Supporting Information – eTables

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eTable1: MEDLINE search strategy

Search terms used for MeSH terms and keywords in title and abstract

1. Preconception Care/

2. pre?conception*.tw.

3. pre?pregnan*.tw.

4. pre?gestat*.tw.

5. prior to pregnancy.tw.

6. before conception.tw.

7. before pregnan*.tw.

8. inter?conception*.tw.

9. inter?pregnan*.tw.

10. inter?gestation*.tw.

11. inter?natal*.tw.

12. peri?conception*.tw.

13. contemplat* pregnan*.tw

14. consider* pregnan*.tw

15. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14

16. ((overview$ or review or synthesis or summary or cochrane or analysis) and (reviews or meta-analyses or articles or umbrella)).ti. or umbrella review.ab. or (meta-review or metareview).ti,ab.

17. ((review or meta-analysis).ab. or (review or meta-analysis).pt. or meta-analysis.ti.) not (letter or comment or editorial).pt.

18. 16 or 17

17. 15 and 18

eTable 2. GRADE domains for downgrading and upgrading evidence certainty

GRADE domain	Rating	Informed by
Risk of bias	0 (no serious concerns) -1 (serious) -2 (very serious)	- The source review's AMSTAR 2 rating - The review authors' assessments of the methodological quality of the primary studies included for the exposure-outcome association in question
Imprecision	0 (no serious concerns) -1 (serious) -2 (very serious)	- Whether the summary estimate's interpretation would differ substantially if the true effect was at the upper rather than the lower end of the reported confidence interval - Whether the summary estimate was derived from just one or two small studies or few events
Inconsistency	0 (no serious concerns) -1 (serious) -2 (very serious)	- The (dis)similarity of point estimates and the overlap of their confidence intervals - Reported heterogeneity statistics (e.g. I^2 and chi-squared)
Indirectness	0 (no serious concerns) -1 (serious) -2 (very serious)	- Whether included participants differed from the population for whom the review's recommendations were made - Whether the evaluated interventions differed from the real outcomes/whether a surrogate outcome studied was used
Publication bias	0 (not likely) -1 (likely) -2 (very likely)	- Whether publication bias was assessed and, if so, whether a high likelihood of publication bias was found
Large magnitude of effect	0 (no large effect) +1 (large effect) +2 (very large effect)	- Whether strong, consistent evidence of an effect/association (RR > 2 or RR < 0.5) derived from ≥2 studies with plausible confounders adjusted for was reported (+1) OR: - Whether very strong, direct evidence of an effect/association (RR > 5 or RR < 0.2) with no substantial validity issues was reported (+2)
Dose-response gradient	0 (no/not reported) +1 (yes)	- Whether evidence of a dose-response gradient was reported
Confounder-adjusted estimate(s) reported	0 (no/not reported) +1 (yes)	- Whether all plausible confounders would have lessened a reported effect/association, or would have suggested a false effect/association if no effect/association was observed

eTable 3. GRADE ratings for all exposure-outcome associations

i. Demographic and Reproductive Exposures

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
AGE - PATERNAL											
<20 years	Jia et al.	Anencephaly	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
<20 years	Jia et al.	Spina bifida	Serious limitations	No serious limitations	No serious limitations	No serious concerns	No serious concerns	No	Yes	No/not reported	Low
20-24 years	Jia et al.	Spina bifida	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
30-34 years	Du Fossé et al.	Miscarriage	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Very low
35-39 years	Du Fossé et al.	Miscarriage	Serious limitations	Serious limitations	No serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Low
40-44 years	Du Fossé et al.	Miscarriage	Serious limitations	No serious limitations	No serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Moderate
≥40 years	Flenady et al.	Stillbirth	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
45-49 years	Jia et al.	Spina bifida	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
≥45 years	Du Fossé et al.	Miscarriage	Serious limitations	No serious limitations	No serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Moderate
⩾50 years	Jia et al.	Spina bifida	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
AGE – MATERNAL											
<17 years	Duckitt & Harrington	Pre-eclampsia	Very serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
<20 years	Duckitt & Harrington	Pre-eclampsia	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
<20 years	Flenady et al.	Stillbirth	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
>30 years	Czarnobay et al.	Macrosomia	Serious limitations	Very serious limitations	Very serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
>35 years	Flenady et al.	Stillbirth	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
AGE – MATERNAL [continued]											
≥35 years	Duckitt & Harrington	Pre-eclampsia	Very serious limitations	Serious limitations	Very serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
≥35 years	Barbosa et al.	Urinary incontinence	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	Yes	Low
≥45 years	Leader et al.	Abnormal APGAR score	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	No/not reported	No/not reported	Low
≥45 years	Leader et al.	Caesarean delivery	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	No/not reported	No/not reported	Low
≥45 years	Leader et al.	Foetal loss	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	No/not reported	No/not reported	Low
≥45 years	Leader et al.	Pregnancy complications	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	No/not reported	No/not reported	Low
≥45 years	Leader et al.	Intrauterine growth restriction	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
≥45 years	Leader et al.	Preterm birth	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
≥45 years	Leader et al.	Periconception haemorrhage	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
DEMOGRAPHICS (OTHER)											
Ethnicity (White)	Czarnobay et al.	Birthweight	Serious limitations	Serious limitations	Serious limitations	Serious limitations	Serious limitations	No	No/not reported	No/not reported	Very low
Maternal foreign birth	Tabb et al.	Low birthweight	Very serious limitations	Serious limitations	Serious limitations	Serious limitations	Serious limitations	No	No/not reported	No/not reported	Very low
Maternal foreign birth	Tabb et al.	Preterm birth	Serious limitations	Serious limitations	Serious limitations	Serious limitations	Serious limitations	No	No/not reported	No/not reported	Very low

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
INTERPREGNANCY/BIRTH INTERVALS (IPI/BI) - SHORT											
IPI <6 months	Ahrens et al.	Congenital anomalies	Very serious limitations	No serious concerns	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
IPI <6 months	Ahrens et al.	Low birthweight	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
IPI <6 months	Conde-Agudelo et al.a	Low birthweight	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Low
IPI <6 months	Ahrens et al.	NICU admission	Serious limitations	No serious concerns	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
IPI <6 months	Ahrens et al.	Preterm birth	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	Yes	Low
IPI <6 months	Conde-Agudelo et al.a	Preterm birth	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Low
IPI <6 months	Ahrens et al.	Small for gestational age	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
IPI <6 months	Conde-Agudelo et al.a	Small for gestational age	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Low
IPI <6 months	Regan et al.	Perinatal mortality	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
IPI <12 months	Conde-Agudelo et al.b	Placenta previa	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
IPI/BI <13 months	Conde-Agudelo et al.b	Pre-eclampsia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
IPI <14 months	Conde-Agudelo et al.b	Premature rupture of membranes	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
IPI/BI <24 months	Conde-Agudelo et al.b	Anaemia (maternal)	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	Yes	Very low
IPI/BI <24 months	Conde-Agudelo et al.b	Maternal death	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
IPI/BI <24 months	Conde-Agudelo et al.b	Postpartum haemorrhage	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
IPI <24 months	Hutcheon et al.	Labour dystocia	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
IPI >24 months	Regan et al.	Perinatal mortality	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
INTERPREGNANCY/BIRTH INTERVALS (IPI/BI) - LONG											
IPI/BI >48 months	Conde-Agudelo et al.b	Pre-eclampsia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	Low
IPI ≥60 months	Conde-Agudelo et al.a	Low APGAR score	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
IPI ≥60 months	Conde-Agudelo et al.a	Low birthweight	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Low
IPI ≥60 months	Conde-Agudelo et al.a	Preterm birth	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Low
IPI ≥60 months	Conde-Agudelo et al.a	Small for gestational age	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Low
IPI/BI ≥3 years	Conde-Agudelo et al.b	Labour dystocia	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
PARITY											
Nulliparity	Duckitt & Harrington	Pre-eclampsia	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	Yes	No/not reported	No/not reported	Very low
Nulliparity	Duckitt & Harrington	Pre-eclampsia	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	Yes	No/not reported	No/not reported	Very low
Primiparity	Flenady et al.	Stillbirth	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
(Multi) parity	Hill et al.	Gestational weight gain	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Multiparity	Czarnobay et al.	Birth weight ≥90th percentile	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Multiparity *(vs nulliparity)*	Barbosa et al.	Urinary incontinence	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	Yes	Low
Multiparity *(vs multiparity)*	Barbosa et al.	Urinary incontinence	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Low

Abbreviations: NICU, Neonatal intensive care unit

ii. Health Behaviours and Wider Determinants of Health

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
ABUSE/NEGLECT											
Abuse[a]	Nesari et al.	Low birthweight	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Low
Abuse[a]	Nesari et al.	Preterm birth	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Childhood trauma /abuse	Bayrampour et al.	Antenatal anxiety	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
History of neglect /abuse	Bayrampour et al.	Antenatal anxiety	Serious limitations	Serious limitations	No serious concerns	No serious concerns	Serious limitations	Yes	No/not reported	No/not reported	Very low
ALCOHOL											
Alcohol intake (highest category)	Leng et al.	Neural tube defects	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Alcohol intake	McBride & Johnson	Birthweight	Very serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Alcohol intake	McBride & Johnson	Miscarriage	Very serious limitations	Serious limitations	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Alcohol (any, three months preconception	Zhang et al.	Congenital heart defects	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	Yes	Low
Alcohol (≥5 drinks per sitting)	Zhang et al.	Congenital heart defects	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
DIET & NUTRITION											
'Healthy' dietary patterns	Gete et al.	Preterm birth	Serious limitations	No serious concerns	Serious limitations	No serious concerns	Serious limitations	No	Yes	Yes	Very low
Mediterranean - type diet	Raghavan et al.	Hypertensive disorders in pregnancy	Very serious limitations	No serious concerns	Serious limitations	No serious concerns	Serious limitations	No	Yes	Yes	Very low
Mediterranean - type diet	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	Yes	Low
High AHEI diet adherence	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	Yes	Low
Prudent/ Western diet	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low

[a] Physical, emotional or sexual

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
Dairy intake (highest quintile)	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	No serious concerns	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
Fast food intake (highest frequency)	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
Fruit intake (high)	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
Iron/ haem intake	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	Yes	Low
Red meat intake	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	No serious concerns	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
EDUCATION											
Education (level of)	Ngandu et al.	Small for gestational age	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
Education (level of)	Ngandu et al.	Preterm birth	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
Education ('high')	Silvestrin et al.	Low birthweight	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	No/not reported	Very low
Education ('average')	Silvestrin et al.	Low birthweight	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	Yes	No/not reported	Very low
Education (low)	Jia et al.	Neural tube defects	Very serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	Yes	Very low
Education (≤4 years)	Czarnobay et al.	Macrosomia	Serious limitations	Very serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Education (low; ⩽10 years)	Flenady et al.	Stillbirth	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
ENVIRONMENTAL EXPOSURES											
Metal exposure	Spinder et al.	Congenital heart defects	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Metal exposure	Spinder et al.	Neural tube defects	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Pesticide exposure	Spinder et al.	Cleft lip	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Pesticide exposure	Spinder et al.	Neural tube defects	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
FOLIC ACID & OTHER VITAMINS											
Folate supplementation	De-Regil et al.	Cleft lip	No serious concerns	Very serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Folate supplementation	De-Regil et al.	Cleft palate	No serious concerns	Very serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Folate supplementation	De-Regil et al.	Congenital heart defects	No serious concerns	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Low
Folate supplementation	De-Regil et al.	Low birthweight	No serious concerns	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Low
Folate supplementation	De-Regil et al.	Miscarriage	No serious concerns	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Low
Folate supplementation	De-Regil et al.	Neural tube defects	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	High
Folate supplementation	De-Regil et al.	'Other' birth defects	No serious concerns	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Low
Folate supplementation	De-Regil et al.	Termination for foetal anomaly	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	High
Folate supplementation	Li et al.	Preterm birth	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	Yes	Low
Folate supplementation	De-Regil et al.	Twinning	No serious concerns	Very serious limitations	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Low
Folate supplementation	De-Regil et al.	Stillbirth	No serious concerns	Very serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Vitamin supplementation	Rumbold et al.	Miscarriage	No serious concerns	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Low
Vitamin supplementation	Rumbold et al.	Stillbirth	No serious concerns	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Low
OVER-THE-COUNTER DRUGS											
Oral contraceptive use	Tang et al.	Low birthweight	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Oral contraceptive use	Tang et al.	Miscarriage	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Oral contraceptive use	Tang et al.	Preterm birth	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Weight loss products	Hoang et al.	Neural tube defects	Very serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
PHYSICAL ACTIVITY											
Physical activity (any type)	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Physical activity (leisure time, any)	Mijatovic-Vukas et al.	Gestational diabetes	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	Yes	Very low
Physical activity (leisure-time, highest level)	Aune et al. 2017	Preterm birth	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
Physical activity (highest level)	Aune et al. 2014a	Pre-eclampsia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
High-intensity physical activity	Aune et al. 2014a	Pre-eclampsia	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	Yes	Very low
SMOKING											
Smoking	Czarnobay et al.	Excess birth weight	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Passive smoking	Sabbagh et al.	Non-syndromic orofacial clefts	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
VACCINATION											
4vHPV vaccination (0-45 days before last menses)	Tan et al.	Miscarriage	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low

Abbreviations: AHEI, Alternative Healthy Eating Index; 4vHPV, 4-Valent Human Papillomavirus

iii. Pre-pregnancy Weight/Body Mass Index (BMI)

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
LOW WEIGHT/UNDERWEIGHT											
Under-weight[a]	Heslehurst et al. (critical)	Caesarean delivery	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Under-weight[a]	Heslehurst et al. (critical)	Haemorrhage	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Under-weight[a]	Rahman et al. (critical)	Hypertension (pregnancy-induced)	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	Yes	No/not reported	Mod-erate
Under-weight[a]	Heslehurst et al. (critical)	Perineal trauma	Very serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Under-weight[a]	Heslehurst et al. (critical)	Post-term pregnancy	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
Under-weight[a]	Heslehurst et al. (critical)	Retained placenta	Very serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
BMI <20 kg m^2	Torloni et al. (critical)	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	Yes	Low
BMI <20 kg m^2	Wang et al. (critical)	Pre-eclampsia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	Low
BMI ≤18.5 kg m^2	Liu et al. 2016 (critical)	Large for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	Low
BMI ≤18.5 kg m^2	Liu et al. 2016 (critical))	Low birth weight	Serious limitations	No serious concerns	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
BMI ≤18.5 kg m^2	Liu et al. 2016 (critical)	Macrosomia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	No/not reported	Low
BMI ≤18.5 kg m^2	Liu et al. 2016 (critical)	NICU admission	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
BMI <18.5 (±1.5) kg m^2	Balsells et al. (critical)	Miscarriage	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
BMI <18.5 kg m^2	Huang et al. (critical)	Breast-feeding initiation	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
BMI <18.5 kg m^2	Liu et al. 2019 (critical)	Foetal distress	Serious limitations	Serious limitations	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low

[a]Author-defined

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
LOW WEIGHT/UNDERWEIGHT [continued]											
BMI <18.5 kg m^2	Liu et al. 2019 (critical)	Neonatal asphyxia	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
BMI <18.5 kg m^2	Adane et al. (critical)	Placental abruption	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	Yes	Low
BMI <18.5 kg m^2	Liu et al. 2019 (critical)	Preterm birth	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	Yes	Very low
BMI <18.5 kg m^2	Liu et al. 2019 (critical)	Small for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	No/not reported	No/not reported	Low
OVERWEIGHT/OBESITY/INCREASING BMI											
Increasing BMI	Aune et al. 2014b (low)	Neonatal death	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Increasing BMI	Aune et al. 2014b (low)	Miscarriage	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
BMI	Ioannidou et al. (low)	Hyperemesis Gravidarum	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Greater BMI	Roelants et al. (critical)	Neonatal fat mass	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Obesity[a]	Molyneaux et al. (low)	Antenatal depression	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	Low
Obesity[a]	Molyneaux et al. (low)	Antenatal anxiety	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	No/not reported	Very low
Obesity[a]	Molyneaux et al. (low)	Antenatal binge eating disorder	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
BMI 25-29.9 kg m^2	Huang et al. (critical)	Breastfeeding initiation	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	No/not reported	Very low
BMI ≥30 kg m^2	Huang et al. (critical)	Breastfeeding initiation	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	No/not reported	Very low
Over-weight[a]	Heslehurst et al. (critical)	Caesarean delivery	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Obesity[a]	Heslehurst et al. (critical)	Caesarean delivery	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	Yes	No/not reported	Yes	Low
Severe obesity[a]	Heslehurst et al. (critical)	Caesarean delivery	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low

[a]Author-defined

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
OVERWEIGHT/OBESITY/INCREASING BMI [continued]											
Obesity[a]	Heslehurst et al. (critical)	Failure to progress in labour	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	Yes	No/not reported	Yes	Low
Over-weight[a]	Heslehurst et al. (critical)	Foetal distress	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	Yes	No/not reported	Yes	Low
Obesity[a]	Heslehurst et al. (critical)	Foetal distress	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	Yes	Yes	Yes	Mod-erate
BMI ~25-29.9 kg/m^2	Torloni et al. (critical)	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	Yes	Yes	Mod-erate
BMI >30 kg/m^2	Torloni et al. (critical)	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	Yes	Yes	Mod-erate
Over-weight[a]	Heslehurst et al. (critical)	Haemorrhage	Very serious limitations	No serious concerns	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Obesity[a]	Heslehurst et al. (critical)	Haemorrhage	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	No/not reported	Very low
Over-weight[a]	Heslehurst et al. (critical)	Hospital stay length (days)	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	Yes	Yes	No/not reported	Low
Obesity[a]	Heslehurst et al. (critical)	Hospital stay length (days)	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	Yes	Yes	No/not reported	Low
Over-weight	Rahman et al. (critical)	Hypertension (pregnancy-induced)	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	Yes	No/not reported	Mod-erate
Obesity[a]	Rahman et al. (critical)	Hypertension (pregnancy-induced)	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	Yes	No/not reported	Mod-erate
Over-weight[a]	Heslehurst et al. (critical)	Instrumental delivery	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
Obesity[a]	Heslehurst et al. (critical)	Instrumental delivery	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Large for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	Low
BMI ≥30 kg/m^2	Gaudet et al. (critical)	Large for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	Yes	No/not reported	Mod-erate

[a]Author-defined

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
OVERWEIGHT/OBESITY/INCREASING BMI [continued]											
Obesity[a]	Heslehurst et al. (critical)	Low Apgar score (at five minutes)	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	Yes	Yes	No/not reported	Low
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Low birthweight	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
BMI ≥30 kg m^2	Liu et al. 2016 (critical)	Low birthweight	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Macrosomia (>4 kg)	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	No/not reported	Low
BMI ≥30 kg/m^2	Liu et al. 2016 (critical)	Macrosomia (>4 kg)	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	Yes	Yes	No/not reported	Mod-erate
Obesity[a]	Heslehurst et al. (critical)	Maternal infection	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	Yes	No/not reported	No/not reported	Very low
Obesity[a]	Heslehurst et al. (critical)	Maternal tears/ lacerations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
BMI 25-29.9 (±1.5) kg/m^2	Balsells et al. (critical)	Miscarriage	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	Low
BMI ≥30 (±1.5) kg/m^2	Balsells et al. (critical)	Miscarriage	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	Low
BMI >23 kg/m^2	Liu et al. 2019 (critical).	Neonatal asphyxia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Obesity[a]	Heslehurst et al. (critical)	Neonatal jaundice	Very serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	NICU admission	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	No/not reported	Very low
BMI ≥30 kg/m^2	Liu et al. 2016 (critical)	NICU admission	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	No/not reported	Low
Overweight[a]	Heslehurst et al. (critical)	Perineal trauma	Very serious limitations	Serious limitations	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	No/not reported	Very low
BMI 25-29.9 kg/m^2	Adane et al. (critical)	Placental abruption	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
BMI ≥30 kg/m^2	Adane et al. (critical)	Placental abruption	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Obesity[a]	Heslehurst et al. (critical)	Placenta previa	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low

[a]Author-defined

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
OVERWEIGHT/OBESITY/INCREASING BMI [continued]											
Over-weight[a]	Heslehurst et al. (critical)	Post-term pregnancy	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	Yes	Low
Obesity[a]	Heslehurst et al. (critical)	Post-term pregnancy	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	Yes	Low
BMI ~25-29.9 (±0.5) kg/m^2	Wang et al. (critical)	Pre-eclampsia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
BMI ~30–34.9 (±0.5) kg/m^2	Wang et al. (critical)	Pre-eclampsia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	Yes	Yes	Mod-erate
BMI ≥35 (±0.5) kg/m^2	Wang et al. (critical)	Pre-eclampsia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	Yes	Yes	Mod-erate
Obesity[a]	Heslehurst et al. (critical)	Premature rupture of membranes	Very serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low
BMI 25-29.9 kg /m^2	Liu et al. 2016 (critical)	Preterm birth	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
BMI ≥30 kg/m^2	Liu et al. 2016 (critical)	Preterm birth	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Small for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	Low
BMI ≥30 kg/m^2	Liu et al. 2016 (critical)	Small for gestational age	Serious limitations	No serious concerns	Serious limitations	No serious concerns	No serious concerns	No	Yes	No/not reported	Very low
BMI ≥30 kg/m^2	Zhang et al. (critical)	Shoulder dystocia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Overweight/ Obesity[a]	Barbosa et al. (low)	Urinary incontinence	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No/not reported	Yes	Very low

Abbreviations: BMI, Body mass index; NICU, Neonatal intensive care unit. [a]Author-defined

iv. Interpregnancy Weight Change

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
INTERPREGNANCY WEIGHT LOSS											
Loss of > 1 kg/m^2	Timmermans et al.	Caesarean delivery	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	Yes	Very low
Loss of > 1 kg/m^2	Teulings et al.	Gestational diabetes	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	Yes	Very low
Loss of > 1 kg/m^2	Timmermans et al.	Large for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	Yes	Low
Loss of > 1 kg/m^2	Timmermans et al.	Preterm birth	Serious limitations	No serious concerns	No serious concerns	No serious concerns	Serious limitations	No	Yes	Yes	Low
Loss of > 1 kg/m^2	Oteng-Ntim et al.	Small for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	Yes	Low
Loss of > 2 kg/m^2	Martinez-Hortelano et al.	Gestational hypertension	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
Loss of > 2 kg/m^2	Martinez-Hortelano et al.	Pre-eclampsia	Serious limitations	Serious limitations	Serious limitations	No serious concerns	No serious concerns	No	No/not reported	No/not reported	Very low
INTERPREGNANCY WEIGHT GAIN											
Gain of >1 kg/m^2	Oteng-Ntim et al.	Small for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	No/not reported	Yes	Low
Gain of 1-<3 kg/m^2	Timmermans et al.	Caesarean delivery	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Gain of ≥3 kg/m^2	Oteng-Ntim et al.	Caesarean delivery	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Gain of 1-<3 kg/m^2	Teulings et al.	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Gain of ≥3 kg/m^2	Teulings et al.	Gestational diabetes	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	Yes	Yes	Yes	Mod-erate
Gain of 1-<3 kg/m^2	Timmermans et al.	Large for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Gain of ≥3 kg/m^2	Timmermans et al.	Large for gestational age	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Gain of 2-4 kg/m^2	Timmermans et al.	Preterm birth	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No	Yes	Very low
Gain of ≥4 kg/m^2	Timmermans et al.	Preterm birth	Serious limitations	Serious limitations	Serious limitations	No serious concerns	Serious limitations	No	No	Yes	Very low

Exposure	Review	Outcome	Risk of bias	Imprecision	Inconsistency	Indirectness	Publication bias	Large magnitude of effect	Dose-response gradient	Confounder-adjusted estimate(s)	GRADE rating
INTERPREGNANCY WEIGHT GAIN [continued]											
Gain of ≥2 kg/m^2	Martinez-Hortelano et al.	Gestational hypertension	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	Yes	Mod-erate
Gain of ≥2 kg/m^2	Martinez-Hortelano et al.	Pre-eclampsia	Serious limitations	No serious concerns	No serious concerns	No serious concerns	No serious concerns	No	Yes	No/not reported	Low

eTable 4. Eligible, superseded reviews .

Eligible systematic reviews superseded by a Cochrane review or a review with a greater number of studies for the relevant exposure-outcome association are listed below, alongside the systematic review they were superseded by

Superseded review	Eligible exposure-outcome association(s)	Superseded by
Aune et al. 2016 (1)	Maternal physical activity &:	
	- Gestational diabetes mellitus	- Mijatovic-Vukas et al. 2018
Brandão et al. 2020 (2)	Maternal excess weight &:	
	- Hypertensive disorders of pregnancy	- Rahman et al. 2015
	- Gestational diabetes mellitus	- Torloni et al. 2009
	- Caesarean delivery	- Heslehurst et al. 2008
Brown et al. 2013 (3)	'Short' maternal interpregnancy interval &:	
	- Maternal mortality	- Conde-Agudelo et al. 2007
Cnossen et al. 2007 (4)	Maternal overweight/obesity &:	
	- Pre-eclampsia	- Wang et al. 2013
Dai et al. 2018 (5)	Maternal obesity &:	
	- Macrosomia	- Liu et al. 2016
Forsum et al. 2013 (6)	Maternal interpregnancy weight loss &:	
	- Gestational diabetes mellitus	- Teulings et al. 2019
He et al. 2020 (7)	Maternal overweight/obesity &:	
	- Pre-eclampsia	- Wang et al. 2013
Imdad et al. 2011 (8)	Maternal folate supplementation &:	
	- Neural tube defects	- De-Regil et al. 2015
	- Stillbirth	- De-Regil et al. 2015
Jahanbin et al. 2018 (9)	Maternal folate supplementation &:	
	- Offspring oral clefts	- De-Regil et al. 2015
Lassi et al. 2020 (10)	Maternal folate supplementation &:	
	- Neural tube defects	- De-Regil et al. 2015
Lassi et al. 2013 (11)	Maternal folate supplementation &:	
	- Neural tube defects	- De-Regil et al. 2015
	- Preterm birth	- Li et al. 2019
	'Long' maternal interpregnancy intervals &:	
	- Pre-eclampsia	- Conde-Agudelo et al. 2007
	- Foetal death	- Regan et al. 2020
Muggli et al. 2007 (12)	Maternal folate supplementation &:	
	- Twinning	- De-Regil et al. 2015
Najafi et al. 2019 (13)	Maternal pre-pregnancy body mass index (BMI) &:	- Torloni et al. 2009
	- Gestational diabetes mellitus	
Oostingh et al. 2019 (14)	Maternal folate supplementation &:	
	- Miscarriage	- De-Regil et al. 2015
	Maternal pre-pregnancy BMI &:	
	- Miscarriage	- Balsells et al. 2016
Ramakrishnan et al. 2012 (15)	Maternal folate supplementation &:	
	- Neural tube defects	- De-Regil et al. 2015
	- Preterm birth	- Li et al. 2019

Superseded review	Eligible exposure-outcome association(s)	Superseded by
Shannon et al. 2014 (16)	Maternal folate supplementation &:	
	- Congenital disorders	- De-Regil et al. 2015
Steinig et al. 2017 (17)	Maternal pre-pregnancy obesity &:	
	- Antenatal depression	- Molyneaux et al. 2014
Temel et al. 2014 (18)	Maternal folate supplementation &:	
	- Congenital disorders	- De-Regil et al. 2015
Torloni et al. 2009 (19)	Maternal pre-pregnancy BMI &:	
	- Preterm birth	- Liu et al. 2016
Viswanathan et al. 2017 (20)	Maternal folate supplementation &:	
	- Neural tube defects	- De-Regil et al. 2015
	- Twinning	- De-Regil et al. 2015
Wilson et al. 2015 (21)	Maternal folate supplementation &:	
	- Neural tube defects	- De-Regil et al. 2015
	- 'Other' folate-related congenital anomalies	- De-Regil et al. 2015
Yakoob et al. 2009 (22)	Maternal interpregnancy intervals &:	
	- Perinatal death	- Regan et al. 2020

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eTable 5. Characteristics of included reviews

	Search: number of databases; date range	Eligibility restrictions		Eligible exposure categories reported ([M]ale/[F]emale):
		Included only:	Excluded:	
Adane et al. 2019	4; inception-2018	Case-control, cross-sectional and cohort studies involving participants with singleton pregnancies	-	BMI (F)
Ahrens et al. 2019	5; 2006-2017	Studies conducted in 'very highly developed' nations that involved ≥100 women aged 13-49 years (with ≥1 previous live birth), adjusted for maternal age and ≥1 measure of socioeconomic status and were published in English	Studies where women whose last pregnancy was a stillbirth made up ≥5% of the study sample and studies that measured only interbirth intervals	Interpregnancy intervals (F)
Aune et al. 2014a	3; inception-2012	Published cohort, case-cohort, nested case-control, and retrospective case-control studies	-	Physical activity (F)
Aune et al. 2014b	2; inception-2014	Published cohort studies reporting adjusted relative risk estimates for ≥3 categories of BMI	-	BMI (F)
Aune et al. 2017	2; inception-2017	Prospective cohort, case-cohort, cohort-nested case-control and randomised study designs published in English. Cohort studies were required to report risk estimates adjusted for ≥1 confounder	Studies of physically burdensome work Studies whose authors could not provide a numerical measure of activity level and the overall number of cases and person-years (or participants) were excluded from the dose-response analysis	Physical activity (F)
Balsells et al. 2016	1; 1990-2015	Cohort and case-control studies published in English, French, Italian, Spanish or Portuguese and involving pregnancies after spontaneous conception or any form of assisted reproduction technique, including women with known risk factors for miscarriage (e.g. recurrent miscarriages)	-	BMI (F)
Barbosa et al. 2018	4; inception - 2017	Cohort, case-control and cross-sectional studies involving low-risk pregnant women aged 14 to 48 years, which used multivariate logistic analysis. No language or publication year restrictions were applied.	Studies involving participants with neuromuscular or kidney disease, active urinary tract infection or double incontinence, previous urogynaecological surgery or malformation, or pelvic cancer	Age (F) BMI (F) Parity (F)

	Search: number of databases; date range	Eligibility restrictions		Eligible exposure categories reported ([M]ale/[F]emale):
		Included only:	Excluded:	
Bayrampour et al. 2018	4; inception-2015	Cohort, cross-sectional, and case-control studies reported in English and rated as having strong or moderate methodological quality	Studies that measured anxiety as a sub-score of overall mental health or that focused on specific anxiety disorders (e.g., PTSD)	Abuse/neglect (F)
Conde-Agudelo et al. 2006	6; 1966-2006	Cohort, cross-sectional and case-control studies reporting any adverse perinatal outcome	Studies that did not adjust for at least socioeconomic status and maternal age in their analyses, or did not provide data for 4+ interpregnancy interval strata	Interpregnancy intervals (F)
Conde-Agudelo et al. 2007	6; 1966-2006	Cohort, cross-sectional and case-control studies reporting any adverse maternal outcome	Studies that did not adjust for at least socioeconomic status and maternal age in their analyses, or did not provide data for 4+ interpregnancy interval strata	Interpregnancy/birth intervals (F)
Czarnobay et al. 2019	5; inception-2017	Cohort, cross-sectional and case-control studies involving Brazilian participants	Studies that did not define their classification of foetal macrosomia as >4,000g or ≥4,000 g and their classification of large for gestational age as >90th percentile	Age (F) Education (F) Parity (F) Smoking (F)
De-Regil et al. 2015	4+; inception-2015	Randomised trials involving women of any age, parity or previous pregnancy outcome becoming pregnant	Trials that continued supplementation beyond 12 weeks' gestation	Folic acid (F)
Du Fossé et al. 2020	4; inception-2019	Studies reported in English	Studies that did not adjust for maternal age or included only participants who had undergone artificial reproductive technology (ART)	Age (M)
Duckitt & Harrington 2005	2; 1974-2002	Cohort and case-control studies that investigated risk factors observable at antenatal booking visits	Studies without a comparator and studies which scored '0' in any category of the methodological quality checklist used	Age (F) Parity (F)
Flenady et al. 2011	3; 1990–2009	Studies conducted in high-income countries (World Bank OECD country classification), published in English, and deemed to be of 'sufficient quality' (assessed using the Newcastle-Ottawa scale)	-	Age (F & M) Education (F) Parity (F)

	Search: number of databases; date range	Eligibility restrictions		Eligible exposure categories reported ([M]ale/[F]emale):
		Included only:	Excluded:	
Gaudet et al. 2014	3; inception-2011	Published observational studies in which maternal weight was obtained by direct measurement or self-report	-	BMI (F)
Gete et al. 2020	4; 2002-2018	Observational and interventional studies published in English	Studies involving the following, alone or not alongside dietary intake: nutrients, nutritional supplements, artificially or sugar-sweetened beverages, alcohol or caffeine consumption, the intake of contaminated fish and the evaluation of biomarkers of nutritional intake	Diet (F)
Heslehurst et al. 2008	6; 1990-2007	Cohort studies reported in English, with at least one comparison and one obese group and where maternal weight/BMI was recorded before 16 weeks' gestation	Studies that asked women to report their pre-pregnancy weight postnatally	BMI (F)
Hill et al. 2017	3; 1961-2015	Peer-reviewed studies published in English and involving healthy pregnancies in women aged ≥18 years	Studies that included participants with multiple gestations or gestational diabetes or that did not report data on pre-pregnancy BMI and gestational weight gain and the proportion of nulliparous and multiparous women	Parity (F)
Hoang et al. 2018	2; 1946-2016	-	In vitro studies and studies that did not include a comparison group	(Over the counter) Drugs (F)
Huang et al. 2019	4; inception-2019	Cohort and longitudinal studies	Studies with high-risk populations (e.g. women serious pregnancy complications or infectious disease and infants with serious illness birth abnormalities)	BMI (F)
Hutcheon et al. 2019	5; 2006-2017	Studies conducted in 'very highly developed' nations that involved ≥100 women aged 13-49 years (with ≥1 previous live birth), adjusted for maternal age and ≥1 measure of socioeconomic status, and were published in English	Studies in which women whose last pregnancy was a stillbirth made up ≥5% of the study sample and studies that measured only interbirth intervals	Interpregnancy intervals (F)

	Search: number of databases; date range	Eligibility restrictions		Eligible exposure categories reported ([M]ale/[F]emale):
		Included only:	Excluded:	
Ioannidou et al. 2019	3; inception-2017	Studies involving pregnant women (first trimester) with urinal ketones and ≥4 episodes of vomiting a day	-	Age (F)
Jia et al. 2019	3; inception-2018	Studies published in any language/year	Studies that did not account for the impact of genetic variables on outcome risk	Age (M) Education (F)
Leader et al. 2018	2;1946-2015	Studies published in any language	Publications in which only multiple births were reported	Age (F)
Leng et al. 2016	3; inception-2014	Case-control and cohort studies reported in English	-	Alcohol (F)
Li et al. 2019	4; inception-2018	Observational studies involving healthy women who were already, or intending to become, pregnant	Randomised clinical trials whose control groups were not provided folic acid	Folic acid (F)
Liu et al. 2016	7; inception-2015	Studies published in Chinese or English in which BMI was self-reported or measured before pregnancy, during the first trimester or at the first prenatal visit and where the comparison group was women with 'normal' BMI	Women with non-singleton pregnancies or pre-existing hypertension or diabetes	BMI (F)
Liu et al. 2019	6; inception-2017	Prospective and retrospective cohort studies published in English or Chinese with sample sizes of >1000 pregnant women, that compared the BMI categories of underweight, overweight and/or obesity with 'normal' weight	Non-Chinese women	BMI (F)
Martinez-Hortelano et al. 2020	5; inception-2019	All study design types (trials and observational studies) involving women with ≥2 pregnancies, that investigated hypertensive disorders of pregnancy	Studies involving non-singleton pregnancies	Interpregnancy weight change (F)
McBride & Johnson 2016	7; 1990-2014	Peer-reviewed studies deemed to have a 'good-quality research design (determined by considering random allocation/the provision of participant selection criteria, response and attrition rates, study time period, source of the report and whether the sample size was determined using power calculations)	-	Alcohol (M)

	Search: number of databases; date range	Eligibility restrictions		Eligible exposure categories reported ([M]ale/[F]emale):
		Included only:	Excluded:	
Mijatovic-Vukas et al. 2018	5; 1985-2017	Cohort & longitudinal studies published in English	Non-singleton pregnancies	Physical activity (F) Diet (F)
Molyneaux et al. 2014	5; inception-2013	Cohort, cross-sectional, case-control and intervention studies (baseline data only) published in English that compared overweight or obese women with normal-weight women	Studies deemed to be of 'low' methodological quality	BMI (F)
Nesari et al. 2018	10; inception-2017	-	Studies involving antenatal interventions to lower stress which did not report control data	Abuse/neglect (F)
Ngandu et al. 2019	3; 1990-2018	Studies conducted in Sub-Saharan African countries	-	Education (F)
Oteng-Ntim et al. 2018	6; 1990-2017	Observational studies involving singleton pregnancies from parity 0 to 1	Studies including only women with previous diabetes diagnoses	Interpregnancy weight change (F)
Raghavan et al. 2019	9; 1980- 2017	Randomised control trial, cohort and nested case-control studies published in English in peer-reviewed journals and involving pregnant or pre-pregnant women aged 15–44 years from nations with 'high' or 'very high' human development	Studies in which all subjects had a chronic or pregnancy-related condition, or that lacked a valid comparison group or did not describe the dietary pattern's components (i.e., foods and beverages)	Diet (F)
Rahman et al. 2015	4; inception-2014	Cohort studies conducted in 'developing' nations with pregnant women aged 15 years or over	Studies involving high-risk populations (e.g., women with heart disease, diabetes) or patients with pregnancy-induced hypertension or pre-eclampsia at baseline	BMI (F)
Regan et al. 2020	3; inception-2019	Studies of women following a previous live birth, published in English	Studies measuring only interbirth intervals	Interpregnancy intervals (F)
Roelants et al. 2016	6; inception-2015	Studies reported in English that used dynamic and quantifiable prenatal variables as markers (e.g. BMI or laboratory indications) of neonatal fat mass measured within one month postpartum	-	BMI (F)

	Search: number of databases; date range	Eligibility restrictions		Eligible exposure categories reported ([M]ale/[F]emale):
		Included only:	Excluded:	
Rumbold et al. 2011	5; inception-2010	Randomised or quasi-randomised trials that compared ≥1 vitamin with either other vitamins, no vitamins, placebo or other intervention(s) and involved reproductive age-women intending to become pregnant, regardless of miscarriage risk	-	Vitamins (F)
Sabbagh et al. 2015	3; 1980-2013	Case-control, cross-sectional and cohort studies with a control or comparison group, that involved smoking and non-smoking mothers	Studies reporting associations with genes considered to modulate the effect of smoking or gene-environmental joint effects related to the outcome	Smoking (F)
Silvestrin et al. 2013	1; inception-2011	Cross-sectional and cohort design studies, published in English, Portuguese, or Spanish, that presented results for maternal education in three strata: low, medium and high	-	Education (F)
Spinder et al. 2019	2; inception-2017	Case-control and cohort studies, published in English, German, French, or Dutch, in which the exposure was confirmed by an expert or through using Job-Exposure Matrices or expert literature	Studies that used self-reported exposure and outcomes or accepted occupation as a proxy for exposure	Environmental exposures (F)
Tabb et al. 2017	4; inception-2016	'Quantitative' studies conducted in the USA and published in English	Studies that did not adjust for pre-pregnancy weight or pregnancy weight gain in their analyses	Immigration status (F)
Tan et al. 2019	3; inception-2019	Published clinical trials and cohort studies that reported the time interval between exposure and conception	-	Vaccination (F)
Tang et al. 2020	3; inception-2019	Published cross-sectional, case-control and cohort studies	Studies that recruited participants from high-risk populations (e.g., patients with human immunodeficiency viruses [HIV] or a history of adverse pregnancy outcomes)	(Over the counter) Drugs (F)

	Search: number of databases; date range	Eligibility restrictions		Eligible exposure categories reported ([M]ale/[F]emale):
		Included only:	Excluded:	
Teulings et al. 2019	4; inception-2019	Observational (cohort and case-control) studies reported in English with a sample size of ≥50 involving multiparous women with any time interval between the consecutive births	Studies that did not report interpregnancy weight change in kilogram, BMI units or percentage change in body weight or did not use a comparison group of interpregnancy weight change between 1 unit of weight loss and 1 unit of weight gain	Interpregnancy weight change (F)
Timmermans et al. 2020	4; 1990-2019	Cohort, longitudinal and case-control studies reported in English (no language, country or publication date restrictions) involving multiparous women with any time interval between the consecutive births	Studies involving women who experienced perinatal complications in their initial pregnancy	Interpregnancy weight change (F)
Torloni et al. 2009	4; 1977-2007	Cohort, case-control and cross-sectional studies involving women of any age, socioeconomic status, parity or race/ethnicity, that used 'normal' BMI as their comparator	Women with previously diagnosed type 1 or 2 diabetes and studies involving selective screening for gestational diabetes in high-risk populations (e.g. high maternal age, parity, obesity, reproductive history & family history of diabetes)	BMI (F)
Wang et al. 2013	3; inception-2012	Cohort studies reporting sufficient data to calculate relative risks or hazard or odds ratios with 95% confidence intervals for ≥3 categories of BMI, with BMI <30 as the comparator	Studies that did not measure BMI before pregnancy, during the first trimester or at the first prenatal visit	BMI (F)
Zhang et al. 2018	2; inception-2016	Case-control and cohort studies reported in English	Non-singleton pregnancies only	BMI (F)
Zhang et al. 2020	6; 1950-2019	Cohort and case-control studies published in Chinese or English	-	Alcohol (M)

Abbreviations: BMI, body mass index

eTable 6: AMSTAR 2 critical appraisal ratings

	(1) PICO in RQs and inclusion criteria	(2) A priori protocol/ guide development	(3) Explanation for study design selection	(4) Comprehensive literature search	(5) Duplicate study selection	6) Duplicate extraction	(7) Justification for study exclusion	(8) Included Studies – adequate description	(9) Risk of Bias (RoB) – satisfactory assessment	(10) Reporting of study funding Sources	(11) Appropriate statistical combination	(12) RoB impact on pooled results assessed	(13) RoB consideration in results interpretation	(14) Heterogeneity - explanation/discussion	(15) Publication bias assessed	(16) Conflict of Interest	Overall rating
Adane et al., 2019	Yes	Yes	No	No	Yes	Yes	No	PY	Yes	No	No[c]	No	Yes	No	Yes	Yes	Critically low
Ahrens et al., 2019	Yes	PY	No	No	No	Yes	No	PY	PY	No	N/A	N/A	Yes	No	N/A	Yes	Critically low
Aune et al., 2014a	Yes	PY	No	PY	No	No	No	PY	No	No	No[c]	No	Yes	Yes	Yes	Yes	Critically low
Aune et al., 2014b	Yes	No	No	PY	No	No	Yes	PY	PY	No	No[c]	Yes	Yes	Yes	Yes	Yes	Low
Aune et al., 2017	Yes	No	No	No	Yes	Yes	Yes	PY	PY	No	No[c]	Yes	Yes	Yes	No	Yes	Critically low
Balsells et al., 2016	Yes	PY	No	No	Yes	Yes	No	PY	PY	No	No[b c]	Yes	No	Yes	Yes	No	Critically low
Barbosa et al., 2018	Yes	Yes	No	PY	Yes	Yes	No	PY	Yes	No	No[c]	No	Yes	Yes	No	No	Low
Bayrampour et al., 2018	No[a]	No	No	No	Yes	Yes	No	No	PY	No	N/A	N/A	Yes	No	N/A	Yes	Critically low
Conde-Agudelo et al., 2006	Yes	PY	No	PY	Yes	Yes	Yes	PY	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Moderate
Conde-Agudelo et al., 2007	No[a]	PY	No	PY	Yes	Yes	Yes	PY	No	No	N/A	N/A	Yes	No	N/A	Yes	Low
Czarnobay et al., 2019	Yes	Yes	No	PY	Yes	Yes	No	No	PY	No	N/A	No	No	No	N/A	Yes	Critically low
De-Regil et al., 2015	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No[e]	Yes	High
Du Fossé et al., 2020	Yes	Yes	No	No	Yes	Yes	No	PY	PY	No	Yes	No	Yes	No	Yes	Yes	Low
Duckitt & Harrington, 2005	Yes	No	No	PY	No	Yes	No	No	No	No	No[b c]	No	No	No	Yes	Yes	Critically low
Flenady et al., 2011	Yes	No	No	No	No	Yes	No	PY	PY	No	No[c]	Yes	No	No	No	Yes	Critically low
Gaudet et al., 2014	Yes	No	No	No	Yes	Yes	No	No	PY	No	No[c]	Yes	Yes	No	No	Yes	Critically low
Gete et al., 2020	Yes	Yes	No	No	No	Yes	No	PY	PY	No	N/A	N/A	No	No	N/A	Yes	Critically low
Heslehurst et al., 2008	Yes	No	No	No	Yes	Yes	No	PY	PY	No	No[b c]	Yes	No	No	No	Yes	Critically low
Hill et al., 2017	Yes	No	No	PY	No	No	Yes	Yes	PY	No	No[b c]	No	Yes	No	No	Yes	Critically low
Hoang et al., 2018	Yes	No	No	PY	Yes	No	No	PY	PY	No	N/A	N/A	Yes	No	N/A	No	Critically low
Huang et al., 2019	No[a]	No	No	PY	Yes	Yes	No	PY	PY	No	No[b c]	Yes	Yes	Yes	Yes	Yes	Critically low
Hutcheon et al., 2019	Yes	PY	No	No	No	Yes	No	PY	PY	No	N/A	N/A	Yes	No	N/A	Yes	Critically low
Ioannidou et al., 2019	Yes	No	No	PY	No	Yes	Yes	PY	PY	No	N/A	N/A	Yes	No	N/A	Yes	Low
Jia et al., 2019	No[a]	No	No	PY	Yes	Yes	Yes	No	PY	No	No[c]	No	Yes	Yes	Yes	Yes	Low
Leader et al., 2018	Yes	No	No	PY	Yes	Yes	No	No	PY	No	No[c]	No	No	No	No	Yes	Critically low
Leng et al., 2016	Yes	No	No	No	No	Yes	No	PY	PY	No	No[b c]	No[d]	Yes	Yes	Yes	Yes	Critically low
Li et al., 2019	Yes	No	Yes	PY	No	No	No	PY	PY	No	No[c]	No	No	Yes	Yes	Yes	Critically low

	(1) PICO in RQs and inclusion criteria	(2) A priori protocol/ guide development	(3) Explanation for study design selection	(4) Comprehensive literature search	(5) Duplicate selection	6) Duplicate extraction	(7) Justification for study exclusion	(8) Included Studies – adequate description	(9) Risk of Bias (RoB) – satisfactory assessment	(10) Reporting of study funding sources	(11) Appropriate statistical combination	(12) RoB impact on pooled results assessed	(13) RoB consideration in results interpretation	(14) Heterogeneity - explanation/discussion	(15) Publication bias assessed	(16) Conflict of Interest	Overall rating
Liu et al., 2016	Yes	No	No	No	Yes	Yes	No	PY	PY	No	No[b]	No	No	Yes	Yes	Yes	Critically low
Liu et al., 2019	Yes	No	No	No	No	Yes	No	PY	PY	No	No[c]	No	Yes	Yes	Yes	Yes	Critically low
Martinez-Hortelano et al.2020	Yes	Yes	No	PY	Yes	No	No	PY	PY	No	No[b c]	No	Yes	Yes	Yes	Yes	Low
McBride & Johnson, 2016	No[a]	No	No	No	No	No	No	PY	No	No	N/A	N/A	Yes	No	N/A	Yes	Critically low
Mijatovic-Vukas et al., 2018	No[a]	Yes	No	No	No	Yes	No	PY	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Critically low
Molyneaux et al., 2014	Yes	Yes	No	No	Yes	Yes	No	PY	PY	No	Yes	Yes	Yes	No	Yes	Yes	Low
Nesari et al., 2018	No[a]	Yes	No	Yes	Yes	Yes	No	PY	PY	No	Yes	No[d]	Yes	No	Yes	Yes	Moderate
Ngandu et al., 2019	No[a]	Yes	No	No	Yes	Yes	No	PY	No	No	N/A	N/A	Yes	No	N/A	Yes	Critically low
Oteng-Ntim et al., 2018	Yes	Yes	No	No	Yes	Yes	No	PY	PY	No	Yes	Yes	Yes	Yes	No[e]	Yes	Low
Raghavan et al., 2019	Yes	No	No	No	Yes	Yes	Yes	PY	PY	Yes	N/A	N/A	Yes	No	N/A	Yes	Critically low
Regan et al., 2020	Yes	Yes	No	No	Yes	Yes	No	PY	PY	No	No[b]	No	Yes	Yes	No	Yes	Critically low
Rahman et al. 2015	Yes	No	No	PY	No	Yes	No	PY	PY	No	No[b c]	No[d]	No	No	Yes	Yes	Critically low
Roelants et al., 2016	No[a]	No	No	No	Yes	No	No	No	No	No	N/A	N/A	Yes	Yes	N/A	Yes	Critically low
Rumbold et al., 2011	Yes	Yes	No	PY	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	High
Sabbagh et al., 2015	Yes	PY	No	No	No	Yes	No	PY	PY	No	No[b]	Yes	Yes	Yes	Yes	Yes	Critically low
Silvestrin et al., 2013	Yes	No	No	No	Yes	No	No	PY	PY	No	No[b c]	No	No	No	Yes	Yes	Critically low
Spinder et al., 2019	Yes	Yes	No	No	Yes	Yes	No	PY	PY	No	No[b c]	Yes	Yes	Yes	Yes	Yes	Low
Tabb et al., 2017	Yes	Yes	No	No	No	No	No	No	PY	No	N/A	N/A	Yes	No	N/A	Yes	Critically low
Tan et al., 2019	No[a]	Yes	No	PY	Yes	No	No	PY	No	No[a]	No[b c]	No	Yes	No	No	Yes	Critically low
Tang et al., 2020	No[a]	No	No	PY	Yes	No	No	No	PY	No	No[b]	No	Yes	No	Yes	Yes	Critically low
Teulings et al., 2019	Yes	Yes	No	No	Yes	Yes	No	No	PY	No	No[c]	Yes	Yes	No	No[e]	Yes	Critically low
Timmermans et al., 2020	Yes	Yes	No	No	Yes	No	No	PY	Yes	No	Yes	Yes	Yes	No	No	Yes	Low
Torloni et al., 2009	Yes	No	No	No	Yes	Yes	Yes	PY	PY	No	No[c]	Yes	Yes	Yes	No	Yes	Critically low
Wang et al., 2013	Yes	No	No	PY	No	Yes	Yes	PY	PY	No	No[b c]	No[d]	No	Yes	Yes	Yes	Critically low
Zhang et al., 2018	Yes	No	No	No	Yes	Yes	No	PY	PY	No	No[b c]	No	Yes	Yes	Yes	Yes	Critically low
Zhang et al., 2020	Yes	No	No	No	No	Yes	No	PY	PY	No	No[b c]	Yes	Yes	Yes	Yes	Yes	Critically low
Total 'No', %[f]	21.2	50.0	98.1	59.6	34.6	25.0	76.9	19.2%	15.4	94.2	76.9%	57.5%	21.2%	53.8%	35.9%	5.8	

Abbreviations: RQ, Research questions; RoB, Risk of bias; PY, Partial yes. [a] The intended comparator(s) is not stated in the review's objective(s) or methods. [b] Did not justify combining unadjusted estimates. [c] Did not justify combining the data in a meta-analysis. [d] All included studies were rated as being of high or moderate quality. [e] Due to a low (<10) number of included studies. [f] Percentage is based on the number of eligible reviews per item

eTable 7. Summary of findings for all exposure-outcome associations

i. Demographic and Reproductive Exposures [eTable 7]

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
AGE - MATERNAL												
<17 years	Duckitt & Harrington (critical)	Female	Pericon	≥17 years	Pre-eclampsia	RR 1.24 (0.69, 2.23)	78.3	Very low	4 (1987-1995)	11,589	USA (3), UK (1)	Cohort (3), Case-control (1)
<20 years	Duckitt & Harrington (critical)	Female	Pericon	≥20 years	Pre-eclampsia	RR 1.02 (0.59, 1.74)	23.0	Very low	3 (1996-2000)	15,295	Saudi Arabia, Sweden, Taiwan (all 1)	Cohort (3)
<20 years	Flenady et al. (critical)	Female	Pericon	*Not reported*	Stillbirth	Not associated in all studies	-	Very low	6 (1998-2007)	24,602,960	Australia (2), New Zealand, Sweden, UK, USA (all 1)	Cohort (6)
>30 years	Czarnobay et al. (critical)	Female	Pericon	*Not reported*	Macrosomia	Positively associated in both studies	-	Very low	2 (2001-2003)	25,367	Brazil (2)	Cross-sectional (2)
>35 years	Flenady et al. (critical)	Female	Pericon	<35 years	Stillbirth	aOR 1.65 (1.61, 1.71)	16.7	Very low	6 (1998-2008)	5,847,748	Australia, Canada, Italy, New Zealand, Sweden, USA (all 1)	Cohort (4), Case control (2)
≥35 years	Duckitt & Harrington (critical)	Female	Pericon	<35 years	Pre-eclampsia	RR 0.64 (0.03, 13.33)	99.8	Very low	3 (1996-2000)	65,314	Taiwan (2), Saudi Arabia (1)	Cohort (2), Case-control (1)
≥35 years	Barbosa et al. (low)	Female	Pericon	<35 years	Urinary incontinence	aOR 1.53 (1.45, 1.62)	0.0	Low	4 (2007-2016)	45,824	Australia, Norway, Spain, Turkey (all 1)	Cohort (3), Cross-sectional (1)
≥45 years	Leader et al.(critical)	Female	Pericon	<45 years	Abnormal Apgar score[a]	OR 2.49 (1.37, 4.54)	73.0	Low	5 (2010-2014)	1,866,786	USA (2), Israel (2), Thailand (1)	Cohort (5)

[a] At five minutes postpartum

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
AGE – MATERNAL [continued]												
≥45 years	Leader et al.(critical)	Female	Pericon	<45 years	Caesarean delivery	OR 4.00 (2.48, 6.43)	97.0	Low	10 (1998-2014)	1,958,882	Israel (3), USA (2), Australia, Belgium, Canada, Thailand, UK (all 1)	Cohort (10)
≥45 years	Leader et al.(critical)	Female	Pericon	<45 years	Foetal loss	OR 2.60 (1.47, 4.62)	99.0	Low	5 (2004-2014)	24,764,227	USA (3), Belgium (1), Denmark (1)	Cohort (5)
≥45 years	Leader et al.(critical)	Female	Pericon	<45 years	Pregnancy complications[a]	OR 3.32 (2.37, 4.67)	91.0	Low	11 (1998-2014)	1,959,429	Israel (4), USA (3), Australia, Belgium, Canada, Thailand (all 1)	Cohort (11)
≥45 years	Leader et al.(critical)	Female	Pericon	<45 years	Intrauterine growth restriction	OR 1.58 (0.87, 2.85)	22.0	Very low	4 (2010-2014)	7,133	Canada, Israel, Thailand, UK (all 1)	Cohort (4)
≥45 years	Leader et al.(critical)	Female	Pericon	<45 years	Preterm birth	OR 1.96 (1.61, 2.39)	91.0	Very low	9 (1998-2014)	16,259,741	Israel (3), USA (2), Australia, Belgium, Canada, Thailand, (all 1)	Cohort (9)
≥45 years	Leader et al.(critical)	Female	Pericon	<45 years	Periconception haemorrhage	OR 1.92 (0.89, 4.12)	66.0	Very low	3 (2010-2014)	5,994	Israel, Thailand, USA (all 1)	Cohort (3)
AGE - PATERNAL												
<20 years	Jia et al. (low)	Male	Precon	25-29 years	Anencephaly	OR 1.08 (0.71, 1.63)	69.7	Very low	3 (1995-2007)	7,864,762	Norway, UK, USA (all 1)	Case-control (1), Cohort (2)
<20 years	Jia et al. (low)	Male	Precon	25-29 years	Spina bifida	OR 1.41 (1.10, 1.81)	0.0	Low	3 (1995-2007)	7,864,762	Norway, UK, USA (all 1)	Case-control (1), Cohort (2)
20-24 years	Jia et al. (low)	Male	Precon	25-29 years	Spina bifida	OR 1.26 (0.96, 1.66)	78.2	Very low	3 (1995-2007)	7,864,762	Norway, UK, USA (all 1)	Case-control (1), Cohort (2)

[a] Hyperemesis, hypertension disorder in pregnancy, diabetes, placental previa, and/or placental accrete/increta

Exposure	Review (AMSTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
AGE – PATERNAL [continued]												
30-34 years	Du Fossé et al. (low)	Male	Precon	<29 years	Miscarriage	Adjusted risk estimate[a] 1.04 (0.90, 1.21)	62.0	Very low	9 (2002-2019)	70,944	USA (2), China, Denmark, France, Israel, Japan, UK, Multiple EU (all 1)	Case-control (5), Cohort (4)
35-39 years	Du Fossé et al. (low)	Male	Precon	<29 years	Miscarriage	Adjusted risk estimate[a] 1.15 (0.92, 1.43)	75.6	Low	9 (2002-2019)	70,944	USA (2), China, Denmark, France, Israel, Japan, UK, Multiple EU (all 1)	Case-control (5), Cohort (4)
40-44 years	Du Fossé et al. (low)	Male	Precon	<29 years	Miscarriage	Adjusted risk estimate[a] 1.23 (1.06, 1.43)	16.8	Mod-erate	9 (2002-2019)	70,944	USA (2), China, Denmark, France, Israel, Japan, UK, Multiple EU (all 1)	Case-control (5), Cohort (4)
≥40 years	Flenady et al. (critical)	Male	Precon	*Not reported*	Stillbirth	Mixed findings	-	Very low	2 (2004-2005)	3,640,443	Denmark, Italy (all 1)	Cohort (2)
45-49 years	Jia et al. (low)	Male	Precon	25-29 years	Spina bifida	OR 0.83 (0.59, 1.15)	0.0	Very low	3 (1995-2007)	7,864,762	Norway, UK, USA (all 1)	Case-control (1), Cohort (2)
≥45 years	Du Fossé et al. (low)	Male	Precon	25-29 years	Miscarriage	Adjusted risk estimate[a] 1.43 (1.13, 1.81)	0.0	Mod-erate	4 (2004-2019)	48,371	Denmark, France, UK, USA (all 1)	Case-control (2), Cohort (2)
⩾50 years	Jia et al. (low)	Male	Precon	25-29 years	Spina bifida	OR 1.34 (0.81, 2.20)	8.5	Very low	3 (1995-2007)	7,864,762	Norway, UK, USA (all 1)	Case-control (1), Cohort (2)
DEMOGRAPHICS (OTHER)												
Ethnicity (White)	Czarnobay et al. (critical)	Female	Pericon	*Not reported*	Birth weight	Not associated in all studies	-	Very low	3 (2008-2016)	1,061	Brazil (3)	Cross-sectional (2) Cohort (1)
Maternal foreign birth	Tabb et al. (critical)	Female	Precon	Native birth (USA)	Low birth weight	Mixed findings	-	Very low	4 (1990-2014)	203,513	USA (4)	Cohort (3), Cross-sectional (1)
Maternal foreign birth	Tabb et al. (critical)	Female	Precon	Native birth (USA)	Preterm birth	Mixed findings	-	Very low	3 (1990-2014)	201,378	USA (3)	Cohort (2), Cross-sectional (1)

[a] Adjusted odds ratios, hazard ratios and rate ratios were combined without conversion.

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
INTERPREGNANCY/BIRTH INTERVALS (IPI/BI) - SHORT												
IPI <6 months	Ahrens et al. (critical)	Female	Precon	IPI 12-23 months	Congenital anomalies	Not significantly associated in all studies	-	Very low	3 (2015-2017)	413,379	Canada (2), USA (1)	Cohort (3)
IPI <6 months	Ahrens et al. (critical)	Female	Precon	*Not reported*	Low birth weight	Positively associated in five of eight studies	-	Very low	8 (2011-2017)	703,933	Canada (3), Netherlands (2), Australia, Poland, USA (all 1)	Cohort (8)
IPI <6 months	Conde-Agudelo et al.a (moderate)	Female	Precon	IPI 18-23 months	Low birth weight	aOR 1.61 (1.39, 1.86)	87.0	Low	4 (1997-2005)	1,717,455	USA (3), 18 Latin American countries (1)	Cohort/ Cross-sectional (4)
IPI <6 months	Ahrens et al. (critical)	Female	Precon	IPI 12-60 months	NICU admission	Not significantly associated in all studies	-	Very low	3 (2003-2015)	186,333	Sweden, UK, USA (all 1)	Cohort (3)
IPI <6 months	Ahrens et al. (critical)	Female	Precon	IPI ≥18 months	Preterm birth	Positively associated in eight of 10 studies	-	Low	10 (2011-2017)	1,910,676	Canada (4), USA (3), Netherlands (2), Australia(1)	Cohort (10)
IPI <6 months	Conde-Agudelo et al.a (moderate)	Female	Precon	IPI 18-23 months	Preterm birth	aOR 1.40 (1.24, 1.58)	60.0	Low	8 (1997-2005)	3,146,300	USA (6), UK (1), 18 Latin American countries (1)	Cohort/ Cross-sectional (8)
IPI <6 months	Ahrens et al. (critical)	Female	Precon	*Not reported*	Small for gestational age	Positively associated in three of seven studies	-	Very low	7 (2008-2017)	555,681	Netherlands (3), Canada (2), Australia, USA (both 1)	Cohort (7)
IPI <6 months	Conde-Agudelo et al.a (moderate)	Female	Precon	IPI 18-23 months	Small for gestational age	aOR 1.26 (1.18, 1.33)	89.0	Low	6 (1989-2005)	2,828,207	USA (4), UK (1), 18 Latin American countries (1)	Cohort/ Cross-sectional (6)

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
INTERPREGNANCY/BIRTH INTERVALS (IPI/BI) – SHORT [continued]												
IPI <6 months	Regan et al. (critical)	Female	Precon	IPI ≥6 months	Perinatal mortality	OR 1.34 (1.17, 1.53)	0.0	Very low	5 (1982-2018)	1,073,100	Bangladesh, Denmark, Kuwait, UK, USA (all 1)	Cohort (5)
IPI <12 months	Conde-Agudelo et al.b (low)	Female	Precon	IPI ≥18 months	Placenta previa	Positively associated in both studies	-	Very low	2 (2000-2006)	613,364	USA (1), 18 Latin American countries (1)	Cross-sectional (2)
IPI/BI <13 months	Conde-Agudelo et al.b (low)	Female	Precon	IPI/BI 13-60 months	Pre-eclampsia	Positively associated in both studies	-	Very low	2 (2001-2005)	558,360	Bangladesh, Norway (both 1)	Cohort (2)
IPI <14 months	Conde-Agudelo et al.b (low)	Female	Precon	IPI 18-50 months	Premature rupture of membranes	Mixed findings	-	Very low	2 (2000-2005)	468,011	Bangladesh, 18 Latin American countries (both 1)	Cross-sectional (2)
IPI/BI <24 months	Conde-Agudelo et al.b (low)	Female	Precon	IPI/BI ≥18 months	Maternal anaemia	Mixed findings	-	Very low	5 (1998-2005)	472,614	Bangladesh, Nigeria, Singapore, Pakistan, 18 Latin American countries (all 1)	Cross-sectional (3), Cohort (2)
IPI/BI <24 months	Conde-Agudelo et al.b (low)	Female	Precon	IPI/BI ≥15 months	Maternal death	Positively associated in all studies	-	Very low	5 (1993-2005)	575,113	Bangladesh (2) India, 18 Latin American countries, Several developing countries (all 1)	Case-Control (3), Cross-sectional, Cohort (both 1)
IPI/BI <24 months	Conde-Agudelo et al.b (low)	Female	Precon	IPI/BI 18-60 months	Postpartum haemorrhage	Positively associated in both studies	-	Very low	2 (2000-2004)	456,989	Nigeria (1), 18 Latin American countries (1)	Cross-sectional, Cohort (both 1)
IPI <24 months	Hutcheon et al. (critical)	Female	Precon	IPI ≥12 months	Labour dystocia	Inversely associated in both studies	-	Very low	2 (2006-2012)	660,624	Sweden, USA (both 1)	Cohort (2)

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
INTERPREGNANCY/BIRTH INTERVALS (IPI/BI) – LONG												
IPI >24 months	Regan et al. (critical)	Female	Precon	Longer IPIs (various)	Perinatal mortality	Mixed findings	-	Very low	11 (2003-2019)	4,822,899	Multiple South & Central American countries, UK, USA (all 2), Brazil, Canada, Cameroon, Sweden, Tanzania (all 1)	Cohort (10), Case-control (1)
IPI/BI >48 months	Conde-Agudelo et al.b (low)	Female	Precon	IPI/BI <60 months	Pre-eclampsia	Positively associated in all studies	-	Low	6 (2000-2005)	1,606,426	Norway (2), Bangladesh, Denmark, USA, 18 Latin American countries (all 1)	Cohort/ Cross-sectional (5), Case-control (1)
IPI ≥60 months	Conde-Agudelo et al.a (moderate)	Female	Precon	IPI <60 months	Low Apgar score	Not associated in either study	-	Very low	2 (2004-2005)	1,080,750	Nigeria, 18 Latin American countries (both 1)	Cohort/ Cross-sectional (1), Case-control (1)
IPI ≥60 months	Conde-Agudelo et al.a (moderate)	Female	Precon	IPI 18-23 months	Low birth weight	aOR 1.43 (1.27, 1.62)	84.0	Low	4 (1997-2005)	1,717,455	USA (3), 18 Latin American countries (1)	Cohort/ Cross-sectional (4)
IPI ≥60 months	Conde-Agudelo et al.a (moderate)	Female	Precon	IPI 18-23 months	Preterm birth	aOR 1.20 (1.17, 1.24)	95.0	Low	7 (1990-2005)	3,057,157	USA (6), 18 Latin American countries (1)	Cohort/ Cross-sectional (7)
IPI ≥60 months	Conde-Agudelo et al.a (moderate)	Female	Precon	IPI 18-23 months	Small for gestational age	aOR 1.29 (1.20, 1.39)	88.0	Low	6 (1989-2005)	2,793,789	USA (4), Sweden, 18 Latin American countries (both 1)	Cohort/ Cross-sectional (6)
IPI/BI ≥3 years	Conde-Agudelo et al.b (low)	Female	Precon	Shorter IPI/BI (various)	Labour dystocia	Mixed findings	-	Very low	2 (2004-2006)	648,125	Nigeria, USA (both 1)	Cross-sectional (1), Case-control (1)

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
PARITY												
Nulliparity	Duckitt & Harrington (critical)	Female	Precon	Multiparity	Pre-eclampsia	RR 2.35 (1.80, 3.06)	97.3	Very low	6 (1991-2000)	304,560	USA (4), Norway (1), Taiwan (1)	Case-control (6)
Nulliparity	Duckitt & Harrington (critical)	Female	Precon	Multiparity	Pre-eclampsia	RR 2.91 (1.28, 6.61)	94.3	Very low	3 (1995-2000)	37,988	Saudi Arabia, Taiwan, USA (all 1)	Cohort (3)
Primiparity	Flenady et al. (critical)	Female	Precon	*Not reported*	Stillbirth	aOR 1.42 (1.33, 1.51)	0.0	Very low	3 (1994-2008)	1,108,940	Australia, Sweden, USA (all 1)	Cohort (2), Case-control (1)
(Multi) parity	Hill et al. (critical)	Female	Precon	Fewer/no offspring	Gestational weight gain	*r* (adjusted) -0.08 (-0.19, 0.03)	-	Very low	10 (2003-2014)	62,923	USA (3), Australia, Brazil, France, Norway, Pakistan, Poland, Sweden (all 1)	Cohort (8), Cross-sectional (2)
Multiparity	Czarnobay et al. (critical)	Female	Precon	*Not reported*	Birth weight ≥90th percentile	Positively associated in one of eight studies	-	Very low	8 (2004-2017)	3,131	Brazil (8)	Cross-sectional (5), Cohort (2), Case-control (1)
Multiparity	Barbosa et al. (low)	Female	Precon	Nulliparity	Urinary incontinence	aOR 2.09 (1.07, 4.08)	90.0	Low	4 (2007-2017)	29,799	Turkey (3), Norway (1)	Cross-sectional (3), Cohort (1)
Multiparity	Barbosa et al. (low)	Female	Precon	Primiparity	Urinary incontinence	aOR 1.26 (0.97, 1.64)	49.0	Low	4 (2007-2017)	24,121	Turkey (3), Norway (1)	Cross-sectional (3), Cohort (1)

Abbreviations: Precon, Preconception; Pericon, Periconception; (a)RR, (adjusted) risk ratio; (a)OR, adjusted odds ratio; EU, European Union

ii. Health Behaviours and Wider Determinants of Health [eTable 7]

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
ABUSE/NEGLECT												
Abuse *(physical/ emotional/ sexual)*	Nesari et al. (moderate)	Female	Precon	No abuse experience	Low birth weight	OR 1.35 (1.14, 1.59)	69.0	Low	11 (1994-2014)	218,061	USA (8), Norway (2), UK (1)	Cohort (6), Case-control (5), Cross-sectional (1)
Abuse *(physical/ emotional/ sexual))*	Nesari et al. (moderate)	Female	Precon	No abuse experience	Preterm birth	OR 1.28 (1.12, 1.47)	75.0	Very low	14 (1994-2016)	278,401	USA (8), Norway (2), UK, Australia, Canada, Switzerland (all 1)	Cohort (7), Case-control (6), Cross-sectional (1)
Childhood trauma/abuse	Bayrampour et al. (critical)	Female	Precon	Non-exposure	Antenatal anxiety	Mixed finding	-	Very low	4 (2008-2015)	3,083	Canada (2), Australia, USA (both 1)	Longitudinal /cohort (2), Cross-sectional (1), RCT (1)
History of neglect/abuse	Bayrampour et al. (critical)	Female	Precon	Non-exposure	Antenatal anxiety	Positively associated in both studies	-	Very low	2 (both 2015)	3,327	Canada, Germany (both 1)	Cohort/ longitudinal (2)
ALCOHOL												
Alcohol intake *(highest category)*	Leng et al. (critical)	Female	Pericon	Lowest category of intake	Neural tube defects	1.15 (0.55, 2.40)	81.5	Very low	3 (2004-2013)	1,421 *(cases only)*	Italy, Netherlands, USA (all 1)	Case-control (3)
Alcohol intake	McBride & Johnson (critical)	Male	Precon	Lower or no intake	Birth weight	Mixed findings	-	Very low	2 (1995-1998)	8,989	UK, USA (both 1)	Cohort (1), Case-control (1)
Alcohol intake	McBride & Johnson (critical)	Male	Precon	Lower or no intake	Miscarriage	Positively associated reported in all	-	Very low	3 (1992-2004)	2,577	USA (2), Denmark (1)	Cohort (2), Case-control (1)
Alcohol *(any, three months pre-gravid)*	Zhang et al. (critical)	Male	Precon	No exposure	Congenital heart defects	OR 1.44 (1.19, 1.74)	90.0	Low	24 (1997-2019)	48,141	China (21), USA (2), Netherlands (1)	Case-control (24)
Alcohol *(≥5 drinks per sitting)*	Zhang et al. (critical)	Male	Precon	*Not reported*	Congenital heart defects	OR 1.52 (1.20, 1.95)	83	Very low	9 (1997-2018)	29,925	China (7), USA (2)	Case-control (9)

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
DIET & NUTRITION												
'Healthy' dietary patterns	Gete et al. (critical)	Female	Precon	Lower/ higher intake or usual diet	Preterm birth	Inversely associated in both studies	-	Very low	2 (2014-2018)	915	Australia, Norway (both 1)	RCT (1), Cross-sectional (1)
Mediterranean-type diet	Raghavan et al. (critical)	Female	Precon	Lower adherence /other diet pattern	Hypertensive disorders in pregnancy	Inversely associated in both studies	-	Very low	2 (2015-2016)	6,749	Australia (2)	Cohort/ longitudinal (2)
Mediterranean-type diet	Mijatovic-Vukas et al. (critical)	Female	Precon	*Not reported*	Gestational diabetes	Inversely associated in all (15–38% lower risk)	-	Low	3 (2012-2016)	22,485	Australia (2), USA (1)	Cohort/ longitudinal (3)
High AHEI diet adherence	Mijatovic-Vukas et al. (critical)	Female	Precon	Non-adherence	Gestational diabetes	Associated with a 19-46% lower risk	-	Low	2 (2012-2014)	29,691	USA (2)	Cohort/ longitudinal (2)
Prudent/ Western diet	Mijatovic-Vukas et al. (critical)	Female	Precon	Non-adherence	Gestational diabetes	Mixed findings	-	Very low	2 (2006-2008)	14,843	USA (2)	Cohort/ longitudinal (2)
Dairy intake *(highest quintile)*	Mijatovic-Vukas et al. (critical)	Female	Precon	Lowest quintile of intake	Gestational diabetes	Not associated in either study	-	Very low	2 (2013-2016)	18,708	USA (2)	Cohort/ longitudinal (2)
Fast food intake *(highest frequency)*	Mijatovic-Vukas et al. (critical)	Female	Precon	Lowest frequency of intake	Gestational diabetes	Positively associated in both studies	-	Very low	2 (both 2014)	18,075	Spain, USA (both 1)	Cohort/ longitudinal (2)
Fruit intake *(high)*	Mijatovic-Vukas et al. (critical)	Female	Precon	Low intake	Gestational diabetes	Mixed findings	-	Very low	2 (2006-2012)	26,585	USA (2)	Cohort/ longitudinal (2)
Iron/haem intake	Mijatovic-Vukas et al. (critical)	Female	Precon	Lower intake	Gestational diabetes	Positively associated in both studies	-	Low	2 (both 2011)	16,633	USA (2)	Cohort/ longitudinal (2)
Red meat intake	Mijatovic-Vukas et al. (critical)	Female	Precon	Lower intake	Gestational diabetes	Positively associated in all studies	-	Very low	3 (2006-2015)	32,257	USA (2), Australia (1)	Cohort/ longitudinal (3)

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
EDUCATION												
Education *(level of)*	Ngandu et al. (critical)	Female	Precon	*Not reported*	Small for gestational age	Mixed findings	-	Very low	2 (2012-2016)	21,637	South Africa, Tanzania (both 1)	Cohort (1), Cross-sectional (1)
Education *(level of)*	Ngandu et al. (critical)	Female	Precon	*Not reported*	Preterm birth	Mixed findings	-	Very low	2 (2012-2016)	21,637	South Africa, Tanzania (both 1)	Cohort (1), Cross-sectional (1)
Education *('high')*	Silvestrin et al. (critical)	Female	Precon	'Low' education	Low birth weight	RR 0.67 (0.51, 0.88)	66.6	Very low	9 (1987-2009)	70,900	USA (3), Canada, India, Iran, Ireland, Norway, Taiwan (all 1)	Cohort (5), Cross-sectional (4)
Education *('average')*	Silvestrin et al. (critical)	Female	Precon	'Low' education	Low birth weight	RR 0.86 (0.70, 1.06)	70.4	Very low	9 (1987-2009)	70,900	USA (3), India, Canada, Iran, Ireland, Taiwan Norway, (all 1)	Cohort (5), Cross-sectional (4)
Education *(low)*	Jia et al. (low)	Female	Precon	Greater education	Neural tube defects	OR 1.40 (1.10, 1.84)	46.4	Very low	4 (1996-2006)	978	USA (2), China, Turkey (both 1)	Case-control (4)
Education *(≤4 years)*	Czarnobay et al. (critical)	Female	Precon	*Not reported*	Macrosomia (≥4kg)	Not associated in either study	-	Very low	2 (2004-2008)	667	Brazil (2)	Cross-sectional (1), Cohort (1)
Education *(≤10 years)*	Flenady et al. (critical)	Female	Precon	Greater education	Stillbirth	aOR 1.68 (1.42, 1.96)	85.3	Very low	5 (1996-2007)	5,254,804	Canada (2), Italy, Norway, USA (all 1)	Cohort (4), Cross-sectional (1)
ENVIRONMENTAL EXPOSURES												
Metal exposure	Spinder et al. (low)	Female	Pericon	Non-exposure	Congenital heart defects	OR 1.83 (0.65, 5.20)	49.8	Very low	3 (2004-2015)	2,780	China (1), Netherlands (1), USA (1)	Case-control (3)
Metal exposure	Spinder et al. (low)	Female	Pericon	Non-exposure	Neural tube defects	Mixed findings	-	Very low	2 (1996-2006)	997	Netherlands (1), USA (1)	Case-control (2)
Pesticide exposure	Spinder et al. (low)	Female	Pericon	Non-exposure	Cleft lip[a]	OR 1.30 (0.84, 2.01)	0.0	Very low	2 (1999-2017)	5,222	Netherlands (1), USA (1)	Case-control (2)
Pesticide exposure	Spinder et al. (low)	Female	Pericon	Non-exposure	Neural tube defects	OR 0.93 (0.76, 1.15)	0.0	Very low	4 (1996-2014)	4,831	USA (3), Netherlands (1)	Case-control (4)

[a] With or without cleft palate

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
FOLIC ACID & OTHER VITAMINS												
Folate supplem-entation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	Cleft lip	RR 0.79 (0.14, 4.36)	20.8	Very low	3 (1991-1994)	5,612	Hungary, Ireland, Multiple (all 1)	Randomised trial (3)
Folate supplem-entation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	Cleft palate	RR 0.73 (0.05, 10.89)	33.2	Very low	3 (1991-1994)	5611	Hungary, Ireland, Multiple (all 1)	Randomised trial (3)
Folate supplem-entation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	Congenital heart defects	RR 0.57 (0.24, 1.33)	0.0	Low	3 (1991-1994)	5612	Hungary, Ireland, Multiple (all 1)	Randomised trial (3)
Folate supplem-entation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	Low birth weight	RR 1.13 (0.84, 1.52)	6.5	Low	2 (1994-2000)	5,048	Hungary, India (both 1)	Randomised trial (2)
Folate supplem-entation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	Miscarriage	RR 1.10 (0.94, 1.28)	5.0	Low	5 (1981-2000)	7,391	Hungary, India, Ireland, UK, Multiple (all 1)	Randomised trial (5)
Folate supplem-entation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	Neural tube defects	RR 0.31 (0.17, 0.58)	0.0	High	5 (1981-2000)	6,708	Hungary, India, Ireland, UK, Multiple (all 1)	Randomised trial (5)
Folate supplem-entation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	'Other' birth defects[a]	RR 0.94 (0.53, 1.66)	40.3	Low	3 (1991-1994)	5,612	Hungary, Ireland, Multiple (all 1)	Randomised trial (3)
Folate supplem-entation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	Pregnancy termination for a foetal anomaly	RR 0.29 (0.15, 0.56)	0.0	High	4 (1981-2000)	7,110	Hungary, India, UK, Multiple countries (all 1)	Randomised trial (4)
Folate supplem-entation	Li et al. (critical)	Female	Pericon	Never/no use	Preterm birth	aOR 0.87 (0.84, 0.91)	0.0	Low	8 (2004-2015)	496,442	China (3), USA (3), Netherlands, Denmark (both 1)	Cohort (8)
Folate supplem-entation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	Twinning	RR 1.38 (0.89, 2.14)	0.0	Low	4 (1991-2000)	7,280	Hungary, India, Ireland, Multiple (all 1)	Randomised trial (4)

[a] Excluding neural tube and congenital heart defects and cleft lip and palate

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
FOLIC ACID & OTHER VITAMINS [continued]												
Folate supplement-ation	De-Regil et al. (high)	Female	Pericon	No intervention, placebo or other vitamins/minerals	Stillbirth	RR 1.05 (0.54, 2.05)	0.0	Very low	4 (1991-2000)	6,597	Hungary, India, Ireland, Multiple (all 1)	Randomised trial (4)
Vitamin supplement-ation	Rumbold et al. (high)	Female	Pericon	Minimal vitamins or none	Miscarriage	RR 1.07 (0.93, 1.24)	36.2	Low	4 (1991-2003)	7,809	Hungary, India, Japan, Multiple (all 1)	Randomised trial (4)
Vitamin supplement-ation	Rumbold et al. (high)	Female	Pericon	Minimal/no vitamin intake	Stillbirth	RR 0.94 (0.48, 1.85)	0.0	Low	3 (1991-2000)	7,785	Hungary, India, Multiple (all 1)	Randomised trial (3)
OVER-THE-COUNTER DRUGS												
Oral contraceptive use	Tang et al. (critical)	Female	Precon	No pre-gravid use	Low birth weight	OR 1.36 (0.92, 2.02)	66.0	Very low	4 (1991-2009)	11,101	Canada, Korea, Thailand, USA (all 1)	Cohort (3), Cross-sectional (1)
Oral contraceptive use	Tang et al. (critical)	Female	Precon	No pre-gravid use	Miscarriage	OR 0.63 (0.41, 0.96)	92.0	Very low	4 (1997-2008)	99,736	Denmark, Korea, USA, Thailand (all 1)	Cohort (3), Cross-sectional (1)
Oral contraceptive use	Tang et al. (critical)	Female	Precon	No pre-gravid use	Preterm birth	OR 1.17 (1.07, 1.27)	0.0	Very low	4 (2004-2015)	49,030	Canada, Korea, Norway, USA (all 1)	Cohort (3), Cross-sectional (1)
Weight loss products	Hoang et al. (critical)	Female	Pericon	Unexposed/ controls	Neural tube defects	Positively associated in all studies	-	Very low	3 (2003-2012)	14,482	USA (3)	Case-control (3)
PHYSICAL ACTIVITY												
Physical activity *(any type)*	Mijatovic-Vukas et al. (critical)	Female	Precon	No physical activity	Gestational diabetes	OR 0.70 (0.57, 0.85)	52.0	Mod-erate	11 (1997-2016)	51,722	USA (8), Australia, Canada, Norway (all 1)	Cohort/ longitudinal (11)
Physical activity *(leisure time, any)*	Mijatovic-Vukas et al. (critical)	Female	Precon	No leisure-time physical activity	Gestational diabetes	OR 0.65 (0.43, 1.00)	90.0	Very low	10 (1997-2016)	49,973	USA (8), Australia, Norway (both 1)	Cohort (10)

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
PHYSICAL ACTIVITY [continued]												
Physical activity *(leisure-time, highest level)*	Aune et al. 2017 (critical)	Female	Precon	Lowest level of leisure-time activity	Preterm birth	RR 0.87 (0.70, 1.06)	16.5	Very low	5 (2005-2016)	12,723	USA (4), New Zealand (1)	Cohort (5)
Physical activity *(highest level)*	Aune et al. 2014a (critical)	Female	Precon	Lowest level of physical activity	Pre-eclampsia	aRR 0.65 (0.47, 0.89)	0.0	Mod-erate	5 (2003-2011)	10,317	USA (3), Denmark, Norway (both 1)	Cohort (4), Case-control (1)
High-intensity physical activity	Aune et al. 2014a (critical)	Female	Precon	Low-intensity physical activity	Pre-eclampsia	aRR 0.55 (0.25, 1.21)	56.0	Very low	2 (2003-2010)	4,240	Norway, USA (both 1)	Cohort (1), Case-control (1)
SMOKING												
Smoking	Czarnobay et al. (critical)	Female	Precon	Non-smoking	Excess birth weight	Not significantly associated in either study	-	Very low	2 (both 2017)	645	Brazil (2)	Cross-sectional (2)
Passive smoking	Sabbagh et al. (critical)	Female	Precon	No exposure	Non-syndromic orofacial clefts	OR 1.62 (0.93, 2.82)	0.0	Very low	2 (2007-2011)	3,873	Greece, USA (both 1)	Case-control (2)
VACCINATION												
4vHPV vaccination *(0-45 days before last menses)*	Tan et al. (critical)	Female	Precon	No/placebo vaccination or vaccination 16-22 weeks before last menstruation	Miscarriage	RR 1.00 (0.80, 1.24)	0.0	Very low	3 (2009-2018)	3,604	Multiple (2), USA (1)	Clinical trial (2), Cohort (1)

Abbreviations: Precon, Preconception; Pericon, Periconception; (a)OR, adjusted odds ratio; (a)RR, (adjusted) risk ratio; RCT, Randomized controlled trial; AHEI, Alternate healthy eating index; 4vHPV, 4-Valent Human Papillomavirus

iii. Pre-pregnancy Weight/Body Mass Index (BMI) [eTable 7]

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
LOW WEIGHT/UNDERWEIGHT												
Under-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Caesarean delivery	OR 0.81 (0.72, 0.90)	30.5	Very low	9 (1995-2006)	>23,546	USA (5), Denmark, Finland, Iran, Sweden (all 1)	Cohort (9)
Under-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Haemorrhage	OR 0.67 (0.55, 0.82)	36.0	Very low	4 (1995-2006)	22,215	Austria, Denmark, Finland, USA (all 1)	Cohort (4)
Under-weight[a]	Rahman et al. (critical)	Female	Pericon	'Normal' BMI	Hypertension (pregnancy-induced)	OR 0.50 (0.40, 0.61)	0.0	Mod-erate	5 (2005-2013)	37,577	China (2), Brazil, India, Iran (all 1)	Cohort (5)
Under-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Perineal trauma	Mixed findings	-	Very low	2 (1999-2006)	5,590	Denmark, USA (both 1)	Cohort (2)
Under-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Post-term pregnancy	Mixed findings	-	Very low	2 (1995-2006)	41,815	Denmark, Finland (both 1)	Cohort (2)
Under-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Retained placenta	Mixed findings	-	Very low	2 (1999-2006)	5,590	Denmark, USA (both 1)	Cohort (2)
BMI <20 kg/m^2	Torloni et al. (critical)	Female	Pericon	BMI 20–24.9 kg/m^2	Gestational diabetes	OR 0.75 (0.69, 0.82)	16.8	Low	16 (1997-2007)	356,403	USA (8), Canada (4), Japan (2), Brazil, UK (both 1)	Cohort (16)
BMI <20 kg/m^2	Wang et al. (critical)	Female	Pericon	BMI 20–24.9 kg/m^2	Pre-eclampsia	aRR 0.77 (0.63, 0.95)	52.5	Low	6 (1999-2009)	99,015	USA (4), Argentina, Australia (both 1)	Cohort (6)
BMI ≤18.5 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Large for gestational age	OR 0.52 (0.44, 0.61)	45.8	Low	9 (2001-2013)	103,415	China (3), USA (2), India, Ireland, Korea, Spain (all 1)	Cohort (9)
BMI ≤18.5 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Low birth weight	OR 1.67 (1.39, 2.02)	68.2	Very low	15 (1998-2013)	219,675	China (6), UK (3), USA (2), India, Iran, Korea, Spain (all 1)	Cohort (15)

[a] Author-defined

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
LOW WEIGHT/UNDERWEIGHT [continued]												
BMI ≤18.5 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Macrosomia	OR 0.55 (0.47, 0.63)	34.2	Low	28 (2001-2014)	170,484	China (17), UK (3), Korea (2), Australia, Iran, Ireland, Italy, Spain, USA (all 1)	Cohort (28)
BMI ≤18.5 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	NICU admission	OR 1.01 (0.92, 1.11)	52.5	Very low	6 (1998-2012)	28,764	China (3), India, Spain, USA (all 1)	Cohort (6)
BMI <18.5 (±1.5) kg/m^2	Balsells et al. (critical)	Female	Pericon	BMI 18.5–24.9 (±1.5) kg/m^2	Miscarriage	RR 1.08 (1.05, 1.11)	23.0	Very low	30 (1999-2016)	211,079	USA (5), Denmark (4), UK (4), China (3), France (3), Australia, Ireland, Spain (all 2), Brazil, Canada, Korea, Kuwait, Norway (all 1)	Cohort (30)
BMI <18.5 kg m^2	Huang et al. (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Breast-feeding initiation	RR 1.28 (1.11, 1.48)	66.2	Very low	14 *(Not reported)*	11,710	*Not reported*	Cohort (14)
BMI <18.5 kg/m^2	Liu et al. 2019 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Foetal distress	OR 0.96 (0.82, 1.12)	0.0	Very low	5 (2010-2015)	20,210	China (5)	Cohort (5)
BMI <18.5 kg/m^2	Liu et al. 2019 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Neonatal asphyxia	OR 1.18 (0.91, 1.54)	17.0	Very low	9 (2005-2016)	13,101	China (9)	Cohort (9)
BMI <18.5 kg/m^2	Adane et al. (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Placental abruption	OR 1.38 (1.12, 1.70)	55.2	Low	7 (2010-2019)	595,546	UK, USA (both 2), Australia, Taiwan, Turkey (all 1)	Cohort (6), Case-control (1)

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
LOW WEIGHT/UNDERWEIGHT [continued]												
BMI <18.5 kg/m^2	Liu et al. 2019 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Preterm birth	OR 1.03 (0.95, 1.15)	59.1	Very low	21 (2008-2016)	678,104	China (21)	Cohort (21)
BMI <18.5 kg/m^2	Liu et al. 2019 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Small for gestational age	OR 1.75 (1.51, 2.02)	80.0	Low	10 (2005-2016)	170,569	China (10)	Cohort (10)
OVERWEIGHT/OBESITY/INCREASING BMI												
Increasing BMI	Aune et al. 2014b (low)	Female	Pericon	Lowest category of BMI	Neonatal death	aRR 1.15 (1.07, 1.23)	78.5	Mod-erate	12 (2005-2014)	3,321,555	UK (6), Denmark (2), Australia, China, Sweden, USA (all 1)	Cohort (12)
Increasing BMI	Aune et al. 2014b (low)	Female	Pericon	Lowest category of BMI	Miscarriage	aRR 1.16 (1.07, 1.26)	33.0	Mod-erate	5 (1992-2011)	138,924	UK (3), Australia, Denmark (both 1)	Cohort (5)
BMI	Ioannidou et al. (low)	Female	Pericon	Women without pregnancy difficulties	Hyperemesis Gravidarum	Mixed findings	-	Very low	3 (2006-2017)	258	Turkey (3)	Case-control (3)
Greater BMI	Roelants et al. (critical)	Female	Pericon	*Not reported*	Neonatal fat mass	Mixed findings	~	Very low	3 (2011-2015)	954	Ireland, UK, USA (all 1)	Longitudinal /Cohort (3)
Obesity[a]	Molyneaux et al. (low)	Female	Pericon	'Normal' weight	Antenatal depression	OR 1.43 (1.27, 1.61)	44.4	Low	28 (2000-2013)	47,929	USA (17), UK, Netherlands (both 2), Australia, Brazil, France, India, Japan, Peru, Spain (all 1)	Cohort (20), Cross-sectional (3), RCT baseline (2), Case-control (2)
Obesity[a]	Molyneaux et al. (low)	Female	Pericon	'Normal' weight	Antenatal anxiety	OR 1.41 (1.10, 1.80)	60.7	Very low	10 (2002-2013)	30,516	USA (4), UK (2), Brazil, France, Peru, Spain (all 1)	Cohort (7), Cross-sectional (2), Case-control (1)

[a] Author-defined

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
OVERWEIGHT/OBESITY/INCREASING BMI [continued]												
Obesity[a]	Molyneaux et al. (low)	Female	Pericon	'Normal' weight	Antenatal binge eating disorder	Mixed findings	-	Very low	2 (2007-2013)	28,862	Norway, UK (both 1)	Cohort (1), Cross-sectional(1)
BMI 25-29.9 kg/m^2	Huang et al. (critical)	Female	Pericon	BMI 20–24.9 kg/m^2	Breastfeeding initiation	RR 1.32 (1.19, 1.48)	86.4	Very low	21 (2004-2018)	46,288	United States (8), Canada (4), Australia (2), Belgium, Denmark, Germany, Iran, France, Norway, Spain (all 1)	Cohort/ longitudinal (21)
BMI ≥30 kg/m^2	Huang et al. (critical)	Female	Pericon	BMI 20–24.9 kg/m^2	Breastfeeding initiation	RR 1.49 (1.33, 1.67)	86.2	Very low	18 *(not reported)*	33,977	*Not reported*	Cohort/ longitudinal (18)
Over-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Caesarean delivery	OR 1.48 (1.39, 1.58)	0.0	Very low	14 (1995-2007)	>39,220	USA (5), Denmark (3), Australia, France, Iran, Italy, Sweden, UK (all 1)	Cohort (14)
Obesity[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Caesarean delivery	OR 2.00 (1.87, 2.15)	0.0	Low	16 (1995-2006)	>58,429	USA (8), Denmark (3), Australia, Finland, France, Iran, UK (all 1)	Cohort (16)
Severe obesity[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Caesarean delivery	aOR 1.43 (1.35, 1.52)	95.1	Very low	5 (1998-2007)	577,984	USA (2), Australia, Sweden, UK (all 1)	Cohort (5)
Obesity[a] [b]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Failure to progress in labour	OR 2.31 (1.87, 2.84)	50.9	Low	3 (1998-2007)	14,721	USA (2), UK (1)	Cohort (3)
Over-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Foetal distress	OR 2.06 (1.44, 2.96)	0.0	Low	4 (2004-2007)	6,469	USA (3), UK (1)	Cohort (4)

[a] Author-defined; [b] Includes 'severe' obesity

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
OVERWEIGHT/OBESITY/INCREASING BMI [continued]												
Obesity[a] [b]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Foetal distress	OR 1.74 (1.67, 1.81)	87.7	Mod-erate	6 (1998-2007)	628,337	USA (4), Sweden, UK (both 1)	Cohort (6)
BMI ~25-29.9 kg/m^2	Torloni et al. (critical)	Female	Pericon	BMI 20–24.9 kg/m^2	Gestational diabetes	OR 1.97 (1.77, 2.19)	55.6	Mod-erate	17 (1995-2007)	395,338	USA (10), Canada (4), Brazil, France, UK (all 1)	Cohort (17)
BMI >30 kg/m^2	Torloni et al. (critical)	Female	Pericon	BMI 20–24.9 kg/m^2	Gestational diabetes	OR 3.76 (3.31, 4.28)	72.8	Mod-erate	31 (1992-2007)	364,668	USA (14), Canada, France (both 4), UK (2), Brazil, Denmark, Israel, Italy, Mexico, Spain, Sweden (all 1)	Cohort (31)
Over-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Haemorrhage	OR 1.42 (1.10, 1.84)	44.8	Very low	3 (1999-2006)	13,578	Austria, Denmark, USA (all 1)	Cohort (3)
Obesity[a] [b]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Haemorrhage	OR 1.24 (1.20, 1.28)	80.0	Very low	8 (1995-2006)	776,949	USA (2), Austria, Denmark, Finland, Israel, Sweden, UK (all 1)	Cohort (8)
Over-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Hospital stay *(length of)*	OR 2.56 (2.46, 2.67)	88.6	Low	4 (1995-2006)	>9,511	France (2), Australia (1), USA (1)	Cohort (4)
Obesity[a] [b]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Hospital stay *(length of)*	OR 2.84 (2.77, 2.91)	94.4	Low	4 (1995-2006)	>20,414	USA (2), Australia, France (both 1)	Cohort (4)
Over-weight[a]	Rahman et al. (critical)	Female	Pericon	'Normal' BMI	Hypertension *(pregnancy-induced)*	OR 2.27 (2.01, 2.56)	0.1	Mod-erate	5 (2005-2013)	40,140	China (2), Brazil, India, Iran (all 1)	Cohort (5)
Obesity[a]	Rahman et al. (critical)	Female	Pericon	'Normal' BMI	Hypertension *(pregnancy-induced)*	OR 5.61 (4.86, 6.46)	0.0	Mod-erate	5 (2005-2013)	34,358	China (2), Brazil, India, Iran (all 1)	Cohort (5)
Over-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Instrumental delivery	OR 0.77 (0.67, 0.89)	42.7	Very low	3 (1999-2006)	12,984	Australia, Denmark, USA (all 1)	Cohort (3)

[a] Author-defined; [b] Includes 'severe' obesity

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
OVERWEIGHT/OBESITY/INCREASING BMI [continued]												
Obesity[a] [b]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Instrumental delivery	aOR 1.17 (1.13, 1.21)	51.7	Very low	2 (2004-2005)	617,763	Denmark, Sweden (both 1)	Cohort (2)
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Large for gestational age	OR 1.45 (1.29, 1.63)	67.7	Low	13 (2001-2015)	138,290	USA (4), India (3), Australia (2), Canada, China, Finland, Ireland (all 1)	Cohort (13)
BMI ≥30 kg/m^2	Gaudet et al. (critical)	Female	Pericon	BMI <25 kg/m^2	Large for gestational age	OR 2.42 (1.16, 2.72)	97.0	Mod-erate	13 (1995-2011)	1,234,580	USA (6), Denmark (2), Australia, Finland, Germany, Hong Kong, UK	Cohort (12), RCT baseline (1)
Obesity[a] [b]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' & non-obese BMI	Low Apgar score *(at five minutes*)	OR 1.69 (1.60, 1.80)	82.2	Low	5 (1998-2005)	760,099	Denmark, Israel, Sweden, UK, USA (all 1)	Cohort (5)
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Low birth weight	OR 1.09 (0.95, 1.26)	69.2	Very low	18 (1998-2015)	235,379	China (4), UK (3), India, USA (both 2), Canada, Finland, Iran, Korea, Spain, Turkey, UAE (all 1)	Cohort (18)
BMI ≥30 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Low birth weight	OR 1.24 (1.09, 1.41)	47.5	Very low	17 (1998-2015)	242,695	China, UK (both 3), India, USA (both 2), Canada, Finland, Iran, Korea, Nigeria, Turkey, UAE (all 1)	Cohort (16), Case-control (1)
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Macrosomia	OR 1.70 (1.55, 1.87)	48.6	Low	27 (2004-2015)	446,753	China (12), Korea, UK (both 2), Australia, Canada, Denmark, India, Iran, Ireland, Italy, Sudan, Turkey, UAE, USA (all 1)	Cohort (27)

[a] Author-defined; [b] Includes 'severe' obesity

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
OVERWEIGHT/OBESITY/INCREASING BMI [continued]												
BMI ≥30 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Macrosomia (>4 kg)	OR 2.92 (2.67, 3.20)	0.0	Mod-erate	23 (2000-2015)	93,017	China (11), USA (2), Australia, Canada, Iran, Ireland, Israel, Italy, Korea, Nigeria, Spain, UAE (all 1)	Cohort (21), Case-control (2)
Obesity[a b]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' & non-obese BMI	Maternal infection	OR 3.34 (2.74, 4.06)	89.6	Very low	6 (1993-2006)	37,988	UK, USA (both 2), Austria, Finland (both 1)	Cohort (6)
Obesity[a b]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Maternal tears/ lacerations	OR 1.02 (0.97, 1.08)	0.0	Very low	5 (1995-2006)	624,925	Denmark, Finland, Sweden, UK, USA (all 1)	Cohort (5)
BMI 25-29.9 (±1.5) kg/m^2	Balsells et al. (critical)	Female	Pericon	BMI 18.5–24.9 (±1.5) kg/m^2	Miscarriage	RR 1.09 (1.04, 1.13)	28.0	Low	23 (2002-2016)	138,988	Denmark, USA (both 4), UK (3), Australia, Ireland, Spain (all 2), Brazil, Canada, China, France, Kuwait, Norway (all 1)	Cohort (23)
BMI ≥30 (±1.5) kg/m^2	Balsells et al. (critical)	Female	Pericon	BMI 18.5–24.9 (±1.5) kg/m^2	Miscarriage	RR 1.21 (1.15, 1.27)	20.0	Low	22 (2002-2014)	121,393	Denmark, USA (both 4), Australia, Ireland, Spain, UK (all 2), Brazil, Canada, China, France, Kuwait, Norway (all 1)	Cohort (22)
BMI >23 kg/m^2	Liu et al. 2019 (critical).	Female	Pericon	BMI 18.5–24.9 kg/m^2	Neonatal asphyxia	OR 1.74 (1.39, 2.17)	0.0	Very low	9 (2005-2016)	13,101	China (9)	Cohort (9)
Obesity[a b]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Neonatal jaundice	OR 1.04 (0.93, 1.16)	52.8	Very low	3 (2003-2007)	10,761	Australia, Denmark, Thailand (all 1)	Cohort (3)
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	NICU admission	OR 1.29 (1.12, 1.48)	59.4	Very low	11 (1998-2015)	69,989	China (3), India (2), Australia, Canada, Finland, UAE, USA, UK (all 1)	Cohort (11)

[a] Author-defined; [b] Includes 'severe' obesity

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
OVERWEIGHT/OBESITY/INCREASING BMI [continued]												
BMI ≥30 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	NICU admission	OR 1.91 (1.60, 2.29)	66.3	Low	17 (1998-2015)	72,398	China (3), India, UAE, UK, USA (all 2), Australia, Canada, Finland, Israel, Nigeria, Spain (all 1)	Cohort (15), Case-control (2)
Over-weight[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Perineal trauma	Not associated in either study	-	Very low	2 (1999-2006)	5,555	Denmark, USA (both 1)	Cohort (2)
BMI 25-29.9 kg/m^2	Adane et al. (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Placental abruption	OR 0.84 (0.76, 0.93)	0.0	Mod-erate	7 (2013-2019)	595,439	UK (2), Australia, Canada, Taiwan, Turkey, USA (all 1)	Cohort (6), Case-control (1)
BMI ≥30 kg/m^2	Adane et al. (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Placental abruption	OR 0.77 (0.68, 0.87)	28.2	Mod-erate	7 (2009-2019)	595,809	USA (2), Australia, Canada, Taiwan, Turkey, UK (all 1)	Cohort (5), Case-control (2)
Obesity[a] [b]	Heslehurst et al. (critical)	Female	Pericon	''Ideal' & non-obese BMI	Placenta previa	OR 0.83 (0.71, 0.96)	26.8	Very low	4 (2001-2004)	753,639	Israel, Sweden, UAE, USA (all 1)	Cohort (4)
Over-weight[a]	Heslehurst et al. (critical)	Female	Pericon	''Ideal' BMI	Post-term pregnancy	OR 1.28 (1.20, 1.37)	51.5	Low	3 (1995-2006)	50,989	Denmark (2), Finland (1)	Cohort (3)
Obesity[a] [b]	Heslehurst et al. (critical)	Female	Pericon	''Ideal' BMI	Post-term pregnancy	OR 1.41 (1.38, 1.45)	78.8	Low	4 (1995-2006)	654,753	Denmark (2), Finland, Sweden (both 1)	Cohort (4)
BMI ~25-29.9 (±0.5) kg/m^2	Wang et al. (critical)	Female	Pericon	BMI ~20–24.9 kg/m^2	Pre-eclampsia	aRR 1.70 (1.60, 1.81)	29.4	Mod-erate	10 (1997-2012)	944,324	USA (4), Denmark (2), Argentina, Australia, Ireland, Sweden (all 1)	Cohort (10)

[a] Author-defined; [b] Includes 'severe' obesity

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
OVERWEIGHT/OBESITY/INCREASING BMI [continued]												
BMI ~30–34.9 (±0.5) kg/m^2	Wang et al. (critical)	Female	Pericon	BMI ~20–24.9 kg/m^2	Pre-eclampsia	aRR 2.93 (2.58, 3.33)	66.6	Mod-erate	9 (1997-2012)	1,720,331	Denmark, Sweden, USA (all 2), Argentina, Australia, Ireland (all 1)	Cohort (9)
BMI ≥35 (±0.5) kg/m^2	Wang et al. (critical)	Female	Pericon	BMI ~20–24.9 kg m^2	Pre-eclampsia	aRR 4.14 (3.61, 4.75)	0.0	Mod-erate	4 (2004-2012)	863,221	USA (2), Ireland, Sweden (both 1)	Cohort (4)
Obesity[a]	Heslehurst et al. (critical)	Female	Pericon	'Ideal' BMI	Premature rupture of membranes	Positively associated in all studies	-	Very low	3 (1993-2004)	143,044	Israel, UK, USA (all 1)	Cohort (3)
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Preterm birth	OR 1.00 (0.96, 1.03)	58.0	Very low	18 (2001-2013)	183,259	China (4), USA (3), UK (2), Australia, Finland, Iran, Ireland, Korea, Nigeria, Sudan, Turkey, UAE (all 1)	Cohort (17), Case-control (1)
BMI ≥30 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Preterm birth	OR 1.05 (1.01, 1.09)	62.8	Very low	15 (2001-2013)	232,099	USA (3), UK (3), China (2), Australia, India, Ireland, Korea, Sudan, Turkey, UAE (all 1)	Cohort (15)
BMI 25-29.9 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Small for gestational age	OR 0.71 (0.66, 0.76)	37.4	Low	11 (2001-2015)	77,726	USA (3), Australia, China, India (both 2), Canada, Finland (both 1)	Cohort (11)
BMI ≥30 kg/m^2	Liu et al. 2016 (critical)	Female	Pericon	BMI 18.5–24.9 kg/m^2	Small for gestational age	OR 0.88 (0.78, 0.99)	68.8	Very low	20 (2001-2015)	215,983	USA (6), China (4), India (3), Australia (2), Canada, Finland, Ireland, Spain, UK (all 1)	Cohort (20)
BMI ≥30 kg/m^2	Zhang et al. (critical)	Female	Pericon	BMI <30 kg/m^2	Shoulder dystocia	aRR 1.76 (1.12, 2.77)	50.4	Mod-erate	6 (2003-2016)	162,827	USA (2), Denmark, Finland, France, India (all 1)	Cohort (5), Case-control (1)

[a] Author-defined

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (years published)	N sample	Countries (#)	Study designs
OVERWEIGHT/OBESITY/INCREASING BMI [continued]												
Over-weight/ Obesity[a]	Barbosa et al. (low)	Female	Pericon	'Low or normal weight'	Urinary incontinence	OR 1.45 (0.95, 2.23)	77.0	Very low	2 (2010-2016)	1,988	Australia (1), Turkey (1)	Cohort (1), Cross-sectional (1)

Abbreviations: BMI, Body mass index; NICU, Neonatal intensive care unit; Precon, Preconception; Pericon, Periconception; (a)RR, (adjusted) risk ratio; (a)OR, adjusted odds ratio; NICU, Neonatal intensive care unit. [a] Author-defined

iv. Interpregnancy Weight Change [eTable 7]

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
INTERPREGNANCY WEIGHT LOSS												
Loss of > 1 kg/m^2	Timmermans et al. (low)	Female	Precon	BMI maintenance (-1 to 1 kg/m^2)	Caesarean delivery	aOR 1.01 (0.94, 1.10)	40.0	Very low	4 (2006-2017)	123,642	Belgium, Sweden, UK, USA (all 1)	Cohort (4)
Loss of > 1 kg/m^2	Teulings et al. (critical)	Female	Precon	BMI maintenance (-1 to 1 kg/m^2)	Gestational diabetes	aOR 0.89 (0.68, 1.09)	58.1	Very low	5 (2006-2015)	258,970	USA (2), Australia, Norway, Sweden (all 1)	Cohort/ case-control (5)
Loss of > 1 kg/m^2	Timmermans et al. (low)	Female	Precon	BMI maintenance (-1 to 1 kg/m^2)	Large for gestational age	aOR 0.80 (0.66, 0.98)	95.0	Low	4 (2006-2019)	102.496	UK (2), Sweden, USA (both 1)	Cohort (4)
Loss of > 1 kg/m^2	Timmermans et al. (low)	Female	Precon	BMI maintenance (-1 to 1 kg/m^2)	Preterm birth	aOR 1.40 (1.08, 1.83)	72.0	Low	2 (2014-2019)	8,406	UK, USA (both 1)	Cohort (2)
Loss of > 1 kg/m^2	Oteng-Ntim et al. (low)	Female	Precon	BMI maintenance (≤2 kg/m2)	Small for gestational age	aOR 1.31 (1.06, 1.63)	53.5	Low	3 (2004-2016)	49,008	USA (2), UK (1)	Cohort (3)
Loss of > 2 kg/m^2	Martinez-Hortelano et al. (low)	Female	Precon	BMI maintenance (≤2 kg/m^2)	Gestational hypertension	OR 0.90 (0.76, 1.04)	20.4	Very low	6 (1999-2017)	239,150	USA (2), Belgium, Canada, Sweden, UK (all 1)	Cohort (6)
Loss of > 2 kg/m^2	Martinez-Hortelano et al. (low)	Female	Precon	BMI maintenance (≤2 kg/m^2)	Pre-eclampsia	OR 0.93 (0.71, 1.15)	78.1	Very low	5 (2006-2017)	364,943	USA (3), Sweden, UK (both 1)	Cohort (5)
INTERPREGNANCY WEIGHT GAIN												
Gain of >1 kg/m^2	Oteng-Ntim et al. (low)	Female	Precon	BMI maintenance (≤2 kg/m^2)	Small for gestational age	aOR 0.83 (0.70, 0.99)	56.8	Low	3 (2004-2016)	49,008	USA (2), UK (1)	Cohort (3)
Gain of 1-<3 kg/m^2	Timmermans et al. (low)	Female	Precon	BMI maintenance (-1 to 1 kg/m^2)	Caesarean delivery	aOR 1.13 (1.06, 1.20)	51.0	Mod-erate	4 (2006-2017)	158,364	Belgium, Sweden, UK, USA (all 1)	Cohort (4)
Gain of ≥3 kg/m^2	Oteng-Ntim et al. (low)	Female	Precon	BMI maintenance (≤2 kg/m^2)	Caesarean delivery	aOR 1.72 (1.32, 2.24)	89.1	Mod-erate	4 (2006-2016)	341,960	Belgium, Sweden, UK, USA (all 1)	Cohort (4)

Exposure	Review (ASMTAR 2 rating)	Sex	Period	Comparison	Outcome	Summary estimate (95% CI)	I^2	GRADE rating	# of studies (publication years)	N sample	Countries (#)	Study designs
INTERPREGNANCY WEIGHT GAIN [continued]												
Gain of 1-<3 kg/m^2	Teulings et al. (critical)	Female	Precon	BMI maintenance (-1 to 1 kg/m^2)	Gestational diabetes	aOR 1.51 (1.22, 1.80)	71.0	Mod-erate	5 (2006-2015)	251,992	USA (2), Belgium, Norway, Sweden (all 1)	Cohort (5)
Gain of ≥3 kg/m^2	Teulings et al. (critical)	Female	Precon	BMI maintenance (-1 to 1 kg/m^2)	Gestational diabetes	aOR 2.37 (1.40, 3.34)	91.0	Mod-erate	4 (2006-2017)	234,772	USA (2), Australia, Sweden (both 1)	Cohort (5)
Gain of 1-<3 kg/m^2	Timmermans et al. (low)	Female	Precon	BMI maintenance (-1 to 1 kg/m^2)	Large for gestational age	aOR 1.33 (1.11, 1.60)	0.00	Mod-erate	4 (2006-2019)	138,205	UK (2), Sweden, USA (both 1)	Cohort (4)
Gain of ≥3 kg/m^2	Timmermans et al. (low)	Female	Precon	BMI maintenance (-1 to 1 kg/m^2)	Large for gestational age	aOR 1.54 (1.28, 1.86)	0.00	Mod-erate	4 (2006-2019)	103,350	UK (2), Sweden, USA (both 1)	Cohort (4)
Gain of 2-4 kg/m^2	Timmermans et al. (low)	Female	Precon	BMI maintenance (-2 to 2 kg/m^2)	Preterm birth	aOR 1.09 (0.88, 1.36)	*NR*	Very low	2 (both 2016)	422,291	Australia, Sweden (both 1)	Cohort (2)
Gain of ≥4 kg/m^2	Timmermans et al. (low)	Female	Precon	BMI maintenance (-2 to 2 kg/m^2)	Preterm birth	aOR 1.05 (0.83, 1.34)	*NR*	Very low	2 (both 2016)	377,114	Australia, Sweden (both 1)	Cohort (2)
Gain of $\geq$2 kg/m^2	Martinez-Hortelano et al. (low)	Female	Precon	BMI maintenance (-2 to 2 kg/m^2)	Gestational hypertension	OR 1.45 (1.11, 1.80)	76.1	Mod-erate	6 (1999-2017)	239,150	USA (2), Belgium, Canada, Sweden, UK (all 1)	Cohort (6)
Gain of >2 kg/m^2	Martinez-Hortelano et al. (low)	Female	Precon	BMI maintenance (-2 to 2 kg/m^2)	Pre-eclampsia	OR 1.39 (1.18, 1.60)	39.2	Low	5 (2006-2017)	364,943	USA (3), Sweden, UK (both 1)	Cohort (5)

Abbreviations: BMI, Body mass index; Precon, Preconception; Pericon, Periconception; (a)RR, (adjusted) risk ratio; (a)OR, adjusted odds ratio; NR, Not reported