An evidence map of ultrafine epidemiology

Doug Brugge[1], Flora Berklein[1], Qisi Yao[1], Alex Turner[1], Wig Zamore[2], Mei Chung[1]

Affiliation:
1. Tufts University School of Medicine
2. Somerville Transportation Equity Partnership

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Introduction

There is growing interest in the health effects of ultrafine particles which are unregulated in the US.

Methods

We conducted a systematic literature search in PubMed, Global Health, Scopus and TOXLINE from their inception through April 2017. Search terms were in three categories: exposure (e.g., particle number count, PNC), health outcomes (e.g., cardiovascular) and sources (e.g., traffic). We identified 8,630 records without duplicates. Abstract review by two independent screeners resulted in selection of 292 articles for full text review. Data was extracted from full text reviews using a standardized form.
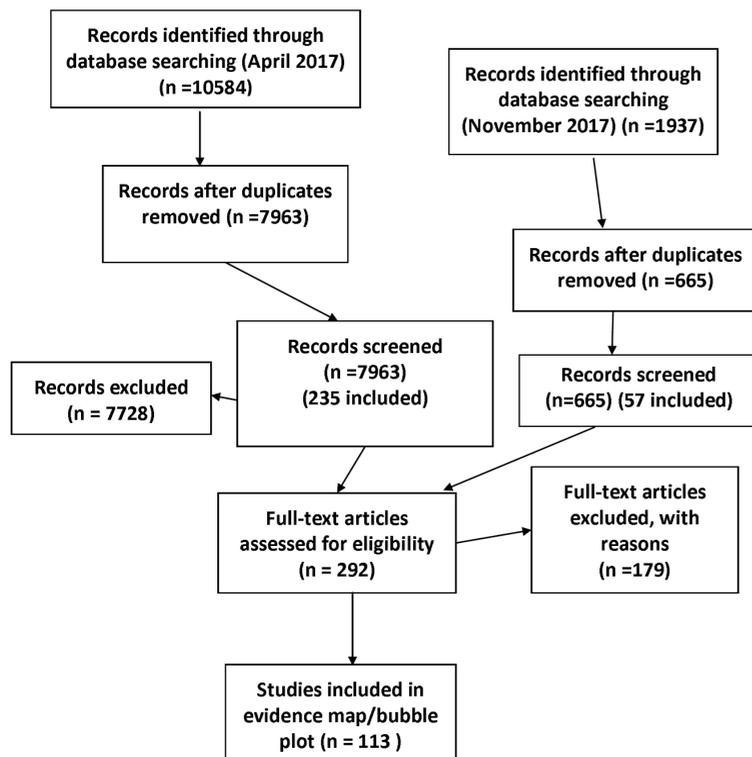

Figure 1. Flow diagram of screening of articles to include in the evidence map.

Tables 1 & 2.. Categories of search terms for the two stages of searches. The second search was conducted to capture relevant articles missed by the first search.

List 1: Exposure	Size of particle: ultrafine particles, particulate matter, particle number count
List 2: Health outcomes	Cardiovascular, respiratory, neurological, cognitive.
List 3: Source	Traffic/combustion-derived

List 1: Exposure	Ultrafine particles
List 2: Health outcomes	Cardiovascular, respiratory, neurological, cognitive.
List 3: Source	Air pollution

Results

Of the articles screened, 113 are included in the evidence map. The largest reason for exclusion was not measuring PNC (67). We also excluded from the evidence map controlled exposure and occupational studies. And, we excluded studies that used a measure of ultrafine particles other than PNC. Most of these studies (95) were short term (<month) while only 6 were of long term (usually annual) associations. There were 455 short term associations and 18 long term associations reported. Most of the reported associations were for cardiovascular (340 and 14, short and long term respectively) or respiratory (101 and 4) measures. Evidence was categorized as strong (statistically significant; 149 and 5, short and long term respectively), suggestive (trend, 150 and 2) or null (156 and 11).

Table 3.. Stratification of articles included in the review by short and long term studies and by disease outcome and strength of association.

	Long-term (>3 months)	Short-term
Outcome type		
Cardiovascular	14	340
Respiratory	4	101
Other	0	14
Strength of evidence of association		
Strong evidence	5	149
Weak/moderate evidence	2	150
Little/no evidence	11	156
TOTAL outcomes	18	455
TOTAL papers	6	95
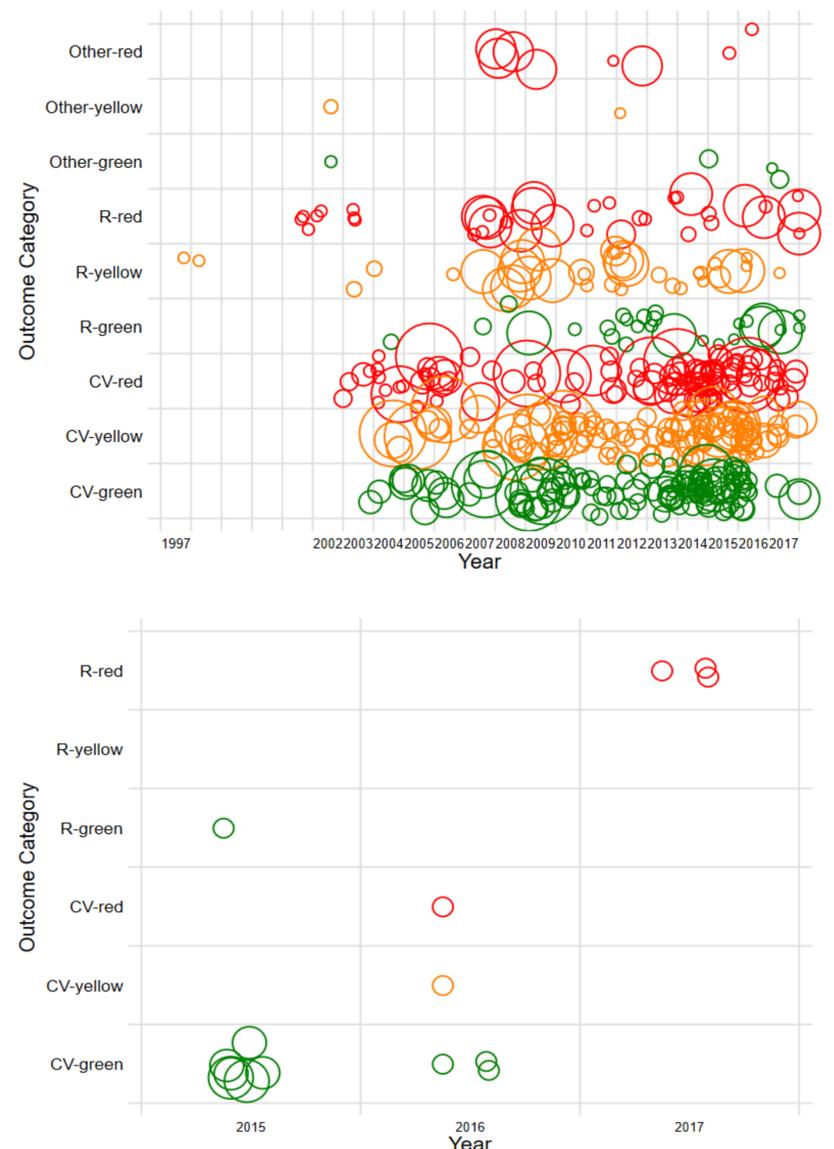
Figure 2. Bubble maps of associations extracted from the literature plotted by year and by disease type (CV=cardiovascular; R=respiratory; o=other). The top panel is short term studies, the bottom panel lis long term studies. The size of circles indicates the sample size for each association. Green is no evidence of association, orange is some evidence of association and red is for statistically significant associations.

Conclusions

Our review shows that there is a robust and growing literature of associations between ultrafine particles and cardiovascular and respiratory health. However, the literature is much larger for short term, time series-type studies and there is a need for more and better long term studies since they will be needed to drive policy decisions.

Acknowledgements

This review is nested within a community-level intervention study in the City of Somerville and the neighborhood of Chinatown in Boston, MA, USA. The evidence map is a step toward a systematic review and meta analysis.