

Near Roadway Indoor Air Pollution: Assessing Health Effects and Mitigation Strategies

Appendix C9. Health Effects Tier 2 Results

This document contains 6 tables with narrative summaries of the Tier 2 exposure/outcome pairs. Though limited in that they have not had a rigorous evaluation of the certainty of evidence, these results provide additional insight into the research that has been conducted on the health effects of NRAP exposure and opportunity for future research to evaluate the certainty of the evidence for additional exposure/outcome pairs.

Table 1. Association between NRAP and cardiovascular outcomes for Tier 2 studies

Contributing Review	Number of Included Studies (Date Range)	Narrative Summary
<i>Ischemic heart disease (IHD)</i>		
HEI 2022	4 (2006-2016)	Distance measures: Three studies observed positive associations, with two statistically significant, RR ranging from 1.02 to 1.75. Traffic-density measures: One study found no association while one study observed a positive estimate.
<i>Incidence of coronary events</i>		
HEI 2022	8 (2007-2018)	Distance measures: Five of seven studies observed positive associations, with four statistically significant, RR ranging from 0.96 to 3.79. Traffic-density measures: Three of four studies found a positive association, with two statistically significant HR ranging from 0.97 to 1.21.
<i>Stroke (fatal and non-fatal)</i>		
HEI 2022	6 (2012-2018)	Distance measures: Two of three studies observed positive associations, with one statistically significant, RR ranging from 0.98 to 1.42. Traffic-density measures: Three of four studies observed positive associations, none were statistically significant, HR ranging from 0.99 to 1.06.

Table 2. Association between NRAP and respiratory outcomes for Tier 2 studies

Contributing Review	Number of Included Studies (Date Range)	Narrative Summary
<i>Prevalence of asthma ever in children</i>		
HEI 2022	23 (1993-2018)	Distance measures: Eleven of fourteen studies observed positive associations, with four statistically significant, RR ranging from 0.62 to 4.01. Traffic-density measure: Five of six studies found a positive association, with two statistically significant, RR ranging from 0.30 to 2.83.

<i>Prevalence of asthma ever in adults</i>		
HEI 2022	5 (1996-2015)	Distance measures: Two of three studies observed positive associations, none were statistically significant, RR ranging from 1.01 to 1.68. Traffic-density measures: Both studies found a positive association, neither were statistically significant, RR ranging from 1.20 to 1.30.
	3 (2008-2017)	NO ₂ : Two out of three studies showed a positive association, with only one statistically significant. Effect estimates were reported as RR and OR, ranging from 0.99-1.11.
<i>Incidence of COPD</i>		
HEI 2022	4 (2011-2016)	Distance measures: One of three studies observed a positive association, it was not statistically significant, RR ranging from 0.90 to 1.04. Traffic-density measures: Two of three studies found a positive association, neither were statistically significant, RR ranging from 0.94 to 1.26.
<i>Prevalence of COPD</i>		
HEI 2022	3 (2005-2014)	Two of the three studies evaluated traffic measures with Prevalence of COPD and a single study evaluated density measures. Distance measures: Both studies showed a positive association, only one was statistically significant, RR ranging from 1.54-1.79. Traffic-density measures: The one study that measured density found a positive but non-significant effect.
	4 (2003-2018)	NO ₂ : All four studies showed a positive association, only one was statistically significant, effect estimates ranging from 1.07 to 1.37.

Table 3. Association between NRAP and reproductive outcomes for Tier 2 studies

Contributing Review	Number of Included Studies (Date Range)	Narrative Summary
<i>Term low birth weight</i>		
HEI 2022	14 (2008-2019)	Distance measures: Six out of ten studies showed positive associations, with four statistically significant, RR ranging from 0.90 to 1.50. Traffic density: Four out of seven studies showed positive associations, with three statistically significant, RR ranging from 0.90 to 1.12.
<i>Decreased term birth weight</i>		
HEI 2022	4 (2013-2016)	Distance measures: All three studies showed positive associations, only one was statistically significant. Traffic density measures: Both studies reported positive associations, however, neither were statistically significant.
<i>Small for gestational age</i>		

HEI 2022	12 (2008-2017)	<p>Distance measures: Six out of twelve studies reported a positive association with only one statistically significant, RR ranging from 0.91 to 1.14.</p> <p>Traffic density measures: Two of four studies reported a positive association, neither reaching statistical significance, RR ranging from 0.98 to 1.12.</p> <p style="text-align: center;"><i>Preterm birth</i></p>
HEI 2022	18 (2003-2017)	<p>Distance measures: Nine out of eleven showed a positive association, with six of eleven reaching statistical significance, RR ranged from 0.96 to 1.70.</p> <p>Traffic density: Three of seven studies showed a positive association, two were statistically significant, RR ranging from 0.88 to 1.25.</p>

Table 4. Association between NRAP and cognitive outcomes for Tier 2 studies

Contributing Review	Number of Included Studies (Date Range)	Narrative Summary
<i>Dementia</i>		
Tang 2022	6 (2017-2020)	<p>Distance measures: Three out of four studies reported positive associations, with two statistically significant, RR ranged from 1.00-1.14.</p> <p>NO₂: Two of four studies showed positive associations, one was statistically significant, RR range from 0.94 to 1.13.</p>
<i>Cognitive Function</i>		
Power 2016	3 (2009-2015)	<p>Distance measures: Two studies on distance to road found a significant association of shorter distance to road and worse performance on assessment of cognition and test of selective attention.</p> <p>Density measures: One study on traffic load did not find an association with worse performance on a test of visuo-spatial ability.</p> <p>No quantitative results were reported.</p>

Table 5. Association between NRAP and endocrine outcomes for Tier 2 studies

Contributing Review	Number of Included Studies (Date Range)	Narrative Summary
<i>Type 2 diabetes</i>		
Zhao 2016	8 (2010-2016)	<p>Six studies examined residential proximity to major roadways and two studies examined residential proximity to roads with high traffic intensity.</p> <p>Distance measures: Meta-analysis of the six studies found it significantly increased type 2 diabetes risk (RR = 1.11, 95% CI: 1.04–1.19, p = 0.001, I₂ = 1.3%).</p> <p>Density measures: Meta-analysis of the two studies found residential proximity to roads with high traffic intensity</p>

significantly increased risk of type 2 diabetes (RR = 1.81, 95% CI: 1.06–3.08, p = 0.028, I² = 0%).

Table 6. Association between NRAP and additional outcomes for Tier 2 outcomes

Contributing Review	Number of Included Studies (Date Range)	Narrative Summary
<i>Breast cancer risk</i>		
Praud 2023	5 (1996-2017)	Five studies used spatial surrogate variables of TRAP to evaluate associations with breast cancer risk. The heterogeneity of the exposure assessment made it challenging to summarize narratively. Distance measures: Two out of five studies showed positive associations, one was statistically significant, RR ranging from 0.94 to 1.40. Traffic density: One out of the three studies showed positive associations, which was not statistically significant, RR ranging from 0.9-1.29.
	13 (2010-2022)	NO ₂ : Thirteen studies were pooled together, the overall RR for the association between invasive breast cancer and 10 µg/m ³ increase in NO ₂ was 1.015 (95% CI: 1.003; 1.028, p = 0.02).
<i>All-cause mortality</i>		
HEI 2022	11 (2004-2019)	Distance measures: Eight of the ten studies reported positive associations, four were statistically significant, RR ranging from 0.94 to 1.57. Density measures: All four studies showed a positive association, two were statistically significant, RR ranging from 1.01 to 1.15.
<i>Cause-specific mortality – circulatory</i>		
HEI 2022	12 (2005-2019)	Distance measures: Ten out of eleven studies reported positive associations with seven statistically significant, RR ranging from 0.98 to 1.95. Density measures: One out of three studies was positive and statistically significant, RR ranging from 0.99 to 1.05.
<i>Cause-specific mortality – respiratory</i>		
HEI 2022	6 (2005-2019)	Distance measures: Four out of five studies reported positive associations with one statistically significant, RR ranging from 0.95 to 3.54. Density measures: All three studies were positive and two were statistically significant, RR ranging from 1.03 to 1.21.
<i>Cause-specific mortality – lung cancer</i>		
HEI 2022	5 (2008-2019)	Distance measures: Three out of five studies reported positive associations and two were statistically significant, RR ranging from 0.62 to 2.30. Density measures: Both were positive, but neither were statistically significant, RR ranging from 1.03 to 1.07.

<i>Cause-specific mortality – IHD</i>		
HEI 2022	6 (2009-2019)	Distance measures: All five studies reported positive associations with two statistically significant, RR ranging from 1.04 to 1.25. Density measures: All four studies reported positive associations, one was statistically significant, RR ranging from 1.02 to 1.05.
<i>Cause-specific mortality – stroke</i>		
HEI 2022	8 (2005-2019)	Distance measures: Five out of seven studies reported positive associations with two statistically significant, RR ranging from 0.70 to 2.94. Density measures: Three out of four studies reported positive associations, none were statistically significant, RR ranging from 0.81 to 1.04.
<i>Cause-specific mortality – ALRI</i>		
HEI 2022	2 (2010-2013)	Two studies on ALRI mortality reported a positive association with LUR modeled NO ₂ and ALRI mortality, neither were statistically significant, RR were 1.15 to 1.18 per 10 ug/m ³ increase.