

# **NTP Evaluation Concept: Pregnancy Outcomes Associated With Traffic-Related Air Pollution**

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# Background and Rationale

- Received an external nomination to evaluate emerging children's health issues associated with ambient air pollution
  - Broad range of types of air pollution, including traffic
  - Health effects other than prevalence or exacerbation of respiratory disease
- Consulted with federal experts on research efforts and literature synthesis needs on ambient air pollution
- Supported by funding from the NIEHS Global Environmental Health Program



# Recent reviews of health effects of ambient air pollution

- In 2010, Health Effects Institute (HEI) published a review of health effects associated with traffic-related air pollution
  - Exposures included only:
    - direct traffic measures (e.g., proximity)
    - exposure surrogates that also measured (or modeled) proximity to traffic
  - Evaluated health outcome data for causal associations
    - Suggestive evidence for asthma incidence or prevalence
    - Supportive evidence for asthma exacerbation
    - Too few studies on pregnancy outcomes and childhood cancer to determine a causal association

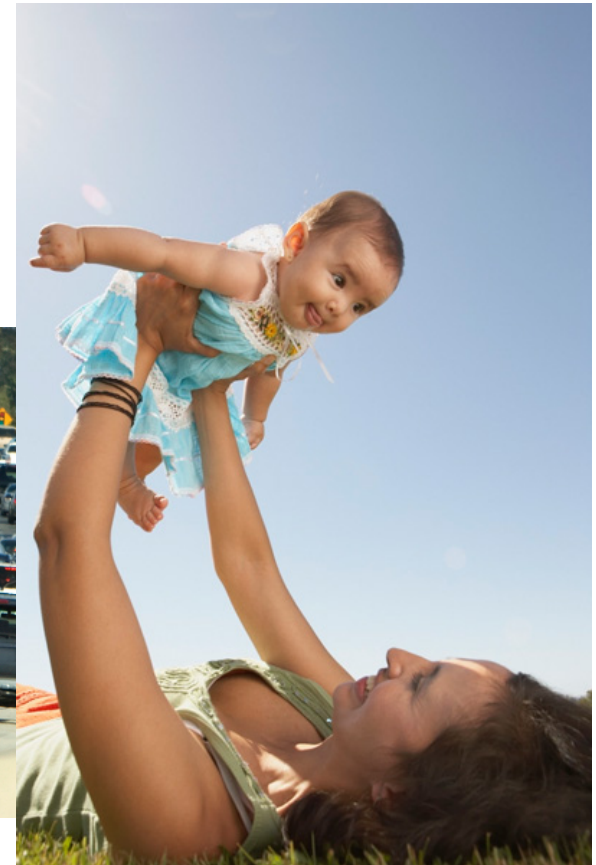


# Recent reviews of health effects of ambient air pollution (cont'd)

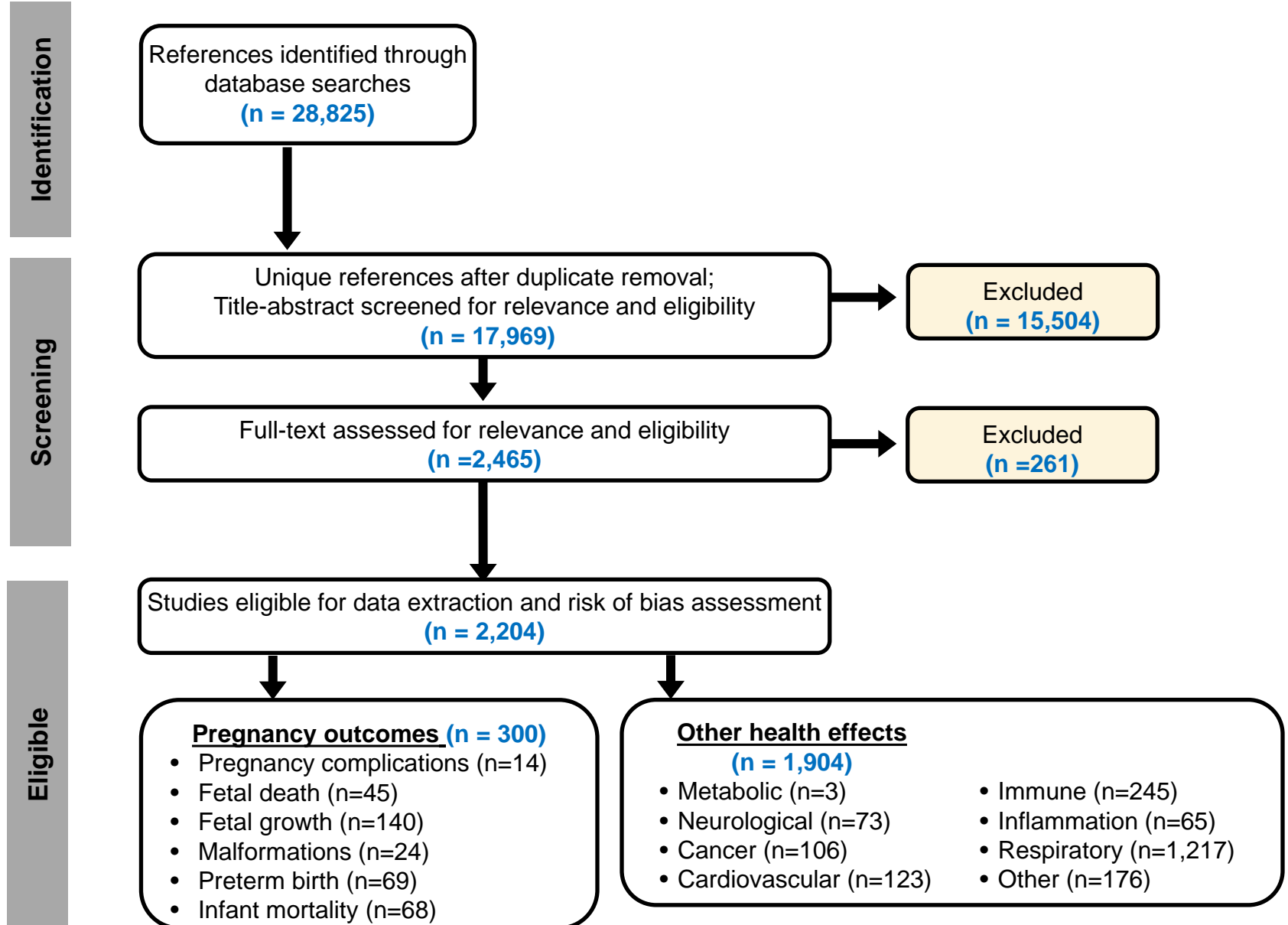
- EPA prepares Integrated Science Assessments that review epidemiological and toxicological literature for 6 principal air pollutants
  - Carbon monoxide (CO; 2010), Lead (2013); Nitrogen oxides (NO<sub>x</sub>; 2008), Ozone (O<sub>3</sub>; 2013), Particulate matter (PM; 2009) and Sulfur oxides (SO<sub>x</sub>; 2008)
- CDC published a systematic review and meta-analysis of childhood cancer associated with direct traffic exposure metrics (April 2014)
  - Included studies measuring:
    - traffic exposure based on the distance to roads and traffic density (e.g., not exposure surrogates)
    - traffic exposure at the residential address
  - Reported that childhood leukemia was associated with residential traffic exposure during the postnatal period, but not during the prenatal period
- CDC is currently completing a systematic review of pregnancy outcomes using similar exposure inclusion criteria

# Preliminary Literature Search

- To determine the extent of the literature on children's health and ambient air pollution
  - Studies binned by:
    - evidence stream
    - health outcome
    - exposure



# Preliminary Literature Screening



# Focus of proposed OHAT evaluation

- To conduct a systematic review of the literature to evaluate an association between pregnancy outcomes and traffic-related air pollution
  - Exposures include:
    - Direct traffic measures (e.g., density, frequency, proximity)
    - Environment gases (CO, NO<sub>x</sub>, O<sub>3</sub>, SO<sub>x</sub>)
    - Particulate matter (PM<sub>2.5</sub>, PM<sub>10</sub>, black carbon, ultrafine and coarse, total suspended particulates)
    - Constituents of traffic air pollution (benzene, diesel exhaust, polycyclic aromatic hydrocarbons (PAHs)).
- Pregnancy outcomes were selected based on abundance of literature available
  - OHAT is considering evaluating other health effects, which would be approached as separate evaluations

# Key Issues

- Multiple exposure surrogates used to measure traffic-related air pollution
  - Direct traffic measures are reported to provide most accurate exposure
  - Environmental gases are frequently used as surrogates
    - CO, NO<sub>x</sub>
  - Particulate Matter
    - Composition varies by fuel type and source
  - Other measures include:
    - Diesel exhaust
    - Benzene
    - PAHs





## Key Issues (cont'd)

- Composition of the traffic-related pollution has changed over time
- Many of the exposure surrogates are also generated by sources other than traffic
- Synthesis of the international literature is complicated by differences in the composition of the vehicle fleet



# Specific Aims

- To develop hazard identification conclusion(s) for the association between traffic-related air pollution and pregnancy outcomes
- If insufficient data exist, write a state-of-the-science paper on this topic



# Key Questions

- Considering individual types of exposure surrogates, what is our confidence in the body of evidence for an association between pregnancy outcomes in humans and traffic-related air pollution?
- How do the associations between pregnancy outcomes and environmental gases, PMs, diesel exhaust, benzene, or PAHs compare to each other and to the associations based on direct traffic measures (e.g., density, proximity, frequency)?

# Pregnancy outcomes

- Pregnancy complications
- Congenital malformations
- Fetal growth
  - Intrauterine growth restriction (IUGR)
  - Low birth weight
  - Small for gestational age (SGA)
- Preterm birth
- Perinatal mortality
  - Spontaneous abortion
  - Stillbirth
- Postnatal (infant) mortality



# Proposed approach

- Work with technical advisors and evaluation design team to:
  - Further refine the exposures included in the evaluation
  - Consider statistical approaches to compare the effects of the various exposure metrics
- Conduct evaluation using the OHAT Approach to Systematic Review and Evidence Integration
  - Utilize existing reviews on traffic-related air pollution and pregnancy outcomes as well as EPA air quality criteria assessments

# Significance

- Proposed evaluation will build upon and extend HEI, EPA and CDC efforts to understand the effects of traffic-related air pollution on children's health
  - If sufficient data exist, will reach hazard identification conclusions
  - Will review how well the effects of exposure surrogates of traffic-related pollution compare to the effects of more direct traffic measures
- Data management will be conducted in a manner that permits public sharing of:
  - Exploratory literature search strategy results
  - Data extracted from relevant studies

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  - Catherine Carr (Univ. of WA)
  - Melanie Marty (State of CA; OEHHA)

# Charge Questions

1. Please comment on the clarity and validity of the rationale for the proposed evaluation as articulated in the draft concept.
2. Please comment on the merit of the proposed evaluation relative to the goals of the NTP.

*The NTP's objectives are to: provide information on potentially hazardous substances; develop and validate improved test methods; strengthen the science base in toxicology; coordinate toxicology testing programs across DHHS.*

3. Please comment on the proposed approach for the evaluation.
4. Please comment on the scope of the proposed evaluation and its appropriateness, relative to the public health importance of the issue.
5. What priority (low, moderate, or high) should NTP give the proposed evaluation given the rationale, merit, and scope?
6. Provide any other comments you feel staff should consider in developing this evaluation