

Dietary intake of acrylamide and risk of breast, endometrial and ovarian cancer: a systematic review and dose-response meta-analysis

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Background

Acrylamide is a probable human carcinogen that occurs naturally in starchy foods during cooking processes at high temperatures. Aside from occupational exposures and smoking, the main source of human exposure is diet, particularly consumption of

potatoes, grain products, and coffee. High acrylamide intake has been associated with altered sex-steroid hormone concentrations and increased risk of hormone-dependent gynecologic neoplasms in animal models and in some observational studies in humans.

Methods

We performed a systematic review of the papers investigating the association between acrylamide intake and risk of breast, endometrial and ovarian cancer. We also examined a possible dose-response relation by carrying out a dose-response meta-analysis of these

studies. We used a restricted cubic spline model with 3 knots at fixed percentiles (10, 50, 90%) and we pooled study specific estimates using restricted maximum likelihood methods in a random effects meta-analysis.

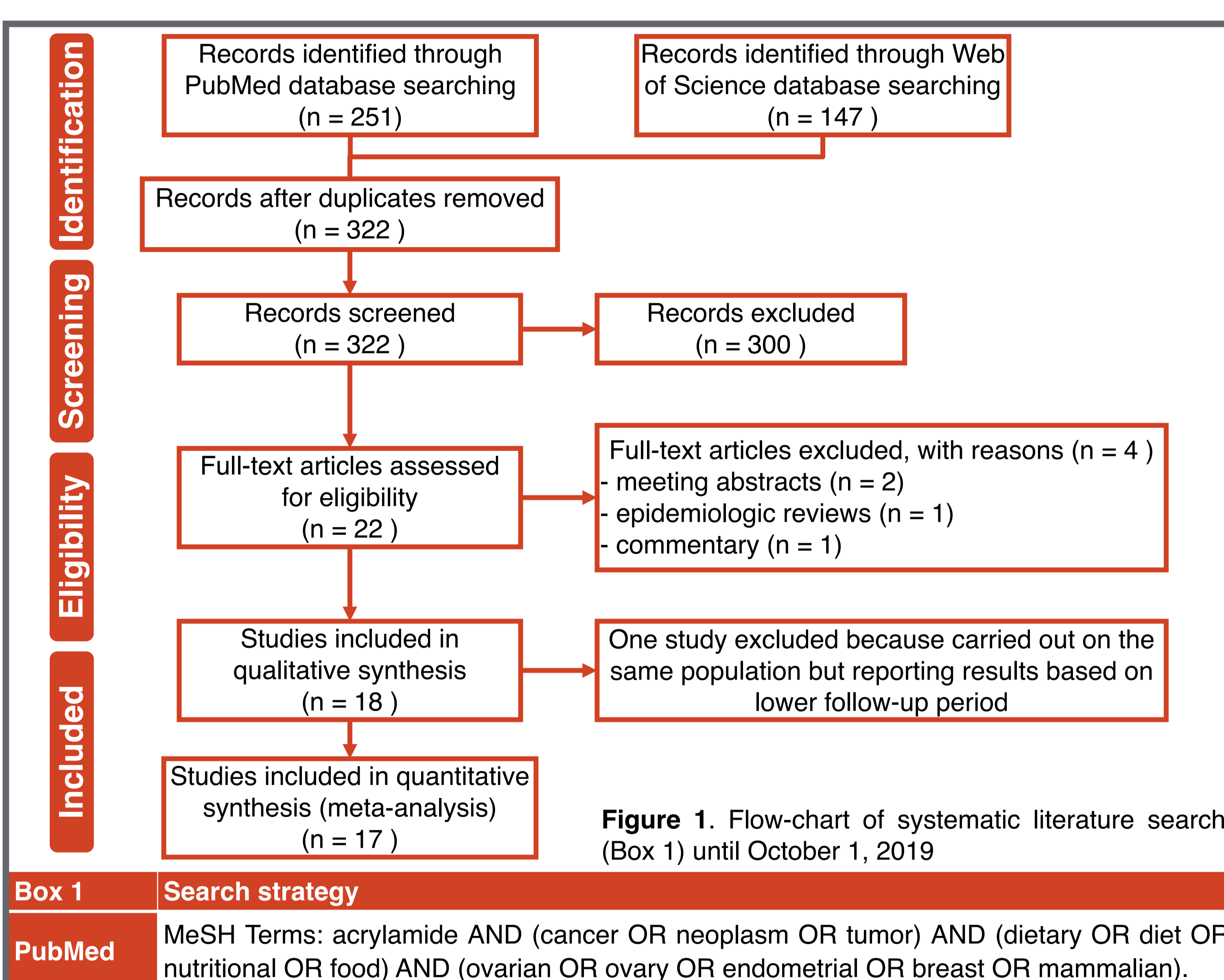


Figure 1. Flow-chart of systematic literature search (Box 1) until October 1, 2019

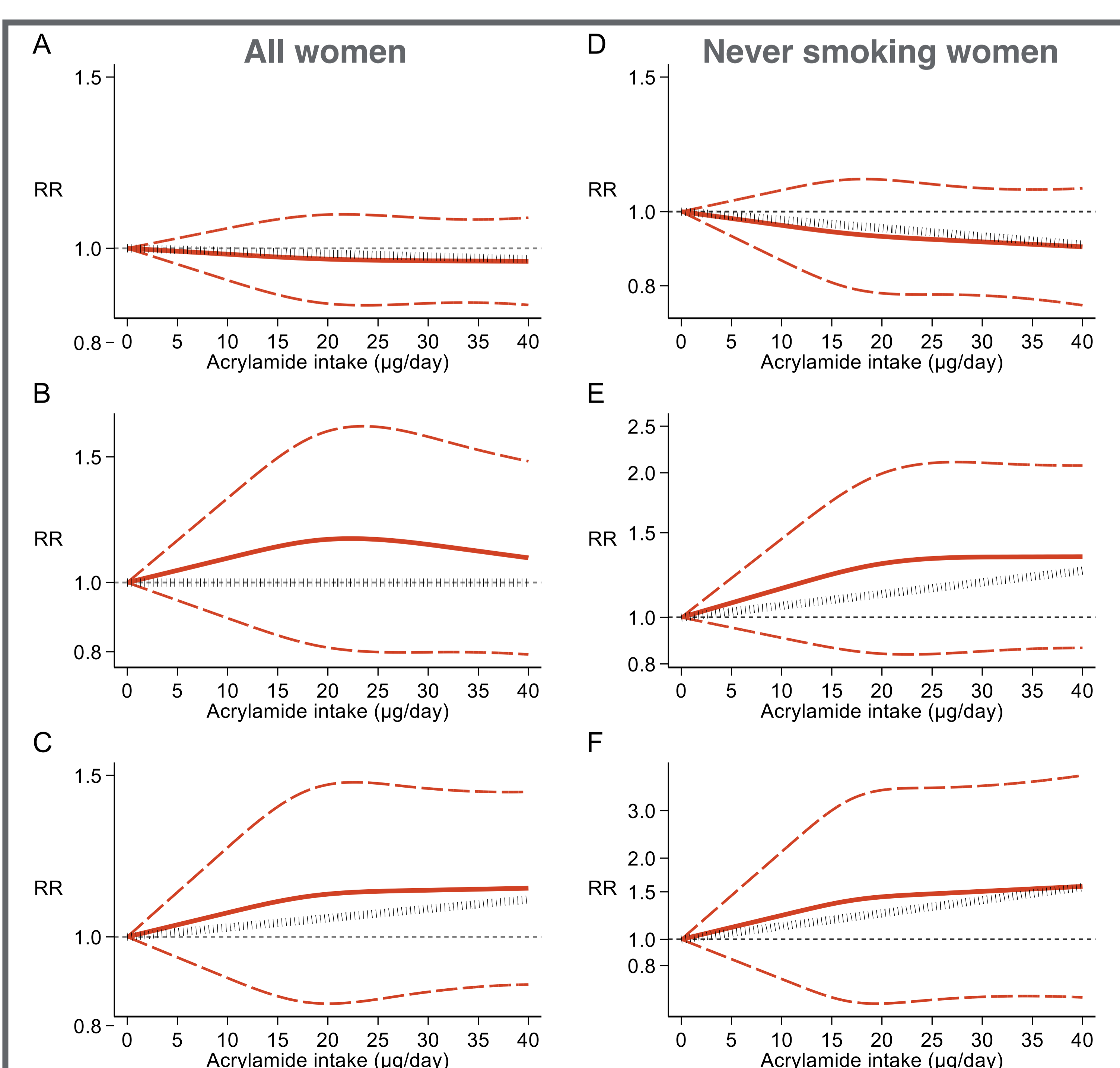


Figure 2. Dose-response meta-analysis between acrylamide intake and risk of breast (A), endometrial (B) and ovarian cancer (C) in all women and in never smoking women (D, E and F). Spline curve (solid line) with 95% confidence limits (long-dashed lines), null association (short-dashed line), and linear trend (vertical bar line). RR, risk ratio.

Results

We retrieved 18 studies: 11 cohort, 5 case-cohort, and 2 case-control studies. Since some studies assessed more than one cancer type, we found a total of ten studies on risk of breast cancer, seven on endometrial cancer, and seven on ovarian cancer (Figure 1). In the dose-response meta-analysis, acrylamide intake was associated with slightly increased risks of endometrial and ovarian cancers, with a stronger and almost linear increased risk among never smokers (Figure 2), with similar results in post-menopausal women only

(Figure 3). Conversely for breast cancer, we found no evidence to support an increased risk following acrylamide exposure (Figure 2), with a slight decrease risk especially in never smoking and post-menopausal women, while we found an imprecise but positive association among pre-menopausal women exposed to at least 20 µg/day of acrylamide (Figure 3). No evidence of publication bias was found since funnel plots showed a substantial symmetrical distribution for all types of cancer (Figure 4).

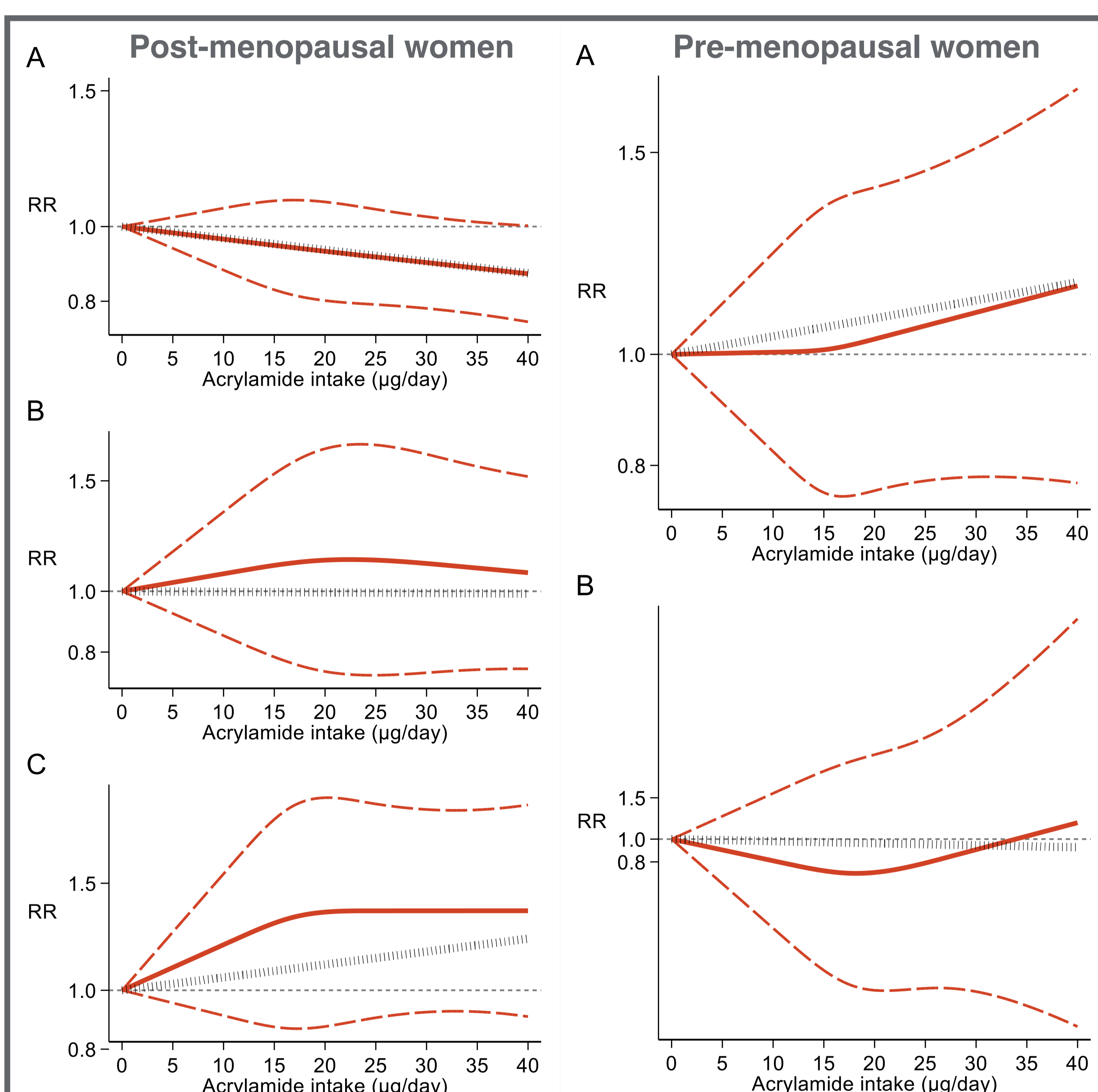


Figure 3. Dose-response meta-analysis between acrylamide intake and risk of breast (A), endometrial (B) and ovarian cancer (C) in post- and pre-menopausal women. Spline curve (solid line) with 95% confidence limits (long-dashed lines), null association (short-dashed line), and linear trend (vertical bar line). RR, risk ratio.

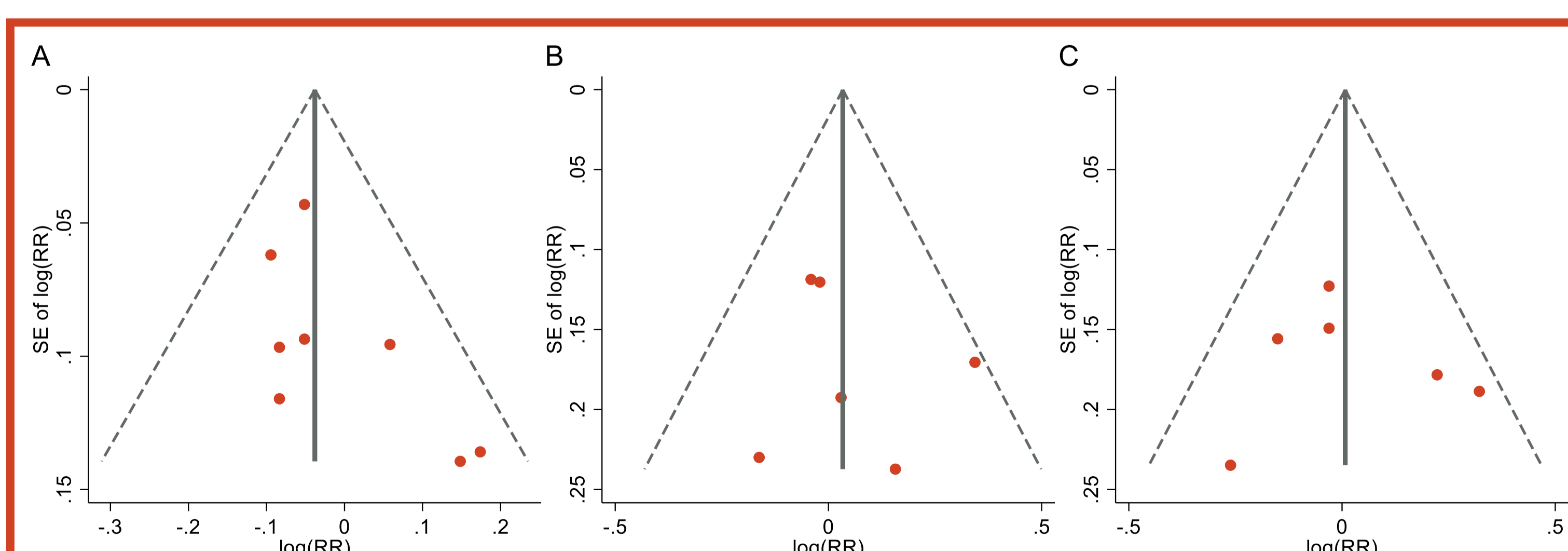


Figure 4. Funnel plots for publication bias for breast (A) endometrial (B) and ovarian cancer (C). The outer dash lines indicate the triangular region within which 95% of studies are expected to lie in the absence of both bias and heterogeneity.

Conclusions

Based on the relatively small number of studies published to date, acrylamide intake was associated with a little increased risk of endometrial and ovarian cancer in a dose-response fashion, with a slightly stronger association observed among never smokers and partially in post-

menopausal women. Acrylamide intake was associated with an increased risk of breast cancer only among pre-menopausal women and at intakes greater than 20 µg/day, while no evidence of increased risk was found in post-menopausal or never smoking women.