anal sphincter tear				
Elvander et al 2015	AQ (+)	Study aims to determine the association between birth position and obstetric anal sphincter injury in spontaneous vaginal births	Compared with sitting position, the lithotomy position involved an increased risk of OASIS among nulliparous and parous women	aRR: Nulliparous: 1.17 (1.06-1.29) Parous women 1.66 (1.35-2.05)

			Birth seat and squatting position involved an increased risk of OASIS among nulliparous and parous women	aRR Nulliparous 1.36 [1.03-1.80] Parous 2.16 [1.15-4.07]
• Appears that compared with sitting position, lateral position has a slightly protective effect on OASIS in nulliparous women whilst an increased risk is noted among women in the lithotomy position, irrespective of parity • Appears that squatting and birth seat position involve an increase in risk of OASIS among parous women				
Maheux-Lacroix et al 2013	AQ (+)	Study aims to compare an alternative method of positioning at delivery (APOR B method) with the dorsal recumbent (supine) position	Women in the alternative method of positioning at delivery (APOR B) group were less likely to have vaginal tears (15% vs 28%)	aOR: 0.45 (0.23-0.89)
			The two methods of positioning are not significant factors in severe perineal tearing	Third degree: 1.53 (0.44-5.40) Fourth degree: 0.76 (0.00-9.75)
• Appears that there is no difference in third- and fourth-degree tears between alternative method of positioning at delivery (APOR B method) and the dorsal recumbent (supine) position • Appears that there are fewer vaginal tears in the alternative method of positioning at birth compared to the supine position				
De Jonge et al 2010	LQ (0)	Study aims to examine the association between semi-sitting and sitting position at the time of birth and perineal damage amongst low-risk women in primary care	Women in sitting position were less likely to have an episiotomy and more likely to have a perineal tear than women in recumbent position	OR: 0.29 (0.16-0.54)
			Women in semi-sitting position were more likely to have a labial tear than women in recumbent position	OR: 1.43 (1.0-2.04)
• Appears that women in a sitting birthing position are more likely to have a perineal tear than women in a recumbent position • Appears that women in a semi-sitting position are more likely to have a labial tear than women in a recumbent position				
Gottvalll et al 2007	AQ (+)	Study aims to assess the role of birth position in the occurrence of anal sphincter tears	Lithotomy and squatting positions were associated with a significantly increased risk for anal sphincter tears	aOR: Lithotomy: 2.02 (1.58–2.59) Squatting: 2.05 (1.09–3.82)
			Other major risk factors for anal sphincter trauma were primiparity, prolonged second stage, infant birthweight more than 4 kg and large infant head circumference	Primiparity: (adjusted OR 3.29, 95% CI 2.55–4.25) Prolonged second stage of labour >1 hour (adjusted OR 1.52, 95% CI 1.11–2.10) Infant birthweight more than 4 kg (adjusted OR 2.12, 95% CI 1.64–2.72

				Large infant head circumference (adjusted OR 1.57, 95% CI 1.23–1.99)
• Appears that Lithotomy and squatting positions at birth are associated with an increased risk for AST				

Birth Setting

There were five SRs that reviewed the evidence associated with birth setting and risk of perineal tears. Eight cohort studies were also identified that were not included in the SRs.

Systematic Reviews

Scarf et al. 2018

Scarf et al. 2018 ((QS: LQ (-)) undertook a SR on the evidence related to maternal and perinatal outcomes by planned place of birth among women with low-risk pregnancies in high-income countries. They identified nine studies that explored the risk of third- and fourth-degree perineal tears (Birthplace in England Collaborative Group 2011; Blix et al. 2012; Bolten et al. 2016; Davis et al. 2011; Halfdansdottir et al. 2015; Hiraizumi & Suzuki 2013; Homer et al. 2014; Miller & Skinner 2012; Wiegerinck et al. 2016).

The authors concluded that women experienced severe perineal trauma at a lower rate in planned home births than in obstetric units, and there was no significant difference in rates of severe perineal trauma between planned birth centre and hospital births. The odds of severe perineal trauma were significantly lower amongst planned home births, regardless of study quality and among higher-quality studies of births planned in birth centres.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Scarf et al 2018	LQ (-)	<u>Planned home birth vs hospital</u> Evidence suggests that women experienced severe perineal trauma at a lower rate in planned home births than in obstetric units	OR 0.57, 95%CI 0.40 to 0.81	Nine studies
		<u>Planned birth in birth centre vs hospital</u> The review found no significant difference in rates of severe perineal trauma between planned birth centre and hospital births	OR 1.01, 0.96 to 1.07	11 studies

Zielinski et al 2015

Zielinski et al 2015 ((QS: LQ (-)) undertook a SR on the evidence exploring the issue of risk and benefits to both mother and infant related to place of birth – specifically home birth. Five studies were found that related to third- and fourth-degree perineal tears (Catling-Paul et al. 2013; Hutton, Reitsma & Kaufman 2009; Cox et al. 2013; Lindgren et al. 2008; Kataoka, Eto & Iida 2013).

The authors concluded that the benefits of planned home birth include lower rates of maternal morbidity, such as postpartum haemorrhage and perineal lacerations, and lower rates of interventions such as episiotomy, instrumental vaginal birth, and caesarean birth.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Zielinski et al 2015	LQ (-)	Maternal outcomes are consistently better for planned home birth, including less intervention and fewer complications when compared to hospital birth	54% home vs 61% hospital (P<0.000)	One retrospective cohort
		Studies indicate that maternal complications related to birth, such as third- and fourth-degree perineal lacerations, are lower in women who plan a home birth when compared to a hospital birth	18% home vs 31% hospital	One retrospective cohort

Wax et al. 2010a

Wax et al. 2010a ((QS: HQ (++)) undertook a MA on the evidence related to maternal outcomes, including the risk of perineal tears, in planned home birth vs planned hospital births. This review included studies performed in developed Western countries, published in English-language peer-reviewed literature and where maternal outcomes were analysed by planned birth location. The review identified 12 studies (Ackermann-Liebrich et al. 1996; Shearer 1985; Wiegars et al. 1996; Lindgren et al. 2008; Woodcock et al. 1994; Hutton, Reitsma & Kaufman 2009; Janssen et al. 2009; Koehler, Solomon & Murphy 1984; Dowswell et al. 1996; Pang et al. 2002; deJong et al. 2009; Janssen et al. 2002).

The authors concluded that planned home births were associated with fewer maternal interventions including epidural analgesia, electronic foetal heart rate monitoring, episiotomy, operative birth and lacerations. When analysed with older and poorer quality studies excluded, no significantly different findings were found from the original MA. When analysed with the 4 papers employing matching excluded, there was no significant differences between planned home and planned hospital births regarding ≥ third degree lacerations (OR, 0.90; 95% CI, 0.62–1.31). This suggests that differences in planned home and planned hospital births reflect differences in women who attend each.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Wax et al 2010a	HQ ++	Planned home births were associated with reduced risk of ≥ third degree lacerations compared to planned hospital births	OR: 0.38 95% CI, 0.33 to 0.45	Eight trials
		Planned home births were associated with reduced risk of all perineal lacerations compared to planned hospital births	OR: 0.76 95% CI 0.72 to 0.81	Six trials

Wax et al. 2010b

Wax et al. 2010b ((QS: LQ (-)) undertook a SR on the evidence related to maternal outcomes, including the risk of perineal tears, in home birth vs hospital births. This review identified 12 studies (Zaza et al. 2000; Dowswell et al. 1996; Janssen et al. 2002; Pasupathy et al. 2009; Crotty et al. 1990; Bastian, Keirse & Lancaster 1998; Vintzileos 2009; Wolleswinkel-van den Bosch et al. 2002; vanderHulst et al. 2004).

Two studies found no significant differences in perineal laceration frequency, while one paper each favoured home and hospital birth, respectively. In contrast, vaginal lacerations occurred less often in home (1.0% and 17.9%) as compared with hospital (1.8%and 31.5%) deliveries. The authors concluded that current home birth practices were, especially when birth attendants are highly trained and fully integrated into comprehensive health care delivery systems, associated with fewer caesareans, operative vaginal births, episiotomies, infections, and third- and fourth-degree lacerations.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Wax et al 2010b	LQ (-)	The evidence in this review suggests that the risk of sustaining third- or fourth-degree lacerations is less in home birth vs hospital birth	OR 0.38 (0.33-0.45)	Five trials

Hodnett et al. 2005

Hodnett et al. 2005 ((QS: HQ (++)) undertook a SR on the evidence related to the risk of perineal tears in home-like versus conventional institutional settings for birth. They included trials where the intervention involved care during labour and birth in a home-like institutional birth setting. Care may have been provided by the same group of caregivers, or by separate groups of caregivers in the home-like versus conventional settings. The review included all study designs and identified five studies (Byrne, Crowther & Moss 2000; Hundley et al. 1994; MacVicar et al. 1993; Waldenstrom, Nilsson & Winbladh 1997; Klein et al. 1984) that focussed on perineal tears (of unspecified grades).

The authors concluded that when compared to conventional institutional settings, home-like settings for childbirth are associated with modest benefits, including reduced medical interventions and increased maternal satisfaction. However, women who received care in a home-like birth setting were more likely to have vaginal/perineal lacerations (four trials; n = 8415; RR 1.08, 95% CI 1.03 to 1.13).

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Hodnett et al 2005	HQ (++)	Allocation to a home-like setting when compared to conventional birth setting significantly increased the likelihood of vaginal/perineal tears	RR 1.08, 95% CI 1.03 to 1.13	Four trials

Cohort Studies

Study	SIGN rating	Objective	Result	Likelihood
Mesterton et al 2018	AQ (+)	Study aims to estimate case mix adjusted variations in central indicators of health outcomes in childbirth care and to assess whether hospitals who perform well on one indicator also perform well on others	No hospital had a statistically significant higher or lower rate across all four indicators of health outcomes which include OASIS	No p value given
• Appears that OASIS was the indicator with the lowest level of variation across hospitals in Sweden				
Nethery et al 2018	AQ (+)	The study aims to (1) describe rates for mode of delivery and other maternal and neonatal outcomes among rural women with low-risk pregnancies who planned a community birth with a midwife; and (2) to compare rates of modes of delivery and adverse outcomes among rural vs nonrural women	There is no association between rural or non-rural women who planned community births and third- and fourth-degree perineal tears	aOR 0.95 (0.65-1.34)
• Appears that both rural and non-rural community birth is not a significant risk factor for third- and fourth-degree perineal tear				
Ignatov et al 2017	LQ (0)	Study aims to evaluate the perinatal and maternal outcomes at term at a single tertiary, university hospital in women with low-risk pregnancies.	Rates of third- and fourth-degree perineal trauma were significantly lower for women who gave birth in the hospital	P =0.0001
• Appears that hospital births are associated with reduced rate of third and fourth degrees of perineal trauma in comparison with home births				
Gottvall et al 2011	AQ (+)	Study aims to evaluate the perinatal and maternal outcomes at term at a single tertiary, university hospital in women with low-risk pregnancies	Anal sphincter tears were less frequent in multiparas in the modified birth centre group compared with the standard care group, even when adding instrumental birth as a confounder	OR: 0.45 (0.22-0.92)
• Appears that anal sphincter tears are less frequent in multiparas in the modified birth centre group compared with the standard care group				
Raisanen et al 2010	AQ (+)	Study aims to assess risks of OASIS among five university teaching hospitals and 14 non university central hospitals with more than 1,000 deliveries annually during 1997-2007 in Finland	In the five university hospitals, occurrences of OASIS in primiparous women varied from 0.7% to 2.1% and from	p ≤ 0.001

			0.1% to 0.3% in multiparous women	
			In non-university hospitals, the occurrence of OASIS varied from 0.2% to 1.4% in primiparous women and from 0.02% to 0.4% in multiparous women	p ≤ 0.001
			There is 3.2-fold in the risk of having an OASIS for primiparous depending on the university hospital where the birth occurred	Hospital A 1 (reference) B 1.37 (1.08-1.74) p=0.01 C 1.52 (1.21-1.91) p<0.001 D 3.22 (2.64-1.93) p<0.001 E 1.11 (0.81-1.52) p=0.53
			There are 3-fold differences in the risk of having an OASIS for multiparous women, depending on the university hospital where the birth occurred	Hospital A 1 (reference) B 1.14 (0.69-1.87) p=0.61 C 1.91 (1.23-2.97 p=0.004 D 3.03 (1.97-4.67) p<0.001 E 1.0 (0.53-1.92) p=0.99
			There were up to 3-fold differences in risks of OASIS for primiparous among these non-university central hospitals	Hospital OASIS rate: Low (≤0.5%): 1 (reference) Medium (0.6-1%): 1.84 (1.38-2.47) P <0.001 High (1.1-1.4%): 2.97 (2.29-3.85) P <0.001
			There were up to 8.2-fold differences in risks of OASIS for multiparous among these non-	Hospital OASIS rate: Low (<0.1%): 1 (reference) Medium (0.1-0.2%): 4.37 (1.62-11.81)

			university central hospitals	P =0.004 High (0.3-0.4%): 8.24 (3.03-22.41) P <0.001
• Appears to be up to 3.2-fold inter-hospital differences in OASIS risk which demonstrates significant differences in the quality of Finnish obstetric care				
Robson et al 2008	AQ (+)	Study aims to compare the rate of serious adverse perinatal outcomes of term labour between private and public maternity hospitals in Australia	The rate of third- or fourth-degree perineal injury was higher in public hospitals compared to private hospitals	0.8% v 1.4% OR: 1.81 (1.72–1.9)
			After adjusting for maternal age, Indigenous status, parity, smoking during pregnancy status, reported diabetes or hypertension, remoteness of usual residence, and method of birth, the adjusted odds ratio (AOR) for perineal injury also favoured private hospitals	aOR: 2.28 (2.16–2.40)
• Appears that for women delivering a single baby at term in Australia, the odds of perineal injury are higher in public hospitals than in private hospitals				
Valbo et al 2008	AQ (+)	Study aims to analyse circumstances relating to severe anal sphincter tears occurring at spontaneous birth, in view of reported differences in practice regarding manual perineal protection during birth	Sphincter tear incidence varied significantly between the five hospitals	RR: 3.14 (2.38-5.56) p <0.001
• Appears that there is a significant difference between the hospitals in the incidence of sphincter tears occurring in midwife-conducted births				
Parratt & Johnston 2002	LQ (0)	This paper reports and comments on quantitative aspects of 440 planned homebirths attended by registered midwives in Victoria during the three years studied, 1995 - 1998	Homebirths either in or out of water reported high rates of intact perineums	Percentage: 65%
• The rate of having an intact perineum at homebirths in and out of water is 65%. The study is purely descriptive in nature				

Devices

There were three SRs that reviewed the use of devices in reducing perineal tears. One RCT and one case control study were identified which were not included within these SRs.

Systematic Reviews

Delgado et al. 2019

Delgado et al. 2019 (QS: AQ (+)) undertook a review of the use of a birth ball for women in labour. Two RCTs were found relating to maternal and neonatal outcomes (Delgado-Garcia et al. 2011, Lopes et al. 2003).

The use of a birth ball versus usual care did not result to reducing perineal lacerations, particularly third- and fourth-degree tears.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Delgado et al 2019	AQ (+)	No difference was shown between the birth ball or usual care in relation to perineal lacerations of third or fourth degrees, based on a very low level of evidence	RR 0,94 95% CI 0,42 to 2.11	Two trials

Divakova et al. 2019

Divakova et al. 2019 (QS: R (0)) conducted a SR to compare risk of OASI in women who had undergone episiotomy with Episcissors-60™ versus those who had an episiotomy with other scissors. The review was quality scored as poor quality with significant flaws due to its pooling of findings from different study designs. Four relevant studies were included in the review (van Roon et al. 2015; Sawant et al. 2015; Lou et al. 2016; Mohiudin et al. 2018). All included studies consisted of women who had undergone mediolateral or lateral episiotomy.

The review conducted a meta-analysis including three of the studies (van Roon et al. 2015; Sawant et al. 2015; Mohiudin et al. 2018). These studies compared 797 women who had episiotomies with Episcissors-60™ to 1122 women who had episiotomies with other scissors. The results suggested a significant reduction in OASI: risk difference = −0.04 (95% CI = −0.07 to −0.01; p = 0.005, I2 = 41%). The authors also reported a number needed to treat of 25 (95% CI = 14–100). The authors concluded that although the studies are few, and of small size and low quality, the results are promising in terms of possible reduction in OASI.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Divakova et al 2019	R (0)	Low quality evidence with pooled findings from different study designs suggests that there is a significant reduction in OASI in women who had undergone episiotomy with Episcissors-60™ compared to the use of other scissors	Risk difference: −0.04 95% CI: −0.07 to −0.01	Four studies of varying designs

Brito et al. 2015

Brito et al. 2015 (QS: LQ (-)) undertook a review of the effect of the Epi-No birth trainer. Two RCTs were found that related to all perineal tears and severe perineal tears (Dietz et al. 2014;

Ruckhaberle et al. 2009). One prospective non-randomised trial was found that related to assessing condition of the perineum (Kovacs et al. 2004).

The authors concluded that the Epi-No birth trainer did not result in reducing all types of perineal tears and severe types of perineal tears.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Brito et al 2015	LQ (-)	Epi-No birth trainer is a device that had no influence on reducing perineal tears	RR 0.99, 95%CI 0.84–1.17 p=0.93 all perineal tears	Two RCTs
		No influence of Epi-No on reducing all perineal tears or severe perineal tears	RR 1.31, 95%CI 0.72–2.37 severe (3rd/4th) perineal tears	
		Epi-No increased the number of intact perineum and showed a trend toward decreasing perineal tears	Not reported	One prospective non-randomised trial

Controlled Trial

One RCT not included in the SRs was identified that investigated the use of a device to prevent vaginal birth-related pelvic floor trauma.

Kamisan Atan et al. 2016

Kamisan Atan et al. (2016): (QS: (HQ ++)) conducted a multicentre prospective RCT to investigate the use of the Epi-No device compared with control group in preventing vaginal birth-related pelvic floor trauma. There were 660 women with uncomplicated singleton pregnancy between 33 and 35 weeks of gestation, maternal age ≥18 years, no previous pregnancy beyond 20 weeks of gestation and aiming for normal vaginal birth included in the study. Perineal trauma was defined as anal sphincter injury or trauma.

There was no statistical difference in the use of Epi-No compared with control in the incidence of perineal tears (51 versus 53%; RR 0.96, 95% CI 0.78–1.17; ARR 0.02, 95% CI 0.08 to 0.13; P = 0.65)

Authors concluded that the Epi-No device is unlikely to be beneficial in the prevention of perineal trauma.

Study	SIGN rating	Objective		Result
Kamisan Atan et al 2016	HQ (++)	To investigate the use of the Epi-No device to prevent vaginal birth-related pelvic floor trauma	There was no statistical difference in the use of Epi-No compared with control in the incidence of perineal tears	51 versus 53%; RR 0.96, 95% CI 0.78–1.17; ARR 0.02, 95% CI 0.08 to 0.13; P = 0.65
• The Epi-No device is unlikely to be clinically beneficial in the prevention of perineal trauma				

Case Control

Study	SIGN rating	Objective		Result
Doyle et al 2019	AQ (+)	Study aims to pilot Relaxbirth®, an investigational device designed to facilitate upright positioning intrapartum. The objective was to 1) compare birth outcomes with and without the use of Relaxbirth®, and 2) assess device usability	Relaxbirth women did not experience more adverse birth outcomes including perineal lacerations compared to the control group	P=0.23
• Appears that there is no significant difference between Relaxbirth® group and no use of Relaxbirth in terms of perineal lacerations				

Diabetes

Three cohort studies were identified which looked at the effect of diabetes on perineal tears. No SRs or RCTs were found.

Cohort Studies

Study	SIGN rating	Objective	Result	Likelihood
Zeki et al 2019	AQ (+)	To compare rates of OASIs between women with GDM and women without GDM by mode of birth and birthweight	The rate of OASIs was 3.6% (95% CI: 2.6–2.7) vs 2.6% (95% CI: 3.4–2.8; P < 0.001) among women with and without GDM, respectively	-
			Women with GDM and a macrosomic baby (birthweight ≥ 4000 g) had a higher risk of OASIs with forceps or vacuum compared with those without GDM	Forceps (aOR 1.76, 95% CI: 1.08–2.86, P = 0.02) Vacuum (aOR 1.89, 95% CI: 1.17– 3.04, P = 0.01)
• Appears that women with GDM and a macrosomic baby are at increased risk of OASIs with both vacuum and forceps.				
Strand-Holm et al 2019	AQ (+)	To study the association between Diabetes Mellitus (all types combined), Type 1 Diabetes Mellitus, Type 2 Diabetes Mellitus and Gestational Diabetes Mellitus and lower genital tract tears after vaginal birth	The overall risk of lower genital tract tears was similar among women with a diagnosis of diabetes (Type1 Diabetes Mellitus, Type 2 Diabetes Mellitus, and Gestational Diabetes Mellitus) compared to women without diabetes	P>0.05
• Appears that women with Diabetes Mellitus without a previous cesarean section who gave birth vaginally to a single child at term or near term do not experience an increased risk of lower genital tract tears.				
Malinowska-Polubiec et al 2014	LQ (0)	To analyse antepartum and peripartum risk factors and complications of shoulder dystocia in diabetic and non-diabetic women	Diabetic women with shoulder dystocia had a higher incidence of first and second degree perineal tears compared with the non-diabetic group	23.1% vs. 0%, p=0.02
• Appears that diabetic women had a significantly higher incidence of first and second degree perineal tears.				

Duration of second stage of labour

One SR was identified investigating duration of the second stage of labour as a risk factor for perineal tears. No RCTs were found on the topic which were not included in the SR, however, six relevant cohort studies were identified.

Systematic Review

Altman et al. 2006

Altman et al. 2006 ((QS: HQ (++)) undertook a SR on the evidence related to the risk of adverse maternal and perinatal outcomes related to prolonged second stage of labour. The review included all study designs and identified three relevant studies (Janni et al. 2002; Myles & Santolaya 2003; Cheng et al. 2004) that focused on severe obstetric lacerations, defined as third- or fourth-degree perineal lacerations, or deep vaginal lacerations after vaginal birth.

The authors concluded that there was evidence of a significant association between prolonged second stage of labour and maternal outcomes such as postpartum haemorrhage, infection and severe obstetric lacerations, however, one study that reported an increase in severe lacerations associated with prolonged second stage identified that this association was not significant when restricted to spontaneous vaginal birth (OR 1.2 [95% CI 0.4–2.9]). Inherent limitations in methodology were evident in the studies.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Altman et al 2006	LQ (-)	One study reported an increase in severe lacerations associated with prolonged second stage of labour	All prolonged labours OR 2.7, 95% CI 1.4–5.2	One study
		No significant increase in severe perineal lacerations were shown when restricted to spontaneous vaginal births	Spontaneous vaginal birth OR 1.2 [95% CI 0.4–2.9])	One study

Cohort Studies

Study	SIGN rating	Objective	Result	Likelihood
Simic et al 2017	HQ (++)	Study aims to investigate the effect of duration of the second stage of labour on the risk of severe perineal lacerations in primiparous mothers	The odds of having perineal laceration is increased with prolonged duration of the second stage of labour	aOR 0-<1 hour: 1 (reference) 1-<2 h: 1.25 (1.13-1.38) 2-<3 h: 1.42 (1.28-1.58) 3-<4 h: 1.45 (1.29-1.64) ≥4 h: 1.41 (1.24-1.61)
• Appears that the risk of severe perineal lacerations increases with duration of second stage of labour				

<table>
<tr><td rowspan="2">Aiken et al 2015</td><td rowspan="2">AQ (+)</td><td rowspan="2">Study aims to determine whether there is an association between second stage duration and risk of OASIS that is independent of the association with other confounding variables</td><td>For nulliparous women undergoing spontaneous vaginal birth, no association between the length of the second stage and the risk of OASIS</td><td>OR (95% CI)
1.00 (0.95-1.05)</td></tr>
<tr><td>For women who underwent instrumental birth, a higher risk of OASIS was associated with a longer duration of second stage of labour (per 15-minute increase)</td><td>OR (95% CI)
1.06 [1.01-1.11]
p < 0.01</td></tr>
<tr><td colspan="5">• Appears that the duration of second stage is not an independent risk factor for OASIS in women undergoing spontaneous vaginal birth
• Appears that for women who underwent instrumental birth, a higher risk of OASIS is associated with a longer duration of second stage of labour</td></tr>
<tr><td rowspan="2">Laughon et al 2013</td><td rowspan="2">AQ (+)</td><td rowspan="2">Study aims to assess neonatal and maternal outcomes when the second stage of labour was prolonged according to American College of Obstetricians and Gynaecologists guidelines</td><td>There is an increase in odds of third- or fourth-degree perineal laceration among nulliparous women with epidural who delivered after a prolonged second stage of labour</td><td>aOR:
1.80 (1.58-2.05)</td></tr>
<tr><td>There is an increase in odds of third- or fourth-degree perineal laceration among nulliparous women without epidural who delivered after a prolonged second stage of labour</td><td>aOR:
1.62 (1.24-2.12)</td></tr>
<tr><td colspan="5">• Appears that a prolonged second stage of labour is a risk factor for third- or fourth-degree perineal lacerations among nulliparous women</td></tr>
<tr><td>Giannella et al 2013</td><td>AQ (+)</td><td>Study aims to compare obstetric outcomes in women undergoing vaginal birth with or without delay in the second and third stage of labour</td><td>A prolonged second stage of labour was associated perineal tears = third or fourth degree</td><td>OR = 3.53, 95% CI 2.10–5.94,
p < 0.0001</td></tr>
</table>

• Appears that there is an association between a prolonged second stage of labour and third- and fourth-degree perineal tears				
Rouse et al 2009	AQ (+)	Study aims to assess maternal and perinatal outcomes as a function of second-stage labour duration	Third- or fourth-degree perineal laceration is associated with duration of the second stage of labour	aOR: 1.44 (1.29-1.60)
			Second-stage duration of at least 3 hours was associated with significantly higher rates of third or fourth-degree perineal lacerations	$p < 0.01$
• Appears that third- or fourth-degree perineal lacerations are associated with the duration of the second stage of labour, with a second stage of labour of at least 3 hours being associated with significantly higher odds of laceration				
Cheng et al 2007	AQ (+)	Study aims to examine perinatal outcomes associated with the second stage of labour in multiparous women	Rates of third- or fourth degree perineal laceration increased steadily from 1.8% for women with a second stage between 0 and 1 hour to 12.7% when delivered between 2- and 3-hour interval and 14.9% when second stage progressed beyond 3 hours or longer	$p < 0.0001$
			There is an association between the length of second stage of labour (2 – 3 hours) and third- or fourth-degree perineal tear	OR (95%CI) 3.04 (1.76-5.29)
			There is an association between the length of second stage of labour (≥3 hours) and third- or fourth-degree perineal tear	2.56 (1.44-4.55)

- Appears that there is an increased risk of third- and fourth-degree perineal tears in multiparous women when the length of second stage of labour is between 2 and 3 hours and ≥ 3 hours

Elective Induction of Labour

Two SRs were identified that explored induction of labour as a risk factor for perineal tears. No RCTs were found on the topic which were not included in the SR, however, eight relevant cohort studies were identified.

Systematic Reviews

Sotiriadis et al. 2019

Sotiriadis et al. 2019 ((QS: HQ (++)) undertook a SR/MA on the evidence related to the effect of elective induction of labour at 39 weeks on the risk of Cesarean section, and on maternal and perinatal outcomes. Only RCTs comparing elective induction of labour with expectant management in low-risk singleton pregnancy at term were considered eligible for inclusion, with 5 RCTs (7261 subjects) identified (Grobman et al. 2018; Walker et al. 2016; Amano et al 1999; Martin et al. 1978; Cole et al. 1975) that explored the risk of third- and fourth-degree perineal tears.

The authors concluded that elective induction of labour in uncomplicated singleton pregnancy at 39 weeks' gestation is not associated with maternal or perinatal complications and may reduce the need for Cesarean section, risk of hypertensive disease of pregnancy and need for neonatal respiratory support.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Sotiriadis et al 2019	HQ (++)	There was no difference between elective induction of labour with expectant management in low-risk singleton pregnancy, in the rates of third and fourth perineal lacerations	RR 1.18, 95% CI, 0.89–1.50	Two trials

Middleton et al. 2018

Middleton et al. 2018 ((QS: HQ (++)) undertook a SR/MA on the evidence related to the effects of a policy of labour induction at or beyond term compared with a policy of awaiting spontaneous labour (or until an indication for birth induction of labour is identified) on pregnancy outcomes for infant and mother. The review focussed on RCTs and identified 4 RCTs that included perineal tears as an outcome (Brane et al. 2014; Heimstad et al. 2007; Kortekaas et al. 2014; Walker et al. 2016).

The authors concluded that there were no clear differences between a policy to induce at or later than term or waiting in the risks of mothers having trauma to their perineum or bleeding after birth, although it was acknowledged that the evidence for both were of low-quality.

Study	SIGN rating	Conclusions	Likelihood	Evidence base

Middleton et al 2018	HQ (++)	No clear differences in perineal trauma were seen between induction and expectant management (low quality evidence); On sensitivity analysis of 3 trials, results were similar to the overall analysis In subgroup analyses, no clear differences between timing of induction (< 41 weeks versus ≥ 41 weeks' gestation) or by state of cervix were seen for perinatal death, stillbirth, NICU admission, caesarean section, or perineal trauma	RR 1.09, 95% 0.65 to 1.83	Four trials

Cohort studies

Study	SIGN rating	Objective	Result	Likelihood
Souter et al 2019	AQ (+)	To compare outcomes for electively induced births at >39 weeks gestation with those that were not electively induced	No significant difference in third- and fourth-degree lacerations at 39 weeks among nulliparous and multiparous women who were electively induced compared to those not electively induced	Nulliparous (Adj OR 0.94, 95%CI 0.51-1.73, p=0.837) Multiparous (Adj OR 0.66 95%CI 0.38-1.13, p=0.127)
			No significant difference in third- and fourth-degree lacerations at 40 weeks among nulliparous and multiparous women who were electively induced compared to those not electively induced.	Nulliparous (Adj OR 1.01, 95%CI 0.63-1.62, p=0.961) (Adj OR 1.36, 95%CI 0.83-2.23, (p=0.217)
• Appears that induction for nulliparous women and multiparous women at 39- or 40-weeks' gestation does not increase the risk for third- and fourth-degree lacerations				
Thangarajah et al 2016	AQ (+)	To determine the effects of induction of labour in late-term pregnancies on the mode of delivery, maternal and neonatal outcome	Rate of perineal lacerations (First/second/third degree) was significantly higher in the induction of labour group compared to expectantly managed group (38.1% vs. 26.4%)	p = 0.002
			Rate of third-degree lacerations was significantly higher in the induced group compared to the expectantly managed group (6% vs. 2.8%)	p = 0.044
			In a subgroup of primiparous women, there was no significant difference between the induction of labour group and expectantly managed group (9.4% vs. 5.0%)	p = 0.138
• Appears that induction of labour in late and post term pregnancies increased the overall risk for first, second and third-degree perineal lacerations				

Kacvisnska et al 2016	LQ (0)	Study aims to determine the effect of labour induction using prostaglandin, gestation period and birth type on the cause and extent of birth canal injuries	Non-operative vaginal birth is a significant risk factor for first-degree perineal tear	RR = 25.52 95% CI 10.58, 61.60, OR = 33.06 95% CI 13.51, 80.90
			Significant risk factors for third-grade perineal tear during vaginal birth are forceps and vacuum extractor	Forceps p = 0.005534 Vacuum p = 0.03554
• Appears that labour induced with prostaglandins increases the occurrence of perineal tears				
Vendittelli et al 2014	AQ (+)	To assess whether a policy of induction of labour for women with a constitutionally large-for-gestational-age fetus might reduce the occurrence of severe perineal tears	The relative risk for all types of perineal tears was not significantly different between the suspected macrosomia group compared with the not suspected of macrosomia group	RR 0.89 95%CI 0.64-1.25 aRR 1.01 95%CI 0.72-1.40
			A lower rate of 3rd-degree perineal tears was observed in the induction-of-labour group (0.8 vs. 1.4%) and, inversely, a higher rate of 4th degree tears (1.6 vs. 0.1) but should be interpreted cautiously according to authors due to lack of power in the study	-
• Appears that a policy of induction of labour for women with a constitutionally large-for-gestational-age fetus does not lower rates of perineal tears				
Darney et al 2013	AQ (+)	Study aims to test the association of elective induction of labour at term compared with expectant management and maternal and neonatal outcomes.	The odds of third- and fourth-degree lacerations are significantly lower among women in the induction without medical indication group at 37, 38 and 39 weeks of gestation among all births, however not at 40 weeks	37 weeks: 0.66 (0.47-0.93) 38 weeks: 0.61 (0.50-0.75) 39 weeks: 0.65 (0.55-0.78) 40 weeks: 0.82 (0.68-10.0)
• Appears that elective induction without medial indication is associated with a decreased odds of severe lacerations at 37, 38 and 39 weeks, however, not at 40 weeks when compared to expectant management				
Osmundson et al 2011	AQ (+)	Study aims to compare outcomes of labour between nulliparas with an unfavourable cervix who underwent either elective labour induction or expectant management beyond 39 weeks of gestation	No significant difference between the expectantly managed and electively induced groups on maternal outcomes such as the third- and fourth-degree perineal tears	p=0.34
• The rate of third- and fourth-degree lacerations is not significantly different between the electively induced and the expectantly managed group				

Janakiraman et al 2010	AQ (+)	Study aims to compare the duration and complications of the second stage of labour between women in induced and spontaneous labour	The risk of complications such as third- and fourth-degree lacerations increased as the duration of the second stage increased among women in spontaneous and induced labours	p<0.001
			After controlling for potential confounders, induction did not confer an increased risk of any labour and delivery complications such as third- and fourth-degree lacerations among multiparas	aOR 0.58 (0.37-1.06)
			After controlling for potential confounders, induction did not confer an increased risk of any labour and delivery complications such as third- and fourth-degree complications among nulliparas	aOR: 1.00 (0.74-1.36)
• Appears that induction of labour did not confer increased odds for third- and fourth-degree perineal lacerations				
Triebwasser et al 2019	LQ (0)	To assess whether prolonged induction of labour was associated with increased maternal or neonatal morbidity	There were less perineal lacerations in the prolonged induction group; however, severe lacerations were not significantly different between the two groups	Length of induction (<24 hours, 24-36 hours, >36 hours) Nulliparous p=0.72 Multiparous p=0.45
				Overall comparison of duration of induction of labour (≤36 hours vs >36 hours) p=0.07
• Appears that overall length of induction of labour does not increase the risk for severe perineal lacerations				

Episiotomy

A total of five SRs were identified that reviewed the effectiveness of episiotomy in regard to the outcome of perineal tears. The SRs ranged from low (-) to high (++) quality and included 54 individual studies. Two RCTs and 13 cohort studies were identified that were not included in the SRs.

Systematic Reviews

Jiang et al. 2017

Jiang et al. (2017) (QS: HQ (++)) conducted a Cochrane review which aimed to assess the effects on mother and baby of a policy of selective episiotomy (‘only if needed’) compared with a policy of routine episiotomy (’part of routine management’) for vaginal births. The systematic review and meta-analysis contained 12 randomised controlled trials which were of relevance to this review (Ali et al. 2004; Belizan et al. 1993; Dannecker et al. 2004; Eltorkey et al. 1994; Harisson et al. 1984; House et al. 1986; Juste-Pina et al. 2007; Klein et al. 1992; Rodriquez et al. 2008;

Sleep et al. 1984; Sulaiman et al. 2013; Murphy et al. 2008). These 12 trials studied a total of 6177 women, with the sample sizes in the included studies ranging from 109 (Dannecker et al. 2004) to 2606 (Belizan et al. 1993). Eleven of the studies included women in labour for whom a vaginal birth was intended, and one (Murphy et al. 2008) included women where an assisted birth was anticipated.

The authors of the review reported that the difference within trials between the selective and the routine episiotomy groups ranged from 21% to 92% more episiotomies in the control arm.

Eleven of the trials compared restrictive versus routine episiotomy (where non-instrumental was intended) in relation to the outcome of severe perineal/vaginal trauma (third- and fourth-degree tears). Only eight of these trials contributed estimable data to the meta-analysis. Overall, it was found that there was a 30% reduction in severe perineal/vaginal trauma (RR: 0.70, 95% CI 0.52 to 0.94; 5375 women; eight trials; I2 = 37%; low-certainty evidence).

A subgroup analysis of these trials was conducted which compared those with a difference in episiotomy rate less than 30% to those greater than 30%. In trials where the difference in episiotomy rates between selective and routine groups was less than 30%, there was no obvious difference in outcome (RR 1.03, 95% CI 0.63 to 1.69; 1300 women, three contributing trials). However, in trials where the difference in the rate was greater than 30%, there was a clear effect on severe vaginal/perineal trauma (RR 0.55, 95% CI 0.38 to 0.81; 4877 women, seven contributing trials; I2 = 21%).

One trial was conducted among women with anticipated operative vaginal birth (Murphy 2008b). No clear difference was shown on the outcome of severe perineal/ vaginal trauma between the two groups (RR 1.30, 95% CI 0.55 to 3.07, 175 women).

The authors, therefore, concluded that in women where no instrumental birth is intended, selective episiotomy policies result in fewer women with severe perineal/vaginal trauma. Other findings, both in the short or long term, provide no clear evidence that selective episiotomy policies results in harm to mother or baby.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Jiang et al 2017	HQ (++)	Low certainty evidence suggests that restrictive episiotomy results in a statistically significant reduction in severe perineal/vaginal trauma (refers to a third-degree or fourth-degree tear) when compared to routine episiotomy among women where non-instrumental was intended	RR: 0.70, 0.52 to 0.94	Based on eight RCTs
		No significant difference was found in the outcomes of severe perineal/vaginal trauma when the difference in episiotomy rates between selective and routine groups was less than 30%	RR: 1.03, 0.63 to 1.69	Based on three RCTs
		The evidence suggests that the rate of severe perineal/vaginal trauma is reduced in the selective episiotomy group compared to the routine episiotomy group when the difference in the rate of episiotomy is greater than 30%	RR: 0.55, 0.38 to 0.81	Based on seven RCTs

		No significant difference was found on the outcome of severe perineal/vaginal trauma when comparing selective and routine episiotomy among women with anticipated operative vaginal birth	RR: 1.30, 0.55 to 3.07	Based on one RCT

Verghese et al. 2016

Verghese et al. (2016) (QS: AQ (+)) undertook a SR to compare rates of OASI amongst women who had undergone mediolateral episiotomy versus those who did not. Sixteen studies were included in the review (Gurol-Urganci et al. 2013; Prager et al. 2008; Bodner-Adler et al. 2004; Buekens et al. 1985; Lam et al. 2006; Samarasekera et al. 2009; Steiner et al. 2012; Andrews et al. 2006; Jango et al. 2013; Baghestan et al. 2010; Ampt et al. 2013; Revicky et al. 2010; Shihadeh et al. 2001; Angioli et al. 2000; Mora-Hervas et al. 2015; Twidale et al. 2013). All were non-randomised, population based or retrospective cohort studies, which compared mediolateral episiotomy to spontaneous tears, with OASI being the outcome of interest. There was great variation in quality amongst these studies. Seven studies involving 801,182 women were included in the meta-analysis (Gurol-Urganci et al. 2013; Prager et al. 2008; Bodner-Adler et al. 2004; Buekens et al. 1985; Lam et al. 2006; Samarasekera et al. 2009; Steiner et al. 2012).

The results of the meta-analysis suggested that mediolateral episiotomy reduced the risk of OASI (RR 0.67 95 % CI 0.49-0.92) in vaginal birth when combining data from nulliparious and multiparous women. However, the pooled results from 5 studies with nulliparous women only, suggested that the rate of OASI is not different in those who had mediolateral episiotomy versus those who sustained perineal tear although there was trend towards protection (RR 0.71 95 % CI 0.44-1.14).

The authors concluded that the pooled analysis of a large number of women undergoing vaginal birth, most of whom were nulliparous, indicates that mediolateral episiotomy has a beneficial effect in prevention of OASI. It was suggested that an accurately given mediolateral episiotomy might have a role in reducing OASI and should not be withheld, especially in nulliparous women.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Verghese et al 2016	AQ (+)	The available evidence in this review suggests that mediolateral episiotomy reduces the risk of OASI in vaginal birth when combining data from nulliparous and multiparous women	RR: 0.67, 0.49-0.92	Based on seven non-randomised studies
		Evidence supports that there is no significant difference between the rate of OASI in nulliparous women who have mediolateral episiotomy compared to those who sustained spontaneous tears	RR: 0.71, 0.44-1.14	Based on five non-randomised studies

Correa et al. 2016

Correa et al. (2016) (QS: LQ (-)) conducted a descriptive review of the literature in order to assess whether the implementation of selective episiotomy protects against severe perineal lacerations, the indications for the procedure, and the best technique to perform it. The

authors suggested that the heterogeneity of the studies published in the literature does not allow the application of a SR on the intended theme.

Twenty-four studies were selected that dealt with the risk of severe perineal lacerations with or without episiotomy, perineal protection techniques, or episiotomy. Thirteen studies evaluated the risk of severe perineal lacerations with and without episiotomy (Revicky et al. 2010; Landy et al. 2011; Aukee et al. 2006; Moini et al. 2009; Eskandar et al. 2009; Raisanen et al. 2014; Fritel et al. 2008; Murphy et al. 2008; Macleod et al. 2008; De Leeuw et al. 2008; Islam et al. 2013; Sulaiman et al. 2013; Hauck et al. 2015). All studies were published between 2005 and 2015.

Out of the 13 studies that evaluated the risk of severe lacerations with and without episiotomy, five demonstrated a protective role of selective episiotomy, and four showed no significant differences between the groups. The authors of the review suggested that three small studies confirmed the finding that episiotomy should be performed selectively and not routinely, and one study showed that midline episiotomy increased the risk of severe lacerations. As for the surgical technique, episiotomies performed with wider angles (> 40°) and earlier in the second stage (before "crowning ") appeared to be more protective.

The authors concluded that selective episiotomy decreases the risk of severe lacerations when compared with non-performance or performance of routine episiotomy. The use of a proper surgical technique is fundamental to obtain better results, especially in relation to the angle of incision, the distance from the vaginal introitus, and the correct timing for performing the procedure. Not performing the episiotomy when indicated or not applying the correct technique may increase the risk of severe perineal lacerations.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Correa et al 2016	LQ (-)	Limited quality evidence suggests that selective episiotomy decreases the risk of severe perineal lacerations when compared to routine episiotomy	RR: 0.67, 0.49-0.91	Based on 13 studies of varying quality

Sagi-Dain et al. 2015

Sagi-Dain et al. (2015) (QS: HQ (++)) undertook a SR and meta-analysis of the existing literature examining the effectiveness of episiotomy in the prevention of advanced perineal tears, and other maternal and neonatal complications, at the time of vacuum birth. Fifteen studies consisting of 350,764 subjects were included in the review (Robinson et al 1999; Parnell et al 2001; Dandolu et al 2005; Youssef et al 2005; Kudish et al 2006; Aukee et al 2006; De Leeuw et al 2008; Mcleod et al 2008; Raisanen et al 2009; Reinbold et al 2012; Rognant et al 2012; Baghurst et al 2012; Gurol-Urganci et al 2013; Jango et al 2013; Ampt et al 2013).

The results of the review suggested that a non-significant relationship was shown between mediolateral episiotomy and OASIS in nulliparous women (OR 0.68, 95% CI 0.43–1.07; six studies), whereas an increased risk was demonstrated in parous women (OR 1.27, 95% CI 1.05–1.53; two reports). A higher risk of OASIS with median episiotomy use was shown in nulliparous (OR 5.11, 95% CI 3.23–8.08; two studies) as well as in parous (OR 89.4, 95% CI 11.8–677.1; one

study) women. Lateral episiotomy was related to lower OASIS risk in nullipara (OR 0.59, 95% CI 0.49–0.70; single paper). Overall, the quality of evidence was rated as low to very low.

The authors concluded that mediolateral and median episiotomy in parous woman may increase the rate of OASIS at vacuum birth, whereas lateral episiotomy in nulliparous women could be associated with a decreased risk of OASIS.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Sagi-Dain et al 2015	HQ (++)	Very low-quality evidence suggests a non-significant relationship between mediolateral episiotomy and OASIS in nulliparous women	OR 0.68, 0.43–1.07	Based on six studies of very low quality
		Very low-quality evidence suggests a higher risk of OASIS with mediolateral episiotomy use in parous women	OR 1.27, 1.05–1.53	Based on two studies of low quality
		Very low-quality evidence suggests a higher risk of OASIS with median episiotomy use in nulliparous women	OR 5.11, 3.23–8.08	Based on two studies of very low quality
		Very low-quality evidence suggests a higher risk of OASIS with median episiotomy use in parous women	OR 89.4, 11.8–677.1	Based on one study of very low quality
		Low-quality evidence suggests a reduced risk of OASIS with lateral episiotomy use in nulliparous women	OR 0.59, 0.49–0.70	Based on one study of low quality
		Very low-quality evidence suggests a non-significant relationship between lateral episiotomy and OASIS in parous women	OR 1.51, 0.91–2.51	Based on one study of low quality

Hartmann et al. 2005

Hartmann et al. (2005) (QS: LQ (-)) conducted a SR of the best evidence available about maternal outcomes of routine vs restrictive use of episiotomy. Twenty-six studies were included in the review of which seven were relevant to this review (Sleep et al. 1984; Harrison et al. 1984; House et al. 1986; Klien et al. 1992; Argentine Episiotomy Trial Collaborative Group 1993; Eltorkey and Nuaim 1994; Dannecker et al. 2014). All seven were RCTs. Six of the seven trials used mediolateral episiotomy.

The trial by Sleep et al. (1984) rated as good quality by the review authors achieved a wide gradient of episiotomy use: 10.2% in the restrictive use group and 51.4% in the routine use group. Third- and fourth degree lacerations were rare (0.5% overall) and did not differ by group. The Argentine study was rated as fair quality and contained 2606 participants. This study documented a 2.4-fold increase in risk of anterior tears among women in the restrictive use group (95% CI, 1.89- 2.94) compared with routine use. Sleep et al. (1984) and Klein et al. (1992) reported more third- and fourth-degree lacerations in the routine use group. The authors suggested that all trials were underpowered to distinguish differences, with a total of 105 rectal injuries among 5001 participants (RR for routine vs restrictive use, 1.13; 95% CI, 0.78- 1.65).

The authors concluded that fair to good evidence from clinical trials suggests that immediate maternal outcomes of routine episiotomy, including severity of perineal laceration, pain, and pain medication use, are not better than those with restrictive use.

Study	SIGN rating	Conclusions	Likelihood	Evidence base

Hartmann et al. 2005	LQ (-)	Conflicting evidence suggests that there is no significant difference between third- and fourth-degree perineal lacerations when comparing routine and restrictive episiotomy use	RR: 1.13, 0.78-1.65	Based on six RCTs

Controlled trials

Two RCTs that were not included in previously reported SRs were identified which investigated the effect of episiotomy on perineal tears.

Amorim et al. 2017

Amorim et al. (2017) (QS: AQ (+)) conducted a RCT to compare maternal and perinatal outcomes in women submitted to a non-episiotomy protocol versus one of selective episiotomy. 115 women were assigned to a non-episiotomy protocol and 122 to a selective episiotomy protocol. All Included women where clinically stable and in active labour with a live, full-term foetus (37 to 41 weeks of pregnancy) in cephalic presentation (vertex position), and with dilatation of 6 to 8 cm.

The trial classified perineal lacerations as first degree (involving the skin and/or vaginal mucosa), second degree (affecting the perineal muscle), third degree (affecting the anal sphincter muscle) and fourth degree (in addition to the sphincter, the rectal mucosa is also affected). Third- and fourth-degree tears were classified as severe perineal damage.

The result of the trial suggested that there was no difference between the two groups with respect to maternal or perinatal outcomes. Of relevance to this review severe perineal trauma occurred in 1.8% of the women in the non-episiotomy group and in 2.5% of those randomised to the selective episiotomy group. No significant difference was seen between the two groups in regards to severe perineal lacerations (RR: 0.85, 0.41-2.76). The authors concluded that a non-episiotomy protocol appears to be safe for mother and child, and highlighted the need to investigate whether there is, in fact, any indication for this procedure.

Study	SIGN rating	Objective	Result	Likelihood
Amorim et al. 2017	AQ (+)	To compare maternal and perinatal outcomes in women submitted to a non-episiotomy protocol versus one of selective episiotomy	No significant difference noted between two groups regarding incidence of third- and fourth-degree tears	RR: 0.85, 95% CI 0.41-2.76

Swift et al. 2014

Swift et al. (2014): (QS: (HQ (++)) conducted a feasibility trial to investigate the use of curved compared with straight scissors to avoid third- and fourth-degree perineal tears. There were 20 women booked for maternity care at the study hospital expecting their first vaginal birth, included in the study. There were 12 women randomly allocated to the use of straight scissors and eight to the curved scissors.

There was one in each group who had a third-degree tear. The OR was 1.57 (95%CI 0.08-29.40). However, as this is a feasibility study and had a very small sample, clinical findings would not be conclusive.

Study	SIGN rating	Objective	Result	Likelihood
Swift et al 2014	HQ (++)	To investigate the use of curved compared with straight scissors to avoid third- and fourth-degree perineal tears	There was 1/12 (8.3%) woman with 3rd degree tear in the straight scissors group and 1/8 (12.5%) with third degree tear in the curved scissors group.	OR 1.57 (95%CI 0.08-29.40)
• This is a feasibility study and clinical findings would not be conclusive				

Cohort Studies

Study	SIGN rating	Objective	Result	Likelihood
Boujenah et al 2019	LQ (-)	To compare the OASIS rate during Operative Vaginal Birth (OVB) according to episiotomy practice.	In nulliparous women the multivariate analysis showed a lower incidence of OASIS with the use of episiotomy whatever the mode of assisted birth Episiotomy was associated with a 72% decreased risk of OASIS in nulliparous women, with the shortest confidence interval of the model	(OR 0.267 IC 0.132-0.541)
• Appears that episiotomy is a modifiable risk factor which can contribute to reduce the risk of OASIS in nulliparous women with operative vaginal birth				
van Bavel et al 2018	LQ (-)	To assess whether the intervention of a mediolateral episiotomy is associated with a lower incidence of OASIS in women undergoing an operative vaginal birth	OASIS following vacuum birth - The incidences of OASIS following vacuum birth in 130,157 primiparous women were 2.5% and 14% in those with and without a mediolateral episiotomy, respectively - The incidences of OASIS following vacuum birth in 29,183 multiparous women were 2.1% and 7.5% in those with and without a mediolateral episiotomy, respectively - A sub analysis including only the higher-grade ruptures (third-degree grades 3b and 3c and fourth-degree tears) showed a similar risk reduction - The incidences of total rupture of the perineum (third-degree grades 3b and 3c and fourth-degree	(adjusted OR 0.14, 95% CI 0.13–0.15) (adjusted OR 0.23, 95% CI 0.21–0.27). (adjusted OR 0.15, 95% CI 0.14–0.16)

			tears) following a vacuum birth in primiparous women were 0.9% and 5.1% in those with and without a mediolateral episiotomy, respectively - The incidences of total rupture of the perineum (third-degree grades 3b and 3c and fourth-degree tears) following a vacuum birth in multiparous women were 0.7% and 2.4% in those with and without a mediolateral episiotomy, respectively OASIS following forceps birth - The incidences of OASIS following a forceps birth in 9,855 primiparous women were 3.4% and 26,7% in those with and without a mediolateral episiotomy, respectively - The incidences of OASIS following a forceps birth in multiparous women were 2.6% and 14.2% in those with and without a mediolateral episiotomy, respectively - Separate analysis of higher-grade ruptures (third-degree grades 3b and 3c and fourth-degree tears) showed comparable risks - The incidences of high-grade OASIS following a forceps birth in primiparous women were 1.2% and 12.1% in those with and without a mediolateral episiotomy, respectively - The incidences of high-grade OASIS following a forceps birth in multiparous women were 1.0% and 5.3% in those with and without a mediolateral episiotomy, respectively - In women undergoing a vacuum birth, the NNT, i.e.	(adjusted OR 0.25, 95% CI 0.20–0.31) (adjusted OR 0.09, 95% CI 0.07–0.11) (adjusted OR 0.13, 95% CI 0.08–0.22) (adjusted OR 0.09, 95% CI 0.06–0.12) (adjusted OR 0.14, 95% CI 0.06–0.30)).

			the number of episiotomies needed to prevent one OASIS (third-degree grades 3a–c and fourth-degree tears) in one woman was 8 in primiparous women and 18 in multiparous women - In women undergoing a forceps birth, the NNT for prevention of OASIS (third-degree grades 3a–c and fourth-degree tears) was 4 in primiparous women and 9 in multiparous women	
• Appears that the use of a mediolateral episiotomy during both vacuum birth and forceps birth is associated with a fivefold to tenfold reduction in the rate of OASIS in primiparous and multiparous women				
Bechard et al 2018	LQ (-)	To evaluate episiotomy technique, in particular suture angles, and any correlation between suture angle and severe perineal tears	The risk of sphincter injury was higher with suture angles <45° The risk of sphincter injury was significantly higher when the suture angle fell outside the 45–60° range The greater the suture angle, the lower the risk of injury (p = 0.01) After multivariate logistic regression and adjustment for clinically relevant factors implicated in sphincter injury, suture angle was no longer a significant risk factor for sphincter injury, although a difference persisted (p = 0.079) Sphincter injury was associated with longer episiotomy, shorter distance from anus, smaller suture angle Suture angle distribution differed significantly (p = 0.049) between women who sustained sphincter injuries and those who did not	OR 5.46, 95%CI [1.11–26.75], p = 0.037). After multivariate analysis, this result was no longer significant (p = 0.079). OR 5.35, 95%CI [1.11–25.85]; p = 0.037) but was unaffected by the other factors Longer episiotomy (4.75 [4–5.25] vs 4 [3–4.625] cm; p = 0.031), shorter distance from the anus (2.5 [2.25–3.25] vs 3.5 [2.625–4] cm; p = 0.023), smaller suture angle (308 [20–41.25] vs 458 [37–50]; p = 0.01) and a greater though not statistically significant difference between the subjective incision angle and the suture angle (308 [23.75–54.75] vs 258 [10–40]; p = 0.162)

• Appears that sphincter injury is associated with longer episiotomy, shorter distance from anus, smaller suture angle				
Yamasato et al 2016	AQ (+)	To examine maternal and neonatal injuries with restricted episiotomy use	The episiotomy rate was 6.7 % overall and 22.9 % in operative vaginal births - Episiotomies, both midline and mediolateral, were associated with increased risks of maternal and neonatal injuries regardless of parity (p<0.0001) - Adjusted-odds' ratios demonstrated a continued association between episiotomy and maternal injuries (third- and fourth-degree tears)	aOR 1.67, 95%CI 1.39–2.05
• Appears that episiotomy is associated with increased third- and fourth-degree lacerations with restricted use, particularly in spontaneous vaginal births				
Rusavy et al 2016	AQ (+)	To compare immediate birth outcome as well as healing, pain, anal incontinence and sexuality in a short-term and a long-term follow up after episiotomy performed before or at crowning in nulliparous women	Significant differences between before crowning and at crowning groups were observed in additional vaginal trauma Difference in obstetric anal sphincter injuries rate did not reach statistical significance	26 (30.2%) vs. 66 (16.3%), respectively, p < 0.001 [0 (0.0%) vs. 7 (1.7%), p = 0.61
• Appears that episiotomy performed at crowning compared to before crowning is not associated with obstetric anal sphincter injuries				
Blondel et al 2016	AQ (+)	To determine the variations in rates of severe perineal tears and episiotomies in 20 European countries	A negative correlation between the rates of episiotomies and severe tears was observed in all births After the exclusion of Cyprus, Germany, Portugal, Poland, Romania and Switzerland, all of which had caesarean section rates higher than 30%	- (rho = 0.66; p = 0.001), instrumental births (rho = 0.67; p = 0.002) and non-instrumental births (rho = 0.72; p < 0.001) - Association remained statistically significant in all vaginal births (rho = 0.55; p = 0.04; n = 14) and in non-instrumental vaginal births (rho = 0.69; p = 0.01; n = 13). It was no longer significant, however, in instrumental vaginal births (rho = 0.48; p = 0.09; n = 14) - Association was statistically significant in all vaginal births (rho = 0.58; p = 0.049; n = 12), in instrumental

			After the exclusion of countries with rates of third- and fourth-degree perineal tears under 1% (Cyprus, Estonia, France, Latvia, Poland, Portugal, Romania and Slovenia)	vaginal births (rho = 0.74; p = 0.01; n = 11) and in non-instrumental vaginal births (rho=0.66; p=0.03; n=11)
• Appears that there is a negative correlation between the rates of episiotomies and severe tears when all births are considered				
Raisanen et al 2013	LQ (-)	To evaluate the changing association between lateral episiotomy and OASIS for women with low and high baseline risk of OASIS	During 2004–2011 total episiotomy rates declined, while OASIS incidences increased among both women with first vaginal births and women with prior vaginal births - An increasingly positive association between episiotomy and OASIS was observed, as episiotomy was used increasingly restrictively	-
• Appears that OASIS incidence increases among both women with first vaginal births and women with prior vaginal births when undergoing lateral episiotomy				
Raisanen et al 2011	AQ (+)	Study aims to assess the impact of hospital episiotomy policy on obstetric and anal sphincter rupture (OASR, n=2448) rates and risks among singleton vaginal births in Finland between 1997 and 2007	In primiparous women, the results of the univariate analysis remained unchanged, and the risk of OASR was 39% lower among the women who gave birth in hospitals in the highest episiotomy quartile	OR 0.61, 95% CI 0.52–0.71
			Among multiparous women, episiotomy increased the risk of OASR 2.4-fold at an individual level, however, the results of the multivariate analysis showed a 45% lower OASR risk in hospitals included in the highest episiotomy quartile	OR 0.55 (0.42–0.72)
• Appears that a high episiotomy rate provided protection from OASR				
Alperin et al 2008	LQ (0)	Study aims to examine whether episiotomy at first vaginal birth increases the risk of spontaneous obstetric laceration in the subsequent birth	Spontaneous second-degree lacerations at the time of second birth occurred in 51.3% of women with history of episiotomy at first birth compared with 26.7% without history of episiotomy	P<0.001
			Severe lacerations (third or fourth degree) occurred in 4.8% of women with history of episiotomy at first birth compared with 1.7% without history of episiotomy	P<0.001
			Prior episiotomy remained a significant risk factor for second degree obstetric lacerations in the second vaginal birth after controlling for confounders	OR 4.47 (3.78 –5.30)
			Prior episiotomy remained a significant risk factor for severe obstetric lacerations in the second vaginal birth after controlling for confounders	OR 5.25 (2.96 –9.32)

• Appears that episiotomy at first vaginal birth increases the risk of spontaneous minor and severe obstetric lacerations in the subsequent birth				
Webb et al 2002	LQ (0)	Study aims to assess the extent of hospital variation in the use of episiotomy and the relationship between hospital episiotomy use and the incidence and risk of perineal trauma among women residing in a large urban area in the United States	Rates of episiotomy were significantly correlated with rates of a third- or fourth-degree perineal laceration	(r = 0.70; p <0.01),
			Rates of episiotomy were significantly correlated with rates of a third- or fourth-degree perineal laceration and with the hospital-specific, adjusted odds ratios for such lacerations)	(r = 0.65; p <0.01
• Appears that the rates of episiotomy were significantly correlated with rates of third- and fourth-degree perineal lacerations				
Martin et al 2001	AQ (+)	Study aims to assess whether women who had a perineal trauma (episiotomy or spontaneous tear of the second degree or higher) at the first birth were at increased risk for spontaneous perineal tears at the next birth, and whether the risk increases with the severity of previous perineal trauma	Having a perineal trauma at the first birth more than tripled the risk of spontaneous perineal tears at the second birth	RR: 3.3 (2.6-4.2)
• Appears that the risk of spontaneous perineal tears at subsequent births increases with the presence and the severity of perineal trauma at the first birth				
Nager et al 2001	AQ (+)	Study aims to determine the clinical factors that contribute to posterior perineal laceration length	None of 35 women without an episiotomy had a recognized anal sphincter disruption and 6 of 27 women with an episiotomy did	P < .001
			A multivariate stepwise linear regression equation revealed that episiotomy adds nearly 3 cm to perineal lacerations	-
			Tear length was highly associated with the degree of tear and the risk of recognized anal sphincter disruption	(R = 0.86, R2 = 0.73)
• Appears that episiotomy is a determinant of perineal laceration length and recognized anal sphincter disruption				
Shorten et al 2000	LQ (0)	Study aims to assess the extent to which variations in episiotomy rates in Australian hospitals are justified by clinical variables and to further explore the relationships between episiotomy, insurance status, perineal trauma and outcomes for babies	There is a significant difference between women who had episiotomy and major perineal trauma compared to women not having episiotomy	X2=24.22, df=1, p<0.01
• Appears that women who have an episiotomy compared to those not having an episiotomy are significantly more likely to sustain a severe perineal trauma				

Episiotomy in Vacuum Assisted Birth

One SR was identified which assessed whether episiotomy affects the risk of perineal trauma.

Systematic Reviews

Lund et al. 2016

Lund et al. (2016) (QS: HQ (++)) undertook a SR and meta-analysis to assess whether mediolateral or lateral episiotomy affects the risk of OASIS in vacuum-assisted birth among primiparous women. The review contained 15 relevant studies to this review. Ten of the relevant studies were cohort studies (Jango et al. 2014; Baghurst and Antoniou 2012; Rognant et al. 2012; Baghestan et al. 2010; De Leeuwe et al. 2007; Dahl and Kjolhede 2006; Rygh et al. 2014; De Vogel et al. 2012; Ampt et al. 2013; Gurol-Urganci et al. 2013) and the final five were case-controls (Schmitz et al. 2014; Hirsch et al. 2014; Räisänen et al. 2009; Räisänen et al. 2012; Parnell et al. 2001).

The meta-analysis showed a significant reduction in the rate of OASIS for primiparous women in vacuum-assisted births with mediolateral or lateral episiotomy compared to births without episiotomy (OR 0.53 (95% CI 0.37–0.77). The NNT was 18.3 (95% CI 17.7–18.9), which means that 19 episiotomies had to be performed in vacuum-assisted births in order to prevent one case of OASIS. Sensitivity analysis, in which one study was removed from the analysis at a time, did not affect the main outcome. A separate analysis of exclusively mediolateral episiotomy in primiparous women showed a significant reduction in the frequency of OASIS (OR 0.53 (95% CI 0.35–0.81) (data not shown). A subgroup analysis of the two studies of exclusively lateral episiotomy yielded an OR of 0.59 (95% CI 0.39–0.90) (data not shown).

The authors concluded that this meta-analysis of more than 320,000 primiparous women delivered by vacuum extraction showed that mediolateral or lateral episiotomy can protect against OASIS.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Lund et al 2016	HQ (++)	The evidence suggests that there is significant reduction in the rate of OASIS for primiparous women in vacuum-assisted births with mediolateral or lateral episiotomy compared to births without episiotomy	OR: 0.53 95% CI 0.37–0.77	10 cohort and five case-control studies
		The evidence suggests that there is a significant reduction in the frequency of OASIS for primiparous women in vacuum-assisted births with exclusively mediolateral episiotomy	OR: 0.53 95% CI 0.35–0.81	Data not shown
		The evidence suggests that there is a significant reduction in the frequency of OASIS for primiparous women in vacuum-assisted births with exclusively lateral episiotomy	OR: 0.59 95% CI 0.39–0.90	Two studies

Foetal Death

One case control study investigated foetal death as a risk factor for perineal tears.

Case Control

Study	SIGN rating	Objective	Result	Likelihood
Basu et al 2014	HQ (++)	Study aims to evaluate any differences in the incidence of perineal trauma in women undergoing vaginal birth following intrauterine foetal death (IUFD) versus live-births	Women with an IUFD had a significantly lower risk of perineal trauma overall	RR: 0.16 (0.12-0.22)
			Women with an IUFD had a significantly lower risk of obstetric anal sphincter injury	RR: 0.12 (0.03-0.50)
• Women delivering vaginally after IUFD have a lower incidence of perineal trauma compared with women delivering a live infant				

Foetal Position

Cohort Studies

No SRs or RCTs have been conducted to investigate the effect of foetal position on perineal tears. Five cohort studies have investigated foetal position as a risk factor for perineal tears.

Study	SIGN rating	Objective		Result
Cheng et al 2006	AQ (+)	To identify maternal and foetal risk factors associated with persistent occiput posterior position at birth, and to examine the association of occiput posterior position with subsequent obstetric outcomes.	Incidence of severe anal sphincter tears in cephalic, singleton births, with occiput posterior position compared with anterior occiput orientation	OR 2.38; 2.03-2.79
• Appears that persistent occiput posterior position was associated with increased rates of third- or fourth-degree perineal lacerations • Appears that epidural use, artificial rupture of the membranes, African-American ethnicity, nulliparity, and birth weight >4000g are associated with persistent OP position at birth, with higher rates of operative births and obstetric complications				

Benavides et al 2005	AQ (+)	The objective of this study was to assess whether occiput posterior position confers an incrementally increased risk for anal sphincter injury above that present with forceps births	Incidence of severe anal sphincter tears in forceps assisted, vaginal birth with occiput posterior position compared with anterior occiput orientation	adj. OR 3.1; 1.6-6.2 OR 2.2; 1.3-3.6
• Within this population of forceps births, an occiput posterior position further increases the risk of third- or fourth-degree lacerations when compared with an occiput anterior position				
Senecal et al 2005	LQ (0)	To evaluate the effect of foetal position on 1) second-stage labour duration and 2) indicators of maternal and neonatal morbidity	Prevalence of severe perineal tears in nulliparas births, occiput anterior (n = 1198), transverse (n = 200) and posterior (n = 210) position delivery	Anterior 8% Transverse 13% Posterior 10%
• Appears that there is higher rates of severe perineal tears in women whose baby was in an occiput posterior and occiput transverse position				
Wu et al 2005	LQ (0)	The purpose of this study was to determine whether an occiput posterior foetal head position increases the risk for anal sphincter injury when compared with an occiput anterior position in vacuum-assisted births	Incidence of severe anal sphincter tears in vacuum-assisted, nulliparas, occiput posterior position delivery	adj. OR 4.0; 1.7-9.6 OR 2.5; 1.4-4.7
• Appears that among vacuum births, an occiput posterior head position confers an incrementally increased risk for anal sphincter injury over an occiput anterior position				
Ponkey et al 2003	AQ (+)	To evaluate the obstetric outcomes associated with persistent occiput posterior position of the foetal head in term labouring women	Prevalence of severe anal sphincter tears in nulliparas (n = 2774) and multiparas (n = 3300), occiput anterior position delivery	Nulliparas 10.6% Multiparas 2.6%
			Prevalence of severe anal sphincter tears in nulliparas (n = 223) and multiparas (n = 137), occiput posterior position delivery	Nulliparas 15.3% Multiparas 5.1%
• Appears that persistent occiput posterior position, whether nulliparas or multiparas delivery, is associated with a significantly higher rate of third and fourth degree tears than occiput anterior position				

Foetal Rotation

No SR has been conducted to investigate the effect of foetal rotation on perineal tears. One RCT was identified that investigated the effect of knowing the foetal spine position in terms of

increasing the success rate of manual rotation and other outcomes. Six cohort studies have investigated foetal rotation as a risk factor for perineal tears.

Controlled trial

Masturzo et al. 2017

Masturzo et al. (2017): (QS: (LQ (-)) conducted a trial to investigate whether sonographic (US) diagnosis of the foetal spine position could increase the success rate of manual rotation of the foetal occiput in second-stage arrest in persistent occiput posterior position. There were 58 nulliparous women, singleton and term pregnancy, with arrest of the second stage of labour and with the foetus in cephalic presentation and occiput posterior position. There were 29 women randomly assigned to the unknown foetal spine position and 29 in the known position as diagnosed with the use of US. Perineal lacerations were defined as first, second, third- and fourth-degree tears.

The sonographic (US) diagnosis of the foetal spine position did not significantly affect the rate of first to third degree perineal lacerations during manual rotation of the foetal occiput (p=>0.05). First degree laceration results were, for unknown position, 3.4% and known position 6.9%. Second-third degree laceration results were, for unknown position, 17.2% and known position, 10.3%.

Study	SIGN rating	Objective		Result
Masturzo et al 2017	LQ (-)	To investigate whether sonographic (US) diagnosis of the foetal spine position could increase the success rate of manual rotation of the foetal occiput in second-stage arrest in persistent occiput posterior position	The sonographic (US) diagnosis of the foetal spine position did not significantly affect the rate of first to third degree perineal lacerations during manual rotation of the foetal occiput - First degree laceration results were, for unknown position, 3.4% and known position 6.9%. Second-third degree laceration results were, for unknown position, 17.2% and known position, 10.3%.	(P=>0.05)

- The sonographic (US) diagnosis of the foetal spine position does not significantly affect the rate of first to third degree perineal lacerations during manual rotation of the foetal occiput

Cohort studies

Study	SIGN rating	Objective		Result
Guerby et al 2018	AQ (+)	To compare the maternal and neonatal outcomes associated with Instrumental Rotation to operative vaginal birth in occiput posterior position with Thierry's spatulas, in the setting of failed manual rotation	Incidence of severe perineal tears in vaginal birth in the occiput posterior position without rotation attempt	adj. OR 9.49; 2.05-44.05

• Appears that there is an increased risk of severe perineal tears in vaginal births in the occiput posterior position when there is no attempt at instrumental rotation (Forceps) following a failed manual rotation attempt				
Tempest et al 2017	LQ (0)	To evaluate the neonatal and maternal outcomes associated with successful operative vaginal births assisted by manual rotation	Prevalence of obstetric anal sphincter injury following manual rotation	6/349 (1.7%)
			Prevalence of obstetric anal sphincter injury following rotational ventouse	1/171 (0.6%)
• Appears that the risk of OASI is similar when successful manual rotations followed by direct traction instruments are compared to traditional methods of operative births				
Bradley et al 2013	AQ (+)	To determine the difference in the rates of severe perineal lacerations between forceps-assisted vaginal births in the occiput-posterior position compared with forceps assisted vaginal births in which the foetal head was rotated to occiput anterior prior to birth	Incidence of severe perineal tears in forceps assisted vaginal birth in the occiput posterior position without rotation	adj. OR 3.67; 1.42-9.47 OR 2.79; 1.25-6.23
• Appears that forceps-assisted vaginal birth after rotation of an occiput-posterior position to an occiput anterior position is associated with less severe maternal perineal trauma than forceps-assisted birth in the occiput-posterior position				
Vidal et al 2013	LQ (0)	To evaluate immediate perineal and neonatal morbidity associated with instrumental rotations performed with Thierry's spatulas for the management of persistent posterior occiput (OP) positions	Prevalence of third- and fourth-degree perineal laceration following instrumental rotation in persistent posterior position vaginal births	Third degree 1/53 (1.9%) Fourth degree 0/53 (0%)
• Instrumental rotation using Thierry's spatulas was not associated with a reduced risk of severe perineal lacerations for the management of persistent occiput posterior births				
Bahl et al 2013	HQ (++)	To compare the maternal and neonatal morbidity associated with alternative instruments used to perform a mid-cavity rotational birth	Incidence of severe perineal tears in nulliparous women who had a mid-cavity rotational, operative vaginal birth. Manual rotation vs rotational vacuum birth	adj. OR 0.85; 0.13-1.89
			Incidence of severe perineal tears in nulliparous women who had a mid-cavity rotational, operative vaginal birth. Manual rotation vs	adj. OR 0.94; 0.39-1.82

			rotational forceps birth	
• Appears that there is no difference in severe perineal tears in nulliparous women who had a mid-cavity rotation, operative vaginal birth (Kielland forceps or vacuum extraction) when compared to manual rotation				
Shaffer et al 2011	AQ (+)	To examine mode of birth and perinatal outcomes in women with occiput posterior (OP) or transverse (OT) position in the second stage of labour with a trial of manual rotation compared to expectant management	Incidence of severe perineal tears in vaginal birth in the occiput posterior position. Manual rotation vs No rotation attempt	adj. OR 0.64; 0.47-0.88
• Appears that when compared with no rotation attempt, a trial of manual rotation with persistent foetal occiput posterior/transverse position is associated with a reduction in the odds of severe perineal tears				

Female Genital Mutilation

One cohort study investigating FGM as risk for perineal tears was identified.

Cohort Study

Study	SIGN rating	Objective		Result
Varol et al 2016	HQ (++)	To examine the impact of FGM on obstetric outcomes for women with FGM who were cared for in a metropolitan Australian hospital with expertise in FGM management	There was a statistically significant higher rate of first- and second-degree perineal tears among women with FGM (esp FGM type III)	-
• Appears that FGM is associated with a higher rate of first- and second-degree tears				

Fundal Pressure

One SR was identified that looked at the effect of fundal pressure (also known as the Kristeller manoeuvre) in relation to perineal tears. Fundal pressure was described as involving application of manual pressure to the uppermost part of the uterus directed towards the birth canal, in an attempt to assist spontaneous vaginal birth. No RCTs that were not included in previously reported SRs were identified. One cohort study was identified that was not included in the SR. The SR was of adequate quality and investigated the effectiveness of fundal pressure during the second stage of labour.

Systematic Reviews

Hofmeyr et al. 2017

Hofmeyr et al. (2017) (QS: HQ (++)) conducted a SR and meta-analysis to determine if fundal pressure is effective in achieving spontaneous vaginal birth and preventing prolonged second stage or the need for operative birth, and to explore maternal and neonatal adverse effects related to fundal pressure. The review contained 5 studies which were of relevance to this review (Acmaz et al 2015; Acanfiora et al 2013; Cox et al 1999; Kang et al 2009; Kim et al 2013).

These five studies consisted of randomised and quasi-randomised controlled trials of fundal pressure (manual or by inflatable belt) versus no fundal pressure in women in the second stage of labour with singleton cephalic presentation.

The included studies reported on a number of different outcomes in relation to the tear type and grade. The review categorised the outcome of interest as soft tissue damage and then subcategorized by the area affected (perineal/vaginal/anal sphincter/uterine).

Only one of the studies (Acmaz et al. 2016) investigated manual fundal pressure. The trial included 295 women. Acmaz et al. 2016 reported that more women who received manual fundal pressure had cervical tears than in the control group (RR 4.90, 1.09-21.98). There was no clear difference in the two groups in relation to vaginal lacerations (RR 1.24, 0.75-2.03). Other types of soft tissue damage (anal, uterine) were not reported.

Four studies (Acanfiora et al 2013; Cox et al 1999; Kang et al 2009; Kim et al 2013) compared fundal pressure by inflatable belt to no fundal pressure. The risk of perineal damage in the two groups was not clearly different (average RR 0.53, 0.20-1.38; 897 women), however, this analysis included results from reported data that ranged from severe perineal trauma in one study (Acanfora et al. 2013) to intact perineum in another (Cox et al. 1999). Acanfora et al. 2013 and Kang et al. 2009 reported cervical tears; there was no difference between the two groups (RR 0.42, 0.06- 2.82; 203 women). Only one of these studies (Cox et al. 1999) reported on anal sphincter soft tissue damage. The authors reported 17 third degree tears in the inflatable belt group compared with just one in the control group (RR 15.69, 2.10-117.02; 500 women).

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Hofmeyr et al. 2017	HQ (++)	Significantly more women who received manual fundal pressure had cervical tears than in the control group who received no fundal pressure	RR: 4.90, 1.09-21.98	Based on one RCT
		Evidence suggests no significant difference between manual fundal pressure and no fundal pressure in relation to vaginal lacerations	RR: 1.24, 0.75-2.03	Based on one RCT
		The available evidence reporting on cervical tears suggests that there is no difference between fundal pressure by inflatable belt and no fundal pressure	RR: 0.42, 0.06-2.82	Based on two RCTs
		Limited evidence suggests that third degree perineal tears were increased in those who received fundal pressure by inflatable belt compared to those who received no fundal pressure	RR: 15.69, 2.10-117.02	Based on one RCT

Cohort studies

Study	SIGN rating	Objective		Result

Furrer et al 2016	AQ (+)	Study aimed to evaluate maternal and foetal outcomes after uterine fundal pressure in spontaneous and assisted vaginal births	Incidence of anal sphincter tears in spontaneous birth with vs without uterine fundal pressure	adj. OR 46.25; 11.78-181.6 OR 1.82; 0.92-3.57
			Incidence of anal sphincter tears in assisted vaginal birth with vs without uterine fundal pressure	adj. OR 0.97; 0.27-3.4 OR 1.04; 0.31-3.52
• Appears that the occurrence of anal sphincter tears is more frequent after the application of uterine fundal pressure in spontaneous births • Appears that there is no significant difference regarding the incidence of anal sphincter tears in assisted vaginal births when comparing birth with vs without uterine fundal pressure				

Gestational age

Four cohort studies that looked at gestational age as a risk for perineal tears were identified. No SRs or RCTs were found.

Cohort Studies

Study	SIGN rating	Objective		Result
Greve et al 2011	AQ (+)	To evaluate pregnancy outcome after spontaneous labour by day of gestation between 40+0 and 41+6 weeks of gestation	Rates of third- or fourth-degree perineal lacerations did not increase by day of gestation	P=0.27
• Appears that spontaneous labour at 40-42 weeks of gestation does not increase rates of third- and fourth-degree lacerations				
Caughey et al 2007	AQ (+)	To estimate when rates of maternal pregnancy complications increase beyond 37 weeks of gestation	Rates of 3rd- or 4th-degree perineal laceration increased at 40 weeks as compared to 39 weeks of gestation	OR 1.15, 95% CI 1.06, 1.24 P < .001
• Appears that birth at 40 weeks of gestation and beyond increased the risk for third and fourth-degree perineal laceration				
Caughey et al 2006	AQ (+)	To determine when rates of maternal pregnancy complications increase for low-risk nulliparous and multiparous women at term	Rates of third- or fourth-degree perineal lacerations increased at ≥40 weeks of gestation (P<0.001)	40 weeks (OR 1.17, 95%CI 1.04-1.32) 41 weeks (OR 1.26, 95%CI 1.10-1.44) 42 weeks (OR 1.23, 95%CI 1.03-1.47)
• Appears that birth at 40 weeks of gestation and beyond increased the risk for third and fourth-degree perineal laceration among low-risk nulliparous and multiparous women				

Nicholson et al 2006	LQ (0)	To estimate the gestational age ranges that result in optimal birth outcomes for each of four risk-defined groups	Rate of major perineal trauma significantly increased when gestational age at birth was after 39 weeks compared to those delivered before 39 weeks	RR: 1.93 (P<0.001)
• Appears that birth after 39 weeks of gestation increased the risk for major perineal trauma				

Hands on versus hands off (or poised)

Two SRs were identified that reviewed whether hands on vs hands off (hands poised) prevent or reduce the likelihood of perineal tears. Both SRs are of adequate quality. No RCTs or cohort studies were identified that were not included in the SRs.

Systematic Reviews

Bulchandani et al. 2015

Bulchandani et al. (2015) (QS: AQ (+)) conducted a SR and meta-analysis regarding the effect of routine 'hands on'/manual perineal support during childbirth compared to ad hoc/no perineal support ('hands off/poised'), on the risk and degree of perineal trauma. The review contained 12 studies which were of relevance to this review (De Costa et al 2006; Foroughhipour et al 2011; Meyerhofer et al 2002; McCandlish et al 1998; Fahami et al 2012; Alders et al 1996; Murphy et al 1998; Pirhonen et al 1998; Hals et al 2010; Laine et al 2012; Samuelsson et al 2000; Smith et al 2013). The 12 studies consisted of five RCTs and seven non-randomised trials which were compared separately within the meta-analysis.

The risk of an OASIS in 'hands on' versus 'hands off' procedures was analysed in three RCTs which included 6647 women and three non-randomised trials which included 74,744 women. Meta-analysis results of the RCTs did not demonstrate a statistically significant protective effect of manual perineal support on the risk of OASIS (RR: 1.03, 0.32–3.36). However, the non-randomised trials showed a significant reduction in the risk of OASIS with routine manual perineal support (RR: 0.45, 0.40–0.50).

Five of the RCTs which involved 6818 women considered the effect of 'hands on' versus 'hands off' procedures on the risk of first- and second-degree tears. Meta-analysis of the five RCTs suggested no significant difference between the techniques (RR 1.00, 0.90–1.11).

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Bulchandani et al 2015	AQ (+)	Evidence suggests conflicting results for the protective effect of routine manual perineal support (hands on policy) on the risk of OASIS	RCT RR: 1.03, 0.32–3.36 Non-randomised trials RR: 0.45, 0.40–0.50	Based on three RCTs and three non-randomised trials

		Manual perineal support (hands on policy) had no statistically significant effect on the risk of first- and second-degree tears when compared to hands of procedures	RR: 1.00, 0.90–1.11	Based on five RCTs

Petrocnik et al. 2015

Petrocnik et al. (2015) (QS: AQ (+)) completed a modified systematic literature review that compared the hands-on and hands-poised techniques of perineal management during the second stage of labour. The review contained five relevant studies (Da Costa et al 2006; Foroughhipour et al 2011; Meyerhofer et al 2002; Fahami et al 2012; Smith et al 2013). Four of these studies were included in the review by Bulchandani et al. 2015 (Da Costa et al 2006; Foroughhipour et al 2011; Meyerhofer et al 2002; Fahami et al 2012). The studies consisted of two RCTs, one Quasi-experimental clinical trial, one prospective randomized multicentre study and one prospective observational study.

The five included studies outlined the importance of both techniques. The study by Da Costa et al. (2006) reported that perineal lacerations were common and similar in both, hands-on and hands-poised groups. Fahamietal et al. (2012) outlined significantly higher perineal tears in the Ritgen's manoeuvre group (p=0.04). Foroughipouretal et al. (2011) did not find any significant difference between the two groups. Mayerhoferetal et al. (2002) reported similar rates of perineal trauma in both groups, with the exception of third-degree tears, which were significantly higher in the hands-on group (p=0.035). Smith et al 2013 concluded that the hands-poised technique was associated with a significantly reduced risk of obstetric anal sphincter injuries.

The authors of the review suggested that the hands-poised technique appeared to cause less perineal trauma. It was concluded that the evidence suggests that the hands-poised technique is a safe and recommended technique for perineal management. However, they mentioned that until there is conclusive evidence, the choice of the hands-on or hands-poised technique should ultimately be determined by the clinical judgment of the individual midwife at the time of birth.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Petrocnik et al 2015	AQ (+)	Evidence suggests that the hands-poised technique appears to cause less perineal trauma than hands-on techniques during the second stage of labour. However, the available evidence in this review was insufficient to draw conclusions.	N/A	Based on two RCTs, one Quasi-randomised trial, one randomised multicentre study and one prospective cohort study

Health Professionals

Two SRs explored the role of health professionals or the health professionals' setting in the risk of perineal tears. Fifteen cohort studies were also identified that were not reported in the two SRs.

Systematic Reviews

Sandell et al. 2016

Sandell et al. 2016 ((QS: HQ (++)) undertook a SR on the evidence related to midwife-led continuity models versus other models of care (including obstetrician-provided care, family-doctor provided care and shared models of care) for childbearing women. The review focussed on RCTs and identified ten relevant studies that focussed on perineal laceration requiring suturing (Begley 2011; Biro 2000; Kenny 1994; MacVicar 1993; McLachlan 2012; North Stafford 2000; Rowley 1995; Tracy 2013; Turnbull 1996; Waldenstrom 2001).

The authors identified that there were no differences between groups for foetal loss equal to/after 24 weeks and neonatal death, induction of labour, antenatal hospitalisation, antepartum haemorrhage, augmentation/artificial oxytocin during labour, opiate analgesia, perineal laceration requiring suturing, postpartum haemorrhage, breastfeeding initiation, low birthweight infant, five-minute Apgar score less than or equal to seven, neonatal convulsions, admission of infant to special care or neonatal intensive care unit(s) or in mean length of neonatal hospital stay (days).

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Sandell et al 2016	HQ (++)	There were no statistically significant differences between midwife-led continuity care versus other models of care such as obstetrician-provided care, family-doctor provided care and shared models of care, for perineal laceration requiring suturing	average RR 1.02, 95% CI 0.96 to 1.10	Ten trials

Johantgen et al. 2012

Johantgen et al. 2012 ((QS: HQ (++)) undertook a SR on the evidence related to the labour and delivery care provided by certified nurse-midwives (CNMs) and physicians (MD) and included all study design types. The review identified one RCT (Chambliss et al. 1992) and four cohort studies (Hueston & Rudy 1993; Low et al. 2000; Oakley et al. 1996; Robinson et al. 2000) which explored the risk of severe (third and fourth) degree tears.

The authors concluded that differences in practice between certified nurse-midwives and physicians were well documented, particularly in the use of technology, and the findings provided evidence that care by certified nurse-midwives is safe and effective. The four measures related to the process of birth have similar findings that favour the certified nurse-midwives in the use of fewer caesarean births, operative vaginal births (forceps or vacuum), and episiotomy; and more vaginal births after caesarean birth. All five studies reporting third- or fourth-degree perineal lacerations favoured the certified nurse-midwives, including the one RCT.

However, the majority of studies were observational, and it was not always clear how women were selected for care by certified nurse-midwives versus physicians. Women having a midwife-attended birth by definition have, generally, lower risk for poor outcomes.

Study	SIGN rating	Conclusions	Likelihood	Evidence base

Johantgen et al 2012	HQ (++)	All five studies reporting third- or fourth-degree perineal lacerations favoured the certified nurse midwives versus physicians	Not reported	Five trials

Cohort studies

Study	SIGN rating	Objective		Result
Sentilhes et al 2019	AQ (+)	To determine whether the maternal or neonatal outcome after an attempted operative vaginal birth by residents under supervision is poorer than after such births managed by attending obstetricians	There was no difference in third- or fourth-degree perineal tear in the management of attempted operative vaginal births by residents under the supervision of attending obstetricians, compared with by the attending obstetricians themselves	P=1.00
• Appears that the management of attempted operative vaginal births by residents under the supervision of attending obstetricians, compared with by the attending obstetricians themselves, is not associated with third- or fourth-degree perineal tears				
Bergendahl et al 2019	AQ (+)	To investigate risk factors for OASIS in vacuum extraction in nulliparous women, and specifically to assess the association between operator-related factors and the prevalence of OASIS	The adjusted risk of OASIS in nulliparous women was five times higher in vacuum extractions performed by residents compared with those performed by obstetricians	aOR: 5.13 (95% CI: 2.20-11.95)
			Vacuum extractions performed by gynaecologists did not carry an increased risk of obstetric anal sphincter injury	aOR:1.84 (95% CI: 0.72-4.70)
			Experience in years of training, rather than frequency of the procedure, seemed to have the highest impact on reducing obstetric anal sphincter injury in vacuum	-

			extractions, which indicates a need for increased training and supervision	
• Appears that there is an increased risk of tears with vacuum birth with residents compared to obstetricians				
Yee et al 2018	AQ (+)	To estimate whether there are differences in obstetric interventions or outcomes by the gender of the delivering physician	No significant difference between by physician gender regarding 3rd or 4th degree perineal lacerations	AOR: 0.98 95%CI 0.68 - 1.43
• Appears that physician gender is not associated with 3rd or 4th degree perineal lacerations				
Edqvist et al 2018	AQ (+)	To describe methods used by midwives during the second stage of labour and to assess potential associations with perineal trauma	The most common techniques used during the second stage were directed pushing (57.1%), digital stretching of the vagina (levator pressure) (29.8%), and manual stretching of the perineum (21.9%)	-
			None of the methods used by the midwives were associated with second-degree tears	Directed pushing = OR 1.07 (0.73–1.57) The toweltrick = OR 1.58 (0.92–2.72) Levator pressure= OR 1.18 (0.77–1.80) Pressure applied at the spinae ischiadica = OR 0.99 (0.42–2.31) Fundal pressure= OR 3.78 (0.50–29.86) Manipulation of the symphysis bone = OR 0.82 (0.43–1.57) Digital stretching of the perineum= OR 0.88 (0.56–1.38)
			None of the methods used by the midwives were associated with severe perineal trauma	Directed pushing = OR 0.96 (0.43–2.15) The toweltrick = OR 0.60 (0.18–2.03) Levator pressure= OR 1.11 (0.47–2.62)

				Pressure applied at the spinae ischiadica = NA Fundal pressure= NA Manipulation of the symphysis bone = OR 2.06 (0.68–6.19) Digital stretching of the perineum= OR 0.30 (0.07–1.30)
• Appears that methods used by midwives during the second stage of labour are not associated with second-degree tears or severe perineal trauma				
Knight et al 2016	AQ (+)	To examine whether rates of obstetric intervention and outcome change “out-of-hours,” i.e., when consultants are not providing dedicated, on-site labour ward cover	There was some evidence that the severe perineal tear rate was reduced in out-of-hours vaginal births	3.3%versus 3.6% adj. OR 0.92; 95%CI 0.85 to 1.00
• Appears that out-of-hours vaginal births by consultants seem to decrease the rate of severe perineal tears				
Aiken et al 2016	AQ (+)	Examine whether consultants currently perform fewer births during weekends versus weekdays, and whether adverse outcomes increase during weekends	There is no significant difference in adverse outcomes such as severe maternal perineal trauma during periods of the weekend when consultants are not routinely present compared to equivalent periods during weekdays	P=0.71
• Appears that weekend births are not associated with severe maternal perineal trauma				
Gossett et al 2016	AQ (+)	To evaluate the association of a forceps simulation training curriculum for obstetrics residents on rates of severe perineal lacerations after forceps births	There was a 22% reduction in severe perineal laceration among women delivered by residents who had completed forceps simulation training compared with women delivered by residents who had not	OR: 0.78; P5.005
			After adjusting for known maternal and birth risk factors for perineal laceration, the magnitude of the reduction increased to 26%	-

• Appears that forceps simulation curriculum for obstetrics residents is associated with a reduction in severe perineal lacerations				
Monk et al 2014	AQ (+)	To compare maternal and neonatal birth outcomes and morbidities associated with the intention to give birth in two freestanding midwifery units and two tertiary-level maternity units in New South Wales, Australia	No significant difference between the free-standing units compared with the tertiary units in terms of perineal trauma (including episiotomy extending to third- or fourth-degree tear)	1st/2nd degree tear Adj OR 1.15 95%CI 0.93-1.42, p=0.210 3rd/4th degree tear Adj OR 0.90 95%CI 0.56-1.45, p=0.671
• Appears that there is no difference in minor and severe perineal tears between women giving birth in freestanding midwifery units compared to tertiary-level maternity units				
Butler et al 2014	AQ (+)	To evaluate maternal and neonatal outcomes associated with operative vaginal births performed by day and at night	The incidence of anal sphincter tears was similar by day and at night	Adj OR: 1.34 95%CI 0.70-2.55
• Appears that the time of the day was not associated with anal sphincter tears				
Barber et al 2011	LQ (0)	To estimate whether a night-float call schedule for attending obstetricians is associated with different labour management or obstetric outcomes compared with a traditional call schedule	Change to a night-float call schedule was associated with fewer observed third-degree and fourth-degree lacerations	10.3% to 3.3%, P=0.045
• Appears that a night-float call schedule is associated with reduced third-degree and fourth-degree lacerations				
Raisanen et al 2010	AQ (+)	To assess whether human factors, workload and staffing at night, at weekends and during holidays has an effect on the increasing OASR rates among all singleton vaginal births having occurred between 1997 and 2007 in Finland	The risk of OASR was 11% lower at night and 15% lower in July - the main holiday month	Night, p=0.01 July, p=0.02
• Appears that night time births and holiday month (July) births are associated with lower OASR rates				
Browne et al 2010	AQ (+)	To determine if there is a difference in rates of perineal injury sustained by nulliparous women attended by obstetricians compared with certified nurse-midwives at a US community hospital	There was a significant difference between obstetrician-attended births versus certified nurse-midwives-attended births for a spontaneous minor perineal laceration versus intact perineum	OR: 1.82; 95% CI, 1.33–2.48
			There was a significant difference between obstetrician-attended births versus certified nurse-midwives-attended births	OR: 2.29; 95% CI, 1.13–4.66

			for a spontaneous major laceration versus intact perineum	
• Appears that certified nurse-midwives attended births are associated with lower perineal injuries (minor and major lacerations)				
Sze et al 2008	LQ (0)	To identify risk factors that account for the difference in anal sphincter tears among midwife, private obstetrician, and resident births	Private obstetricians and residents had higher rates of anal sphincter tear during vaginal birth than midwives	Private obstetricians OR: 1.81, 95% CI: 1.27–2.56 Residents OR: 1.60, 95% CI: 1.20–2.15
• Appears that private obstetrician and resident births are associated with higher anal sphincter tear rates than midwives' births				
Abenhaim et al 2007	AQ (+)	To examine the role of specialty training on the management of vaginal births (obstetrician vs family physician)	There were more women managed by family physicians who sustained a perineal injury	OR 1.51; 95% CI 1.36–1.68
			There were no differences in the incidence of third- and fourth-degree tears	OR 0.84; 95% CI 0.61-1.15
• Appears that family physicians were more likely to have women who sustained a perineal injury when compared to obstetricians • Appears that the management of vaginal births by obstetrician compared with family physician do not lead to any differences in third- and fourth-degree tears				
Myles et al 2003	LQ (0)	To estimate whether variations in intrapartum management and complications exist with regard to the time of delivery within the academic year	More perineal trauma was noted in the fourth quarter (first 3.3%, second 4.5%, third 3.7%, fourth 5.5%	$P < .037$
• Appears that the time of delivery in the year (fourth quarter) was associated with more perineal trauma				

Hyaluronidase

Systematic Reviews

One SR was identified by the search which investigated the effect of Hyaluronidase injection on perineal trauma.

Zhou et al. 2014

Zhou et al 2014 ((QS: HQ (++)) undertook a SR/MA on the evidence related to the effectiveness and safety of perineal Hyaluronidase injection for reducing spontaneous perineal trauma, episiotomy and perineal pain in vaginal births. The review focused on published and unpublished randomised and quasi-randomised controlled trials comparing perineal Hyaluronidase injection with placebo injection or no intervention in vaginal births. They identified four relevant RCTs (n= 595 women) (Chatfield et al 1996; Colacioppo et al 2011; O'Leary et al 1965; Scarabotto et al 2008) that reviewed the risk of first, second, third- and fourth-degree tears.

The authors concluded that there was no clear evidence that Hyaluronidase injection lowered the incidence of first and second degree and more severe (third and fourth degree) perineal tears when compared with placebo injection, control or no intervention

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Zhou et al 2014	HQ (++)	Hyaluronidase injection versus control - Data from four trials involving 599 women suggested there was no clear evidence of a reduction in first and second-degree perineal lacerations and third- and fourth-degree perineal lacerations	First and second-degree perineal lacerations (RR 0.71, 95% CI 0.38 to 1.33) and third- and fourth-degree perineal lacerations (RR 0.12, 95% CI 0.01 to 2.13)	Four trials
		Hyaluronidase injection versus placebo injection - Data from two trials involving 283 women indicated that there was no clear evidence of a reduction in the incidence of first- and second-degree perineal lacerations and third- and fourth-degree perineal lacerations with perineal Hyaluronidase injection	First and second-degree perineal lacerations (RR 1.08, 95% CI 0.83 to 1.40) and third- and fourth-degree perineal lacerations (RR 0.12, 95% CI 0.01 to 2.13)	Two trials
		Hyaluronidase injection versus no intervention - Data from three trials involving 373 women suggested that perineal Hyaluronidase injection during second stage of labour had no clear effect on in the incidence of first- and second-degree perineal lacerations	First and second-degree perineal lacerations (RR 0.58, 95% CI 0.31 to 1.10)	Three trials

Intervention Programs

One high quality SR was identified which investigated the Finnish intervention program and its effect on OASIS. There were also two controlled trials found which were not included in the SR. These trials investigated the effect of different interventional programs to prevent perineal trauma or lacerations. The studies varied in methodological quality. One study was high quality (Levett et al. 2016) and one (Hensel et al. 2016) was low.

Systematic Review

Poulsen et al. 2015

Poulsen et al. 2015 (QS: (HQ ++)) reviewed the evidence regarding the Finnish intervention designed to prevent obstetric anal sphincter injuries. The Finnish intervention is a package of care from Norway. It consists of: (1) good communication between the accoucheur and the delivering woman, (2) the 'Finnish manoeuvre', (3) use of a birth position that allows visual examination of the perineum during the last minutes of delivery, and (4) mediolateral episiotomy on indication. The review found seven studies (Pirhonen et al 1998; Laine et al 2008; Laine et al 2009; Hals et al 2010; Laine et al 2012; Laine et al 2013; Stedenfeldt et al 2013).

The authors concluded that the Finnish intervention led to a reduction in OASIS, based on low level evidence. Higher level studies need to be conducted before the intervention can be recommended in the clinical settings.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Poulsen et al 2015	HQ ++	A reduction in OASIS has been attributed to the Finnish intervention in seven observational studies, all with a low level of evidence. All studies found a reduction in OASIS after the introduction of the Finnish intervention for all vaginal births when compared to periods or settings in which it was not routinely used	-	Seven studies (Three register studies, four before and after studies)

Controlled trials

Levett et al. 2016

Levett et al. (2016): (QS: (HQ (++)) conducted a trial to investigate the effect of complementary therapies for labour and birth. There were 176 women in 24 to 34 weeks' gestation, singleton pregnancy with a cephalic presentation, low risk (no pre-existing medical complications or existing obstetric complications), were first-time mothers (nulliparous) and had knowledge of sufficient English to participate in a course, included in the study. Eighty-nine women were included in the complementary therapies group and 87 in the control group. The complementary therapies group participated in an integrative medicine education programme which consisted of a two-day course and complementary therapies labour and birth protocol. There were tools used such as visualisation, yoga postures, breathing techniques, massage, acupressure and facilitated partner support. Usual care consisted of the hospital-based antenatal education course routinely available. Topics included are pregnancy changes, exercise and back care during pregnancy, signs of labour, unexpected outcomes in labour and birth, pharmacological pain management, managing labour and birth, newborn care and breast feeding, parenthood, and baby's first weeks. Perineal trauma was described as first, second, third- or fourth-degree tears.

There was no significant difference in the two groups in terms of third- or fourth-degree tears (RR: 0.94 95% CI, 0.57 to 1.55, p=0.85).

Authors concluded that the complementary therapies for labour and birth significantly reduced outcomes such as epidural use and caesarean section but not third- or fourth-degree tears.

Study	SIGN rating	Objective		Result
Levett et al 2016	HQ (++)	To investigate the effect of complementary therapies versus usual antenatal care for labour and birth	There was no significant difference in the two groups in terms of third- or fourth-degree tears	RR: 0.94 95% CI 0.57 to 1.55 p=0.85
• Complementary therapies for labour and birth do not reduce third- or fourth-degree tears				

Hensel et al. 2016

Hensel et al. (2016): (QS: (LQ (-)) conducted a trial to evaluate the safety of an Osteopathic Manipulative Treatment (OMT) protocol applied during the third trimester of pregnancy by

analyzing incidence of high-risk status and labour and birth outcomes. There were 380 women, aged 18-24 years, included in the study. There were 129 women randomly allocated to the usual care with OMT group, 129 in the usual care only (UCO) and 122 in the placebo ultrasound treatment (PUT). The OMT protocol included the following: seated forward-leaning thoracic spine articulator; supine cervical soft tissue myofascial release (MFR), occipitoatlantal decompression, thoracic inlet MFR, lateral recumbent scapulothoracic MFR, lumbosacral soft tissue, abdominal diaphragm MFR, pelvic diaphragm MFR, sacroiliac articulation, frog-leg sacral release, pubic symphysis decompression, and compression of the fourth ventricle. Perineal lacerations were noted in the study, but no specific grades reported.

There was no difference in the incidence of perineal laceration in all three groups. The OMT protocol did not increase risk for lacerations (p=0.487).

Authors concluded that the usual care with OMT protocol given during the third trimester of pregnancy is safe with regards to labour and birth outcomes.

Study	SIGN rating	Objective		Result
Hensel et al 2016	LQ (-)	To evaluate the safety of an Osteopathic Manipulative Treatment protocol applied during the third trimester of pregnancy by analysing incidence of high-risk status and labour and birth outcomes	The Osteopathic Manipulative Treatment protocol did not increase the incidence of perineal laceration compared with participants in the other two groups	p=0.487

- The usual care with Osteopathic Manipulative Treatment protocol given during the third trimester of pregnancy did not increase the risk of perineal lacerations when compared to usual care only or placebo ultrasound treatment

Macrosomia

Cohort Studies

One cohort study that investigated macrosomia in utero as a risk for perineal tears was identified.

Study	SIGN rating	Objective	Result	Likelihood
Vendittelli et al 2012	AQ (+)	To determine whether prenatal identification of macrosomia (>4000 g) reduces neonatal complications and maternal perineal lesions during birth	Perineal lesions were observed at a higher rate in the macrosomia in utero group than in the nonexposed group	P = 0.02
			First- and second-degree lacerations were slightly less frequent in the macrosomia group	21.4% vs. 25.4% P= 0.02
			Third- and fourth-degree lacerations slightly more	1.7% vs. 0.9%

			frequent in the macrosomia group	P= 0.02
• Appears that macrosomia in utero leads to a higher rate of third- and fourth-degree lacerations and lower rate of first- and second-degree lacerations				

Manoeuvres for Shoulder Delivery

One controlled trial was found that investigated the effect of shoulder manoeuvres during vaginal birth in women having their first vaginal birth in terms of incidence and degree of perineal trauma. Two cohort studies that investigated manoeuvres for shoulder delivery as a risk for perineal tears were also identified.

Controlled Trial

Aabakke et al. 2016

Aabakke et al. (2016): (QS: (HQ (++)) conducted a trial to investigate the effect of primary delivery of the anterior shoulder compared with primary delivery of the posterior shoulder during vaginal birth in women having their first vaginal birth on the incidence and degree of perineal trauma. There were 650 nulliparous women and women with a previous caesarean birth having their first vaginal birth in whom a vaginal birth of a foetus in the cephalic presentation was planned, included in the study. There were 325 women randomly allocated to the primary birth of the anterior shoulder and 325 in the primary birth of the posterior shoulder. Perineal tears were categorised into first, second, third- and fourth-degree tears.

There was no difference in the degree of perineal trauma caused by primary birth of the anterior shoulder compared with the posterior shoulder at vaginal birth (OR: 1.13, 95% CI 0.628-2.032, p=0.691) and in the incidence of OASIS (OR: 0.799, 95% CI 0.373-1.712, p=0.602)

Results suggest that both manoeuvres can be used at vaginal birth.

Study	SIGN rating	Objective		Result
Aabakke et al 2016	HQ (++)	To investigate the effect of primary birth of the anterior shoulder compared with primary birth of the posterior shoulder during vaginal birth in women having their first vaginal birth on the incidence and degree of perineal trauma	There was no difference in the degree of perineal trauma caused by primary birth of the anterior shoulder compared with the posterior shoulder at vaginal birth	OR: 1.13,95% CI 0.628-2.032, p=0.691
			There was no difference in the incidence of OASIS	OR: 0.799, 95% CI 0.373-1.712, p=0.602
• During vaginal birth in these women no difference was found in the incidence of OASIS and degree of perineal trauma caused by primary birth of the anterior shoulder compared with primary birth of the posterior shoulder				

Cohort Studies

Study	SIGN rating	Objective		Result

Hulot et al 2019	LQ (0)	To evaluate the impact of active birth of the anterior arm with Couder's Manoeuvre during vacuum-assisted vaginal birth on perineal tears among nulliparous women	There was a significant decrease in the rate of second-degree perineal tears between the two cohorts of women	42.4 versus 15% p<.001
			There was a significant increase in the rate of intact perineum between the two cohorts of women	34.1 versus 54.7% p<.001
			There was no influence of Couder's Manoeuvre on the rate of obstetrical anal sphincter injury between the two cohorts of women	3.9 versus 2.6% p=0.44
• Appears that Couder's Manoeuvre decreases the rate of second-degree perineal tears and has a protective effect on the perineum • Appears that Couder's Manoeuvre does not influence the rate of obstetrical anal sphincter injuries.				
Mottet et al 2017	AQ (+)	To evaluate the feasibility of active birth of the anterior arm (Couder's Manoeuvre) during spontaneous birth in primiparous women	There was a significant increase in first-degree tears	P=0.03
			There was a significant reduction in the number of second-degree perineal tears in the women exposed to Couder's manoeuvre	P= < 0.001
• Appears that Couder's Manoeuvre increases first-degree tears but decreases the rate of second-degree perineal tears				

Metformin

One SR was identified by the search which investigated the use of Metformin for women who are overweight or obese during pregnancy and its effect on perineal tears.

Systematic Review

Dodd et al. 2018

Dodd et al. 2018 ((QS: HQ (++)) undertook a SR/MA on the evidence related to the use of Metformin for women who are overweight or obese during pregnancy for improving maternal and infant outcomes including third- and fourth-degree tears. The review included all studies but identified only one RCT relevant to perineal tears (Syngelaki 2016) involving 397 subjects.

The authors concluded that there were no important differences identified between Metformin and placebo for maternal secondary outcomes, including caesarean birth, birth before 37 weeks of pregnancy, shoulder dystocia, perineal tear, or postpartum haemorrhage.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Dodd et al 2018	HQ (++)	There were similar rates of third- or fourth-degree perineal tears for women who received metformin (2/202) or placebo (1/195)	RR 1.93, 95% CI 0.18 to 21.12.	One trial 397 subjects

Multiple Risk Factors

Four systematic reviews and fifty-one cohort studies investigated the effect of multiple risk factors on the risk of perineal tears.

Systematic Reviews

Aasheim et al. 2017

Aasheim et al. (2017) (QS: HQ (++)) conducted a SR to assess the effect of perineal techniques during the second stage of labour on the incidence and morbidity associated with perineal trauma. Multiple risk factors for perineal trauma were assessed including Hands off vs hands on, Perineal massage, Warm compress, Ritgen's manoeuvre, Primary birth of posterior shoulder and Perineal protection. Eighteen relevant published and unpublished randomised and quasi-randomised controlled trials were included in the review (De Costa et al. 2006; Foroughipour et al. 2011; Mayerhofer et al. 2002; McCandlish et al. 1998; Harlev et al. 2013; Rezaei et al. 2014; Albers et al. 2005; Dahlen et al. 2007; Sohrabi et al. 2012; Terre-Rull et al. 2014; Attarha et al. 2009; Fahami et al. 2012; Galledar et al. 2010; Geranmayeh et al. 2012; Stamp et al. 2001; Jönsson et al. 2008; Aabakke et al. 2016; Lavesson et al. 2014). These trials were at moderate to high risk of bias; none had adequate blinding, and most were unclear for both allocation concealment and incomplete outcome data.

Hands off (or poised) compared to hands on

Hands on or hands off the perineum made no clear difference in first-degree perineal tears (average RR 1.32, 95% CI 0.99 to 1.77, two studies, 700 women; low-quality evidence), second-degree tears (average RR 0.77, 95% CI 0.47 to 1.28, two studies, 700 women; low-quality evidence), or third- or fourth-degree tears (average RR 0.68, 95% CI 0.21 to 2.26, five studies, Tau^2 0.92, I^2 72%, 7317 women; very low-quality evidence). Substantial heterogeneity for third- or fourth-degree tears means these data should be interpreted with caution.

Warm compresses versus control (hands off or no warm compress)

A warm compress did not have any clear effect on perineal trauma requiring suturing (average RR 1.14, 95% CI 0.79 to 1.66; 76 women; one study; very low-quality evidence), second-degree tears (average RR 0.95, 95% CI 0.58 to 1.56; 274 women; two studies; very low-quality evidence). It is uncertain whether warm compress increases or reduces the incidence of first-degree tears (average RR 1.19, 95% CI 0.38 to 3.79; 274 women; two studies; I^2 88%; very low-quality evidence. Fewer third- or fourth-degree perineal tears were reported in the warm-

compress group (average RR 0.46, 95% CI 0.27 to 0.79; 1799 women; four studies; moderate-quality evidence).

Massage versus control (hands off or routine care)

This group experienced fewer third- or fourth-degree tears (average RR 0.49, 95% CI 0.25 to 0.94, five studies, 2477 women; moderate-quality evidence). There were no clear differences between groups for perineal trauma requiring suturing (average RR 1.10, 95% CI 0.75 to 1.61, one study, 76 women; very low-quality evidence), first-degree tears (average RR 1.55, 95% CI 0.79 to 3.05, five studies, Tau^2 0.47, I^2 85%, 537 women; very low-quality evidence), or second-degree tears (average RR 1.08, 95% CI 0.55 to 2.12, five studies, Tau^2 0.32, I^2 62%, 537 women; very low-quality evidence). Heterogeneity was high for second-degree tears; therefore, this data should be interpreted with caution.

Ritgen's manoeuvre versus standard care

One study (66 women) found that women receiving Ritgen's manoeuvre were less likely to have a first-degree tear (RR 0.32, 95% CI 0.14 to 0.69; very low-quality evidence) and more likely to have a second-degree tear (RR 3.25, 95% CI 1.73 to 6.09; very low-quality evidence). One larger study reported that Ritgen's manoeuvre did not have an effect on incidence of third- or fourth-degree tears (RR 1.24, 95% CI 0.78 to 1.96,1423 women; low-quality evidence).

Other comparisons:

The delivery of posterior versus anterior shoulder first, use of a perineal protection device, different oils/wax, and cold compresses did not show any effects on perineal outcomes.

Primary delivery of posterior versus anterior shoulder

When measuring the incidence of third-degree or fourth-degree perineal tear, an outcome reported in one study (Aabakke 2016), there was no clear difference between the groups (RR 0.81, 95% CI 0.39 to 1.67, one study, 543 women).

Perineal protection device versus perineal support

When measuring the incidence of first- and second-degree perineal tears, there was no clear difference between the groups (RR 1.00, 95% CI 0.98 to 1.02, one study, 1098 women). When measuring the incidence of third- and fourth-degree perineal tears, there was no clear difference between the groups (RR 1.01, 95% CI 0.54 to 1.89; one study, 1098 women).

Enriched oil versus liquid wax

When measuring the incidence of second-degree perineal tear, an outcome reported in one study (Harlev 2013), there was no clear difference between the groups (RR 0.88, 95% CI 0.58 to 1.31, one study, 164 women).

The authors concluded that moderate-quality evidence suggests that warm compresses, and massage, may reduce third- and fourth-degree tears but the impact of these techniques on other outcomes was unclear or inconsistent. There were insufficient data to show whether other perineal techniques result in improved outcomes.

Study	SIGN rating	Conclusions	Likelihood	Evidence base

	Aasheim et al. 2017	HQ (++)	Moderate quality evidence suggests that warm compress may reduce third- and fourth-degree tears Warm compress did not have any clear effect on: - first-degree tears - second-degree tears	average RR 0.46, 95% CI 0.27 to 0.79 1.19, 95% CI 0.38 to 3.79 0.95, 95% CI 0.58 to 1.56	Four controlled trials Two controlled trials Two controlled trials
			Moderate quality evidence suggests that massage may reduce third- and fourth-degree tears Massage did not have any clear effect on: - first-degree tears - second-degree tears	average RR 0.49, 95% CI 0.25 to 0.94 average RR 1.55, 95% CI 0.79 to 3.05 average RR 1.08, 95% CI 0.55 to 2.12	Five controlled trials Five controlled trials Five controlled trials
			Hands on or hands off the perineum made no clear difference in: - first-degree perineal tears - second-degree perineal tears - third- or fourth-degree perineal tears	average RR 1.32, 95% CI 0.99 to 1.77 average RR 0.77, 95% CI 0.47 to 1.28 average RR 0.68, 95% CI 0.21 to 2.26	Two controlled trials Two controlled trials Five controlled trials
			Women receiving Ritgen's manoeuvre were: - Less likely to have a first-degree tear - More likely to have a second-degree tear - Likely to have no difference in incidence of third- or fourth-degree tears	RR 0.32, 95% CI 0.14 to 0.69 RR 3.25, 95% CI 1.73 to 6.09 RR 1.24, 95% CI 0.78	One controlled trial One controlled trial One controlled trial
			Primary delivery of posterior versus anterior shoulder did not shown any effects on third- and fourth-degree tears	RR 0.81, 95% CI 0.39 to 1.67	One controlled trial
			Use of a perineal protection device compared to perineal support did not show any clear difference between: - first- and second-degree tears	RR 1.00, 95% CI 0.98 to 1.02 RR 1.01, 95% CI 0.54 to 1.89	One controlled trial

		- third- and fourth-degree tears		
		No clear difference in second degree perineal tears was shown between the use of enriched oil and liquid wax	RR 0.88, 95% CI 0.58 to 1.31	One controlled trial

Jha et al. 2016

Jha et al. (2016) (QS: HQ (++)) undertook a SR and meta-analysis to estimate the risk of recurrent obstetric anal sphincter injury (rOASI) in women who have suffered anal sphincter injury in their previous pregnancy and analyse risk factors for recurrence. The review included fifteen relevant observational studies of cohort or case–control design (Payne et al. 1999; Peleg et al. 1999; Harkin et al. 2003; Elfaghi et al. 2004; Dandolu et al. 2005; Burton et al. 2009; Jango et al. 2012; Baghestan et al. 2012; Parmar et al. 2012; Basham et al. 2013; Yogev et al. 2014; Doumouchtsis et al. 2014; Boggs et al. 2014; Ali et al. 2014; Edozien et al. 2014; Ampt et al. 2015). Overall 99,042 women were included in the SR with sample sizes ranging from 53 to 43,583.

The results of the review suggested that the overall risk of OASI was 6.3% compared with a 5.7% risk of OASI in the first pregnancy. The risk in parous women with no previous OASI was 1.5%. Factors that increased the risk in a future pregnancy were instrumental birth with forceps (OR 3.12, 95% CI 2.42–4.01) or ventouse (OR 2.44, 95% CI 1.83–3.25), previous fourth-degree tear (OR 1.7, 95% CI 1.24–2.36) and birth weight ≥4 kg (OR 2.29, 95% CI 2.06–2.54). Maternal age ≥35 years marginally increased the risk (OR 1.16, 95% CI 1–1.35).

<u>Episiotomy</u>

Eight studies assessed the effect of episiotomy on rOASI. Of these, four did not state the type of episiotomy, one included both midline and mediolateral episiotomy and the remaining three had exclusive mediolateral episiotomies. Midline episiotomies have a higher risk of OASI.

<u>Forceps</u>

There was a significant increase in the risk of rOASI following forceps birth (OR 3.12; CI 2.42–4.01). Five studies assessed the impact of a forceps birth on rOASI.

<u>Ventouse</u>

There was a significant increase in the risk of rOASI with at least a doubling of incidences. Five studies reported on the impact of a ventouse birth on rOASI, but did not differentiate between the different types of cups, i.e. kiwi, silicon or metal.

<u>Grade of previous tear (third- or fourth degree)</u>

A previous fourth-degree tear increased the odds of rOASI (OR 1.7, 95% CI 1.24–2.36)

<u>Birthweight</u>

Increasing BW >4 kg was associated with an increase in rOASI rates [BW 4 kg, (OR 2.29, 95% CI 2.06–2.54); BW 4.5 kg (OR 2.89, 95% CI 2.45–3.40)]. BW >5 kg was even more significant, with an OR 9.92, 95% CI 7.44–13.22 reported by Parmar et al. and an OR 4.5, 95% CI 2.8–6.99

reported in another study. Two studies documented decreasing rOASI rates when BW is <4 kg. One study reported on the difference in BW between the primary OASI and rOASI pregnancies.

Time between pregnancies

Five studies report on interpregnancy interval and association with rOASI. No studies reported on a positive association, with 95% CI crossing unity in all studies.

Maternal age

Two studies examined maternal age >40 years for rOASI, and both demonstrated an increased risk, with OR of 1.34 (95% CI 1.14–1.58) and 1.95 (95% CI 1.06–3.55). Three studies analysed rOASI in women >35 years and demonstrated a slight increase in risk (OR 1.16, 95% CI 1–1.35).

Asian ethnicity

Two studies reported on Asian ethnicity as an underlying risk factor for rOASI. This failed to reach statistical significance (OR 0.81, 95% CI 0.58–1.11).

Induction

Three studies assessed induction of labour in the rOASI group. Two studies could be combined and showed no significant association (OR 1.09, 95% CI 0.8–1.50). The third study could not be used for analysis, but results were similar.

Epidural

Two studies reported on the effect of epidural analgesia and failed to show an association with rOASI (OR 0.86; 95% CI 0.62–1.18).

Two Previous OASI

One study assessed the risk of OASI in third pregnancies. After two previous OASIs, this was particularly high (absolute risk 9.55, adjusted OR 10.6).

Shoulder dystocia

Two studies reported on shoulder dystocia as a risk factor, and both documented a significant increase in rOASI risk. One study reported an OR of 3.7, 95% CI 2.2–6.4, whereas another study reported an even higher risk (OR4.27, 95% CI 3.83–4.76).

Sex of the infant

One study reported on the sex of the child in the subsequent pregnancy and found no association with rOASI risk (OR 1.12, 95% CI 0.87–1.44).

Maternal BMI

One study reported on the impact of maternal BMI and rOASI. The association was nonsignificant, with OR 1.02 and 95% CI 1.00–1.04.

Occipit posterior position

One study reported on occipit posterior position of the baby and the risk of rOASI, showing a significant association, with OR 1.73, 95% CI 1.14–2.63).

Labour augmentation

One study reported no association between augmentation and rOASI, whereas another showed a positive association (OR 1.5, 95 % CI 1.14–1.97)

The authors concluded that an instrumental birth with either forceps or ventouse, BW >4 kg, shoulder dystocia or a prior fourth-degree tear all increase the risk of rOASI in a future pregnancy. The overall rate of rOASI and associated risk factors for recurrence are similar to the rate and risk factors of primary OASI. They suggested that antenatal decisions could be based on assessment of foetal weight and intrapartum decisions based upon the requirement for an instrumental birth.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Jha et al 2016	HQ (++)	Significant increase in the risk of rOASI following forceps birth	OR: 3.12; CI 2.42–4.01	Five observational studies
		Significant increase in the risk of rOASI following ventouse	OR 2.44, 95% CI 1.83–3.25	Five observational studies
		Previous fourth-degree tear increased the odds of rOASI	OR 1.7, 95% CI 1.24–2.36	Not reported
		Birthweight greater than 4kg was associated with an increase in rOASI rates	OR 2.29, 95% CI 2.06–2.54	Not reported
		Maternal age ≥35 years marginally increased the risk of rOASI	OR 1.16, 95% CI 1–1.35	Two observational studies
		No significant difference in the risk of rOASI was found when comparing the time between pregnancies	Not reported	Five studies
		Asian ethnicity did not influence the risk of rOASI	OR 0.81, 95% CI 0.58–1.11	Two observational studies
		Induction of labour did not influence the risk of rOASI	OR 1.09, 95% CI 0.8–1.50	Two observational studies
		Epidural analgesia did not influence the risk of rOASI	OR 0.86; 95% CI 0.62–1.18	Two observational studies
		In third pregnancies following two previous OASI there was an increased risk of rOASI	absolute risk 9.55, adjusted OR 10.6	One observational study

		Shoulder dystocia significantly increased the risk of rOASI	OR: 3.7, 95% CI 2.2–6.4 OR: 4.27, 95% CI 3.83–4.76	One observational study One observational study
		Sex of the child in the subsequent pregnancy had no association with rOASI risk	OR: 1.12, 95% CI 0.87–1.44	One observational study
		Maternal BMI did not influence the risk of rOASI	OR: 1.02 and 95% CI 1.00–1.04	One observational study
		Occipitoposterior position of the baby significantly increased the risk of rOASI	OR: 1.73, 95% CI 1.14–2.63	One observational study
		Conflicting results were reported on the effect of labour augmentation on the risk of rOASI	-	Two observational studies

Pergialiotis et al. 2014

Pergialiotis et al. (2014) (QS: AQ (+)) conducted a SR and meta-analysis to identify factors that lead to the occurrence of severe perineal lacerations. Twenty-seven prospective and retrospective observational studies were included (Samuelsson et al. 2000; Kudish et al. 2006; Dahlen et al. 2007; Sleep et al. 1984; Harrison et al. 1984; House et al. 1986; Klien et al al. 1992; Argentine Episiotomy Trial Collaborative Group 1993; Anthony et al. 1994; Labrecque et al. 1997; Klein et al. 1997; Robinson et al. 1999; Jones et al. 2000; Angioli et al. 2000; De Leueuw et al. 2001; Jander et al. 2001; Bodner-Adler et al. 2001; Raskin-Mashiah et al. 2002; Macarthur et al. 2004; Eogan et al. 2006; Hudelist et al. 2005; Sheiner et al. 2005; Aukee et al. 2006; Lowder et al. 2007; Hornermann et al. 2010; Groutz et al. 2011a; Groutz et al. 2011b).

The meta-analysis consisted of 22 studies which included 651,934 women. The results suggested that women with severe perineal tears were more likely to have had heavier infants (mean difference 192.88 g [95% CI, 139.80–245.96 g]), an episiotomy (OR 3.82 [95% CI, 1.96–7.42]), or an operative vaginal birth (OR 5.10 [95% CI, 3.33–7.83]). Epidural anaesthesia (OR 1.95 [95% CI, 1.63–2.32]), labour induction (OR 1.08 [95% CI, 1.02–1.14]), and labour augmentation (OR 1.95 [95% CI, 1.56–2.44]) were also more common among women with perineal lacerations. The authors concluded that various factors contribute to the occurrence of perineal lacerations.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Pergialiotis et al 2014	AQ (+)	Women with severe perineal tears were more likely to have heavier infants	mean difference 192.88 g [95% CI, 139.80–245.96 g	Six observational studies

		Women who underwent episiotomy were at increased risk of severe perineal tears	OR 3.69 [95% CI, 1.45–9.38]	Fifteen observational studies
		Women who underwent median episiotomy were at increased risk of severe perineal tears	OR 3.82 [95% CI, 1.96–7.42]	Nine observational studies
		Women who underwent operative vaginal birth were at increased risk of severe perineal tears	OR 5.10 [95% CI, 3.33–7.83	Nineteen observational studies
		Epidural anaesthesia increased the risk of severe perineal tears	OR 1.95 [95% CI, 1.63–2.32]	Not reported
		Labour induction increased risk of severe perineal tears	OR 1.08 [95% CI, 1.02–1.14]	Not reported
		Labour augmentation increased risk of severe perineal tears	OR 1.95 [95% CI, 1.56–2.44]	Not reported

Eason et al. 2000

Eason et al. (2000) (QS: LQ (-)) conducted a SR which investigated techniques proposed to prevent perineal trauma during childbirth and meta-analysed the evidence of their efficacy from RCTs. Twenty relevant RCTs were included in the review (Harrison et al. 1984; Sleep et al. 1984; House et al. 1986; Klein et al. 1992; Argentine et al. 1999; Lasbrey et al. 1964; Vacca et al. 1983; Johanson et al. 1989; Johanson et al. 1993; Salamalekis et al. 1995; Boffil et al. 1996; Labrecque et al. 1999; Shipman et al. 1997; Labrecque et al. 1994; Stewart et al. 1983; Liddell et al. 1985; Turner et al. 1986; Stewart et al. 1989; Gardosi et al. 1989; Crowley et al. 1991). All studies looked at the outcomes of sutured perineal trauma and anal sphincter trauma.

Results indicated good evidence that avoiding episiotomy decreased perineal trauma (absolute risk difference 20.23, 95% CI 20.35, 20.11). In nulliparas, perineal massage during the weeks before giving birth also protected against perineal trauma (risk difference 20.08, CI 20.12, 20.04). Vacuum extraction (risk difference 20.06, CI 20.10, 20.02) and spontaneous birth (20.11, 95% CI 20.18, 20.04) caused less anal sphincter trauma than forceps birth. The mother's position during the second stage has little influence on perineal trauma (supported upright versus recumbent: risk difference 0.02, 95% CI 20.05, 0.09)

The authors suggested that the factors shown to increase perineal integrity include avoiding episiotomy, spontaneous or vacuum assisted rather than forceps birth, and in nulliparas, perineal massage during the weeks before childbirth. Second-stage position was shown to have little effect.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Eason et al 2000	LQ (-)	Results suggested that avoiding episiotomy decreased the risk of perineal trauma	Absolute risk difference -0.23, 95% CI -0.35, -0.11	Five RCTs
		Results suggested that in nulliparas, perineal massage during the weeks before giving birth protected against perineal trauma	Risk difference -0.08, CI -0.12, -0.04	Three RCTs
		Vacuum extraction caused less anal sphincter trauma than forceps birth	Risk difference -0.06, CI -0.10, -0.02	Seven RCTs
		Spontaneous birth caused less anal sphincter trauma than forceps birth	Risk difference -0.11, 95% CI -0.18, -0.04	Not reported
		No significant difference in anal sphincter injury was shown between supported upright position and recumbent position	Not reported	Seven RCTs

Cohort studies

Study	SIGN rating	Objective	Result	Likelihood
Yamasato et al 2019	LQ (0)	Examined associations between maternal BMI, race, and OASI (3rd/4th degree perineal lacerations)	Compared to women with BMI < 30 kg/m2, women with BMI > 50 kg/m2 had a lower odds of OASI	OR: 0.31 95%CI 0.11 – 0.83 aOR 0.28 95% CI 0.08 – 0.96
			Compared to White women, Native Hawaiian and other Pacific Islanders women had lower OASI prevalence	aOR 0.79 95% CI 0.62 – 1.01
			Asian women demonstrated increased prevalence of OASI	aOR 1.50 95% CI 1.22 – 1.85
• Appears that obese women, including those with BMI > 50kg/m2, have lower OASI risk • Appears that race is a significant factor, with Asian women being at a higher risk of OASI than white women				
Kamisan Atan et al 2019	LQ (0)	This study aimed to determine the association between variations in obstetric practice (between hospitals) and maternal birth trauma	Birth by vacuum was not associated with an increased risk	-

			of any form of maternal trauma	
			The significant differences in maternal birth trauma observed between these two tertiary hospitals were largely due to a variation in forceps rates	-
**Maternal birth trauma = LAM avulsion and external anal sphincter deficit • Appears that birth by vacuum does not increase the risk of maternal birth trauma • Appears that rates of forceps use significantly affects the risk of maternal birth trauma				
O'Leary et al 2019	AQ (+)	To identify risk factors for sphincter injury associated with shoulder dystocia	Nulliparous women with births complicated by shoulder dystocia had a significantly increased risk of anal sphincter injury than multiparous women	OR 2.67, 95% CI 1.12–6.54 p= 0.036
• Appears that nulliparous women with births complicated by shoulder dystocia have a significantly increased risk of anal sphincter injury compared to multiparous women				
Tunestveit et al 2018	AQ (+)	The objective of this study was to investigate the association between OASI and factors related to midwife-led birth such as manual support of perineum, active delivery of baby's shoulders, maternal birth position, and pushing and breathing techniques in second stage of labour	There was an increased risk of OASI if women actively pushed when the head was crowning compared to breathing the head out	adjusted OR: 3.10; 95% CI: 1.75 to 5.47
			The maternal birth position associated with the lowest risk of OASI was kneeling position	adjusted OR: 0.15; 95% CI: 0.03 to 0.70
			Supine maternal birth position was associated with an increased risk of OASI	adjusted OR: 2.52; 95% CI: 1.04 to 4.90
			Oxytocin augmentation more than 30 min in second stage was associated with an increased risk of OASI	OR: 1.93; 95% CI: 1.68 to 15.63
• Appears that actively pushing when the baby's head is crowning is associated with increased risk of OASI when compared to intact perineum • Appears that a supine maternal birth position is associated with increased risk of OASI when compared to intact perineum				

• Appears that oxytocin augmentation more than 30 min in second stage is associated with increased risk of OASI when compared to intact perineum • Appears that a kneeling maternal birth position is associated with a decreased risk of OASI				
Ramm et al 2018	AQ (+)	To characterise the rate of obstetric anal sphincter injuries and identify key risk factors of obstetric anal sphincter injuries, including duration of the second stage of labour	Women with a vacuum-assisted vaginal birth had four times the odds of obstetric anal sphincter injury	Adjusted OR: 4.23, 95% CI 3.59–4.98
			Women whose second stage of labour lasted at least 180 minutes vs less than 60 minutes had three times the odds of incurring obstetric anal sphincter injury	adjusted OR: 3.20, 95% CI 2.62–3.89
			Asian women had an increased risk of obstetric anal sphincter injury compared to white women	Adjusted OR: 2.31, 95% CI 1.99-2.69
			Nulliparous women had an increased risk of obstetric anal sphincter injury compared to multiparous women	Adjusted OR: 2.32, 95% CI 2.0-2.71
			Vaginal birth after cesarean birth had an increased risk of obstetric anal sphincter injury compared to no VBAC	Adjusted OR: 2.87, 95% CI 2.14-3.85
			Episiotomy had an increased risk of obstetric anal sphincter injury compared to no episiotomy - Midline - Mediolateral	Adjusted OR: 2.93, 95% CI 2.36-3.65 Adjusted OR: 1.72, 95% CI 1.14-2.6
• Appears that women with second stage of labour longer than 2 hours, Asian race, nulliparity, vaginal birth after cesarean birth, episiotomy, and vacuum birth have a higher risk of an obstetric anal sphincter injury				
Hehir et al 2018	AQ (+)	To examine the incidence and risk factors associated with obstetric anal sphincter injury in a large cohort of consecutive cases of shoulder dystocia over a 5-year period	Nulliparity in women with a birth complicated by shoulder dystocia	aOR: 3.88 (1.91-7.86)

			significantly increased the risk of anal sphincter injuries	
			Operative vaginal birth in women with a birth complicated by shoulder dystocia significantly increased the risk of anal sphincter injuries	aOR: 3.53 (1.71-7.27)
			Internal manoeuvres in women with a birth complicated by shoulder dystocia significantly increased the risk of anal sphincter injuries	aOR: 1.9 (1.08-3.36)
			Episiotomy in women with a birth complicated by shoulder dystocia significantly decreased the risk of anal sphincter injuries	aOR: 0.44 (0.21-0.91)
• Appears that shoulder dystocia carries a significant risk for anal sphincter injury and risk factors include nulliparity, operative vaginal birth, and use of internal manoeuvres • Appears that episiotomy had a protective effect on the occurrence of sphincter injury in the management of shoulder dystocia				
Peppe et al 2018	LQ (0)	Aimed to determine the prevalence of perineal trauma and its risk factors in a low-risk maternity with a high incidence of upright position during the second stage of labour	Perineal trauma was not associated with: - Maternal position - Health professional (obstetricians or midwives) - Newborns weighing 4 kilos or more - Labour analgesia	 p = 0.285 p = 0.231 p = 0.672 p = 0.319
			White women had an increased risk of perineal tears	3.90 times more risk p=<0.005
			Nulliparous women had an increased risk of perineal tears	2.0 times more risk p=0.005

• Appears that white and nulliparous women are more prone to develop perineal tears • Appears that perineal trauma was not associated with maternal position, health professional (obstetricians or midwives), newborns weighing 4 kilos or more and labour analgesia				
Marschalek et al 2018	AQ (+)	The aim of this study was to analyse risk and protective factors for obstetric anal sphincter injuries in first births in Austria and to describe time trends about the incidence of these injuries and associated risk factors in a country with a long-standing tradition of restricted use of forceps at birth	Independent risk factors for obstetric anal sphincter injuries included: - Age >19 years - Birthweight >4000 g - Operative vaginal birth	20-30 years: aOR: 2.29 (1.57-3.34) 31-40 years: aOR: 2.54 (1.74-3.71) >40 years: aOR: 1.95 (1.21-3.15) aOR: 5.05 (4.33-5.89) Episiotomy aOR: 1.14 (1.03-1.26) Forceps without episiotomy aOR: 6.04 (1.38-26.42) Forceps with episiotomy aOR: 6.45 (4.53-9.19) Vacuum without episiotomy aOR: 3.12 (2.75-3.55) Vacuum with episiotomy aOR: 2.24 (2.04-2.47)
			Mediolateral episiotomy increased the risk for obstetric anal sphincter injuries in spontaneous vaginal birth	Number needed to harm 333
			Mediolateral episiotomy reduced the risk for obstetric anal sphincter injuries in vacuum births	Number needed to treat 50
• Appears that Age >19 years, birthweight >4000 g, and operative vaginal birth are independent risk factors for obstetric anal sphincter injuries • Appears that mediolateral episiotomy increases the risk for obstetric anal sphincter injuries in spontaneous vaginal birth • Appears that mediolateral episiotomy reduces the risk for obstetric anal sphincter injuries in vacuum births				
O'Leary et al 2018	AQ (+)	To establish whether women in their second pregnancy, with one previous uterine scar, are at a higher risk of OASI compared with nulliparous women	No significant difference in OASI rate between primiparous women and those who had a successful VBAC	3.5% (297/8573) versus 3.1% (17/550) P=0.730
			Foetal macrosomia (>4 kg) and forceps	Foetal macrosomia (OR

			birth were risk factors for OASI	1.0 95%CI 1.00-1.00, p=<0.001) Forceps birth (OR 4.39 95%CI 2.96-6.54, p=<0.001)
			Episiotomy and epidural anaesthesia were protective	Episiotomy (OR 0.65 95%CI 0.46-0.92) p=0.015) Epidural anaesthesia (OR 0.59 95%CI 0.45-0.76, p=0.001
• Appears that vaginal birth after caesarean does not increase the risk of OASI • Appears that birthweight >4kg and forceps birth increase the risk for OASI whilst episiotomy and epidural anaesthesia were protective				
Lee et al 2018	AQ (+)	To assess the association of four techniques used in management of second stage with risk of moderate and severe perineal injury (hands poised undirected, hands poised directed, hands on undirected, hands on directed)	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 and severe perineal injuries compared to hands-poised/ undirected	Moderate perineal injury (2nd degree) aOR 1.18, 95% CI 1.10–1.27, p < 0.001 Severe perineal injury (3rd and 4th degree) aOR 1.50, 95% CI 1.20–1.88, p < 0.001
• Appears that in nulliparous women different hand positions and pushing techniques at birth are not associated with any difference in rates of perineal injury • Appears that 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				
Frigerio et al 2018	AQ (+)	This study aimed to evaluate third- and fourth-degree tears rates and related risk factors in a single Italian centre. The secondary goal was to build a predictive model based on identified risk factors	Multivariate analysis identified the following as independent risk factors for third- and fourth-degree tears: - Moderate/ severe obesity - Vacuum birth - Birth weight	OR: 2.8 (1.3-6.1) OR: 2.6 (1.2-5.6) OR: 1.1/hg (1.05-1.2)

			No significant effect on risk of third- and fourth-degree tears - Gestational age > 40 weeks - Nulliparity - Oxytocin in pushing stage - Lithotomy position - Sinciput presentation	 OR: 1.2 (0.7-2.2) OR 1.97 (1.09-3.6) OR: 1.1 (0.6-2.0) OR: 1.87 (1.0-1.194) OR: 2.44 (0.8-7.05)
• Appears that moderate/severe obesity, instrumental birth and foetal weight resulted as independent risk factors for severe obstetrical tears				
Brown et al 2018	AQ (+)	To investigate risk of OASIS associated with country of birth	Women born in South Asia were at a much higher risk of OASIS than other groups, including women born in other Asian countries, compared to the Australian/New Zealand cohort	South asia vs Aust/NZ aOR 3.62 (2.87-4.56) Middle east vs Aust/NZ aOR 1.08 (0.71-1.65)
			Birthweight <2.5kg significantly reduced the risk of OASIS, however, a birthweight of > 4kg increased the risk of OASIS	<2.5 vs 2.5-4kg aOR 0.21 (0.11-0.4) >4 vs 2.5-4kg aOR 2.31 (1.68-3.17)
			Mediolateral episiotomy significantly reduced the risk of OASIS, however, lateral and midline episiotomy had no significant effect	Medio-lateral aOR 0.7 (0.56-0.87) Lateral aOR 1.04 (0.56-1.94) Midline episiotomy aOR 0.81 (0.36-1.83)

			Forceps and vacuum use both significantly increased the risk of OASIS	Forceps aOR: 2.48 (1.96-3.14) Vacuum aOR: 1.68 (1.3-2.16)
			A maternal age of <25 years was associated with a reduced risk of OASIS	<25 vs 25-35 aOR 0.61 (0.48-0.78)
• Appears that women born in South Asia have an increased risk of OASIS • Appears that a maternal age of <25 years reduces the risk of OASIS, however, a maternal age > 35 increases the risk of OASIS • Appears that a birth weight < 2.5kg reduces the risk of OASIS, however, a birth weight > 4kg increases the risk of OASIS • Appears that mediolateral episiotomy reduces the risk of OASIS and lateral and midline episiotomy have no significant effect • Appears that both forceps and vacuum birth increase the risk of OASIS				
Antonakou et al 2017	AQ (+)	To identify the incidence of and risk factors for a repeat OASIS in women who sustained an OASIS in their first vaginal birth and have a subsequent vaginal birth	Among women who delivered vaginally, 16 (8.4%) women had a repeat OASIS	-
			Epidural analgesia, an episiotomy in the first birth and a short labour (<2.8 h) in the second birth increased the risk of a repeat OASIS	Epidural analgesia OR = 3.66; 95% CI: 1.14–11.71 Episiotomy in the first birth OR = 3.93; 95% CI:1. 03–15.02 Short labour in the second birth OR = 14.55; 95% CI: 1.83–115.75
			The time interval between the two vaginal births was not associated with any increased risk of a repeat OASIS	-
• Appears that epidural analgesia, episiotomy in the first birth and a short labour (<2.8 h) in the second birth increased the risk for a repeat OASIS whilst the time interval between the two births does not increase the risk				

Carlson et al 2017	LQ (0)	The purpose of this study was to compare 2 matched cohorts of healthy, nulliparous, women who were obese and had spontaneous labour onset with different models of intrapartum care	Women who were obese and cared for in labour by certified nurse-midwife were 76.3% less likely to have third- or fourth-degree perineal lacerations compared to women who were obese and had similarly sized neonates but who were cared for by obstetricians	Lacerations aOR, 0.31; 95% CI, 0.13-0.79
• Appears that in women with spontaneous labour onset who were healthy, obese, and nulliparous, watchful waiting and use of physiologic labour interventions, characterising certified nurse-midwife intrapartum care, were associated with outcomes that were similar to, or better than, those of women who were obese and exposed to more high-technology interventions characterising intrapartum care by obstetricians				
Vale de Castro et al 2016	LQ (0)	The aim of this study was to assess the occurrence of severe perineal lacerations in vaginal birth and its relationship with predisposing clinical and obstetric factors	Predictors of severe perineal lacerations included: - Gestational age - Primigravida - Oxytocin in labour	aOR: 2.22 (1.25-3.92) aOR: 5.32 (1.09-1.32 aOR: 1.86 (1.05-3.32)
			Episiotomy did not show a protective effect against severe laceration occurrence	P=0.999
• Appears that severe perineal lacerations were associated with operative birth, primiparity, gestational age, and epidural anesthesia • Appears that episiotomy was not protective of severe perineal lacerations				
Gauthaman et al 2016	AQ (+)	To identify the incidence and risk factors for obstetric anal sphincter injuries in women who sustained shoulder dystocia at birth	Instrumental birth was associated with an increased risk of OASIS	Failed ventouse OR 3.981: 95 % CI 1.355– 11.178 p=0.012 Forceps OR 2.890: 95 % CI 1.165–7.170 p=0.022
			Four or more manoeuvres was associated with an increased risk of OASIS	OR 3.963: 95 % CI 1.504–10.453 p=0.005
			Internal manoeuvres such as Woods' screw	Woods' screw

			and reverse Woods' screw an increased risk of OASIS	OR 2.800: 95 % CI 1.363–5.762 p=0.005 Reverse Woods' screw OR 3.627: 95 % CI 1.145–11.489 p=0.028
• Appears that in instrumental births, the use of internal manoeuvres (Woods' screw and reverse Woods' screw) and four or more manoeuvres for the management of shoulder dystocia are independently associated with a higher incidence of OASIS				
Mesterton et al 2016	LQ (0)	The objective of this study was to identify and quantify maternal characteristics that impact a set of important indicators of health outcomes, resource use and care process and which could be used for case mix adjustment of comparisons between hospitals	Nulliparity was strongly associated with higher risk of perineal tears	OR: 6.14 (5.46-6.92)
			Previous CS was strongly associated with higher risk of perineal tears	OR: 5.90 (5.17-6.72)
			Higher maternal age increased perineal tears	OR: 1.04 (1.03-1.04)
			Premature birth (w32 + 0–w36 + 6) was associated with lower risk of perineal tears	OR: 0.22 (0.17-0.30)
• Appears that both nulliparity and previous CS are strongly associated with higher risk of perineal tears • Appears that higher maternal age increases perineal tears • Appears that premature birth (w32 + 0–w36 + 6) is associated with lower risk of perineal tears				
Rosen et al 2016	AQ (+)	Aimed to determine if twin births are associated with an increased rate of obstetric anal sphincter injuries compared with singleton	Obstetric sphincter injury (Third and fourth degree tears) rate was not significantly lower in the twins group Obstetric sphincter injuries were associated with: - Nulliparity - Forceps - Vacuum - Earlier gestational age - Episiotomy - Birth weight over 3500 g	Mutivariable analysis Twins OR: 0.7 (0.4-1.2) OR=3.9, 95% CI 3.4–4 OR=6.8, 95% CI 5.8–7.8 OR=2.9, 95% CI 2.5–3.3 OR=0.2, 95% CI 0.1–0.3 OR=0.8, 95% CI 0.7–0.9 OR=1.8, 95% CI 1.6–2.0

• Appears that obstetric sphincter injury rate is not significantly lower in twins • Appears that obstetric sphincter injuries are associated with nulliparity, forceps, vacuum, earlier gestational age, episiotomy, and birth weight over 3500g				
Kapaya et al 2015	AQ (+)	The aim of this study was to determine risk factors for obstetric anal sphincter injury and whether any of them were modifiable	The following risk factors were strongly associated with OASI - Primiparity - Episiotomy - Gestational age over 41 weeks - Foetal weight over 4 kg - Asian ethnicity	OR 9.8; CI 7.8–12.3 OR 8.6; CI 6.4–11.6 OR 1.5; CI 1.2–1.9 OR 3.2; CI 2.3–4.4 OR 1.9; CI 1.4–2.7
			BMI over 30 appeared to have a protective effect on the risk of OASI	OR 0.4; CI 0.2–0.5
• Appears that primiparity, episiotomy, gestational age over 41 weeks, foetal weight over 4 kg and Asian ethnicity are all strongly associated with OASI • Appears that BMI over 30 appears to have a protective effect on the risk of OASI				
Ott et al 2015	LQ (0)	To evaluate experienced midwives and compare their performance concerning perineal lacerations	The individual midwife is an independent factor that influences the risk for overall perineal lacerations	ß-values −0.028 to 0.899
			For severe perineal lacerations, the midwife was not of significant influence	-
			The risk of perineal lacerations of any degree were significantly increased by the following factors: Maternal age Gestational age at birth Birth weight	(ß = 0.170 ± 0.080) (ß = 0.190 ± 0.320) (ß = 0.002 ± 0.000)
			The risk of perineal lacerations of any degree were	

			significantly decreased by the following factors: Multiparity Mediolateral episiotomy	 (ß = −0.379 ± 0.141) (ß = −1.514 ± 0.284)
• Appears that the individual midwife is an independent factor that increases the risk for overall perineal lacerations, however, not severe perineal lacerations • Appears that higher maternal age, gestational age at birth and birth weight significantly increase the risk of perineal lacerations of any degree • Appears that multiparity and mediolateral episiotomy significantly decrease the risk of perineal lacerations of any degree				
Friedman et al 2015	LQ (0)	To examine the patterns and predictors of third-degree and fourth-degree laceration in women undergoing vaginal birth	Risk of third-degree and fourth-degree laceration was most strongly related to: - Shoulder dystocia	Third degree OR: 1.76 (1.72-1.79) Fourth degree OR: 2.71 (2.64-2.78)
			- Forceps birth with episiotomy	Third degree OR: 5.65 (5.55-5.75) Fourth degree OR: 10.55 (10.29-10.81)
			- Forceps birth without episiotomy	Third degree OR: 6.54 (6.4-6.68) Fourth degree OR: 8.81 (8.49-.15)
			- Vacuum birth with episiotomy	Third degree OR: 4.53 (4.47-4.59) Fourth degree OR: 7.45 (7.3-7.6)
			- Vacuum birth without episiotomy	Third degree OR: 3.14 (3.1-3.19) Fourth degree OR: 3.3 (3.21-3.4)
• Appears that the risk of third and fourth-degree lacerations was most strongly related to Shoulder dystocia, Forceps birth with episiotomy, Forceps birth without episiotomy, Vacuum birth with episiotomy and Vacuum birth with episiotomy				
Ampt et al 2015	LQ (0)	To determine whether rates of OASIS are continuing to increase and whether risk of OASIS according to mode of birth is constant over time	Non-instrumental births without episiotomy showed statistically significant increases in OASIS	linear trend p< 0.001

			Forceps births with episiotomy showed statistically significant increases in OASIS	linear trend P=0.004
• Appears that non-instrumental births without episiotomy and forceps births with episiotomy increase the risk of OASIS				
Vathanan et al 2014	LQ (0)	To identify the risks of sustaining obstetric anal sphincter injury (OASI) during childbirth	The following variables increased the risk of OASI -Asian ethnicity - Maternal age of >40 years - Higher foetal birth weight >4500 g - Lower parity (para 0)	OR 4.798, 95% CI 2.998–7.679 OR 2.722, 95% CI 1.315–5.636 OR 6.228, 95% CI 2.695–14.392 OR 16.803, 95% CI 7.697–36.685
			Forceps birth posed the greatest risk of OASI	OR 8.4, 95% CI 5.822–12.151
			Mediolateral episiotomy reduced the risk of OASI	-
• Appears that maternal age >40 years, higher foetal birth weight, lower parity, instrumental birth, and Asian ethnicity increase the risk of OASI • Appears that mediolateral episiotomy reduces the risk of OASI				
McPherson et al 2014	LQ (0)	Aim was to construct a risk scoring model to assist in both prediction and prevention of OASIS	The following factors independently decreased the risk of OASIS - South Asian descent - Vaginal multiparity - Current smoker - Home birth	 2.9 (2.3-3.66) 0.35 (0.30-0.41) 0.58 (0.38-0.87) 0.35 (0.13-0.95)

			Significant variables that increased the risk of OASIs were: - African-Caribbean descent - Water immersion - Water birth - Ventouse birth - Forceps birth	 - 1.68 (1.22-2.32) - 1.54 (1.18-1.99) 3.13 (2.25-4.35)
• Appears that South Asian descent, vaginal multiparity, current smoker and home birth decreases the risk of OASIS • Appears that African-Caribbean descent, water immersion in labour, water birth, ventouse birth and forceps birth increased the risk of OASIS				
Blomberg 2014	AQ (+)	To estimate the association between maternal obesity and risk of three different degrees of severity of obstetric anal sphincter injury	The risk for a partial, total, or a fourth-degree anal sphincter injury decreased with increasing maternal BMI most pronounced for total anal sphincter injury	OR 0.47 95% CI 0.28–0.78
• Appears that the overall risk of getting an anal sphincter injury at birth decreases significantly with increasing maternal BMI				
Komorowski et al 2014	LQ (0)	The primary aim of the study was to determine if a larger infant head circumference as measured shortly after birth increased the degree of perineal trauma in low-risk nulliparous women. The secondary aim was to determine if a shorter prepartum maternal perineal body or genital hiatus increased the risk of perineal trauma *Perineal trauma was defined as trauma that extended into the muscles of the perineum (second-degree or deeper)	Significant association was shown between infant head circumference at birth and perineal trauma There was no association between perineal body or genital hiatus length and perineal trauma	OR: 1.22 for each increase of 1 cm in head circumference (95% CI 1.05–1.43) Perineal body length p=0.35 Genital hiatus length p=0.31
• Appears that in nulliparous low-risk women a larger infant head circumference at birth increases the likelihood of second degree or higher perineal trauma • Appears that antenatal perineal body and genital hiatus measurements do not predict second degree or higher perineal trauma				
Hehir et al 2013	LQ (0)	Set out to analyse the incidence of OASIS and its association with mode of delivery in two large obstetric hospitals across an 8-year study period	Women were more likely to suffer an OASIS when having a forceps birth than when having a normal vaginal birth	8.6% versus 1.3% p<0.0001 OR: 7.1, CI: 6.4–7.9

			Vacuum birth carried an increased risk of sphincter injury compared with normal birth	3.7% versus 1.3%, p<0.0001 OR: 2.9, CI: 2–2.6
• Appears that women are more likely to suffer an OASIS when having a forceps birth than when having a normal vaginal birth • Appears that vacuum birth increases risk of OASIS compared with normal birth				
Porat et al 2013	AQ (+)	Aimed to assess the risk factors related to OASIS for vaginal twin and singleton births	The following risk factors were associated with an increased risk of OASIS during vaginal birth of twins: Nulliparity OP position Large foetal size Instrumental delivery	 5.94 (1.69-20.9) 2.95 (1.09-8.01) 1.09 (1.00-1.19) 4.34 (1.22-15.42)
			The following risk factors were associated with an increased risk of OASIS during singelton vaginal birth: Maternal age > 30 Nulliparity Episiotomy Reginal anesthesisa OP position Large foetal size 2nd stage length > 120 mins Instrumental birth	 1.33 (1.22-1.45) 3.91 (3.5-4.37) 1.32 (1.21-1.45) 1.21 (1.09-1.36) 1.62 (1.34-1.96) 1.07 (1.06-1.08) 1.28 (1.16-1.41) 2.37 (2.16-2.61)
• Appears that the risk factors of nulliparity, OP position, large foetal size, and instrumental birth significantly increased the risk of OASIS in vaginal twin births • Appears that the risk factors of maternal age, nulliparity, episiotomy, reginal anesthesisa, OP position, large foetal size, 2nd stage length > 120 mins and instrumental birth significantly increased the risk of OASIS in vaginal singleton births				
Berggren et al 2013	HQ (++)	To investigate the risk for anal sphincter tears in infibulated women	High birthweight was strongly related to AST	OR 5.36 (4.9-5.87) in those with birthweight >4500 g

			The risk of anal sphincter tears was significantly increased by: Instrumental birth Occipitoposterior foetal head position Episiotomy	 3.07 (2.95-3.19) 1.75 (1.62-1.89) 1.15 (1.11-1.19)
			AST rates decreased gradually with decreasing maternal age	< 19 y.o 0.33 (0.28-0.38) 20-24 y.o 0.63 (0.6-0.67)
			Maternal BMI was not associated with AST	Underweight 0.96 (0.82-1.1) Overweight 0.97 (0.91-1.03) Obese 0.92 (0.84-1.01)
• Appears that high birthweight is strongly related to anal sphincter tear, followed by instrumental birth, occipitoposterior foetal head position and episiotomy • Appears that anal sphincter tear rates decrease gradually with decreasing maternal age • Appears that maternal BMI is not associated with anal sphincter tear				
Dahlen et al 2013	LQ (0)	To determine trends and risk factors for severe perineal trauma between 2000 and 2008	Compared with women who were intact or had minor perineal trauma (first-degree tear, vaginal graze/tear), women with the following risk factors were at significantly higher risk of severe perineal trauma - Primiparous - Born in China or Vietnam - Gave birth in a private hospital - Instrumental birth - Male baby	aOR 1.8 CI (1.65 to 1.95) aOR 1.1 CI (1.09 to 1.23) aOR 1.1 CI (1.03 to 1.20 aOR 1.8 CI (1.65 to 1.95) aOR 1.3 CI (1.27 to 1.34)
			Only giving birth to a male baby, adjusted for birth	aOR 1.5 CI (1.44 to 1.58

			weight remained significant, when women with severe perineal trauma were compared with all other women not experiencing severe perineal trauma	

- Appears that primiparity, Asian ethnicity, birth in a private hospital, instrumental birth and male sex were significant risks for severe perineal trauma compared with women with no or minor trauma
- Appears that only male sex remained significant when compared with all women experiencing or not experiencing severe perineal trauma

Meyvis et al 2012	LQ (0)	This study investigated the effects of maternal position (lateral vs lithotomy) and other variables on the occurrence of perineal damage	Lateral position significantly reduced the likelihood of perineal damage (> grade one) when compared with the lithotomy position	OR: 0.53; 95% CI: 0.36–0.78
			Primiparity significantly reduced the likelihood of perineal damage (> grade one) when compared with multiparity	OR: 0.56; 95% CI: 0.47–0.78 p < 0.001
			Physicians performing the birth significantly increased the likelihood of perineal damage (> grade one) when compared with midwives	OR: 2.92; 95% CI: 1.79–4.78

- Appears that childbirth in the lateral position resulted in less perineal trauma when compared with childbirth in the lithotomy position, even after correcting for parity and birth attendant
- Appears that the probability of an intact perineum increased with births performed by midwives

Da Silva et al 2012	LQ (0)	To identify maternal, newborn and obstetric factors associated with birth-related perineal trauma in one independent birth centre	The following risk factors were associated with second-degree lacerations and episiotomies Parity Use of oxytocin during labour Position at time of giving birth	 P<0.001 P<0.001 P<0.001

			Infant birth weight	P=0.041
• Appears that parity, use of oxytocin during labour, position at time of giving birth and infant birth weight were associated with second-degree lacerations and episiotomies				
Rathfisch et al 2011	LQ (0)	The aim was to determine risk factors for the development of perineal tears in women having vaginal birth	Fundal pressure and length of second stage were determined to be risk factors for the development of perineal tears	Fundal pressure (OR: 3.115) Length of second stage (OR: 2.910)
			No statistically significant relationship was found between previous manner of birth and development of perineal tears	$\chi 2 = 9.752$ $p > 0.045$
			There were no statistically significant relationships found between newborn weight, length or head circumference and perineal tears	-
			The incidence of perineal tears and cervical tears was found to be significantly higher in women who had fundal pressure.	Perineal tears ($\chi 2 = 81.228$; $p < 0.001$) Cervical tears ($\chi 2 = 12.983$; $p < 0.001$)
			A significant relationship was found between early episiotomy and development of perineal tears; women who had an episiotomy done early had an increase in development of perineal tears	$\chi 2 = 25.138$; $p < 0.001$
			No statistically significant relationship was found between perineal tears and health care team assisting in the birth	$\chi 2 = 12.360$; $p = 0.136$

• Appears that fundal pressure and length of second stage is a risk factor for the development of perineal tears • Appears that there is no statistically significant relationship between previous manner of birth, health care team assisting in the birth, newborn weight, length or head circumference and development of perineal tears				
Hamilton et al 2011	LQ (0)	Study examined third-/fourth-degree perineal laceration, first with the use of a standard multivariable logistic regression analysis to assess independent risk factors and then with the use of CART to determine the most discriminating clinical risk groups and their associated risks	Multivariable analyses indicated strong and independent association with the use of forceps, nulliparity, episiotomy, vacuum and birthweight on third- and fourth-degree perineal lacerations	Forceps 10.94 (6.41-18.69) Nulliparity 5.11 (3.85-6.79) Episiotomy 3.73 (3.01-4.62) Vacuum 3.32 (2.63-4.19) Birthweight 1.002 (1.001-1.0023)
• Appears that there is a strong and independent association with the use of forceps, nulliparity, episiotomy, vacuum and birthweight on third- and fourth-degree perineal lacerations				
Roberts et al 2007	LQ (0)	The current study examined the degree to which these risk factors, identified in the literature, explained a higher rate of maternal birth-related trauma observed in Iowa	Multivariable analysis suggested that risk factors for third/fourth degree lacerations were forceps use, vacuum extraction, episiotomy procedure, other/unspecified instruments, urgent/trauma admission type, Asian/Pacific Islander race, late pregnancy >40 weeks, large baby/hydrocephalic disproportion, maternal pyrexia/infection, primigravidas >35 years old, obstructed labour, and long labour	Forceps use OR 5.74 (4.96-6.64) Vacuum extraction OR 3.2 (2.81-3.74) Episiotomy procedure OR 1.65 (1.28-2.14) Other/unspecified instruments OR 7.9 (4.14-15.13) Urgent/trauma admission type OR 1.081 (1.01-1.16) Asian/Pacific Islander race OR 1.58 (1.29-1.94) Late pregnancy >40 weeks OR 1.36 (1.24-1.49) Large baby/hydrocephalic disproportion OR 1.57 (1.37-1.81)

				Maternal pyrexia/infection OR 1.32 (1.37-1.8) Primigravidas >35 years old OR 1.32 (1.08-1.62) Obstructed labour OR 1.63 (1.50 - 1.77) Long labour OR 1.51 (1.26-1.79)
• Appears that risk factors for third/fourth degree lacerations were forceps use, vacuum extraction, episiotomy procedure, other/unspecified instruments, urgent/trauma admission type, Asian/Pacific Islander race, late pregnancy >40 weeks, large baby/hydrocephalic disproportion, maternal pyrexia/infection, primigravidas >35 years old, obstructed labour, and long labour				
Minaglia et al 2007	AQ (+)	The objective of the current study was to determine the rate of obstetrical anal sphincter laceration in a large cohort of women undergoing vaginal birth and to identify characteristics associated with this complication	Episiotomy, vacuum and forceps were modifiable risk factors which increased the risk of perineal tears	Episiotomy OR 1.36 (1.16-1.58) Vacuum OR 3.19 (2.69-3.79) Forceps OR 2.79 (1.93-4.02)
			Epidural anaesthesia and number of previous births significantly reduced the risk of anal sphincter laceration	Epidural anaesthesia OR 0.86 (0.76-0.86) Number of previous births 1: OR 0.57 (0.5-0.66) 2: OR 0.41 (0.35-0.48) 3: 0.18 (0.15-0.22)
			The following risk factors were each associated with the increased risk of anal sphincter laceration:	

			Shoulder dystocia Estimated blood loss Estimated gestational age Birth weight	OR 2.03 (1.44-2.86) OR 1.06 (1.02-1.09) OR 1.03 (1.01-1.06) OR 1.15 (1.08-1.22)
• Appears that episiotomy and operative vaginal birth are significant, modifiable risk factors which increase the risk of anal sphincter laceration • Appears that epidural anaesthesia and number of previous births significantly reduce the risk of anal sphincter laceration • Appears that shoulder dystocia, estimated blood loss, estimated gestational age and birth weight increase the risk of anal sphincter laceration				
Hastings-Tolsma et al 2007	LQ (0)	To identify factors related to perineal trauma in childbirth	Side-lying position for birth, perineal support and compress significantly decreased perineal trauma	$P < 0.05$
			Factors related to laceration were age, insurance status, and marital status	$P < 0.05$
			For all women, laceration was more likely when in lithotomy position for birth or when prolonged second stage labour occurred	Lithotomy position for birth ($p = .002$) Prolonged second stage labour occurred ($p = .001$)
• Appears that side-lying position for birth, perineal support and compress use are important interventions for decreasing perineal trauma • Appears that age > 30 years, insurance status and marital status are significant risk factors for lacerations in nulliparous women				
Fitzgerald et al 2007	AQ (+)	To identify risk factors associated with anal sphincter tear during vaginal birth and to identify opportunities for preventing this cause of fecal incontinence in young women	Forceps birth and episiotomy were strongly associated with a sphincter tear	Forceps birth OR 13.6, 95% CI 7.9 – 23.2 Episiotomy OR 5.3, 95% CI 3.8 –7.6
			The combination of forceps and episiotomy was markedly associated with sphincter tear	OR 25.3, 95% CI 10.2– 62.6
			The addition of epidural anesthesia to forceps and episiotomy further increased	OR 41.0 95% CI 13.5–124.4

			the likelihood of a sphincter tear	
• Appears that forceps birth and episiotomy are strongly associated with a sphincter tear • Appears that the combination of forceps and episiotomy is markedly associated with sphincter tears and that the addition of epidural anesthesia to forceps and episiotomy further increases the likelihood				
Dahlen et al 2007	AQ (+)	To determine risk factors for the occurrence of severe perineal trauma (third- and fourth-degree tears) during childbirth	Primiparity, instrumental birth, heavier babies and being of Asian ethnicity were associated with increased rates of severe trauma	Primiparity aOR 3.98 (2.51-6.32) Instrumental birth aOR 1.92 (1.20-3.07) Heavier babies >4000g aOR 2.64 (1.69-4.13) Asian ethnicity aOR 1.83 (1.22-2.75)
• Appears that primiparity, instrumental birth, Asian ethnicity and heavier babies are associated with an elevated risk of severe perineal trauma				
Baumann et al 2007	AQ (+)	The objective of this study was to identify factors associated with anal sphincter laceration in primiparous women	Episiotomy and forceps birth were most strongly associated with anal sphincter laceration Women with a BMI≥30 kg/m2, smokers and the use of local, pudendal, and epidural analgesia were all associated with reduced risk of anal sphincter laceration	Episiotomy OR, 3.23; CI, 2.73–3.80 Forceps birth OR, 2.68, CI, 2.17–3.33 Women with a BMI≥30 kg/m2 P<0.001 Smokers OR 0.8 (0.7-0.9) Local analgesia OR 0.64 (0.56-0.72) Pudendal analgesia OR 0.38 (0.31-0.47) Epidural analgesia 0.66 (0.57-0.77)
• Appears that episiotomy and forceps assisted birth were strongly associated with anal sphincter lacerations in primiparous women at term • Appears that women with a BMI≥30 kg/m2, smokers and the use of local, pudendal, and epidural analgesia were all associated with reduced risk of anal sphincter laceration				
Ogunyemi et al 2006	AQ (+)	The purpose of this study was to identify risk factors for both episiotomy and severe perineal lacerations in a large population from a single institution	Independent predictors of severe perineal lacerations were macrosomia	Macrosomia OR: 7.231 (3.576-14.625) Episiotomy

			seven fold, episiotomy 4.5-fold, primiparity 4.4-fold, shoulder dystocia 3.6-fold, average birthweight 3.5-fold, forceps birth 2.6 fold, vacuum birth two-fold, epidural analgesia two-fold, African-American 1.5-fold	4.468 (3.506-5.683) Shoulder dystocia OR: 3.666 (1.952-6.885) Average birthweight OR: 3.549 (1.823-6.910) Forceps birth OR: 2.591 (2.022-3.322) Vacuum birth 2.032 (1.409-2.929) Epidural analgesia 1.947 (1.294-2.931) African-American OR: 1.542 (1.243-1.913)
			No reassuring foetal heart rate patterns, meconium and cord accidents appear to reduce the risk of severe perineal lacerations	No reassuring foetal heart rate patterns OR: 0.561 (0.382-0.824) Meconium OR: 0.54 (0.356-0.819) Cord accidents OR: 0.269 (0.111-0.653)
• Appears that macrosomia, episiotomy, primiparity, shoulder dystocia, average birthweight, forceps birth, vacuum birth, epidural analgesia and African-American ethnicity increases the risk of severe perineal lacerations in primiparous women • Appears that no reassuring foetal heart rate patterns, meconium and cord accidents reduce the risk of severe perineal lacerations				
Spydslaung et al 2005	AQ (+)	The first aim of this study was to estimate the impact of anal sphincter laceration during the first birth on the risk of recurrence in the second birth. The second aim was to estimate the absolute risk of anal sphincter laceration in the second birth according to the history of anal sphincter laceration and birth weight	Anal sphincter laceration during first birth increased the risk for a sphincter laceration in the next birth	aOR 4.3, 95% CI 3.8–4.8
			Use of forceps and vacuum during the second birth following a prior anal sphincter laceration significantly increased the risk	Forceps aOR 5.1, 95% CI 4.3– 6.0) Vacuum aOR 1.4, 95% CI 1.1–1.7

			of anal sphincter lacerations	
			Birth weight > 5,000 g significantly increased the risk of anal sphincter lacerations when compared to birth weight < 3000 grams	aOR 23.6, 95% CI 16.5–33.6
• Appears that prior anal sphincter laceration is associated with increased risk of laceration in second birth, in particular in women who carry children with high birth weight • Appears that the use of forceps or vacuum during the second birth following a prior anal sphincter laceration significantly increases the risk of anal sphincter lacerations				
Clemons et al 2005	LQ (0)	To determine whether restrictive episiotomy use was associated with decreases in anal sphincter lacerations and the risk of anal sphincter laceration attributable to episiotomy	The episiotomy rate decreased 56% (37% to 17%, P <.001) between 1999 and 2002, whereas the anal sphincter laceration rate decreased 44% (9.7% to 5.4%, P<.001)	-
			The adjusted odds ratio of anal sphincter laceration attributable to episiotomy decreased 55%, from 6.5 (95% CI: 3.8, 11.1) to 2.9 (95% CI: 1.7, 5.0), between 1999 and 2002	-
• Appears that restrictive episiotomy use reduces the risk of anal sphincter lacerations				
Bodner-Adler et al 2005	AQ (+)	Sought to identify risk factors for spontaneous perineal tears of all degrees during vaginal birth in nulliparous women	Absence of episiotomy, high women's age and large foetal size were independently associated with an increased risk of perineal lacerations	Absence of episiotomy p = 0.0001 High women's age p = 0.027 Large foetal size p = 0.049
			Age, the use of epidural analgesia, the donation of oxytocin, PROM and the duration of the second stage of labour showed no	p > 0.05

			statistically significant influence on the occurrence of perineal lacerations	
• Appears that absence of episiotomy, high women's age and large foetal size are independent risk factors for perineal tears of all degrees in nulliparous women • Appears that the use of epidural analgesia, the donation of oxytocin, PROM and the duration of the second stage of labour showed no statistically significant influence on the occurrence of perineal lacerations				
Aytan et al 2005	AQ (+)	To determine the patient-related factors associated with severe perineal lacerations in nulliparous women and to evaluate the effect of episiotomy type on the risk of severe perineal tears	In women with severe lacerations who underwent midline episiotomy, perineal length was significantly shorter	$p < 0.001$
			In women with severe lacerations who underwent midline episiotomy, the head circumference of their babies was significantly greater than normal	$p < 0.05$
			In women with severe lacerations, birth weights were significantly greater in the mediolateral episiotomy group	$p < 0.05$
			A cut-off value for perineal length of 3.05 cm was found for severe lacerations in the midline group	$P < 0.001$
• Appears that the risk of severe lacerations is significantly greater in women who underwent midline episiotomy who had short perineal length and babies with large head circumference • Appears that the risk of severe lacerations is significantly greater in the mediolateral episiotomy group when the birthweight of the baby was greater • Appears that a cut-off value for perineal length of 3.05 cm can be used to reduce the risk of severe lacerations in the midline group				
Simhan et al 2004	LQ (0)	To identify the risk factors for rectal injury following vaginal birth and to determine the impact of accoucheur experience (resident vs. attending) on those risk factors	Rectal injury was significantly increased with birthweight >4000g, midline episiotomy, or operative vaginal birth	Birthweight >4000g OR: 2.3 (2.0-2.7) Midline episiotomy OR: 3.7 (3.2-4.4) Operative vaginal birth - Vacuum OR: 2.3 (1.6-3.3)

				- Forceps OR: 2.7 (2.3-3.1)
			Multiparity significantly reduced the risk of rectal injury	3+ OR: 0.09 (0.05-0.16) 1 to 2 OR: 0.22 (0.2-0.26)
			Epidural anaesthesia and operator status did not affect the risk of rectal injury	Resident vs attending OR: 0.86 (0.73-1.0)
• Appears that there is a significantly increased risk of rectal injury with birthweight >4000g, midline episiotomy, or operative vaginal birth • Appears that multiparity significantly reduces the risk of rectal injury • Appears that epidural anaesthesia and operator status has no effect on the risk of rectal injury				
Burrows et al 2004	LQ (0)	To identify factors related to pregnancy and childbirth that predispose to perineal trauma	The risk of third and fourth-degree lacerations increases with the use of forceps or vacuum, the use of episiotomy, the presence of hypertension and with increasing birth weight	Forceps or vacuum OR = 3.04, CI = 2.42, 3.84 Episiotomy OR = 6.94, CI = 5.36, 8,99 Hypertension OR = 1.63, CI = .998, 1.714 Increasing birth weight OR = 1.001, CI = 1.001, 1.001
			The risk of third and fourth-degree lacerations decreases with 1 or more previous births and increasing pre-pregnancy maternal weight	1 or more previous births OR = .239, CI = .183, .314 Increasing pre-pregnancy maternal weight OR = .990, CI = .986, .994
• Appears that operative birth, episiotomy use, the presence of hypertension and increasing birth weight increase the risk of third and fourth-degree perineal lacerations • Appears that multiparity and increasing pre-pregnancy maternal weight reduce the risk of 3rd and 4th-degree perineal lacerations				
McLeod et al 2003	AQ (+)	(I) To identify independent risk factors for anal sphincter laceration. (2) to determine the trend in rates of anal sphincter laceration over a 10-year period, and (3) to examine the impact of temporal trends in risk factors on anal sphincter laceration rates	The following factors increased the risk of anal sphincter laceration: Nulliparity Occiput posterior position	RR = 6.97 (5.4-8.99) RR =2.44 (2.07-2.89)

			Non-vertex presentations Second stage ≥ 120 min Delivery by an obstetrician Birth weight ≥3000 g	RR =2.27 (1.34-3.85) RR range = 1.47-2.02 RR = 1.30 (1.1-1.4) RR range = 1.43-6.6
			Instrument-assisted birth involved risks that ranged from a 2-fold increase for a vacuum-assisted birth to a greater than 5-fold increase for a forceps birth after an unsuccessful vacuum extraction	Vacuum RR =2.15 Forceps birth after an unsuccessful vacuum extraction RR = 5.69
			Episiotomy, particularly midline incisions, increased the risk of laceration	RR =2.57
• Appears that nulliparity, occiput posterior position, non-vertex presentations, second stage ≥ 120 min, birth by an obstetrician and birth weight ≥3000 g increased the risk of anal sphincter laceration • Appears that instrument-assisted birth (vacuum-assisted birth and forceps birth after an unsuccessful vacuum extraction) increased the risk of anal sphincter laceration • Appears that episiotomy, particularly midline incisions, increases the risk of laceration				
Gupta et al 2003	AQ (+)	The aim of this study was to ascertain if there were other factors that increased the risk of anal sphincter tears	Foetal macrosomia and doctor-conducted deliveries were independent risk factors associated with an increase in the risk of occurrence of anal sphincter tears	Foetal macrosomia OR: 2.8 (1.8-4.6) Doctor-conducted deliveries OR: 2.6 (1.0-6.0)
			Gestational age, postdates, induction of labour, spinal analgesia alone at birth and assisted vaginal birth did not affect the incidence of anal sphincter tears	Gestational age OR 1.3 (1.0-1.6) Postdates OR (0.8 (0.5-1.5) Induction of labour OR 1.3 (0.8-1.9) Spinal analgesia alone at birth OR 2.0 (0.8-5.0)

				Assisted vaginal birth OR 0.7 (0.3-1.6)
• Appears that foetal macrosomia and doctor-conducted deliveries significantly increase the risk of occurrence of anal sphincter tears • Appears that gestational age, postdates, induction of labour, spinal analgesia alone at birth and assisted vaginal birth do not affect the incidence of anal sphincter tears				
Bodner-Adler et al 2003	LQ (0)	To examine the association of the frequency and severity of perineal trauma with episiotomy performed at forceps birth	The frequency and severity of perineal tears were significantly lower in forceps births when an episiotomy was performed	-
			When mediolateral episiotomy was performed compared to midline episiotomy there was a significantly reduced risk of perineal trauma in women undergoing forceps birth	-
• Appears that the risk and severity of perineal tears is significantly lower in forceps births when an episiotomy is performed • Appears that mediolateral episiotomy significantly reduces the risk of perineal trauma in women undergoing forceps birth when compared to midline episiotomy				
Samuelsson et al 2002	AQ (+)	To ascertain the occurrence and distribution of various types of first to fourth degree tears, during childbirth, and analyze risk factors for perineal second degree tears	The following factors remained independently associated with second degree tear:	
			Slight perineal edema	OR: 0.609 (0.494-0.75)
			High infant weight	OR: 1.801 (1.529-2.123)
			Excellent visualization of perineum	OR: 0.637 (0.529-0.767)
			Increasing age of the mother	OR: 1.046 (1.028-1.064)
			Excellent cooperation of the women	OR: 0.716 (0.603-0.85)
			Protracted second phase (>60 min)	OR: 1.307 (1.027-1.663)
			Duration of second phase <30 min	OR: 0.729 (0.586-0.908)

- Appears that nulliparous women are more likely to have severe perineal lacerations
- Appears that slight perineal edema, duration of second phase < 30 min, excellent cooperation of the women and excellent visualization of perineum reduced the risk of second-degree tears
- Appears that high infant weight, increasing age of the mother and protracted second phase > 60 min increased the risk of second-degree tears

Riskin-Mashiah et al 2002	AQ (+)	Aim was to investigate the risk factors associated with severe perineal tears defined as either third- or fourth-degree tears and, ultimately, find strategies for prevention	The following factors carried a significantly higher risk for severe laceration: Midline episiotomy First vaginal birth Use of pudendal block Forceps births Birth weight more than 4000 g	 OR: 6.91 (6.06-7.88) OR: 6.4 (5.11-8.01) OR: 5.63 (4.72-6.71) OR: 4.48 (3.85-5.2) OR: 2.35 (1.91-2.89)
			The study of interactions demonstrated that mediolateral episiotomy was associated with an increased risk for severe tear only during the first vaginal birth, but not during a repeat vaginal birth	-

- Appears that midline episiotomy, first vaginal birth, forceps birth, foetal weight above 4000 g, and the use of pudendal analgesia increased the risk for severe perineal tears

Richter et al 2002	LQ (0)	This study was conducted to identify obstetric risk factors for anal sphincter tear in primiparous women, women with a previous cesarean birth (VBAC), and women with a previous vaginal birth (PVB)	The risk of anal sphincter tear was significantly increased with primiparity and VBAC compared with PVB, birth weight greater than 4000 g, forceps birth, vacuum birth, shoulder dystocia, and episiotomy	Primiparity RR 4.08 (3.16-5.28) VBAC compared with PVB RR 5.46 (3.69-8.08) Birth weight greater than 4000g RR 2.41 (1.79-3.23) Forceps birth RR 6.00 (4.96-7.25) Vacuum birth RR 2.18 (1.69-2.8) Shoulder dystocia RR 3.28 (2.04-5.26) Episiotomy RR 2.59
• Appears that the risk of anal sphincter tears is significantly increased with primiparity and VBAC compared with PVB, birth weight greater than 4000 g, forceps birth, vacuum birth, shoulder dystocia, and episiotomy				
De Leeuw et al 2001	LQ (0)	To determine risk factors for the occurrence of third-degree perineal tears during vaginal birth	Mediolateral episiotomy appeared to protect strongly against damage to the anal sphincter complex during birth	OR: 0.21, 95% CI: 0.20±0.23
			All types of assisted vaginal birth were associated with third degree perineal ruptures, with forceps birth carrying the largest risk of all assisted vaginal births	Forceps birth (OR: 3.33, 95%-CI: 2.97±3.74)
• Appears that mediolateral episiotomy reduces the risk against damage to the anal sphincter complex during birth • Appears that all types of assisted vaginal birth (fundal expression, fundal expression plus vacuum or forceps, vacuum, vacuum plus forceps, forceps, intervention for shoulder dystocia and breech extraction) were associated with third degree perineal ruptures, with forceps birth carrying the largest risk of all assisted vaginal births • Appears that the use of forceps combined with other types of assisted vaginal birth increases the risk even further				
Bodner et al 2001	LQ (0)	The aim of the study was to assess the frequency of perineal lacerations during normal spontaneous vaginal birth and to evaluate potential risk factors	During normal spontaneous vaginal birth, the following factors increased the risk of perineal lacerations	

			Episiotomy Head diameter Maternal age	OR: 4.3 (2.7-6.9) P= 0.0001 OR: 1.2 (1.1-1.3) P=0.0004 OR: 1.0 (1.0-1.1) P=0.03
			During normal spontaneous vaginal birth Parity (>2) reduced the risk of perineal lacerations	OR: 0.3 (0.2-0.5) P=0.0001
			During normal spontaneous vaginal birth, the following factors did not influence the risk of perineal lacerations Oxytocin Epidural analgesia Second stage of labour	OR: 1.0 (0.7-1.4) P=0.98 OR: 0.9 (0.6-1.3) P=0.29 OR: 1.1 (0.9-1.3) P=0.17

- Appears that an advanced age of the mother, episiotomy and large head diameter increase the risk of perineal lacerations
- Appears that parity > 2 reduces the risk of perineal lacerations
- Appears that oxytocin use, epidural analgesia and length of second stage of labour do not influence the risk of perineal lacerations

Obesity/BMI

One controlled trial was found that investigated the effect of a weight prevention program and its impact on the risk for perineal tears or lacerations. Twelve cohort studies were also found which investigated the potential risk factors of obesity and BMI.

Controlled Trial

Asbee et al. 2009

Asbee et al. (2009): (QS: (AQ (+)) conducted a trial to prevent excessive weight gain during pregnancy and assess effects on different outcomes including vaginal/perineal lacerations. There were 100 women with prenatal care established at 6–16 weeks of gestation, aged 18–49 years, all prenatal care received at the Resident Obstetrics Clinic, English-speaking, Spanish-speaking, or both, and singleton pregnancy, included in the study. There were 57 women randomly allocated in the intensive program of dietary and lifestyle counselling and 43 in the control group. The intensive program of dietary and lifestyle counselling included complete history and physical examination, consultation with a registered dietician with information on

pregnancy-specific dietary and lifestyle choices and exercise instructions and information on the appropriate weight gain during pregnancy using the IOM guidelines. The control group received routine antenatal care which included routine prenatal care for the remainder of the pregnancy. Perineal lacerations were noted as secondary outcome.

There was no difference between the two groups in terms of perineal lacerations. No specific data was provided regarding this outcome.

<table>
<tr><th>Study</th><th>SIGN rating</th><th>Objective</th><th></th><th>Result</th></tr>
<tr><td>Asbee et al 2009</td><td>AQ (+)</td><td>To estimate whether an organised, consistent program of dietary and lifestyle counselling prevents excessive weight gain in pregnancy</td><td>No statistically significant differences were noted between the groups in adherence to IOM guidelines, rate of caesarean birth, preeclampsia, gestational diabetes mellitus, operative vaginal birth, or vaginal lacerations</td><td></td></tr>
<tr><td colspan="5">• An organized, consistent program of dietary and lifestyle counselling did reduce weight gain in pregnancy but there was no difference in terms of vaginal lacerations</td></tr>
</table>

Cohort Studies

<table>
<tr><th>Study</th><th>SIGN rating</th><th>Objective</th><th>Result</th><th>Likelihood</th></tr>
<tr><td rowspan="2">Durnea et al 2018</td><td rowspan="2">AQ (+)</td><td rowspan="2">Study aimed to investigate the association between perineal trauma at childbirth and maternal BMI, and estimate the risk of perineal trauma among different BMI groups</td><td>Increasing BMI was inversely associated with the risk of having minor tears (first and second degree)</td><td>BMI: OR
<25: 1 (reference)

25-<30: 1.04 (0.98-1.11)

30 -<35: 0.91 (0.84 – 0.99)

≥35: 0.88 (0.63-1.23)</td></tr>
<tr><td>Increasing BMI was not significantly associated with OASIS (third- and fourth-degree perineal tears)</td><td>BMI:OR
<25 : 1 (reference)

25-<30: 1.14 (0.99-1.30)

30 -<35: 0.88 (0.71 – 1.10)

≥35: 0.88 (0.63-1.23)</td></tr>
<tr><td colspan="5">• Appears that increased BMI is associated with a reduced incidence of minor perineal trauma at birth, but is not associated with OASIS (third and fourth grade perineal tears)</td></tr>
</table>

Ramo Isgren et al 2017	AQ (+)	Study aims to evaluate the associations of BMI in adolescents and obstetric outcomes and to determine whether the outcomes in the BMI groups of adolescents differ from those of a low risk population of adult women	The occurrence of OASI was not influenced by increasing BMI among adolescents	BMI: OR (95%CI) <18.5: 0.23 (0.15-0.38) 18.5 to 24.9: 0.233 (0.29-0.38) 25 to 29.9: 0.33 (0.26-0.33) $\geq$30: 0.38 (0.26-0.57)
• Appears that adolescents in both the overweight and the obesity classes have more than 60% decreased risk for OASI, and around 40% lower risk for instrumental vaginal delivery, than women with normal BMI.				
Deruelle et al 2017	HQ (++)	Study aimed to evaluate, in a French multicentre cohort, the risk of C-section based on a high pre-pregnancy body mass index (BMI). Secondary objectives were to assess the risk of elective C-section, severe post-partum haemorrhage (> 1 L), severe perineal tears (3rd and 4th degree) and neonatal complications according to pre-pregnancy BMI	Third- and fourth-degree perineal tears did not increase with increased BMI	$p < 10^{-4}$
			After adjustment, the RR of 3rd and 4th degree perineal tears were not significantly associated with increased BMI	aRR: BMI: 25-29: 1.08 (0.91-1.27) BMI 30-39: 0.99 (0.75-1.27) BMI $\geq$ 40: 0.37 (0.06-1.13)
• Appears to be no significant association between BMI and severe perineal tears (Third- and fourth-degree lacerations)				
Lee et al 2016	AQ (+)	Study aims to compare perinatal outcomes between elective induction of labour and expectant management in obese women	The proportions of perineal lacerations were not significantly different between elective induction and expectant management groups at any gestational age, regardless of parity among	$p > 0.05$

			obese women	
• Appears to be no significant difference in the proportion of perineal lacerations among obese women regardless of age and parity				
Hollowell et al 2014	AQ (+)	Study aims to evaluate the impact of maternal BMI on intrapartum interventions and adverse outcomes that may influence choice of planned birth setting in healthy women without additional risk factors	There were no consistent, statistically significant associations between maternal BMI and third/fourth degree tear in healthy women without additional risk factors	BMI: uOR/aOR Underweight: 0.94 (0.51-2.34 / 1.03 (0.48-2.21) Normal weight: Reference Overweight: 0.88 (0.74-1.04) / 0.93 (0.78-1.10) Obese: 0.94 (0.63-1.40) / 0.82 (0.60-1.13) Very obese: 0.66 (0.34-1.28) / 0.77 (0.40-1.50)
• Appears to be no relationship between BMI and third- or fourth-degree perineal tear among women without medical or obstetric risk factors other than obesity				
Gallagher et al 2014	AQ (+)	Study aims to explore the impact of BMI or pregnancy weight gain on the presence, site, and severity of genital tract trauma at childbirth in nulliparous women	Obese women were not more likely to sustain severe third- and fourth-degree lacerations compared to non-obese women	p= 0.21
• Appears that a women's BMI or excessive weight gain in pregnancy does not influence her risk of severe perineal trauma				
Lindholm & Altman 2013	HQ (++)	Study aims to assess the risk for obstetric anal sphincter lacerations in relation to maternal obesity among primiparous women in Sweden	Increasing BMI showed a near-dose–response	BMI: OR (95%CI)

			type of protective effect against grade III–IV perineal lacerations	<25: 1 (reference) 25 to <30: 0.89 (0.85-0.95) 30 to <35: 0.84 (0.76-0.92) >35: 0.70 (0.59-0.82)
			Increasing BMI had a dose–response type of increase in risk for grade first to second lacerations	BMI: OR (95%CI) <25: 1 (reference) 25 to <30: 1.13 (1.11-1.16) 30 to <35: 1.23 (1.11-1.16) >35: 1.32 (1.23-1.41)
• Appears that increasing BMI is a significant risk factor for minor perineal lacerations and is protective against severe perineal lacerations				
Voldner et al 2009	AQ (+)	Study aims to examine the relationship between modifiable factors and birth complications among women with singleton pregnancy	No significant association between BMI $\geq$ 25 and perineal lacerations	OR (p value) 0.7 (0.22)
			No significant association between BMI $\geq$ 30 and perineal lacerations	OR (p value) 2 (0.30)
• Appears to be no association between high BMI (overweight and obese) and perineal lacerations				
Usha Kiran et al 2005	AQ (+)	Study aims to show the increased risk of adverse outcomes in labour and foetomaternal morbidity in obese women (BMI > 30)	Those with BMI >30 were not at any higher risk of third- or fourth-degree perineal tears	OR of non-significant risk factors were not shown in the study
• Appears to be no significant increase in the rate of third- or fourth-degree perineal tears seen among obsese women				

Rode et al 2005	AQ (+)	Study aims to investigate the relationship between pre-pregnancy and obstetric BMI as well as foetal complications in a large, unselected cohort of Danish women with single cephalic pregnancies	Nulliparous women had an increased risk of perineal rupture compared with multiparous women when including vacuum extraction in the multivariate logistic regression analysis	OR 1.7, 95% CI (1.1–2.8)
• Appears that the rate of complications during pregnancy and birth increases with an increasing pre-pregnancy BMI in women with single cephalic term pregnancies, particularly in nulliparous women				
Albers et al 2006	LQ (0)	Study aims to describe the relationship of BMI and pregnancy weight gain to clinical intrapartum care, infant birthweight and genital tract trauma with vaginal birth	Obese women (prepregnant BMI > 30) who gained > 40 pounds experienced perineal and vaginal trauma more frequently than did obese women who gained < 40 pounds	$p < 0.01$
• Appears that the obese women who gained less weight had less genital tract trauma than those who gained ≥ 40 pounds				
Buhimschi et al 2004	AQ (+)	Study tested the hypothesis that obese women have inadequate intrauterine pressures during the second stage of labour	Obese women did not suffer a higher frequency of perineal laceration compared to normal and overweight women	p value = 0.82
• Appears that obesity does not increase the incidence of perineal lacerations				

Obstetric Gel

Controlled Trials

One controlled trial was found that investigated the effect of using an obstetric gel during the second stage of labour and its effect on the perineum.

Schaub et al. 2008

Schaub et al. (2008): (QS: (AQ (+)) conducted a trial to determine whether the obstetric gel shortens the second stage of labour and exerts a protective effect on the perineum. There were 228 nulliparous women with singleton low-risk pregnancies in vertex position, estimated birth weight between 2000 g and 4500 g, and low risk pregnancy at 37-42 weeks of gestation, included in the study. The women were randomly assigned to Group A (without obstetric gel) and Group B (with obstetric gel use). The obstetric gel was intermittently applied into the birth canal during vaginal examinations, starting at the early first stage of labour (prior to 4 cm dilation) and ending with delivery.

Perineal tears were significantly reduced (P=0.024) with the use of obstetric gel in vaginal births without interventions, such as C-section, vaginal operative procedure or Kristeller manoeuvre.

Authors concluded that systematic vaginal application of obstetric gel showed a significant reduction in the second stage of labour and a significant increase in perineal integrity.

Study	SIGN rating	Objective		Result
Schaub et al 2008	AQ (+)	To determine whether the obstetric gel shortens the second stage of labour and exerts a protective effect on the perineum	For vaginal births without interventions, such as C-section, vaginal operative procedure or Kristeller manoeuvre, obstetric gel use significantly shortened the second stage of labour and significantly reduced perineal tears	Shortened second stage of labour by 26 min (30%) (P=0.026)
				Reduced perineal tears (P=0.024)

- A systematic vaginal application of obstetric gel significantly reduced the number of perineal tears in vaginal births without interventions, such as C-section, vaginal operative procedure or Kristeller manoeuvre

Oxytocin

One controlled trial and one cohort study was found investigating the use of oxytocin to stimulate labour, as a risk for perineal tears.

Controlled trials

Bor et al. 2006

Bor et al. (2006): (QS: (AQ (+)) conducted a trial to investigate whether discontinuation of oxytocin infusion could affect the duration of the active phase of labour compared with continuation of oxytocin until delivery, in terms of maternal and neonatal complications. There were 200 pregnant women who underwent either labour induction or augmentation with oxytocin. There were 100 women randomly allocated to continued use of oxytocin until delivery and 100 women in the discontinuation of oxytocin. Perineal tears were reported as first, second, third- and fourth-degree tears.

The rate of perineal tears was not significantly different (p=0.17) in the two groups. First, second and third-degree tears were collectively analysed as perineal tears and were calculated only for women with vaginal birth.

Authors concluded that discontinuation of oxytocin infusion in the active phase of labour may improve some labour outcomes but has the disadvantage of increasing the duration of the

active phase of labour. Continued oxytocin use and discontinued oxytocin use do not have a significant effect on rates of perineal tears.

Study	SIGN rating	Objective		Result
Bor et al 2006	AQ (+)	To investigate whether discontinuation of oxytocin infusion could affect the duration of the active phase of labour compared with continuation of oxytocin until delivery, and to compare maternal and neonatal complications	Rates of caesarean births, uterine tachysystole, postpartum haemorrhage, and third-degree perineal tears were noted to be greater in the continued oxytocin group than the discontinued oxytocin group; however, these differences were not significant	P=0.17
• Continued oxytocin use and discontinued oxytocin use do not have a significant effect on rates of perineal tears				

Cohort studies

Study	SIGN rating	Objective		Result
Hidalgo-Lopezosa et al 2016	AQ (+)	To evaluate the effects of labour stimulation with oxytocin on the maternal and neonatal outcomes	No differences in 3rd and 4th degree lacerations were observed between the group submitted to oxytocin and the group with no oxytocin in primiparous women	OR 0.47 95%CI 0.07-2.87
			No differences in 3rd and 4th degree lacerations were observed between the group submitted to oxytocin and the group with no oxytocin in multiparous women	OR 1.51 95%CI 0.09-24.7
• Appears that Oxytocin stimulation does not increase the risk of 3rd and 4th degree lacerations				

Parity

Cohort Studies

One cohort study that specifically investigated parity as a risk for perineal tears was identified.

Study	SIGN rating	Objective		Result
Kamisan et al 2018	AQ (+)	To determine the prevalence of levator ani muscle and external anal sphincter trauma in primiparous (VP1) and multiparous (VP2+) women who had delivered vaginally to assess if there were differences between the two groups	No significant difference in the prevalence of levator avulsion and external anal sphincter defects between primiparous and	OR 1.9, 95% CI 0.72–5.01, p = 0.26) and (OR 1.2, 95% CI 0.4–3.8, p = 0.76

			multiparous women who delivered vaginally	
• Appears that parity is not associated with external anal sphincter defects				

Passive Second Stage of Labour

Case Controls

One case control study investigated passive second stage of labour as a risk factor for perineal tears.

Study	SIGN rating	Objective	Result	Likelihood
Gossett et al 2016	AQ (+)	Study aims to estimate the relationship between a passive second stage of labour and OASIS	OASIS were recorded among 1452 (57.8%) of 2510 women who did not labour down compared with 169 (40.0%) of 423 women who laboured down	P<0.001
			In binary logistic regression, the addition of labouring down to the model only increased the predictive accuracy	80.1% to 80.7%
• Appears that when known risk factors for OASIS are accounted for, the effect of labouring down on perineal outcome is negligible				

Pelvic Floor Muscle Function & Exercise

One SR investigated the role of pelvic floor muscle function and exercise on the risk of perineal tears. One controlled trial and three cohort studies not reported in previous review were also identified.

Systematic Review

Du et al 2015

Du et al 2015 ((QS: HQ (++)) undertook a SR/MA of the evidence associated with the effect of antenatal pelvic floor muscle training (PFMT) on labour and birth outcomes, focusing on all perineal tears (first, second, third- and fourth-degree tears). The review was limited to RCTs and quasi randomised trials and found six relevant studies (Salvesen 2004; Gaier 2010; Mason 2010; Dias 2011; Po-Chun Ko 2011; X Wang 2014).

The authors concluded that antenatal PFMT might be effective at shortening the first and second stage of labour in the primigravida, however, it did not appear to affect the risk of episiotomy, instrumental birth, and perineal laceration in the primigravida.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Du et al 2015	HQ (++)	The result of the meta-analysis shows that the association between antenatal pelvic floor muscle training (PFMT) versus control on the risk of perineal laceration is not statistically significant	OR=0.96, 95% CI: 0.66 to 1.40	Six trials 2,243 women

Controlled trial

Leon-Larios et al. 2017

Leon-Larios et al. (2017): (QS: (AQ +)) conducted a trial to investigate the effect of a pelvic floor training programme to prevent perineal trauma. There were 466 women, singleton pregnancy with cephalic presentation, anticipating a normal birth at a public hospital, signed consent form and ability to understand instructions in Spanish, included in the study. There were 254 women randomised in the pelvic training group and 212 in the control group. The pelvic training consisted of combined pelvic floor exercise and perineal massage training programme. The control group received no instruction on massage or pelvic floor exercises. Severe perineal trauma was noted.

There were more severe perineal tears in the control group (15.6%) compared with the pelvic floor training programme group (5.7%), p=0.003.

Authors concluded that a combined perineal/pelvic floor training programme based on pelvic floor exercises and perineal massage for primiparous women appears to increase the likelihood of having an intact perineum and reduces rates of episiotomy and severe perineal trauma.

Study	SIGN rating	Objective		Result
Leon-Larios et al 2017	AQ (+)	To investigate the effect of a pelvic floor training programme to prevent perineal trauma	There were more severe perineal tears in the control group (15.6%) compared with the pelvic floor training programme group (5.7%)	(p=0.003)
• A combined perineal/pelvic floor training programme based on pelvic floor exercises and perineal massage for primiparous women increases the likelihood of having an intact perineum and reduces rates of severe perineal trauma when compared to women who received no instruction on massage or pelvic floor exercises				

Cohort Studies

Three cohort studies not reported in the previous review that investigated the association of pelvic floor exercises and other exercise, with risk for perineal tears were identified.

Study	SIGN rating	Objective		Result
Rise et al 2019	LQ (0)	To investigate whether nulliparous pregnant women reporting regular abdominal strength training prior to and at two time points during pregnancy have reduced risk of caesarean section, instrumental assisted vaginal birth and third- and fourth-degree perineal tears	For acute caesarean section, no difference was found among those training with the same frequency before and during pregnancy	adjusted odds ratios were 0.97 (95% CI 0.79-1.19)

			compared to those that never trained	
• Appears that regular abdominal strength training before and during pregnancy is not associated with third- and fourth-degree perineal tears				
Bo et al 2013	HQ (++)	To investigate whether vaginal resting pressure, pelvic floor muscle strength, or endurance at midpregnancy affect birth outcome	Vaginal resting pressure, pelvic floor muscle strength and endurance were not associated with third- and fourth-degree perineal tears	Vaginal resting pressure, p=0.20 Pelvic floor muscle strength, p=0.87 Endurance, p=0.77
• Appears that vaginal resting pressure, pelvic floor muscle strength and endurance are not associated with third- and fourth-degree perineal tears				
Bo et al 2009	LQ (0)	To estimate whether women doing pelvic floor muscle training before and during pregnancy have increased risk of perineal lacerations, episiotomy, vacuum/forceps birth, or acute caesarean birth	Exercising at least three times per week was not associated with first-degree and second-degree perineal lacerations	adjusted OR 1.03 (95% CI 0.86–1.25)
			Exercising at least three times per week was not associated with third-degree and fourth-degree perineal lacerations	adjusted OR 0.86 (95% CI 0.60–1.24)
• Appears that regular pelvic floor muscle training before and during pregnancy is not associated with minor or severe perineal tears				

Perineal Length

Cohort Studies

Seven cohort studies investigated perineal length as a risk factor for perineal tears.

Study	SIGN rating	Objective	Result	Likelihood
Lane et al 2017	AQ (+)	Study aims to assess the relation between perineal body length and the risk of perineal laceration extending into the anal sphincter during vaginal birth in primigravid women at an institution with a low utilization of episiotomy	The length of the perineal body was a significant predictor of third- and fourth-degree lacerations	OR 24 (1.3-456) $p < 0.04$
• Appears that perineal body length of ≤3.5 cm is associated with an increased risk of third- and fourth-degree lacerations in primigravid women				
Meriwether et al 2016	AQ (+)	Study aims to evaluate whether perineal stretch was associated with postpartum pelvic floor dysfunction, and hypothesized that greater perineal stretch would correlate with worsened outcomes	Perineal body change was not associated with perineal lacerations or	$p>0.05$

			outcomes postpartum	
• Appears that there is no association between perineal body stretch during labour and perineal lacerations				
Yeaton-Massey et al 2015	LQ (0)	Study aims to examine the association between race/ethnicity, perineal length and the risk of perineal laceration	There was no statistically significant difference in mean perineal length by race/ethnicity	P>0.05
			More multiparous Asian and African-American women had a short perineal length	p=0.05
			The rate of severe perineal lacerations in the cohort was 2.6% overall, but was 8.2% among Asian women	P=0.04
• Appears that there is no relationship between short perineal length and risk of severe perineal laceration with vaginal birth, or a difference in mean perineal length by maternal race/ethnicity • Appears that women of different racial/ethnic groups have varying rates of severe perineal laceration, with Asian women comprising the highest proportion				
Hokenstad et al 2015	AQ (+)	Study aims to determine whether pelvic organ prolapse quantification measurements of genital hiatus or perineal body obtained in the late third trimester are predictors of obstetric perineal laceration in nulliparous women	No significant difference in the median genital hiatus and perineal body measurements among women with and without perineal lacerations	p>0.05
• Appears that antenatal measurement of genital hiatus and perineal body does not correlate with the risk of obstetric perineal laceration in nulliparous women undergoing spontaneous vaginal birth				
Geller et al 2014	HQ (++)	Study aims to determine if shortened perineal body length (<3 cm) is a risk factor for ultrasound-detected anal sphincter tear at first birth	Women with perineal body length <3cm had a significantly higher rate of ultrasound-diagnosed anal sphincter tear	P=0.038
			When comparing women with and without sphincter tear, there was a significant difference in	P=0.043

			mean antepartum PB	
• Appears that a shortened perineal body length in primiparous women is associated with an increased risk of anal sphincter tear at the time of first birth				
Dua et al 2009	AQ (+)	Study aims to provide normative data of perineal length for women in the first stage of labour and to correlate the length with perineal tears during labour	Primigravid women with short perineum were more likely to have a third-degree perineal tear in labour	P=0.03
			There was a 32% reduction in the probability of a third- or fourth-degree perineal tear per 1 cm increase in perineal length but this was not statistically significant	OR: 0.68 P=0.085
			Adjusting for confounding factors including BMI, foetal position parity and birth weight, a strong correlation was noted between length and third-degree tears which was significant	r=0.6 p=0.047
• Appears that there is a negative correlation between perineal length and third-degree tear in primigravid women				
Deering et al 2004	LQ (0)	Study aims to define normal perineal body length during labour and determine if a shortened perineal body is associated with perineal lacerations or operative vaginal birth	Women with a perineal body of < 2.5 cm had a significantly higher chance of sustaining a third- or fourth-degree laceration	40% vs. 5.6% P=0.004
• Appears that there is an increased risk of significant lacerations and operative vaginal birth in women with a shortened perineal body				

Perineal Massage

Two SRs were identified that reviewed whether perineal massage can prevent or reduce the likelihood of perineal tears. One RCT and no cohort studies were identified that were not included in the SRs.

Systematic Reviews

Aquino et al. 2018

Aquino et al. (2018) (QS: HQ (++)) conducted a SR and meta-analysis regarding the effect of perineal massage versus no perineal massage in women with singleton gestation and cephalic presentation at >36 weeks. Perineal massage was defined as massage of the posterior perineum by the clinician's fingers (with or without lubricant). The review contained nine relevant RCTs (Stamp et al 2001; Albers et al 2005; Attarha et al 2009; Galledar 2012; Fahami et al 2012; Geranmayeh et al 2012; Karacam et al 2012; Sohrabi & Shirinkam 2012; Demirel & Golbasi 2015).

The review reported that perineal massage was usually done by a midwife in the second stage, during or between and during pushing time. The midwife will massage the posterior perineum using the index and middle fingers using a water-soluble lubricant. Perineal massage during labour was found to be associated with significant lower risk of severe perineal trauma, such as third- and fourth-degree lacerations. The incidence of intact perineum was significantly higher in the perineal massage group (RR 1.40, 95% 1.01–1.93).

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Aquino et al 2018	HQ ++	Women randomised to receive perineal massage during labour had a significantly lower incidence of severe perineal trauma, compared to those who did not	RR 0.49, 95% CI 0.25–0.94	Based on five RCTs

Beckmann & Stock 2013

Beckmann & Stock (2013) (QS: HQ (++)) conducted a SR and meta-analysis regarding the effect of antenatal digital perineal massage for reducing perineal trauma. The review contained four relevant trials (Shima et al 2005; Labrecque et al 1999; Shipman et al 1997; Labrecque et al 1994).

There were no differences found in the incidence of first- or second-degree perineal tears or third-/fourth-degree perineal trauma in performing digital perineal massage.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Beckmann and Stock 2013	HQ ++	First-degree perineal tear There was no difference in the incidence of first-degree perineal tear overall	average RR 0.96 (95% CI 0.78-1.19)	Based on four RCTs
		Second-degree perineal tear There was no difference in the incidence of second-degree perineal tear overall	RR 0.99 (95% CI 0.85 - 1.15)	Based on four RCTs
		Third- or fourth-degree perineal trauma There was no difference in the incidence of third- or fourth-degree perineal trauma overall	RR 0.81 (95% CI 0.56 - 1.18)	Based on four RCTs

Controlled Trials

Bodner-Adler et al 2002

Bodner-Adler et al. (2002): (QS: (LQ (-)) conducted a trial to investigate the effect of perineal massage during pregnancy in primiparous women. There were 531 primiparous women expecting a normal vaginal birth of a singleton baby with cephalic presentation included in the study. There were 121 women in the perineal massage group and 410 women in the no massage group. Perineal massage was done 3-4 times a week for 5–10 minutes starting six weeks before their estimated due date. Perineal massage consisted of introducing one or two fingers 3–4 cm deep into the vagina and applying and maintaining pressure, first downwards and then to each side of the vaginal entrance. A bottle of almond oil was used for lubrication. Perineal trauma was noted as first, second, third- and fourth-degree perineal tears.

There was no significant reduction of perineal tears in both groups whether analyzed collectively (all types of perineal tears, p=0.40) or separately (third degree tears, p=0.19).

Authors concluded that performing perineal massage during pregnancy showed neither a protective nor a detrimental effect on the occurrence of perineal trauma.

Study	SIGN rating	Objective		Result
Bodner Adler et al 2002	LQ (-)	To evaluate the association of antenatal perineal massage with subsequent perineal outcomes in nulliparous women	Women in the perineal massage group had a statistically non-significant lower rate of perineal tears compared with the control group	P=0.40
			In a separate analysis of third-degree tears, there was a trend towards reduction but not significant	P=0.19
• Perineal massage does not have a significant effect on the occurrence of perineal trauma				

Prenatal Exercise

Two SRs investigated the role of prenatal exercises on the risk of perineal tears.

Davenport et al. 2019

Davenport et al. 2019 ((QS: HQ (++)) undertook a SR/MA of the evidence on the impact of prenatal exercise on maternal harms, labour and birth outcomes, including first, second- and third-degree tears. This review included primary studies of any design with the exception of case studies. A total of eight studies - seven RCTs (Davies et al. 2003; Orsini et al. 2012; Hollingsworth et al. 1987; Lombardi et al. 1999; Nielsen et al. 1998; Stafne et al. 2012; Vinter et al. 2011), two non RCTs, (Moher et al. 2015; Hui et al. 2014) and one cohort study (Villar et al. 2007) were reviewed.

The authors concluded that prenatal exercise reduced the odds of instrumental birth by 24%, however, they did not affect preterm/prelabour rupture of membranes, caesarean section, instrumental birth, induction of labour, length of labour, vaginal tears, fatigue, injury, musculoskeletal trauma, maternal harms and diastasis recti. Further they concluded that there

was no evidence for a dose–response relationship between frequency, intensity, duration or volume of exercise and labour and birth outcomes.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Davenport et al 2019	HQ (++)	There was no relationship between prenatal exercise and vaginal tears	Not reported	12 trials

Domenjoz et al. 2014

Domenjoz et al. 2014 ((QS: HQ (++)) undertook a SR on the effect of physical activity during pregnancy on mode of birth and risk of perineal tears. The review focused on RCTs and was only able to find one RCT that explored the relationship between prenatal physical activity and risk of perineal tears (Barakat et al. 2011)

The authors concluded that women in exercise groups had a significantly lower risk of caesarean birth (RR, 0.85; 95% CI, 0.73–0.99). Birthweight was not significantly reduced in exercise groups and the risk of instrumental birth was similar among groups (relative risk, 1.00; 95% CI, 0.82–1.22). Data on Apgar score, episiotomy, epidural anaesthesia, perineal tear, length of labour, and induction of labour were insufficient to draw conclusions.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Domenjoz et al 2014	HQ (++)	The study mentioned percentage of lacerations for exercise versus no exercise but did not report percentage values in the review. Insufficient to draw conclusions.	-	One trial

Previous Caesarean Section – Vaginal Birth After Caesarean (VBAC)

Six cohort studies that looked at previous C section as a risk for perineal tears were identified.

Cohort Studies

Study	SIGN rating	Objective		Result
Jardine et al 2019	LQ (0)	To evaluate whether there is an association between vaginal birth after caesarean and risk of OASI	OASI rates were 5.0% in primiparous women, 5.8% in secondiparous women undergoing vaginal birth after caesarean after previous elective caesarean, and 7.6% in secondiparous women undergoing vaginal birth after caesarean after previous	-

			emergency caesarean	
			Women having a vaginal birth after caesarean for their second baby following an emergency caesarean section in their first birth had higher rate of OASI than primiparous women	adjusted OR 1.31; 95% CI: 1.20, 1.4
• Appears that having a vaginal birth after emergency caesarean in initial birth leads to a higher rate of OASI than primiparous women				
Nettle et al 2018	LQ (0)	To ascertain the rate of severe perineal injuries in women achieving VBAC at a major tertiary obstetric hospital, and to determine if vaginal birth is more likely to be associated with perineal injuries in women with one previous caesarean section compared with nulliparous women	No significant difference in the rate of third- and fourth-degree tears in the VBAC group compared with the nulliparous group	6.0% vs 5.6% P = 0.73
			No significant increase in anal sphincter injuries in the first VBAC group compared with the nulliparous group	6.0% vs 7.4% P = 0.25
• Appears that vaginal birth after caesarean does not increase the risk of severe perineal injuries				
Elvander et al 2018	AQ (+)	To examine risk of severe perineal trauma among nulliparous women and those undergoing vaginal birth after caesarean birth (VBAC)	Rate of severe perineal trauma among nulliparous women and those undergoing VBAC was 7.0% and 12.3%	-
			There is an increased risk of severe perineal trauma after adjustments among those undergoing VBAC	adjusted RR 1.42, 95% CI 1.23-1.63
• Appears that vaginal birth after caesarean increases the risk of severe perineal trauma				
Hehir et al 2014	AQ (+)	To examine the incidence of obstetric anal sphincter injury in women who had a successful VBAC	Women having VBAC were at greater risk of anal sphincter injury than	OR 1.4, 95% CI 1.15–1.75 p = 0.001

			nulliparous women having a vaginal birth over the same period (5% [98/,981] versus 3.5% [1216/34496]	
• Appears that vaginal birth after caesarean increases the risk of OASI				
Raisanen et al 2013	LQ (0)	To assess an association between prior CS and incidence of OASIS across groups of women categorised according to singleton first, second, and third vaginal births between 1997 and 2007	Incidence of OASIS was 1.8 % at a first vaginal birth after a prior CS compared with 1.0 % at a first vaginal birth without prior CS	
			Prior CS was associated with a 1.42-fold risk of OASIS only at the first vaginal birth, with no further significant risk after one or two previous vaginal births	OR 1.42 95%CI 1.25-1.61 p=<0.001
• Appears that vaginal birth after caesarean increases the risk of OASIS				
Rozen et al 2011	AQ (+)	To do a 6-year review of VBAC at a large tertiary centre, formally assessing the primary outcomes of uterine rupture, PPH, third/fourth degree tears and neonatal morbidity, defined as admissions to SCN (special care nursery)/NICU (neonatal intensive care unit)	Third- and fourth-degree tears among nulliparous women and multiparous women with no previous caesarean birth were not significantly different with those women who had VBAC	1.3% vs 2.6%, p = 0.07
• Vaginal birth after caesarean does not increase the risk of third- and fourth-degree tears when compared with nulliparous women				

Previous History of OASI or other Perineal Trauma

Cohort studies

Three cohort studies that looked at previous history of OASIS as risk for perineal tears were identified.

Study	SIGN rating	Objective		Result
Manzanares et al 2013	LQ (0)	To assess whether the presence of an episiotomy or second-degree or higher spontaneous tear at the first birth increases the risk of having these lacerations at the next one	Risk of having second-degree or higher spontaneous tear in the next birth was fivefold for	adjusted OR 5.15, 95% CI 3.11–8.54

			those with perineal trauma	
• Appears that a previous history of episiotomy or second-degree or higher spontaneous tear at the first birth significantly increases the risk of having perineal trauma in the next birth				
Priddis et al 2013	AQ (+)	To determine the risk of recurrence, subsequent mode of birth and morbidity for women who experienced severe perineal trauma during their first birth in New South Wales between 2000 – 2008	2,784 (1.6%) primiparous women experienced severe perineal trauma	
			Women who experienced severe perineal trauma were not at risk of a severe perineal tear in the second birth	OR 0.9; CI 0.67-1.34
• Appears that severe perineal trauma in the first birth was not a risk for severe perineal tear in the second birth				
Edwards et al 2006	AQ (+)	To examine the risk of recurrence of obstetric anal sphincter lacerations	Six (2.4%) women had recurrence of anal sphincter lacerations, and five of them were third degree lacerations	
			Rate of recurrent lacerations was not significantly different from the rate of initial lacerations (2.4% vs. 3.3%)	OR 0.72, 95% CI 0.33–1.59 p=0.4
• Appears that having previous anal sphincter lacerations did not increase the risk for recurrence of anal sphincter lacerations				

Pushing Technique

Two SRs investigated the role of pushing technique in the second stage of labour as a risk factor for perineal tears. There were also two trials not included in the systematic reviews that investigated the effect of pushing technique in relation to perineal tears.

Systematic Reviews

Lemos et al. 2017

Lemos et al. 2017((QS: HQ (++)) undertook a SR/MA of the evidence related to pushing/bearing down methods for the second stage of labour. The review focussed on RCTs and quasi-RCTs assessing the effects of pushing/bearing down techniques (type and/or timing) performed during the second stage of labour on maternal and neonatal outcomes. The review identified 21 studies of which eight explored the effect on third- and fourth-degree perineal lacerations.

The authors identified that timing of pushing with epidural was consistent in that delayed pushing leads to a shortening of the actual time pushing and increase of spontaneous vaginal birth. However, there was no clear difference in serious perineal laceration and episiotomy,

and in other neonatal outcomes (admission to neonatal intensive care, five-minute Apgar score less than seven and delivery room resuscitation), between delayed and immediate pushing.

Therefore, for the type of pushing, with or without epidural, there was no conclusive evidence to support or refute any specific style as part of routine clinical practice, and in the absence of strong evidence supporting a specific method or timing of pushing, the woman's preference and comfort and clinical context should guide decisions.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Lemos et al 2017	HQ (++)	Types of pushing: spontaneous pushing versus directed pushing There was no clear difference in third- or fourth-degree perineal laceration	RR 0.87, 95% CI 0.45 to 1.66	One trial
		Timing of pushing: delayed pushing versus immediate pushing (all women with epidural) Delayed pushing was associated with no clear difference in third- or fourth-degree perineal laceration	RR 0.94, 95% CI 0.78 to 1.14	Seven trials

Roberts et al. 2004

Roberts et al. 2004 ((QS: LQ (-)) undertook a SR and MA into the effect of delayed versus early pushing in women with epidural analgesia in the risk of second, third- and fourth-degree perineal tears. This review focused on RCT evidence and included five studies (Mayberry et al 1999; Fitzpatrick et al 2002; Fraser et al 2000; Plunkett et al 2003; Vause et al 1998). In the studies involving perineal lacerations there were 2530 subjects investigated.

The authors concluded that there were no other statistically significant maternal morbidity results, with similar rates among delayed and early pushing groups for episiotomy, perineal lacerations, postpartum haemorrhage and maternal satisfaction with labour care.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Roberts et al 2004	LQ (-)	No significant difference in rates of perineal tears among delayed and early pushing groups	RR 0.90, 0.7 to 1.17	Five trials

Controlled Trials

Cahill et al 2018

Cahill et al. (2018) (QS: (HQ (++)) conducted a randomised trial to evaluate whether immediate or delayed pushing results in higher rates of spontaneous vaginal birth and lower rates of maternal and neonatal morbidities. There were 2410 nulliparous pregnant women at or beyond 37 weeks' gestation, admitted for spontaneous or induced labour with neuraxial analgesia, included in the study. There were 1200 women randomly allocated to the immediate pushing group and 1210 in the delayed pushing group. Immediate pushing is initiating pushing

with uterine contractions once complete cervical dilation occurs. Delayed pushing is waiting 60 minutes prior to initiation of pushing unless instructed to do otherwise by their clinician or unless they had an irresistible urge to push. Perineal lacerations were described as second, third- or fourth-degree tears.

Perineal lacerations were common but there was no significant difference in the overall rates between the two groups (RR, 0.99 [95% CI, 0.95 to 1.04]). However, for third degree tears only, it was found that they were significantly higher in the immediate pushing group compared with the delayed pushing group (5.3% vs 4.3%, respectively; absolute difference, 0.9% [95% CI, −0.8% to 2.6%]; RR, 1.2 [95% CI, 1.0 to 1.4], P = .02. In a post hoc analysis, the risk of severe perineal laceration (third or fourth degree) was still significantly higher in the immediate pushing group compared with the delayed pushing group (5.7%vs 4.6%, respectively; absolute difference, 1.1% [95% CI, −0.7% to 2.9%]; RR, 1.2 [95% CI, 1.1 to 1.5], P = .01.

Third-degree perineal lacerations were significantly higher in the immediate pushing group in nulliparous women receiving neuraxial anaesthesia.

Study	SIGN rating	Objective		Result
Cahill et al 2018	HQ (++)	To evaluate whether immediate or delayed pushing results in higher rates of spontaneous vaginal birth and lower rates of maternal and neonatal morbidities	Perineal lacerations were common but there was no significant difference in the overall rates between the two groups	RR, 0.99 [95% CI, 0.95 to 1.04]
			In a separate analysis of third-degree tears, there was a significantly higher rate of tears in the immediate pushing group compared with the delayed pushing group	5.3% vs 4.3%, respectively; absolute difference, 0.9% [95% CI, −0.8% to 2.6%]; RR, 1.2 [95% CI, 1.0 to 1.4], P = .02
			In a post hoc analysis, the risk of severe perineal laceration (third or fourth degree) was significantly higher in the immediate pushing group compared with the delayed pushing group	5.7%vs 4.6%, respectively; absolute difference, 1.1% [95% CI, −0.7% to 2.9%]; RR, 1.2 [95% CI, 1.1 to 1.5], P = .01
• Immediate pushing results in significantly more severe perineal lacerations when compared to delayed pushing				

Simpson et al. 2005

Simpson et al. (2005): (QS: (AQ (+)) conducted a trial to compare the effects of immediate versus delayed pushing during second-stage labour on foetal and maternal well-being. There were 45 healthy nulliparous women at term (>37 weeks' gestation based on last menstrual period and/or early second trimester ultrasound), in the second stage of labour with a singleton foetus in a vertex presentation, having an elective induction of labour, with epidural anaesthesia providing adequate pain relief (pain at a level of one on a pain scale of 1–10 with one being no pain and 10 being the worst pain ever experienced), and a reassuring FHR pattern at the time of enrolment who were included in the study. There were 22 women randomly allocated to the immediate pushing group and 23 women in the delayed pushing group. In the immediate pushing intervention group, women were coached by the nurse to use closed-glottis pushing three to four times during each contraction immediately when cervical dilation

reached 10cm and to continue pushing using this method with each contraction until birth. In the delayed pushing group, women were assisted to a left lateral position at 10cm cervical dilation where they remained until they felt the urge to push or the second stage had lasted 2 hr (whichever came first). Perineal status was assessed by noting perineal lacerations.

There were significantly more perineal lacerations in the immediate pushing group (13) compared to the delayed pushing group (5), p=0.01. Immediate pushing resulted in significantly more perineal lacerations.

Simpson et al 2005	AQ (+)	To compare the effects of immediate versus delayed pushing during second-stage labour on foetal and maternal well-being	There were significantly more perineal lacerations in the immediate pushing group (n=13) compared to the delayed pushing group (n=5)	p=0.01
• Immediate pushing resulted in significantly more perineal lacerations when compared to delayed pushing				

Race/Ethnicity

One SR was identified which considered the effect of ethnicity as a risk factor for severe perineal trauma in childbirth.

Systematic Review

Wheeler et al. 2012

Wheeler et al. 2012 (QS: LQ (-)) undertook a SR of the literature to determine whether Asian ethnicity was an independent risk factor for severe perineal trauma in childbirth. In this review the term 'Asian' was used to define any woman born in South East Asia, China, India or Fiji.

The review identified 11 relevant cohort studies that focussed on the risk of severe perineal tears (Dahlen et al 2008; Handa et al 2001; Hopkins et al 2005; Kudish et al 2008; Kudish et al 2006; Dahlen et al 2007; Nakai et al 2006; Lai et al 2009; Jung et al 2008; Green & Soohoo 1989; Goldberg et al 2003).

The authors concluded that Asian ethnicity did not appear to be a risk factor for severe perineal trauma for women living in Asia. In contrast, studies conducted in some Western countries have identified Asian ethnicity as a risk factor for severe perineal trauma. It is unknown why (in some situations) Asian women are more vulnerable to this birth complication. The lack of an international standard definition for the term Asian further undermines clarification of this issue.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Wheeler et al 2012	LQ (-)	There was an overall severe perineal trauma rate of 2—15.4% for women of all ethnicities, with women from an Asian background being significantly more likely to sustain this injury. However, one UK study found no difference in trauma rates for women with an Asian or Caucasian background Asian ethnicity as a risk factor for severe perineal trauma has been described as a 'myth'', with studies conducted in Asian	-	15 studies

		countries (Japan, China and Korea) having a severe perineal trauma rate of between 0.3% and 2.8%, which is at least comparable or lower than in Western countries		

Ritgen's Manoeuvre

One SR that looked at modified Ritgen's technique as a risk factor for perineal tears was identified. One cohort study was also identified which was not found within the SR.

Systematic Review

Aquino et al. 2019

Aquino et al. (2019) (QS: HQ (++)) conducted a SR and meta-analysis to determine the effect of Ritgen's manoeuvre on perineal lacerations and pain at birth. The review contained three studies which were of relevance to this review (Jonsson et al. 2008; Foroughipour et al. 2011; Fahami et al. 2012).

The authors concluded that Ritgen's manoeuvre during labour was not protective for severe perineal lacerations and was associated with higher post-partum pain.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Aquino et al. 2019	HQ (++)	Pooled data showed no significant differences in the incidence of severe perineal lacerations	RR=0.69, 95% CI=0.10–4.61	Based on two RCTs
		Women who received Ritgen's manoeuvre during labour had a lower incidence of first-degree lacerations, however, they had a higher incidence of second-degree lacerations	First degree tears RR=0.47, 95% CI=0.23–0.94), Second degree tears (RR=1.98, 95% (0.74,5.35)	Based on three RCTs

Cohort Studies

Study	SIGN rating	Objective		Result
Habek et al 2018	AQ (+)	To present the 60-year experience in vaginal births using modified Ritgen manual perineal protection (MRMPP) technique according to peripartum tears of the soft birth canal (1950-2010)	Rate of perineal tear grade I was very low until 1995, then increased to 8.6% in 2010	1950-1995 (0.1%-3.4%) 2010 (8.6%)
			Rate of perineal tear grade II never went over 2%	-

			Rate of perineal tear grade III was erratic but never increased more than 0.3%	-
			Only one count of Perineal tear grade IV (0.1%)	-
• Appears that the modified Ritgen manual perineal protection (MRMPP) technique prevents OASIS and reduces minor and severe perineal tears				

Shoulder Dystocia Management

Three cohort studies on shoulder dystocia management as a risk for perineal tears were identified. No SRs or RCTs were found.

Cohort Studies

Study	SIGN rating	Objective		Result
Michelottie et al 2018	AQ (+)	To assess the impact shoulder dystocia has on severe neonatal outcomes and maternal morbidity specific to the type and number of manoeuvres required to achieve resolution	Births complicated by shoulder dystocia are associated with perineal trauma (Third and fourth degree)	OR 1.92, 95% CI 1.54–2.39 P < 0.001
• Appears that shoulder dystocia and manoeuvres to resolve dystocia lead to increased perineal trauma				
Gachon et al 2016	AQ (+)	To compare severe maternal and neonatal morbidities associated with shoulder dystocia according to the management approach that was utilized: foetal manipulation versus no-foetal manipulation	The overall incidence of OASI was 4 %	-
			OASI was more frequent in the foetal manipulation group than in the no-FM group	OR = 9.2, 95% CI 1.32–50.71
• Appears that foetal manipulation results in an increase in OASI				
Gurewitsch et al 2004	LQ (0)	To compare maternal and neonatal outcomes between severe shoulder dystocia births managed with episiotomy and those managed with foetal manipulation	Management by episiotomy or proctoepisiotomy, with or without foetal manipulation, is associated with a nearly 7-fold increase in the rate of severe perineal trauma	P=0.0001
•Appears that episiotomy with or without foetal manipulation increases rate of severe perineal trauma •Appears that if foetal manipulation is performed without episiotomy, severe perineal trauma can be avoided				

Smoking

Cohort Studies

One cohort study looking at smoking as a risk for perineal tears was identified. No SRs or RCTs were identified.

Study	SIGN rating	Objective		Result
Raisanen et al 2012	AQ (+)	To examine whether smoking during pregnancy was associated with the incidence of obstetric anal sphincter injuries (OASIS) among six birthweight groups in singleton vaginal births, considering nulliparous and multiparous women	Of the nulliparous women, 13.1% were smokers, 3.6% had given up smoking during the first trimester of their pregnancy and 81.1% were non-smokers	-
			Of the nulliparous women who were smokers, had given up smoking and non-smokers, rates of OASIS were 0.7%, 0.9% and 1.1%.	p<0.001
			Nulliparous women who smoked, had a 28% lower risk of OASIS compared to non-smokers, when adjusting for background variables	95% CI 16–38% p<0.001
• Appears that smoking does not increase risk for OASIS among nulliparous women				

Socioeconomic Status

One case control study investigated socioeconomic status as a risk factor for perineal tears. No SRs, RCTs or cohort studies were identified.

Case Control

Study	SIGN rating	Objective		Result
Raisanen et al 2013	AQ (+)	Study aims to measure national variation in incidence of OASIS by socioeconomic status	In nulliparae the incidence of OASIS was 18% higher for upper white-collar workers compared with blue-collar workers	aOR 1.18 (1.04-21.34)
			In nulliparae the incidence of	aOR 1.12 (1.02-21.24)

			OASIS was 12% higher for lower white-collar workers compared with blue-collar workers	
			Among women in these higher socioeconomic status groups, 40% of the excess OASIS risk was explained by age, non-smoking, birthweight and mode of delivery	-
• Appears that socioeconomic status is strongly associated with incidence of OASIS				

Staff Training

Three cohort studies that looked at staff training for reducing perineal tears were identified. No SRs or RCTs were found.

Cohort Studies

Study	SIGN rating	Objective		Result
Yeung et al 2018	LQ (0)	To evaluate whether an educational workshop would lead to a significant reduction in OASIS at the authors' institution in the year immediately following the workshop	OASI rates decreased from 211 (3.2%) preintervention to 189 (2.8%) after the workshop, however, the difference was not statistically significant	P = 0.179
			OASI rates following forceps-assisted births decreased significantly from 103 (28%) to 81 (21%)	P = 0.014
			Fourth-degree lacerations during resident births decreased significantly from 10 (0.6%) to 3 (0.2%)	P = 0.047
• Appears that a staff educational workshop focused on perineal support does not have an effect on overall OASI rates • Appears that the provision of the staff educational workshop reduced OASI rates following forceps-assisted births • Appears that resident births after the staff educational workshop had a decreased incidence of fourth degree lacerations				

Skinner et al 2017	LQ (0)	To compare the rates of attempted and successful instrumental births, intrapartum caesarean birth, and subsequent perinatal and maternal morbidity before and after implementing a training intervention to arrest the decline in forceps competency among resident obstetricians	There was no change in rates of third- and fourth-degree tears	Autoregressive integrated moving average coefficient -1.04, 95% CI -3.1 to 1.00; P=0.32
• Appears that the training intervention for forceps competency among resident obstetricians does not have an effect on the rates of third- and fourth-degree tears				
Frost et al 2016	LQ (0)	To determine whether the introduction of a multidisciplinary intrapartum perineal-care training program reduced the rate of obstetric anal sphincter injuries in women undergoing vaginal births	The rate of obstetric anal sphincter injuries decreased from 4.8% to 3.1% of vaginal births	Odds ratio 0.66; 95% confidence interval 0.493–0.899; P=0.008
• Appears that a multidisciplinary intrapartum perineal-care training program decreased OASI rates of vaginal births				

Twin Pregnancy

One cohort study looking at twin pregnancy as a risk for perineal tears was identified. No SRs or RCTs were found.

Cohort studies

Study	SIGN rating	Objective		Result
Doumouchtsis et al 2018	AQ (+)	To establish the incidence of OASIS, and compare women delivering twins to those delivering singletons in risk of OASIS plus maternal, neonatal, and obstetric outcomes	The twin group was not significantly different to the singleton group in risk of OASIS	RR 0.61 (0.27-1.33) P = 0.205
			The conditional logistic regression demonstrated similar results for the risk of OASIS	adjusted RR = 0.58 (0.22-1.47) P = 0.253
• Appears that delivering twins does not increase the risk for OASIS compared with singleton births				

Volume of Delivery Unit

Five cohort studies were found looking at volume of delivery unit as a risk for perineal tears. No SRs or RCTs were identified.

Cohort studies

Study	SIGN rating	Objective		Result
Karalis et al 2018	LQ (0)	To assess the influence of increased number of low-risk births on obstetric and neonatal outcome	Percentage of neonatal transfers, low Apgar scores, and severe perineal tears increased both in study hospital and in	-

			population-based group	
• Appears that increasing patient load in high volume delivery unit can result in increased odds of severe perineal tears				
Kozhimannil et al 2016	LQ (0)	To examine the relationship between hospital birth volume and multiple maternal morbidities among low-risk pregnancies in rural hospitals, urban non-teaching hospitals, and urban teaching hospitals, using a representative sample of U.S. hospitals	Odds of severe perineal lacerations was higher in urban non-teaching maternity hospitals with 651 – 1,400 births, compared to urban non-teaching maternity hospitals with >1,400 births	1.08 (95% CI=1.01, 1.15)
			Odds of severe perineal lacerations was higher in rural hospitals with 201 – 400 births compared to rural hospital 401 or more births per year	1.22 (95% CI=1.06, 1.39)
			In adjusted analyses between rural vs. urban teaching hospitals, results favoured rural hospitals in the odds of severe perineal laceration	AOR=0.84; 95% CI=0.73, 0.97
			A similar protective association for perineal lacerations was observed in low-volume urban non-teaching hospitals	AOR=0.77; 95% CI=0.67, 0.89
• Appears that perineal lacerations were more common in low volume urban non-teaching maternity and rural hospitals • Appears that perineal lacerations were less common in rural teaching hospitals compared with urban teaching hospitals and in low-volume urban non-teaching hospitals				
Snowden et al 2015	AQ (+)	To examine the impact of hospital obstetric volume on maternal outcomes in low-risk women who delivered none low-birthweight infants at term	Rates of severe perineal lacerations did not differ between volume categories in non-rural hospitals	50-1199 births/year (OR: 1.01 95%CI 0.83-1.23) 1200-2300 births/year (OR:

				0.94 95%CI 0.82-1.09) 2400-3599 births/year (OR: 1.04 95%CI 0.87-1.24)
			Rates of severe perineal lacerations did not differ between volume categories in rural hospitals	50-599 births/year (OR: 1.01 95%CI 0.68-1.53) 600-1699 births/year (OR: 0.67 95%CI 0.44-1.01)
• Appears that hospital obstetric volume does not influence the risk of severe perineal tears in both rural and non-rural hospitals				
Palmer et al 2015	AQ (+)	To investigate the association between day of delivery and the quality and safety of care and, in particular, compare weekend with weekday performance. Also explored the association between outcomes and staffing levels	The most common adverse event was perineal tear	3% for weekday and weekend 3% for compliant and non-compliant with consultant staffing levels and indicators of care
			There was no significant difference in perineal tears when comparing weekday to weekend births	OR: 1.00 (0.98 to 1.03)
• Appears that perineal tears were not significantly worse for women admitted, and babies born, at weekends				
Kozhimannil et al 2014	AQ (+)	To measure the relationship between hospital birth volume and obstetric care quality among rural hospitals	No significant difference when comparing third- and fourth-degree lacerations among women with vaginal births	Medium (111-240 births) vs Low-volume (10-110 births) AOR 0.97 (0.83-1.12) Medium-high (241-460 births) vs Low-volume (10-110 births) AOR 0.88 (0.76-1.02) High (>460 births) vs Low-volume (10-110 births) AOR 1.04 (0.90-1.20)
• Appears that hospital birth volume does not influence the risk of severe perineal tears in rural hospitals				

Warm Pack

Controlled Trial

One controlled trial was identified that investigated the application of warm packs to prevent or reduce the likelihood of a tear. No SRs were found.

Dahlen et al. 2007

Dahlen et al. (2007) (QS: HQ (++)) conducted a trial to investigate the effect of applying perineal warm packs on perineal trauma and maternal comfort during the second stage of labour. There were 717 nulliparous women in the study. There were 360 women randomly allocated to have warm packs in their perineum and 357 women who received standard care. Standard care was any second-stage practice by midwives that did not include the application of warm packs to the perineum. Degree of perineal trauma was classified as minor or no trauma (intact perineum, first degree, vaginal or labial tear) and major trauma (second, third- or fourth-degree tears). Third- and fourth-degree tears were considered perineal trauma.

The trial resulted in a significant reduction of third- and fourth-degree tears (OR 2.16, 95%CI 1.15-4.10) with the application of warm packs to the perineum. The authors concluded that application of perineal warm packs in late second stage does not reduce the likelihood of nulliparous women requiring perineal suturing but significantly reduces third- and fourth-degree lacerations.

Study	SIGN rating	Objective		Result
Dahlen et al 2007	HQ (++)	To investigate the effect of applying perineal warm packs on perineal trauma and maternal comfort during the second stage of labour	Incidence of third- and fourth-degree tears in using warm packs versus standard care significantly reduced	OR 2.16, 95% CI 1.15-4.10
• The application of perineal warm packs significantly reduces third- and fourth-degree lacerations				

Water Births

Systematic Reviews

Two SRs were identified that reviewed whether water births increase or decrease the likelihood of a tear. Six cohort studies not included in the previously reported SRs were found.

Cluett et al. 2018

Cluett et al. (2018) (QS: HQ (++)) completed a Cochrane SR and meta-analysis that assessed the effects of water immersion during labour and/or birth (first, second and third stage of labour) on women. The review included RCTs, Quasi-RCTs and Cluster randomised controlled trials and identified eight relevant studies (Eckert et al. 2001; Ohlsson et al. 2001; Rush et al. 1996; Taha et al. 2000; Da Silva et al. 2006; Nikodem et al. 1999; Woodward et al. 2004, Gayiti et al. 2015).

The review reported that from four trials (Eckert 2001; Ohlsson 2001; Rush 1996; Taha 2000) it was unclear if there was a difference in the risk of third and fourth degree tears from water births (RR 1.36, 95% CI 0.85 to 2.18; 2341 women; 4 trials; moderate-quality evidence), and no clear differences between the numbers of women with second-degree tears (RR 0.94, 95% CI 0.74 to 1.20; 1212 women).

The authors concluded that giving birth in water did not appear to affect mode of birth, or the number of women having a serious perineal tear.

Study	SIGN rating	Conclusions	Likelihood	Evidence base
Cluett et al 2018	HQ (++)	Immersion vs no immersion in first stage of labour There were no clear differences between the numbers of women with third- and fourth-degree tears	RR 1.36, 95%CI 0.85 to 2.18	2341 women; four trials
		There were no clear differences between the numbers of women with second degree tears	RR 0.94, 95% CI 0.74 to 1.20	1212 women four trials
		Immersion vs no immersion in second stage of labour There was no clear difference between groups for second degree tears	RR 1.16, 95% CI 0.57 to 2.38;	119 women, one trial
		Immersion vs no immersion during any stage of labour There was no clear effect on incidence of third- and fourth-degree tears	RR 1.37, 95% CI 0.86 to 2.17;	2401 women; five trials
		There was no clear difference in second degree tears	RR 0.89, 95% CI 0.71 to 1.10;	1525 women; seven trials

Nutter et al. 2014

Nutter et al. (2014) (QS: LQ (-)) conducted an integrative analysis of peer-reviewed literature regarding the effect of waterbirths. The review contained 38 studies which were of relevance to this review including 15 cohort studies (Zanetti-Dallenbach et al 2006; Bodner et al 2002; Dahlen et al 2013; Garland et al 2000; Garland et al 2006; Baxter et al 2006; Cortes et al 2011; Geissbuehler et al 2000; Geissbuehler et al 2004; Burns et al 1993; Burke et al 1995; Menakaya et al 2013; Torrisi et al 2010; Zanetti-Dallenbach et al 2007; Otigbah et al 2000). The included studies reviewed 31,453 unique waterbirths.

The review concluded that waterbirth was associated with decreased incidence of severe perineal lacerations, however, it acknowledged that the effect of episiotomy had not been consistently controlled for in analyses. Furthermore, it concluded that when lacerations occurred, waterbirth was associated with an increased likelihood of first-degree and second-degree lacerations rather than severe lacerations, as compared to conventional birth.

In summary, despite the limitations of available data, it appears that waterbirth is likely associated with a decreased likelihood of severe lacerations and a higher incidence of intact perinea.

Study	SIGN rating	Conclusions		Evidence base
Nutter et al 2014	LQ (-)	Higher incidence of intact perinea among women who birthed in water compared with women who birthed conventionally	-	Based on 13 studies

		Evidence suggests that when lacerations do occur, waterbirth may be associated with an increased likelihood of first-degree and second-degree lacerations rather than severe lacerations, as compared to conventional birth	-	Based on six studies

Cohort Studies

Study	SIGN rating	Objective		Result
Preston et al 2019	AQ (+)	To determine whether water birth is an independent risk factor for OASIS	OASI rates were 1.6% on land and 3.3% in water	OR: 2.10, 95% CI 1.5–2.94
			Multivariate analysis confirmed water birth, ethnicity and parity as independent risk factors for OASI	adjusted OR water birth: 1.77 (95% CI 1.25–2.51)
• Appears that water birth increased the risk of OASI compared with land birth • Appears that a number of significant variables increased the risk of OASI, including place of birth, ethnicity, parity, opiate analgesia use, birth weight and length of all stages of labour				
Ulfsdottir et al 2018	AQ (+)	To describe and compare the characteristics and outcome of waterbirth with those of conventional birth in a Swedish context, with the primary outcome of a second-degree perineal tear	Women giving birth in water had a lower risk of second-degree perineal tears	aOR: 0.6, 95% CI (0.4–0.9)
• Appears that waterbirth is associated with a reduction in odds of second-degree perineal tears				
Lathrop et al 2018	LQ (0)	To explore potential benefits of water birth by comparing the experiences of women who gave birth in water versus conventional method	After controlling for potential confounders, water birth was associated with a decreased likelihood of perineal lacerations requiring repair	P = .001
			Water birth was associated with fewer lacerations requiring repair. This was still significant after controlling for age, parity, race/ethnicity, education, insurance, and relationship status	P=0.007
			Water birth does not significantly result in third- or	P=0.109

			fourth-degree perineal tears	
• Appears that water birth decreases the likelihood of perineal lacerations requiring repair and does not significantly result in third- and fourth-degree perineal tears				
Bovbjerg et al 2016	AQ (+)	To report waterbirth outcomes from a large sample of midwife led births occurring at home and in birth centres in the United States	Waterbirth (compared to non-waterbirth) had no additional risk for third- and fourth-degree tears	aOR: 0.79; 95% CI, 0.5-1.24 P =.03
• Appears that midwife led water birth compared with non-water birth poses no additional risk for third- or fourth-degree tears				
Henderson et al 2014	AQ (+)	To describe maternal characteristics, intrapartum events, interventions, maternal and neonatal outcomes for all women who used a birthing pool during labour who either had a waterbirth or left the pool and had a land birth, and for the subgroup of women who had a waterbirth in 19 obstetric units and to compare maternal characteristics, intrapartum events, interventions, and maternal and neonatal outcomes for women who used a birthing pool with a control group of women who did not use a birthing pool for whom we prospectively collected data in a single centre	Significantly more nulliparas had a second-degree perineal tear, with no evidence of a difference for extensive perineal tears	P=0.009
• Appears that the use of the birthing pool is associated with spontaneous vaginal birth but increased second degree tears				
Theoni et al 2005	LQ (0)	To review the first 1600 water births in a unit, with a focus on neonatal infections.	The rate of perineal tears (first, second and third degree) was similar	NS
• Appears that there is no difference between water, bed and stool births in terms of perineal tears				

4. Evidence Statements

4.0

Summary of Evidence Statements

This section contains the risk factors and the evidence statements developed per risk factor based on the evidence base. Of note, the studies marked with an asterisk (*) are studies that reported on multiple risk factors, thus, they are listed in a number of risk factors in this section.

Acupuncture

SR - Smith 2017 (HQ) – No increase [Risk] (Minor)

There is limited strong evidence that the use of Acupuncture compared with usual care for the induction of labour is associated with no increase in risk for minor perineal tears.

Age

Increased maternal age

Cohort – Ankarcrona 2019 (AQ) – No increase [Odds] (Severe)

Cohort - Waldenstrom 2017 (AQ) – Small increase [Odds] (Severe)

Cohort – Richards 2016 (AQ) – Large increase [Risk] (Severe)

Cohort - Rahmanou 2016 (AQ) – Small increase [Odds] (Severe)

Cohort – Omih 2015 (AQ) – Moderate increase [Odds] (Minor)

Cohort – Kawakita 2016 (AQ) – Decreased odds [Odds] (Severe)

Cohort – Blomberg 2014 (AQ) – Small increase [Odds] (Minor and severe)

Cohort – Hornermann 2009 (AQ) – Increased prevalence [P value] (Severe)

*Cohort – Marschalek 2018 (AQ) – Small to moderate increase [Odds] (Severe)

*Cohort – Brown 2018 (AQ) – Increase odds [Odds] (Severe)

*Cohort – Ott 2015 (LQ) – Increased prevalence [P Value] (Severe)

*Cohort – Vathanan 2014 (LQ) – Moderate increase [Odds] (Severe)

*Cohort – Porat 2013 (AQ) – Small increase [Odds] (Severe)

*Cohort – Roberts 2007 (LQ) – Small increase [Odds] (Severe)

*Cohort – Hastings-Tolsma 2007 (LQ) – Increased prevalence [P Value] (Minor and severe)

*Cohort – Bodner-Adler 2005 (AQ) – Increased prevalence [P Value] (Minor and severe)

*Cohort – Samuelsson 2002 (AQ) – Small increase [Odds] (Minor)

*Cohort – Bodner 2001 (LQ) – Small increase [Odds] (Severe)

There is consistent moderate evidence that increased maternal age is associated with a small to moderate increase in odds/prevalence/risk for minor and severe perineal tears.

Teenage/adolescent mothers

Cohort – Shveiky 2019 (AQ) – Decreased odds [Odds] (Minor and severe)

Cohort – Daniels 2017 (AQ) – No increase [Odds] (Severe)

Cohort – Bowling 2009 (AQ) – No increase [Odds] (Severe)

There is inconsistent weak evidence that being a teenage/adolescent mother is associated with no increase to decrease in odds for minor and severe perineal tears.

Teenage mothers - Assisted vaginal birth

Cohort – Patterson 2010 (AQ) – Moderate increase [Odds] (Severe)

There is limited weak evidence that assisted vaginal birth in a teenage population is associated with a moderate increase in odds for severe perineal tears.

Teenage mothers - Episiotomy

Cohort – Patterson 2010 (AQ) – Large increase [Odds] (Severe)

There is limited weak evidence that episiotomy in a teenage population is associated with a large increase in odds for severe perineal tears.

Teenage mothers - Increased birthweight

Cohort – Patterson 2010 (AQ) – Moderate increase [Odds] (Severe)

There is limited weak evidence that increased birthweight in a teenage population is associated with a moderate increase in odds for severe perineal tears.

Teenage mothers - Gestational diabetes requiring insulin for glucose control

Cohort – Patterson 2010 (AQ) – Large increase [Odds] (Severe)

There is limited weak evidence that gestational diabetes requiring insulin for glucose control in a teenage population is associated with a large increase in odds for severe perineal tears.

Analgesia

Epidural analgesia

*SR – Pergialiotis 2014 (AQ) – Small increase [Odds] (Severe)

Cohort - Garcia-Lausin 2019 (HQ) – No increase [Odds] (Severe)

Cohort – Myrick 2018 (AQ) – Decreased risk [Odds] (Minor and severe)

Cohort – Herrera-Gomez 2018 (AQ) – No increase [P value] (Minor and severe)

Cohort – Albers 2007 (HQ) – No increase [Risk] (Minor and severe)

Cohort – Poggi 2004 (LQ) – No increase [P value] (Minor and severe)

Cohort – Carrol 2002 (AQ) – Small increase [Odds] (Severe)

Cohort - Bodner- Adler 2002 (AQ) – No increase [P value] (Minor)

Cohort – Bodner-Adler 2001 (AQ) – No increase [P value] (Minor)

Cohort – Newman 2001 (AQ) – Decreased odds [Odds] (Minor)

*Cohort – Peppe 2018 (LQ) – No increase [P Value] (Minor and severe)

*Cohort – Minaglia 2007 (AQ) – Decreased odds [Odds] (Severe)

*Cohort – Dahlen 2007 (AQ) – Decreased odds [Odds] (Severe)

*Cohort – Ogunyemi 2006 (AQ) – Small increase [Odds] (Severe)

*Cohort – Bodner-Adler 2005 (AQ) – No increase [P Value] (Minor and severe)

*Cohort – Gupta 2003 (AQ) – No increase [Odds] (Severe)

*Cohort – Bodner 2001 (LQ) – No increase [Odds] (Severe)

There is inconsistent moderate evidence that epidural analgesia is associated with no increase in odds/prevalence/risk for minor and severe perineal tears.

<u>Suboptimal analgesia during initial pain control</u>

Cohort – Abenhaim 2008 (HQ) – Small increase [Odds] (Severe)

There is limited weak evidence that suboptimal analgesia during initial pain control is associated with a small increase in odds for severe perineal tears.

<u>Inability to sustain optimal epidural analgesia</u>

Cohort – Abenhaim 2008 (HQ) – Small increase [Odds] (Severe)

There is limited weak evidence that the inability to sustain optimal epidural analgesia is associated with a small increase in odds for severe perineal tears.

<u>Anatomical Risk Factors</u>

<u>Foetal abdominal circumference</u>

Cohort – Kehl 2011 (LQ) – No increase [P value] (Severe)

There is limited very weak evidence that foetal abdominal circumference is associated with no increase in prevalence for severe perineal tears.

<u>Subpubic arch angle</u>

Cohort – Frudinger 2002 (AQ) – No increase [Odds] (Minor and severe)

There is limited weak evidence that subpubic arch angle is associated with no increase in odds for minor and severe perineal tears.

Increased rate of cervical dilatation and head descent

Case control – Nguyen 2010 (AQ) – Increased prevalence [P Value] (Severe)

There is limited very weak evidence that the increased rate of cervical dilatation and head descent is associated with an increase in prevalence for severe perineal tears.

Foetal head circumference

*Cohort – Komorowski 2014 (LQ) – Small increase [Odds] (Minor {second degree} and severe)

*Cohort – Rathfisch 2011 (LQ) – No increase [Odds] (Minor and severe)

*Cohort – Bodner 2001 (LQ) – Small increase [Odds] (Severe)

There is inconsistent weak evidence that foetal head circumference is associated with a small to no increase in odds for minor and severe perineal tears.

Assisted Vaginal Birth

*SR – Pergialiotis 2014 (AQ) – Large increase [Odds] (Severe)

*Cohort – Porat 2013 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Dahlen 2007 (AQ) – Small increase [Odds] (Severe)

*Cohort – Burrows 2004 (LQ) – Large increase [Odds] (Severe)

*Cohort – Gupta 2003 (AQ) – No increase [Odds] (Severe)

*Cohort – De Leeuw 2001 (LQ) – Large increase [Odds] (Severe)

There is consistent moderate evidence that assisted vaginal birth is associated with a moderate to large increase in odds for severe perineal tears.

Assisted vaginal birth – Forceps vs vacuum

*SR – Eason 2000 (LQ) – Increased risk [Risk difference] (Minor and severe)

Cohort – Minaglia 2009 (AQ) – Moderate decrease [Odds] (Severe)

Cohort - Caughey 2005 (AQ) – Increased prevalence [P value] (Severe)

Cohort – Damron 2004 (AQ) – Large increase [Odds] (Severe)

Cohort – Johnson 2003 (AQ) – Small increase [Odds] (Severe)

Cohort – Kabiru 2001 (AQ) – Small increase [Risk] (Severe)

Cohort – Wen 2001 (AQ) – Increased risk [Risk] (Severe)

There is consistent moderate evidence that the use of forceps compared to vacuum is associated with a small increase in odds/prevalence/risk for severe perineal tears.

Assisted vaginal birth – Combined forceps and vacuum use compared to either alone

Cohort – Murphy 2011 (AQ) – Moderate increase [Odds] (Severe)

Cohort – Gardella 2001 (AQ) – Small increase [Risk] (Severe)

There is limited weak evidence that combined forceps and vacuum use compared to use of either alone is associated with a small to moderate increase in odds/risk for severe perineal tears.

Assisted vaginal birth (Forceps/vacuum) – Nulliparous vs multiparous women

Cohort – Minaglia 2009 (AQ) – Increased prevalence [P value] (Severe)

There is limited weak evidence that assisted vaginal birth in nulliparous compared to multiparous women is associated with an increase in prevalence for severe perineal tears.

Assisted vaginal birth (Forceps/vacuum) during 1–3 h of second stage versus spontaneous vaginal birth during >3 h of second stage

Cohort – Cheng 2011 (AQ) – Small increase [Odds] (Severe)

There is limited weak evidence that assisted vaginal birth during 1-3 hours of second stage compared to spontaneous vaginal birth >3 hours of second stage is associated with a small increase in odds for severe perineal tears.

Assisted vaginal birth complicated by shoulder dystocia

Cohort – Boucoiran 2010 (AQ) – Increased prevalence [P value] (Severe)

*Cohort – Hehir 2018 (AQ) – Large increase [Odds] (Severe)

*Cohort – Gauthaman 2016 (AQ) – Moderate to large increase [Odds] (Severe)

There is consistent weak evidence that assisted vaginal birth complicated by shoulder dystocia is associated with a moderate to large increase in odds/prevalence for severe perineal tears.

Forceps

SR – O'Mahony 2010 (HQ) – Small increase [Risk] (Minor and severe)

*SR – Eason 2000 (LQ) – Increased risk [Risk difference] (Minor and severe)

Cohort – Lin 2019 (HQ) – No increase [Odds] (Severe)

Cohort – Wilkie 2018 (LQ) – Moderate increase [Odds] (Severe)

Cohort – Hamouda 2017 (AQ) – Large increase [Odds] (Severe)

Cohort – Simo Gonzalez 2015 (AQ) – Large increase [Odds] (Severe)

Cohort – Gardella 2001 (AQ) – Small increase [Risk] (Severe)

*Cohort – Kamisan Atlan 2019 (LQ) – Increased prevalence [P Value] (Severe)

*Cohort – Brown 2018 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Friedman 2015 (LQ) – Large increase [Odds] (Severe)

*Cohort – Vathanan 2014 (LQ) – Large increase [Odds] (Severe)

*Cohort – McPherson 2014 (LQ) – Large increase [Odds] (Severe)

*Cohort – Hehir 2013 (LQ) – Large increase [Odds] (Severe)

*Cohort – Hamilton 2011 (LQ) – Large increase [Risk] (Severe)

*Cohort – Roberts 2007 (LQ) – Large increase [Odds] (Severe)

*Cohort – Minaglia 2007 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Fitzgerald 2007 (AQ) – Large increase [Odds] (Severe)

*Cohort – Dahlen 2007 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Ogunyemi 2006 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Simhan 2004 (LQ) – Moderate increase [Odds] (Severe)

*Cohort – Riskin-Mashiah 2002 (AQ) – Large increase [Odds] (Severe)

There is consistent strong evidence that the use of forceps is associated with a small increase in risk of minor perineal tears and a small to large increase in risk/odds/prevalence for severe perineal tears.

<u>Forceps birth – Type of birth (Failed ventouse vs Kielland's forceps, Wrigleys vs Kielland's and Andersons vs Kielland's)</u>

Cohort – Gauthaman 2015 (AQ) – No increase [Risk] (Minor and severe)

There is limited weak evidence that the type of forceps birth is associated with no increase in risk for minor and severe perineal tears.

<u>Forceps birth - Obstetric forceps volume</u>

Cohort – Miller 2014 (AQ) – No increase [P Value] (Severe)

Cohort – Solt 2011 (LQ) – No increase [P value] (Severe)

There is limited weak evidence that obstetric forceps volume is associated with no increase in prevalence for severe perineal tears.

<u>Vacuum</u>

Cohort – Hamouda 2017 (AQ) – No increase [Odds] (Severe)

Cohort – Ryman 2015 (LQ) – No increase [Odds] (Severe)

Cohort – Simo Gonzalez 2015 (AQ) – No increase [Odds] (Severe)

Cohort – Gardella 2001 (AQ) – Small increase [Risk] (Severe)

*Cohort – Kamisan Atlan 2019 (LQ) – No increase [P Value] (Severe)

*Cohort – Ramm 2018 (AQ) – Large increase [Odds] (Severe)

*Cohort – Frigerio 2018 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Brown 2018 (AQ) – Small increase [Odds] (Severe)

*Cohort – Friedman 2015 (LQ) – Large increase [Odds] (Severe)

*Cohort – McPherson 2014 (LQ) – Small increase [Odds] (Severe)

*Cohort – Hehir 2013 (LQ) – Moderate increase [Odds] (Severe)

*Cohort – Hamilton 2011 (LQ) – Large increase [Risk] (Severe)

*Cohort – Roberts 2007 (LQ) – Large increase [Odds] (Severe)

*Cohort – Minaglia 2007 (AQ) – Large increase [Odds] (Severe)

*Cohort – Ogunyemi 2006 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Simhan 2004 (LQ) – Moderate increase [Odds] (Severe)

*Cohort – McLeod 2003 (AQ) – Moderate increase [Risk] (Severe)

There is inconsistent moderate evidence that vacuum birth is associated with no increase to large increase in odds/prevalence/risk for severe perineal tears.

<u>Vacuum birth - Soft cup versus metal cup</u>

SR – O'Mahony 2010 (HQ) – No increase [Risk] (Minor and severe)

CT – Eguy 2015 (HQ) – Decreased prevalence [P Value] (Severe)

There is limited strong evidence that soft cup compared to metal cup vacuum birth is associated with no increase in risk for minor perineal tears and no increase to decreased risk/prevalence for severe perineal tears.

<u>Vacuum birth – Hand-held versus any ventouse</u>

SR – O'Mahony 2010 (HQ) – No increase [Risk] (Minor and severe)

There is limited strong evidence that hand-held compared to any ventouse vacuum birth is associated with no increase in risk for minor and severe perineal tears.

<u>Vacuum birth - Obstetrician experience</u>

Cohort – Miller 2019 (AQ) – No increase [Risk] (Severe)

Cohort – Ryman 2015 (LQ) – No increase [Odds] (Severe)

There is limited weak evidence that in vacuum birth, obstetrician experience is associated with no increase in risk/odds for severe perineal tears.

Vacuum birth – Birthweight > 4000g

Cohort – Ryman 2015 (LQ) – Small increase [Odds] (Severe)

There is limited very weak evidence that in vacuum birth, birthweight greater than 4000g is associated with a small increase in prevalence for severe perineal tears.

Birthweight

Increased birthweight

*SR – Pergialiotis 2014 (AQ) – Increased prevalence [P value] (Severe)

Cohort – Turkmen 2018 (AQ) – Increased prevalence [P value] (Minor and severe)

Cohort – Temerinac 2014 (AQ) – No increase [P value] (Severe)

Cohort – Jastrow 2010 (AQ) – Moderate increase [Odds] (Severe)

Cohort – Siggelkow 2008 (AQ) – No increase [P value] (Severe)

Cohort – Stotland 2004 (AQ) – Large increase [Odds] (Severe)

Cohort – Jolly 2003 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Peppe 2018 (LQ) – No increase [P Value] (Minor and severe)

*Cohort – Marschalek 2018 (AQ) – Large increase [Odds] (Severe)

*Cohort – Frigerio 2018 (AQ) – Increased odds [Odds] (Severe)

*Cohort – Brown 2018 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Kapaya 2015 (AQ) – Large increase [Odds] (Severe)

*Cohort – Ott 2015 (LQ) – Increased prevalence [P Value] (Severe)

*Cohort – Vathanan 2014 (LQ) – Large increase [Odds] (Severe)

*Cohort – Porat 2013 (AQ) – Increased odds [Odds] (Severe)

*Cohort – Rathfisch 2011 (LQ) – No increase [P Value] (Minor and severe)

*Cohort – Hamilton 2011 (LQ) – Increase risk [Risk] (Severe)

*Cohort – Dahlen 2007 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Bodner-Adler 2005 (AQ) – Increased prevalence [P Value] (Minor and severe)

*Cohort – Simhan 2004 (LQ) – Moderate increase [Odds] (Severe)

*Cohort – Burrows 2004 (LQ) – Small increase [Odds] (Severe)

*Cohort – McLeod 2003 (AQ) – Small to large increase [Risk] (Severe)

*Cohort – Samuelsson 2002 (AQ) – Small increase [Odds] (Minor)

*Cohort – Riskin-Mashiah 2002 (AQ) – Moderate increase [Odds] (Severe)

There is consistent moderate evidence that increased birthweight is associated with a small to large increase in odds/prevalence/risk for minor and severe perineal tears.

Large for gestational age – Induction of labour at >38 weeks versus expectant management

Cohort – Moldeus 2017 (AQ) – No increase [Odds] (Severe)

There is limited weak evidence that in large for gestational age infants, induction of labour at greater than 38 weeks compared to expectant management is associated with no increase in odds for severe perineal tears.

Sonographically estimated foetal weight in temporal proximity to delivery in neonates weighing greater than 3500g

Cohort – Yee 2016 (AQ) – No increase [P value] (Minor and severe)

There is limited weak evidence that sonographically estimated foetal weight in temporal proximity to delivery in neonates weighing greater than 3500g is associated with no increase in prevalence for minor and severe perineal tears.

Second birth after first birth of a macrosomic infant

Cohort – Mahogany 2006 (LQ) – Increased prevalence [P Value] (Severe)

There is limited very weak evidence that second birth after first birth of a macrosomic infant is associated with an increase in prevalence for severe perineal tears.

Birth Position

Upright versus supine

SR – Gupta 2017 (HQ) – No increase [Risk] (Minor and severe)

*SR – Eason 2000 (LQ) – No increase [Risk difference] (Minor and severe)

Cohort – Louwen 2017 (LQ) – No increase [Odds] (Severe)

Cohort – Serati 2016 (AQ) – Increased prevalence [P Value] (Minor and severe)

*Cohort – Peppe 2018 (LQ) – No increase [P Value] (Minor and severe)

There is consistent strong evidence that upright compared to supine birth position is associated with no increase in risk/odds/prevalence for minor and severe perineal tears.

Non supine (kneeling/hands and knees, sitting and/or squatting) versus supine positions

CT – Terry 2006 (LQ) – Decreased prevalence [P Value] (Minor and severe)

Cohort – Elvander 2015 (AQ) – Decreased risk [Risk] (Severe)

*Cohort – Tunestviet 2018 (AQ) – Decreased odds [Odds] (Severe)

There is consistent weak evidence that non supine (kneeling/hands and knees, sitting and/or squatting) compared to supine positions are associated with decreased risk/odds/prevalence for minor and severe perineal tears.

Flexible sacrum positions (kneeling, standing, all-fours, lateral position, squatting and giving birth on the birth seat) versus non-flexible sacrum positions (supine and sitting)

Cohort – Edqvist 2016 (LQ) – No increase [Odds] (Severe)

There is limited very weak evidence that flexible sacrum positions (kneeling, standing, all-fours, lateral position, squatting and giving birth on the birth seat) compared to non-flexible sacrum positions (supine and sitting) are associated with no increase in prevalence for severe perineal tears.

Birth stool/squatting stool

SR – Gupta 2017 (HQ) – No increase [Risk] (Minor and severe)

SR – Lodge 2016 (LQ) – Increased rate [Not reported] (Minor and severe)

Cohort – Haslinger 2015 (AQ) – Moderate increase [Odds] (Severe)

Cohort – Elvander 2015 (AQ) – Small to moderate increase [Risk] (Severe)

Cohort - Gottvall 2007 (AQ) – Moderate increase [Odds] (Severe)

There is inconsistent strong evidence that birth stool/squatting stool is associated with no increase in risk for minor perineal tears and no increase to moderate increase in odds/risk for severe perineal tears.

Kneeling/All fours

SR – Lodge 2016 (LQ) – Decreased rate [Not reported] (Minor)

Cohort – Haslinger 2015 (AQ) – Moderate increase [Odds] (Severe)

Cohort - Gottvall 2007 (AQ) – No increase [Odds] (Severe)

*Cohort – Tunestviet 2018 (AQ) – Decreased odds [Odds] (Severe)

There is inconsistent weak evidence that kneeling/all fours birth position is associated with a decrease in rate for minor perineal tears and no increase in odds for severe perineal tears.

Birth cushion versus supine position

SR – Gupta 2017 (HQ) – Decreased risk [Risk] (Minor)

SR – Gupta 2017 (HQ) – No increase [Risk] (Severe)

There is limited strong evidence that birth cushion compared to supine birth position is associated with a decreased risk for minor perineal tears and no increase in risk for severe perineal tears.

Birth chair/sitting/semi sitting versus supine position

SR – Gupta 2017 (HQ) – Small increase [Risk] (Minor)

SR – Lodge 2016 (LQ) – Increased rate [Not reported] (Minor and severe)

CT – Thies-Lagergren 2012 (LQ) – No increase [Odds] (Minor and severe)

Cohort - Warmink-Perdijik 2014 (LQ) – No increase [Odds] (Minor and severe)

Cohort – Elvander 2015 (AQ) – Decreased risk [Risk] (Severe)

Cohort – De Jonge 2010 (LQ) – Small increase [Odds] (Minor)

Cohort - Gottvall 2007 (AQ) – No increase [Odds] (Severe)

There is inconsistent strong evidence that birth chair/sitting/semi sitting compared to supine birth position is associated with a small increase in risk/odds for minor perineal tears and no increase in risk/odds for severe perineal tears.

Standing versus sitting

Cohort - Gottvall 2007 (AQ) – No increase [Odds] (Severe)

There is limited weak evidence that standing compared to sitting birth position is associated with no increase in odds for severe perineal tears.

Lithotomy versus other

CT – Corton 2012 (AQ) – No increase [P value] (Minor and severe)

Cohort - Gottvall 2007 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Frigerio 2018 (AQ) – No increase [Odds] (Severe)

*Cohort – Hastings-Tolsma 2007 (LQ) – Increased prevalence [P Value] (Minor and severe)

There is inconsistent weak evidence that lithotomy compared to other birth positions is associated with no increase to moderate increase in odds/prevalence for minor and severe perineal tears.

Lateral (Sidelying) versus other

Cohort - Gottvall 2007 (AQ) – No increase [Odds] (Severe)

*Cohort – Meyvis 2012 (LQ) – Decreased odds [Odds] (Minor and severe)

*Cohort – Hastings-Tolsma 2007 (LQ) – Decreased prevalence [P Value] (Minor and severe)

There is inconsistent weak evidence that lateral (side-lying) compared to other birth positions is associated with no increase in odds/prevalence for severe perineal tears.

APOR B method versus supine

Cohort – Maheux-Lacroix 2013 (AQ) – Decreased odds [Odds] (Minor)

Cohort – Maheux-Lacroix 2013 (AQ) – No increase [Odds] (Severe)

There is inconsistent weak evidence that APOR B method compared to supine birth position is associated with a decrease in odds for minor perineal tears and no increase in odds for severe perineal tears.

Maternal position (Any upright versus any recumbent) in the second stage of labour for women with epidural anaesthesia

SR – Walker 2018 (HQ) – No increase [Risk] (Minor and severe)

There is limited strong evidence that any upright compared to any recumbent maternal position in the second stage of labour for women with epidural anaesthesia is associated with no increase in risk for minor and severe perineal tears.

Horizontal and upright during second stage and supine at birth versus horizontal during second stage and supine at birth

Cohort - Warmink-Perdijik 2014 (LQ) – No increase [Odds] (Minor and severe)

There is limited very weak evidence that horizontal and upright birth positions during second stage and supine at birth compared to horizontal during second stage and supine at birth is associated with no increase in prevalence for minor and severe perineal tears.

Birth Setting

Home birth versus hospital/conventional

SR – Scarf 2018 (LQ) - Decreased odds [Odds] (Severe)

SR – Zielinski 2015 (LQ) – Decreased prevalence [P value] (Severe)

SR – Wax 2010a (HQ) – Decreased odds [Odds] (Minor and severe)

SR – Wax 2010b (LQ) – Decreased odds [Odds] (Severe)

SR – Hodnett 2005 (HQ) – Small increase [Risk] (Minor and severe)

Cohort – Ignatov 2017 (LQ) – Increased prevalence [P value] (Severe)

*Cohort – McPherson 2014 (LQ) – Decreased odds [Odds] (Severe)

There is inconsistent very strong evidence that home birth compared to a hospital/conventional birth setting is associated with a decrease in odds/prevalence/risk for minor and severe perineal tears.

Public hospital versus private hospital

Cohort – Robson 2008 (AQ) - Small to moderate increase [Odds] (Minor and severe)

There is limited weak evidence that public hospital compared to private hospital birth setting is associated with a small to moderate increase in the odds for minor and severe perineal tears.

Birth centre versus hospital

SR – Scarf 2018 (LQ) – No increase [Odds] (Severe)

Cohort – Gottvall 2011 (AQ) – Decreased Odds [Odds] (Severe)

There is limited weak evidence that birth centre compared to hospital birth setting is associated with no increase to decrease in the odds for severe perineal tears.

Rural versus non-rural community birth

Cohort – Nethery 2018 (AQ) - No increase [Odds] (Severe)

There is limited weak evidence that rural compared to non-rural community birth is associated with no increase in the odds for severe perineal tears.

Devices

Birth balls

SR - Delgado 2019 (AQ) - No increase [Risk] (Severe)

There is limited moderate evidence that the use of birth balls compared with usual care is associated with no increase in the risk for severe perineal tears.

Epi-No birth trainer

SR - Brito 2015 (LQ) - No increase [Risk] (Severe)

CT - Kamisan 2016 (HQ) - No increase [Risk] (Severe)

There is limited moderate evidence that the use of Epi-No birth trainer is associated with no increase in the risk for minor and severe perineal tears.

Relaxbirth® for upright positioning

Case control – Doyle 2019 (AQ) – No increase [P Value] (Minor and severe)

There is limited very weak evidence that the use of Relaxbirth® for upright positioning is associated with no increase in the prevalence of minor and severe perineal tears.

Perineal protection device versus perineal support

*SR – Aasheim 2017 (HQ) – No increase [Risk] (Minor and severe)

There is limited strong evidence that the use of a perineal protection device compared to perineal support is associated with no increase in the risk for minor and severe perineal tears.

Diabetes

Diabetes mellitus

Cohort - Strand-Holm (AQ) – No increase [P value] (Minor and major)

There is limited weak evidence that diabetes mellitus is associated with no increase in prevalence for minor and severe perineal tears.

Gestational diabetes mellitus and macrosomic baby – Assisted vaginal birth (Vacuum and forceps)

Cohort – Zeki 2019 (AQ) – Small increase [Odds] (Severe)

There is limited weak evidence that gestational diabetes mellitus and a macrosomic baby during assisted vaginal birth is associated with a small increase in odds for severe perineal tears.

Shoulder dystocia in diabetic versus non-diabetic women

Cohort – Malinowska-Polubiec 2014 (LQ) – Increased prevalence [P Value] (Minor)

There is limited very weak evidence that shoulder dystocia in diabetic compared to non-diabetic women is associated with an increase in prevalence for minor perineal tears.

Duration of Second Stage Labour

Prolonged second stage of labour

SR – Altman 2006 (LQ) – No increase and Moderate increase [Odds] (Severe)

Cohort - Rouse 2019 (AQ) – Small increase [Odds] (Severe)

Cohort – Simic 2017 (HQ) – Small increase [Odds] (Severe)

Cohort – Aiken 2015 (AQ) – No increase [Odds] (Severe)

Cohort - Giannella 2013 (AQ) – Large increase [Odds] (Severe)

Cohort – Laughon 2013 (AQ) – [Odds] Small increase (Severe)

Cohort – Janakiraman 2010 (AQ) – Increased prevalence [P value] (Severe)

Cohort – Cheng 2007 (AQ) – Moderate to large increase [Odds] (Severe)

*Cohort – Ramm 2018 (AQ) – Large increase [Odds] (Severe)

*Cohort – Rathfisch 2011 (LQ) – Moderate increase [Odds] (Minor and severe)

*Cohort – Hastings-Tolsma 2007 (LQ) – Increased prevalence [P Value] (Minor and severe)

*Cohort – Bodner-Adler 2005 (AQ) – No increase [P Value] (Minor and severe)

*Cohort – McLeod 2003 (AQ) – Small increase [Risk] (Severe)

*Cohort – Samuelsson 2002 (AQ) – Small increase [Odds] (Minor)

*Cohort – Bodner 2001 (LQ) – No increase [Odds] (Severe)

There is consistent moderate evidence that a prolonged second stage of labour is associated with a small to large increase in the odds/prevalence/risk for severe perineal tears.

Prolonged second stage of labour in nulliparous women

Cohort – Simic 2017 (HQ) - Small increase [Odds] (Severe)

Cohort – Aiken 2015 (AQ) – No increase [Odds] (Severe)

Cohort – Laughon 2013 (AQ) – Small increase [Odds] (Severe)

There is inconsistent weak evidence that a prolonged second stage of labour in nulliparous women is associated with a small increase in the odds for severe perineal tears.

Prolonged second stage of labour in multiparous women

Cohort – Cheng 2007 (AQ) – Moderate to large increase [Odds] (Severe)

There is limited weak evidence that a prolonged second stage of labour in multiparous women is associated with a moderate to large increase in the odds for severe perineal tears.

Prolonged second stage of labour in assisted vaginal births

Cohort – Aiken 2015 (AQ) – Small increase [Odds] (Severe)

There is limited weak evidence that a prolonged second stage of labour in women who undergo assisted vaginal births is associated with a small increase in the odds of severe perineal tears.

Elective Induction of Labour

Induction at 37- or 38-weeks’ gestation versus no induction

Cohort – Darney 2013 (AQ) – Decreased odds [Odds] (Severe)

There is limited weak evidence that induction at 37- or 38-weeks’ gestation compared to no induction is associated with a decrease in the odds for severe perineal tears.

Induction at 39- or 40-weeks’ gestation versus no induction

SR – Sotiriadis 2019 (HQ) – No increase [Risk] (Severe)

SR – Middleton 2018 (HQ) - No increase [Risk] (Severe)

Cohort – Souter 2019 (AQ) – No increase [Odds] (Severe)

Cohort – Darney 2013 (AQ) – Decreased risk (39 weeks), No increase (40 weeks) [Odds] (Severe)

Cohort – Osmundson 2011 (AQ) – No increase [P value] (Severe)

Cohort – Janakiraman 2010 (AQ) – No increase [P value] (Severe)

There is consistent very strong evidence that induction at 39- or 40-weeks' gestation compared to no induction is associated with no increase in the risk/odds/prevalence for severe perineal tears.

Induction at 41- or 42-weeks' gestation versus no induction

SR – Middleton 2018 (HQ) - No increase [Risk] (Severe)

Cohort – Thangarajah 2016 (AQ) – Increased prevalence [P Value] (Minor and severe)

Cohort – Janakiraman 2010 (AQ) – No increase [P value] (Severe)

There is inconsistent strong evidence that induction at 41- or 42-weeks' gestation compared to no induction is associated with no increase in risk/prevalence for severe perineal tears.

Induction (No timeframe given) versus no induction

*SR – Pergialiotis 2014 (AQ) – Small increase [Odds] (Severe)

*Cohort – Gupta 2003 (AQ) – No increase [Odds] (Severe)

There is limited moderate evidence that induction of labour (no timeframe given) compared to no induction is associated with a small increase in odds for severe perineal tears.

Induction with prostaglandins

Cohort – Kacvisnska 2016 (LQ) – Increased prevalence [P Value] (Minor and severe)

There is limited very weak evidence that induction with prostaglandins is associated with an increase in prevalence for minor and severe perineal tears.

Induction of labour for women with large for gestational age fetus

Cohort – Vendittelli 2014 (AQ) – No increase [Risk] (Minor and severe)

There is limited weak evidence that induction of labour for women with a large for gestation age fetus is associated with no increase in the risk for minor and severe perineal tears.

Length of induction of labour

Cohort – Triebwasser 2019 (LQ) – No increase [P Value] (Severe)

There is limited very weak evidence that length of induction of labour is associated with no increase in prevalence for severe perineal tears.

Episiotomy

Restrictive episiotomy versus routine episiotomy in vaginal birth

SR – Jiang 2017 (HQ) – Decreased risk [Risk] (Severe)

SR – Correa 2016 (LQ) – Decreased risk [Risk] (Severe)

SR – Hartmann 2005 (LQ) – No increase [Risk] (Severe)

CT – Amorim 2017 (AQ) – No increase [Risk] (Severe)

Cohort – Raisanen 2011 (AQ) – Moderate increase [Risk] (Severe)

Cohort – Webb 2002 (LQ) – Decreased prevalence [P value] (Severe)

*Cohort – Clemons 2005 (LQ) – Decreased prevalence [P value] (Severe)

There is inconsistent strong evidence that restrictive episiotomy compared to routine episiotomy in vaginal birth is associated with a decreased risk/prevalence for severe perineal tears.

Restrictive episiotomy versus routine episiotomy in anticipated operative vaginal birth

SR – Jiang 2017 (HQ) – No increase [Risk] (Severe)

There is limited strong evidence that restrictive episiotomy compared to routine episiotomy in anticipated operative vaginal birth is associated with no increase in risk for severe perineal tears.

Mediolateral episiotomy

SR – Verghese 2016 (AQ) – Decreased risk [Risk] (Severe)

*Cohort – Ram 2018 (AQ) – Small increase [Odds] (Severe)

*Cohort – Brown 2018 (AQ) – Decreased risk [Odds] (Severe)

*Cohort – Ott 2015 (LQ) – Decreased prevalence [P Value] (Severe)

*Cohort – Vathanan 2014 (LQ) – Decreased prevalence [P Value] (Severe)

*Cohort – De Leeuw 2001 (LQ) – Decreased odds [Odds] (Severe)

There is consistent moderate evidence that mediolateral episiotomy is associated with a decrease in risk/prevalenceodds for severe perineal tears.

Mediolateral episiotomy in nulliparous women

SR – Verghese 2016 (AQ) – No increase [Risk] (Severe)

SR – Sagi Dain 2015 (HQ) – No increase [Odds] (Severe)

There is limited strong evidence that mediolateral episiotomy in nulliparous women is associated with no increase in risk/odds of severe perineal tears.

Mediolateral episiotomy in multiparous women

SR – Sagi Dain 2015 (HQ) – Small increase [Odds] (Severe)

There is limited moderate evidence that mediolateral episiotomy in multiparous women is associated with a small increase in risk of severe perineal tears.

Mediolateral episiotomy in women undergoing assisted (Vacuum and Forceps) vaginal birth

Cohort – Van Bavel 2018 (LQ) – Decreased odds [Odds] (Minor and severe)

There is limited very weak evidence that mediolateral episiotomy in women undergoing assisted vaginal birth is associated with a decrease in odds for minor and severe perineal tears.

Median (Midline) episiotomy

SR – Sagi Dain 2015 (HQ) – Small increase [Odds] (Severe)

*SR – Pergialiotis 2014 (AQ) – Large increase [Odds] (Severe)

*Cohort – Ram 2018 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Brown 2018 (AQ) – No increase [Odds] (Severe)

*Cohort – Simhan 2004 (LQ) – Large increase [Odds] (Severe)

*Cohort – McLeod 2003 (AQ) – Moderate increase [Risk] (Severe)

*Cohort – Riskin-Mashiah 2002 (AQ) – Large increase [Odds] (Severe)

There is consistent strong evidence that median episiotomy is associated with a small to large increase in odds/risk for severe perineal tears.

Lateral episiotomy in nulliparous women

SR – Sagi Dain 2015 (HQ) – Decreased odds [Odds] (Severe)

*Cohort – Brown 2018 (AQ) – No increase [Odds] (Severe)

There is limited strong evidence that lateral episiotomy in nulliparous women is associated with a decrease in odds for severe perineal tears.

Lateral episiotomy in multiparous women

SR – Sagi Dain 2015 (HQ) – No increase [Odds] (Severe)

There is limited strong evidence that lateral episiotomy in multiparous women is associated with no increase in odds for severe perineal tears.

Episiotomy (All types combined or no type mentioned) vs no episiotomy

*SR – Pergialiotis 2014 (AQ) – Large increase [Odds] (Severe)

*SR – Eason 2000 (LQ) – Increased risk [Risk difference] (Minor and severe)

Cohort – Yamasato 2016 (AQ) – Small increase [Odds] (Severe)

Cohort – Nager 2001 (AQ) – Increased prevalence [P value] (Severe)

Cohort – Shorten 2000 (LQ) – Increased prevalence [P Value] (Severe)

*Cohort – Marschalek 2018 (AQ) – Small increase [Odds] (Severe)

*Cohort – Vale de Castro 2016 (LQ) – No increase [Odds] (Severe)

*Cohort – Kapaya 2015 (AQ) – Large increase [Odds] (Severe)

*Cohort – Porat 2013 (AQ) – Small increase [Odds] (Severe)

*Cohort – Hamilton 2011 (LQ) – Large increase [Risk] (Severe)

*Cohort – Roberts 2007 (LQ) – Small increase [Odds] (Severe)

*Cohort – Minaglia 2007 (AQ) – Small increase [Odds] (Severe)

*Cohort – Fitzgerald 2007 (AQ) – Large increase [Odds] (Severe)

*Cohort – Dahlen 2007 (AQ) – Large increase [Odds] (Severe)

*Cohort – Ogunyemi 2006 (AQ) – Large increase [Odds] (Severe)

*Cohort – Bodner-Adler 2005 (AQ) – Decreased prevalence [P Value] (Minor and severe)

*Cohort – Burrows 2004 (LQ) – Large increase [Odds] (Severe)

*Cohort – Bodner 2001 (LQ) – Large increase [Odds] (Severe)

There is consistent moderate evidence that episiotomy (all types combined, or no type mentioned) compared to no episiotomy is associated with a small to large increase in risk/prevalence/odds for severe perineal tears.

Episiotomy in nulliparous women who undergo assisted vaginal birth

Cohort – Boujenah 2019 (LQ) – Decreased odds [Odds] (Severe)

*Cohort – Marschalek 2018 (AQ) – Moderate to large increase [Odds] (Severe)

*Cohort – Ampt 2015 (LQ) – Decreased prevalence [P Value] (Severe)

*Cohort – Fitzgerald 2007 (AQ) – Large increase [Odds] (Severe)

There is inconsistent weak evidence that episiotomy in nulliparous women who undergo assisted vaginal birth is associated with a moderate to large increase in odds/prevalence for severe perineal tears.

Episiotomy performed before vs at crowning in nulliparous women

Cohort – Rusavy 2017 (AQ) – No increase [P value] (Severe)

There is limited weak evidence that episiotomy performed before crowning compared to at crowning in nulliparous women is associated with no increase in prevalence for severe perineal tears.

Second vaginal birth following episiotomy at first vaginal birth

Cohort – Alperin 2008 (LQ) – Large increase [Odds] (Minor and severe)

Cohort – Martin 2001 (AQ) – Large increase [Risk] (Minor and severe)

There is limited weak evidence that second vaginal birth following episiotomy at first vaginal birth is associated with a large increase in risk/odds for minor and severe perineal tears.

Episiotomy in women with birth complicated by shoulder dystocia

*Cohort – Hehir 2018 (AQ) – Decreased odds [Odds] (Severe)

There is limited weak evidence that episiotomy in women with birth complicated by shoulder dystocia is associated with a decrease in odds for severe perineal tears.

Episiotomy in Vacuum Assisted Birth versus without Episiotomy

SR – Lund 2006 (HQ) – Decreased odds [Odds] (Severe)

There is limited strong evidence that episiotomy in vacuum assisted births compared to without episiotomy is associated with a decrease in odds for severe perineal tears.

Foetal Death

Intrauterine foetal death versus live births

Case control – Basu 2014 (HQ) – Decreased risk [Risk] (Minor and severe)

There is limited very weak evidence that intrauterine foetal death compared to live births is associated with a decrease in risk for minor and severe perineal tears.

Foetal Position

Occiput posterior position versus occiput anterior position

Cohort – Cheng 2006 (AQ) – Moderate increase [Odds] (Severe)

Cohort – Senecal 2005 (LQ) – Increased prevalence [P value] (Severe)

Cohort – Ponkey 2003 (AQ) – Increased prevalence [P value] (Severe)

*Cohort – Porat 2013 (AQ) – Small increase [Odds] (Severe)

*Cohort – McLeod 2003 (AQ) – Moderate increase [Risk] (Severe)

There is consistent weak evidence that occiput posterior position compared to occiput anterior position is associated with a small to moderate increase in odds/prevalence/risk for severe perineal tears.

Occiput transverse position versus occiput anterior position

Cohort – Senecal 2005 (LQ) – Increased prevalence [P value] (Severe)

There is limited very weak evidence that occiput transverse position compared to occiput anterior position is associated with an increase in prevalence for severe perineal tears.

Occiput posterior position versus occiput anterior position - Forceps births

Cohort – Benavides 2005 (AQ) – Moderate to large increase [Odds] (Severe)

There is limited weak evidence that occiput posterior position compared to occiput anterior position for forceps births is associated with a moderate to large increase in odds for severe perineal tears.

Occiput posterior position versus occiput anterior position - Vacuum births

Cohort – Wu 2005 (LQ) – Moderate to large increase [Odds] (Severe)

There is limited very weak evidence that occiput posterior position compared to occiput anterior position in vacuum births is associated with a moderate to large increase in odds for severe perineal tears.

Foetal Rotation

Manual rotation versus no rotation attempt – Occiput posterior/transverse positions

Cohort – Shaffer 2011 (AQ) – Decreased risk [Odds] (Severe)

There is limited weak evidence that manual rotation compared to no rotation attempt for occiput posterior/transverse positions is associated with a decrease in odds for severe perineal tears.

Forceps assisted rotation - Persistent occiput posterior position vaginal births

Cohort – Vidal 2013 (LQ) – No increase [P value] (Severe)

There is limited very weak evidence that in persistent occiput posterior position vaginal births, forceps assisted rotation is associated with no increase in prevalence for severe perineal tears.

Assisted rotation (Forceps or vacuum) versus manual rotation

Cohort – Bahl 2013 (HQ) – No increase [Odds] (Minor and severe)

There is limited weak evidence that assisted rotation using forceps or vacuum compared to manual rotation is associated with no increase in odds for minor and severe perineal tears.

Manual rotation plus assisted vaginal birth versus assisted vaginal birth with no manual rotation attempt

Cohort – Tempest 2017 (LQ) – No increase [P value] (Severe)

Cohort – Bradley 2013 (AQ) – Decreased odds [Odds] (Severe)

There is limited weak evidence that manual rotation plus assisted vaginal birth compared to assisted vaginal birth with no manual rotation attempt is associated with a decrease in odds/prevalence for severe perineal tears.

Sonographic (US) diagnosis of the foetal spine position during manual rotation of the foetal occiput

CT – Masturzo 2017 (LQ) - No increase [P value] (Minor and severe)

There is limited weak evidence that sonographic (US) diagnosis of the foetal spine position during manual rotation of the foetal occiput is associated with no increase in prevalence for severe perineal tears.

Vaginal birth in occiput posterior position following a failed manual rotation attempt – No Forceps rotation attempt versus Forceps rotation attempt

Cohort – Guerby 2018 (AQ) – Large increase [Odds] (Severe)

There is limited weak evidence that, in a vaginal birth in occiput posterior position following a failed manual rotation attempt, no forceps rotation attempt compared to a forceps rotation attempt is associated with a large increase in odds for severe perineal tears.

Female Genital Mutilation

Cohort – Varol 2016 (HQ) – Increased prevalence [P value] (Minor)

*Cohort – Berggren 2013 (HQ) – increased odds [Odds] (Severe)

There is limited weak evidence that female genital mutilation is associated with an increase in odds for severe perineal tears.

Fundal Pressure

Manual fundal pressure versus no fundal pressure – Spontaneous births

SR – Hofmeyer 2017 (HQ) – Large increase [Risk] (Minor and severe)

Cohort – Furrer 2016 (AQ) – Large increase [Odds] (Severe)

*Cohort – Rathfisch 2011 (LQ) – Large increase [Odds] (Minor and severe)

There is consistent strong evidence that manual fundal pressure compared to no fundal pressure in spontaneous births is associated with a large increase in odds/risk for minor and severe perineal tears.

Manual fundal pressure versus no fundal pressure – Assisted vaginal birth

Cohort – Furrer 2016 (AQ) – No increase [Odds] (Severe)

There is limited weak evidence that manual fundal pressure compared to no fundal pressure in assisted vaginal births is associated with no increase in odds for severe perineal tears.

Fundal pressure by inflatable belt versus no fundal pressure

SR – Hofmeyer 2017 (HQ) – No increase [Risk] (Minor)

SR – Hofmeyer 2017 (HQ) – Large increase [Risk] (Severe)

There is limited strong evidence that fundal pressure by inflatable belt compared to no fundal pressure is associated with no increase in risk for minor perineal tears and a large increase in risk for severe perineal tears.

Gestational age

> 39 weeks gestation

Cohort – Greve 2011 (AQ) – No increase [P Value] (Severe)

Cohort – Caughey 2007 (AQ) – Small increase [Odds] (Severe)

Cohort – Caughey 2006 (AQ) – Small increase [Odds] (Severe)

Cohort – Nicholson 2006 (LQ) - Small increase [Risk] (Severe)

*Cohort – Frigerio 2018 (AQ) – No increase [Odds] (Severe)

*Cohort – Porat 2013 (AQ) – Small increase [Odds] (Severe)

*Cohort – Roberts 2007 (LQ) – Small increase [Odds] (Severe)

There is inconsistent moderate evidence that prolonged pregnancy greater than 39 weeks gestation is associated with a small increase in odds/risk/prevalence for severe perineal tears.

Increased gestational age

*Cohort – Frigerio 2018 (AQ) – Small increase [Odds] (Severe)

*Cohort – Vale de Castro 2016 (LQ) – Moderate increase [Odds] (Severe)

*Cohort – Mesterton 2016 (LQ) – Small increase [Odds] (Minor and Severe)

*Cohort – Kapaya 2015 (AQ) – Small increase [Odds] (Severe)

*Cohort – Ott 2015 (LQ) – Increased prevalence [P Value] (Severe)

*Cohort – Gupta 2003 (AQ) – No increase [Odds] (Severe)

There is consistent weak evidence that increasing gestational age is associated with a small increase in odds for minor and severe perineal tears.

Hands on versus hands off (or poised)

*SR – Aasheim 2017 (HQ) – No increase [Odds] (Minor and severe)

SR – Bulchandani 2015 (AQ) – No increase or decreased risk [Risk] (Severe)

SR – Bulchandani 2015 (AQ) – No increase [Risk] (Minor)

SR – Petrocnik 2015 (AQ) - No increase or increased prevalence [P Value] (Minor and Severe)

*Cohort – Lee 2018 (AQ) - No increase (Nulliparous), Small increase (Multiparous) [Odds] (Minor)

*Cohort – Lee 2018 (AQ) - No increase (Nulliparous and Multiparous) [Odds] (Severe)

*Cohort – Hastings-Tolsma 2007 (LQ) – Decreased prevalence [P Value] (Minor and severe)

There is inconsistent strong evidence that hands on compared to hands off or hands poised is associated with no increase in odds/prevalence/risk for minor and severe perineal tears.

Health Professionals

Midwife led care versus other models (Obstetrician-provided care, family doctor provided care and shared model of care)

SR – Sandell 2016 (HQ) – No increase [Risk] (Minor)

SR – Johantgen 2012 (HQ) – Decreased risk [Not reported] (Severe)

Cohort – Monk 2014 (AQ) – No increase [Odds] (Minor and severe)

Cohort – Browne 2010 (AQ) – Decreased odds [Odds] (Minor and severe)

Cohort – Sze 2008 (LQ) – Decreased odds [Odds] (Severe)

*Cohort – Peppe 2018 (LQ) – No increase [P Value] (Minor and severe)

*Cohort – Meyvis 2012 (LQ) – Decreased odds [Odds] (Minor and severe)

*Cohort – Rathfisch 2011 (LQ) – No increase [P Value] (Minor and severe)

*Cohort – Gupta 2003 (AQ) – Decreased odds [Odds] (Severe)

There is inconsistent very strong evidence that midwife led care compared to other models (obstetrician-provided care, family doctor provided care and shared model of care) is associated with a decrease to no increase in odds/prevalence/risk for minor and severe perineal tears.

Residents doctors versus obstetricians - Assisted vaginal births

Cohort – Sentihes 2019 (AQ) – No increase [P Value] (Severe)

Cohort – Bergendahl 2019 (AQ) – Large increase [Odds] (Severe)

*Cohort – Simhan 2004 (LQ) – No increase [Odds] (Severe)

There is inconsistent weak evidence that resident doctors compared to obstetricians in assisted vaginal births are associated with no increase to large increase in odds/prevalence for severe perineal tears.

Family physician/general practitioner versus obstetrician

Cohort – Abenhaim 2007 (AQ) – Small increase [Odds] (Minor)

Cohort – Abenhaim 2007 (AQ) – No increase [Odds] (Severe)

*Cohort – McLeod 2003 (AQ) – Small increase [Risk] (Severe)

There is inconsistent weak evidence that a family physician or general practitioner compared to an obstetrician is associated with a small increase in odds for minor perineal tears and no increase to small increase in odds/risk for severe perineal tears.

Gender of delivering physician

Cohort – Yee 2018 (AQ) – No increase [Odds] (Severe)

There is limited weak evidence that the gender of the delivering physician is associated with no increase in odds for severe perineal tears.

Methods used by midwives during second stage of labour (Directed pushing, toweltrick, levator pressure, pressure to spinae ischiadica, manipulation of symphysis bone, digital stretching of the perineum)

Cohort – Edqvist 2018 (AQ) – No increase [Odds] (Minor and severe)

There is limited weak evidence that methods used by midwives during second stage of labour (directed pushing, toweltrick, levator pressure, pressure to spinae ischiadica, manipulation of symphysis bone and digital stretching of the perineum) are associated with no increase in odds for minor and severe perineal tears.

Out of hours/weekend births

Cohort - Knight 2016 (AQ) – Decreased odds [Odds] (Severe)

Cohort – Aiken 2016 (AQ) – No increase [P Value] (Severe)

Cohort – Butler 2014 (AQ) – No increase [Odds] (Severe)

Cohort – Raisanen 2010 (AQ) – Decreased prevalence [P value] (Severe)

Cohort – Palmer 2015 (AQ) – No increase [Odds] (Minor)

There is inconsistent moderate evidence that out of hours and weekend births are associated with no increase to decrease in odds/prevalence for severe perineal tears.

Assisted vaginal birth training

Cohort – Gossett 2016 (AQ) – Decreased odds [Odds] (Severe)

There is limited weak evidence that assisted vaginal birth training is associated with a decrease in odds for severe perineal tears.

Night float call schedule versus traditional call schedule

Cohort – Barber 2011 (LQ) – Decreased prevalence [P Value] (Severe)

There is limited very weak evidence that night float call schedule compared to traditional call schedule is associated with a decrease in prevalence for severe perineal tears.

Hyaluronidase

Hyaluronidase injection versus control

SR – Zhou 2014 (HQ) – No increase [Risk] (Minor and severe)

There is limited strong evidence that Hyaluronidase injection compared to control is associated with no increase in risk for minor and severe perineal tears.

Hyaluronidase injection versus placebo injection

SR – Zhou 2014 (HQ) – No increase [Risk] (Minor and severe)

There is limited strong evidence that Hyaluronidase injection compared to placebo injection is associated with no increase in risk for minor and severe perineal tears.

Hyaluronidase injection versus no intervention

SR – Zhou 2014 (HQ) – No increase [Risk] (Minor)

There is limited strong evidence that Hyaluronidase injection compared to no intervention is associated with no increase in risk for minor perineal tears.

Intervention Programs

Finnish intervention

SR – Poulsen 2015 (HQ) – Decreased prevalence [P Value] (Severe)

There is limited strong evidence that the Finnish intervention is associated with a decrease in prevalence for severe perineal tears.

Complementary therapies program

CT – Levett 2016 (HQ) – No increase [Risk] (Severe)

There is limited weak evidence that a complementary therapies program is associated with no increase in risk for severe perineal tears.

Osteopathic Manipulative Treatment and usual care versus usual care versus placebo ultrasound treatment

CT – Hansel 2016 (LQ) – No increase [P Value] (Minor)

There is limited weak evidence that osteopathic manipulative treatment and usual care compared to usual care or placebo ultrasound treatment is associated with no increase in prevalence for minor perineal tears.

Dietary and lifestyle counselling program

CT – Asbee 2009 (AQ) – No increase [Not reported] (Minor)

There is limited weak evidence that a dietary and lifestyle counselling program is associated with no increase in minor perineal tears.

Macrosomia

Cohort – Vendittelli 2012 (AQ) – Decreased prevalence [P Value] (Minor)

Cohort – Vendittelli 2012 (AQ) – Increased prevalence [P Value] (Severe)

*Cohort – Ogunyemi 2006 (AQ) – Large increase [Odds] (Severe)

*Cohort – Gupta 2003 (AQ) – Moderate increase [Odds] (Severe)

There is consistent weak evidence that macrosomia is associated with a decrease in prevalence for minor perineal tears and a moderate to large increase in odds/prevalence for severe perineal tears.

Manoeuvres for Shoulder Delivery

Delivery of anterior shoulder versus delivery of posterior shoulder

*SR – Aasheim 2017 (HQ) – No increase [Odds] (Severe)

CT – Aabakke 2016 (HQ) – No increase [Odds] (Minor and severe)

There is limited strong evidence that delivery of anterior shoulder compared to delivery of posterior shoulder is associated with no increase in odds for minor and severe perineal tears.

Couder's Manoeuvre during vacuum birth

Cohort – Hulot 2019 (LQ) – Decreased prevalence [P Value] (Minor)

Cohort – Hulot 2019 (LQ) – No increase [P Value] (Severe)

Cohort – Mottet 2017 (AQ) – Increased prevalence (First degree), Decreased prevalence (Second degree) [P Value] (Minor)

There is inconsistent weak evidence that Couder's manoeuvre during vacuum birth is associated with decreased to increased prevalence for minor perineal tears and no increase in prevalence for severe perineal tears.

Metformin

SR – Dodd 2018 (HQ) – No increase [Risk] (Severe)

There is limited strong evidence that Metformin is associated with no increase in risk for severe perineal tears.

Obesity/BMI

Increased BMI/bodyweight

Cohort – Durnea 2018 (AQ) – Decreased odds [Odds] (Minor)

Cohort – Durnea 2018 (AQ) – No increase [Odds] (Severe)

Cohort – Ramo-Isgren 2017 (AQ) - Decreased odds [Odds] (Severe)

Cohort – Deruelle 2017 (HQ) - No increase [Risk] (Severe)

Cohort – Lee 2016 (AQ) - No increase [P Value] (Minor)

Cohort – Hollowell 2014 (AQ) – No increase [Odds] (Severe)

Cohort – Gallagher 2014 (AQ) – No increase [P Value] (Severe)

Cohort – Lindholm 2013 (HQ) – Small increase [Odds] (Minor)

Cohort – Lindholm 2013 (HQ) – Decreased odds [Odds] (Severe)

Cohort – Voldner 2009 (AQ) – No increase [Odds] (Minor)

Cohort – Usha Kiran 2005 (AQ) – No increase [Odds] (Severe)

Cohort – Rode 2005 (AQ) – No increase [Odds] (Severe)

Cohort – Buhimschi 2004 (AQ) – No increase [P Value] (Minor)

*Cohort – Yamasato 2019 (LQ) – Decreased odds [Odds] (Severe)

*Cohort – Frigerio 2018 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Kapaya 2015 (AQ) – Decreased odds [Odds] (Severe)

*Cohort – Blomberg 2014 (AQ) – Decreased odds [Odds] (Severe)

*Cohort – Dahlen 2007 (AQ) – Decreased prevalence [P Value] (Severe)

*Cohort – Burrows 2004 (LQ) – Decreased odds [Odds] (Severe)

There is consistent strong evidence that increased BMI/bodyweight is associated with no increase in odds/prevalence for minor perineal tears and no increase to decrease in odds/prevalence/risk for severe perineal tears.

Excessive weight gain during pregnancy

Cohort – Gallagher 2014 (AQ) – No increase [P Value] (Severe)

Cohort – Albers 2006 (LQ) – Increased prevalence [P Value] (Minor)

There is limited weak evidence that excessive weight gain during pregnancy is associated with no increase in prevalence for severe perineal tears.

Low maternal weight

Cohort – Ehrenberg 2003 (AQ) – Small increase [Risk] (Minor and severe)

There is limited weak strength evidence that low maternal weight is associated with a small increase in risk for minor and severe perineal tears.

Obstetric Gel

Obstetric gel – Vaginal births without interventions

CT – Schaub 2008 (AQ) – Reduced prevalence [P Value] (Minor)

There is limited weak evidence that obstetric gel in vaginal births without interventions is associated with a decrease in prevalence for minor and severe perineal tears.

Oxytocin

CT – Bor 2006 (AQ) – No increase [P Value] (Severe)

Cohort – Hidalgo-Lopezosa 2016 (AQ) – No increase [Odds] (Severe)

*Cohort – Frigerio 2018 (AQ) – No increase [Odds] (Severe)

*Cohort – Vale de Castro 2016 (LQ) – Small increase [Odds] (Severe)

*Cohort – Da Silva 2012 (LQ) – Increased prevalence [P Value] (Minor)

*Cohort – Bodner-Adler 2005 (AQ) – No increase [P Value] (Minor and severe)

*Cohort – Bodner 2001 (LQ) – No increase [Odds] (Severe)

There is consistent weak evidence that oxytocin is associated with no increase in odds/prevalence for severe perineal tears.

Parity

Nulliparous versus multiparous

Cohort – Kamisan 2018 (AQ) – No increase [Odds] (Severe)

*Cohort – Ramm 2018 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Peppe 2018 (LQ) – Increased prevalence [P Value] (Minor and severe)

*Cohort – Frigerio 2018 (AQ) – No increase [Odds] (Severe)

*Cohort – Vale de Castro 2016 (LQ) – Large increase [Odds] (Severe)

*Cohort – Mesterton 2016 (LQ) – Large increase [Odds] (Minor and Severe)

*Cohort – Kapaya 2015 (AQ) – Large increase [Odds] (Severe)

*Cohort – Ott 2015 (LQ) – Increased prevalence [P Value] (Severe)

*Cohort – Vathanan 2014 (LQ) – Large increase [Odds] (Severe)

*Cohort – McPherson 2014 (LQ) – Increased odds [Odds] (Severe)

*Cohort – Porat 2013 (AQ) – Large increase [Odds] (Severe)

*Cohort – Meyvis 2012 (LQ) – Decreased odds [Odds] (Minor and severe)

*Cohort – Da Silva 2012 (LQ) – Increased prevalence [P Value] (Minor)

*Cohort – Hamilton 2011 (LQ) – Large increase [Risk] (Severe)

*Cohort – Minaglia 2007 (AQ) – Increased odds [Odds] (Severe)

*Cohort – Dahlen 2007 (AQ) – Large increase [Odds] (Severe)

*Cohort – Simhan 2004 (LQ) – Increased odds [Odds] (Severe)

*Cohort – Burrows 2004 (LQ) – Increased odds [Odds] (Severe)

*Cohort – McLeod 2003 (AQ) – Large increase [Risk] (Severe)

*Cohort – Riskin-Mashiah 2002 (AQ) – Large increase [Odds] (Severe)

There is consistent moderate evidence that nulliparous women compared to multiparous women are associated with a moderate to large increase in the risk/prevalence/odds for severe perineal tears.

Passive Second Stage of Labour

Case control – Gossett 2016 (AQ) - No increase [P Value] (Minor and severe)

There is limited very weak to weak evidence that passive second stage of labour is associated with no increase in prevalence for minor and severe perineal tears.

Pelvic Floor Muscle Function & Exercise

Pelvic floor muscle training

SR – Du 2015 (HQ) – No increase [Odds] (Minor and severe)

CT – Leon-Larios 2017 (AQ) – Decreased prevalence [P Value] (Severe)

Cohort – Rise 2009 (LQ) – No increase [Odds] (Severe)

Cohort – Bo 2013 (HQ) - No increase [Odds] (Minor and severe)

There is consistent strong strength evidence that pelvic floor muscle training is associated with no increase in the odds for minor and severe perineal tears.

Vaginal resting pressure

Cohort – Bo 2013 (HQ) – No increase [P Value] (Severe)

There is limited weak evidence that vaginal resting pressure is associated with no increase in the prevalence for severe perineal tears.

Pelvic floor muscle strength/endurance

Cohort – Bo 2013 (HQ) – No increase [P Value] (Severe)

There is limited weak evidence that pelvic floor muscle strength/endurance is associated with no increase in the prevalence for severe perineal tears.

Perineal Length

Short perineal body length

Cohort – Lane 2017 (AQ) – Large increase [Odds] (Severe)

Cohort – Yeaton-Massey 2015 (LQ) – No increase [P Value] (Severe)

Cohort – Hokenstad 2015 (AQ) - No increase [Minor and severe] (Severe)

Cohort – Geller 2014 (HQ) – Increased prevalence [P Value] (Severe)

Cohort – Dua 2009 (AQ) – Increased prevalence [P Value] (Severe)

Cohort – Deering 2004 (LQ) – Increased prevalence [P Value] (Severe)

*Cohort – Komorowski 2014 (LQ) – No increase [Odds] (Minor {second degree} and severe)

There is inconsistent moderate evidence that short perineal body length is associated with no increase to increase in odds/prevalence for severe perineal tears.

Perineal body stretch

Cohort – Meriwether 2016 (AQ) – No increase [P Value] (Minor)

There is limited weak evidence that perineal body stretch is associated with no increase in prevalence for minor perineal tears.

Perineal Massage

SR – Aquino 2018 (HQ) – Decreased risk [Risk] (Severe)

SR – Beckmann 2013 (HQ) – No increase [Risk] (Minor and severe)

*SR – Aasheim 2017 (HQ) – No increase [Risk] (Minor)

*SR – Aasheim 2017 (HQ) – Decreased risk [Risk] (Severe)

*SR – Eason 2000 (LQ) – Decreased risk [Risk difference] (Minor and severe)

CT – Bodner-Adler (LQ) – No increase [P Value] (Minor and severe)

There is inconsistent very strong evidence that perineal massage is associated with no increase in risk for minor perineal tears and a decrease in risk/prevalence for severe perineal tears.

Prenatal Exercise

SR – Davenport 2019 (HQ) – No increase [Not reported] (Minor and severe)

There is limited strong evidence that prenatal exercise is associated with no increase in minor and severe perineal tears.

Previous Caesarean Section – Vaginal Birth After Caesarean (VBAC)

Cohort – Jardine 2019 (LQ) – Small increase [Odds] (Severe)

Cohort – Nettle 2018 (LQ) – No increase [P Value] (Severe)

Cohort – Elvander 2018 (AQ) – Small increase [Risk] (Severe)

Cohort – Hehir 2014 (AQ) – Small increase [Odds] (Severe)

Cohort – Raisanen 2013 (LQ) - Small increase [Odds] (Severe)

Cohort – Rozen 2011 (AQ) – No increase [P Value] (Severe)

*Cohort – Ramm 2018 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – O'Leary 2018 (AQ) – No increase [P Value] (Severe)

*Cohort – Mesterton 2016 (LQ) – Large increase [Odds] (Minor and Severe)

There is inconsistent moderate evidence that vaginal birth after caesarean is associated with a small increase in odds/prevalence/risk for severe perineal tears.

Previous History of OASI or other Perineal Trauma

*SR - Jha et al 2016 (HQ) – Small increase [Odds] (Severe)

Cohort – Manzanares 2012 (LQ) – Large increase [Odds] (Minor and severe)

Cohort – Priddis 2013 (AQ) – No increase [Odds] (Severe)

Cohort – Edwards 2006 (AQ) – No increase [Odds] (Severe)

*Cohort – Spydslaung 2005 (AQ) – Large increase [Odds] (Severe)

There is inconsistent strong evidence that a previous history of OASI or other perineal trauma is associated with a small increase in odds for severe perineal tears.

Previous history of OASI - Forceps birth

*SR - Jha et al 2016 (HQ) – Large increase [Odds] (Severe)

*Cohort – Spydslaung 2005 (AQ) – Large increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and forceps birth is associated with a large increase in odds for severe perineal tears.

Previous history of OASI - Vacuum birth

*SR - Jha et al 2016 (HQ) – Moderate increase [Odds] (Severe)

*Cohort – Spydslaung 2005 (AQ) – Small increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and vacuum birth is associated with a moderate increase in odds for severe perineal tears.

Previous history of OASI – Birthweight > 4kg

*SR - Jha et al 2016 (HQ) – Moderate increase [Odds] (Severe)

*Cohort – Spydslaung 2005 (AQ) – Large increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and birthweight greater than 4kg is associated with a moderate increase in odds for severe perineal tears.

Previous history of OASI – Advanced age > 35

*SR - Jha et al 2016 (HQ) – Small increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and an advanced maternal age greater than 35 years is associated with a small increase in odds for severe perineal tears.

Previous history of OASI – Occiput-posterior position

*SR - Jha et al 2016 (HQ) – Small increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and occiput-posterior position is associated with a small increase in odds for severe perineal tears.

Previous history of OASI – Asian ethnicity

*SR - Jha et al 2016 (HQ) – No increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and Asian ethnicity is associated with no increase in odds for severe perineal tears.

Previous history of OASI – Induction of labour

*SR - Jha et al 2016 (HQ) – No increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and induction of labour is associated with no increase in odds for severe perineal tears.

Previous history of OASI – Gender of child

*SR - Jha et al 2016 (HQ) – No increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and the gender of the child is associated with no increase in odds for severe perineal tears.

Previous history of OASI – Time between pregnancies

*SR - Jha et al 2016 (HQ) – No increase [Odds] (Severe)

*Cohort – Antonakou 2017 (AQ) – No increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and time between pregnancies is associated with no increase in odds for severe perineal tears.

Previous history of OASI – Maternal BMI

*SR - Jha et al 2016 (HQ) – No increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and maternal BMI is associated with no increase in odds for severe perineal tears.

Previous history of OASI – Epidural analgesia

*SR - Jha et al 2016 (HQ) – No increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and epidural analgesia is associated with no increase in odds for severe perineal tears.

Two previous histories of OASI – Third pregnancy

*SR - Jha et al 2016 (HQ) – Large increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and third pregnancy is associated with a large increase in odds for severe perineal tears.

Previous history of OASI – Shoulder dystocia

*SR - Jha et al 2016 (HQ) – Large increase [Odds] (Severe)

There is limited strong evidence that a previous history of OASI and shoulder dystocia is associated with a large increase in odds for severe perineal tears.

Pushing Technique

Spontaneous pushing versus directed pushing

SR – Lemos 2017 2017 (HQ) – No increase [Risk] (Severe)

*Cohort – Lee 2018 (AQ) - No increase (Nulliparous), Small increase (Multiparous) [Odds] (Minor)

*Cohort – Lee 2018 (AQ) - No increase (Nulliparous and Multiparous) [Odds] (Severe)

There is consistent strong evidence that spontaneous pushing compared to directed pushing is associated with no increase in risk/odds for minor and severe perineal tears.

Immediate pushing versus delayed pushing

SR – Lemos 2017 (HQ) – No increase [Risk] (Severe)

SR – Roberts 2004 (LQ) - No increase [Risk] (Severe)

CT – Cahill 2018 (HQ) - No increase [Risk] (Minor)

CT – Cahill 2018 (HQ) – Small increase [Risk] (Severe)

CT – Simpson 2005 (AQ) – Increased prevalence [P Value] (Minor)

There is inconsistent strong evidence that immediate pushing compared to delayed pushing is associated with no increase in risk/prevalence for minor and severe perineal tears.

Pushing performed at crowning versus breathing the head out

*Cohort – Tunestviet 2018 (AQ) – Large increase [Odds] (Severe)

There is limited weak evidence that pushing performed at crowning compared to breathing the head out is associated with a large increase in odds for severe perineal tears.

Race/Ethnicity

Asian ethnicity for women living in Western countries

SR – Wheeler 2012 (LQ) – Increased prevalence (Minor and severe)

There is limited weak evidence that Asian ethnicity for women living in Western countries is associated with an increase in prevalence for minor and severe perineal tears.

Asian ethnicity for women living in Asia

SR – Wheeler 2012 (LQ) – No increase (Minor and severe)

There is limited weak evidence that Asian ethnicity for women living in Asia is associated with no increase in prevalence for minor and severe perineal tears.

Asian ethnicity (Living location not referred to)

*Cohort – Yamasato 2019 (LQ) – Small increase [Odds] (Severe)

*Cohort – Ramm 2018 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Brown 2018 (AQ) – Small to large increase [Odds] (Severe)

*Cohort – Kapaya 2015 (AQ) – Small increase [Odds] (Severe)

*Cohort – Vathanan 2014 (LQ) – Large increase [Odds] (Severe)

*Cohort – Roberts 2007 (LQ) – Small increase [Odds] (Severe)

*Cohort – Dahlen 2007 (AQ) – Small increase [Odds] (Severe)

There is consistent weak evidence that Asian ethnicity when the living location is not referred to is associated with a small to large increase in odds for severe perineal tears.

<u>Ritgen's Manoeuvre</u>

SR – Aqunio 2019 (HQ) – Decreased risk (First degree), No increase (Second degree) [Risk] (Minor)

SR – Aqunio 2019 (HQ) – No increase [Risk] (Severe)

*SR – Aasheim 2017 (HQ) – Decreased risk (First degree), Large increase (Second degree) [Risk] (Minor)

*SR – Aasheim 2017 (HQ) – No increase [Risk] (Severe)

There is limited very strong evidence that Ritgen's manoeuvre is associated with no increase in risk for severe perineal tears.

<u>Shoulder Dystocia</u>

*Cohort – Friedman 2015 (LQ) – Small to moderate increase [Odds] (Severe)

*Cohort – Minaglia 2007 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Ogunyemi 2006 (AQ) – Large increase [Odds] (Severe)

There is consistent weak evidence that shoulder dystocia is associated with a moderate to large increase in odds for severe perineal tears.

<u>Shoulder Dystocia – Nulliparous versus multiparous</u>

*Cohort – O'Leary 2019 (AQ) – Moderate increase [Odds] (Severe)

*Cohort – Hehir 2018 (AQ) – Large increase [Odds] (Severe)

There is limited weak evidence that shoulder dystocia in nulliparous compared to multiparous women is associated with a moderate to large increase in odds for severe perineal tears.

<u>Shoulder Dystocia Management</u>

Cohort – Michelottie 2018 (AQ) – Small increase [Odds] (Severe)

Cohort – Gachon 2016 (AQ) – Large increase [Odds] (Severe)

Cohort – Gurewitsch 2004 (LQ) – Decreased prevalence [P Value] (Severe)

*Cohort – Hehir 2018 (AQ) – Small increase [Odds] (Severe)

*Cohort – Vale de Castro 2016 (LQ) – Moderate to large increase [Odds] (Severe)

There is consistent weak evidence that shoulder dystocia management is associated with a small to large increase in odds/prevalence for severe perineal tears.

Smoking

Cohort – Raisanen 2012 (AQ) – Decreased prevalence or No increase [P Value] (Severe)

*Cohort – McPherson 2014 (LQ) – Decreased odds [Odds] (Severe)

*Cohort – Dahlen 2007 (AQ) – Decreased odds [Odds] (Severe)

There is consistent weak evidence that smoking is associated with a decrease in odds/prevalence for severe perineal tears.

Socioeconomic Status

White collar workers versus blue collar workers

Cohort – Raisanen 2013 (AQ) – Small increase [Odds] (Severe)

There is limited weak evidence that white collar workers compared to blue collar workers are associated with a small increase in odds for severe perineal tears.

Staff Training

Cohort – Yeung 2018 (LQ) – No increase [P Value] (Minor)

Cohort – Yeung 2018 (LQ) – No increase (Third degree), Decreased prevalence (Fourth degree) [P Value] (Severe)

Cohort – Skinner 2019 (LQ) – No increase [P Value] (Severe)

Cohort – Frost 2016 (LQ) – Decreased odds [Odds] (Severe)

There is inconsistent weak evidence that staff training is associated with no increase to decrease in prevalence/odds for severe perineal tears.

Twin Pregnancy

Cohort – Doumouchtsis 2018 (AQ) – No increase [Risk] (Severe)

*Cohort – Rosen 2016 (AQ) – No increase [Odds] (Severe)

There is limited weak evidence that twin pregnancy is associated with no increase in odds/risk for severe perineal tears.

Twin pregnancy – Nulliparity

*Cohort – Porat 2013 (AQ) – Large increase [Odds] (Severe)

There is limited weak evidence that twin pregnancies in nulliparous women is associated with a large increase in odds for severe perineal tears.

Twin pregnancy – Occiput-posterior position of at least one twin

*Cohort – Porat 2013 (AQ) – Moderate increase [Odds] (Severe)

There is limited weak evidence that twin pregnancies whereby at least one twin is in occiput-posterior position is associated with a moderate increase in odds for severe perineal tears.

Twin pregnancy – Increased birthweight of at least one twin

*Cohort – Porat 2013 (AQ) – Small increase [Odds] (Severe)

There is limited weak evidence that twin pregnancies whereby at least one twin has increased birthweight is associated with a small increase in odds for severe perineal tears.

Twin pregnancy – Assisted vaginal birth of at least one twin

*Cohort – Porat 2013 (AQ) – Large increase [Odds] (Severe)

There is limited weak evidence that twin pregnancies whereby at least one twin has an assisted vaginal birth is associated with a large increase in odds for severe perineal tears.

Volume of Delivery Unit

High volume vs low volume

Cohort – Karalis 2018 (LQ) – Small increase [Odds] (Severe)

Cohort – Kozhimannil 2016 (LQ) – Decreased odds [Odds] (Severe)

Cohort – Snowden 2015 (AQ) – No increase [Odds] (Severe)

Cohort – Kozhimannil 2014 (AQ) – No increase [Odds] (Severe)

There is inconsistent weak evidence that high volume compared to low volume delivery units are associated with no increase in odds for severe perineal tears.

Warm Pack/Compress

*SR – Aasheim 2017 (HQ) – No increase [Risk] (Minor)

*SR – Aasheim 2017 (HQ) – Decreased risk [Risk] (Severe)

CT – Dahlen 2007 (HQ) – Decreased odds [Odds] (Severe)

*Cohort – Hastings-Tolsma 2007 (LQ) – Decreased prevalence [P Value] (Minor and severe)

There is consistent strong evidence that the use of warm pack/compress is associated with no increase in risk/prevalence for minor perineal tears and a decrease in risk/prevalence/odds for severe perineal tears.

Water Birth

Immersion versus no immersion during any stage of labour

SR – Cluett 2018 (HQ) – No increase [Risk] (Minor and severe)

SR – Lodge 2016 (LQ) – Increased rate [Not reported] (Minor and severe)

SR – Nutter 2014 (LQ) – Increased likelihood (Minor)

SR – Nutter 2014 (LQ) – Decreased likelihood (Severe)

Cohort – Preston 2019 (AQ) – Increased odds [Odds] (Severe)

Cohort - Ulfsdottir 2018 (AQ) – Decreased odds [Odds] (Minor)

Cohort - Lathrop 2018 (LQ) – No increase [P Value] (Severe)

Cohort - Lathrop 2018 (LQ) – Decreased prevalence [P Value] (Minor)

Cohort – Bovbjerg 2016 (AQ) – No increase [Odds] (Severe)

Cohort – Haslinger 2015 (AQ) – No increase [Odds] (Severe)

Cohort – Henderson 2014 (AQ) – Increase prevalence [P Value] (Minor)

Cohort – Henderson 2014 (AQ) – No increase [P Value] (Severe)

Cohort – Theoni 2005 (LQ) – No increase [P Value] (Minor and severe)

*Cohort – McPherson 2014 (LQ) – Small increase [Odds] (Severe)

There is inconsistent strong evidence that immersion compared to no immersion during any stage of labour is associated with no increase in risk/prevalence/odds for minor and severe perineal tears.

Immersion versus no immersion in first stage of labour

SR – Cluett 2018 (HQ) – No increase [Risk] (Minor and severe)

There is limited strong evidence that immersion compared to no immersion in the first stage of labour is associated with no increase in risk for minor and severe perineal tears.

Immersion versus no immersion in second stage of labour

SR – Cluett 2018 (HQ) – No increase [Risk] (Minor)

There is limited strong evidence that immersion compared to no immersion in the second stage of labour is associated with no increase in risk for minor perineal tears.

Wax/Oil

	*SR – Aasheim 2017 (HQ) – No increase [Risk] (Minor) ***There is limited strong evidence that wax/oil is associated with no increase in risk for minor perineal tears.***

5. References

* References listed here are those used in the introduction and included guidelines, reviews, controlled trials, cohort studies and case control studies.

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