Abortion and the risk of subsequent preterm birth: a systematic review with meta-analyses
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CRD summary
The authors concluded that induced and spontaneous abortion modestly increased the risk of pre-term birth in subsequent pregnancies. The risk varied inversely with the population preterm birth rate. The review was generally well conducted, but potential bias in the primary studies and unquantified heterogeneity among them mean that some caution may be advisable in interpreting these conclusions.

Authors' objectives
To investigate the association between induced or spontaneous abortion and the risk of subsequent preterm birth.

Searching
PubMed, Science Citation Index Expanded, EMBASE and Scopus were searched for articles published between 1995 and October 2007. Search terms were reported. References of retrieved articles were handsearched and an expert informant was consulted. There was no restriction by language.

Study selection
Cohort and case-control studies of induced or spontaneous abortion were eligible for inclusion, provided data on the two types of abortion were reported separately. The outcome of interest in the review was risk of preterm birth. Studies were required to address potential confounders in order to be included in meta-analysis.

Methods for participant selection in the included studies varied widely: data sources included surveys, national registries and hospital records from Europe, Asia, and USA. Studies were controlled for a wide range of demographic and clinical confounders, but maternal age was the only covariate controlled for by all studies. All studies restricted analysis to singleton births. Periods of gestation varied. In studies of induced abortion vacuum aspiration was the most commonly used surgical technique. None of the studies of spontaneous abortion described medical or surgical management. Some studies compared induced abortion with no abortion. Preterm birth was defined as delivery earlier than 37 weeks. The review also reported more marked preterm births (from earlier than 28 weeks to 32 weeks).

The lead author and librarian worked together to identify relevant studies.

Assessment of study quality
Study quality was assessed using a published checklist for observational studies (Tooth 2005) with 33 criteria. Two reviewers independently assessed the studies. Disagreements were resolved by consensus.

Data extraction
Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated from the numbers of preterm births in the intervention and control groups of each study. Confounders were controlled for by comparing adjusted and unadjusted data. The authors stated that they used recommended review methodology (Egger 2001), with data extraction conducted in duplicate by independent reviewers.

Methods of synthesis
Studies were grouped by the type of abortion (induced/spontaneous) and number of abortions (one/more than one) and subgrouped by study design (cohort/case-control). Data were then combined using a random-effects linear mixed model to calculate maximum likelihood estimates of the mean log-odds ratio and between-study variance. Results were displayed graphically in forest plots, including pooled mean ORs with 95% CIs. Meta-regression was used to examine potential heterogeneity (variability between the studies) associated with the preterm birth rate in the non-abortion group in cohort studies. Publication bias was assessed using a modified version of Macaskill's test.

Results of the review
Sixteen studies were included in the review (n=982,579, range 206 to 60,188). There were 12 analyses of induced abortion (eight cohort, n=313,313, and four case-control, n=11,498) and nine of spontaneous abortion (six cohort, n=856,014 and three case-control, n=1,626).

**Induced abortion:** The risk of preterm birth increased modestly following one or more induced abortions (adjusted OR 1.32, 95% CI 1.11 to 1.53; 10 studies). The OR increased with multiple induced abortions and ranged from 1.25 (95% CI 1.03 to 1.48) following one abortion to 1.51 (95% CI 1.21 to 1.75) following two or more abortions. The risk of more marked preterm birth associated with induced abortion was 1.64 (95% CI 1.38 to 1.91; four studies). Results from unadjusted data were similar. Statistical testing showed heterogeneity among the studies.

**Spontaneous abortion:** The risk of preterm birth increased following one spontaneous abortion (adjusted OR 1.43, 95% CI 1.05 to 1.66; six studies) and following more than one spontaneous abortion (adjusted OR 2.27, 95% CI 1.98 to 2.81; seven studies).

Meta-regression showed a statistically significant inverse relationship between the baseline preterm birth rate and the risk associated with either type of abortion. ORs were higher in populations with lower baseline preterm birth rates. This explained some of the heterogeneity between the studies.

The funnel plot did not show evidence of significant publication bias.

**Authors' conclusions**
Induced and spontaneous abortion modestly increased the risk of preterm birth in subsequent pregnancies. The risk varied inversely with the population preterm birth rate.

**CRD commentary**
The objectives and inclusion criteria of the review were clear. Relevant sources were searched for studies without restriction by language or publication status. Steps were taken to reduce the risk of reviewer bias and error by having more than one reviewer conduct study selection, data extraction and validity assessment. Relevant criteria were used to assess validity and only studies meeting predetermined quality criteria were included. However, the specific criteria used to determine study eligibility were not explicit and details of the quality of individual studies were not reported (for example, follow up rates). Appropriate statistical techniques appear to have been used to combine studies, explore differences between them and check for publication bias. However, insufficient details were reported about statistical heterogeneity, such as how it was assessed, the statistical significance of heterogeneity found and the degree of residual heterogeneity after adjustment for baseline preterm birth rates. The authors took into account study quality and design and potential sources of bias (such as reliance on self-reported outcomes in the primary studies) in their interpretation of the evidence. The review was generally well-conducted, but in view of potential bias in the primary studies and unquantified heterogeneity, some caution may be advisable in interpreting these conclusions.

**Implications of the review for practice and research**
**Practice:** The authors stated that their results were only generalisable to developed countries where abortion was legal and vacuum aspiration used routinely.

**Research:** The authors did not state any implications for further research.

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