Bilaga till rapport

Kejsarsnitt på kvinnans önskemål – fördelar och nackdelar för kvinna och barn/Caesarean section on maternal request – risks and benefits for mother and child, rapport 343 (2022)

Bilaga 3. Tabell över inkluderade studier/Appendix 3. Table over included studies

Table 1 Neonatal short term complications.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Geller et al. 2010 USA [1]	To determine whether route of delivery leads to differences in neonatal morbidity. Univ of North Carolina Perinatal Database and Neonatal Database. Between 1995 and 2005, 26 356 deliveries, selected 11 011 primiparous deliveries.	4 048 neonates born to healthy, term, primiparous women (1 520 CS and 2 528 vaginal deliveries). Exclusion criteria multiple gestation, GA<37 weeks, major maternal morbidity or fetal anormaly or morbidity. Group 1 identified as planned CS (n=180) judged as proxy on mother's request. Group 2 planned vaginal deliveries (n=3 868) including unplanned CS (n=1 340). Mean age planned vaginal 25 years and planned CS 28 years.	Planned CS vs planned vaginal delivery. Neonatal morbidity. Data rigorously collected from medical charts to database. Percent missed data not given.	Risk planned vaginal delivery vs planned CS adjusted OR (95 % CI) NICU admission 0.4 (0.3– 0.6), Meconium passage 2.6 (1.5–4.6) Chorionamnionitis 1.5 (1.2–1.8) Also oxygen resuscitation lower in planned vaginal group (p=0.001)	Moderate Adjusted for maternal race, GA, chorionamnionitis.
Hansen et al. 2008 Denmark [2]	Investigate associations between elective CS and neonatal respiratory morbidity and the importance of timing CS. Cohort study with prospectively collected data from the Aarhus Birth Cohort, Denmark 1998–2006. Univ hospital setting. All	34 458 pregnancies. (Low risk subgroup 32 580 pregnancies, excluded intrauterine growth retardation, diabetes, pre-eclampsia or hypertension). Elective 7.8 %, 92.2 % intended vaginal delivery, emergency 8.8 %, parity: primiparous/multiparous about 1/1	Elective CS vs intended vaginal delivery. Missing data 3–20 % various covariates.	Respiratory morbidity (transient tachypnoea, resp. distress syndrome, persistent pulmonary hypertension, serious resp morbidity) 1.8 % whole group, 0.2 % serious. Elective vs intended OR (95 % CI)§ GA 37 week: 3.7 (2.2– 6.1)	Moderate §Adjusted for smoking, alcohol intake, parity, BMI, marital status, maternal age, and years of schooling. #Not adjusted, few cases.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
	liveborn singletons without malformations GA 37-41.			GA 38 week: 3.0 (2.1– 4.4) GA 39 week: 1.9 (1.2– 3.0) GA 40 week: 0.9 (0.2– 3.7) GA 41 week: 1.5 (0.2–11) Serious#: GA 37 week: (5 and 7 infants) 5.0 (1.6–16) GA 38 week: (10 and 8 infants) 4.2 (1.6–11) GA 39 week: (2 and 6 infants) 2.4 (0.5–12) GA 40 week: (0 and 16 infants) GA 41 week: (0 and 10 infants) Similar relative risks for low-risk pregnancies	

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Kolås et al. 2006 Norway [3]	To examine neonatal outcomes among women with a planned caesarean and a planned vaginal delivery at term. Register cohort. Medical Birth Registry of Norway. Analyzed according to intended mode of delivery.	18 653 singleton deliveries 6 months period. Previous caesarean delivery planned vaginal group 5.1 % and planned caesarean 40. 1% respectively.	Planned caesarean vs planned vaginal deliveries, ITT. No missing data reported.	Transfer to neonatal intensive care unit. Vaginal 5.2 %. Planned caesarean 9.8 % (p<0.001). Excluded fetal indications caesarean 9.1 % RR (CI) 1.74 (1.38–2.18). Transient tachypnea and respiratory distress syndrome vaginal 0.8 % and planned caesarean 1.6 % (P=0.01). Excluded fetal indications caesarean 1.6 % RR (CI) 2.09 (1.19– 3.68).	Moderate Adjusted for GA, not for maternal morbidity.

BMI = Body mass index; CDMR = Caesarean delivery on maternal request ; CI =Confidence interval; CS = Caesarean section, GA =Gestational age; ITT =Intention to treat; n = Number; NICU = Neonatal intensive care unit; OR = Odds ratio; RDS =Respiratory distress syndrome; RoB = Risk of bias; RR = Relative risk

Table 2 Neonatal short term complications after one previous caesarean section.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Carlsson Wallin et al. 2010 Sweden [4]	To assess the impact of the indication for a previous CS on the outcome of a subsequent delivery. Cohort study using information from the Medical Birth registry.	Women with two deliveries identified between 1987 and 2007. 69 133 pregnancies following one CS and 487 610 pregnancies following one VD. The indication for the first CS was estimated using a hierarchical system based on information from birth records.	CD first pregnancy (planned or emergency) vs mothers who delivered first child vaginally (VD). National birth registry.	Second delivery for mothers with CS vs VD in first (adjusted OR and 95% CI). Perinatal death: 1.1 (0.97–1.2). Apgar score (<7 at 5 minutes) 1.6 (1.5–1.8).	Low Adjusted for year of birth, maternal characteristic (maternal age, smoking, height, BMI) and fetal/infant parameters (multiple birth, preterm birth, breech presentation, and birth weight standard deviation score) second delivery
Macharey et al. 2020 Finland [5]	To determine whether there is an association between term caesarean breech delivery in the first pregnancy and maternal and neonatal morbidities in the subsequent pregnancy and delivery.	We included all women with the first two consecutive singleton deliveries of which the first one was a breech delivery regardless of mode of delivery (n = 11 953), and constructed a data set in which the first two deliveries for these women were connected.	The outcomes of the second delivery of the women with a first pregnancy that resulted in caesarean breech delivery at term were compared with women whose first pregnancy resulted in a vaginal breech delivery at term. No info on missing data.	Outcome: Adjusted OR (95 % CI). Arterial umbilical pH < 7: 5.66 (1.37–23.46). 5 min APGAR < 4: 1.60 (1.08–2.39). Neonatal NICU admission: 1.56 (1.28–1.90). Neonatal intubation: 1.45 (0.73–2.86).	Moderate Adjusted for: Previous delivery not planned caesarean section, maternal age ≥ 35, maternal BMI ≥ 30, maternal BMI ≥ 35, pregestational diabetes treated with insulin, preeclampsia/chronic hypertension, PPROM, oligohydramnios, congenital anomalies.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Lassey et al. 2018 USA [6]	To compare spontaneous labour outcomes in women undergoing trial of labour after caesarean (TOLAC) and nulliparas. A 4-year retrospective cohort (2011–2014) including women at term in spontaneous labour with vertex singletons and no more than one prior CS. In a subanalysis focus was on a subset of women with a prior CS and predicted success rate ≥ 70 % good candidates TOLACS)	606 TOLACS and 606 nulliparas. (A total of 4 870 women with prior CS, 4147 excluded based o eligibility requirements and 117 declined trial of labour). Good candidates TOLACS n=180.	TOLACS versus nulliparas. No info on missing data.	CS TOLACS (156) 25.7 % and nulliparas (89) 14.7 % (p<0.001). Severe maternal hemorhage: TOLACS (9) 1.5 % and nulliparas (1) 0.2 % (p=0.02). Uterine rupture: TOLACS (12) 1.9 % and nulliparas (0) 0.0 % (p<0.01). Neonatal complications Admission to NICU TOLACS (26) 2.6 % and nulliparas (15) 2.5 % (p=0.12) 5 min Apgar <7 TOLACS (9) 1.5 % and nulliparas (9) 1.5 % (p=0.98) All signifcant risks for mothers and neonates disappeared for “good candidates of TOLAC”.	Moderate Adjusted for BMI, age, race, diabetes, hypertension

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Visser et al. 2020 The Netherlands [7]	To determine the risk of overall preterm birth (PTB) and spontaneous PTB in a pregnancy after a caesarean section (CS) at term. A cohort study based on linked registered data from two subsequent pregnancies in the Netherlands. Longitudinal linked national cohort study using the Dutch Perinatal Registry (1999–2009).	268 495 women with two subsequent singleton pregnancies (all delivered at term first pregnancy) 15.76 % (n = 42 328) had a CS at first pregnancy.	The incidence of overall PTB and spontaneous PTB CS vs vaginal first delivery. No missing data reported.	The incidence of PTB in the second pregnancy was 2.79 % (n = 1 182) in women with a previous CS versus 2.46 % (n= 5 570) in women with a previous vaginal delivery (adjusted odds ratio ,aOR) 1.14, 95 % confidence interval (CI) 1.07–1.21). Risk total preterm births second pregnancy. Planned CS vs vaginal delivery first pregnancy aOR 1.22 (1.09–1.36) and unplanned CS aOR 1.11 (1.03–1.20). aOR on spontaneous PTB for planned CS 1.86 (95 % CI 1.58–2.18) and 1.40 (95 % CI 1.24–1.58) for unplanned CS vs vaginal delivery. This increased risk is mainly driven by an increased risk of spontaneous PTB after previous CS at term (aOR 1.50, 95 % CI 1.38–1.70).	Moderate Adjusted for: maternal age at first delivery, ethnicity, socio-economic status, recurrent HD, inter-pregnancy interval and recurrent SGA.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Williams et al. 2020 UK [8]	To determine the risk of spontaneous and medically indicated preterm birth associated with mode of birth in previous term-born pregnancy. Cohort study two UK maternity units using routinely collected clinical data.	A total of 16 340 women with first two consecutive singleton births and the first birth at term. CS first pregnancy 13.8 % (elective and emergency).	Incidence of spontaneous preterm birth and medically indicated preterm birth at less than 37 weeks of gestation after term birth, in relation to mode of birth in first pregnancy. Subgroup analysis on cervical dilatation at the time of first caesarean birth. No missing data reported	In the second pregnancy 15 833 women (96.9 %) had another term birth, 333 (2.0 %) women had a spontaneous preterm birth at less than 37 weeks of gestation and 174 (1.1 %) had an indicated preterm birth at less than 37 weeks of gestation. **Spontaneous preterm birth:** Previous elective CS 15 (2.2 %). Previous VD 174 (2.3 %) CS vs VD OR 0.89 (95 % CI 0.50–1.49). **Indicated preterm birth:** Previous elective CS 13 (1.9 %). Previous VD 59 (0.8 %) CS vs VD OR 2.30 (1.19–4.15).	Moderate Adjusted for gestational age at first birth, birthweight centile, interpregnancy interval, maternal age, maternal ethnicity, maternal BMI category and maternal deprivation index.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Wood et al. 2015 Canada [9]	Previous CS increases risk of stillbirth an association which could be explained by residual confounding. Matched set of first and second births during 1992–2006 were identified from the Alberta Perinatal Health Project database.	98 538 first and second births. Previous CS 21.1 %. Excluded previous prematurity, SGA <5 %, or PIH.	Risk of stillbirth in current delivery previously exposed or nonexposed to CS. Missing data not reported.	Stillbirth Multivariate analysis OR 1.38 (0.98–1.93). Low risk group§ 0.99 (0.62–1.52) Risk according to indication previous CS Dystocia 0.91 (0.53–1.55). Breech 1.06 (0.50–2.28) Other indication (not reassuring fetal status and fetal distress 1.96 (1.29–2.98).	Moderate Logistic regression controlling for several potential confounders. A second analysis also excluding advserse perinatal outcome in the first.

aOR = Adjusted odds ratio; BMI = Body mass index; CI = Confidence interval; CD = Caesarean delivery; CS = Caesarean section; n = number; HD = Hypertensive disorders of pregnancy; NICU = Neonatal intensive care unit ; OR = Odds ratio; p = probability ; PIH = Pregnancy induced hypertension; PTB = Preterm birth ; RoB = Risk of bias; SGA =Small for gestational age; TOLACS =Trial of labor after caesarean section; VD = Vaginal delivery; vs = Versus

Table 3 Children long term complications.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Ahlqvist et al. 2019 Sweden [10]	To examine the association between different forms of CS and risk of obesity in early adulthood. Register cohort study of males born between 1987 and 1982 followed from birth to conscription. Weight and height measured at conscription and transformed to WHO BMI categories. Maternal and infant data from Medical Birth Register. Sensitivity analyses including fixed effects regression to adjust for confounders shared between full brothers.	97 291 males and 9 676 matchable full brothers. Maternal age at delivery mean 28.5 years and prepregnancy BMI mean 21.9.). Only male.	CS vs vaginal delivery. About 40–50 % of original cohort missing data BMI data or confounders excluded. Considered not different from those with all data available in the final analyses.	4.9 % obese (BMI >30) at conscription, vaginal delivery, elective CS, and emergency CS 4.9 %, 5.5 %, and 5.6 % respectively. RR (95 % CI) obesity vs vaginal delivery: Emergency 0.96 (0.83–1.10). Elective 1.02 (0.88–1.18). No change after sibling analysis.	Low After adjusted for prepregnancy maternal BMI, maternal diabetes, hypertension, smoking, parity, parental education, maternal age, GA, birth weight according to GA, and preeclampsia.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Almqvist et al. 2012 Sweden [11]	To investigate if CS increases risk of childhood asthma. Register based cohort of 87 500 sibling pairs. Asthma outcome from national health registers as diagnosis or medication during 10 or 13. Mode of delivery and confounders from the Medical Birth Register 19931999.	87 500 sibling pairs, 9.4 % delivered by CS (5.4 % emergency and 4.2 % elective. In 20 493 pairs discordant delivery modes.	CS vs vaginal delivery. Missing data a few percent for most population characteristics, BMI 15 % missing.	7 % asthma medication (vaginal delivery 6.8 %, elective CS 7.9 %, emergency CS 8.2 %). Asthma diagnosis 1.6 % (vaginal delivery 1.5 %, elective CS 2.0 %, emergency CS 2.1 %). Adjusted OR (95 % CI) in children born with CS for asthma medication or diagnosis 1.13 (1.04– 1.24) and 1.20 (1.05–1.37) respectively. Asthma medication: Emergency CS 1.16 (1.03–1.29). Elective CS 1.10 (0.97–1.26). Asthma diagnosis: Emergency CS 1.18 (1.00–1.34) Elective CS 1.25 (1.02–1.52). Sibling controlled analysis Asthma medication: Emergency CS 0.99 (0.99–1.60)	Moderate Adjusted for gender, birth weight, GA, birth order, APGAR score, hypoxia/asphyxia, mothers age, smoking during pregnancy, mother living with father of child, mother´s birth country and mothers BMI

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
				Elective CS 0.82 (0.64–1.09) Asthma diagnosis: Emergency CS 1.29 (0.84–1.99). Elective CS 0.65 (0.42–1.02)	
Alterman et al. 2021 UK [12]	To elucidate whether birth by planned or emergency caesarean section is associated with increased risk of hospital admission due to LRTI or URTI in infancy.	Two cohorts: MCS data (15 580 infants) and SAIL data (392 145 infants).	Normal vaginal delivery vs assisted vaginal delivery, planned CS and emergency CS. Missing data most covariates "minimal". Smoking 60 %, breastfeeding 15 %, ethnicity 11 %.	Lower Respiratory Tract Infection: *MCS Data*, Adjusted HR (95 %CI): Assisted VD: 1.18 (0.79, 1.75) Planned CS: 1.39 (1.03, 1.87) Emergency CS: 1.14 (0.79, 1.65) *SAIL data,* Adjusted HR (95 %CI): Assisted VD: 0.97 (0.93, 1.02) Planned CS: 1.10 (1.05, 1.15) Emergency CS: 1.03 (0.98, 1.08) Upper Respiratory Tract Infection: *SAIL data,* Adjusted HR (95 %CI): Assisted VD: 1.03	Moderate Adjusted for mother's age, marital status, education level, asthma/ atopic disease, smoking diabetes, and hypertensive condition. Socioeconomic status, area deprivation quintile, ethnicity, sex, parity, birthweight, gestational age birth, breastfeeding, year of birth, and season of birth

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
				(0.98, 1.07) Planned CS: 1.11 (1.06, 1.16) Emergency CS: 1.09 (1.05, 1.14)	
Andersen et al. 2020 Denmark [13]	Evaluate any associations between CS and development of inflammatory bowel disease (IBD), rheumatoid arthritis RA), coeliac disease CD), and diabetes (DM) among offspring. National population-based register study. Data from the Danish Medical Birth Registry linked to the Danish National Patient Registry from 1973– 2016.	2 672 708 liveborn children. 85 % vaginal delivery, 15 % CS. Acute and elective CS possible to discriminate after 1990, 1 598 834 births (vaginal 82.1 %, elective CS 7.7 % and acute CS 10.3 %.	CS vs vaginal delivery. No missing data reported national registries used.	Compared with vaginal delivery adjusted HR (95 % CI). Diabetes: Elective 1.14 (1.03-1.25), Acute 1.05 (0.96-1.14) RA: Elective 1.14 (1.02– 1.27) Acute 1.09 (0.99–1.20). CD: Elective 1.04 (0.92–1.19) Acute 1.15 (1.03–1.29). IBD: Elective 1.16 (1.03–1.30) Acute 1.06 (0.95–1.18).	Moderate Adjusted for decade of birth, child´s sex, mother´s and father´s age and DM, RA, CD, and IBD:

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Begum et al. 2019 Australia [14]	Estimate diabetes type 1 risk for children born by CS vs vaginal delivery. Whole population study with data from birth registry 1999–2013 linked to inpatient hospitalization data 2001–2014.	286 058 children Vaginal birth 195 512 (68 %) CS 90 546 (32 %) Elective 48 088 (17 %) Emergency 42 088 (15 %)	CS vs vaginal Various missing data for n= 39 237 from initial sample n=286 058 Maternal BMI missing data for n= 190 623, only used in sensitivity analysis.	557 type 1 diabetes. Adjusted HR vs vaginal delivery (95 % CI) CS total 1.05 (0.86–1.28) Elective 1.02 (0.79–1.32) Emergency 1.08 (0.82–1.41).	Low Adjusted for birthweight for GA z-score, parental age, parental occupation, maternal diabetes and hypertension, maternal region of birth, maternal ethnicity, IRSAD, remoteness, birth at public or private hospital, child´s birth order, private or public healthcare, antenatal visit, and maternal smoking.
Blustein et al. 2013 UK [15]	Assess associations between CS with body mass from birth through adolescence. Children born in Avon UK 1991–1992 and followed in a longitudinal study of parents and children. Measures of child height and weight were followed for 15 years.	Final sample included 10 219 mother-child pairs. CS 9.1 %, elective 3.7 %, emergency 5.4 %.	CS vs vaginal Missing data covariates: Fathers BMI 33 %, maternal social class 21 %, most other variables missing 5-10 %.	Z-score increments (95 % CI) 11 and 15 years Elective vs vaginal: -0.07 (-0.22, 0.08) -0.09 (-0.26, 0.09) Emergency vs vaginal: 0.89 (-0.03, 0.21) 0.06 (-0.07, 0.19)	Moderate Adjusted for birth weight, gender, parental body mass, family sociodemographics, gestational and infant feeding patterns.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Bråback et al. 2013 Sweden [16]	Relation between mode of delivery and asthma in children. Register based national cohort study of all firstborn children (1999–2006) aged 2–5 years and 6–9 years linked to dispensed inhaled corticosteroids.	n=199 837, 2–9-year-olds.	Elective CS vs vaginal delivery. Covariates missing data maternal body mass index 6 % and maternal smoking 6 %	Adjusted OR (95 % CI) vs vaginal at least one prescription of inhaled cortisone. 2–5 years: Elective 1.19 (1.09–1.29) Emergency 1.14 (1.04– 1.25). 6–9 years: Elective 1.21 (1.09–1.34) Emergency 1.05 (0.93– 1.17). **Discordant sibling-pairs:** 2–5 years: Elective 1.23 (1.05–1.43) Emergency 0.95 (0.78– 1.14). 6–9 years: Elective 1.06 (0.78–1.44) Emergency 1.02 (0.72–1.44).	Low Adjusted for year of birth, sex, maternal and paternal asthma medication, maternal education, social welfare, maternal age, maternal smoking, urban/rural living, county, maternal diabetes, hypertension, premature rupture of membranes, preeclampsia, gestational diabetes, chorioamnionitis, meconium aspiration, respiratory distress.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Clausen et al. 2016 Denmark [17]	Evaluate the association between prelabor caesarean section and risk of childhood type 1 diabetes. A nationwide cohort study followed all singletons born during 1982–2010. Four national registers provided information on mode of delivery, outcome, and confounders. Classification of diabetes type 1 from diagnosis at discharge or at least two prescriptions of insulin	A total of 1 760 336 singletons included in analyses. Vaginal delivery 85 %, (elective 7 % (4– 11 %), emergency 8 % (7–9 %), total CS 11–20 %. Multiparous 55 %.	Elective CS vs vaginal delivery. Missing values obstetric data and other potential confounders <5 %.	In the cohorts born from 1982 to 2010, the total incidence rate of childhood type 1 diabetes has increased from 18 in 1992 to 31 per 100 000 person-years in 2010. Type 1 diabetes was diagnosed in 4,400 cases (vaginal delivery: 3,762; intrapartum caesarean section: 336; prelabor caesarean section: 302. Risk type I diabetes adjusted HR (95 % CI). Elective vs vaginal 1.2 (1.0–1.3)¤ 1.1 (0.95–1.2).¤¤ Emergency vs vaginal 1.0 (0.92–1.12)¤ 1.0 (0.89–1.1)¤¤	Low Adjusted for year of birth, parity, sex, parental age, and education and paternal type 1 diabetes status at childbirth. After also adjusting for maternal type 1 diabetes status at childbirth.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Dydensborg Sander et al. 2018 Denmark [18]	Investigate the association between mode of delivery and celiac disease. Register based cohort using two independent population cohorts. Included all children born in Denmark between January 1, 1995 and December 31, 2010 and all children born in Norway between January 1, 2004 and December 31, 2012.	1 051 028 children from Denmark (18.9 % CS) and 537,457 from Norway (16.8 % CS).	Elective CS vs vaginal delivery. Missing data smoking 4–17 %. Maternal education 34 %, type of CS <1 %.	Celiac disease 0.13 and 0.35 % in Danish and Norwegian cohorts respectively. Median age 7.4 years at diagnosis. Pooled population# (n=1 391 016) OR vs vaginal ref 1.0 CS 1.05 (0.98–1.13) Emergency 1.03 (0.93–1.14). Elective 1.08 (0.99–1.19). Only Danish cohort also adjusted for autoimmune disease. CS 1.09 (0.95–1.26) Emergency 1.02 (0.83–1.25). Elective 1.17 (0.98–1.39)	Moderate # Adjusted for year of birth, sex, maternal age, parity, GA, weight for GA, smoking.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Hanrahan et al. 2019 United Kingdom [19]	To investigate the relationship between obstetric mode of delivery and longitudinal cognitive outcomes in childhood.	8 845 participants. 6 020 (68 %) were born by normal vaginal delivery,889 (10 %) by assisted vaginal delivery, 846 (10 %) by planned CS, and 1 090 (12 %) by emergency CS.	Normal vaginal delivery vs assisted vaginal delivery, planned CS and emergency CS at 3, 5, 7 and 11 years of age, respectively. Missing data Maternal BMI 7 %, GA missing 0.8 %	BAS Verbal Similarities, Word Reading, Naming Vocabulary N.S for all comparisons and ages. Verbal delay N.S. for all comparisons, frequencies, and ages. Visual-spatial cognitive ability N.S for all outcomes, comparisons, and ages, except from: (adjusted OR, 95% CI) CANTAB SWM Strategy Delay at 11 years of age: 1.31 (1.03–1.65) CANTAB SWM Errors Delay at 11 years of age: 1.01 (0.83–1.22) BAS Pattern Construction Delay at 7 years of age: 1.42 (1.12–1.81) Patterns of visual-spatial delay N.S. for all comparisons, frequencies, and ages.	Moderate Adjusted for gender, ethnicity, number of siblings, maternal age, maternal pre-pregnancy body mass index (BMI), maternal highest educational attainment, paternal highest educational attainment, maternal smoking during pregnancy, maternal alcohol use during pregnancy, preeclampsia, and index of multiple deprivation (IMD) quintile. 45 of 48 analyses N.S.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Håkansson et al. 2003 Sweden [20]	Investigate if CS increases risk of childhood asthma and gastroenteritis compared with vaginal delivery. Register cohort. Women without any background/perinatal morbidity. Data linked from Medical Birth Register 1984-1996 and Hospital Discharge registry 1985-1997. Infants at least one year of age hospitalized for asthma or gastroenteritis	13 058 children with asthma and 20 377 with gastroenteritis treated as inpatients. Asthma parity 1 and 2, 37 %. Gastroenteritis group parity 1 and 2, 44 % and 35 %.	CS vs vaginal delivery. Missing data maternal smoking about 5 %.	Risk asthma OR (95 % CI) controls not admitted to hospital and admitted Non-instrumental vaginal delivery ref 1.0. CS total: 1.31 (1.23–1.40) and 1.14 (1.07–1.22). Acute: 1.26 (1.16–1.37) and 1.08 (0.99–1.18). Elective: 1.38 (1.26–1.52) and 1.23 (1.11–1.36). Instrumental delivery: 1.10 (1.01–1.19) and 1.07 (0.98–1.16). Risk gastroenteritis with controls not admitted and admitted to hospital: CS total: 1.31 (1.24–1.38) and 1.13 (1.07–1.19). Acute: 1.31 (1.23–1.40) and 1.13 (1.07–1.19). Elective: 1.30 (1.20–1.41) and 1.13 (1.04–1.24). Instrumental delivery: 1.07 (1.00–1.14) and 1.02 (0.95–1.09).	Moderate After stratification for year of birth of child, gender, maternal age and parity, smoking in early pregnancy, and education

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Keskii-Nisula et al. 2010 Finland [21]	Investigate relation between obstetric factors during birth and doctor-diagnosed wheezing and allergic sensitization in early childhood. Cohort study, data on doctor-diagnosed wheezing from questionnaires, obstetric data from register. Children born between 2002 and 2005. IgE antibodies in blood measured in 388 children at 1 year of age.	410 women followed from late pregnancy until 18 moths age off their children. Maternal age at delivery mean 32 years, parity 1.3.	Elective vs vaginal delivery. Missing values. Doctor-diagnosed wheezing based on questionnaire data. Type of ruptured fetal membranes during delivery not known for 40 %.	Risk doctor-diagnosed wheezing OR (95 % CI): Spontaneous vaginal delivery; ref 1.0 Assisted vaginal delivery: 1.04 (0.19–5.66) Elective: 0.39 (0.07–2.08) Emergency: 0.86 (0.17– 4.33) Total CS vs vaginal delivery : 0.60 (0.18–1.95). Allergic sensitization at 1 year Vaginal ref 1.0 Assisted vaginal delivery: 0.91 (0.34–2.44) Elective: 0.36 (0.12–1.09) Emergency: 0.30 (0.08– 1.13). Total CS vs vaginal delivery: 0.34 (0.14–0.80)	Moderate Adjusted for maternal age and parity at delivery, maternal weight gain and smoking during pregnancy, education, living on a farm, GA, birth weight, breast feeding, parental allergy, paternal smoking, antibiotics after delivery, Apgar score at 5 min., presence of cats or dogs, day care attendance.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Khashan et al. 2014 Sweden [22]	The association between caesarean section (CS) and type 1 diabetes (T1D), and if the association remains after accounting for familial confounding by using a sibling-control design. Population-based cohort study of all singleton live births in Sweden between 1982 and 2009, followed by sibling-control analyses. T1D diagnoses were identified from the Swedish National Patient Register. Data on obstetric complications were retrieved from the Medical Birth Register.	The final cohort consisted of n = 2 638 083 after exclusion of 74 639 multiple births, 8 343 stillbirths, and 116 991 children with unknown mode of delivery. 79.4 % were unassisted vaginal births, 192 458 (7.3 %) Instrumental vaginal deliveries, 191 646 (7.1 %) emergency CSs, and 159 498 (6.1 %) elective CS.	Elective vs vaginal. Missing data maternal BMI about 27 %, education about 10 %. Most other below 1 %.	Risk T1D Risk T1D Adjusted# OR (95 % CI). No age restriction. Unassisted vaginal birth ref. 1.0. Elective: 1.15 (1.07–1.24) Emergency: 1.03 (0.96–1.11). Instrumental vaginal birth: 1.13 (1.06–1.21). After sibling cohort adjustment: Elective: 1.00 (0.82–1.22) Emergency: 1.08 (0.90–1.30). Instrumental vaginal birth: 1.08 (0.94–1.24).	Moderate # Adjusted for offspring age as a time dependent variable, year of birth, gestational age, and maternal diabetes by using Poisson regression with aggregated person-years.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Korhonen et al. 2018 Finland [23]	Assess incidence and risk for asthma and atopic dermatitis at seven years of age following birth at different gestational ages. Cohort study. Data from medical birth register. Data on asthma medical reimbursement and hospital visits for atopic dermatitis from national health databases.	965 203 infants born between 1991–2008 at ≥37 weeks of gestation.	Incidence and risk factors of asthma at 7 years of age at different gestational ages and delivery methods. Elective and emergency caesarean vs vaginal deliveries. National health databases, missing data not reported.	Asthma medication reimbursement, elective OR 1.14 (1.10–1.18), multivariate. Hospital visits atopic dermatitis OR 1.08 (1.05–1.12).	Moderate Adjusted for covariates like gestational age, mothers age, smoking, parity, birth hospital, sex, gestational weight, child ventilator therapy, antibiotic therapy.
Kristensen et al. 2016 (range 29–34) Denmark [24]	Is mode of delivery associated with diseases of the immune system? Register cohort. Medical Birth Registry of Denmark, Patient registry Denmark.	Data from children born at term 1997–2012, n=790 564 up to 14 years of age. Acute CS =60 319 PL CS= 63 811 Remaining delivered vaginally.	Planned and Acute CS. Controls (reference Vaginal deliveries). Adherence 100 % Loss to follow up 0 %.	Acute and planned CS ass with asthma, laryngitis och GE. Ac CS ass UC and celiac disease. Planned CS associated with lower respiratory tract infection and arthritis. Asthma higher risk after planned CS vs acute CS.	Moderate Adjusted for prespecified covariates: gestational age, sex, birth weight, maternal age, maternal smoking during pregnancy, preeclampsia, eclampsia, haemorrhage, hyperemesis. Diagnosis only from hospital care. No data on maternal asthma and breast feeding.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Li et al. 2014 China [25]	Impact of CS on child overweight. Chinese register.	All deliveries in two provinces of China between 1993 and 1996 (n=210 849) Follow up in 2000, 142 680 delivered vag, 38 700 by CS 1 812 CDMR.	Planned CD (36 888) and CDMR (n= 1 812) analysed separately. Controls (Vaginal deliveries) n= 142 680. Missing data: Maternal age 0.1 %, height 13 %, weight at first prenatal visit 14 %, BMI 14 %, weight gain during pregnancy 19 %, child's birth length 0.3 %. Loss to follow-up 5-10 %	Adjusted OR for CDMR 1.18/1.00-1.41	Moderate Adjusted for maternal age, height, weight at first prenatal visit, BMI, weight gain during pregnancy, education, occupation, parity, folic acid supplementation, child's gender, birth weight, gestational age.
Li et al. 2011 China [26]	Impact of CDMR on child intelligence. Chinese registers	Deliveries 1993–1996. Follow-up in 2000 with various validated tests. Participants chosen at random. 3 524 delivered SVD, 95 by CDMR 525 by AVD	CDMR or AVD Controls SVD Missing data maternal BMI 9 % and intrapartum fetal distress 0.2 %.	CDMR vs SVD adjusted OR 1.6(-1.3–4.5) AVD vs SVD adjusted OR 0.9(-0.4–2).	Moderate Adjusted for maternal residence, education, occupation, BMI, and OQ score, and childs age, gender, and birth weight.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Malmborg et al. 2012 Sweden [27]	Association between CS and CD (Crohn´s disease). Medical Birth Register and inpatient register	Cases: 1 536 Crohn´s Controls 15 439 not CD. Born 1973–2006	Planned and acute CS reported separately. Ref :SVD (vag) National registers with almost full coverage.	Boys: OR 1.25 (1.01– 1.54) Girls: 0.99 (0.76–1.29) Weighted common OR: 1.14 (0.96–1.35)	Moderate Stratification by sex and adjusted for confounders like socioeconomic factors and maternal infection during pregnancy. Presence of mother IBD did not alter risk estimates.
Masukume et al. 2019 Ireland/New Zealand [28]	To investigate the association between CS delivery, particularly elective/planned and childhood obesity at age 24 and 54 months. Cohort study	Pregnant women with an estimated delivery date between 25 April 2009 and March 25th, 2010 north island New Zealand were recruited into the GUiNZ cohort. 6 599 infants, 23.2 % delivered by CS.	Caesarean delivery compared with spontaneous vaginal delivery. Missing data (approx. 20 %) on BMI and household income. Multiple imputation of missing data and analysis of the pooled data did not materially change the study results.	Risk obesity at age 24 months planned CS adjusted relative risk ratio (aRRR=1.59; (95 % CI 1.09 to 2.33)). Emergency CS (aRRR=1.27; (95 % CI 0.89 to 1.82)). At age 54 months planned CS (aRRR=0.89; (95% CI 0.54 to 1.45)), emergency CS (aRRR=1.19; (95% CI 0.80 to 1.77))	Moderate Adjusted for maternal age, education, ethnicity, marital status, infant sex, birth weight, smoking, gestational age, gestational diabetes, parity, pre-pregnancy BMI.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Masukume et al. 2019 Ireland [29]	Investigate association between caesarean section and body fat percentage, BMI, overweight/obesity in early childhood. Prospective longitudinal cohort study.	From Screening for Pregnancy Endpoints Study recruitment between November 2007 and February 2011. 1 305 infants, 27.8 % delivered by CS. Prelabour CS 12 %, CS in labour 15.8 %. Approx 40 % missing data at 5 years.	Caesarean delivery compared with spontaneous vaginal delivery. Approx 40 % missing data at 5 years.	At 6 months mean BMI 17.3 and 17.6 kg/m2 for vaginal and CS delivery respectively (adjusted BMI mean difference 0.24; 95 % CI 0.06–0.41). BMI Normal BMI -base outcome. At 2 years adjusted: overwight/obese. Unassisted vaginal reference 1.0. Operative vaginal 0.95 (0.58–1.56) Elective 1.38 (0.73–2.62 Emergency 0.88 (0.48–1.61). At 5 years adjusted overwight/obese. Unassisted vaginal reference 1.0. Operative vaginal 1.64 (1.00–2.67) Elective 1.37 (0.69–2.69) Emergency 1.69 (0.92–3.08).	Moderate Relatively few cases. Not adjusted for pre-pregnancy BMI but adjusted for antenatal visit BMI

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Masukume et al. 2019 Ireland [30]	Association between CS delivery and childhood obesity. Cohort study. Mother-infant pairs recruited into Millenium Cohort Study.	18 116 infant, CS 21.4 %, elective CS 9.2 %, emergency CS 12.2 %, normal vaginal 69.4 %, and assisted vaginal 9.4 %. Pre pregnancy BMI missing data about 9 %	Caesarean delivery compared with spontaneous vaginal delivery. Missing on couple income data (approx. 20 %) and pre-pregnancy BMI (approx. 9 %).	Obesity prevalence at age 3, 5, 7, 11, and 14 years was 5.4 %, 5.7 %, 6.5 %, 7.1 %, and 7.6 % respectively. Mean BMI elective delivery and normal delivery similar. Adjusted coeff (95 % CI) normal vaginal reference, assisted vaginal -0.03 (-0.13; 0.07), elective 0.00 (-0.10; 0.10), emergency 0.08 (-0.01; 0.17)	Moderate Adjusted for maternal age, ethnicity, education, marital status, couple income, infant sex, birth weight, smoking, gestational age, diabetes mellitus, parity, pre-pregnancy BMI.
Mitselou et al. 2020 Sweden [31]	To examine pregnancy outcome (caesarean delivery, preterm birth, low birthweight) and offspring allergic rhinitis (AR) as defined by national registers.	Nationwide longitudinal cohort study using prospectively recorded register data from 1 059 600 singleton livebirths born in Sweden in 2001–2012	Caesarean delivery (CD) vs vaginal delivery (VD). Study population restricted to singletons with complete data on all outcomes and covariates n=1 059 600.	Allergic rhinitis: Adjusted Hazard ratio; 95 % CI. CD vs VD: 1.12; 1.08–1.16. Elective CD vs VD: 1.10; 1.05–1.15. Emergency CD vs VD: 1.13; 1.08–1.19.	Moderate Adjusted for sex, maternal age at delivery, country of birth, parity, body mass index, early-pregnancy smoking, and maternal asthma/pulmonary disease, caesarean delivery, gestational age, and birthweight

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Mitselou et al. 2018 Sweden [32]	To examine the association between perinatal characteristics and future risk of food allergy in offspring. Nationwide cohort study of children born 2001–2012 using data from health care registries.	Complete data on 1 086 378 children with median follow up 6.4 years, range 0.2–12.8 years. 17 % born by CS, elective CS 8.5 %, emergency 8.3 %.	Risk for food allergy following CS vs vaginal delivery. Cohort n= 1 088 990 with complete data on all covariates.	Normal full-term delivery 2.4% diagnosed with food allergy, CS 2.9%, very preterm 1.9%. Food allergy HR (95% CI) Model 1 Elective 1.16 (1.11–1.21) Model 2 CS 1.21 (1.18– 1.25) Elective 1.18 (1.13–1.23) Emergency 1.24 (1.19– 1.29) For two recorded diagnoses of food allergy. CS 1.21 (1.16–1.26) Elective 1.17 (1.10–1.24) Emergency 1.25 (1.18– 1.32).	Low Adjusted for sex, maternal age, country of birth, parity, BMI, early pregnancy smoking, maternal asthma/pulmonary disease, + caesarean delivery, gestational age and birth weight Model 2). Adjusted for *CS* Model 2

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Momen et al. 2014 Denmark [33]	Association between caesarean section (CS) and risk of childhood cancer <15 years of age. Register data from Denmark, Sweden, and Finland.	Children born in Denmark (1973–2007), Sweden (1973–2006), and Finland (randomly selected sample of 90 %, 1987–2007). n= 7 029 843. CS 12.6 %, (30.3 % of CS elective, unplanned 35.9 %, and no information 33.8 %).	Exposure CS, controls planned and unplanned. Missing data below 5 % for birthweight, gestational, age, smoking. Employment status missing about 14 %.	Cancer diagnosis 11 181. Adjusted risk childhood cancer CS HR 1.05 (CI 0.99–1.11). Elective: 1.04 (0.93– 1.16) Emergency: 1.09 (0.99–1.21) Unknown: 1.12 (1.03– 1.21).	Moderate Adjusted for birth year, country, gestational age, multiple birth, birth weight group, maternal age, and parity.
Moore et al. 2011 Australia [34]	To examine associations between the number of hospital admissions for bronchiolitis and pneumonia and elective caesarean delivery in children aged <12 months and 12–23 months. Population-based data linkage cohort study.	212 068 non-Aboriginal singleton births of 37–42 weeks gestation. Elective caesarean section (n=33 421).	Elective caesarean delivery compared with spontaneous vaginal delivery. Missing data not reported but national registers used.	Adjusted analysis, risk of admissions for bronchiolitis at age <12 months incidence rate ratio (IRR) 1.11; 95% CI 1.01 to 1.23 and 12–23 months IRR 1.20; 95% CI 0.94 to 1.53. Number of pneumonia admissions aged <12 months IRR 1.03; 95% CI 0.80 to 1.33 and 12–23 months IRR 1.09; 95% CI 0.88 to 1.34.	Moderate Adjusted for several potential confounders, maternal age, parity, pre-eclampsia, gestational diabetes, smoking during pregnancy, maternal asthma, infant gender, season of birth, gestational age, a measure of birth weight, socio-economic status. Risk for acute caesarean section lower than for elective.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Richards et al. 2020 USA [35]	Investigate the association between C- section and atopic dermatitis (AD) by age four and examine potential sources of bias in the relationship in a large cohort study.	173 105 children were included in our sample; 12.0 % of children met the case definition for AD and 26.6 % were born via C- section.	Caesarean delivery (CD) vs vaginal delivery (VD). Missing data maternal education about 3 %, BMI 7 %, breast feeding 15 %.	Atopic dermatitis: Adjusted Risk ratio; 95 % CI. CD vs VD: 1.02 0.99–1.05.	Low Potential confounders considered: *Maternal:* age at child's birth, education, self-identified race, pre-pregnancy BMI, smoking during pregnancy, antibiotics during pregnancy, pregnancy-induced hypertension, pre-existing diabetes, asthma, AD, allergic rhinitis, food allergies, and other allergies. *Child*: Sex, gestational age at delivery, birthweight, neonatal intensive care unit (NICU) admission (≥2 days), and birth order breastfeeding status at 2 months, early AD symptoms, gestational age, NICU admission.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Richards et al. 2020 USA [36]	To investigate the association between C- section and allergic rhinitis (AR) at ages 6, 8, and 10 years.	Our cohort included 117 768 children followed through the age of 6 years, 8 years 75 115 and 10 years 40 332.	Caesarean delivery (CD) vs vaginal delivery (VD). Missing data maternal education about 1 %, BMI 9 %, breast feeding 13 %	Allergic rhinitis: Adjusted Risk ratio (95 % CI). Age 6: 0.98 (0.91, 1.04). Age 8: 1.00 (0.95, 1.07). Age 10: 1.03 (0.96, 1.10).	Low Adjusted for: Maternal age, education, race, pre-pregnancy BMI, smoking, antibiotics during pregnancy, maternal asthma, atopic dermatitis, allergic rhinitis, food allergy, other allergy, sex, gestational age, birthweight, NICU admission, birth order, and breastfeeding.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Sevelsted et al. 2016 Denmark [37]	To analyze the risk of asthma before the age of 7 years by delivery from the national registries and including high risk COPSAC2000 cohort. Childhood asthma from use of inhaled corticosteroids.	411 children born 1998– 2001 to mothers with asthma excluding GA <36 weeks and excluding chronic disease or lung symptoms prior to inclusion. Asthma diagnosis before the age of 7 years. 22 % by CS in the COPSAC cohort and 19 % by CS in the whole registry cohort. 910 310 children in whole registry. Emergency CS about 7–9 %, elective about 7–13 % during study period.	CS (elective and emergency vs vaginal delivery). 95 % of the population were selected with data on all confounders.	72 children of 411 (18 %) in CAPSAC cohort and 4.4 % (38 085) in the whole registry cohort developed asthma. CS and asthma adjusted HR 2.18 (95 % CI 1.27–3.73) and in whole population adjusted IRR 1.16 (1.13–1.19) with prematurity as strongest confounder. CS before rupture of membranes (elective) vs vaginal whole population cohort IRR 1.20 (1.16–1.23) and emergency vs vaginal IRR 1.12 (1.09– 1.16).	Moderate In whole population registry adjusted for parity, birth weight, GA, maternal age, asthma, other disease, multiple births, antibiotics during pregnancy, smoking during pregnancy employment.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Sitarik et al. 2020 USA [38]	To assess how C- section types (planned or unplanned C-section) relate to preadolescent obesity. WHEALS birth cohort based in Detroit, Michigan. Children were followed-up at 10 years of age, where a variety of anthropometric measurements were collected.	The study consisted of 570 maternal–child pairs drawn from the cohort 2003–2007.	Obesity was defined based on BMI percentile (≥95th percentile), as well as through Gaussian finite mixture modeling on the anthropometric measurements. Risk ratios (RRs) and 95 % confidence intervals (CIs) for obesity comparing planned and unplanned C-sections to vaginal deliveries. Household income not given for 10 %.	Risk of obesity (≥95th percentile) RR (95% confidence interval). Planned C-section vs vaginal delivery: 1.77 (1.16–2.72). Unplanned C-section vs vaginal delivery: 0.75 (0.45–1.23).	Moderate Adjusted for marital status, maternal race, prenatal tobacco smoke exposure, maternal age, maternal BMI, any hypertensive disorders during pregnancy, gestational diabetes, prenatal antibiotic use, child sex, parity, and birthweight z- score.
Tollånes et al. 2008 Norway [39]	To explore the possible association between CS and later development of asthma. Medical birth registry of Norway. Asthma registered in the National Insurance Scheme.	579 675 singletons without birth defects between 1988–1998 and followed until 2002 for risk of asthma. Elective 4.4 %, emergency CS 7.6 %.	Elective CS vs vaginal delivery. Medical birth registry of Norway. Underreporting of maternal asthma discussed.	Cumulative incidence of asthma per 1 000. Spontaneous vaginal: 7.3 Instrumental vaginal: 6.9 Planned CS: 10.1 Emergency CS: 10.8 HR of asthma (95 % CI) adjusted # Spontaneous vaginal ref 1.0 Instrumental vaginal: 1.14 (1.01–1.28) Planned CS: 1.42 (1.25–1.61) Emergency CS: 1.59 (1.44–1.75).	Moderate #Adjusted for maternal age, birth order, maternal education, maternal asthma, and sex. Not adjusted for maternal smoking?

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Tun et al. 2018 Canada [40]	Association between birth mode, microbiota, and mother and maternal and child overweight. Full term infants born January 2009– December 2012 in the Canadian Healthy Infant Longitudinal Development (CHILD) birth cohort.	935 mother-infant pairs, mean age mothers 32.5 years, 7.5 % of infants overweight at age 1 year and 10.4 % overweight at 3 years.	Elective CS vs vaginal delivery. Birth mode approx. 10 %, infant sex 20 %, maternal prenatal asthma 10 %, oral antibiotic use (0–12 months) 10 %,	Risk OWOB at 1 year: Infants born to OWOB mothers OR 3.80 (95 % CI 1.88–7.66) and at 3 years OR 3.79 (2.10– 6.84). Infants born by vaginal delivery to OWOB mother vs normal weight mother OR 3.33 (95 % CI 1.49– 7.41) and CS delivered infants of overweight mothers OR 5.02 (2.04–12.38). Similar risks at 3 years of age. Risk OWOB: 1 year: Vaginal delivery reference: 1.0. Elective: OR 0.9 (0.6–2.2) Emergency: OR 1.8, (0.9– 4.2). 3 years: Elective: OR 1.3 (0.5–3.1) Emergency: 1.9 (0.9–4.3)	Low Adjusted for location, infant sex, socioeconomic status, maternal race, maternal prenatal asthma, maternal prenatal smoking, breastfeeding status, oral antibiotic use (0– 12 months) and pet exposure.

AD = Atopic dermatitis; aRRR = Adjusted relative risk ratio; AVD = Assisted vaginal delivery; CD = Caesarean delivery; CDMR = Caesarean delivery on maternal request; DM = Diabetes mellitus; IBD = Inflammatory bowel disease; LRTI = Lower Respiratory Tract Infections; OWOB = Overweight and obesity; RA = Reumatoid artrit; SVD = Spontaneous vaginal delivery; URTI = Upper respiratory tract infection

Table 4 Maternal longterm complications.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Abenhaim et al. 2018 Canada [41]	To evaluate the association of caesarean deliveries on the incidence of small bowel obstruction. population-based cohort of all women with a first live birth between 1998 and 2007 using the U.K. Clinical Practice Research Datalink. Women were followed until 2015, the occurrence of a small bowel obstruction, or loss to follow-up.	81 480 women with a median follow-up of 8.0 years (range 6 months to 16.6 years), First CS 20 689, first vaginal delivery 60 791.	CS vs vaginal delivery. No information on missing data.	575 new small bowel obstructions (incidence 9.1/10 000 person-years). There were 280 cases of small bowel obstruction among women with a first caesarean delivery (1.35 %) and 295 cases of small bowel obstruction (SBO) among women with a first vaginal delivery (0.49 %). Hazard ratio all diagnosed SBO (HR) 2.54, 95% CI 2.15–3.00), HR with surgery 2.72 (2.28–3.25)	Low Model adjusted for age, Crohn's disease, ulcerative colitis, laparotomy, appendectomy, ovarian cystectomy or oophorectomy, myomectomy, obesity, and chorioamnionitis.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Andolf et al. 2010 Sweden [42]	To estimate the risk for postoperative adhesions and intestinal obstruction after caesarean delivery and to estimate whether the rate remains stable over time. Diagnosis from. Swedish Hospital Discharge Registry linked to the Swedish Medical Birth Registry. Women included if delivered between 1983–2004.	The total number of births was 1 019 607. Other previous conditions and diagnosis with increased risk like abdominal surgery excluded. Vaginal births only 831 758 (82 %), CS only 9 %.	CS vs successful vaginal births. National registers used with almost full coverage.	Women with adhesions 1 794 (1.8 per 1 000) and intestinal obstruction 1 389 (1.4 per 1 000). Vaginal births only: Adhesions 1 294 (1.6 %), intestinal obstruction 1 023 (1.2 %). CS only: Adhesions 291 (3.1 %), intestinal obstruction 207 (2.2 %). OR # (95 % CI) CS vs vaginal. Adhesions: 2.1 (1.8–2.4) Intestinal obstruction: 2.0 (1.7–2.4). For complications combined 2.0 (1.7–2.3). NNH 360	Low # Stratified for year at last delivery, maternal year of birth, maternal parity, years of involuntary childlessness, smoking, and BMI at the last labor.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Larsson et al. 2009 Sweden [43]	Is there an association between CS and pelvic organ prolapse? Register cohort. Medical Birth Registry of Sweden and Patient registry Sweden	A total of 1.4 million woman investigated delivered during 1973–2004. 1 444 548 had no prolapse while 16 605 did. After exclusion of first prolapse diagnosis before last labour, or within 365 days after last labour, and women > 60 years remaining 15 007 cases.	Intervention: Planned and Acute CS (analysed together) Controls (reference vaginal deliveries) National registers used with almost full coverage.	Risk of surgery for prolapse. Vaginal delivery reference. 15 007 women with surg prolapse diagnoses. Risk vaginal and CS adjusted OR 0. 75 (0.69–0.81). CS only adjusted OR 0.18 (0.16–0.20). Adjusted for possible confounders.	Moderate Adjusted for confounder. Strat for maternal year of birth, year of last delivery, and parity at last delivery.
Leijonhufvud et al. 2011 Sweden [44]	To estimate the risk for stress urinary incontinence and pelvic organ prolapse surgery related to vaginal birth or caesarean delivery. Register cohort. Medical Birth Registry of Sweden and Patient registry Sweden	All primiparae giving birth with CS and subsequent births also delivered by CS between 1973—1982 (n=33 167) and an age-matched sample of women only having vaginal deliveries (n=63 229).	Intervention. Planned and Acute CS (analysed together). Controls (vaginal deliveries). National registers used with almost full coverage.	SUI: CS HR 1.0 ref Vaginal delivery adjusted HR 2.9 (2.4–3.6). POP: CS HR 1.0 ref Vaginal adjusted HR 9.2 (7.0–12.1). Vaginal ref: 0.11 (0.08–0.14).	Moderate Adjusted for confounders year of delivery GA, diabetes, birthweight, head circum. Not adjusted for parity and BMI:

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Persson et al. 2000 Sweden [45]	To evaluate obstetric and maternal risk factors for stress urinary incontinence. Cohort study using 3 Swedish, populationbased registries.	All women born between 1932 and 1977 and operated on for stress urinary incontinence between 1987 and 1996 were identified from the Hospital Discharge Registry. n=10 074. Whole population 876 768.	Elective caesarean delivery compared with normal delivery. National registers. Smoking status only for 422 incontinent women.	Risk stress urinary incontinence surgery. Elective caesarean vs non-instrumental vaginal singleton delivery among women with only one delivery OR 0.21 (95 % CI 0.13–0.34) and any caesarean, 0.34 (95% CI 0.23–0.52).	Moderate Stratified analysis for important confounders but only nonistrumental vaginal delivery
Rortveit et al. 2003 Norway [46]	To investigate whether women who delivered by CS have an increased risk of urinary incontinence as compared with nulliparous women and with women who delivered vaginally. Community based cohort Women asked to complete a questionnaire related to incontinence. Data linked to Medical Birth registry.	15 307 women <65 years of age (80 % responders). No deliveries (n=3 339), mean age 31.0 ±12.0 years. CS (n= 669) mean age 36.0 ± 8.3 years, 1.7 ± 0.8 deliveries, 7.7 ± 6.4 years since last delivery. Vaginal deliveries (n=11 299) mean age 39.8 ± 8.4 years, 2.2 ± 0.8 deliveries, 12.1 ± 8.0 years since last delivery.	CS vs nulliparous vs vaginal delivery. No information on missing data.	Incontinence prevalence (any) Nulliparous group 10.1 % CS (age standardized) 15.9 % Vaginal delivery 21.0 %. Moderate or severe 3.7 %, 6.2 % and 8.7 % respectively. Stress incontinence 4.7 %, 6.9 % and 12.2 % respectively. Vaginal deliveries compared with CS: Any, moderate or severe, stress, urge, mixed type. Adjusted OR (95% CI) 1.7 (1.3–2.1)	Moderate Adjusted for age, parity, years since last delivery, and BMI.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
				2.2 (1.5–3.1) 2.4 (1.7–3.2) 0.9 (0.5–1.6) 1.3 (0.9–1.9).	
Socialstyrelsen May 2018 Data 1987-2016 [47]	Population-based register study using the Medical Birth Register linked with the Patient Register.	Length of follow-up varied and was adjusted for in the analyses. The total n of women with vaginal births, n= 1 278 015, women with CS only=184 425, and women with both CS and vaginal births, n=161 851.	Risk of four selected complications by any previous CS vs no previous CS.	Urinary incontinence IRR 0.3 (0.2–0.3) NNH (15 y follow-up) -221 NNH (25 y follow-up) -150 Prolapse surgery IRR 0.2 (0.1–0.2) NNH (15 y follow up) -151 NNH (25 y follow-up) -72 Abdominal hernia IRR 3.2 (3.0–3.4) NNH (15 y follow up) 139 NNH (25 y follow-up) 75 Adherences IRR 2.8 (2.6–3.1) NNH (15 y follow up) 211 NNH (25 y follow-up) 127	Moderate IIR were estimated considering length of follow-up, adjustments were made for maternal age, parity, smoking, BMI, and educational level. However, NNH estimates are sensitive to under-reporting

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Schwarzman et al. 2019 Israel [48]	To investigate whether caesarean delivery (CD) at the indication of abnormal second stage of labor (ASSL) has protective effect against future pelvic floor disorders (PFDs Population-based cohort study including deliveries from 1991–2017 in a tertiary medical center.	Women were grouped by their delivery mode: patients with vaginal deliveries (VD) only; those with CD only, excluding second-stage indications; and those with CD due to ASSL. A total of 106 003 patients met the inclusion criteria; 86.7 % (n = 91 856) experienced VD only, 11.7 % (n = 12 359) underwent CD only and 1.7 % (n = 1 788) had at least one CD due to ASSL	The outcome measure, PFDs and related repair diagnoses, included any recorded hospitalization involving a pre-defined set of ICD-9 codes. Follow-up till 33 years. Risk of PFDs according to delivery mode. A Kaplan-Meier survival curve compared cumulative PFD morbidity in the different groups. Information on missing data not found.	PFD-related hospitalization incidence was 0.7 % (n = 719) for the entire cohort. Hospitalization rate PFD: VD: 0.7 % ASSL CD: 0.3 % non-ASSL CD: 0.5 %, ($p < 0.001$ for all vs VD). After adjustment only Protective effect of CD and later PFDs only in parturients who did not experience ASSL (aHR 0.679, 95% CI 0.51–0.90, $p = 0.006$). VD ref 1.0 CD only: aHR 0.68 (95% CI 0.51–0.90).	Moderate Adjusted for maternal age, parity, ethnicity, diabetes, hypertension, obesity, smoking, history of assisted delivery and macrosomia at any birth.

Author Year Country Reference	Aim Study design	Population	Intervention Control Missing data	Outcome results	Risk of bias Comments
Åkervall et al. 2020 Sweden [49]	To compare the age-related prevalence of symptomatic genital prolapse in nulliparous, vaginal- and caesarean-delivered women aged 40-64 years (n=14 335). Swedish register cohort. Three source cohorts were retrieved from the Swedish Medical Birth Register and Statistics Sweden and surveyed in 2008 and 2014.	14 335 women 522 with prolapse Nulliparous women unexposed to childbirth (n=9 136), 1-para caesarean delivered women, exposed to 1 pregnancy (n=1 412), and 1-para women exposed to 1 pregnancy followed by vaginal delivery, (n=3 787).	Caesarean delivery compared with vaginal delivery and no delivery. Survey question 99.2 % success rate.	Survey question sensation of tissue protrusion. Prevalence symptomatic prolapse below 5 % in nullipara and CS-delivered women. At age 64 years, the estimated probability of symptomatic prolapse was 12 times higher after vaginal delivery compared with caesarean delivery (13.4%, 95% confidence interval, 9.4–18.9 vs 1.1 %, 95 % confidence interval, 0.4–2.5. The calculated reduction of symptomatic prolapse by caesarean delivery at 64 years of age was thus 92 %. OR 0.065 (95% CI, 0.024–0.177) OR 10 years Vaginal 1.86 (1.28–1.72) CS 0.52 (0.28–0.99) NP 1.47(0.76–2.84)	Low Matched for BMI and age.

ASSL = Abnormal second stage of labor; PFD = Pelvic floor disorders; SBO = Small bowel obstruction

Table 5 Maternal short term complications.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Socialstyrelsen Dec 2019 Sweden. Data 2008–2017 [50]	To compare short-term complications after planned CS to complications after planned vaginal birth.	Outcome among 82 837 women delivered by planned CS compared to 1 028 374 women with planned vaginal birth.	Population based register study. Medical Birth Register linked with patient register and prescribed drug register, and Statistics Sweden's educational register.	Endometritis: RR 1.13 (1.07–1.19) NNH 484 Urinary tract infection: RR 1.41 (1.32–1.52) NNH 340 Mastitis: RR 1.53 (1.48–1.59) NNH 82 Deep vein thrombosis: RR 1.41 (0.94–2.11) NNH 1 1035 Cerebral vein thrombosis: RR 1.61 (0.91–2.84) NNH 17 143 Lung embolism: RR 1.72 (1.39–2.14) NNH 2 311 Antibiotics within 2 weeks: 1.26 (1.22–1.28) NNH 61 Antibiotics within 6 weeks: RR 1.34 (1.31–1.36) NNH 30.	Adjusted for maternal age, parity, smoking, BMI, country of birth, height, and educational level. Moderate risk for confounding for RR estimates, but the NNH estimates are sensitive to under-reporting of absolute risks.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Missing data**	**Outcome results**	**Risk of bias** **Comments**
Socialstyrelsen May 2018 Sweden [47]	Prevalence and risk factors for short- and long-term complications by delivery mode.	Sub analysis: Births 2014–2016. n=287 595 vaginal births among 321 912 planned vaginal births.	Population based register study. Medical Birth Register linked with patient register and prescribed drug register, and SCB educational register.	Risk for sphincter rupture 3.3 % among vaginal births => risk for sphincter rupture among planned vaginal births =2.9 %. Risk for sphincter rupture among planned CS: 0 % NNH=34.	Bias is not an issue – the risk among planned CS =0. The risk for sphincter rupture varies with women's characteristic and region of delivery. However, the NNH estimates are sensitive to probable under-reporting of absolute risks.

BMI = Body mass index; CS = Caesarean section; n =Number; NNH = Number needed to harm; RR = Relative risk

Table 6 Delivery complications at next delivery.

Author **Year** **Country** **Reference**	**Aim** **Study design**	**Population**	**Intervention** **Control** **Adherence** **Loss to follow up**	**Outcome results**	**Risk of bias** **Comments**
Macharey et al. 2020 Finland [5]	To determine whether there is an association between term caesarean breech delivery in the first pregnancy and maternal and neonatal morbidities in the subsequent pregnancy and delivery.	We included all women with the first two consecutive singleton deliveries of which the first one was a breech delivery regardless of mode of delivery (n = 11 953) and constructed a data set in which the first two deliveries for these women were connected.	The outcomes of the second delivery of the women with a first pregnancy that resulted in caesarean breech delivery at term were compared with women whose first pregnancy resulted in a vaginal breech delivery at term.	Outcome: Adjusted OR (95% CI). Maternal blood transfusion: 4.95 (2.51– 9.79). Uterine rupture: 4.09 (1.88–8.88).	Moderate Adjusted for: previous delivery not planned caesarean section, subsequent delivery emergency caesarean section, maternal age ≥ 35, maternal BMI ≥ 30, maternal BMI ≥ 35, pregestational diabetes treated with insulin, preeclampsia/chronic hypertension, PPROM, oligohydramnios
Socialstyrelsen May 2018 Sweden [47]	Prevalence and risk factors for short- and long-term complications by delivery mode	Sub analysis: Any previous CS vs no previous CS. Births 1987–2016	Population based register study. Medical Birth Register linked with patient register and prescribed drug register, and SCB educational register	Uterus rupture OR 24.4 (22.8–26.0) NNH 193. Placenta accrete OR 10.9 (8.4–14.0) NNH 3475	Bias is not an issue. The risk is practically 0 among women without previous CS. Low risk for under-reporting which could affect NNH estimates

BMI = Body mass index; CI = Confidence interval CS = Caesarean section; n = Number; NNH = Number needed to harm; OR = Odds ratio; PPROM = Preterm Premature Rupture of Membranes

Table 7 Experiences and attitudes among women and health care staff about caesarean section on the mothers' request, in the absence of medical indication (as assessed by the health care staff).

Author Year Country Reference	Aim	Theory or approach Competence of researchers	Setting, recruitment	Participants	Data collection	Data analysis
Studies regarding experiences and attitudes among *women* about caesarean section on the mothers' request						
Emmett et al. 2006 UK [51]	To explore women's experiences of decision making about mode of delivery after previous caesarean section.	A qualitative interview study. Multidisciplinary team with experience in psychology, social science, health service research and obstetrics.	Identified through medical records Maternity units in England and Scotland.	21 women with previous CS experience.	Semi-structured interviews.	Thematic framework.
Fenwick et al. 2006 Australia [52]	To describe the childbirth expectations, influences and knowledge of a group of Western Australian women who experienced a caesarean section (CS) and would prefer a CS in a subsequent pregnancy.	The principles of grounded theory in the study approach. RN RM PhD.	Advertisement in newspapers in one Australian city (Perth).	49 women with previous experience of CS and preferred CS in subsequent pregnancy.	Telephone interviews.	Constant comparison method.
Fenwick et al. 2010 Australia [53]	To describe Australian women's request for caesarean section in the absence of medical indicators in their first pregnancy.	Explorative descriptive approach. RN RM PhD.	Advertisment in regional and local newpapers in the states of QLD and WA, Australia.	14 women requested CS during first pregnancy absence of known medical indication.	Telephone interviews.	Thematic analysis.

Author Year Country Reference	Aim	Theory or approach Competence of researchers	Setting, recruitment	Participants	Data collection	Data analysis
Kornelsen et al. 2010 Canada [54]	To explore women's experiences of the decision-making process leading to elective operative delivery without medical indication.	Grounded theory techniques. PhD, Master of Arts.	Five hospitals in British Columbia. Third party recruitment, identified with (i) chart notation by antepartum and labour ward nurse, (ii) community-based public health postpartum visits nurses, (iii) poster advertisement in 25 obstetrician gynaecologists' offices, (iv) advertisement in parenting magazine.	17 primiparous women who had undergone a patient-initiated elective Caesarean section in the absence of any Medical indication.	Explorative in-depth interviews	Grounded theory
McGrath et al. 2009 Australia [55]	This article presents the findings of qualitative research which explored, from the mothers' perspective, the process of decision-making about mode of delivery for a subsequent birth after a previous Caesarean Section.	Descriptive phenomenology.	Obstetric department at a hospital. Women consecutively enrolled from RH hospital list, who had all had a previous CS and a subsequent birth at RH six years prior to the interviews.	16 multiparous women who chose to birth by elective caesarean.	Interviews.	Thematic analysis.

Author Year Country Reference	Aim	Theory or approach Competence of researchers	Setting, recruitment	Participants	Data collection	Data analysis
Ramvi et al. 2011 Norway [56]	The aim of this study was to investigate specifically women who requested a caesarean section due to fear, but who still gave birth vaginally despite this fear. The fear, the decision-making process, and the vaginal birth experience were explored from the women's perspective.	Narrative approach PhD MSC.	A part of an intervention study "Team Midwifery". Recruited from a hospital.	5 women.	Narrative interviews.	Biographical, narrative, interpretative method.
Sahlin et al. 2013 Sweden [57]	To describe the underlying reasons for the desire for a caesarean section in the absence of medical indication in pregnant first-time mothers.	Qualitative design. RNM PhD stud PhD.	One Swedish hospital. Recruited at the obstetrician visit after CS decision was taken.	12 first-time mothers.	Individual interviews.	Qualitative content analysis.
Studies regarding experiences and attitudes among *health care staff* about caesarean section on the mothers' request						
Kamal et al. 2005 UK [58]	To explore the views of health professionals on the factors influencing repeat caesarean section.	Grounded theory.	Two hospitals with maternity care and from midwifery teams.	Twenty-five midwives and doctors.	Interviews	Constant coparative method

Author Year Country Reference	**Aim**	**Theory or approach Competence of researchers**	**Setting, recruitment**	**Participants**	**Data collection**	**Data analysis**
Karlström et al. 2009 Sweden [59]	Describes obstetricians' and midwives' attitudes towards CS on maternal request.	A qualitative descriptive study. RN RM PhD-student PhD.	Purposive sample of midwives and obstetricians from 3 hospitals and antenatal clinics in Sweden.	Sixteen midwives and nine obstetricians.	Focus group discussions.	Content analysis.
Studies regarding experiences and attitudes among *women and health care staff* about caesarean section on the mothers' request						
Eide et al. 2020 Norway [60]	To explore women's *access* to patient-centered counseling for concerns initiating caesarean requests in absence of obstetric indications in pregnancy, and to identify tensions, barriers and facilitators affecting such care.	Systematic text condensation, a method for thematic analysis presented within the frames of Levesque et al. Newly educated medical doctor and PhD student+ experienced obstetrician+ bioethicist.	University hospital in Norway. Informants recruited consecutively. Purposive sample.	17 women (1 nullipara and 16 multipara). 9 midwives 11 obstetricians.	Women: Semi-structured in-depth interviews. Caregivers: focus group discussions.	Systematic Text Condensation a method for thematic analysis presented within the frames of Levesque et al.
Eide et al. 2019 Norway [61]	To provide a qualitative exploration of maternal requests for a planned caesarean section in Norway, in the absence of obstetric indications.	A descriptive qualitative design. MD, obstetrician, and philosopher.	University hospital in Norway. Women recruited consecutively. Referred for birth counselling with a CS request. Purposive sample of midwives.	17 Women 27–42 years (n=14 multiparous; n=3 primiparous). 9 midwives 11 obstetricians.	Women: Semi-structured in-depth interviews. Professionals: focus group discussions.	Systematic Text Condensation.

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