HEI

ADDITIONAL MATERIALS AVAILABLE ON THE HEI WEBSITE

Special Report 23

Systematic Review and Meta-analysis of Selected Health Effects of Long-Term Exposure to Traffic-Related Air Pollution

HEI Panel on the Health Effects of Long-Term Exposure to Traffic-Related Air Pollution

Chapter 9: Traffic-Related Air Pollution and Respiratory Outcomes

Additional Materials 9.1 to 9.7

These Additional Materials were not formatted or edited by HEI. This document was part of the HEI Panel's review process.

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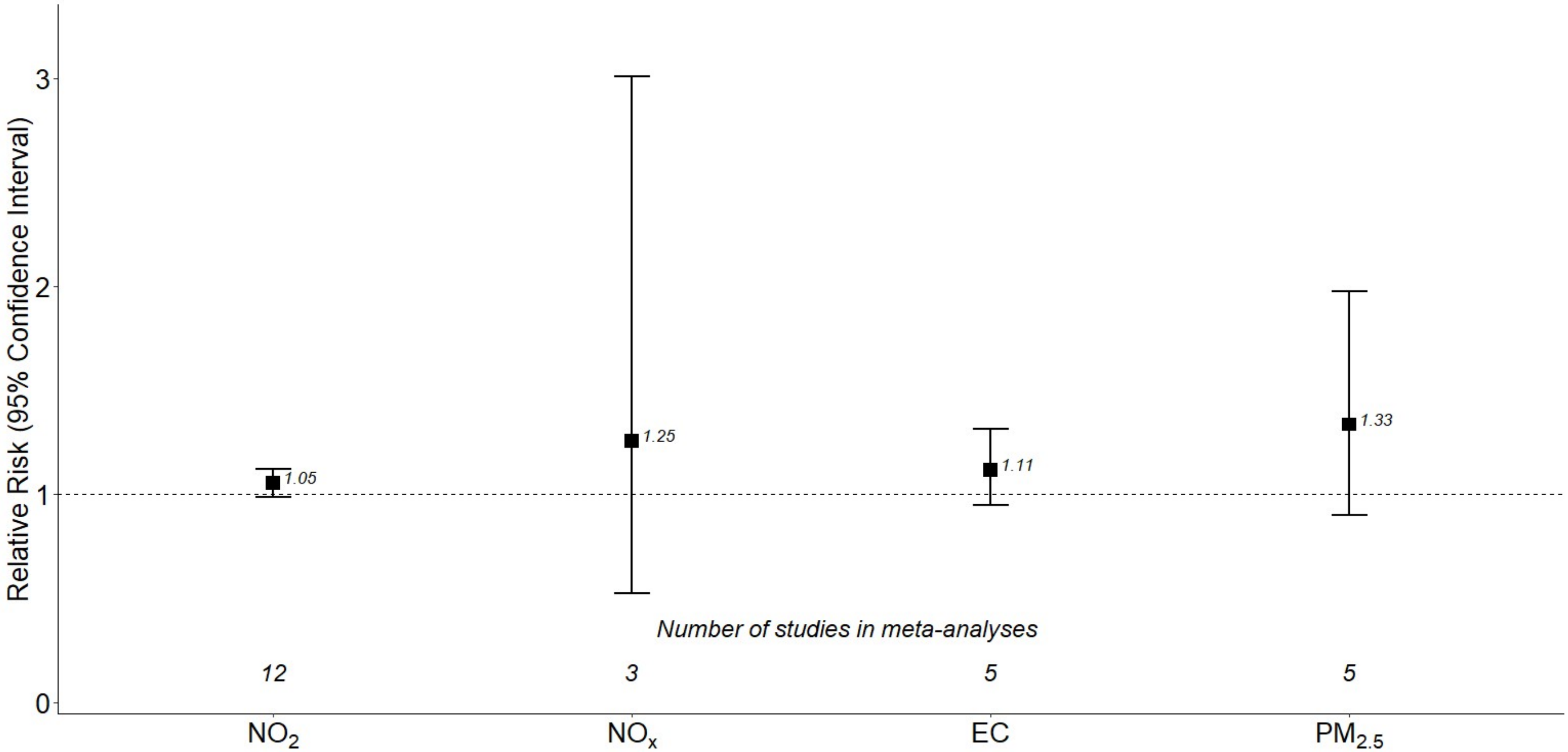
Chapter 9: Traffic-Related Air Pollution and Respiratory Outcomes

Additional Materials: All Analyses

9.1 Asthma onset

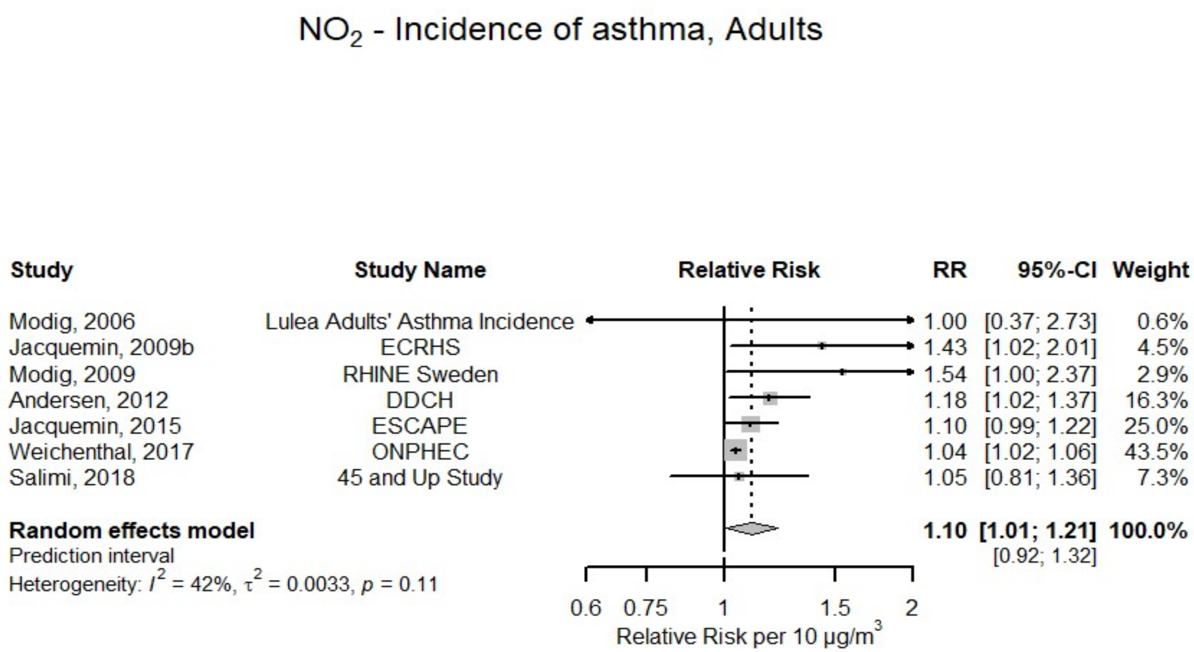
Overview of primary meta-analyses – Children (<18)



Footnote: The following increments were used: 10 µg/m^3 for NO_2, 20 µg/m^3 for NO_x, 1 µg/m^3 for EC, and 5 µg/m^3 for $PM_{2.5}$. Effect estimates cannot be directly compared across the different traffic–related pollutants because the selected increments do not necessarily represent the same contrast in exposure.

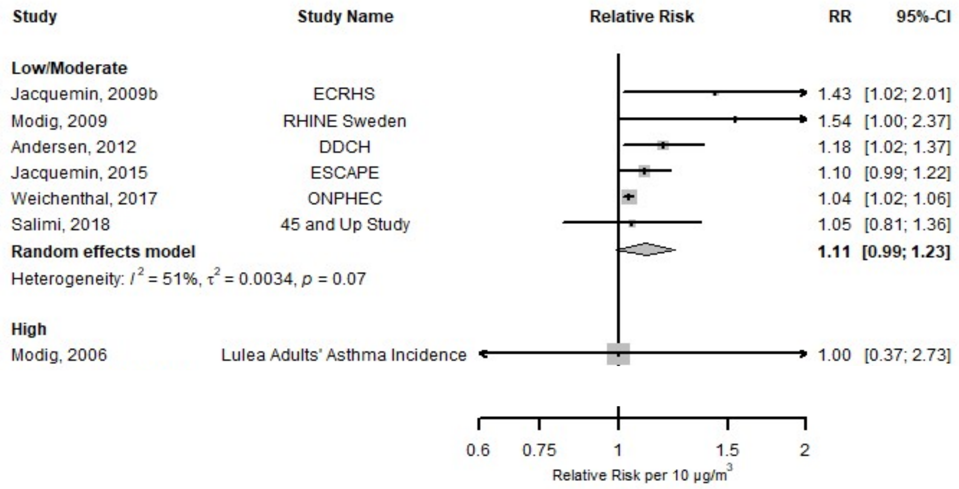
NO_2 – Asthma onset - Adults

Primary meta-analysis



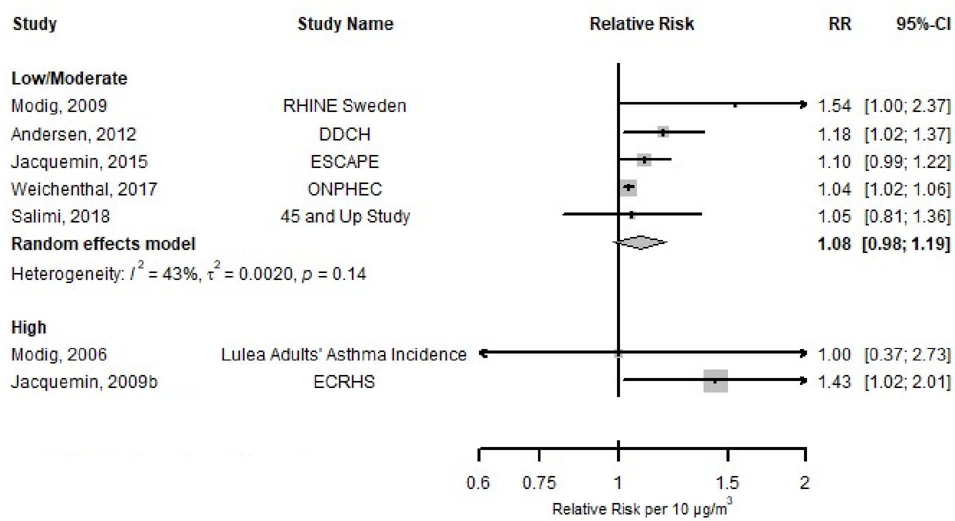
NO$_2$ – Asthma onset – Adults

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low/moderate vs high



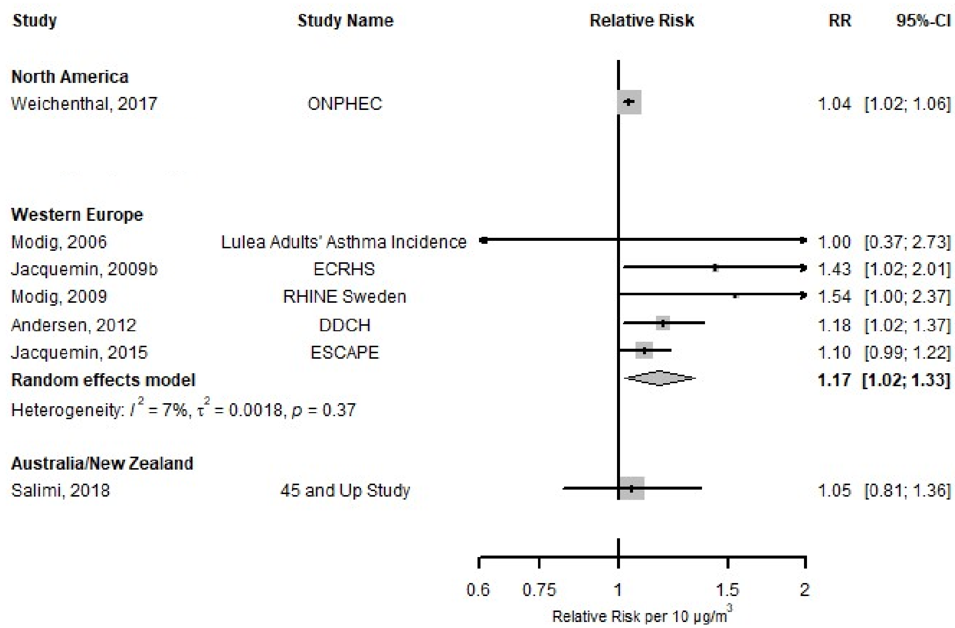
NO_2 – Asthma onset – Adults

Sensitivity analysis – risk of bias missing data domain – low/moderate vs high



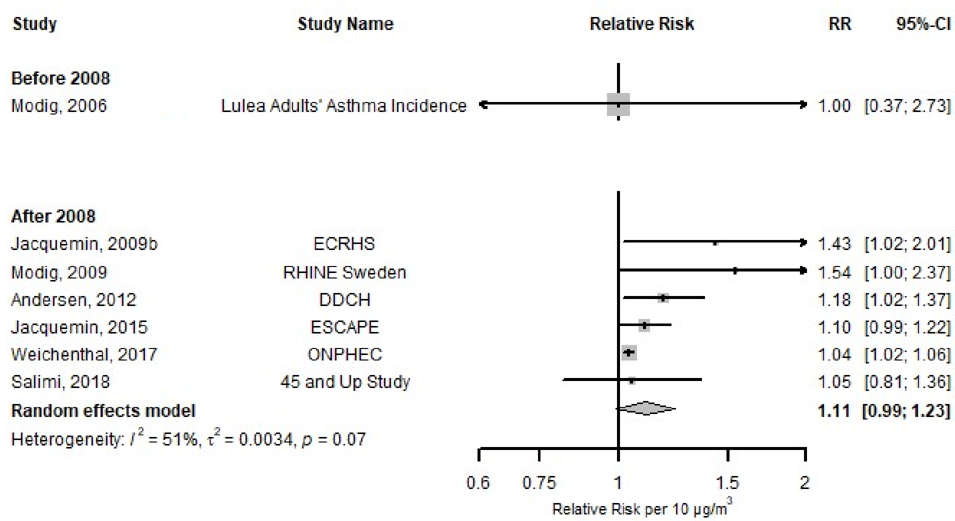
NO_2 – Asthma onset – Adults

Subgroup analysis – region



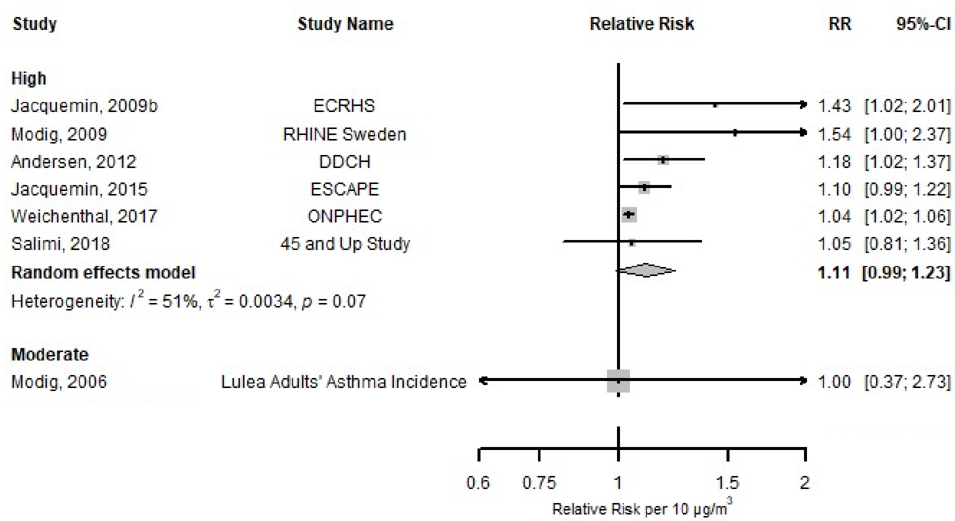
NO_2 – Asthma onset – Adults

Subgroup analysis – year of publication



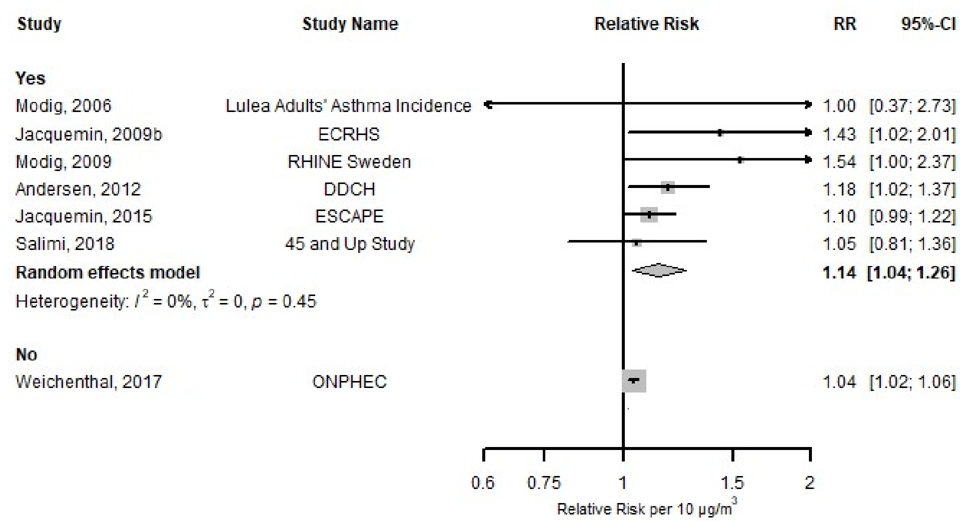
NO_2 – Asthma onset – Adults

Subgroup analysis – traffic specificity



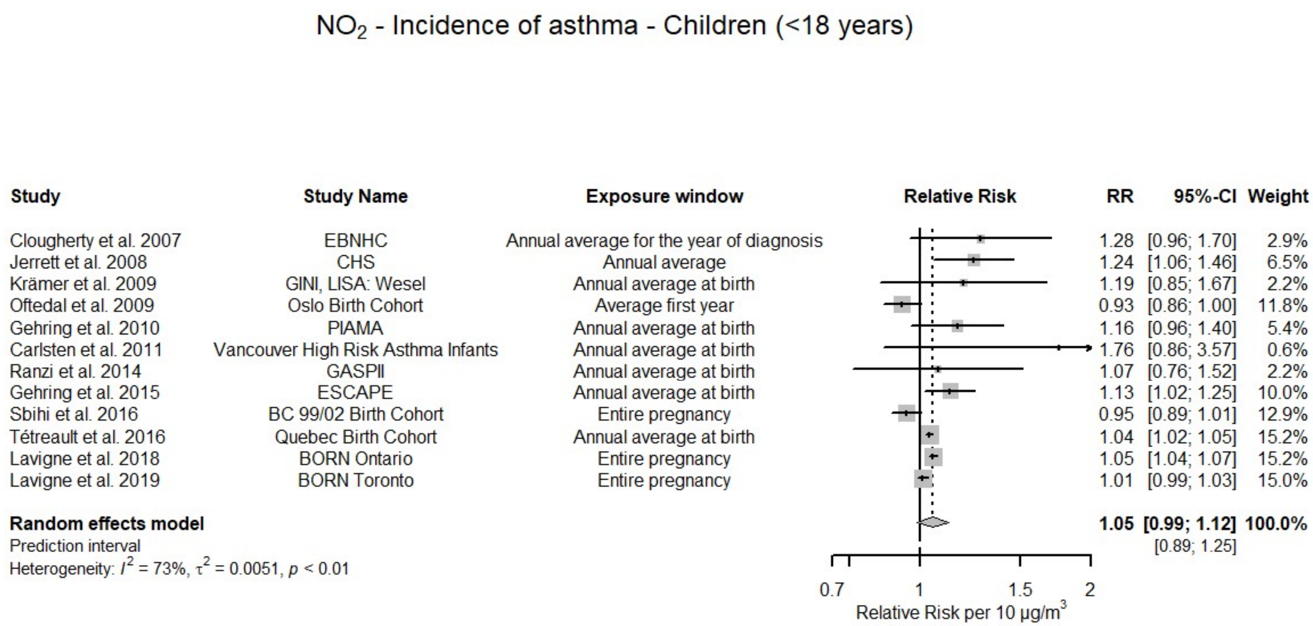
NO_2 – Asthma onset – Adults

Subgroup analysis – smoking adjustment



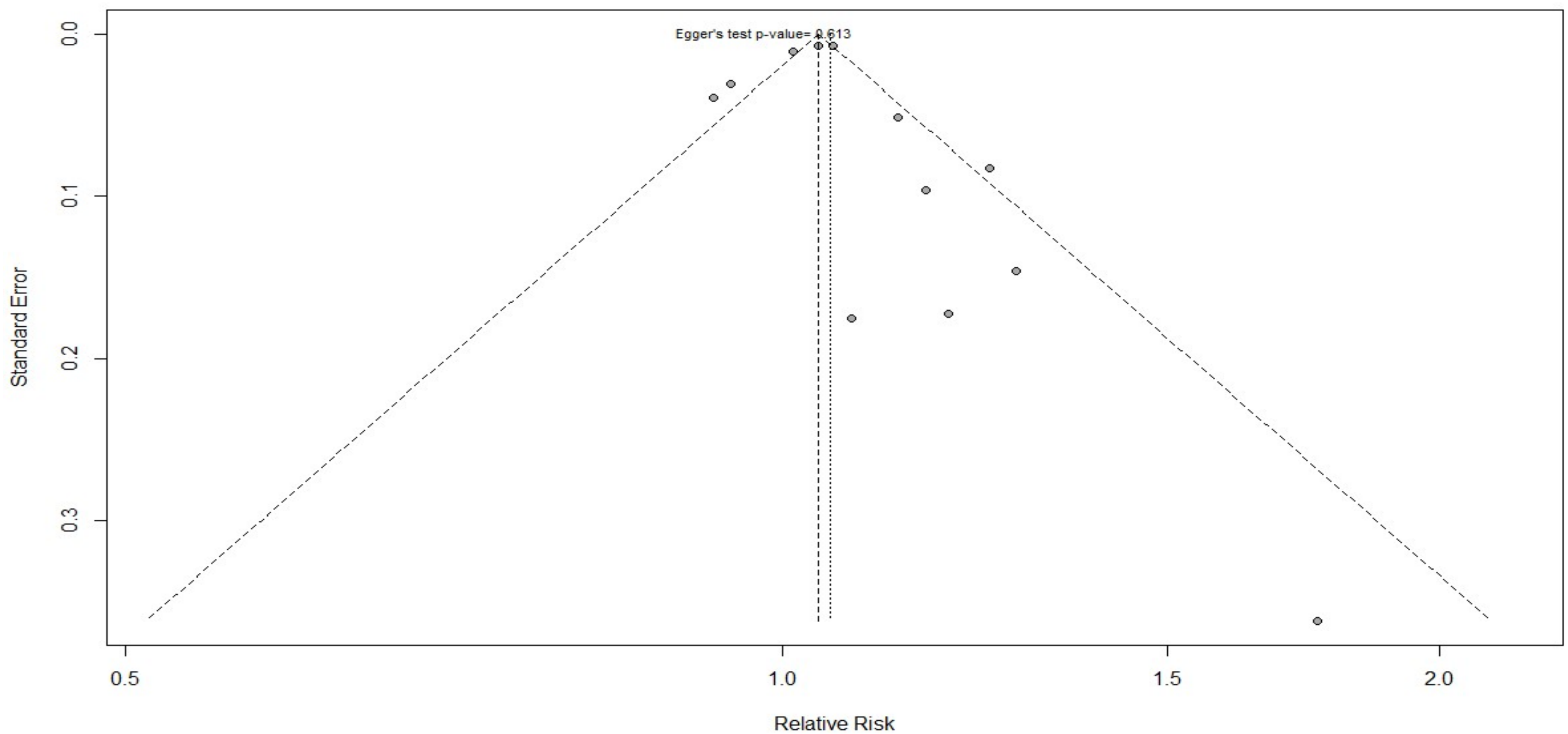
NO_2 – Asthma onset - Children

Primary meta-analysis



NO_2 – Asthma onset – Children

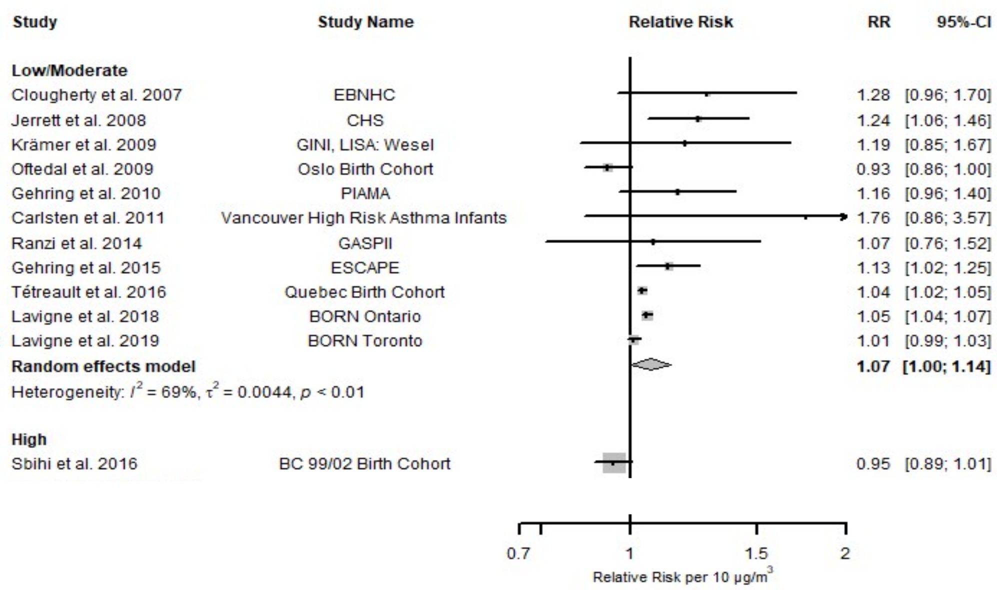
Funnel plot



Footnote: The vertical lines in the funnel plots represent the pooled fixed and random effect estimates. The vertical dashed line in the middle of the funnel shows the fixed effect estimate. As the Panel applied a random–effects model, the funnel plot also presents the random–effects estimate with the dotted line.

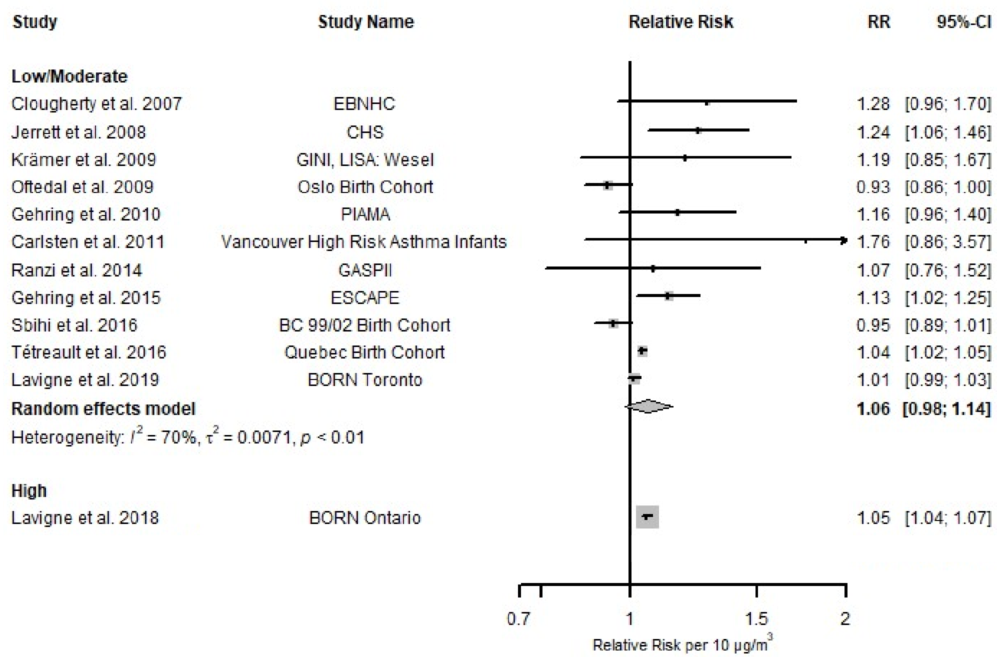
NO_2 – Asthma onset – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low/moderate vs high



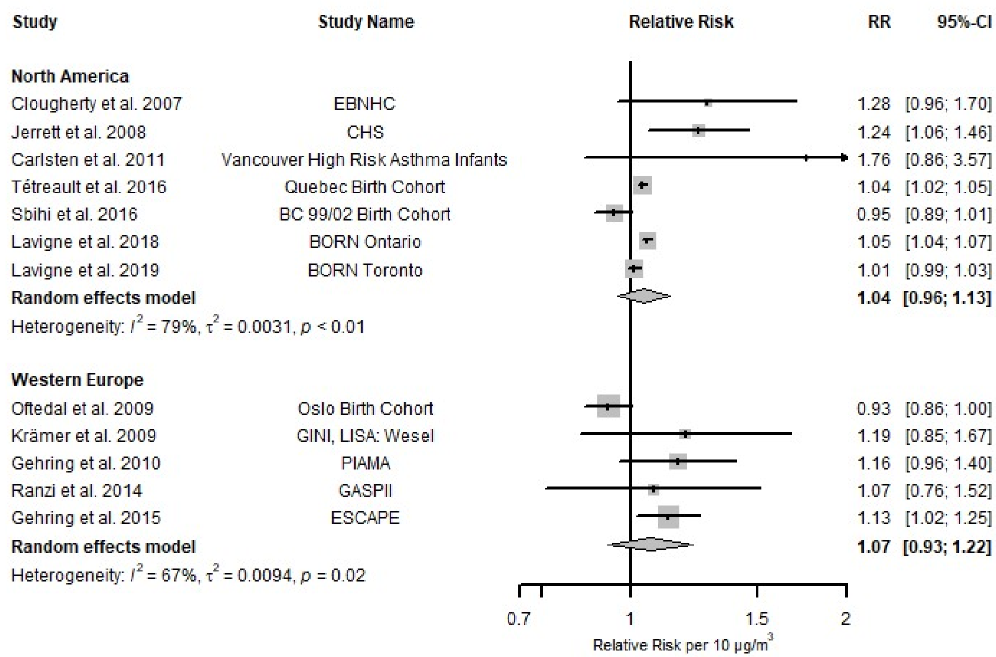
NO$_2$ – Asthma onset – Children

Sensitivity analysis – risk of bias missing data domain – low/moderate vs high



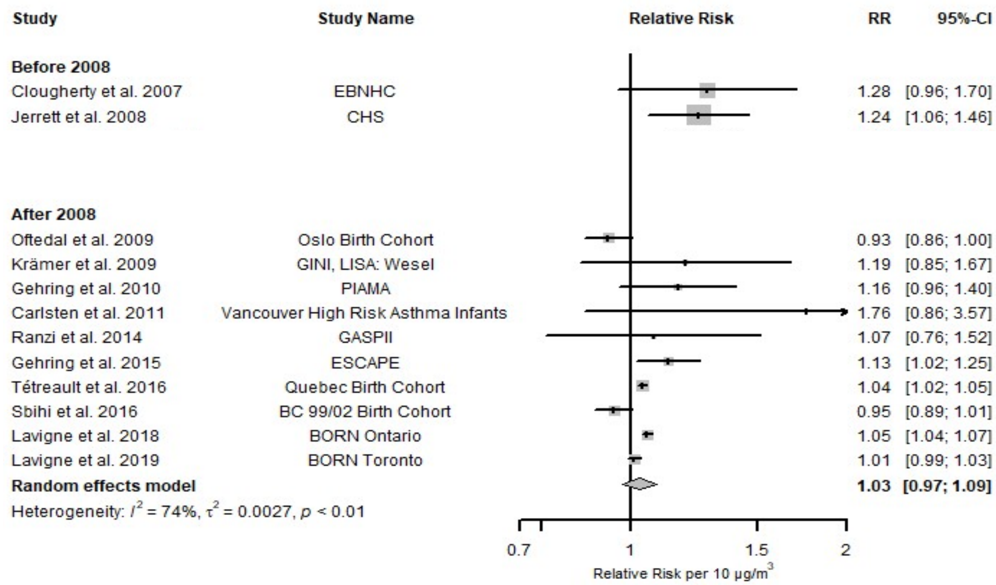
NO_2 – Asthma onset – Children

Subgroup analysis – region



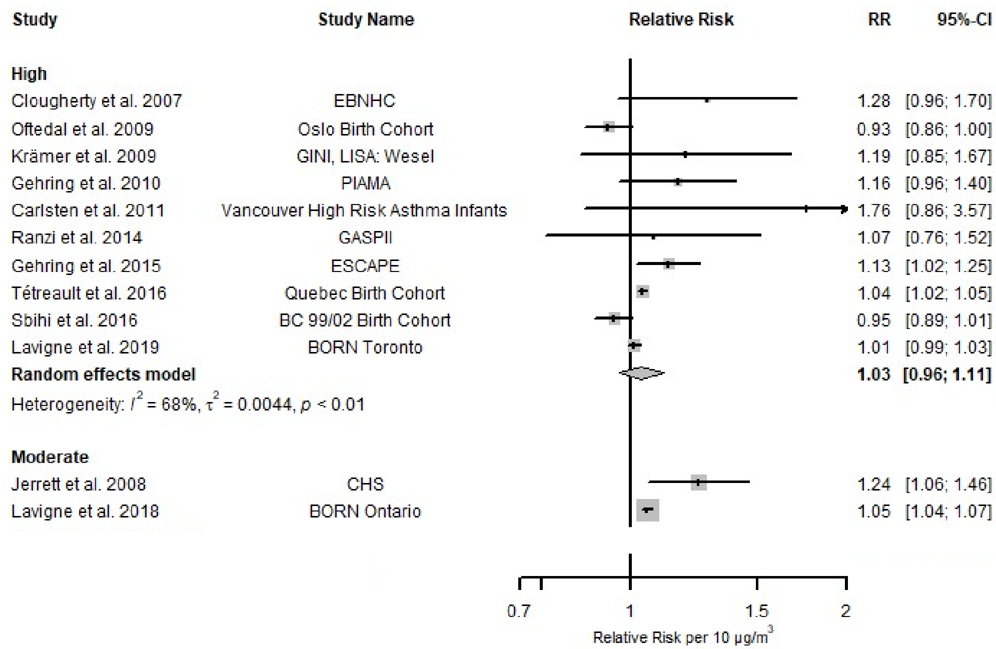
NO_2 – Asthma onset – Children

Sensitivity analysis – year of publication



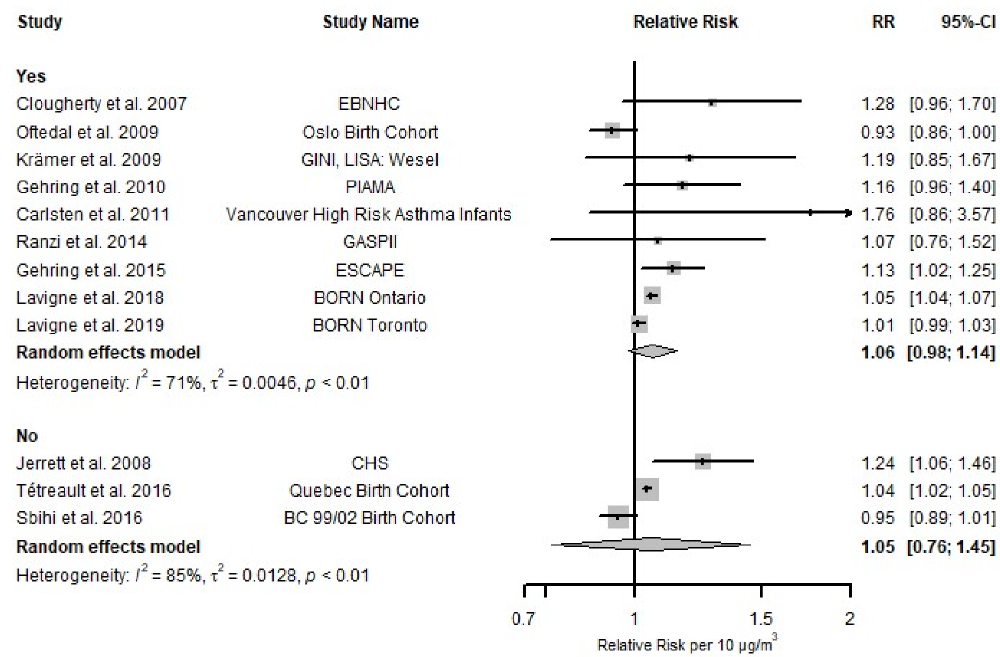
NO_2 – Asthma onset – Children

Sensitivity analysis – traffic specificity



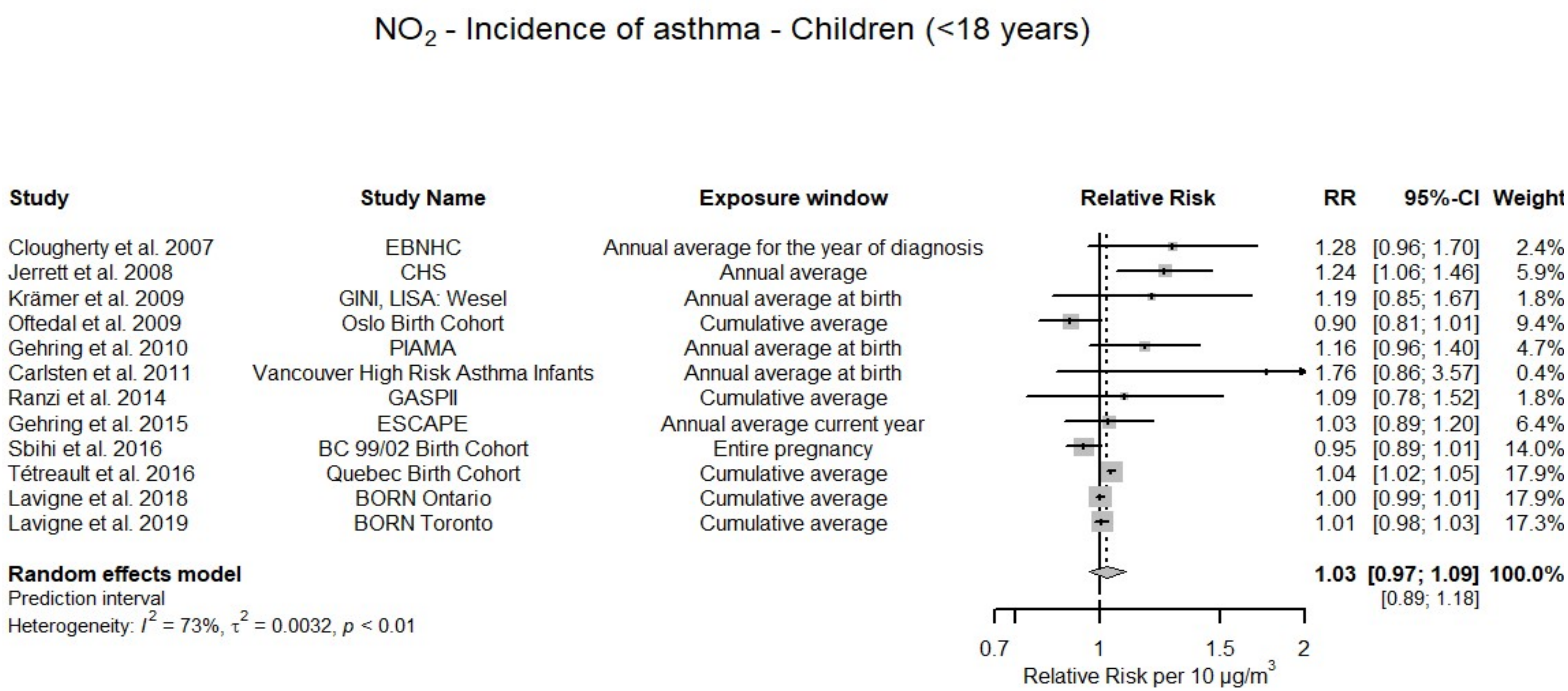
NO_2 – Asthma onset – Children

Subgroup analysis – smoking adjustment



NO_2 – Asthma onset – Children

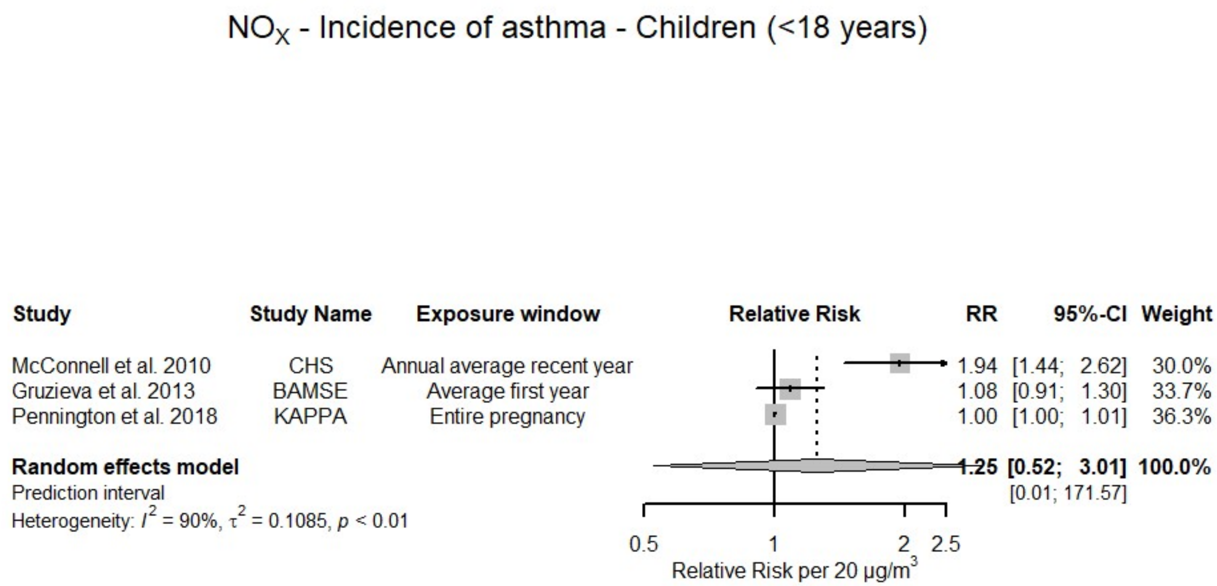
Sensitivity analysis – reverse selection



Recent years > cumulative average > first year of life > at birth > pregnancy

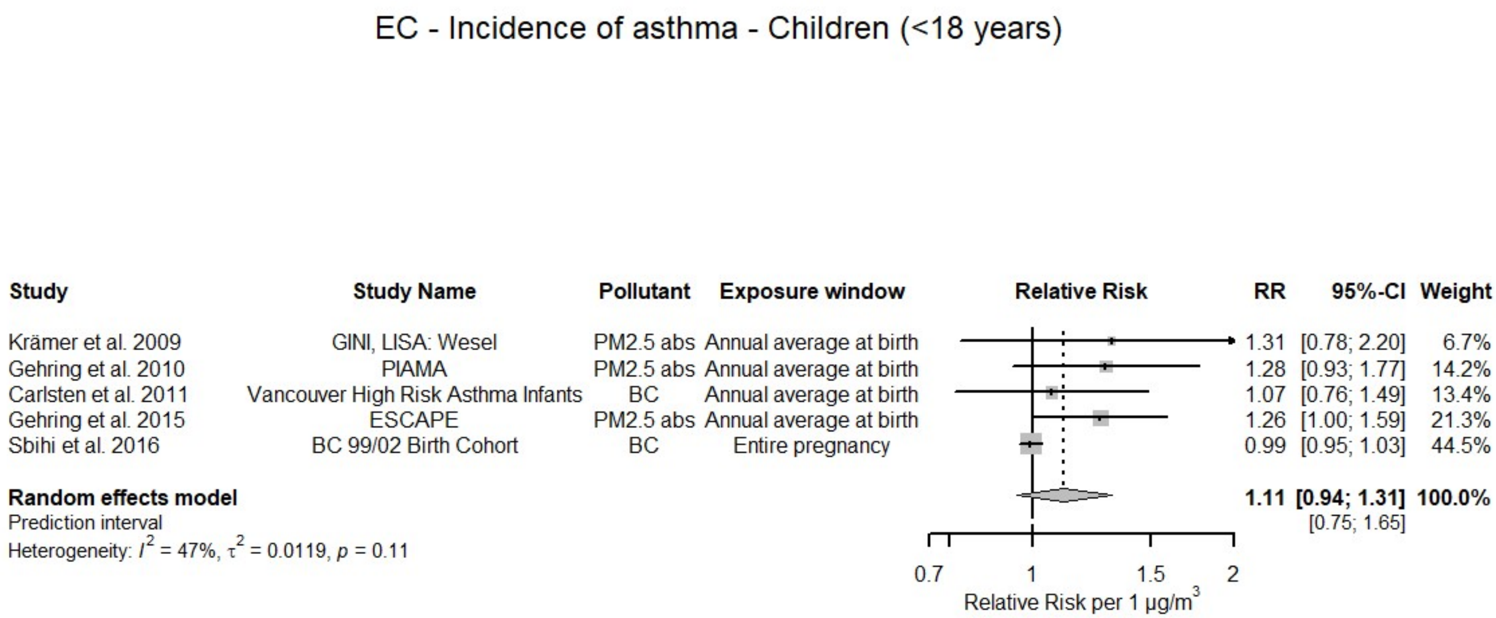
NO_X – Asthma onset - Children

Primary meta-analysis



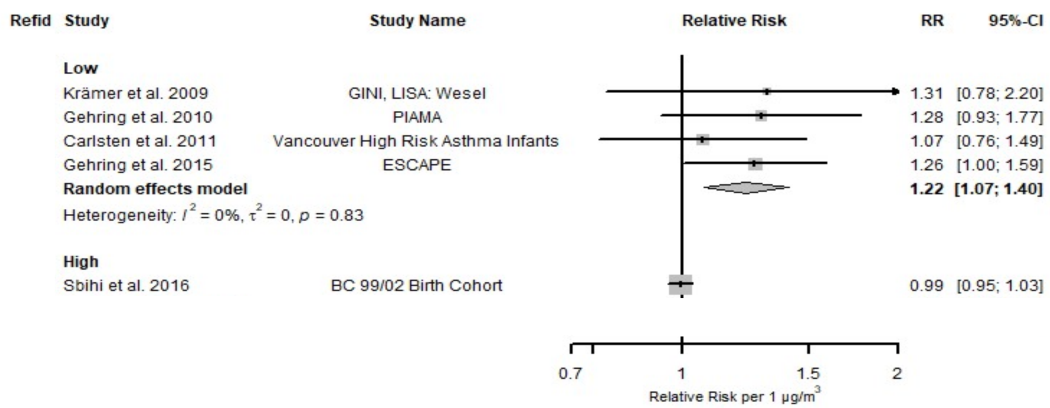
EC – Asthma onset - Children

Primary meta-analysis



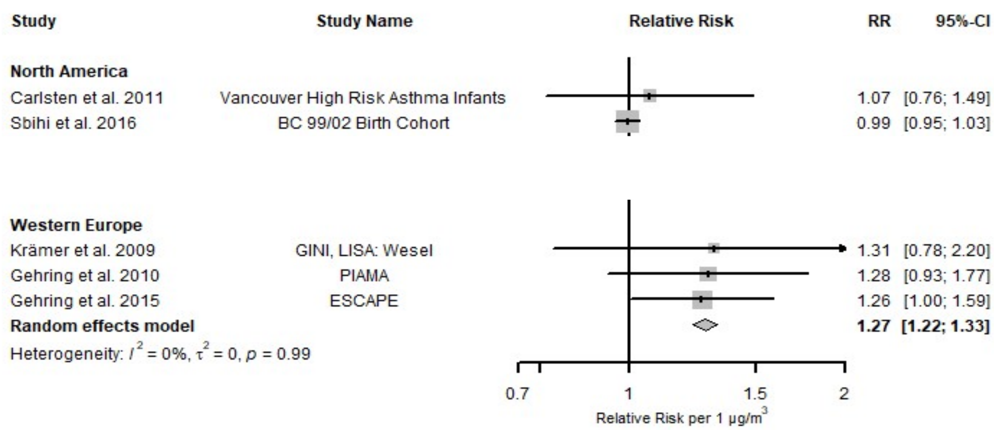
EC – Asthma onset – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low vs high



EC – Asthma onset – Children

Subgroup analysis – region

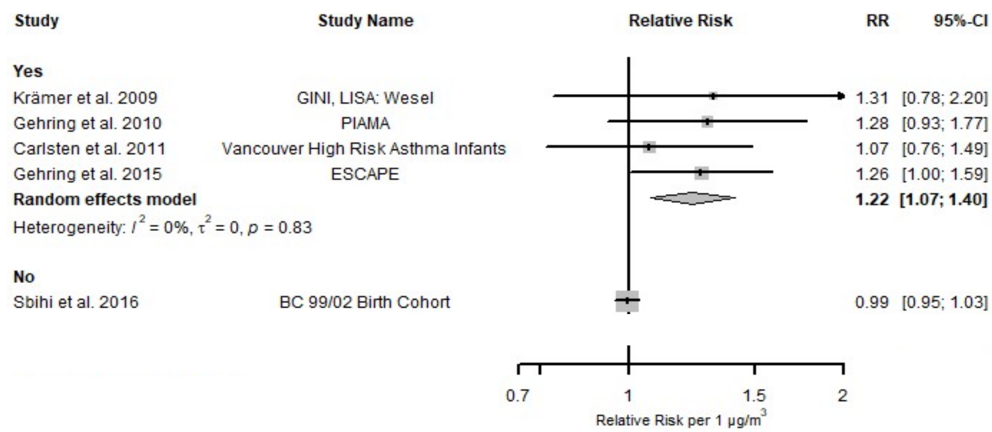


Subgroup analysis – traffic specificity

All studies rated high traffic specificity

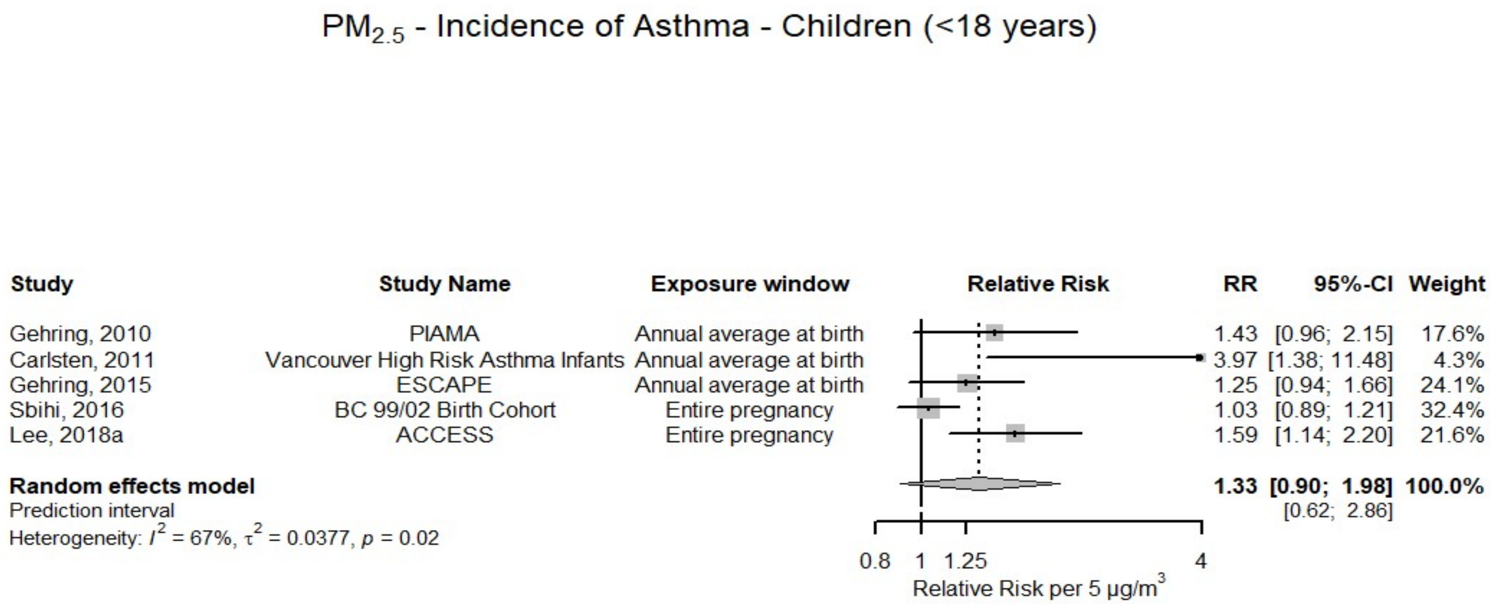
EC – Asthma onset – Children

Subgroup analysis – smoking adjustment



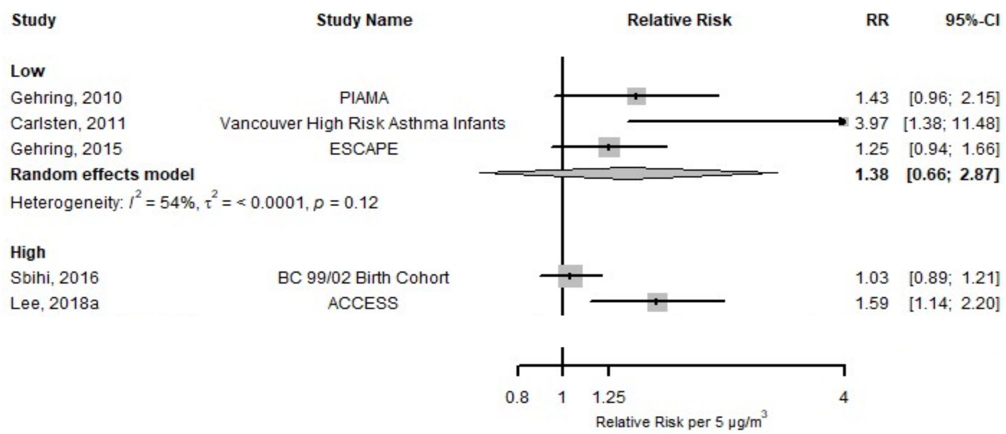
$PM_{2.5}$ – Asthma onset - Children

Primary meta-analysis



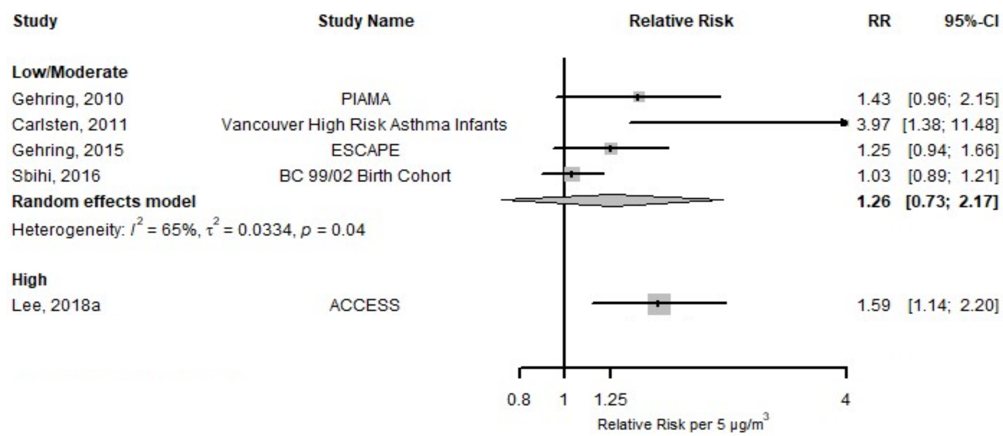
PM$_{2.5}$ – Asthma onset – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low vs high



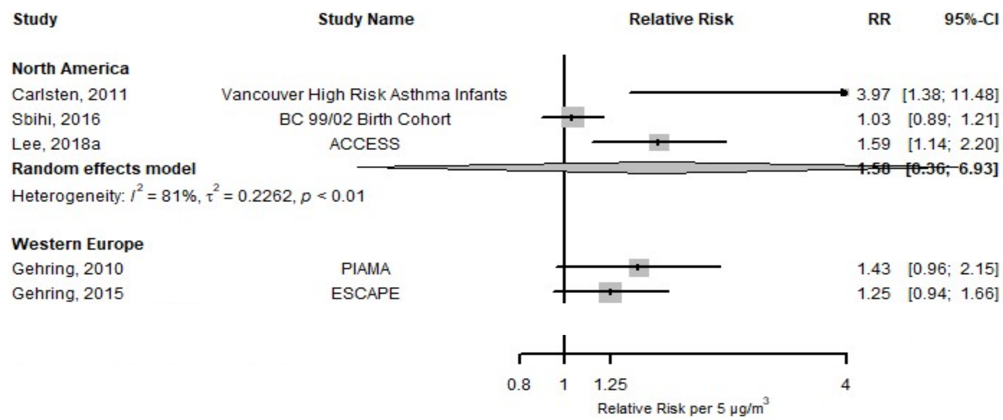
$PM_{2.5}$ – Asthma onset – Children

Sensitivity analysis – risk of bias missing data domain – low/moderate vs high



$PM_{2.5}$ – Asthma onset – Children

Subgroup analysis – region

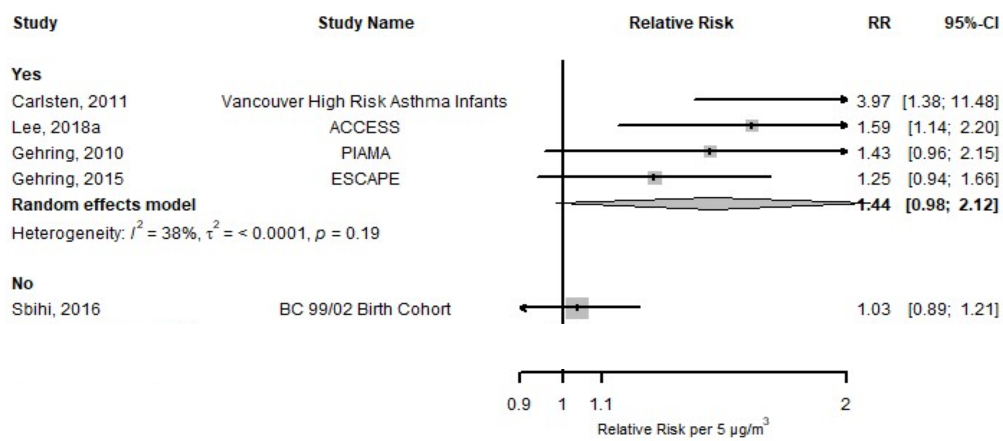


Subgroup analysis – traffic specificity

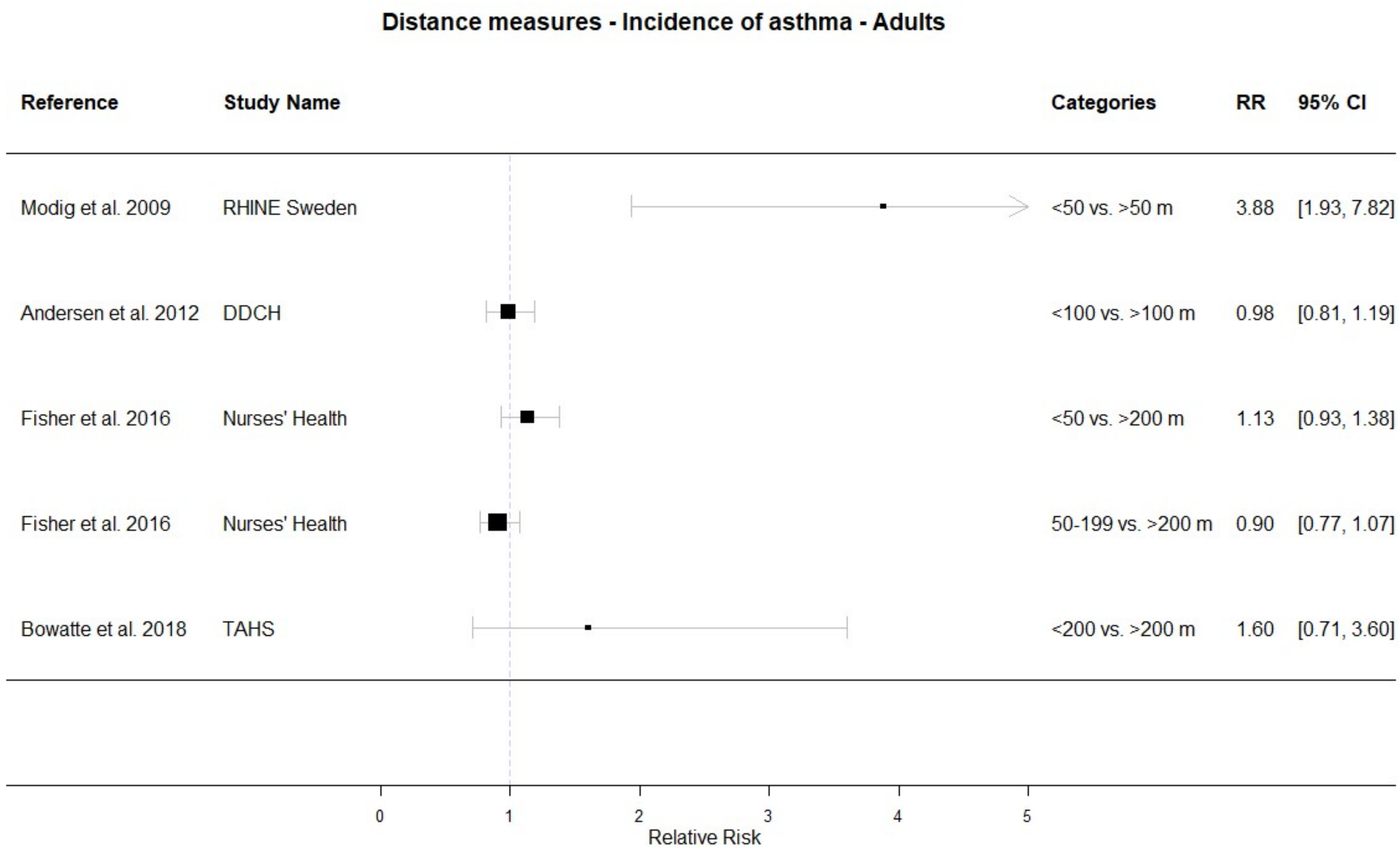
All rated as moderate

PM$_{2.5}$ – Asthma onset – Children

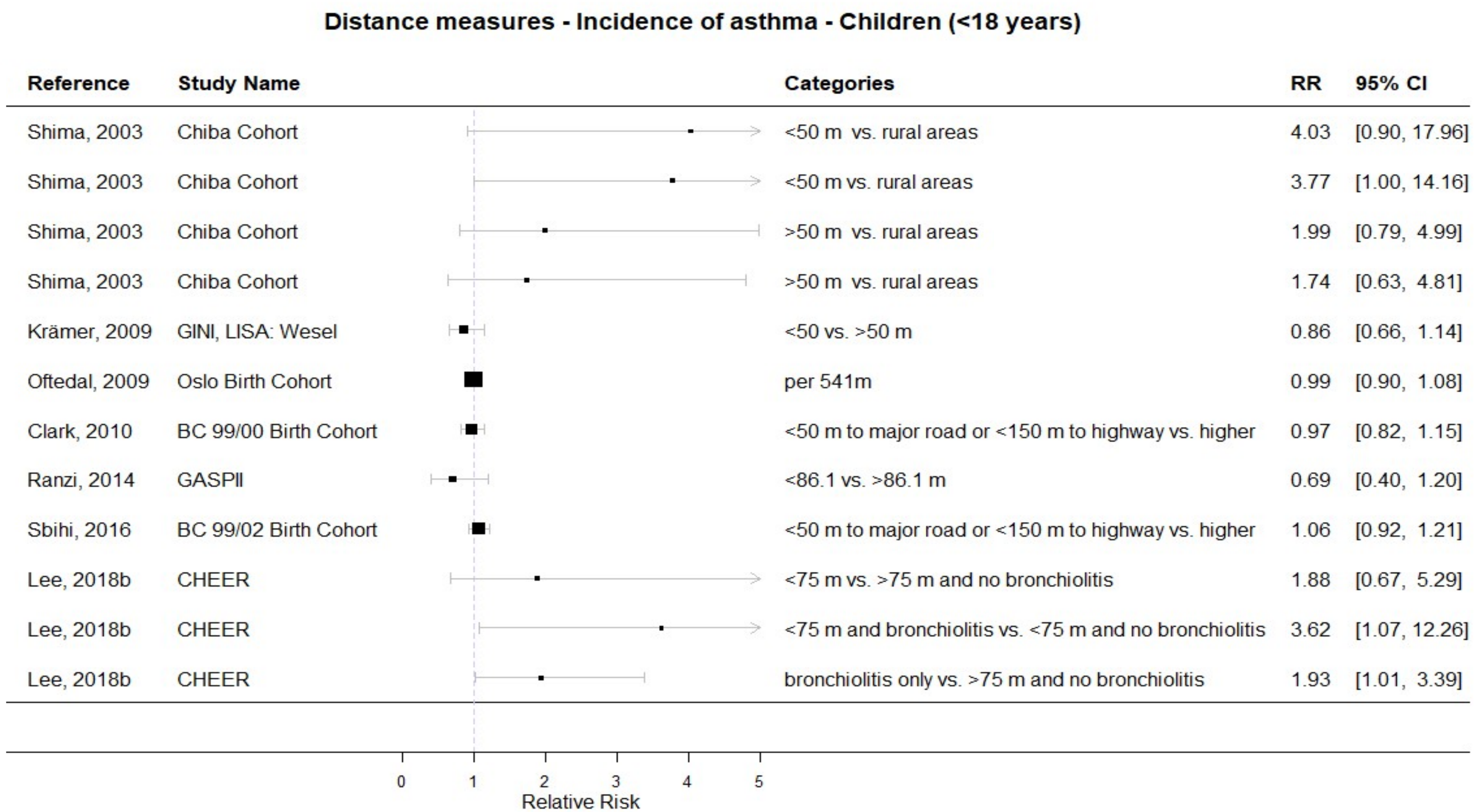
Subgroup analysis – smoking adjustment



Distance measures – Asthma onset – Adults

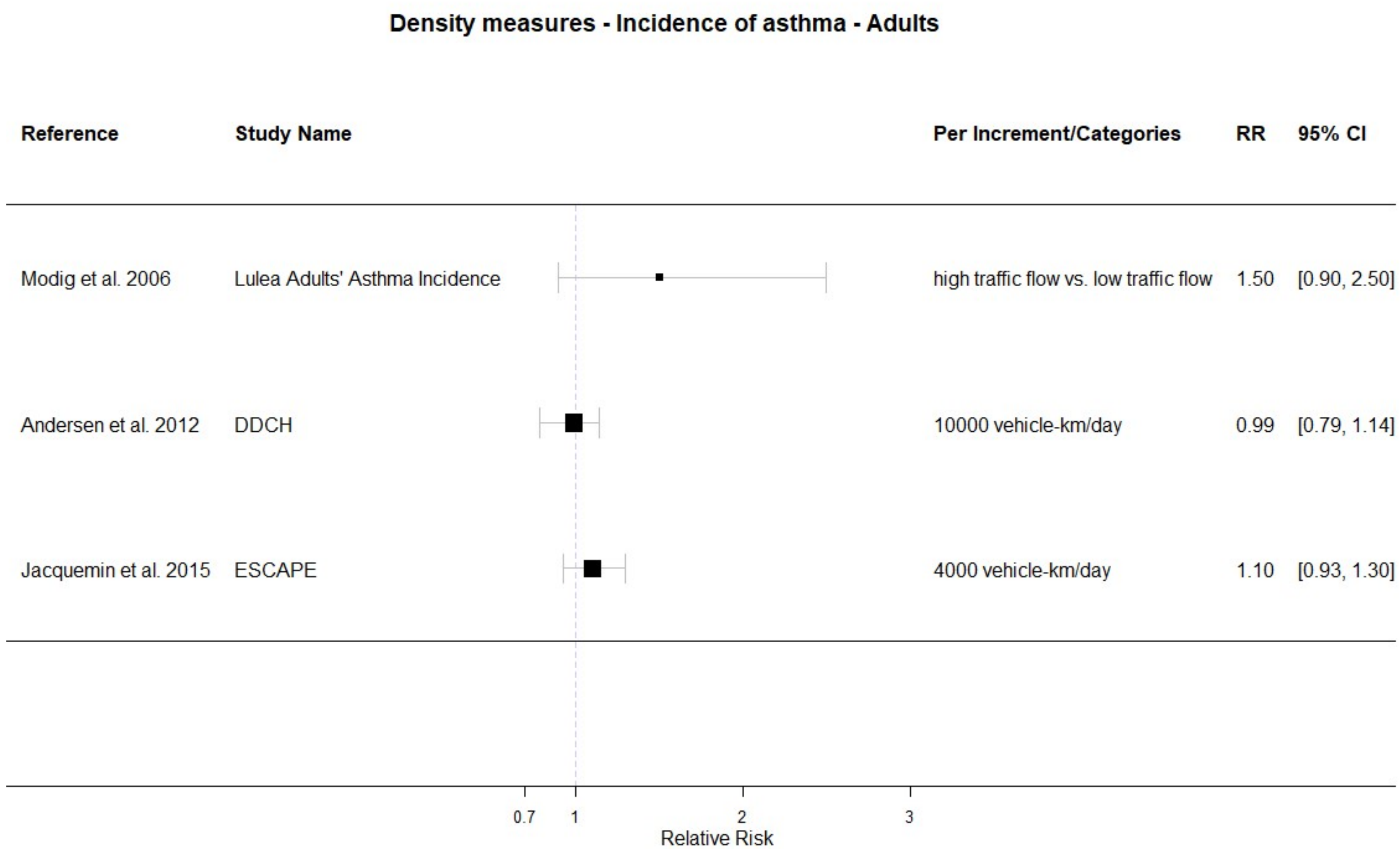


Distance measures – Asthma onset – Children

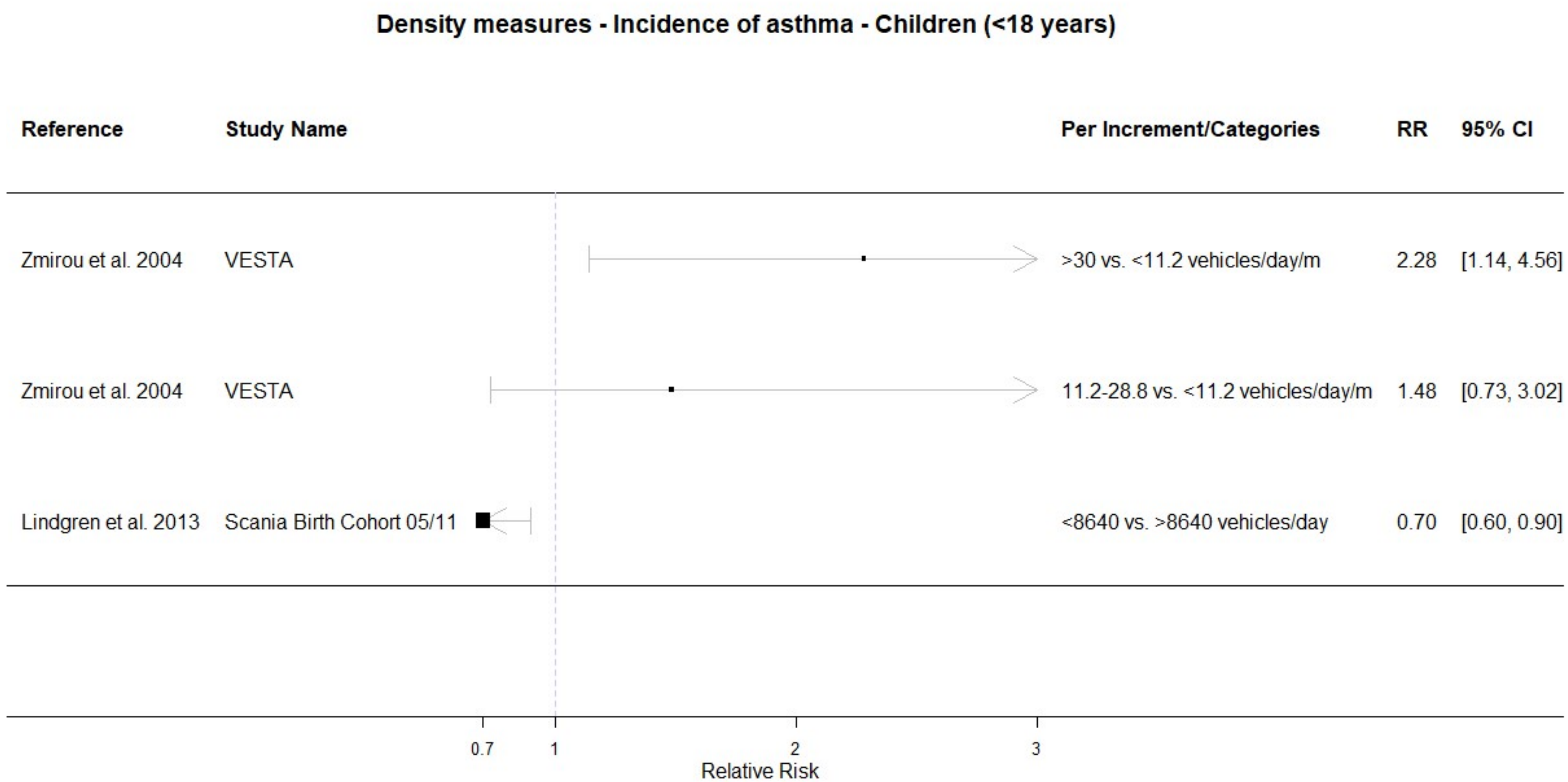


Shima et al. 2003 estimates were stratified by sex.

Density measures – Asthma onset – Adults

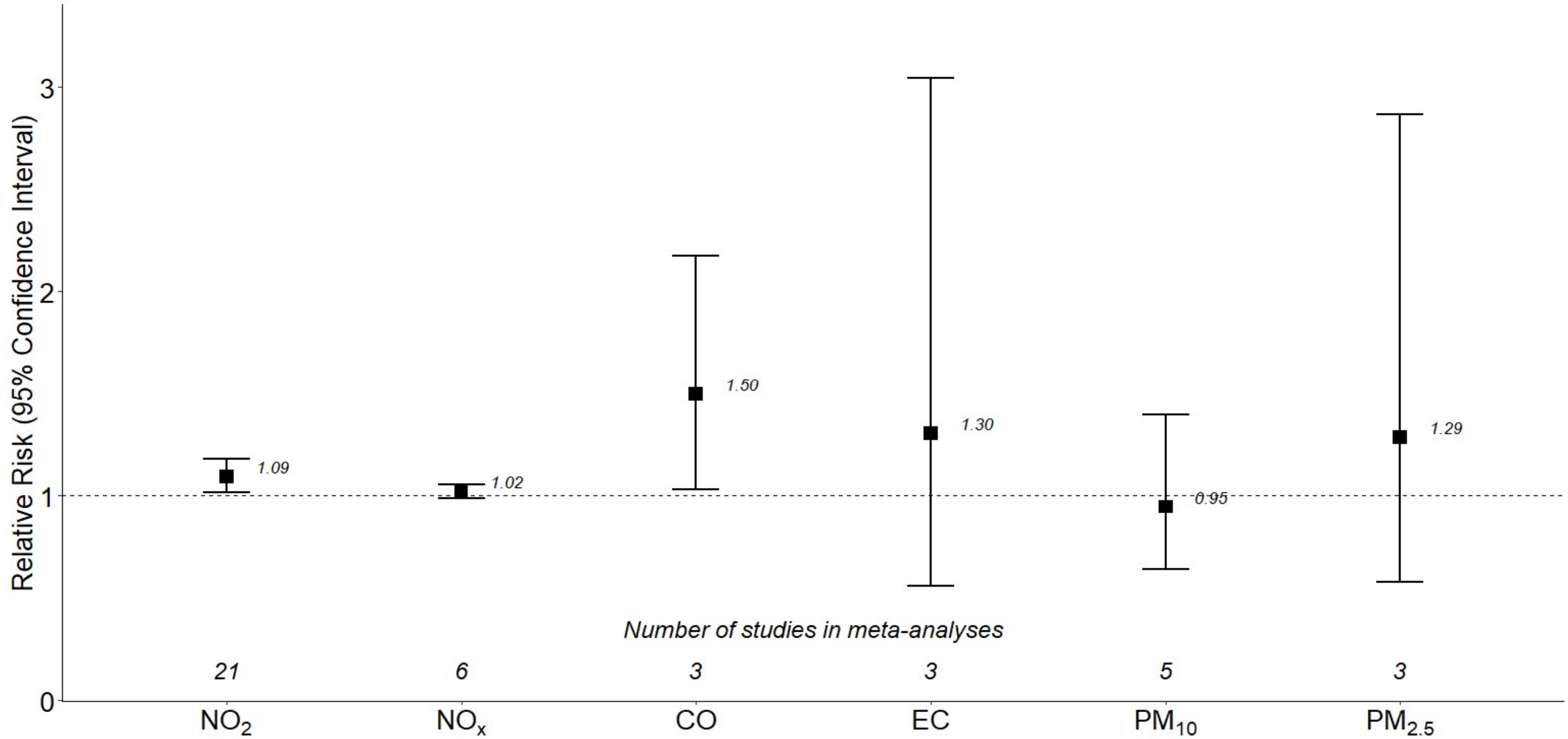


Density measures – Asthma onset – Children



9.2 Prevalence of asthma ever

Meta-analysis overview – Children (<18).

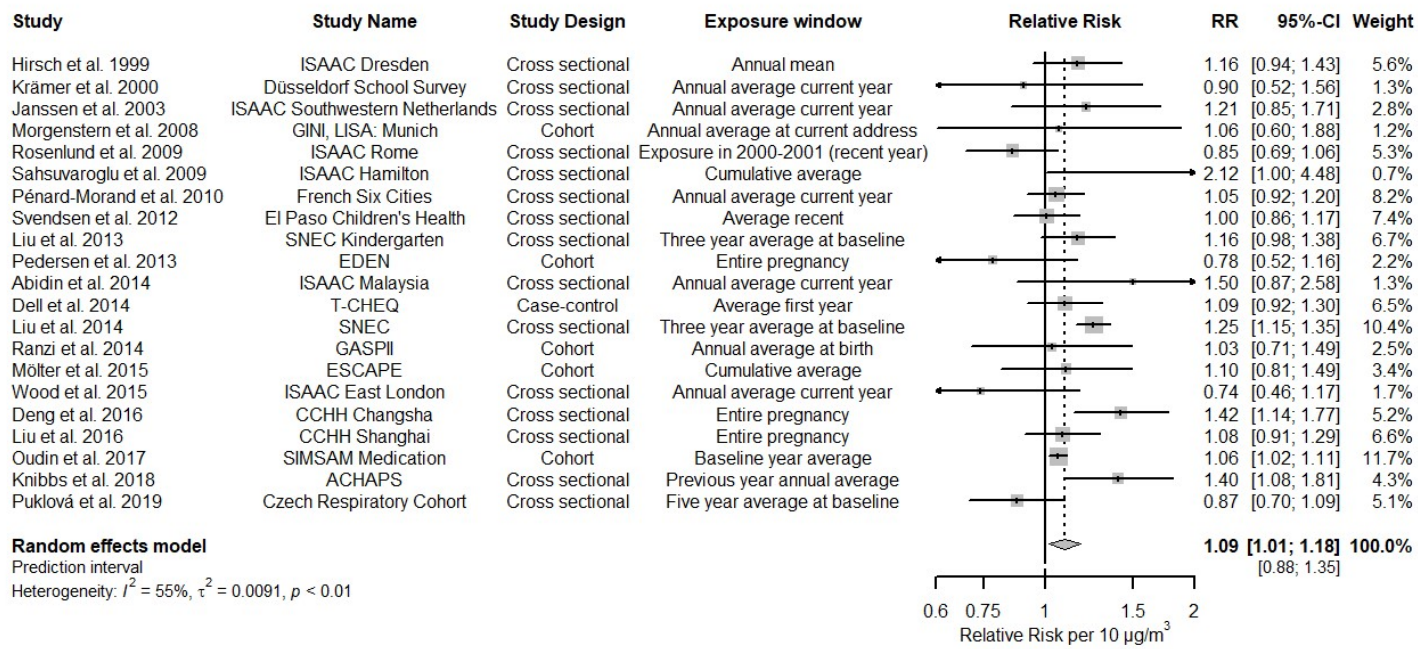


Footnote: The following increments were used: 10 µg/m^3 for NO_2, 20 µg/m^3 for NO_x, 1 mg/ m^3 for CO, 1 µg/m^3 for EC, 10 µg/m^3 for PM_{10} and 5 µg/m^3 for $PM_{2.5}$. Effect estimates cannot be directly compared across the different traffic–related pollutants because the selected increments do not necessarily represent the same contrast in exposure.

NO_2 – Prevalence of asthma ever - children

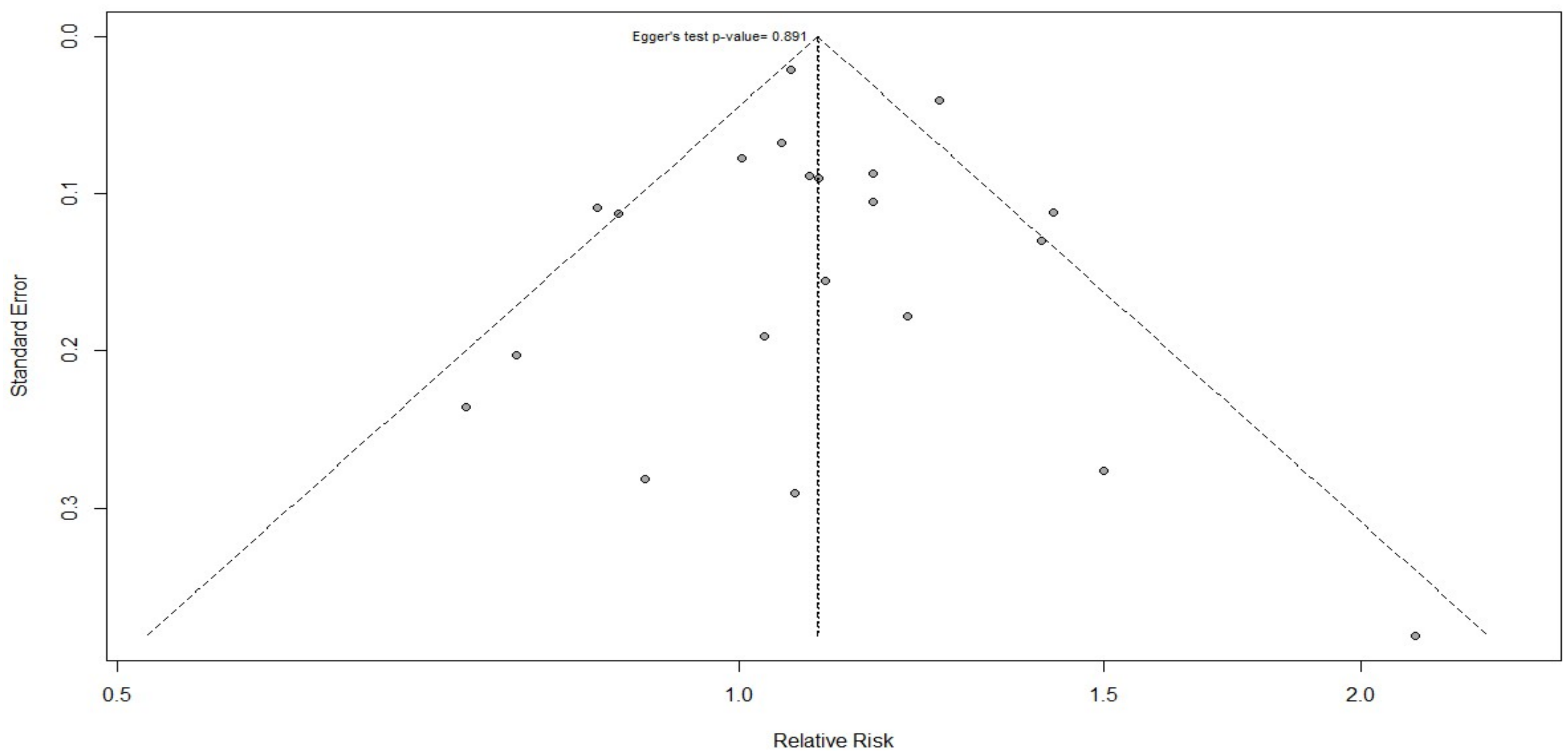
Primary meta-analysis

NO_2 - Prevalence of asthma ever - Children (<18 years)



NO_2 – Prevalence of asthma ever – Children

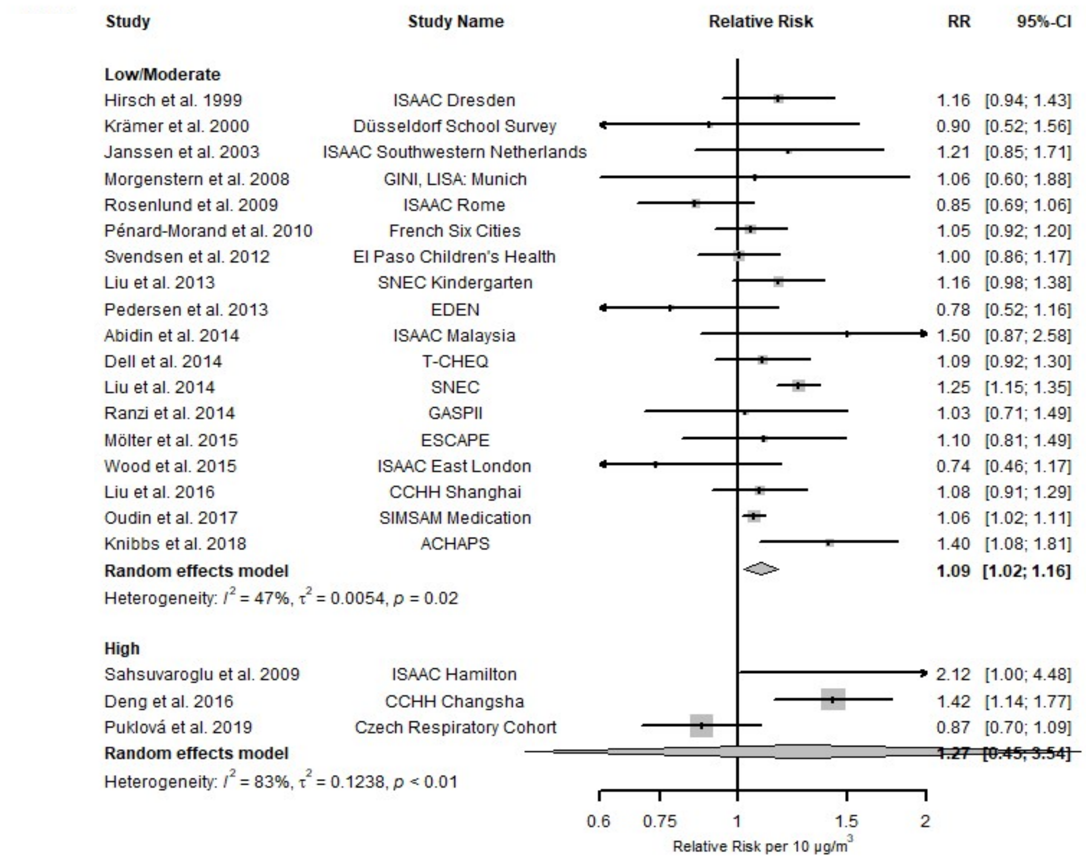
Funnel plot



Footnote: The vertical lines in the funnel plots represent the pooled fixed and random effect estimates. The vertical dashed line in the middle of the funnel shows the fixed effect estimate. As the Panel applied a random–effects model, the funnel plot also presents the random–effects estimate with the dotted line.

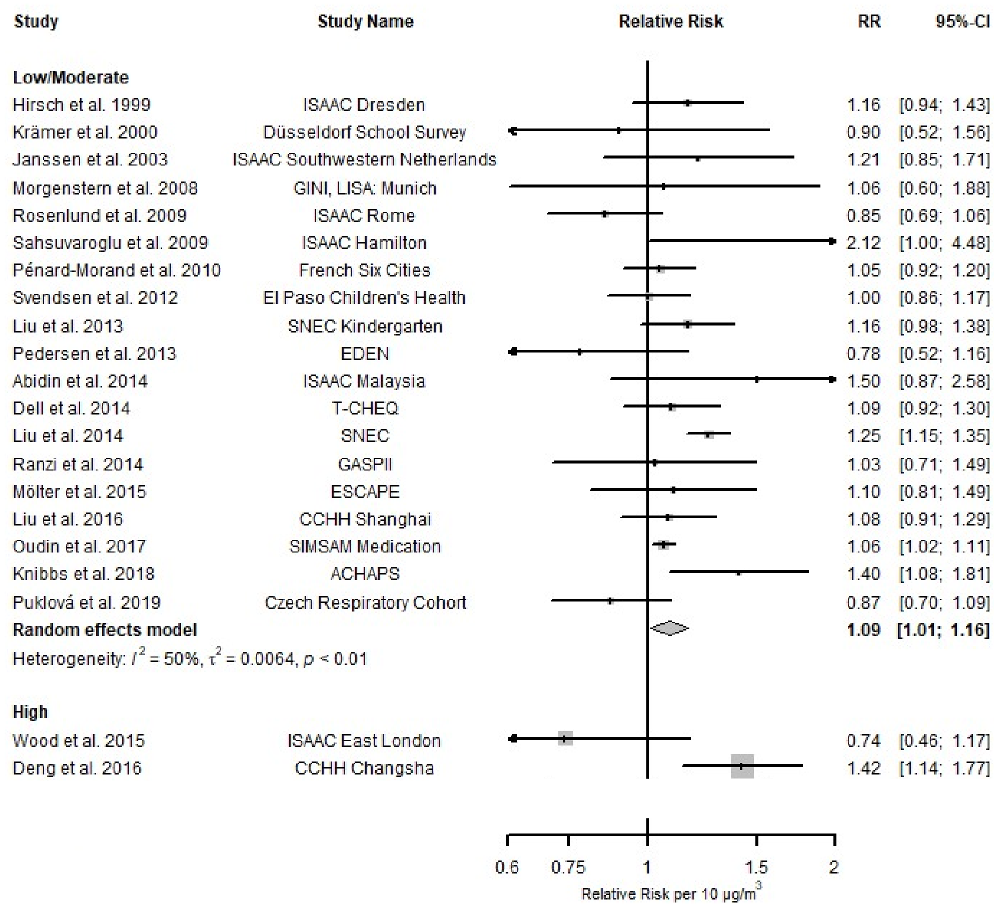
NO_2 – Prevalence of asthma ever – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low/moderate vs high



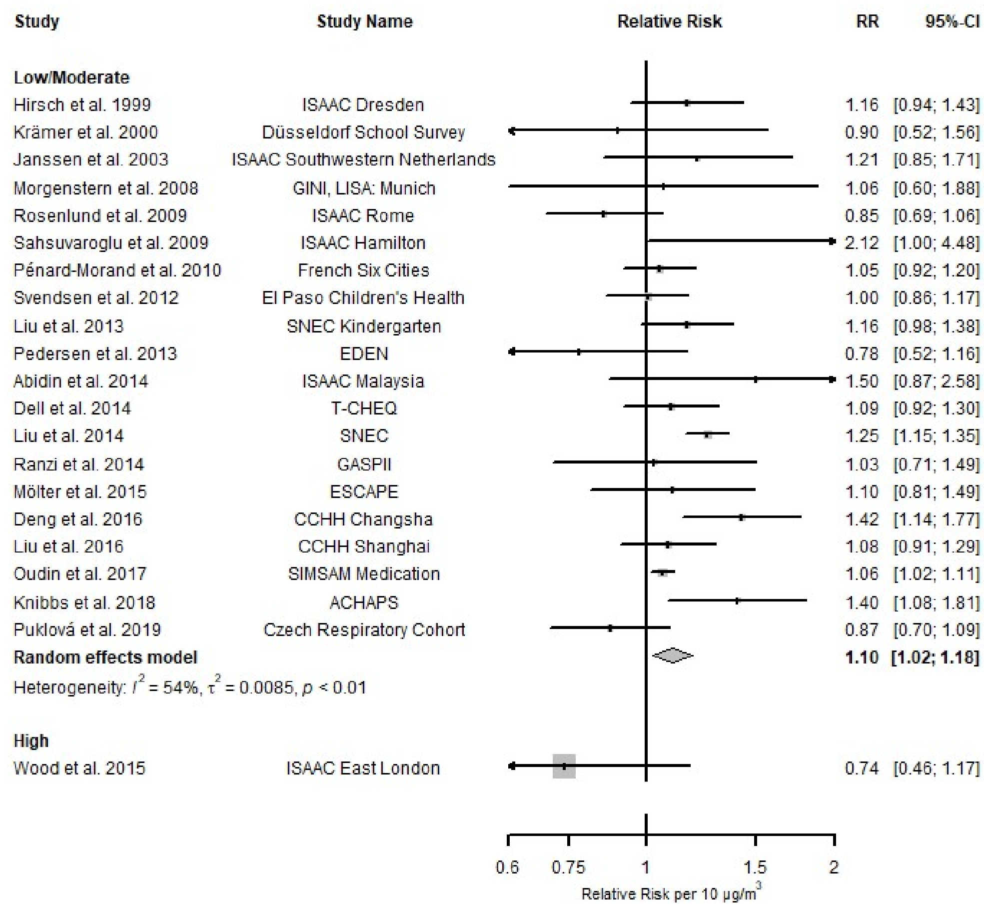
NO_2 – Prevalence of asthma ever – Children

Sensitivity analysis – risk of bias selection bias domain – low/moderate vs high



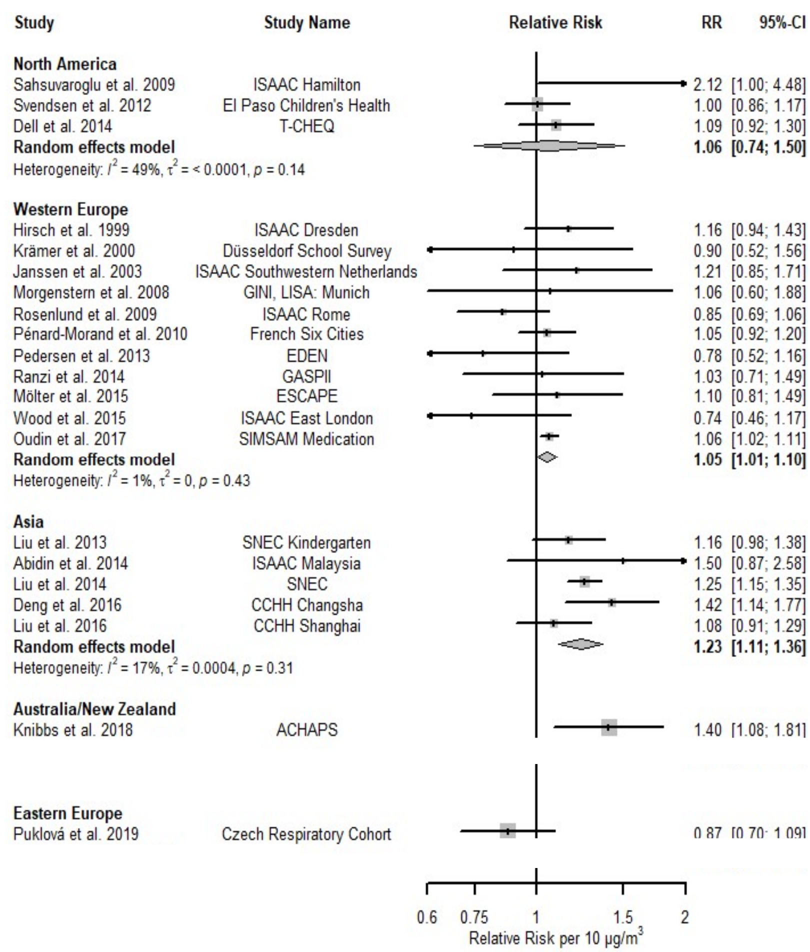
NO_2 – Prevalence of asthma ever – Children

Sensitivity analysis – risk of bias outcome measurement domain – low/moderate vs high



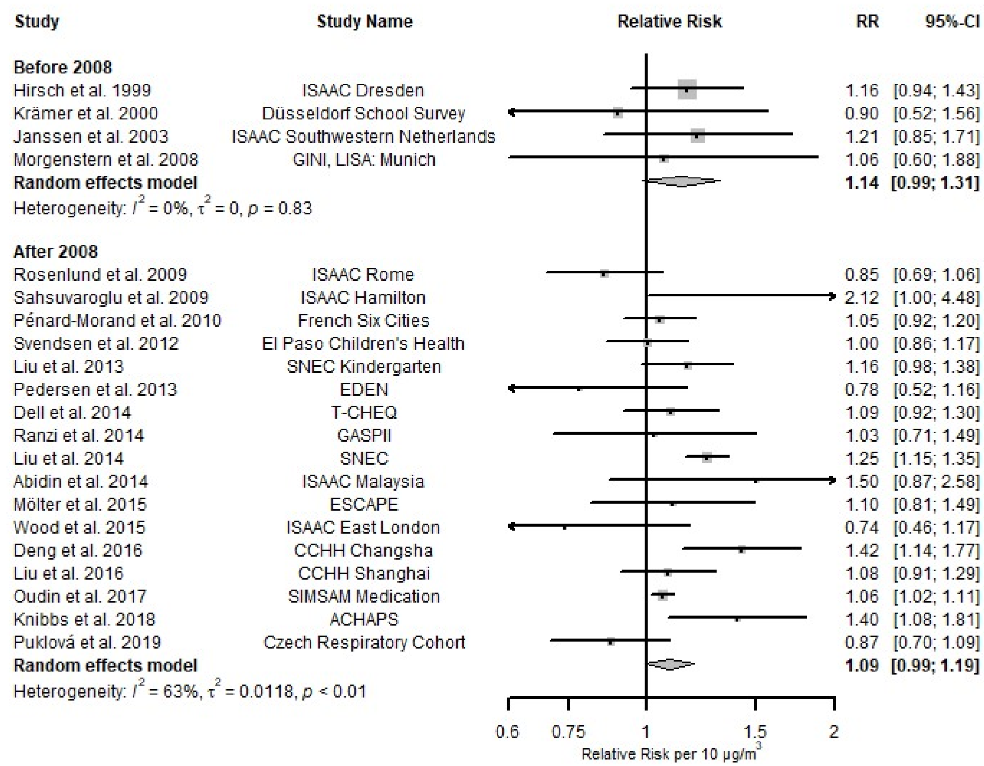
NO_2 – Prevalence of asthma ever – Children

Subgroup analysis – region



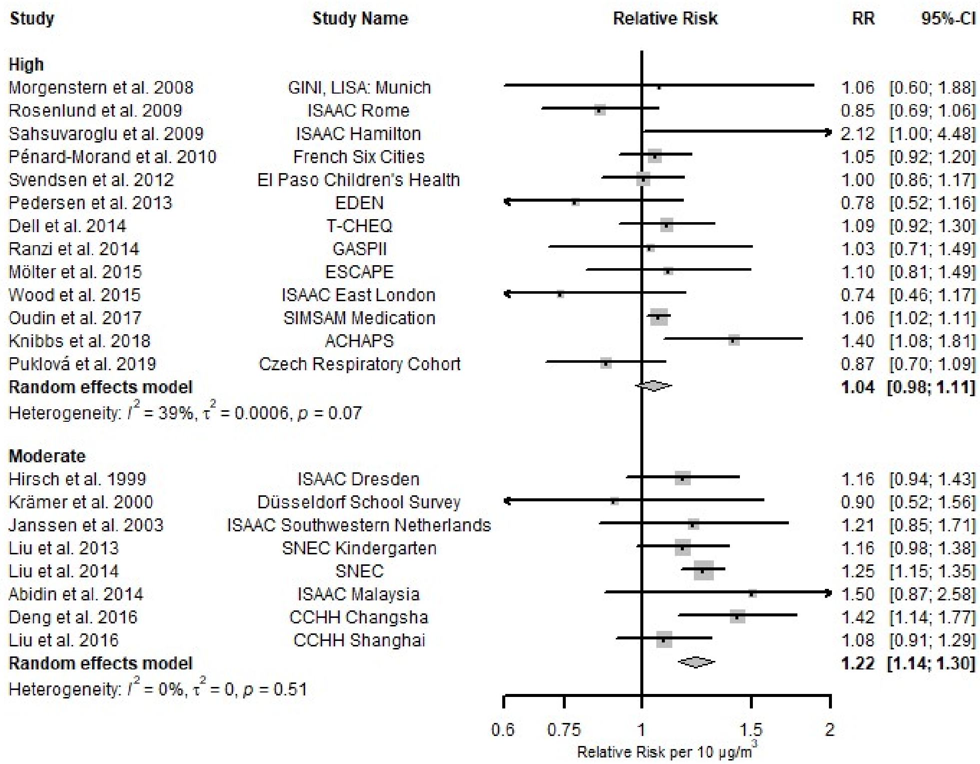
NO_2 – Prevalence of asthma ever – Children

Subgroup analysis – year of publication



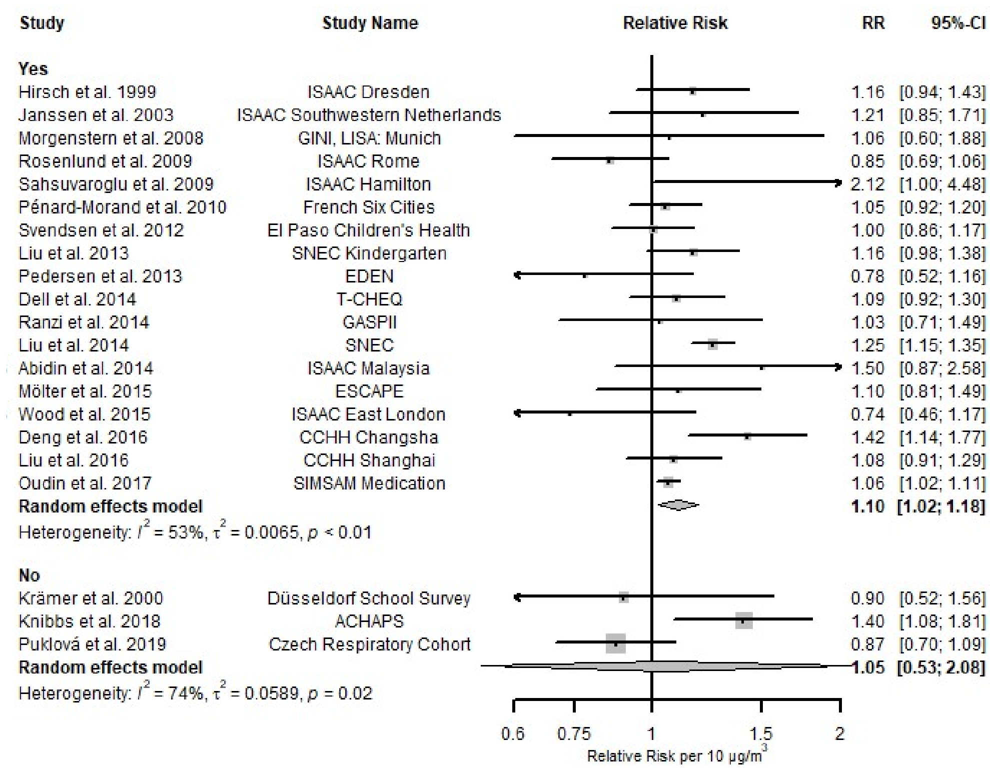
NO_2 – Prevalence of asthma ever – Children

Subgroup analysis – traffic specificity



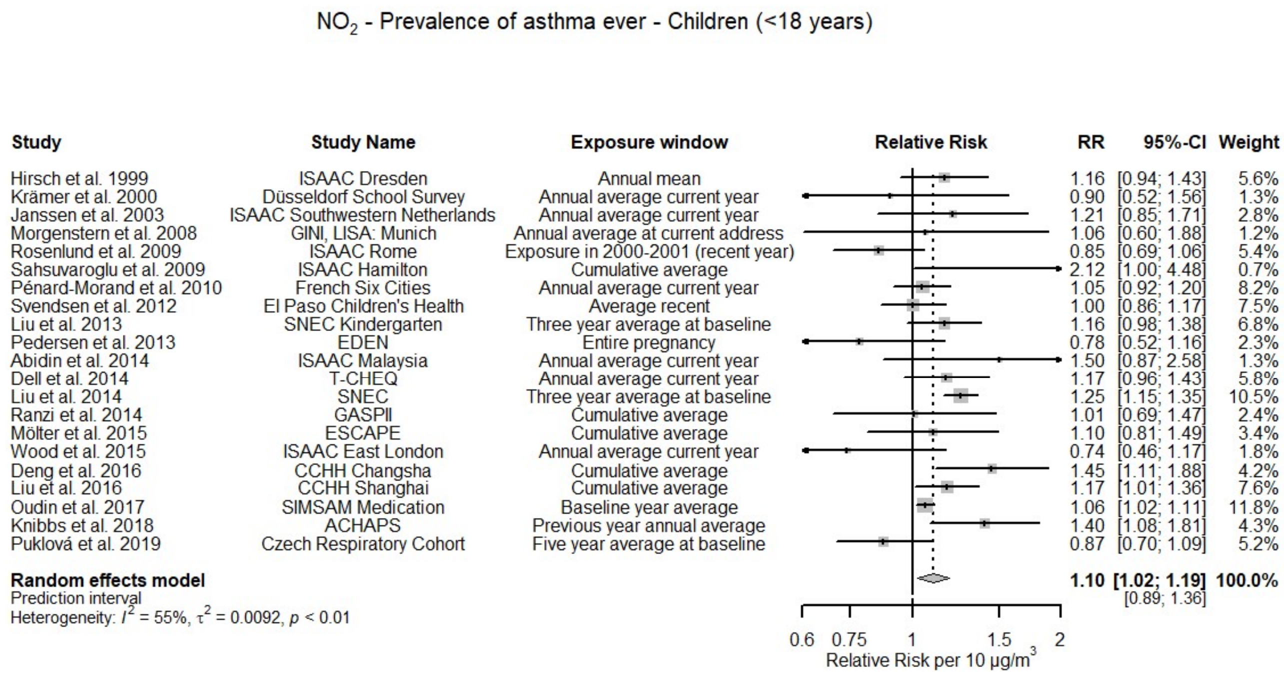
NO_2 – Prevalence of asthma ever – Children

Subgroup analysis – smoking adjustment



NO_2 – Prevalence of asthma ever – Children

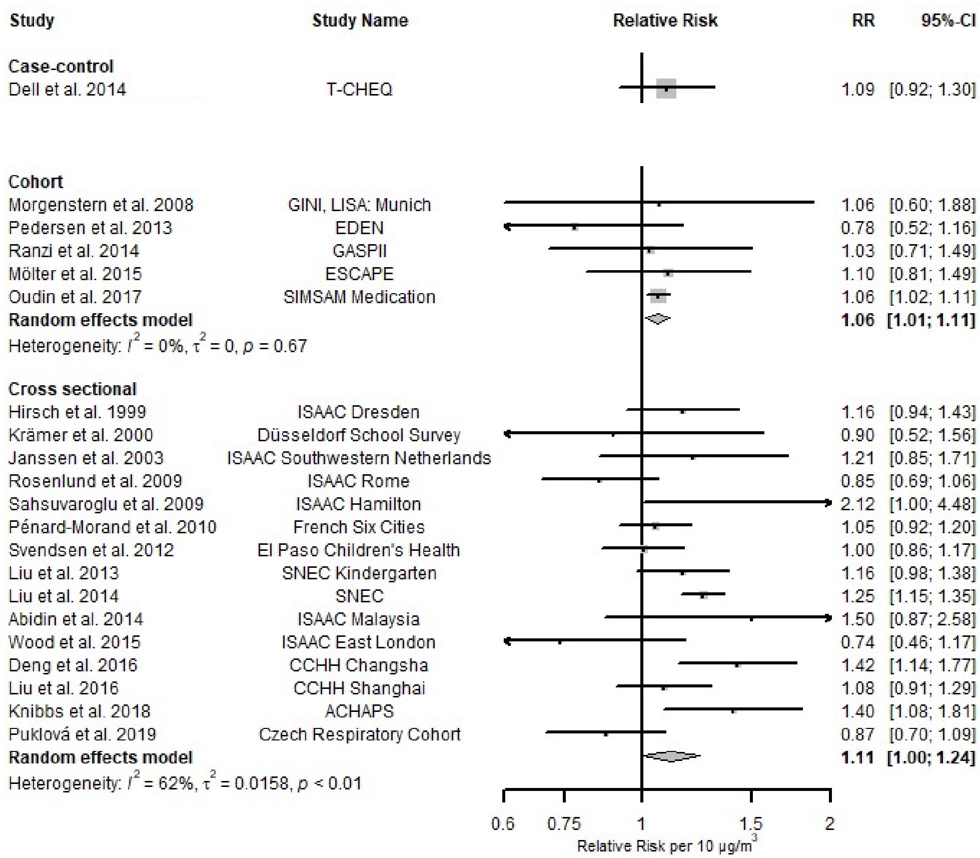
Sensitivity analysis – reverse selection



Recent years > cumulative average > first year of life > at birth > pregnancy

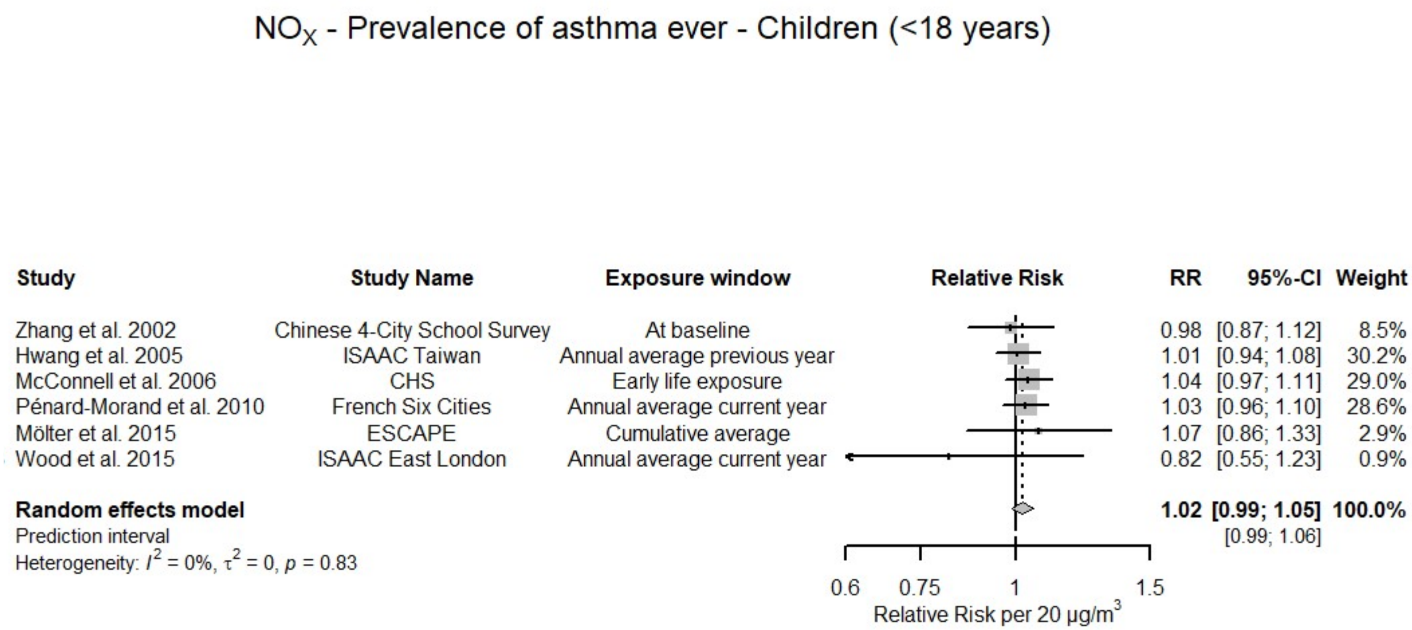
NO_2 – Prevalence of asthma ever – Children

Subgroup analysis – study design



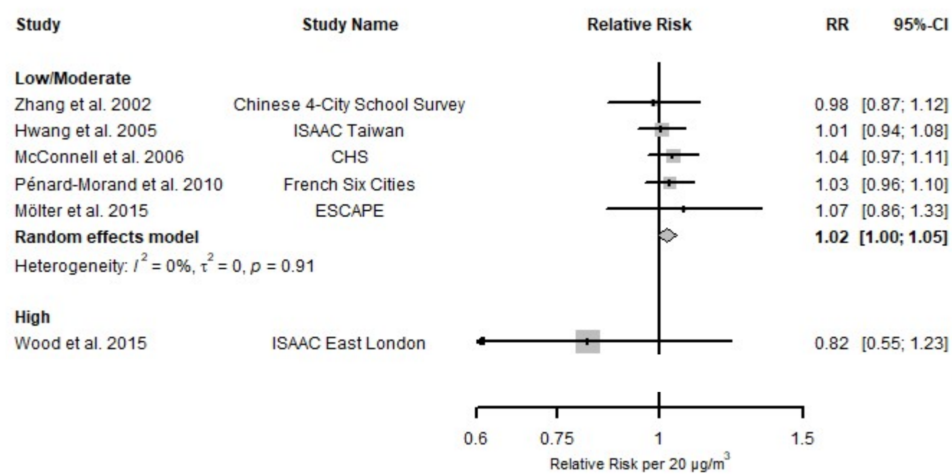
NO_x – Prevalence of asthma ever - Children

Primary meta-analysis



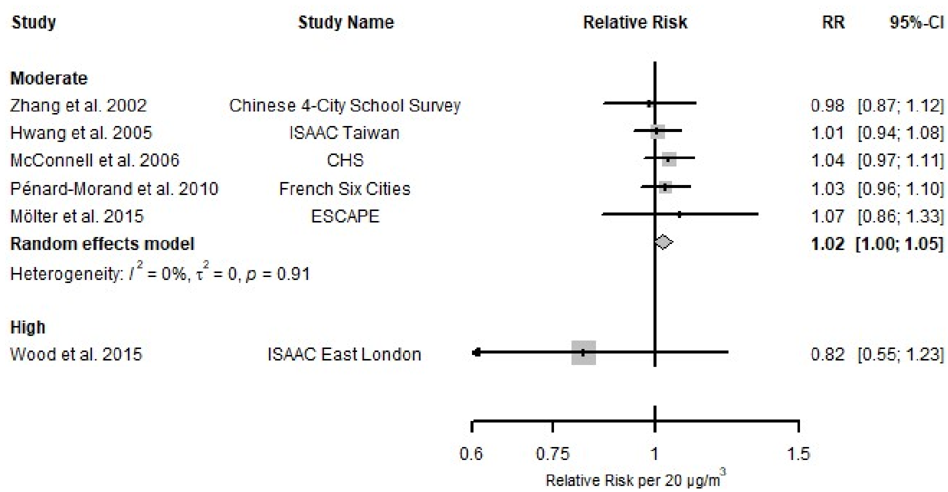
NO_x – Prevalence of asthma ever – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias selection bias domain – low/moderate vs high



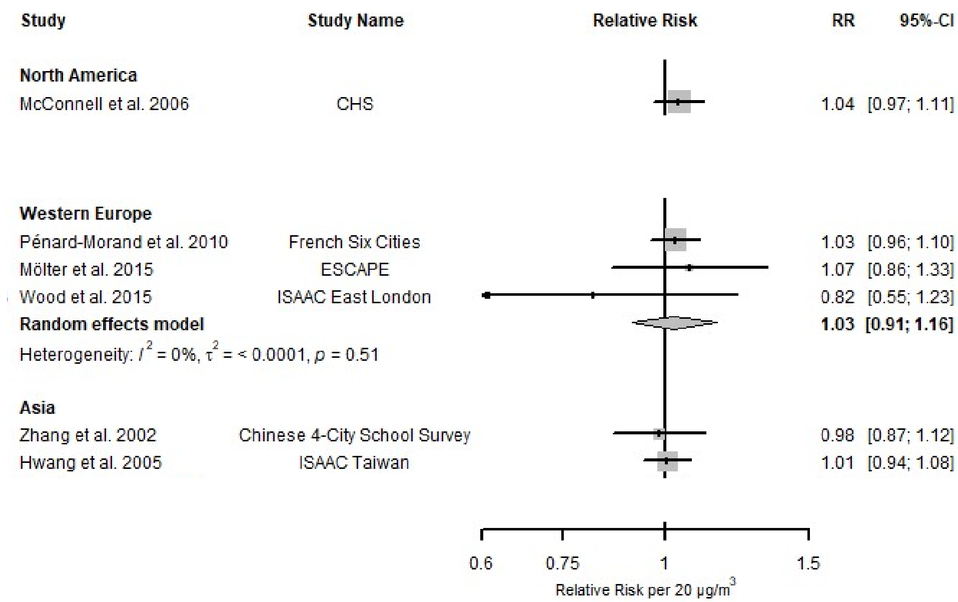
NO_x – Prevalence of asthma ever – Children

Sensitivity analysis – risk of bias outcome measurement domain – moderate vs high



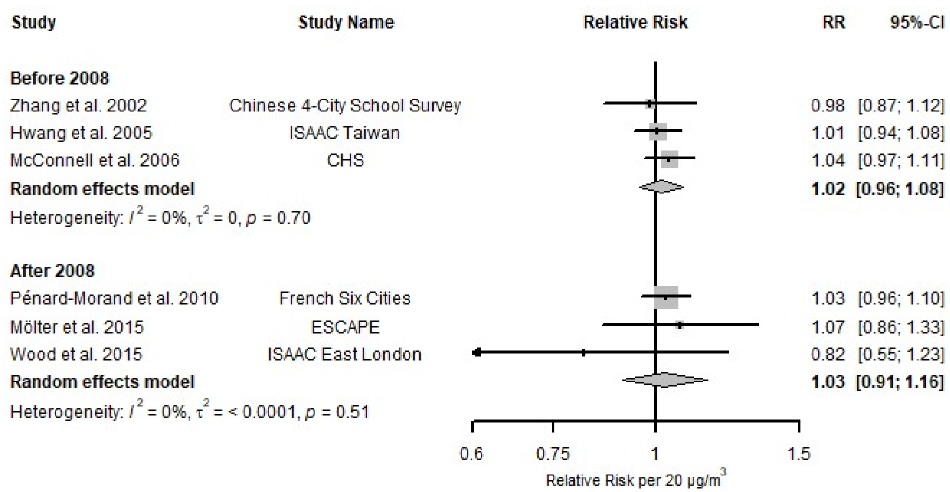
NO_x – Prevalence of asthma ever – Children

Subgroup analysis – region



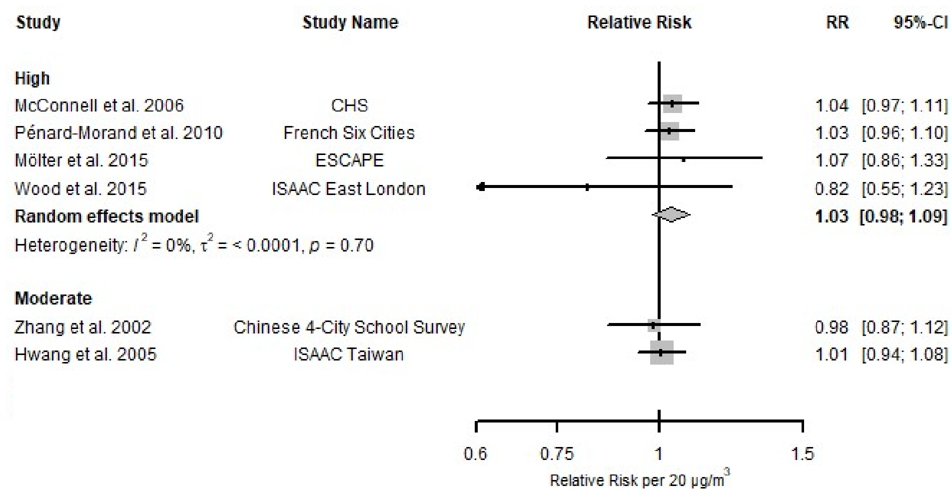
NO_x – Prevalence of asthma ever – Children

Subgroup analysis – year of publication



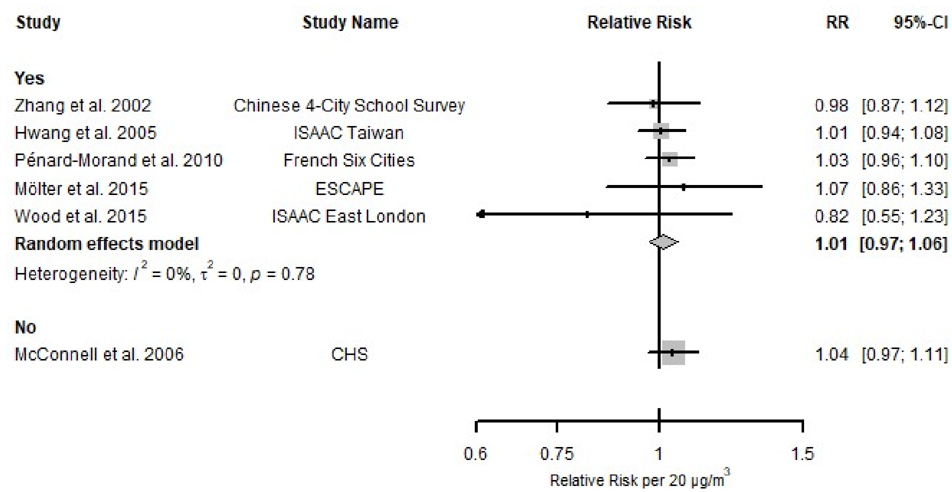
NO_x – Prevalence of asthma ever – Children

Subgroup analysis – traffic specificity



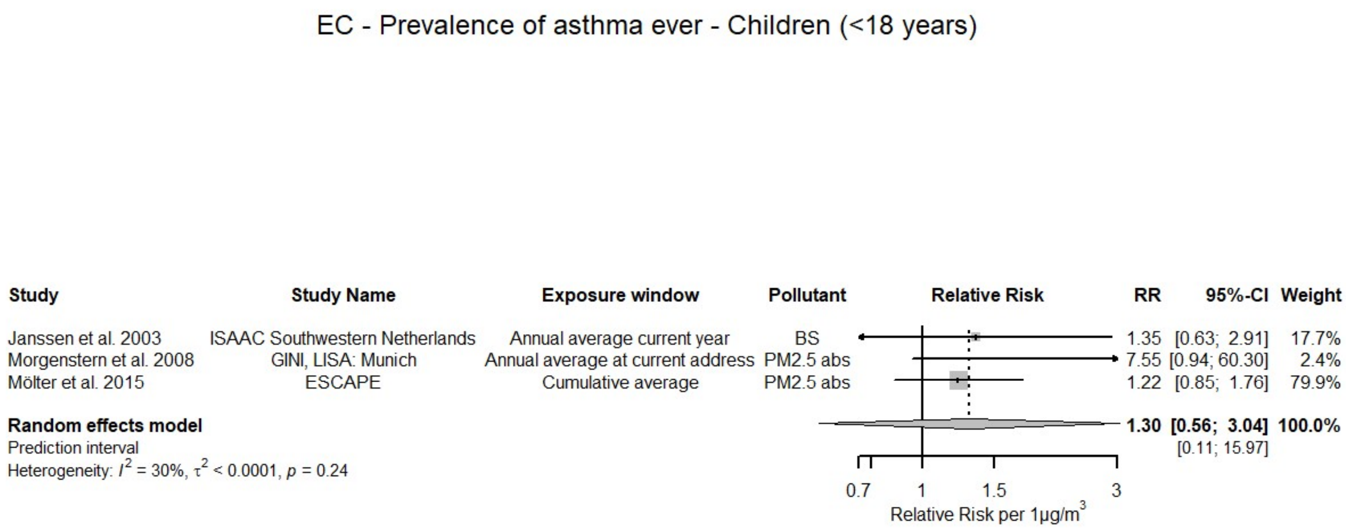
NO_x – Prevalence of asthma ever – Children

Subgroup analysis – smoking adjustment



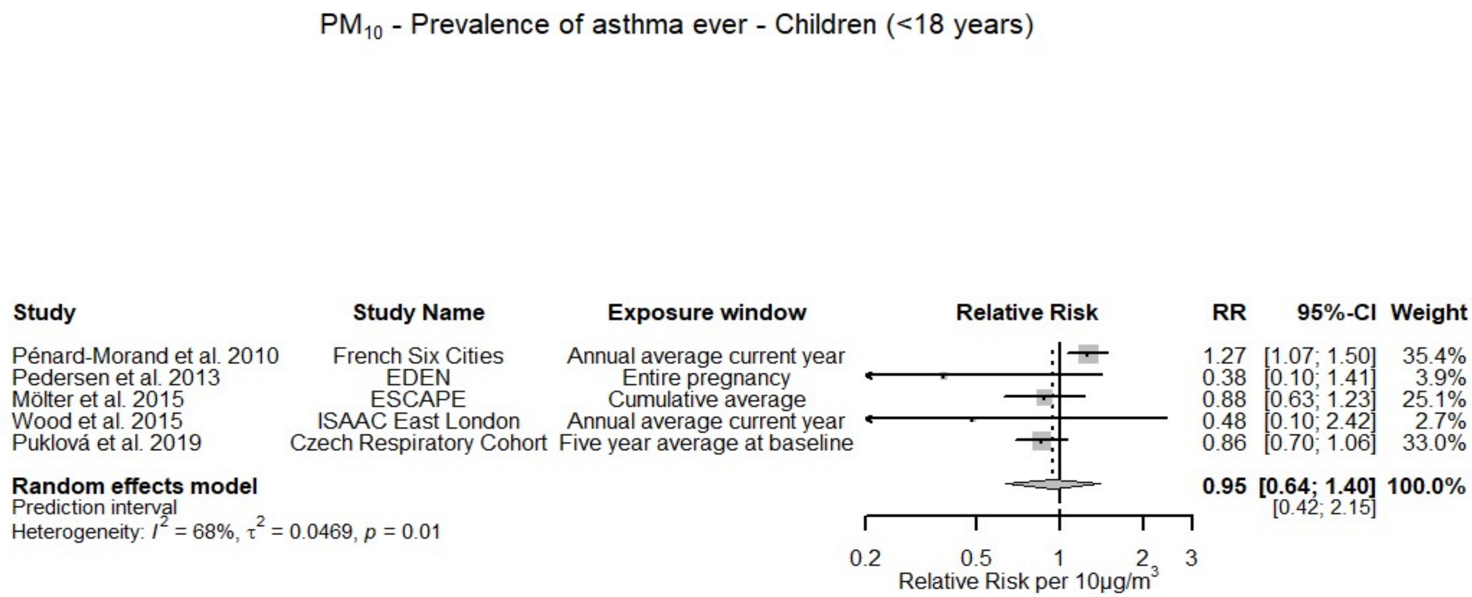
EC – Prevalence of asthma ever – Children

Primary meta-analysis



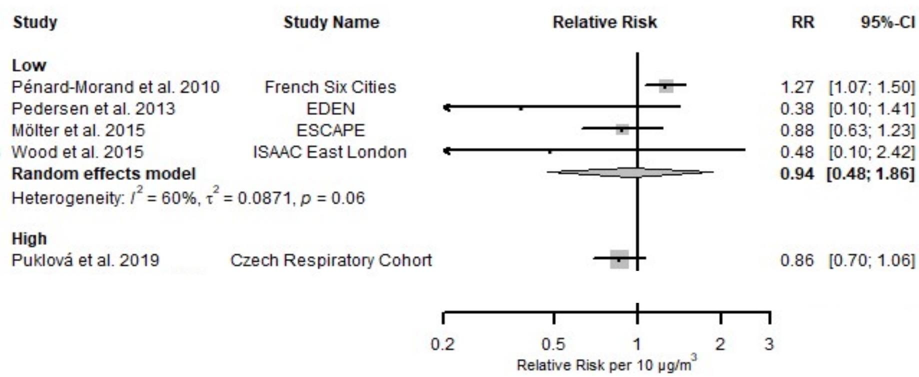
PM$_{10}$ – Prevalence of asthma ever – Children

Primary meta-analysis



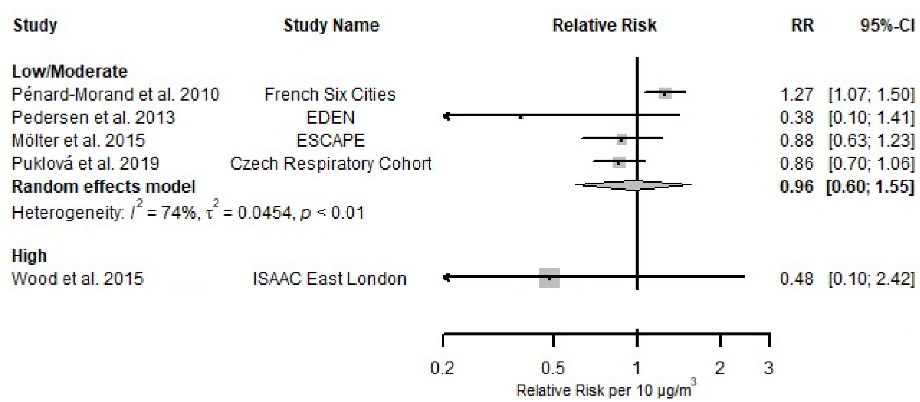
PM_{10} – Prevalence of asthma ever – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low vs high



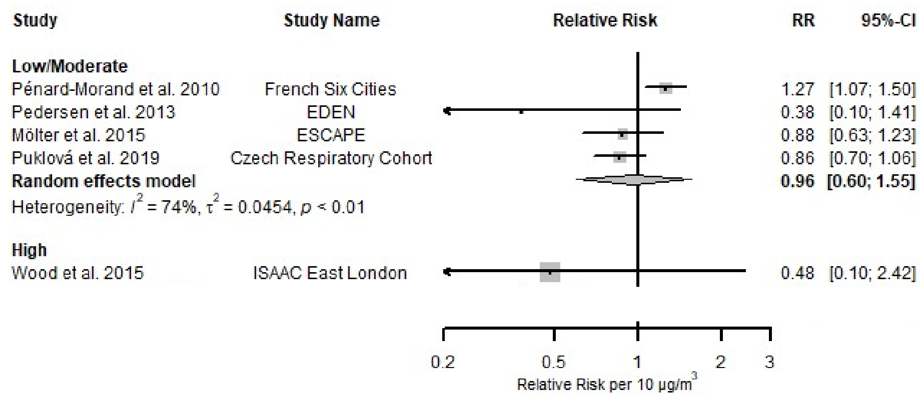
PM_{10} – Prevalence of asthma ever – Children

Sensitivity analysis – risk of bias selection bias domain – low/moderate vs high



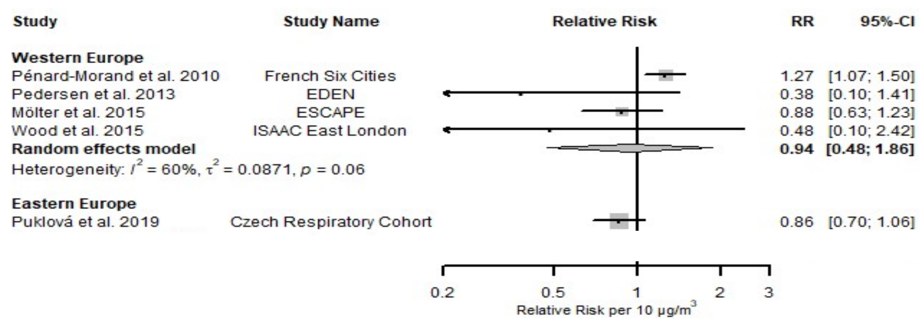
PM$_{10}$ – Prevalence of asthma ever – Children

Sensitivity analysis – risk of bias outcome measurement domain – low/moderate vs high



PM_{10} – Prevalence of asthma ever – Children

Subgroup analysis – region



Subgroup analysis – year of publication

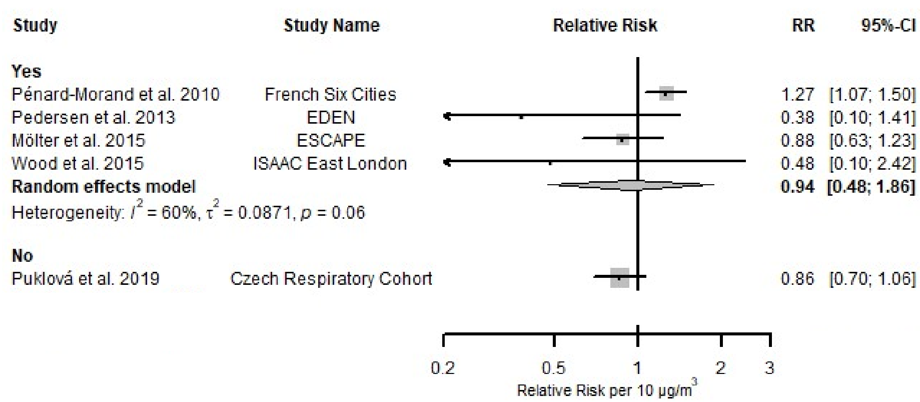
All studies published after 2008

Subgroup analysis – traffic specificity

All studies moderate specificity

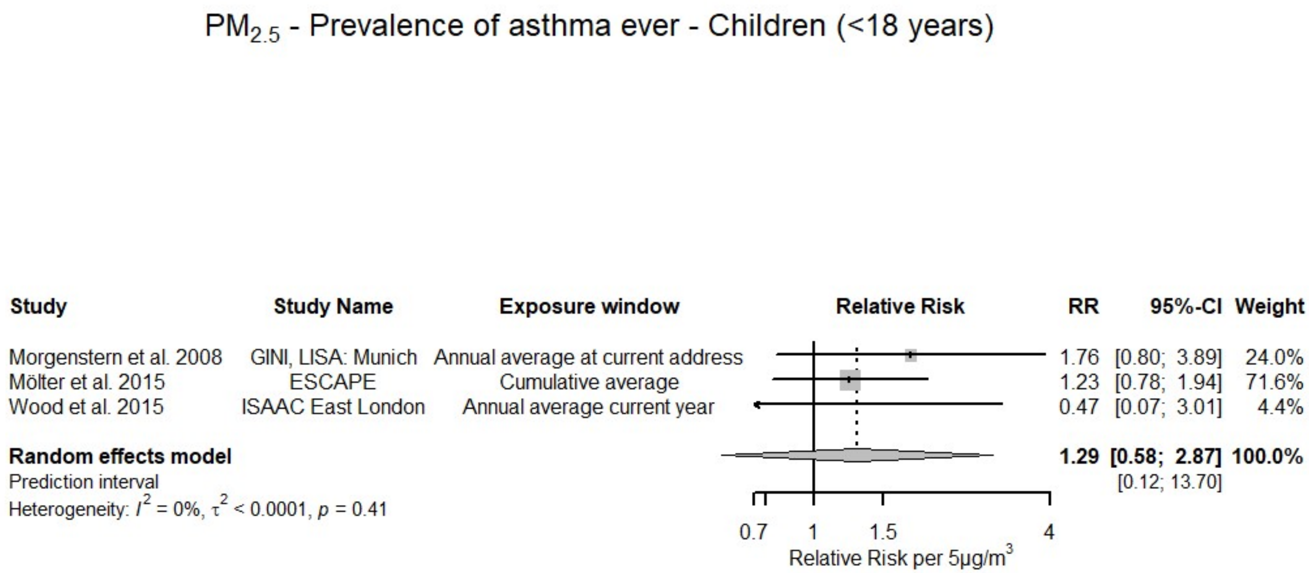
PM_{10} – Prevalence of asthma ever – Children

Subgroup analysis – smoking adjustment



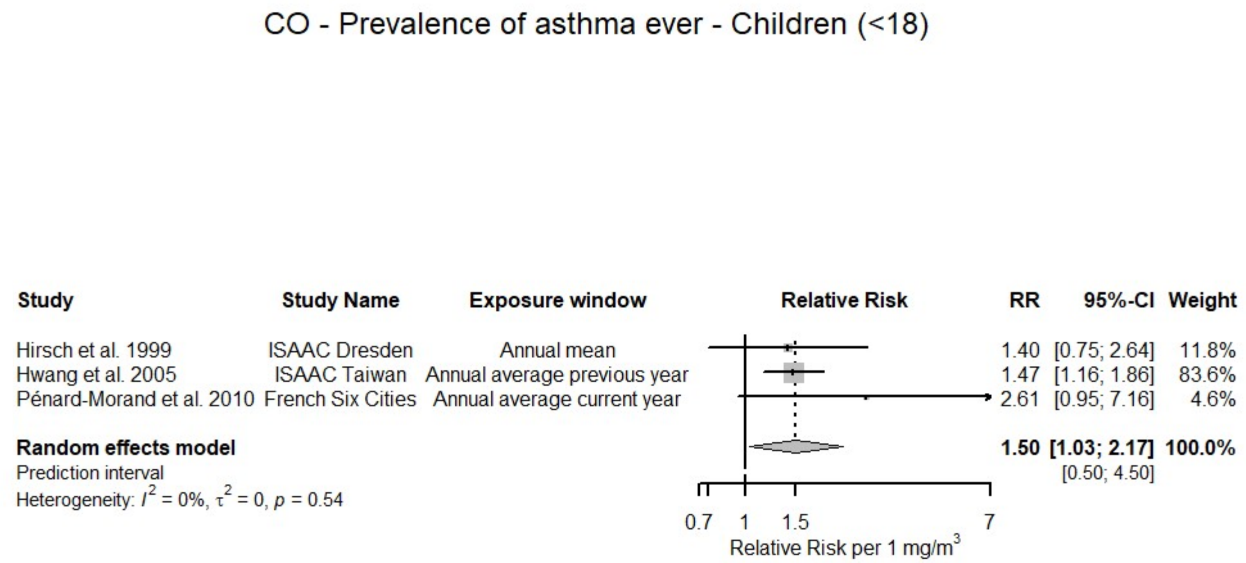
$PM_{2.5}$ – Prevalence of asthma ever – Children

Primary meta-analysis

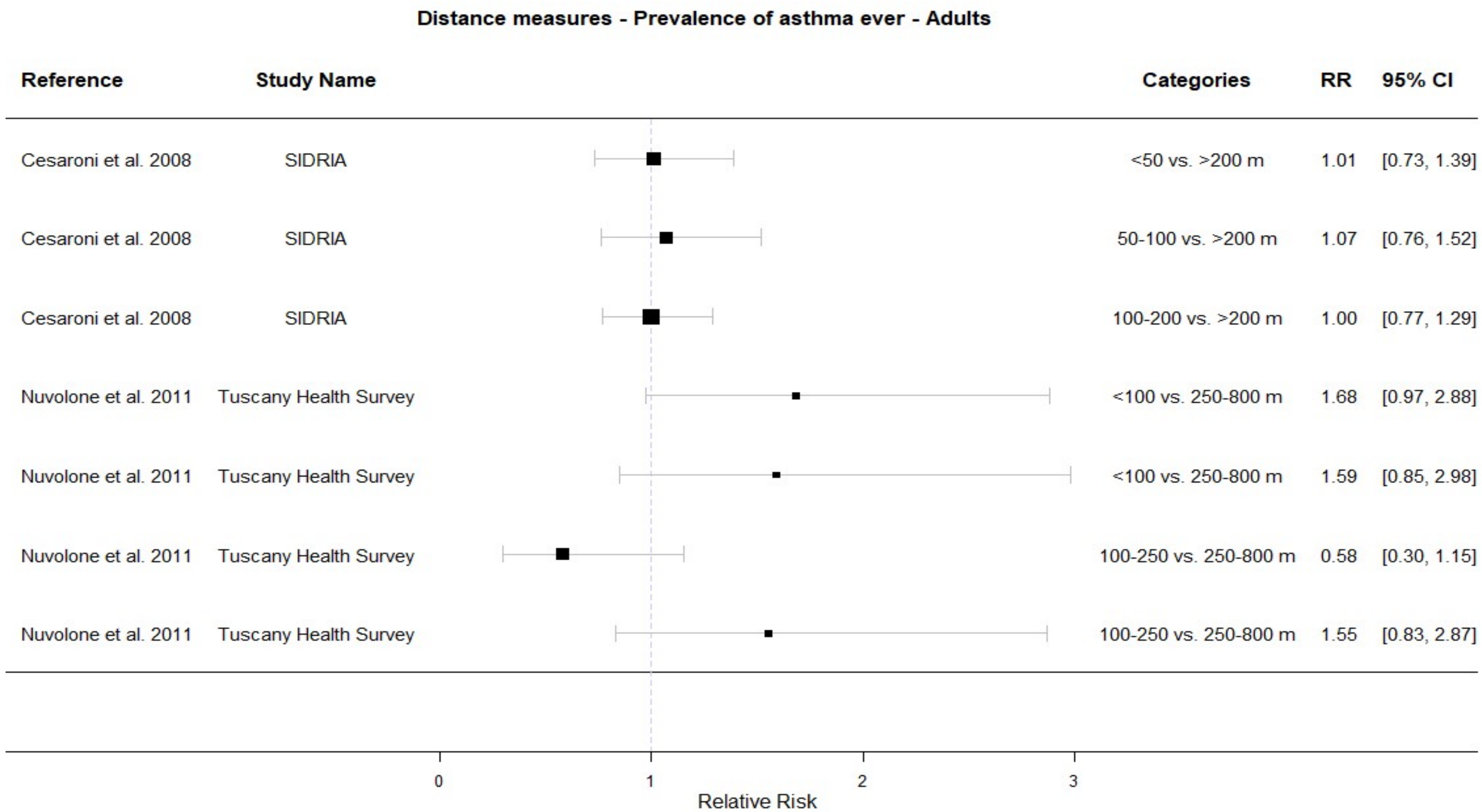


CO – Prevalence of asthma ever – Children

Primary meta-analysis

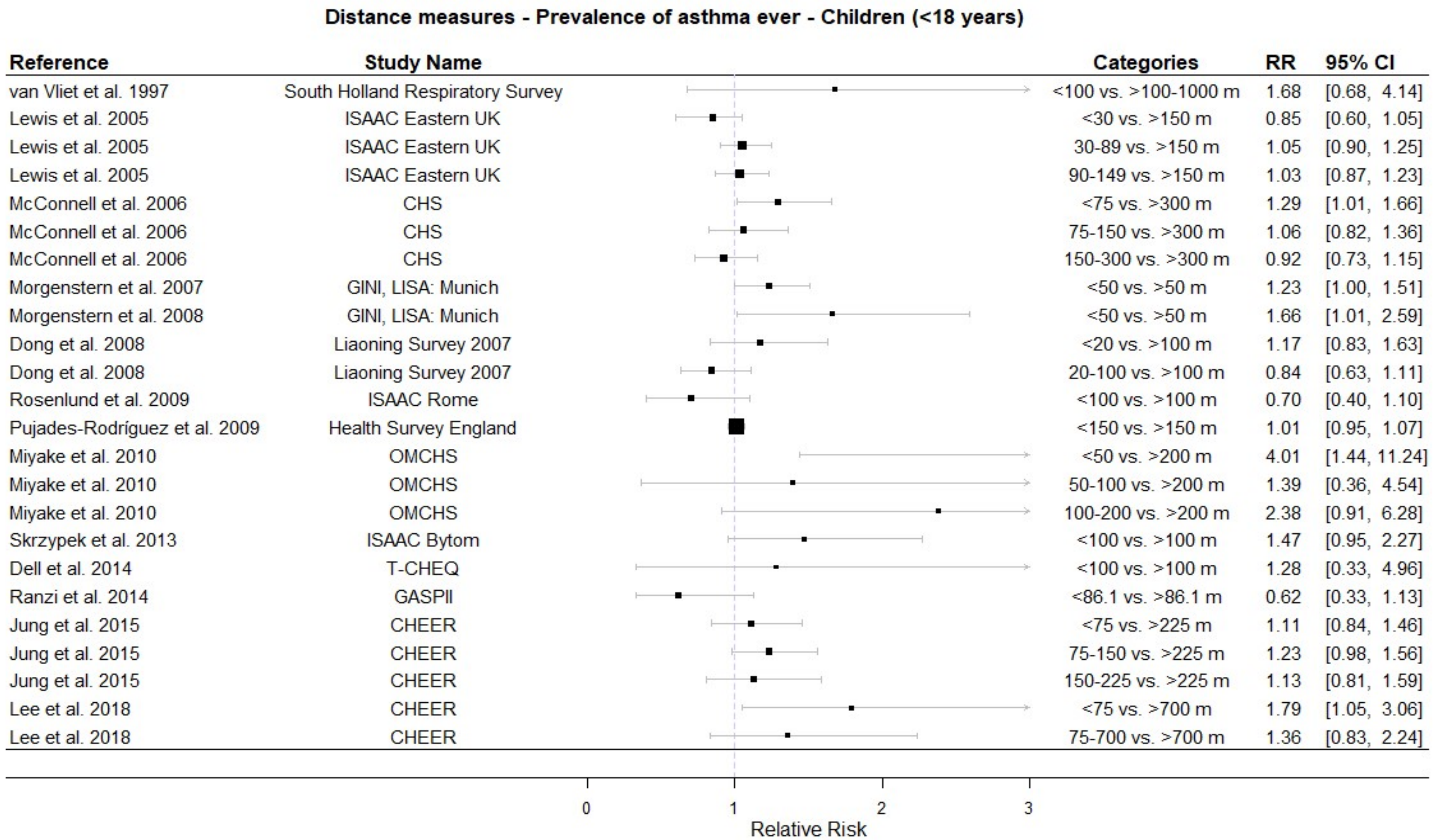


Distance measures – Prevalence of asthma ever – Adults



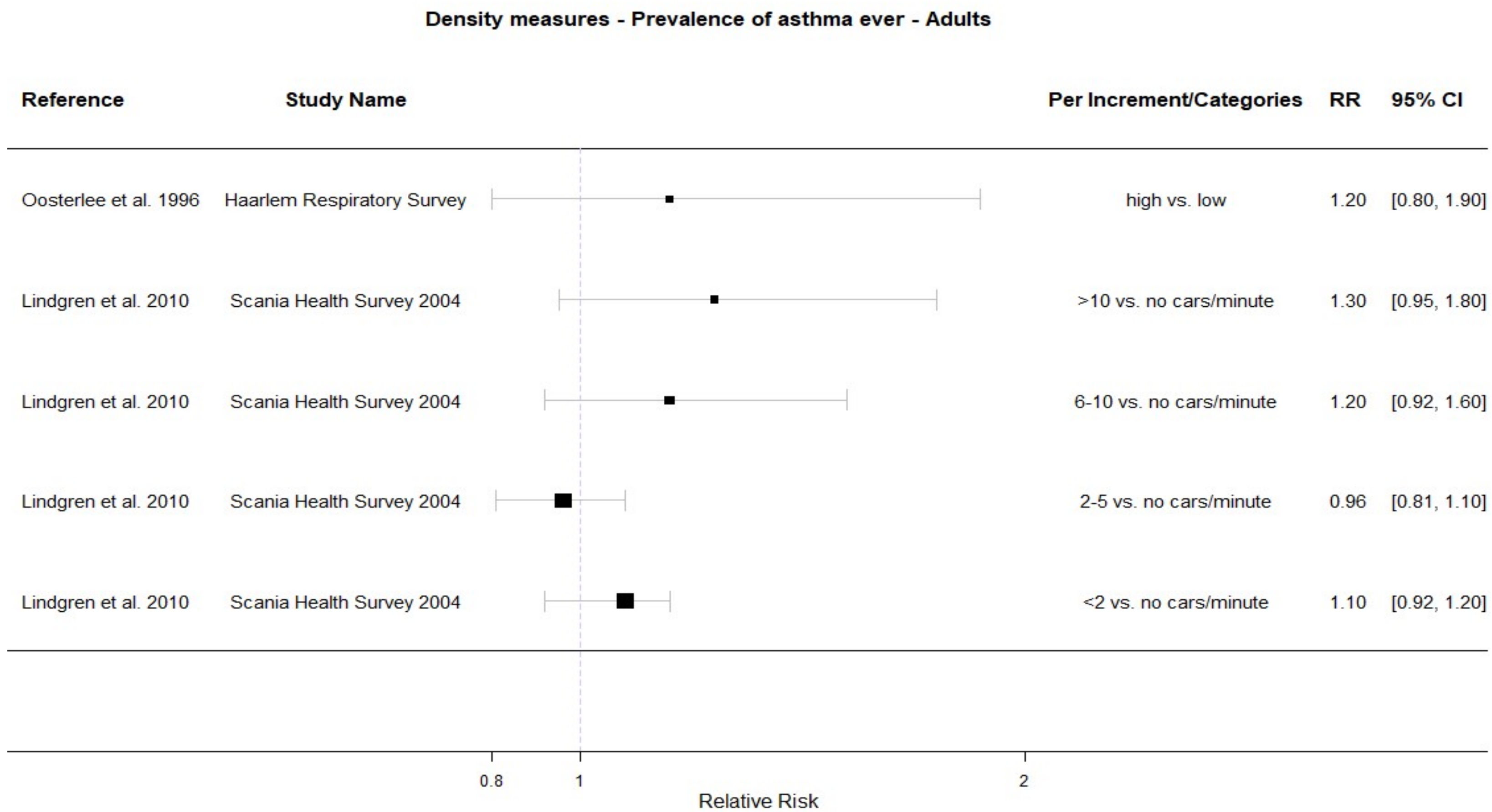
Nuvolone et al. 2011 estimates were stratified by sex. All prevalence studies.

Distance measures – Prevalence of asthma ever – Children



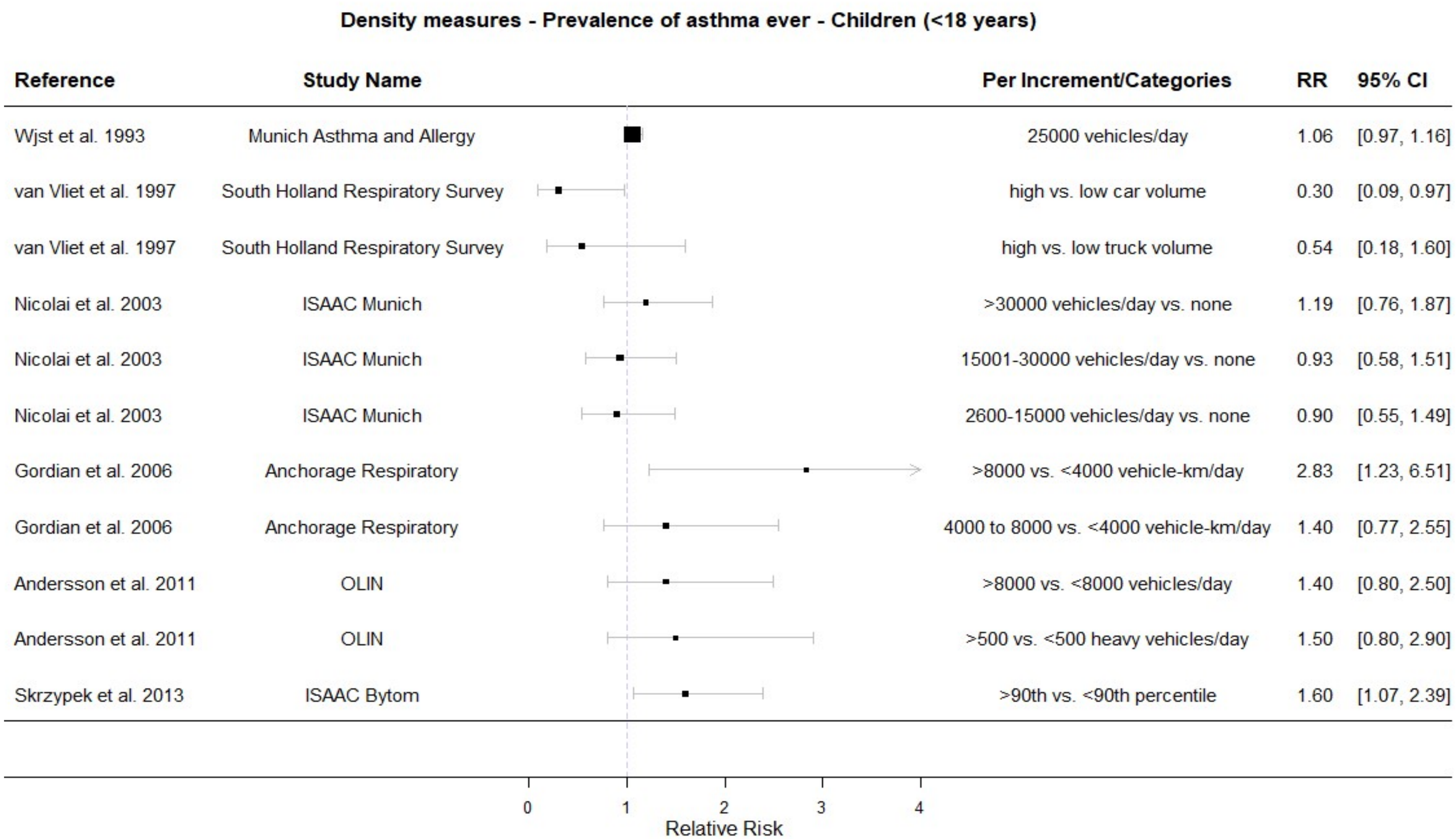
All prevalence studies

Density measures – Prevalence of asthma ever – Adults



All prevalence studies

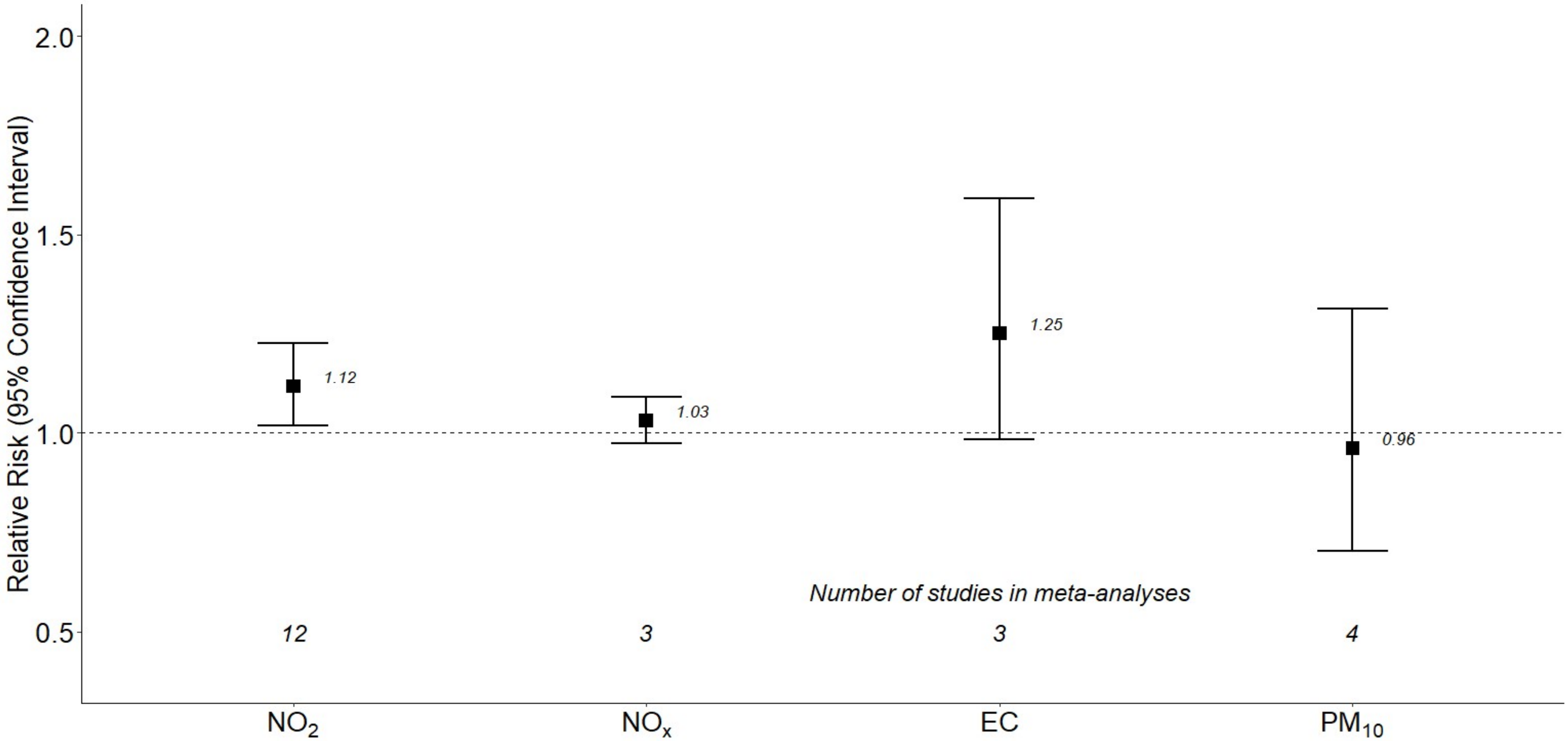
Density measures – Prevalence of asthma ever – Children



All prevalence studies

9.3 Prevalence of active asthma

Meta-analysis overview – Children (<18)

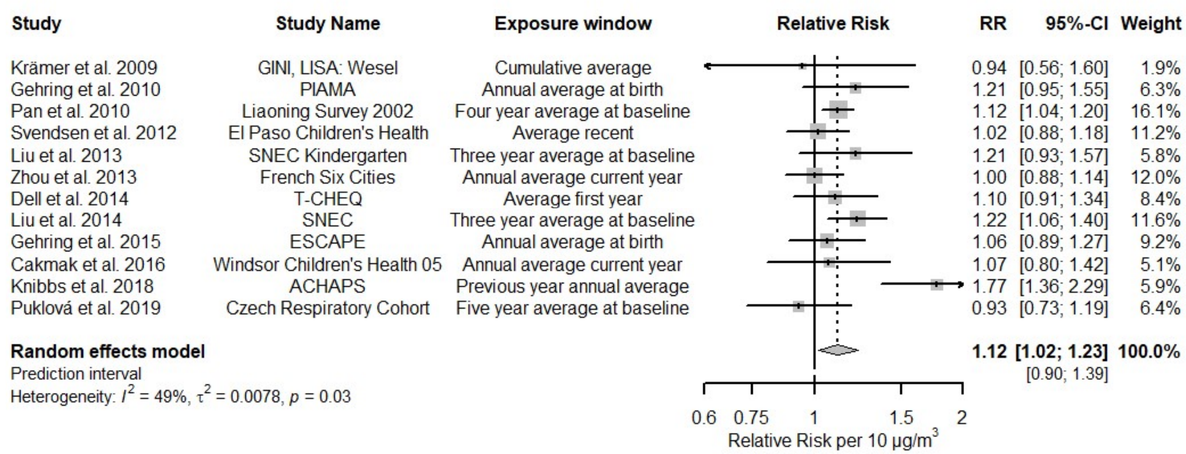


Footnote: The following increments were used: 10 µg/m^3 for NO_2, 20 µg/m^3 for NO_x, 1 µg/m^3 for EC and 10 µg/m^3 for PM_{10}. Effect estimates cannot be directly compared across the different traffic–related pollutants because the selected increments do not necessarily represent the same contrast in exposure.

NO_2 – Prevalence of active asthma – Children

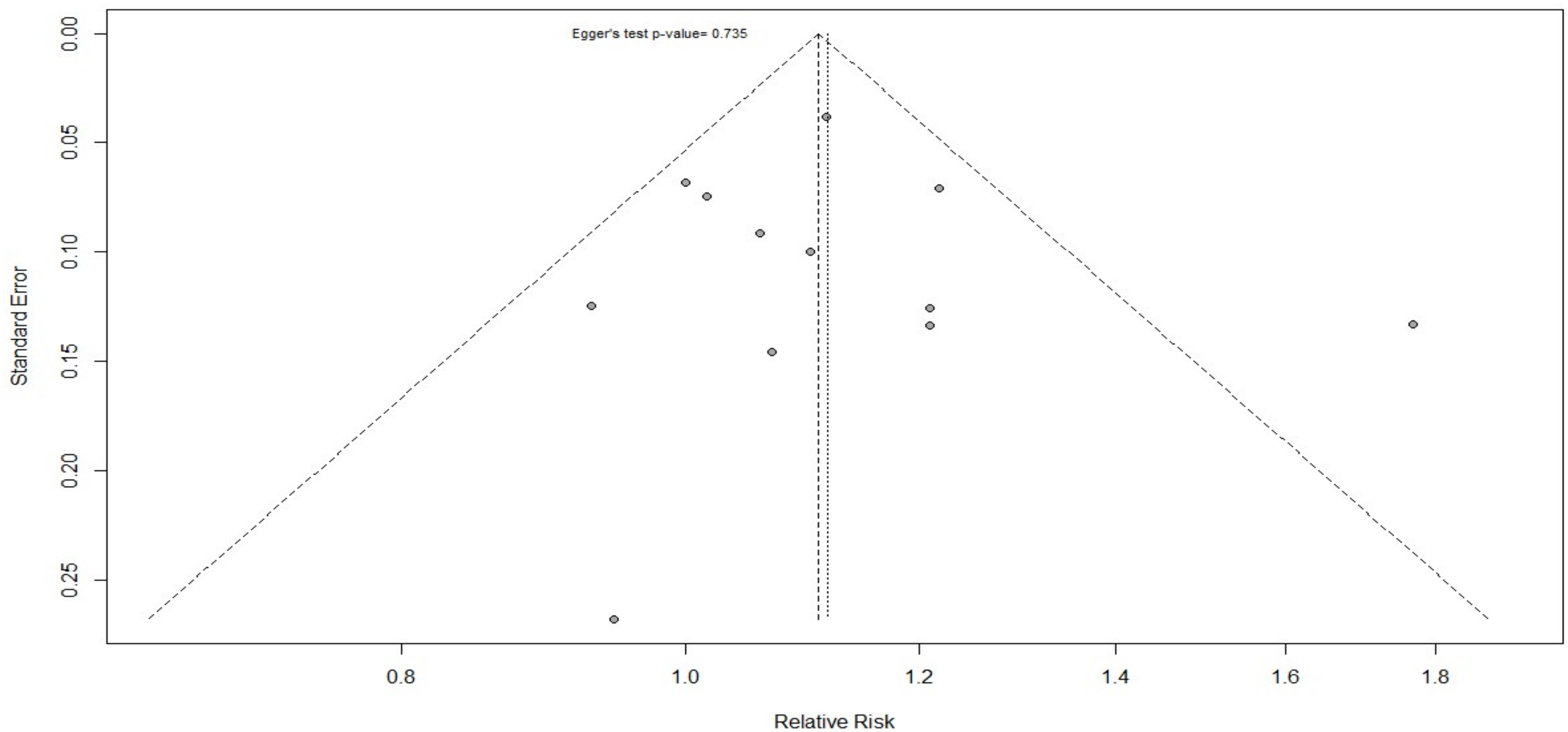
Primary meta-analysis

NO_2 - Prevalence of active/current asthma - Children (<18 years)



NO_2 – Prevalence of active asthma – Children

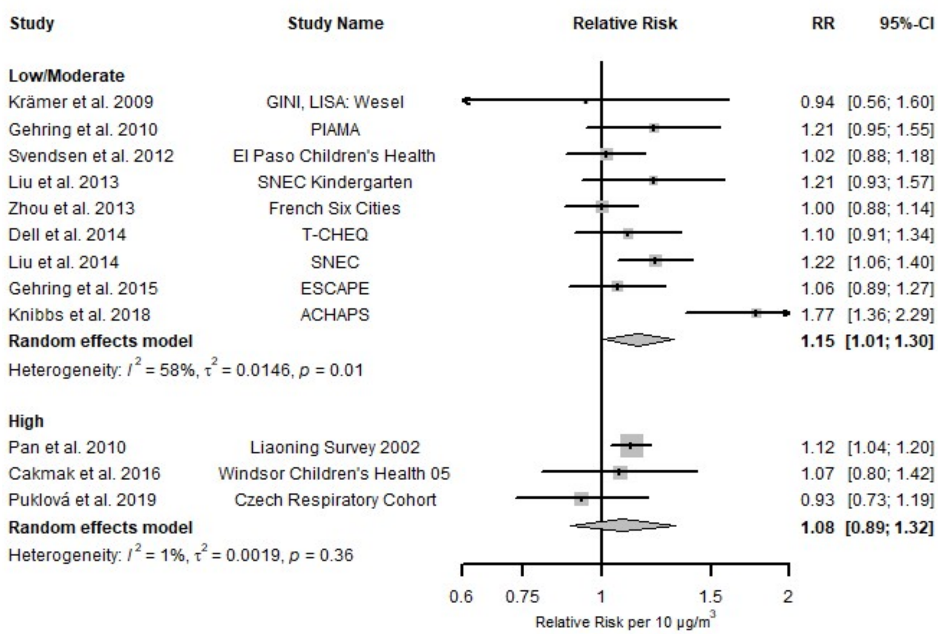
Funnel plot



Footnote: The vertical lines in the funnel plots represent the pooled fixed and random effect estimates. The vertical dashed line in the middle of the funnel shows the fixed effect estimate. As the Panel applied a random–effects model, the funnel plot also presents the random–effects estimate with the dotted line.

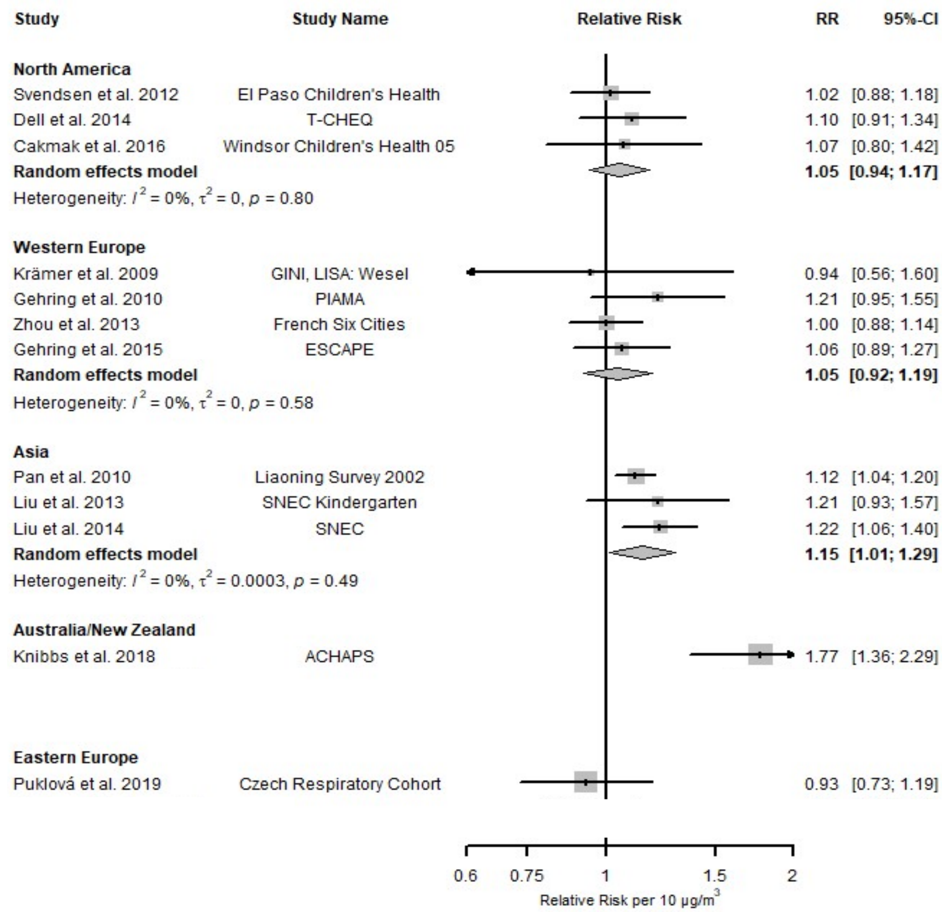
NO$_2$ – Prevalence of active asthma – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low/moderate vs high



NO_2 – Prevalence of active asthma – Children

Subgroup analysis – region

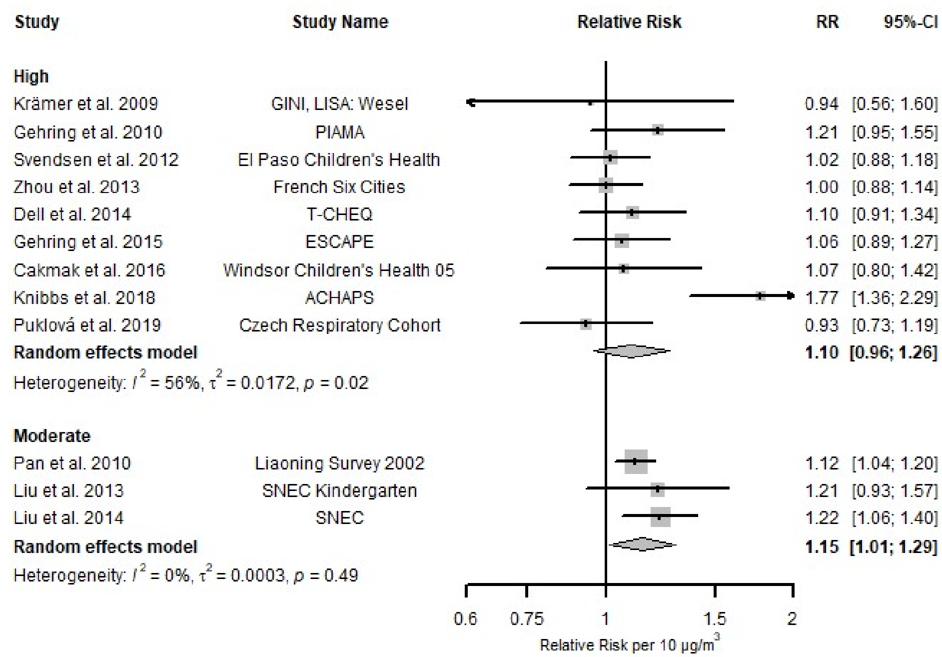


Subgroup analysis – year of publication

All published after 2008

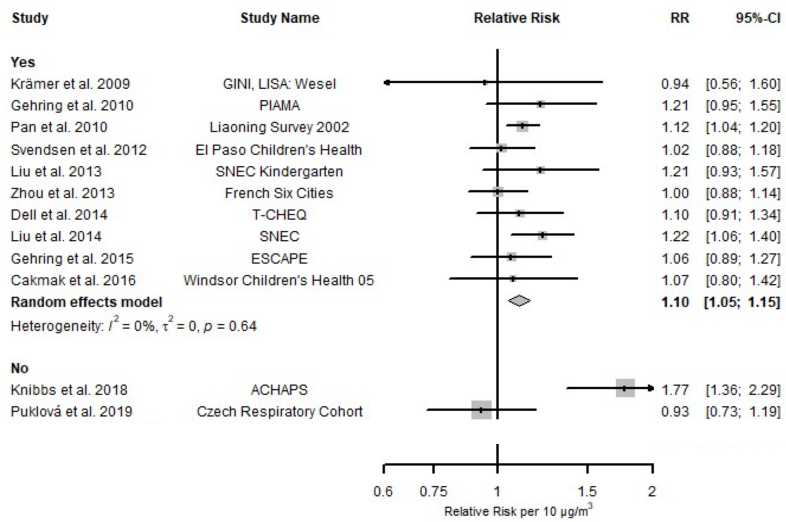
NO_2 – Prevalence of active asthma – Children

Subgroup analysis – traffic specificity



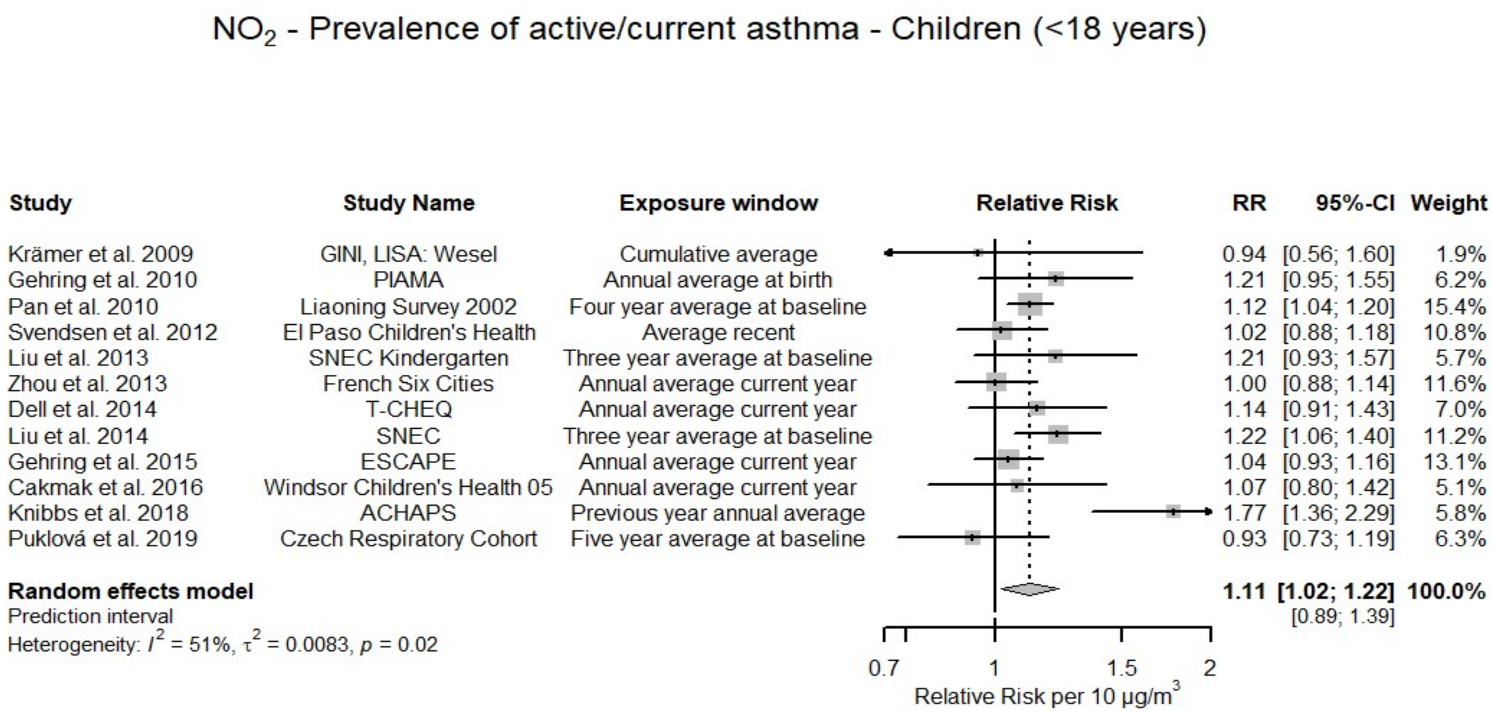
NO_2 – Prevalence of active asthma – Children

Subgroup analysis – smoking adjustment



NO_2 – Prevalence of active asthma – Children

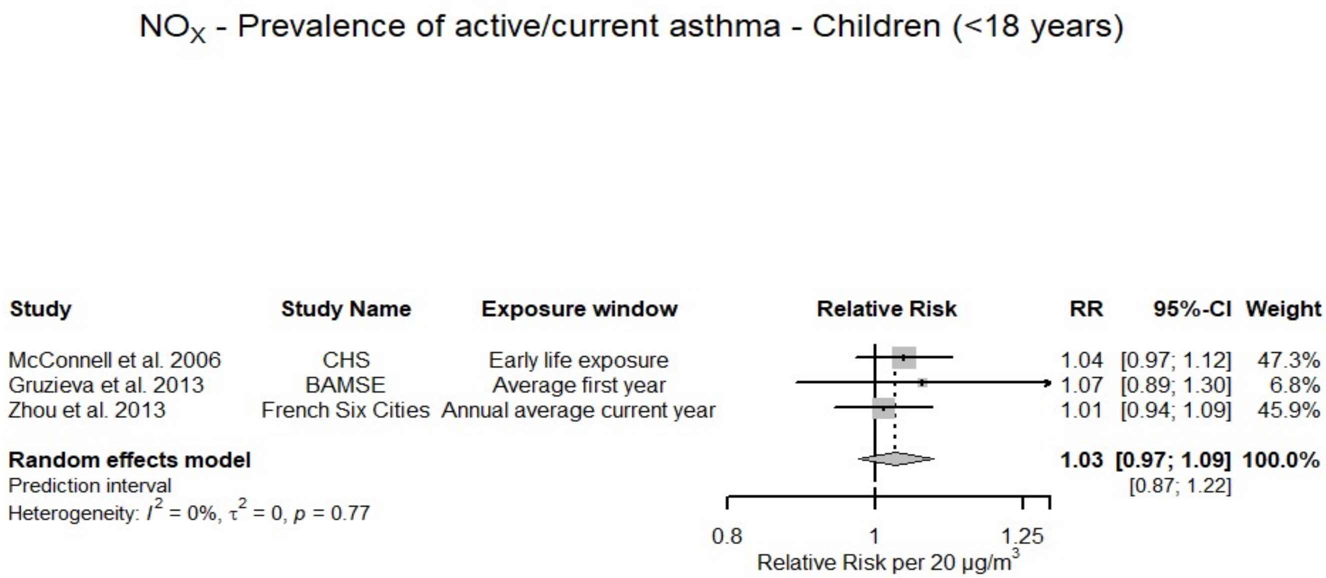
Sensitivity analysis – reverse selection



Recent years > cumulative average > first year of life > at birth > pregnancy

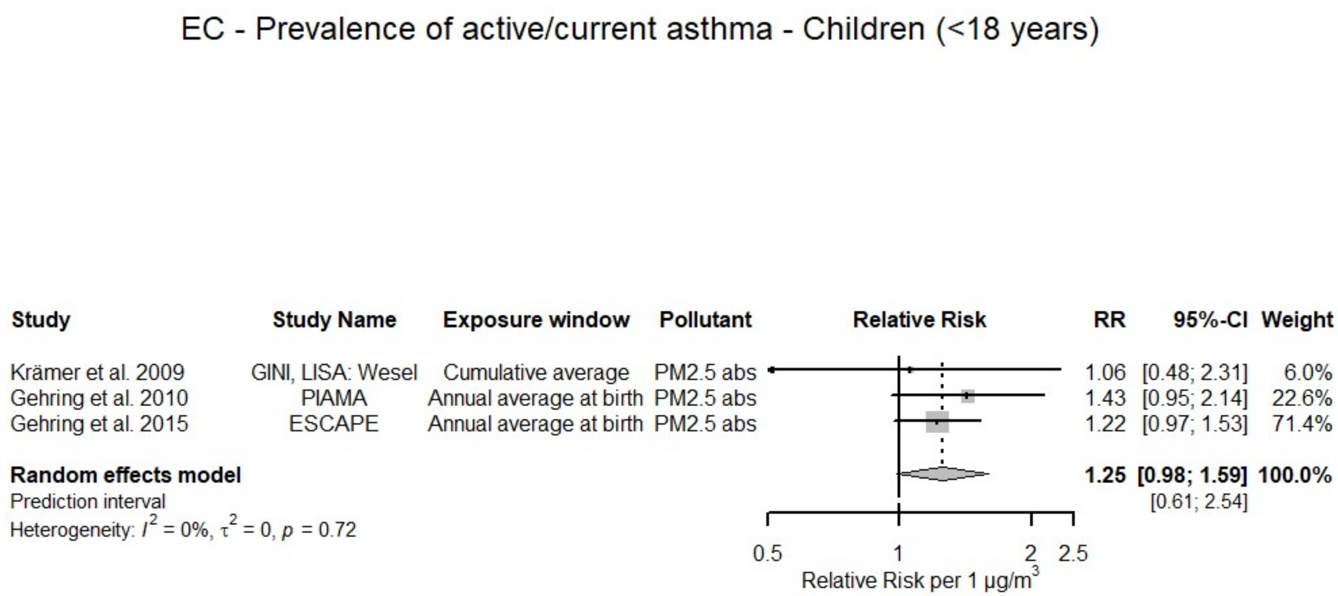
NO_x – Prevalence of active asthma – Children

Primary meta-analysis



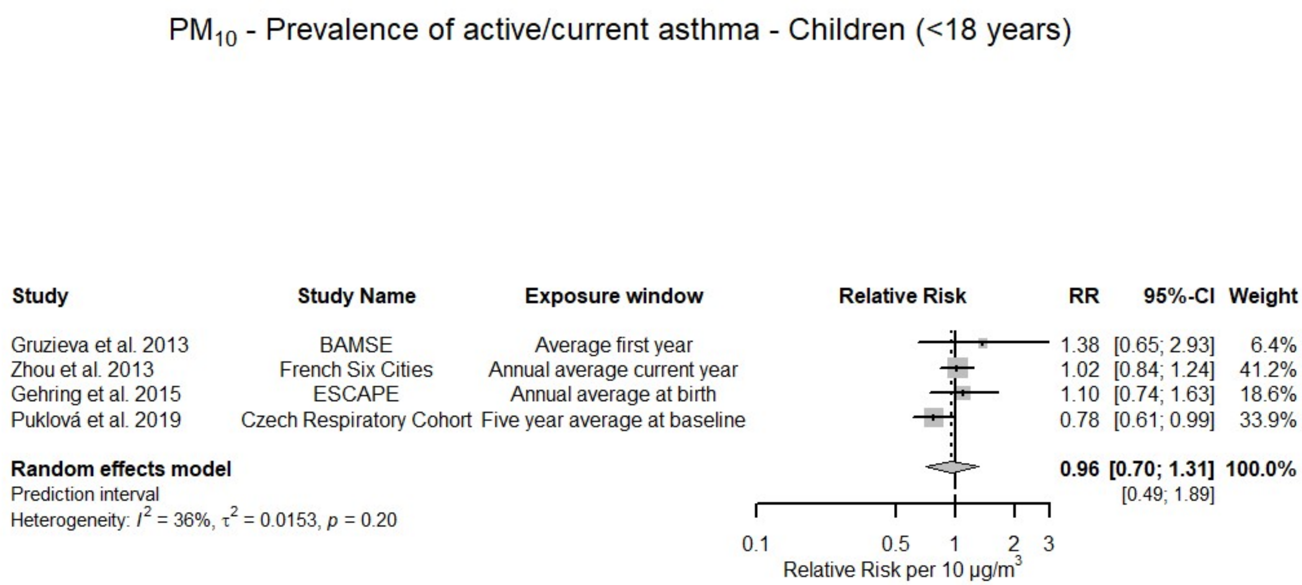
EC – Prevalence of active asthma – Children

Primary meta-analysis



PM_{10} – Prevalence of active asthma – Children

Primary meta-analysis



PM_{10} – Prevalence of active asthma – Children

Sensitivity and subgroup analyses notes:

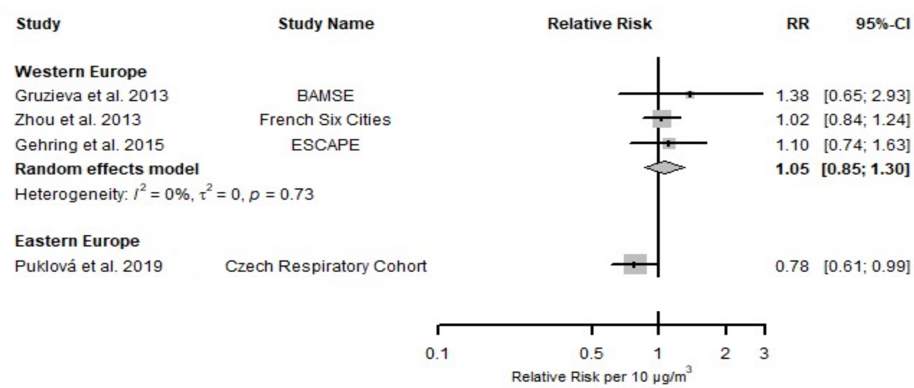
Risk of bias confounding domain – Gruzieva et al. 2013 and Puklova et al. 2019 high risk of bias; other two low risk of bias.

Smoking adjustment: Gruzieva et al. 2013 and Puklova et al. 2019 no smoking adjustment.

Year of publication: All studies published after 2008

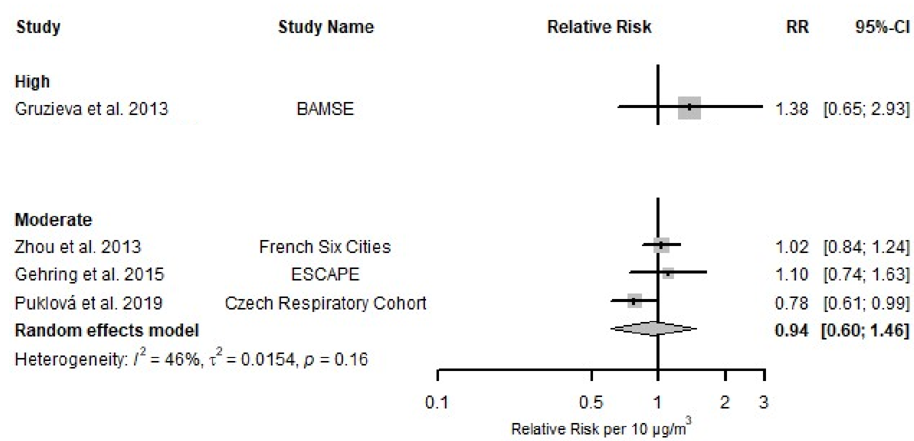
PM_{10} – Prevalence of active asthma – Children

Subgroup analysis – region

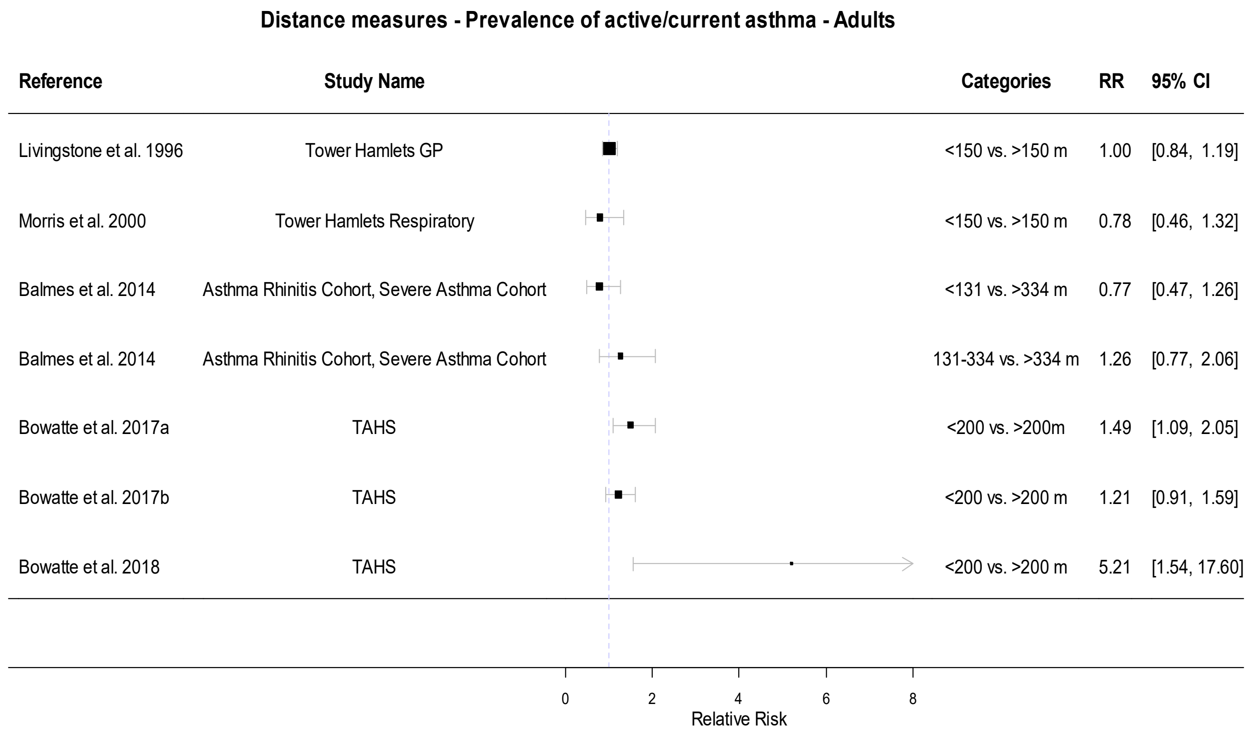


PM_{10} – Prevalence of active asthma – Children

Subgroup analysis – traffic specificity

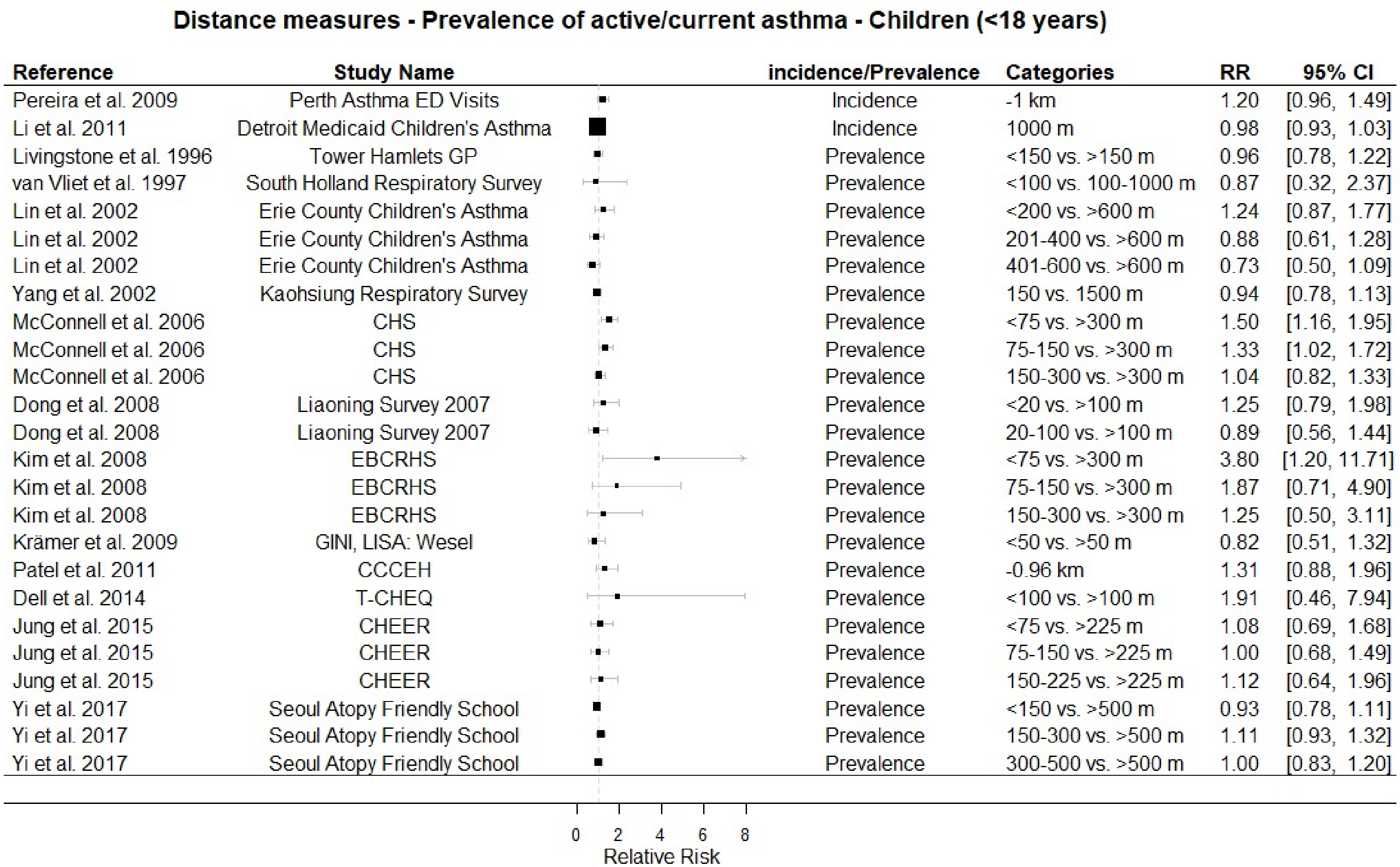


Distance measures - Prevalence of active asthma – Adults

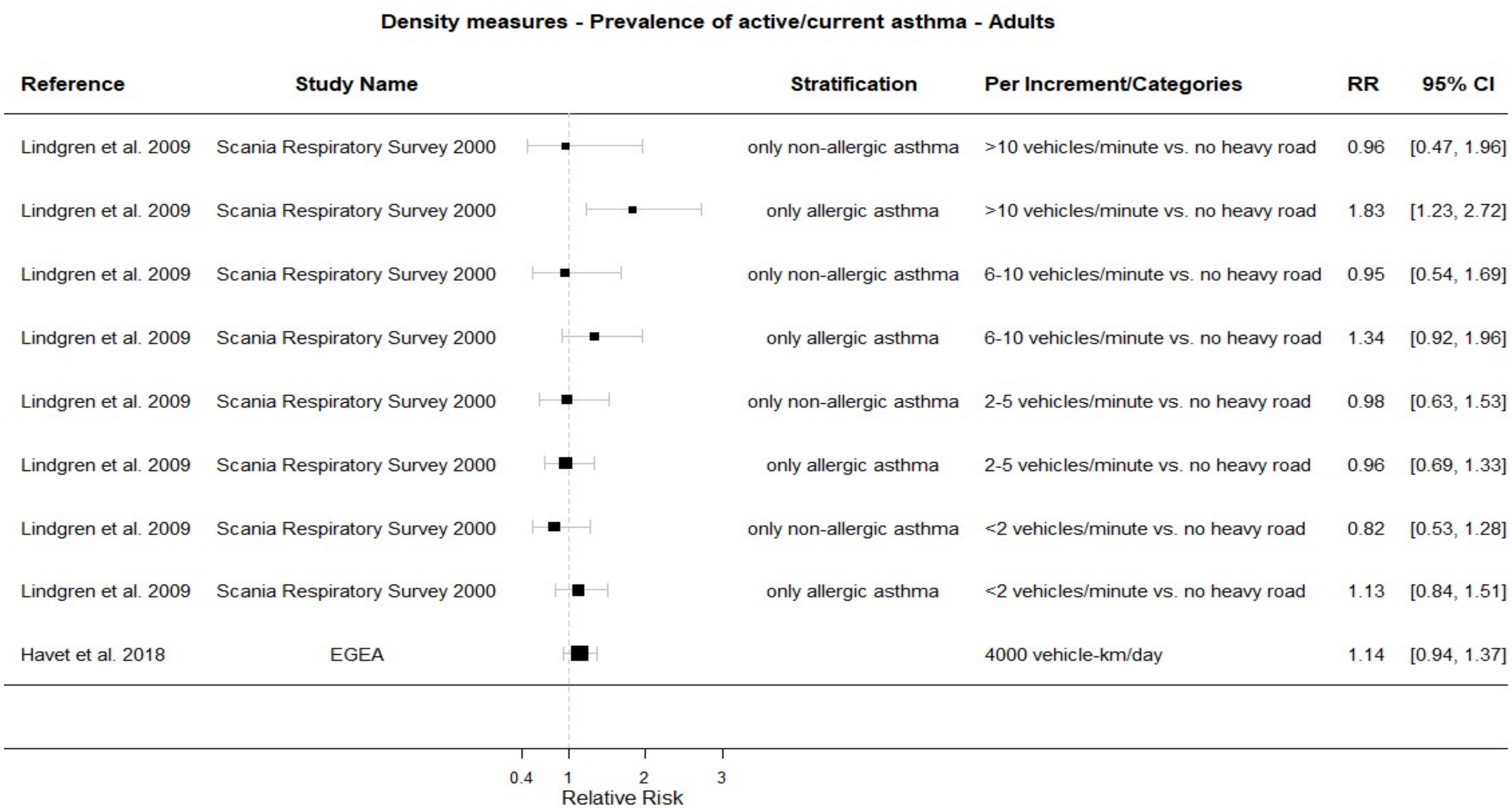


Note: Bowatte et al 2017a & b and 2018 refer to different study designs and study selections. All prevalence studies

Distance measures - Prevalence of active asthma – Children



Density measures - Prevalence of active asthma – Adults

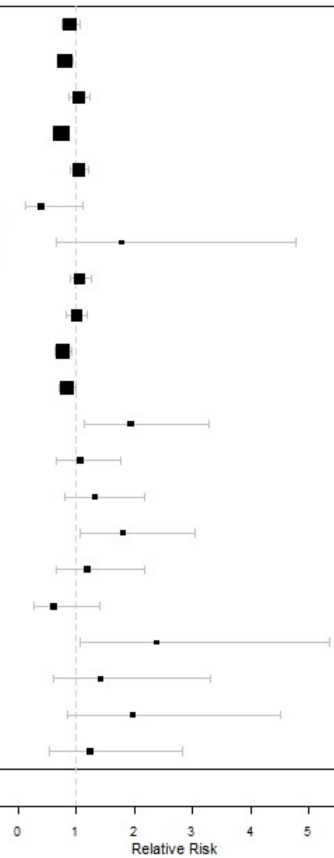


All prevalence studies.

Density measures - Prevalence of active asthma – Children

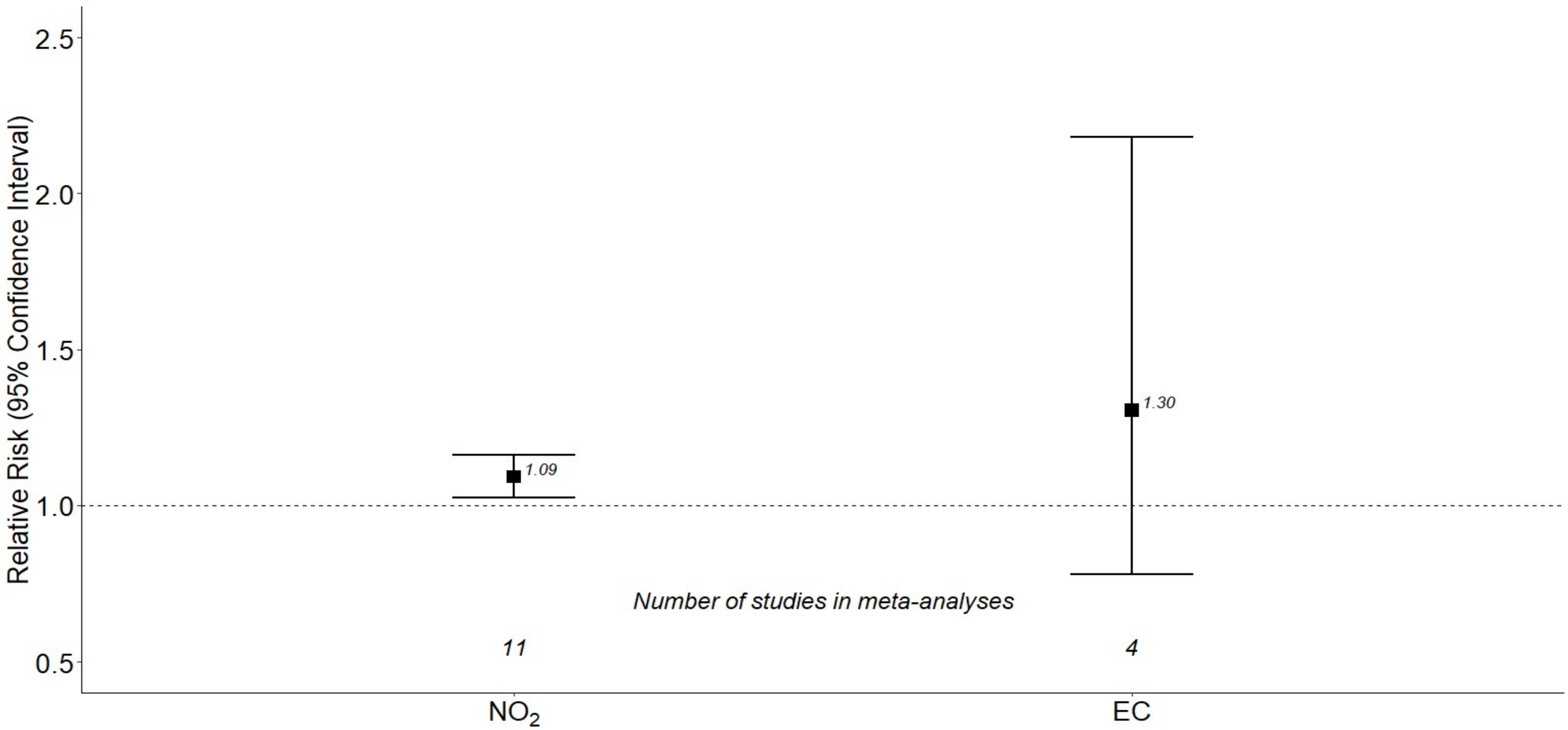
Density measures - Prevalence of active/current asthma - Children (<18 years)

Reference	Study Name	incidence/Prevalence	Per Increment/Categories	RR	95% CI
Wilkinson et al. 1999	London Children's Asthma	Incidence	>50 vs. <1.5 vehicle-km/hour	0.88	[0.74, 1.06]
Wilkinson et al. 1999	London Children's Asthma	Incidence	15-50 vs. <1.5 vehicle-km/hour	0.80	[0.68, 0.95]
Wilkinson et al. 1999	London Children's Asthma	Incidence	1.5-15 vs. <1.5 vehicle-km/hour	1.03	[0.87, 1.22]
Pereira et al. 2009	Perth Asthma ED Visits	Incidence	1000 vehicle-km/peak morning hour	0.73	[0.62, 0.85]
Wjst et al. 1993	Munich Asthma and Allergy	Prevalence	25000 vehicles/day	1.04	[0.89, 1.21]
van Vliet et al. 1997	South Holland Respiratory Survey	Prevalence	high vs. low car volume	0.38	[0.13, 1.12]
van Vliet et al. 1997	South Holland Respiratory Survey	Prevalence	high vs. low truck volume	1.78	[0.66, 4.77]
English et al. 1999	San Diego Children's Asthma	Prevalence	>50100 vs. <9100 vehicles/day	1.05	[0.88, 1.26]
English et al. 1999	San Diego Children's Asthma	Prevalence	25001-50100 vs. <9100 cars/day	1.00	[0.83, 1.19]
English et al. 1999	San Diego Children's Asthma	Prevalence	16701-25000 vs. <9100 cars/day	0.76	[0.63, 0.91]
English et al. 1999	San Diego Children's Asthma	Prevalence	9101-16700 vs. <9100 cars/day	0.83	[0.69, 1.00]
Lin et al. 2002	Erie County Children's Asthma	Prevalence	>4043 vs. no vehicle-miles/day	1.93	[1.13, 3.29]
Lin et al. 2002	Erie County Children's Asthma	Prevalence	2367-4042 vs. no vehicle-miles/day	1.06	[0.64, 1.76]
Lin et al. 2002	Erie County Children's Asthma	Prevalence	<2366 vs. no vehicle-miles/day	1.31	[0.79, 2.16]
Nicolai et al. 2003	ISAAC Munich	Prevalence	>30000 vehicles/day vs. none	1.79	[1.05, 3.05]
Nicolai et al. 2003	ISAAC Munich	Prevalence	15001-30000 vehicles/day vs. none	1.18	[0.64, 2.17]
Nicolai et al. 2003	ISAAC Munich	Prevalence	2600-15000 vehicles/day vs. none	0.61	[0.26, 1.40]
Kim et al. 2008	EBCRHS	Prevalence	9414-74041 vehicles-km/day vs. none	2.37	[1.05, 5.36]
Kim et al. 2008	EBCRHS	Prevalence	4403-9413 vehicles-km/day vs. none	1.40	[0.60, 3.30]
Kim et al. 2008	EBCRHS	Prevalence	1920-4402 vehicles-km/day vs. none	1.96	[0.85, 4.52]
Kim et al. 2008	EBCRHS	Prevalence	<1919 vehicles-km/day vs. none	1.23	[0.53, 2.83]



9.4 Acute lower respiratory infections (ALRI)

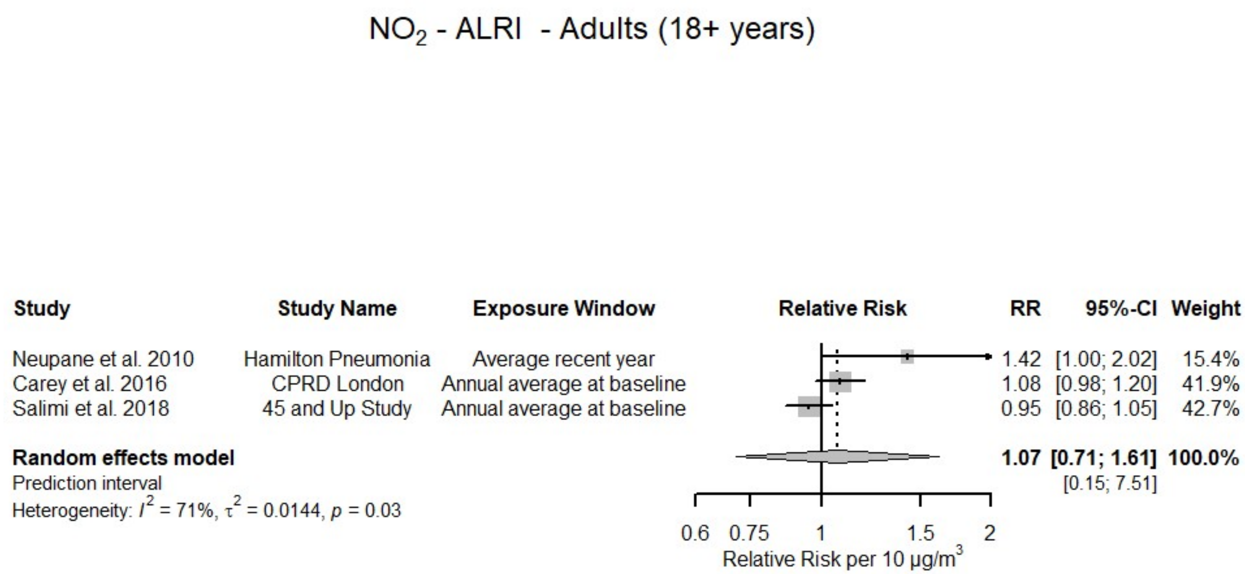
Meta-analysis overview – Children (<18).



Footnote: The following increments were used: 10 µg/m^3 for NO_2 and 1 µg/m^3 for EC. Effect estimates cannot be directly compared across the different traffic–related pollutants because the selected increments do not necessarily represent the same contrast in exposure.

NO_2 – ALRI – Adults

Primary meta-analysis



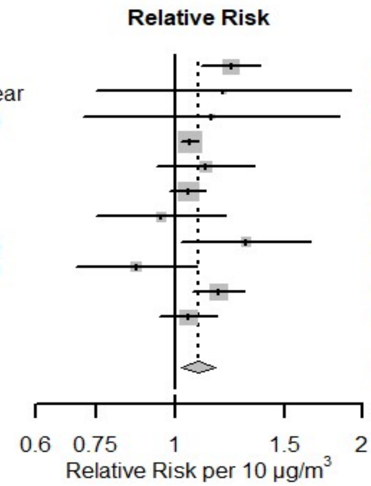
NO_2 – ALRI – Children

Primary meta-analysis

NO_2 - ALRI - Children (<18 years)

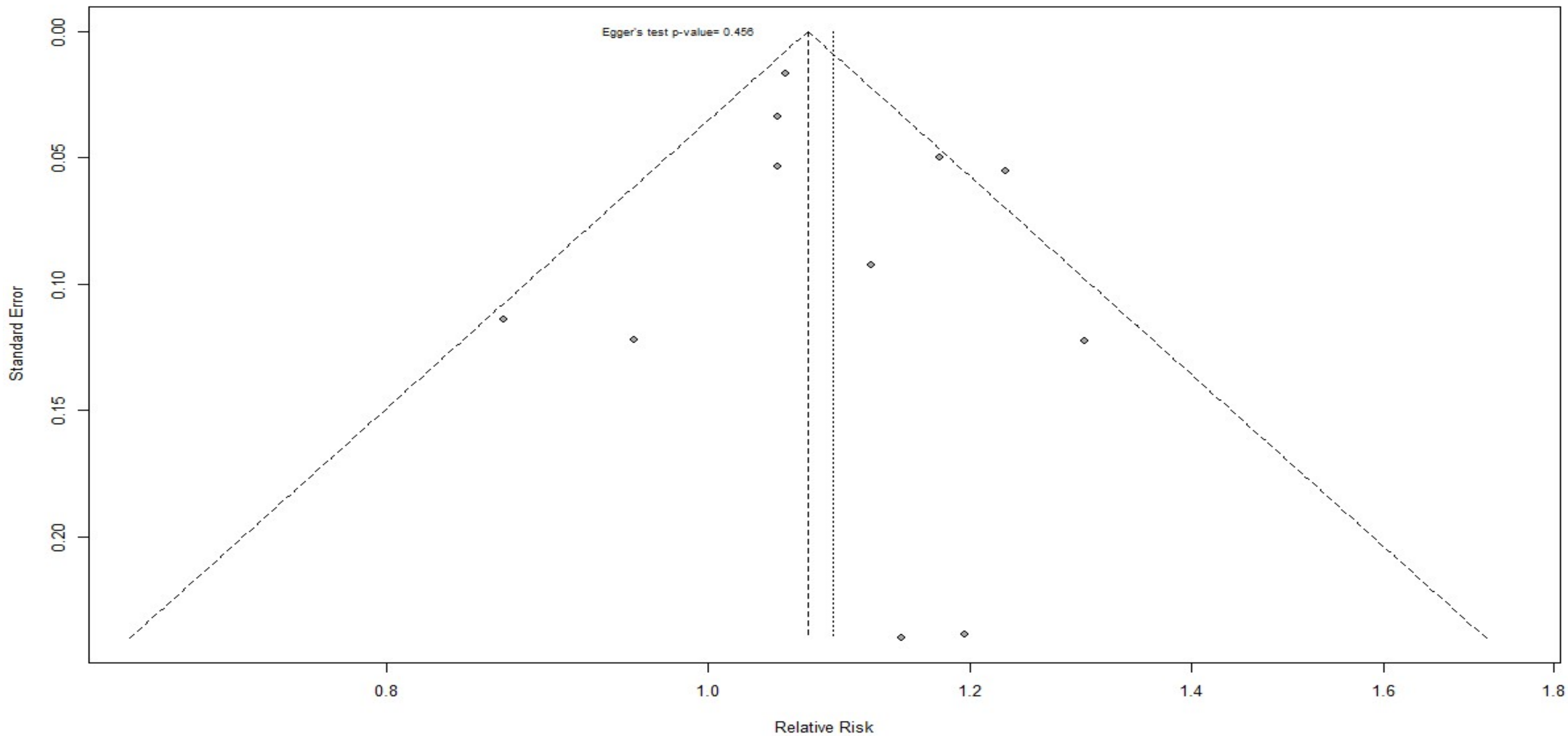
Study	Study Name	Exposure window	RR	95%-CI	Weight
Hirsch et al. 1999	ISAAC Dresden	Annual mean	1.23	[1.10; 1.37]	12.1%
Janssen et al. 2003	ISAAC Southwestern Netherlands	Annual average current year	1.20	[0.75; 1.91]	1.2%
Morgenstern et al. 2007	GINI, LISA: Munich	Annual average at birth	1.14	[0.71; 1.83]	1.2%
Karr et al. 2009	Georgia Air Basin Birth Cohort	Cumulative average	1.06	[1.02; 1.09]	22.5%
Svendsen et al. 2012	El Paso Children's Health	Average recent	1.12	[0.93; 1.34]	6.4%
Aguilera et al. 2013	INMA	Entire pregnancy	1.05	[0.98; 1.12]	17.8%
Pedersen et al. 2013	EDEN	Entire pregnancy	0.95	[0.75; 1.21]	4.1%
MacIntyre et al. 2014	ESCAPE	Annual average at birth	1.30	[1.02; 1.65]	4.1%
Ranzi et al. 2014	GASPII	Annual average at birth	0.87	[0.69; 1.09]	4.6%
Liu et al. 2016	CCHH Shanghai	Entire pregnancy	1.17	[1.07; 1.30]	13.5%
Madsen et al. 2017	MoBa	Entire pregnancy	1.05	[0.95; 1.17]	12.6%
Random effects model			**1.09**	**[1.03; 1.16]**	**100.0%**
Prediction interval				[0.95; 1.25]	

Heterogeneity: $I^2 = 45\%$, $\tau^2 = 0.0030$, $p = 0.05$



NO_2 – ALRI – Children

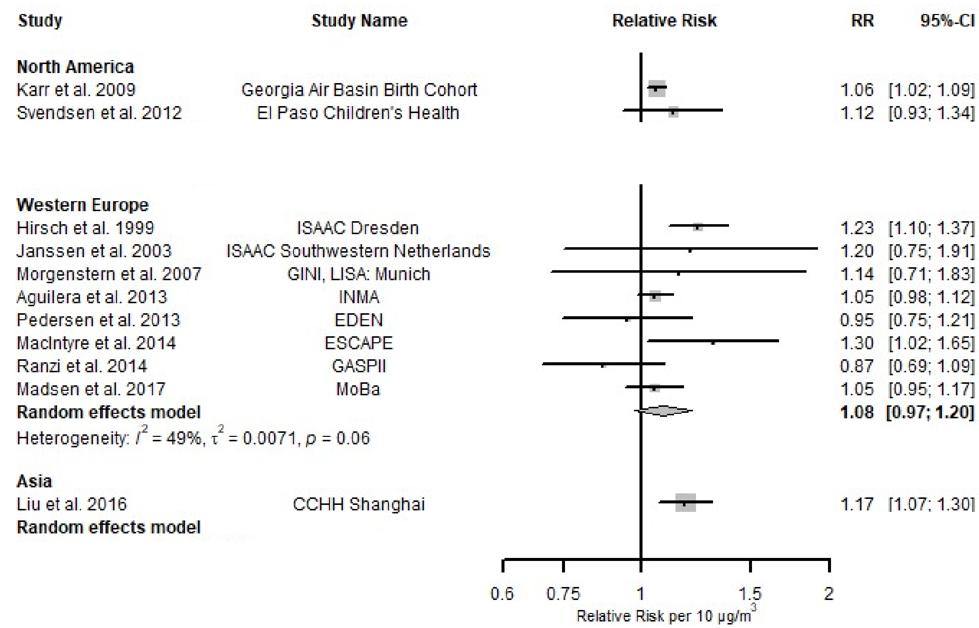
Funnel plot



Footnote: The vertical lines in the funnel plots represent the pooled fixed and random effect estimates. The vertical dashed line in the middle of the funnel shows the fixed effect estimate. As the Panel applied a random–effects model, the funnel plot also presents the random–effects estimate with the dotted line.

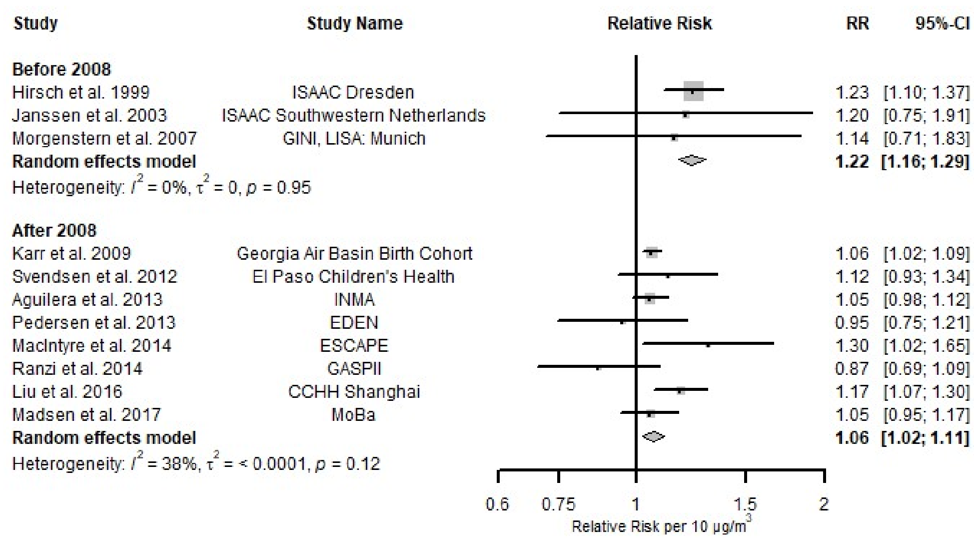
NO_2 – ALRI – Children

Subgroup analysis – region



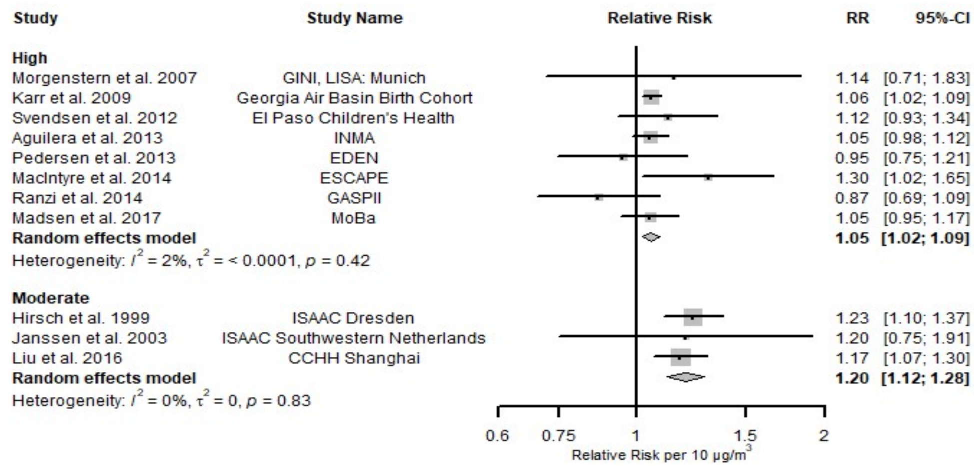
NO_2 – ALRI – Children

Subgroup analysis – year of publication



NO_2 – ALRI – Children

Subgroup analysis – traffic specificity

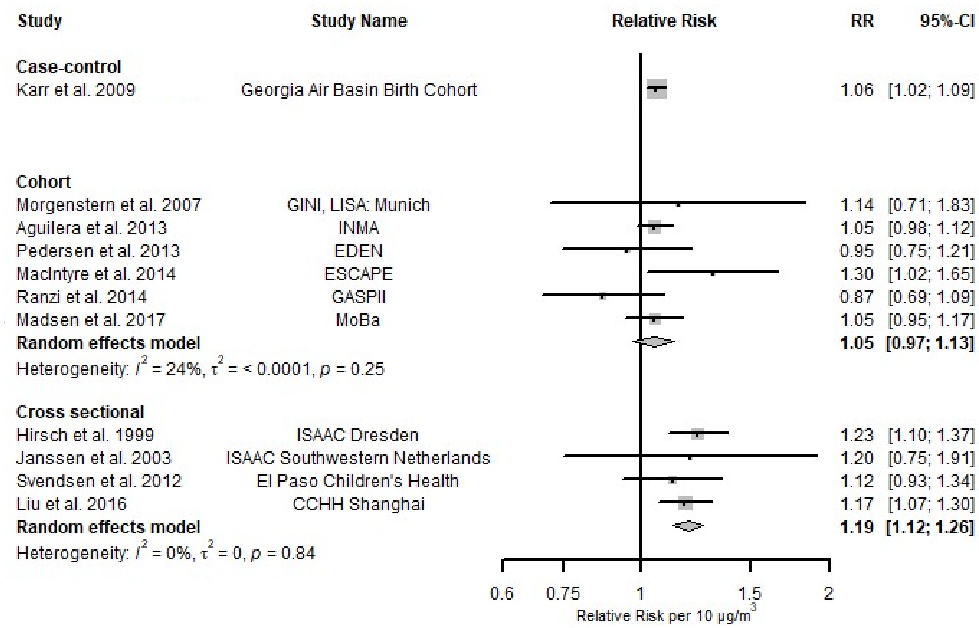


Subgroup analysis – smoking adjustment

All corrected for smoking

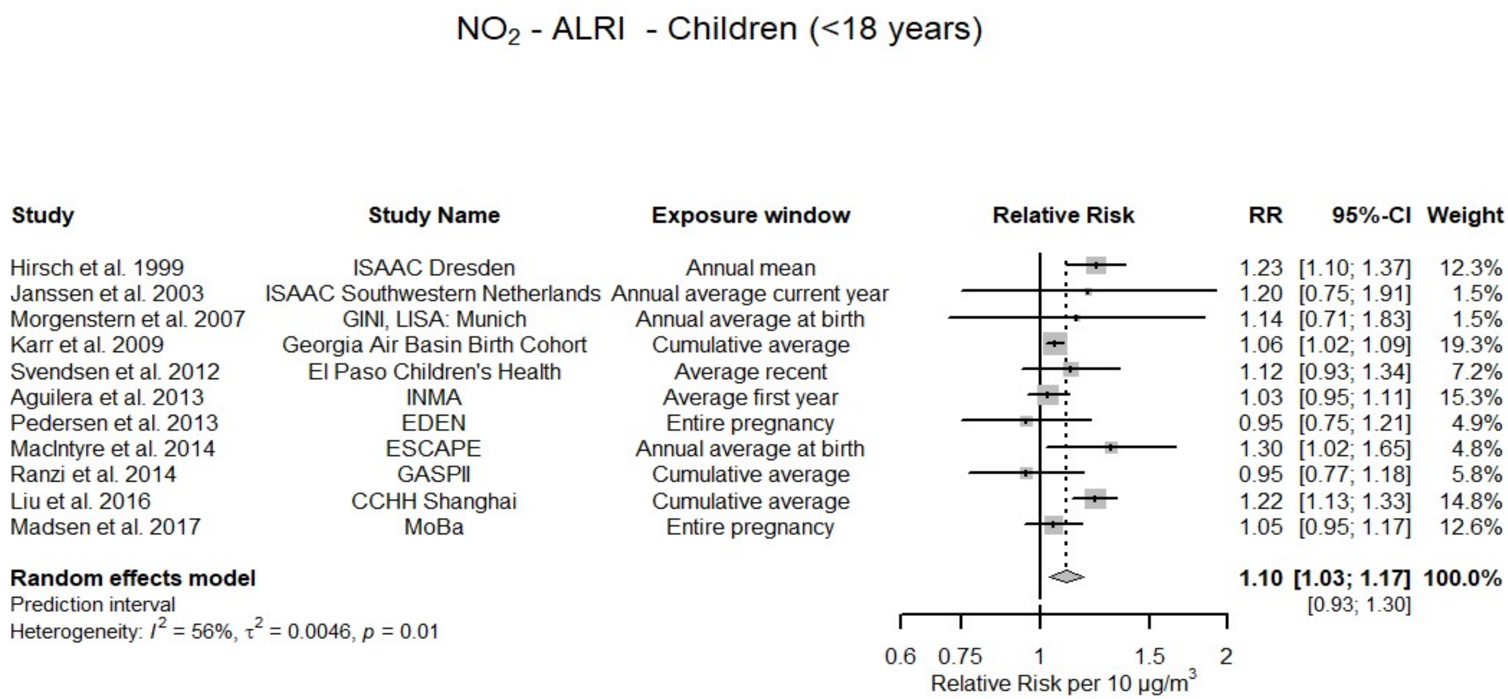
NO_2 – ALRI – Children

Subgroup analysis – study design



NO_2 – ALRI – Children

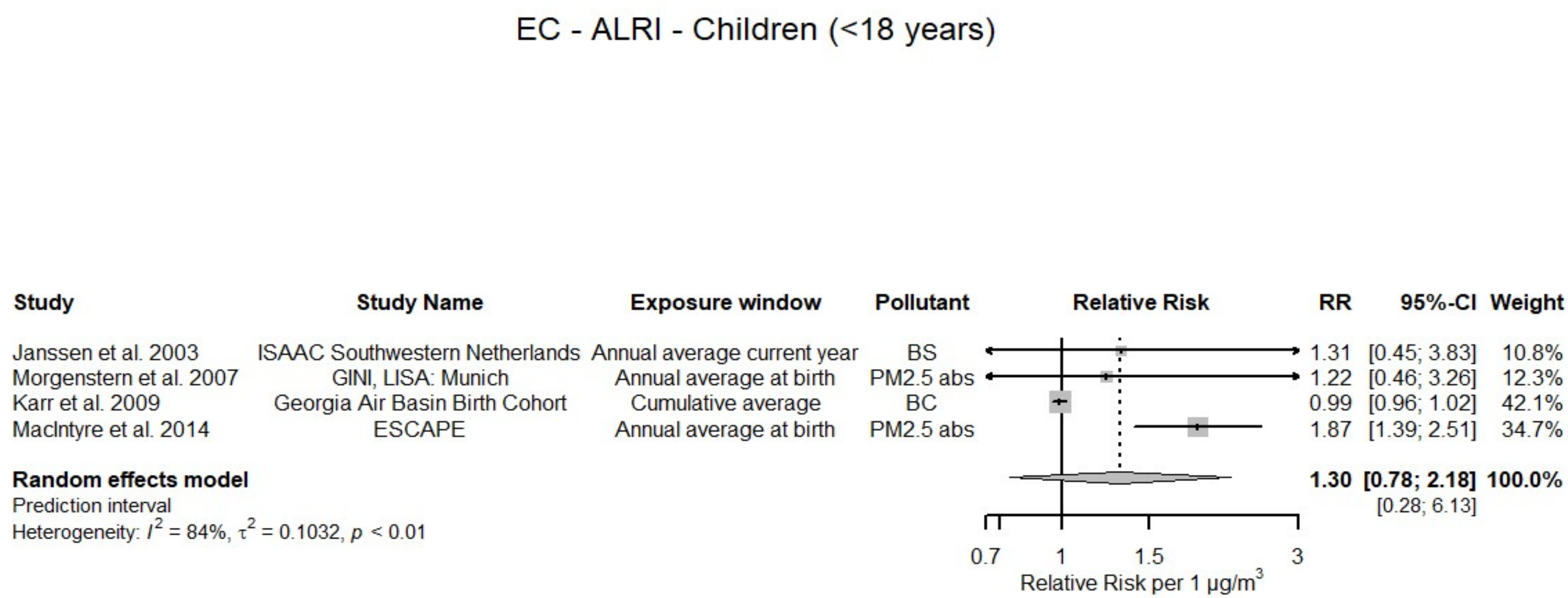
Sensitivity analysis – reverse selection



Recent years > cumulative average > first year of life > at birth > pregnancy

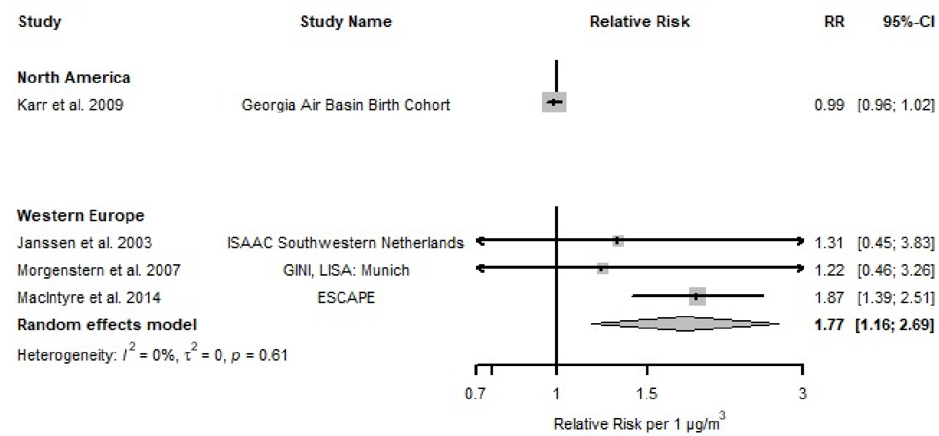
EC– ALRI – Children

Primary meta-analysis



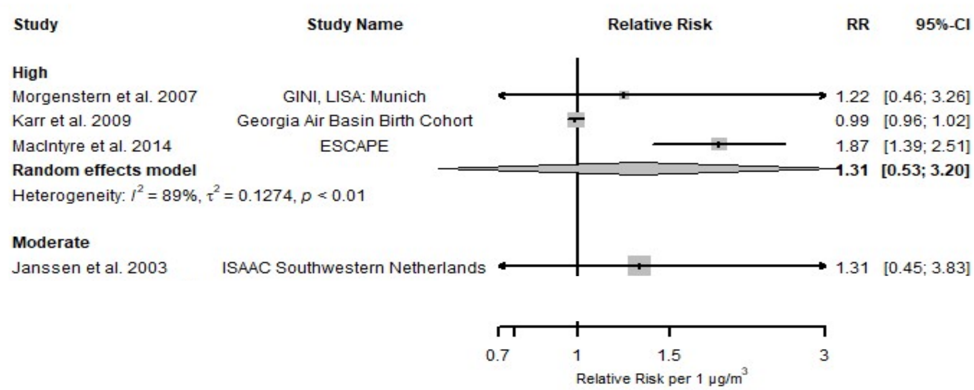
EC – ALRI – Children

Subgroup analysis – region



EC – ALRI – Children

Subgroup analysis – traffic specificity

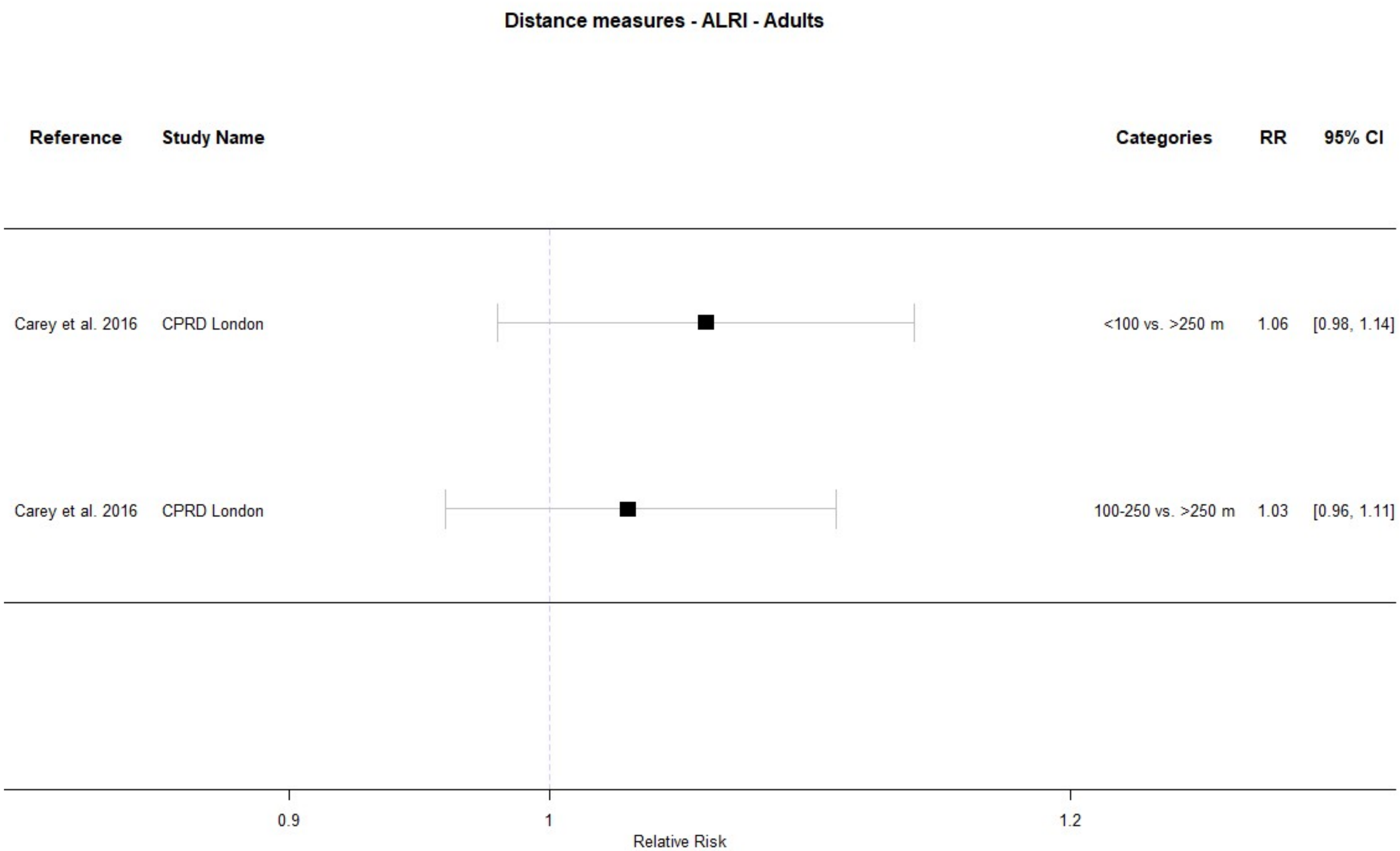


EC – ALRI – Children

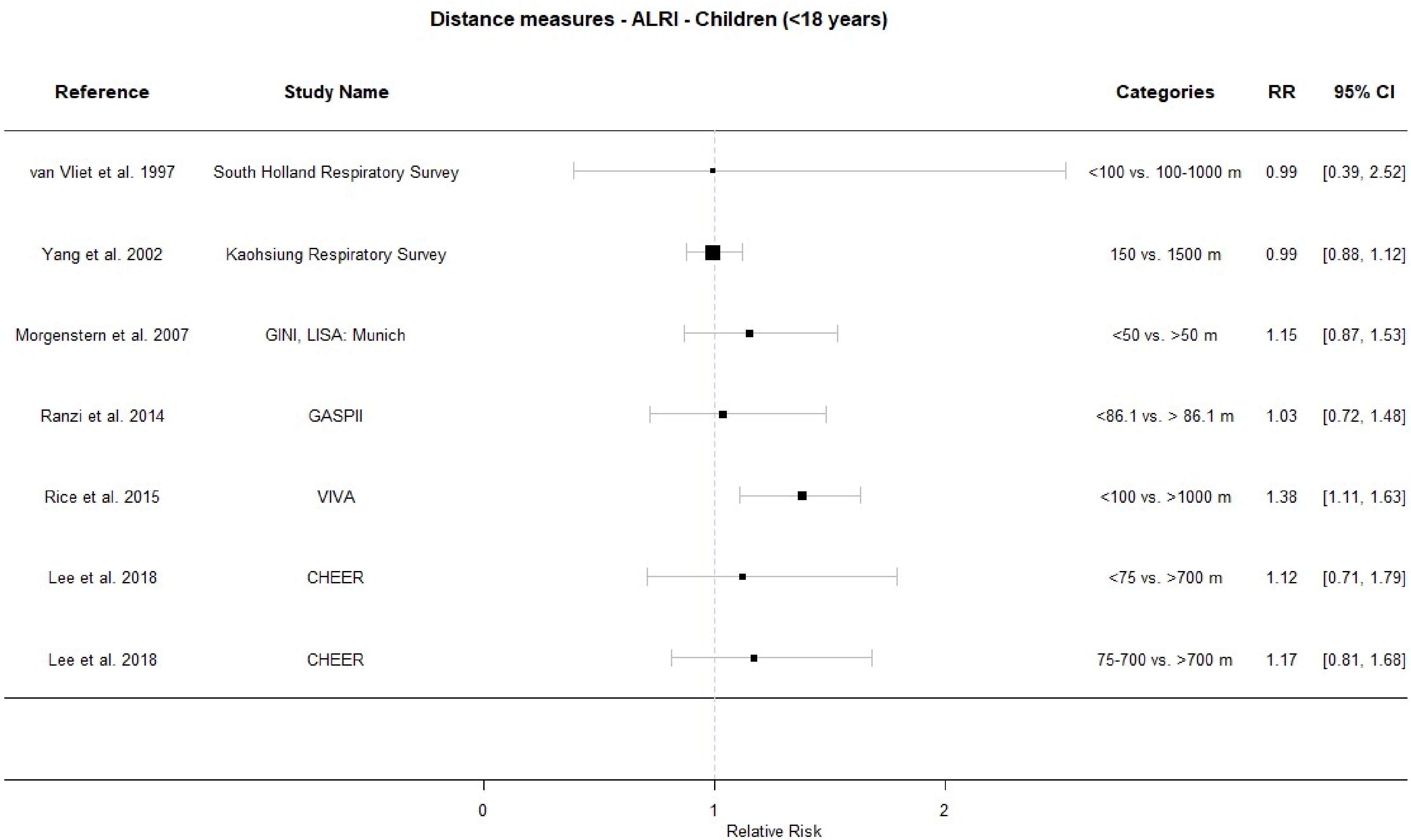
Subgroup analysis notes:

Year of publication: Jansen 2003 and Morgenstern before 2008
Smoking adjustment: All corrected for smoking
Study design: Karr 2009 case-control; Jansen 2003 cross-sectional, the other two cohorts

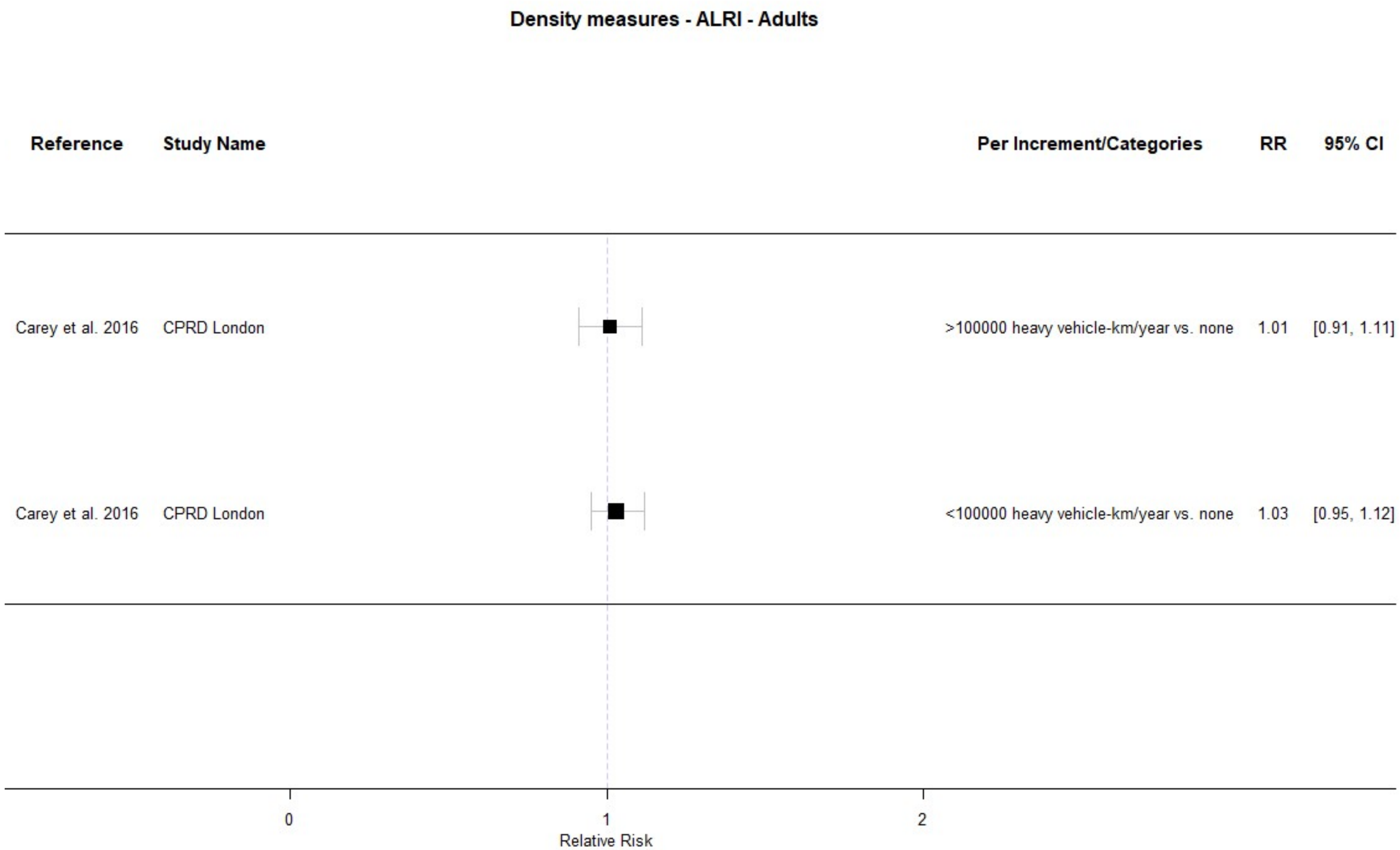
Distance measures – ALRI – Adults



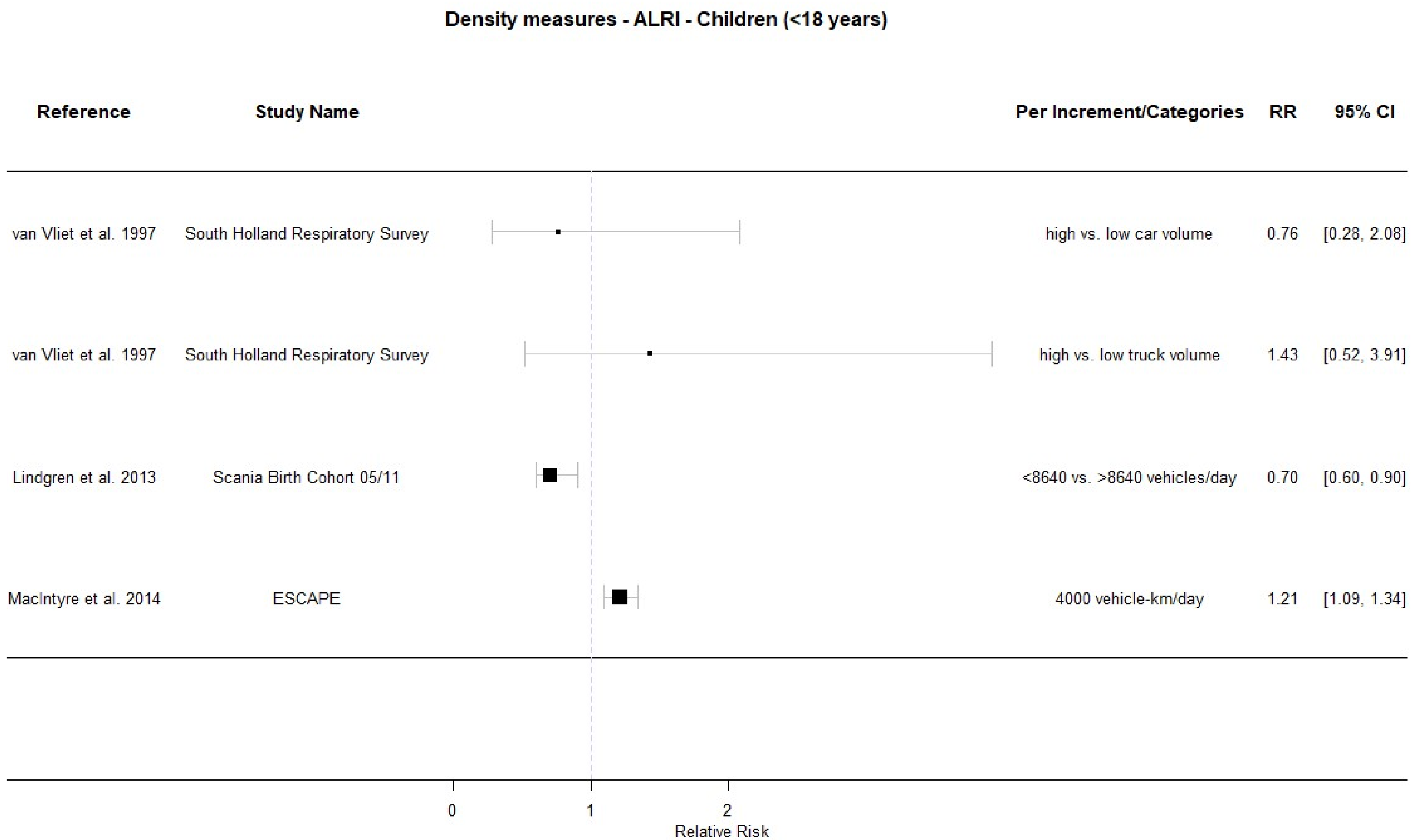
Distance measures – ALRI – Children



Density measures – ALRI – Adults

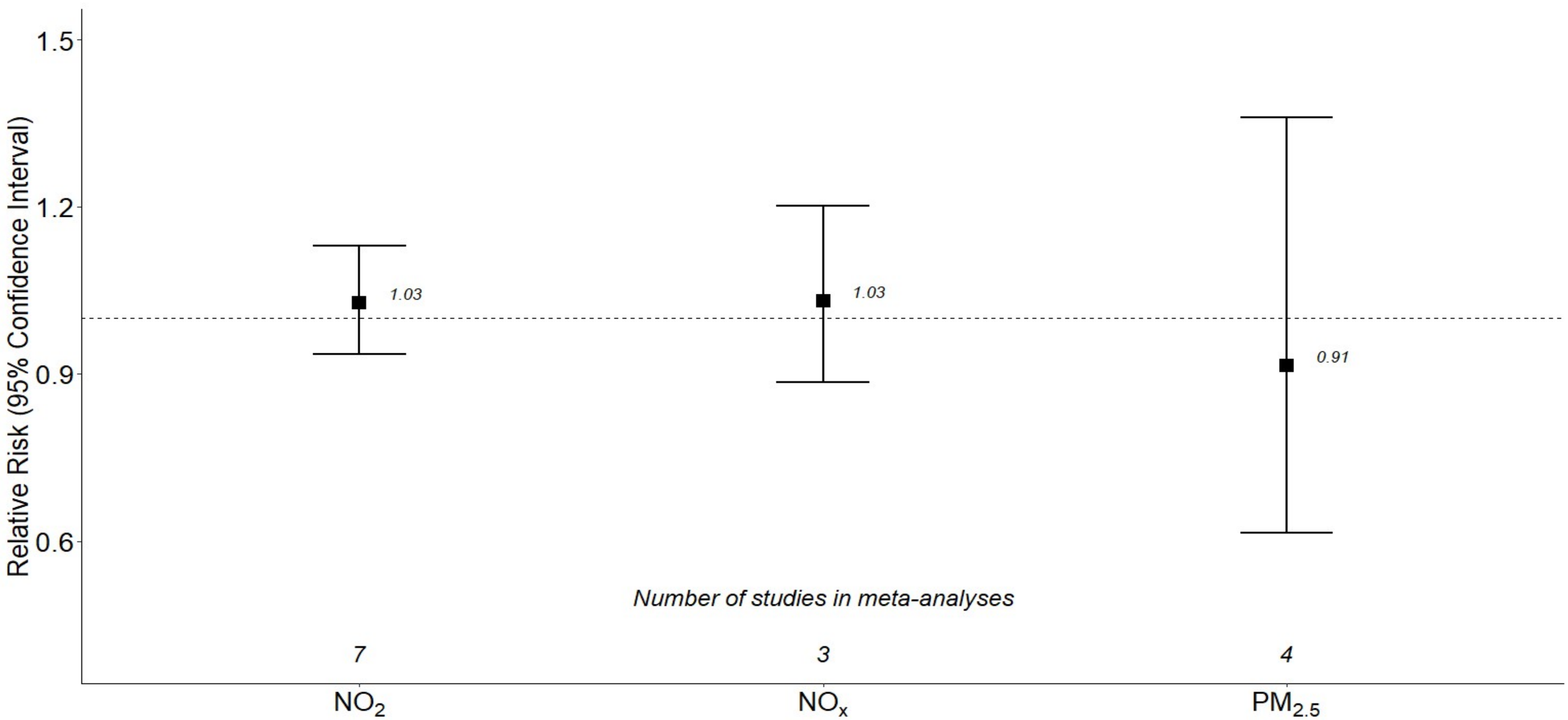


Density measures – ALRI – Children



9.5 Incidence of chronic obstructive pulmonary disease (COPD)

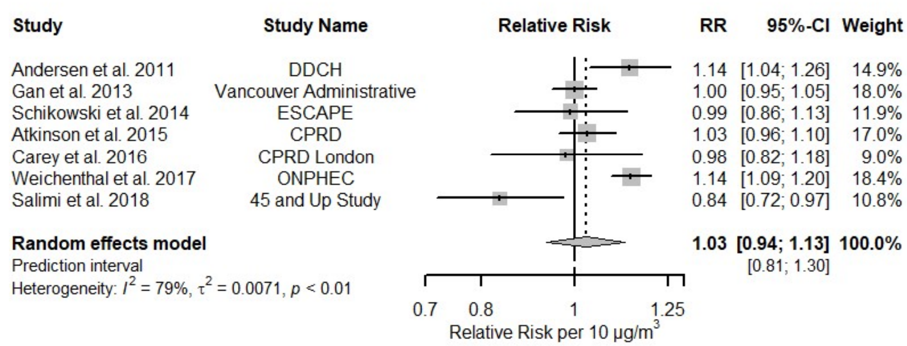
Meta–analysis overview



Footnote: The following increments were used: 10 µg/m^3 for NO_2, 20 µg/m^3 for NO_x and 5 µg/m^3 for $PM_{2.5}$. Effect estimates cannot be directly compared across the different traffic–related pollutants because the selected increments do not necessarily represent the same contrast in exposure.

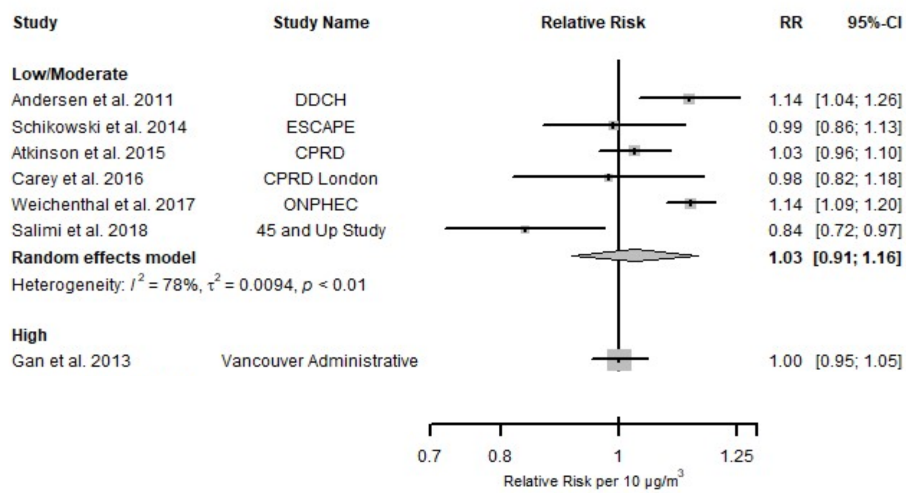
NO$_2$ – Incidence of COPD – Adults

Primary meta-analysis



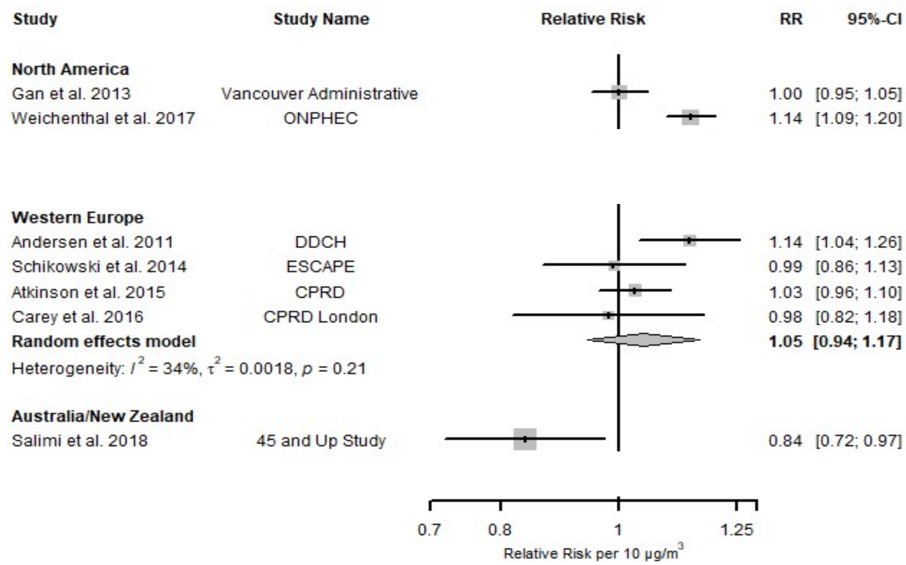
NO_2 – Incidence of COPD – Adults

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low/moderate vs high



NO_2 – Incidence of COPD – Adults

Subgroup analysis – region

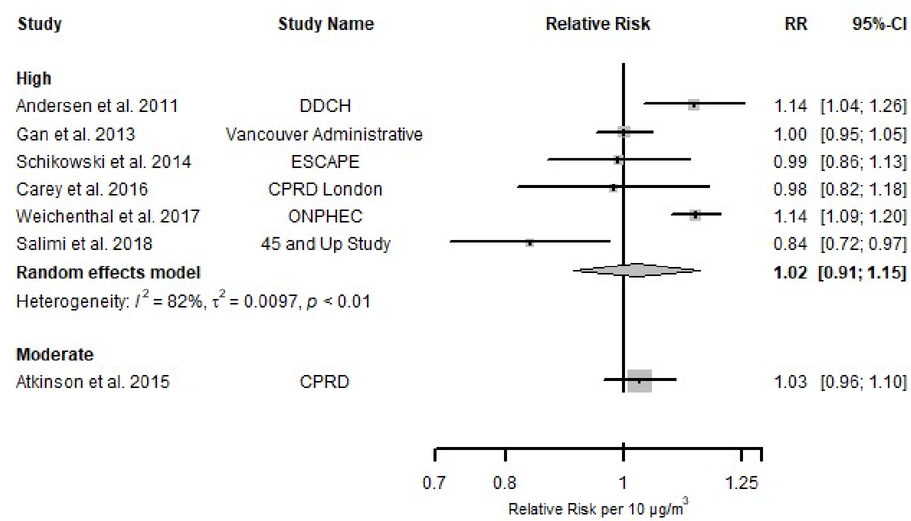


Subgroup analysis – year of publication

All post 2008

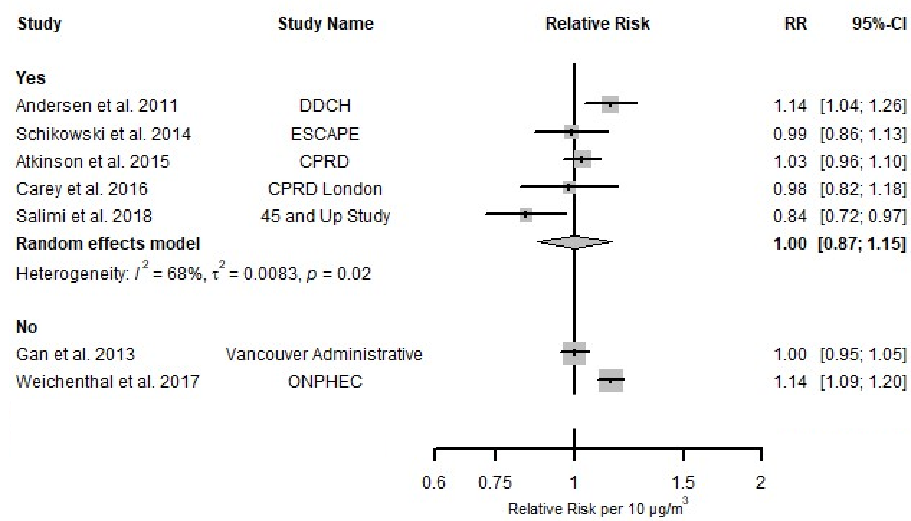
NO_2 – Incidence of COPD – Adults

Subgroup analysis – traffic specificity



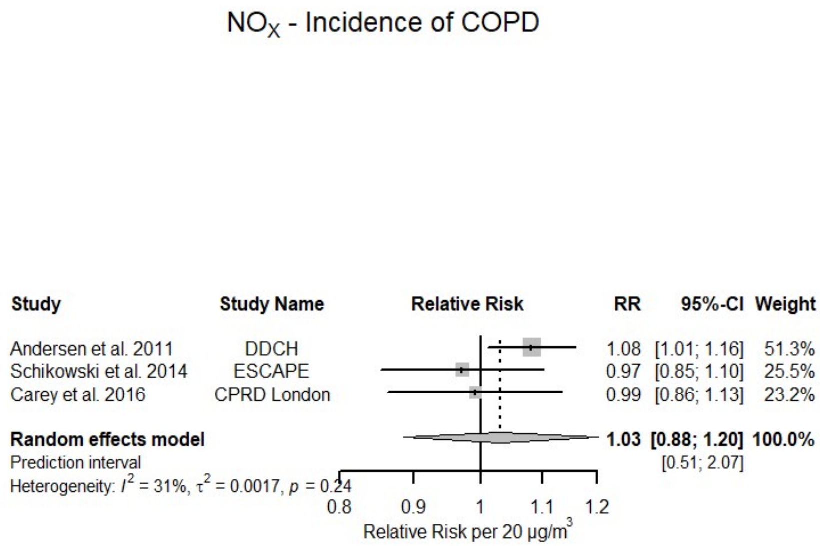
NO$_2$ – Incidence of COPD – Adults

Subgroup analysis – smoking adjustment



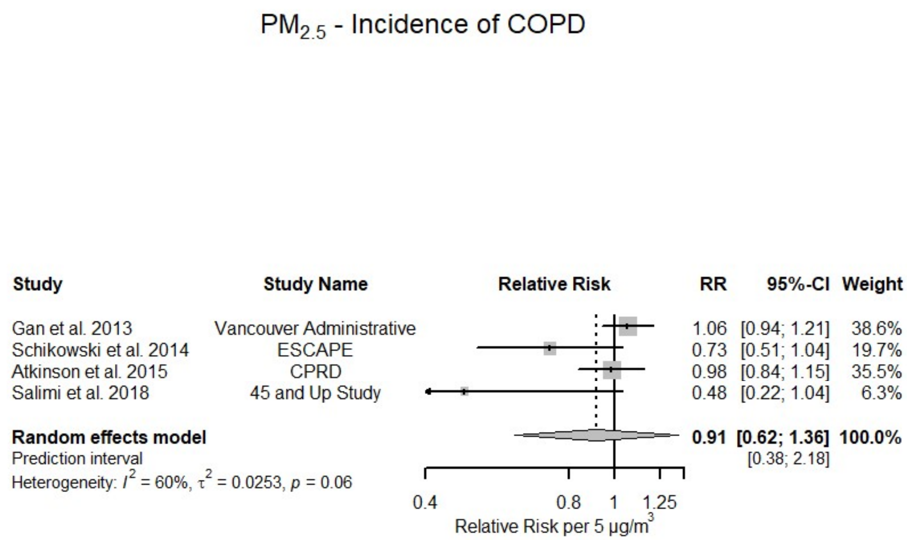
NO_x – Incidence of COPD – Adults

Primary meta-analysis



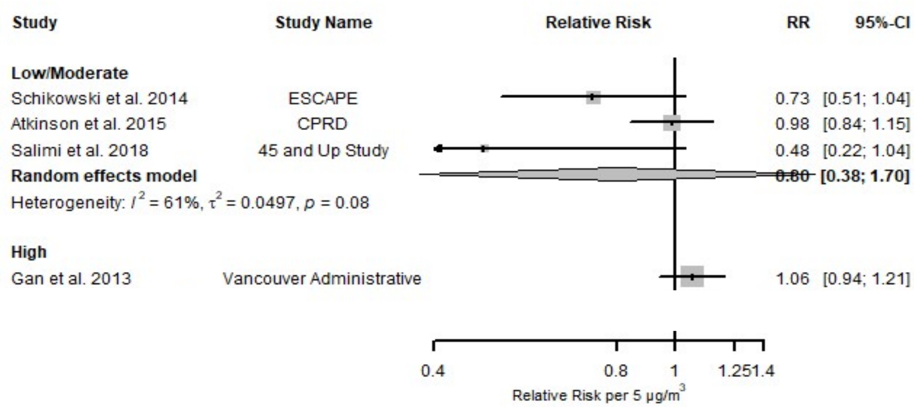
$PM_{2.5}$ – Incidence of COPD – Adults

Primary meta-analysis



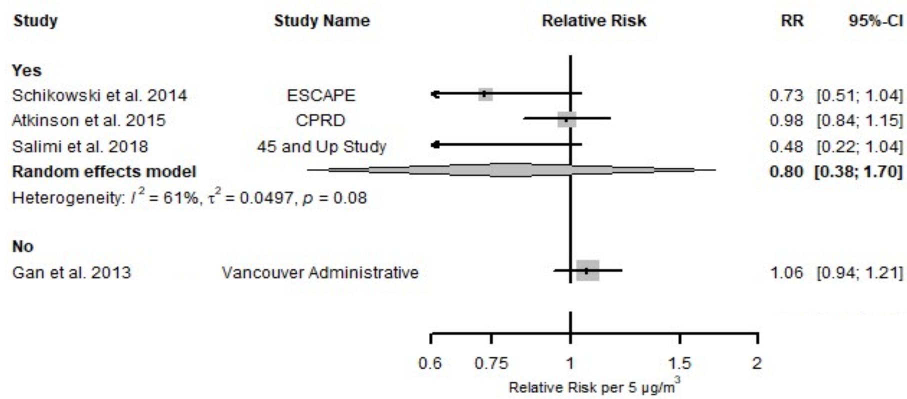
PM$_{2.5}$ – Incidence of COPD – Adults

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low/moderate vs high



PM$_{2.5}$ – Incidence of COPD – Adults

Subgroup analysis – smoking adjustment



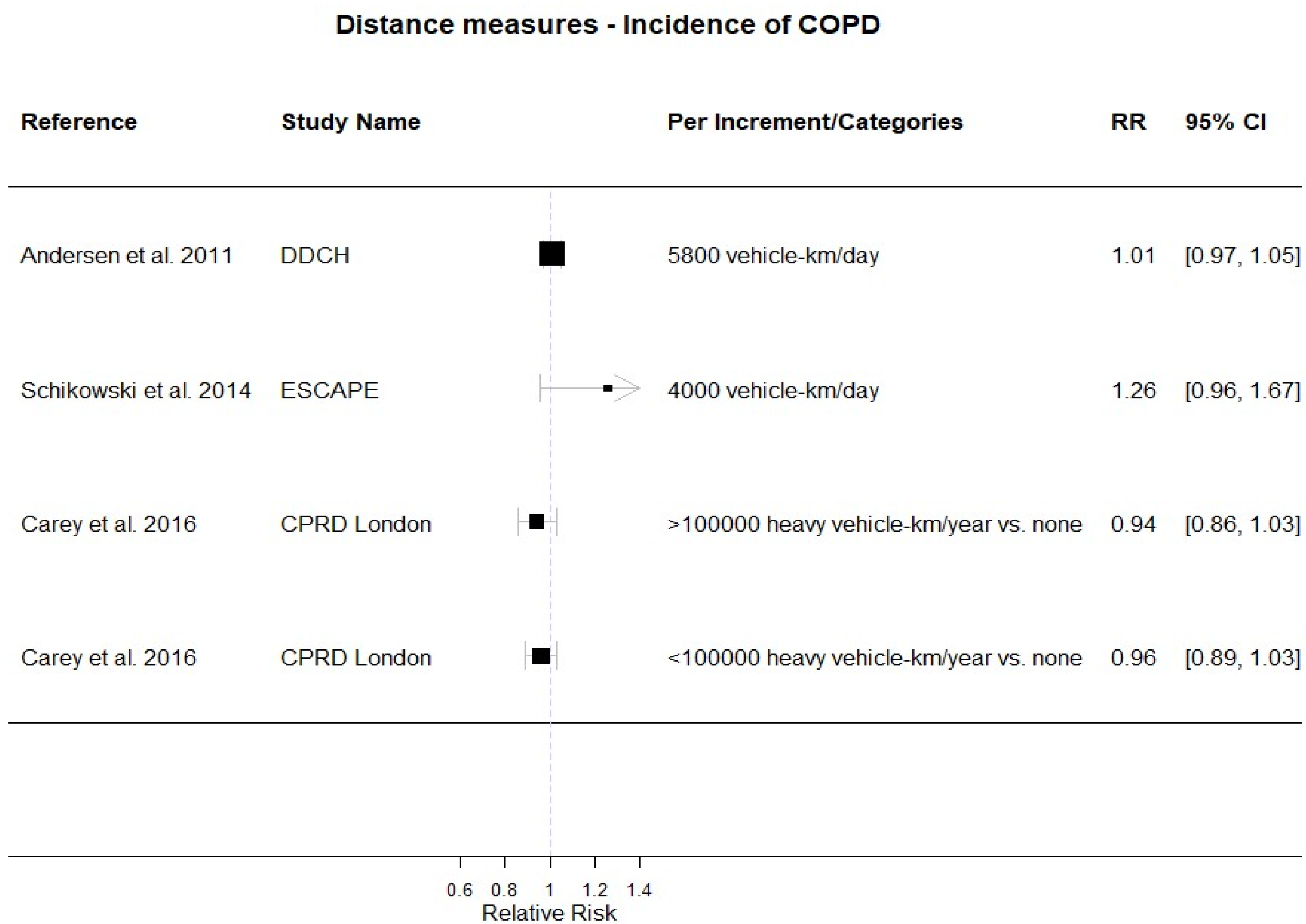
$PM_{2.5}$ – Incidence of COPD – Adults

Subgroup analysis – region
Gan 2013 North America; Schikowski 2014 and Atkinson 2015 Western Europe, and Salimi 2018 Australia/New Zealand

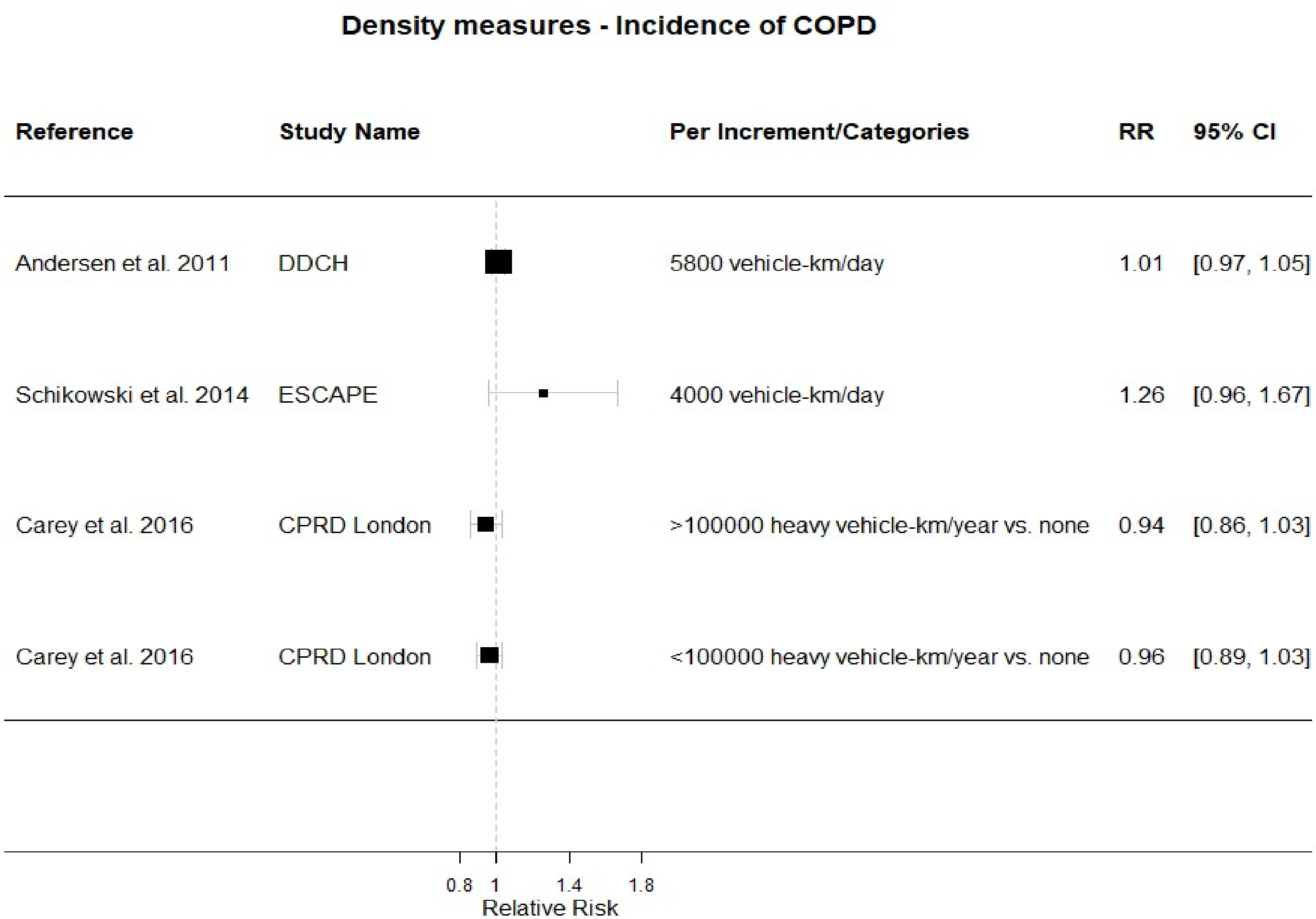
Subgroup analysis – year of publication
All post 2008

Subgroup analysis – traffic specificity
All moderate

Distance measures – Incidence of COPD – Adults

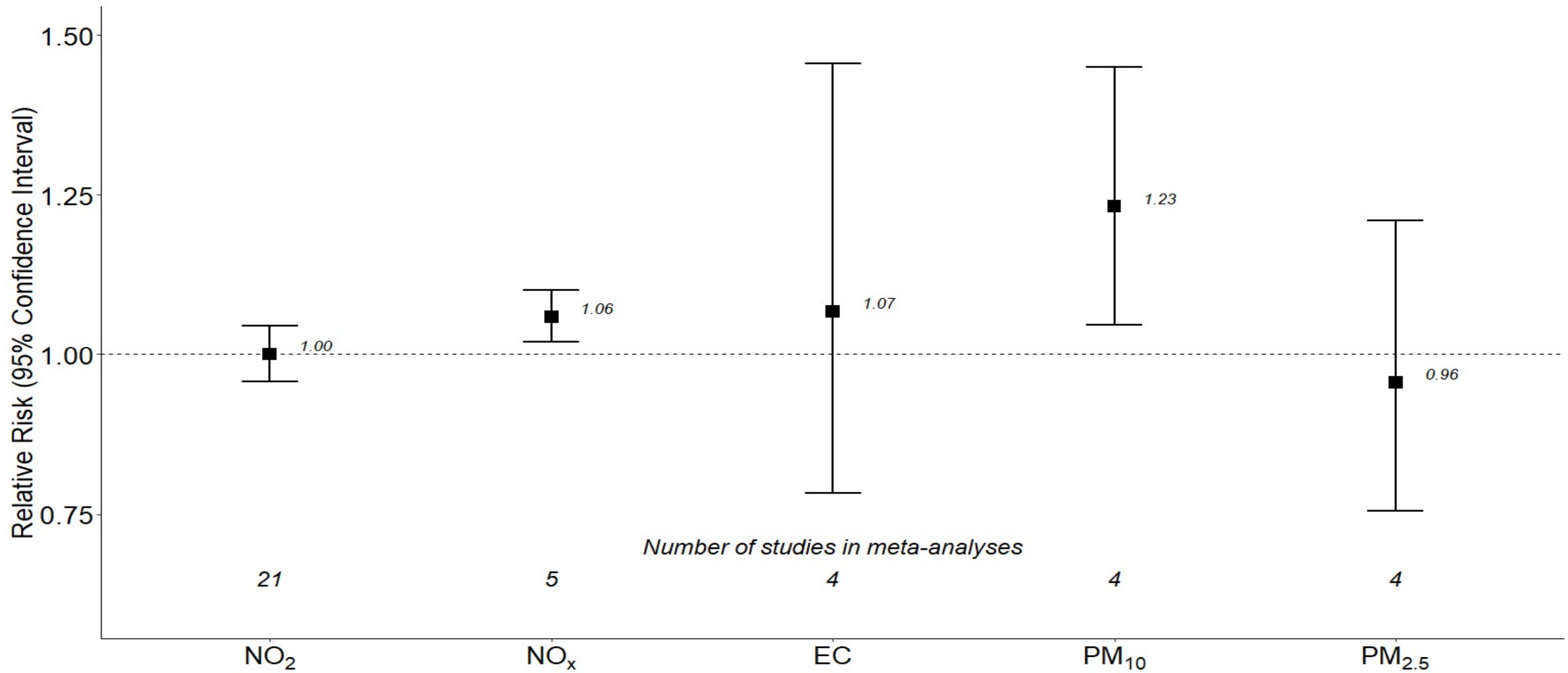


Density measures – Incidence of COPD – Adults



9.6 Prevalence of active wheeze

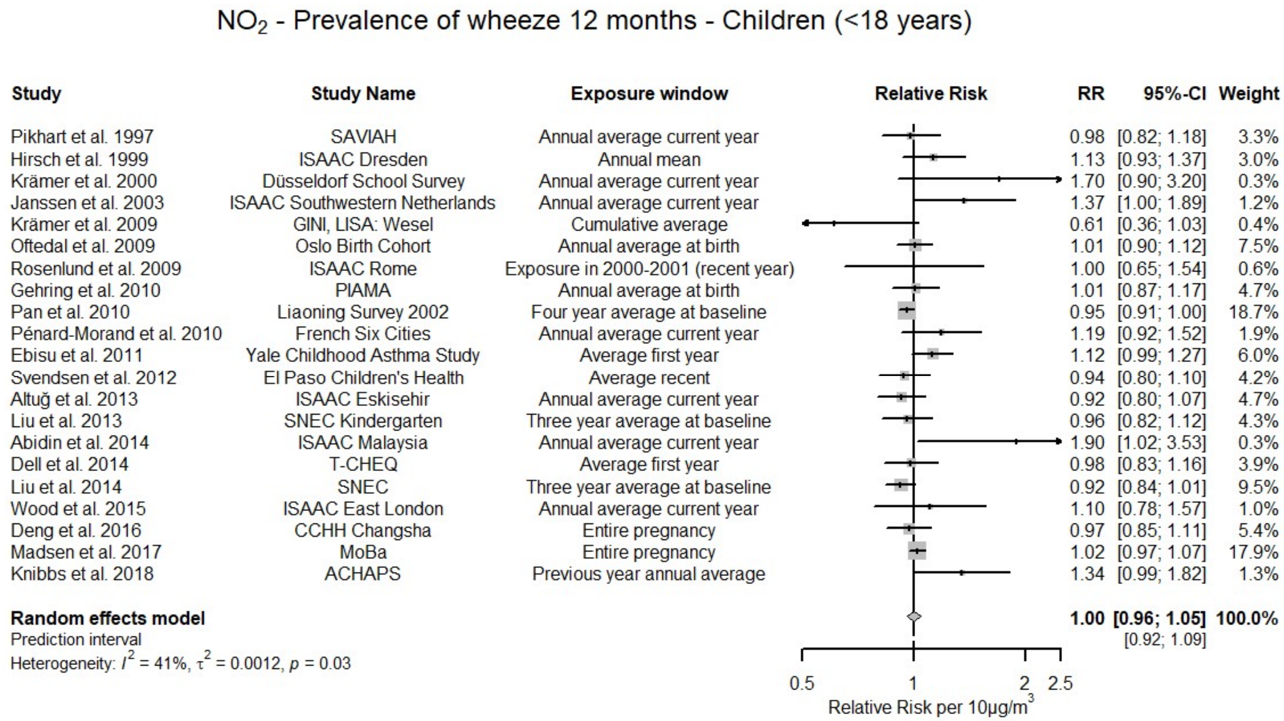
Meta-analysis overview – Children (<18)



Footnote: The following increments were used: 10 µg/m^3 for NO_2, 20 µg/m^3 for NO_x, 1 µg/m^3 for EC, 10 µg/m^3 for PM_{10} and 5 µg/m^3 for $PM_{2.5}$. Effect estimates cannot be directly compared across the different traffic–related pollutants because the selected increments do not necessarily represent the same contrast in exposure.

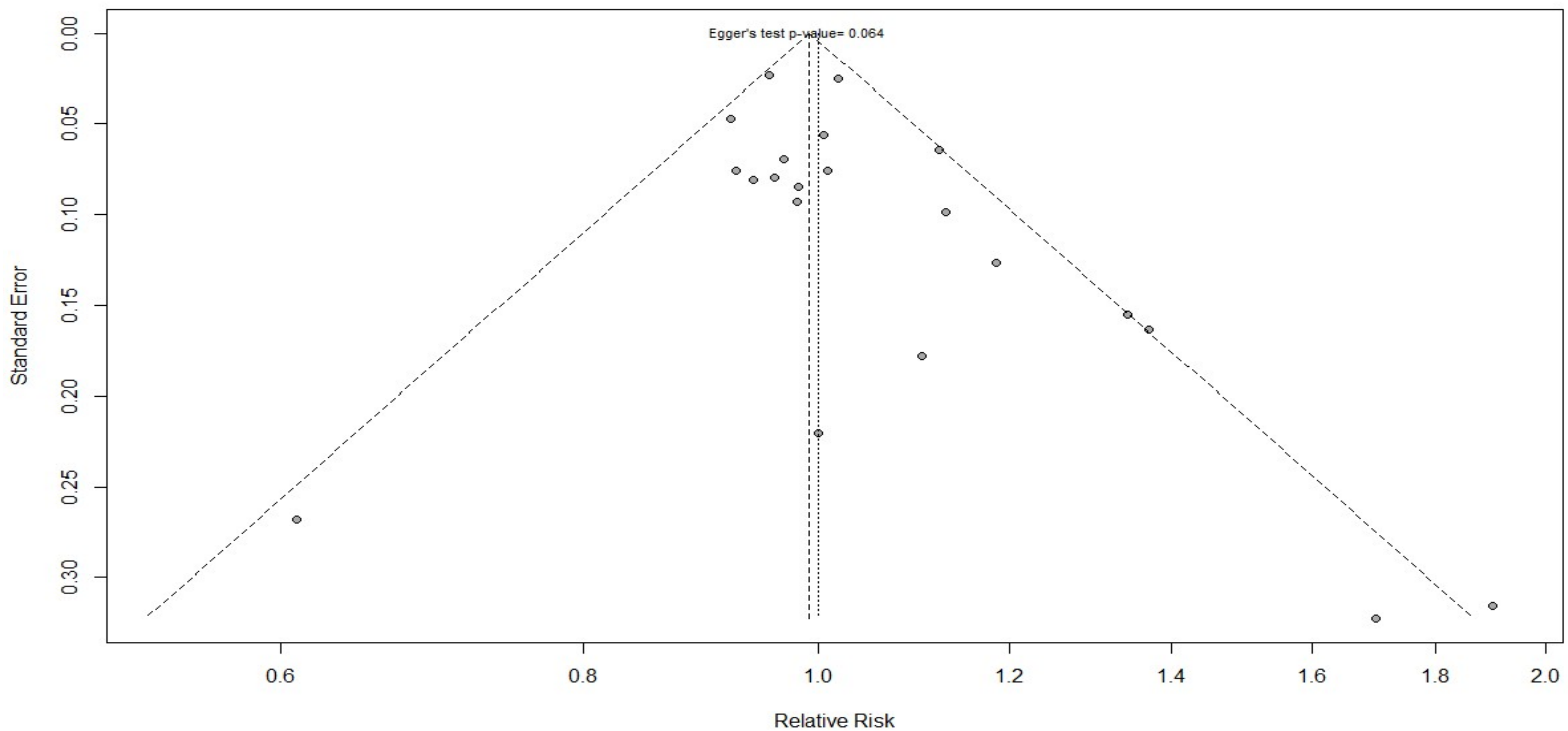
NO_2 – Prevalence of active wheeze – Children

Primary meta-analysis



NO_2 – Prevalence of active wheeze– Children

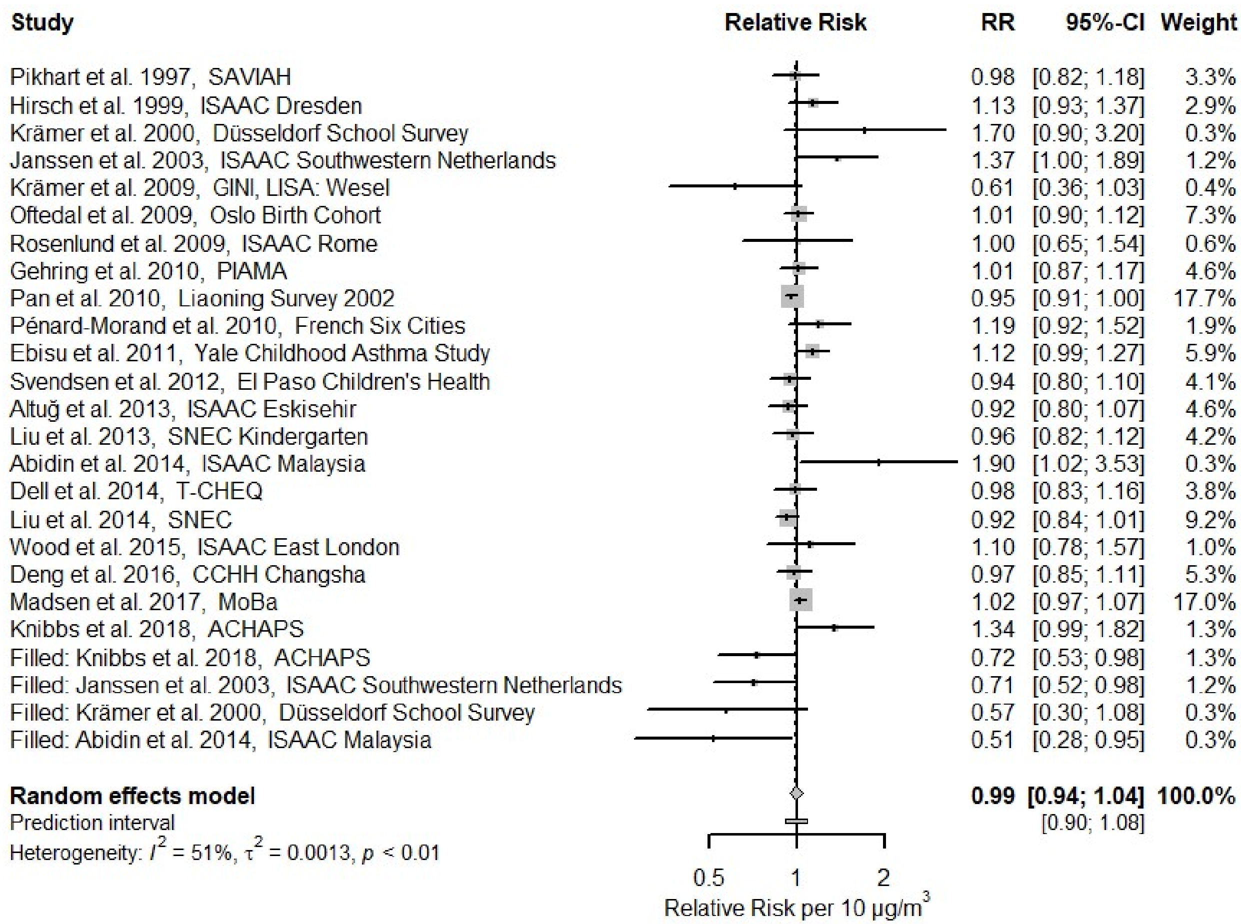
Funnel plot



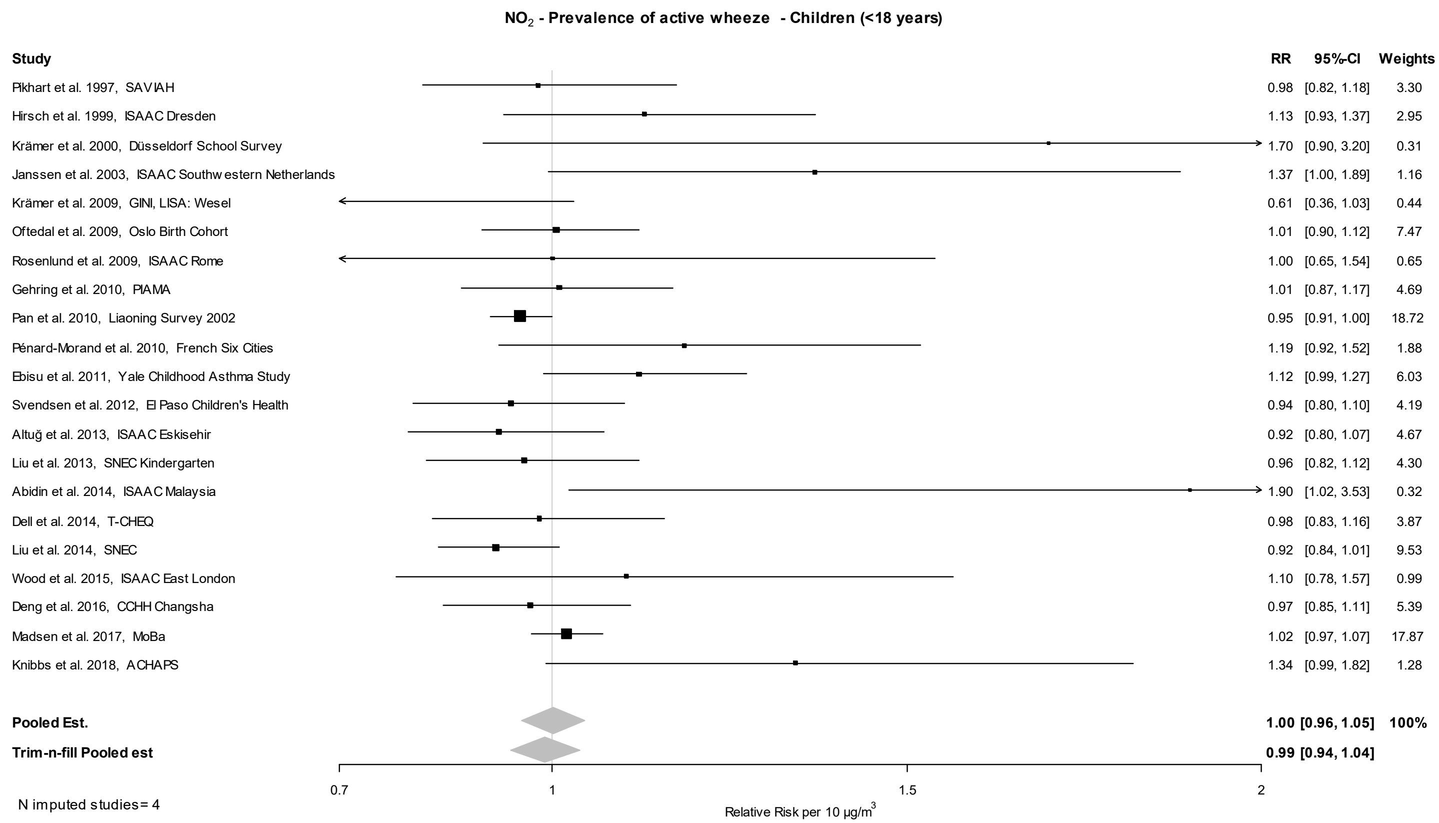
Footnote: The vertical lines in the funnel plots represent the pooled fixed and random effect estimates. The vertical dashed line in the middle of the funnel shows the fixed effect estimate. As the Panel applied a random–effects model, the funnel plot also presents the random–effects estimate with the dotted line.

NO_2 – Prevalence of active wheeze – Children

Trim and fill

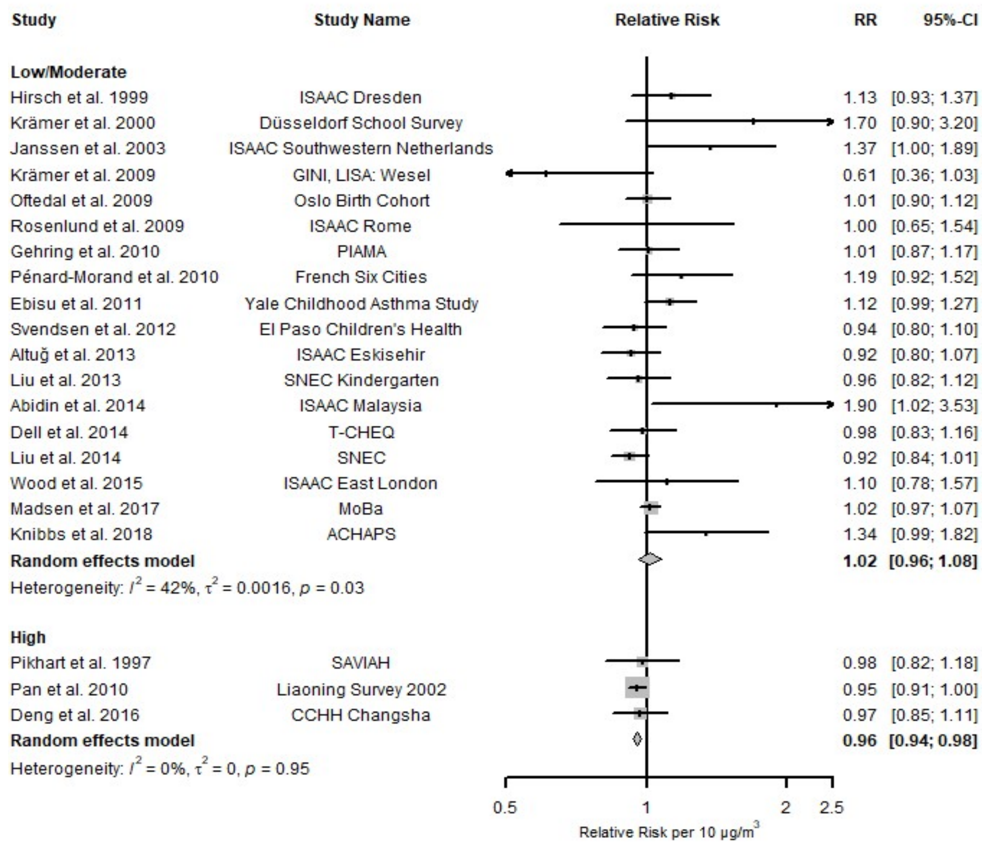


NO_2 – Prevalence of active wheeze – Children



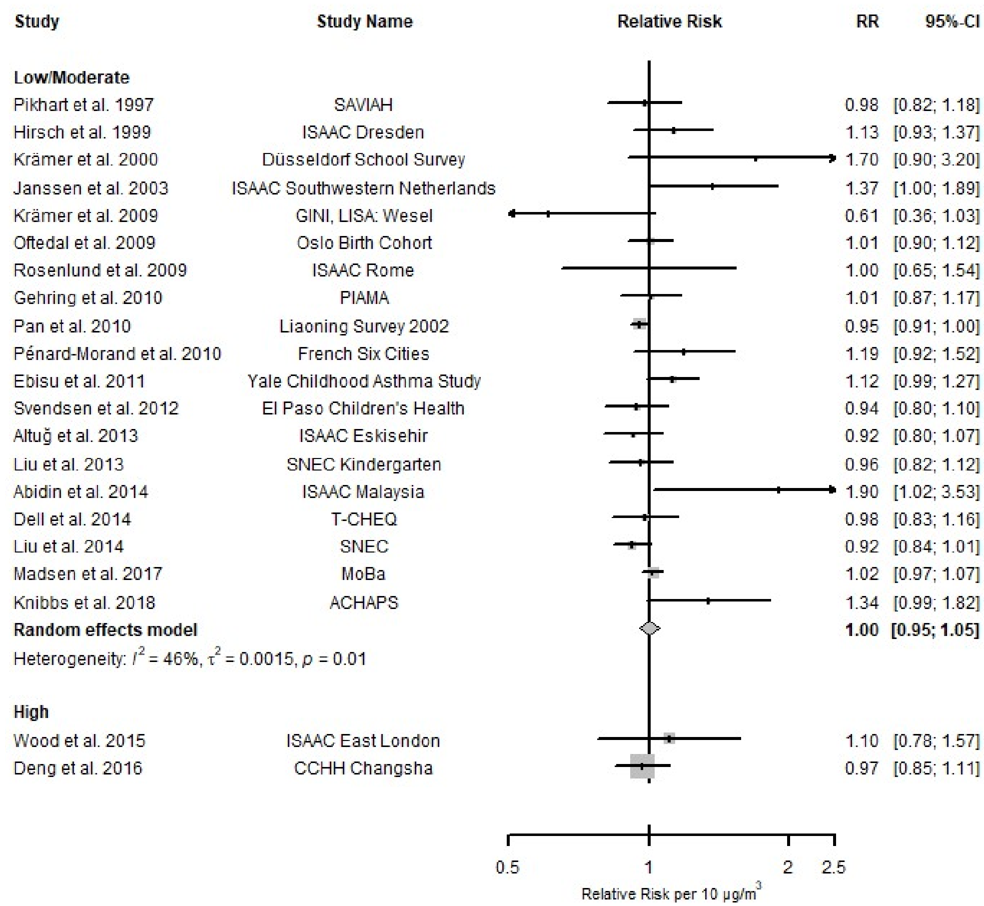
NO_2 – Prevalence of active wheeze – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low/moderate vs high



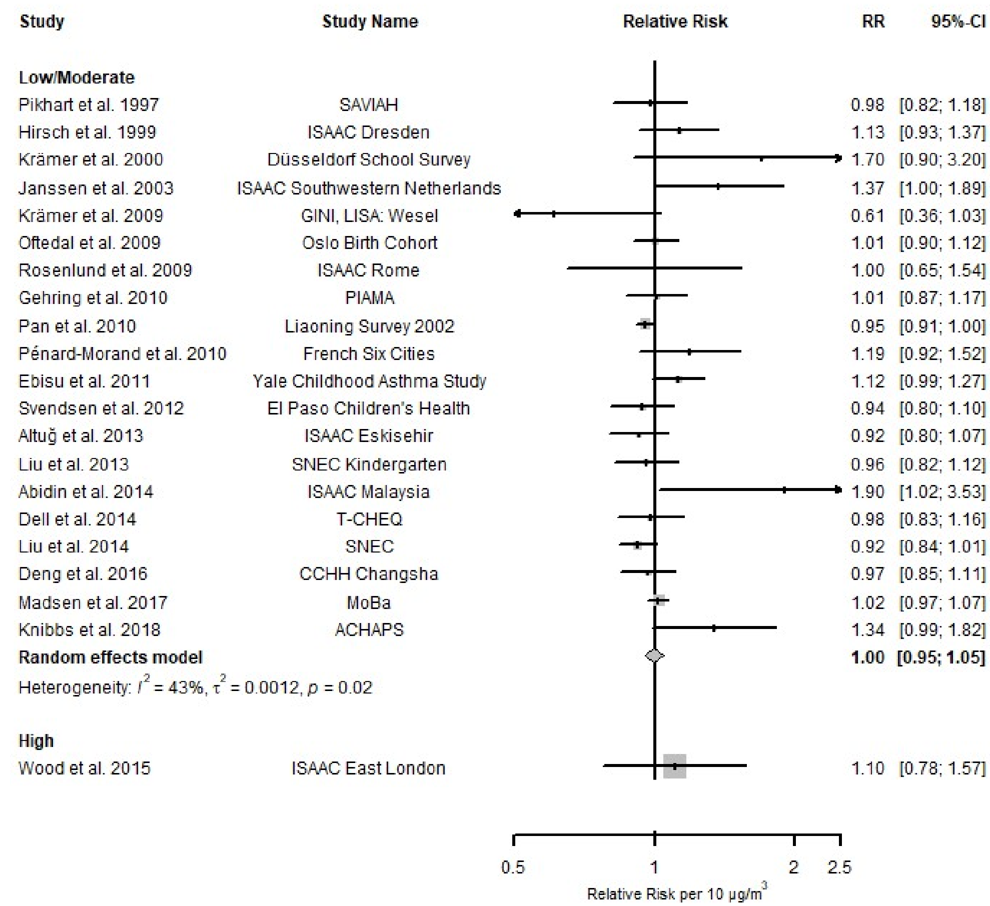
NO_2 – Prevalence of active wheeze – Children

Sensitivity analysis – risk of bias selection bias domain – low/moderate vs high



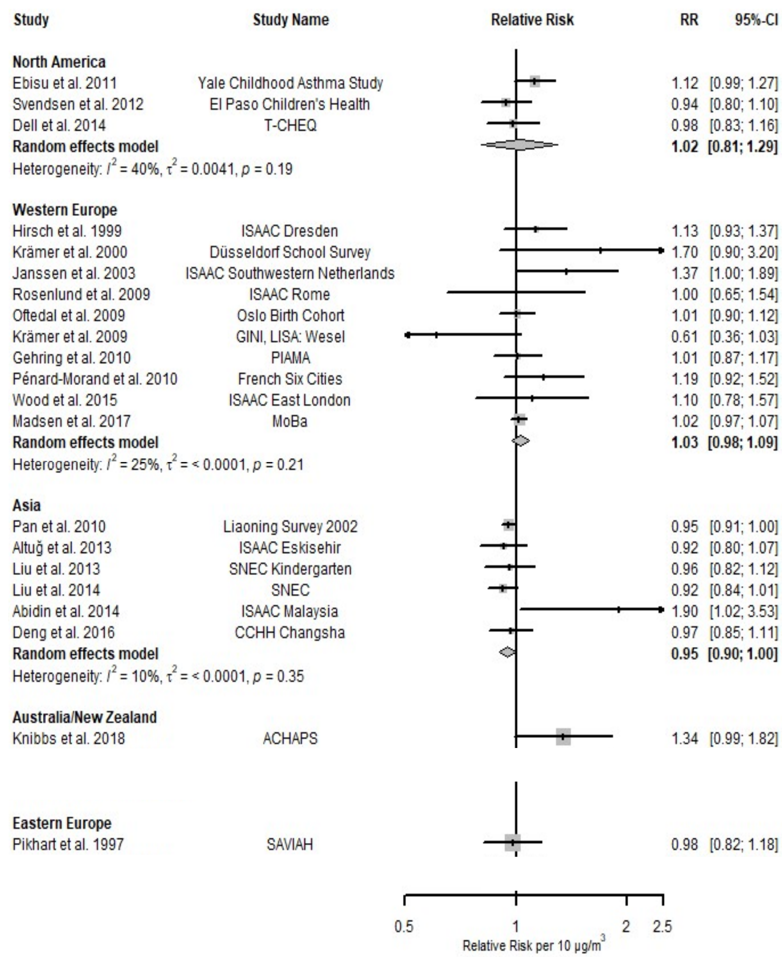
NO_2 – Prevalence of active wheeze – Children

Sensitivity analysis – risk of bias outcome measurement domain – low/moderate vs high



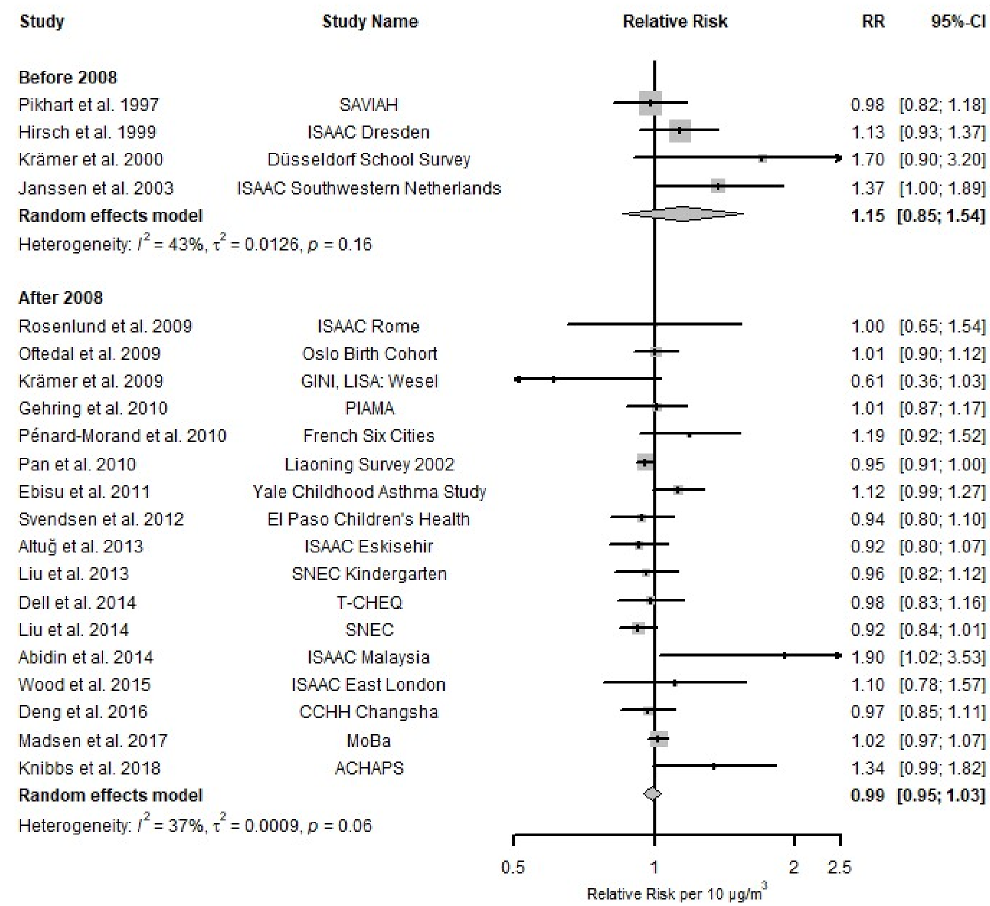
NO_2 – Prevalence of active wheeze – Children

Subgroup analysis – region



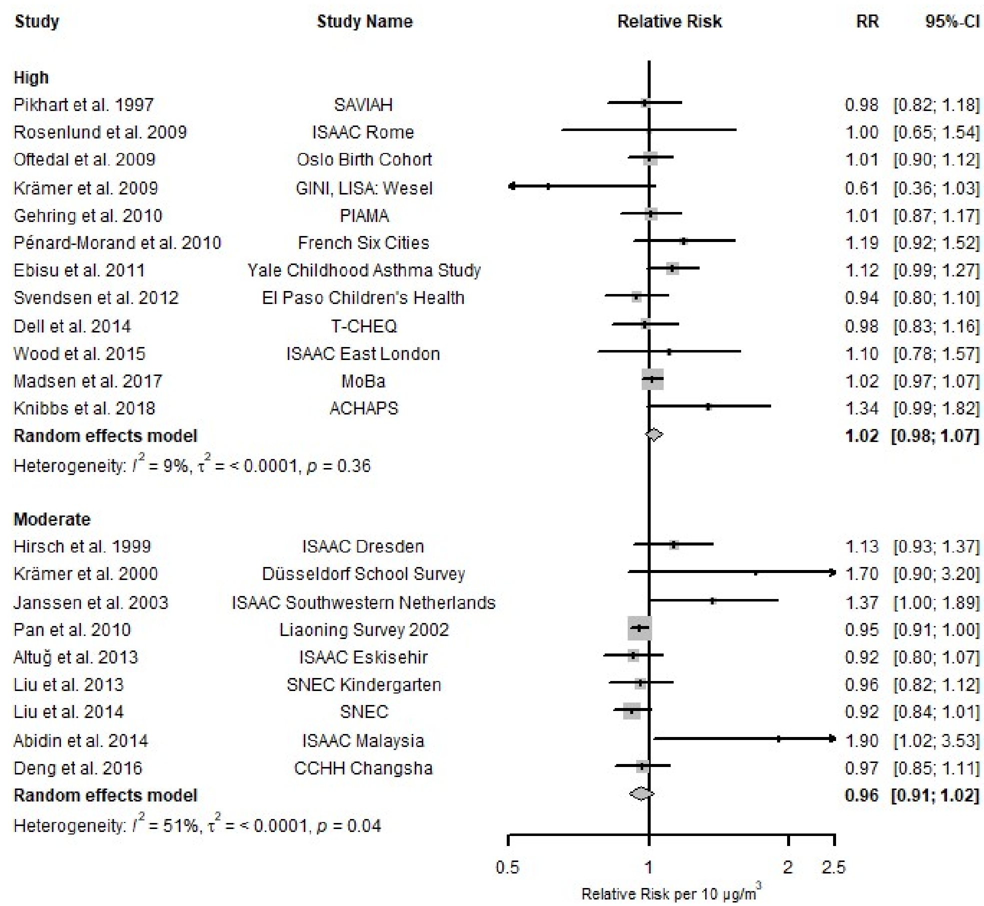
NO_2 – Prevalence of active wheeze – Children

Subgroup analysis – year of publication



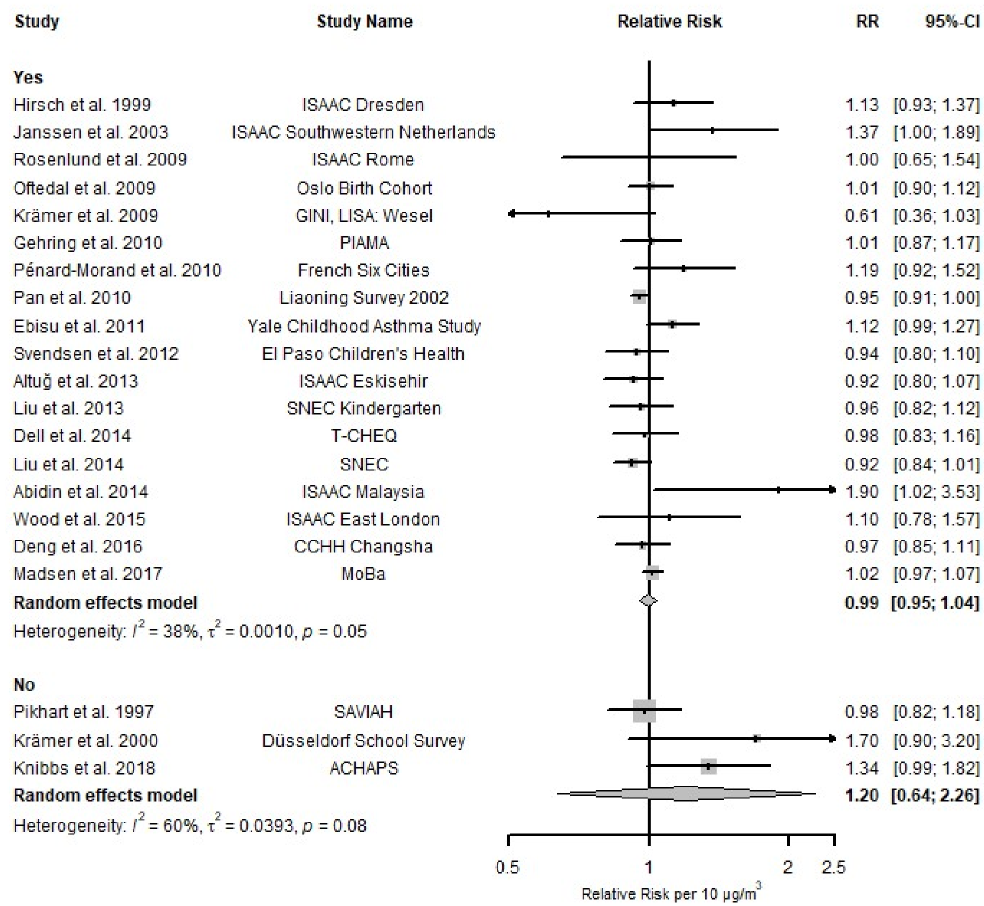
NO_2 – Prevalence of active wheeze – Children

Subgroup analysis – traffic specificity



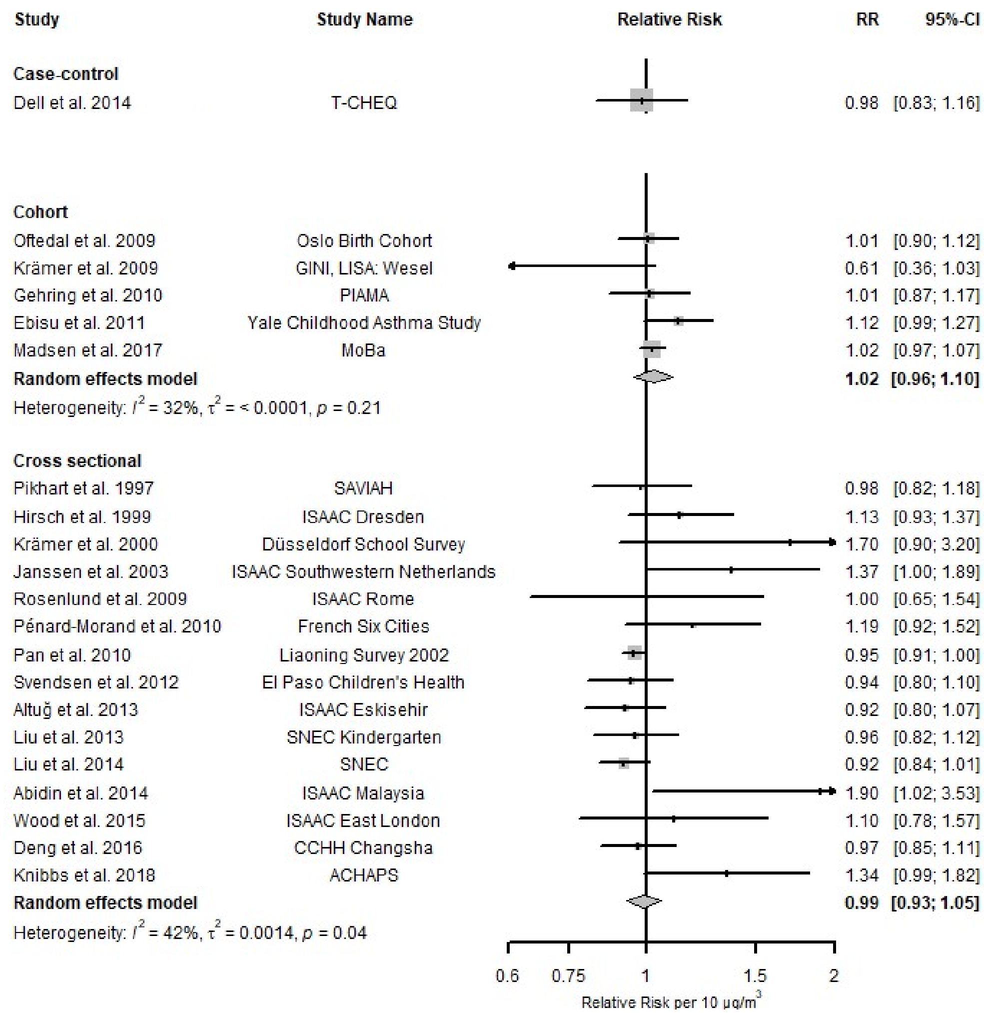
NO_2 – Prevalence of active wheeze – Children

Subgroup analysis – smoking adjustment



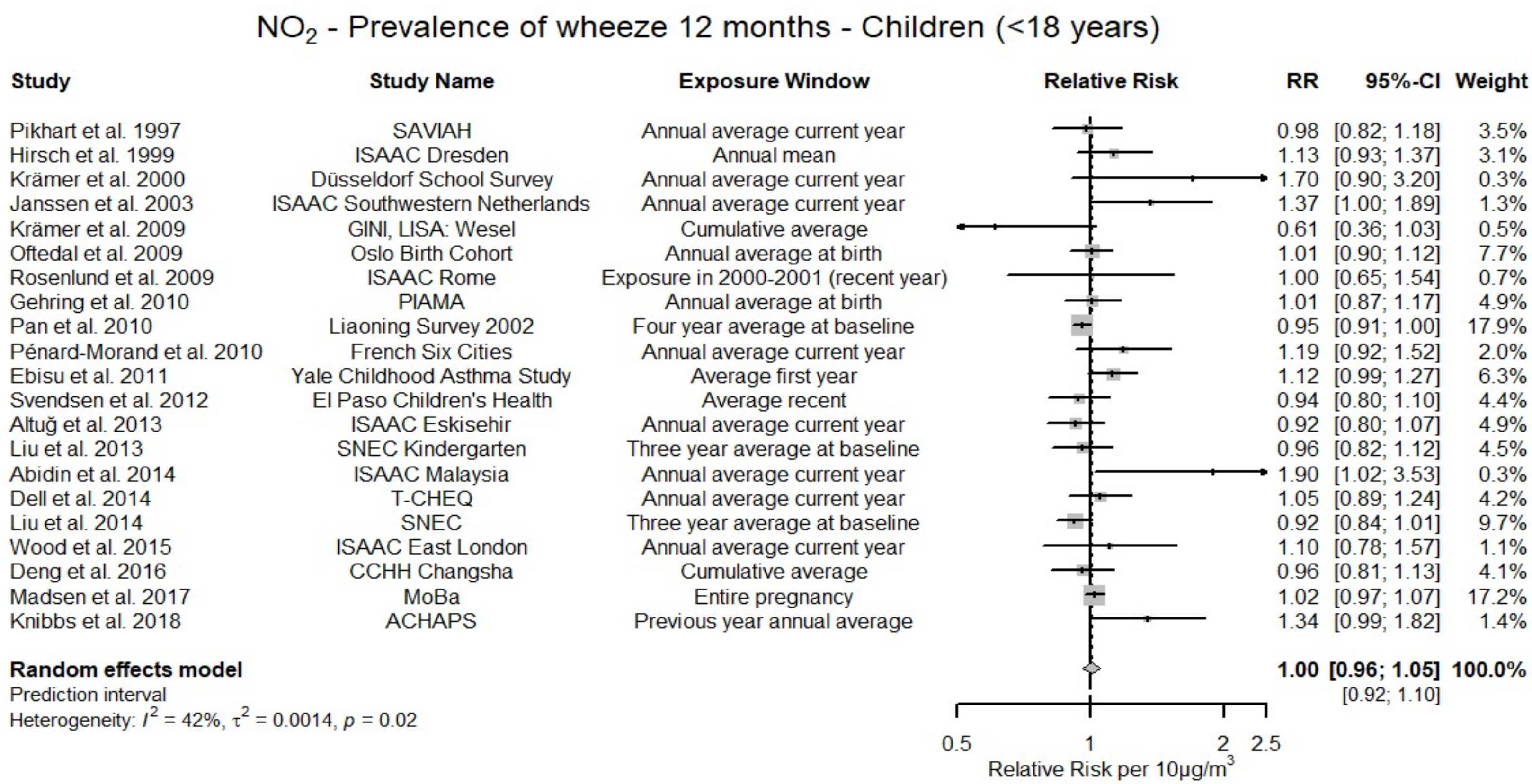
NO_2 – Prevalence of active wheeze – Children

Subgroup analysis – study design



NO_2 – Prevalence of active wheeze – Children

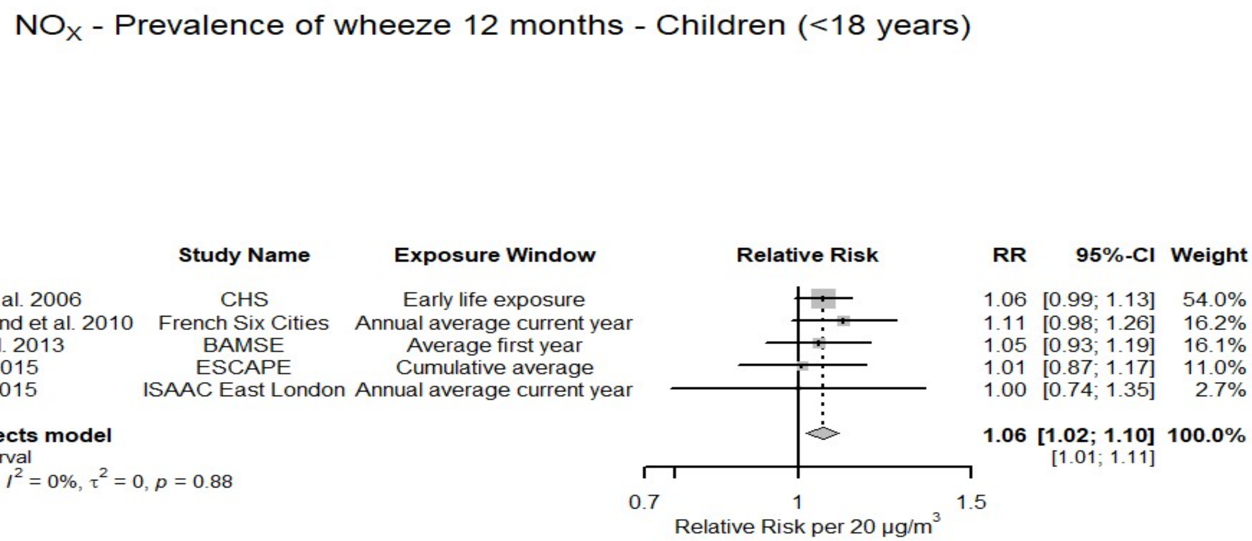
Sensitivity analysis – reverse selection



Recent years > cumulative average > first year of life > at birth > pregnancy

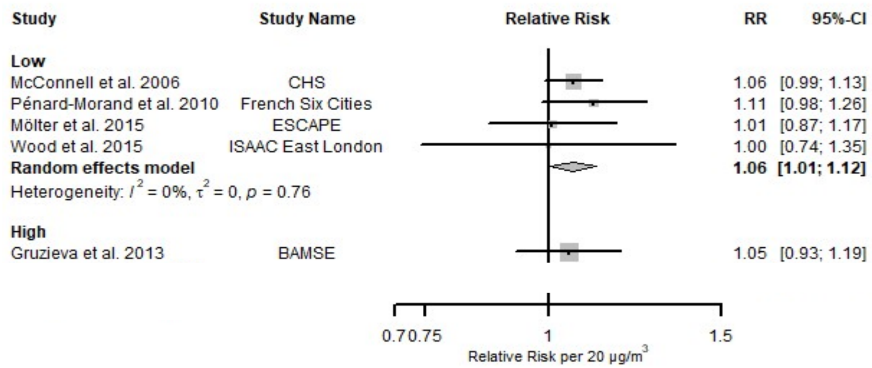
NO_x – Prevalence of active wheeze – Children

Primary meta-analysis



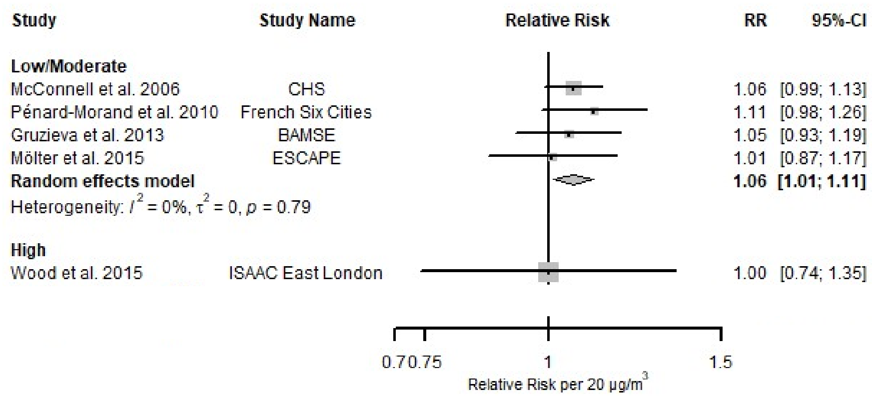
NO_x – Prevalence of active wheeze – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low vs high



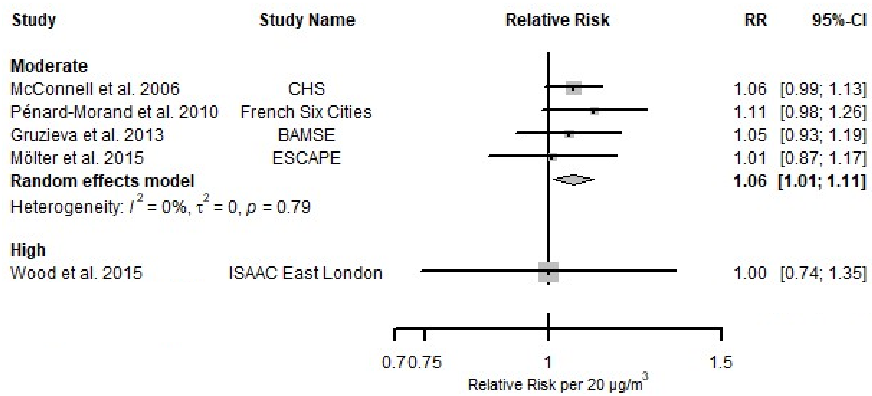
NO_x – Prevalence of active wheeze – Children

Sensitivity analysis – risk of bias selection bias domain – low/moderate vs high



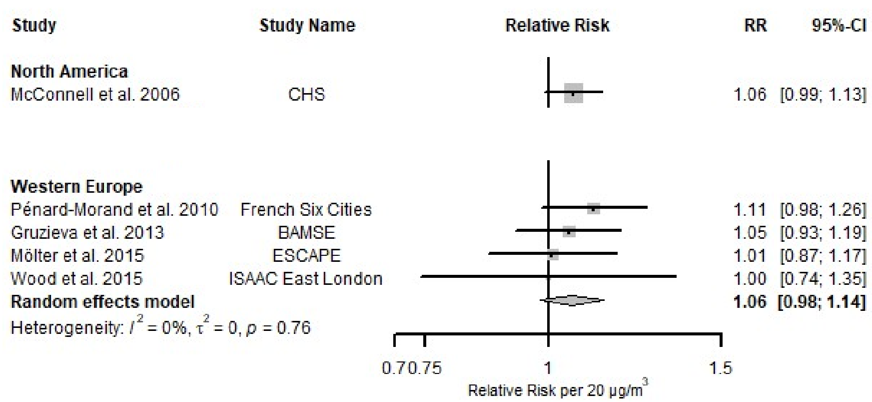
NO_x – Prevalence of active wheeze – Children

Sensitivity analysis – risk of bias outcome measurement domain – moderate vs high



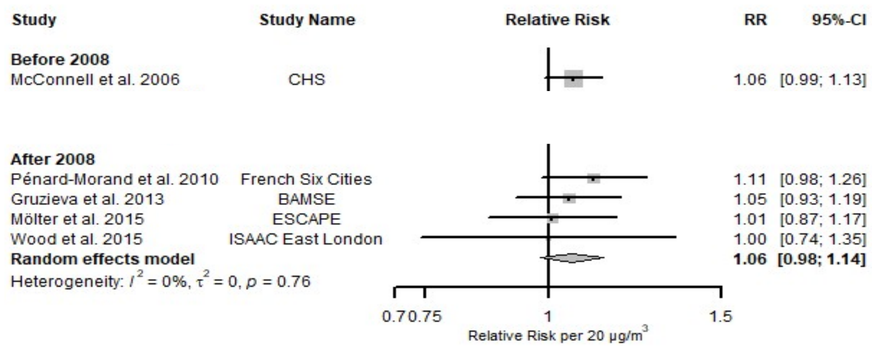
NO_x – Prevalence of active wheeze – Children

Subgroup analysis – region



NO_x – Prevalence of active wheeze – Children

Subgroup analysis – year of publication

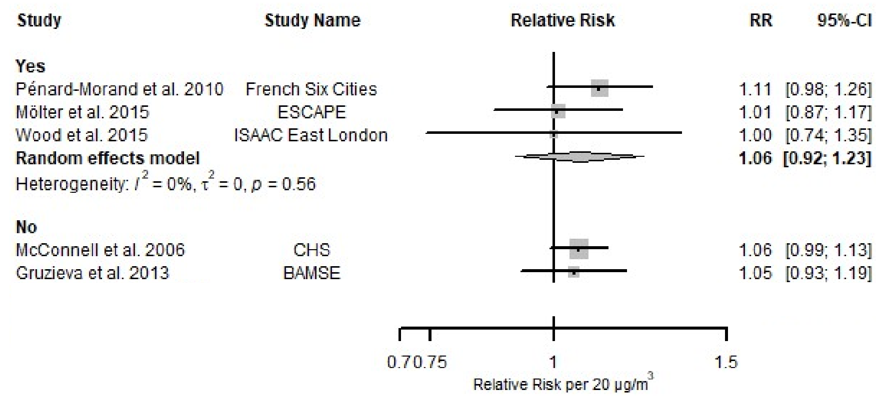


Subgroup analysis – traffic specificity

All high traffic specificity

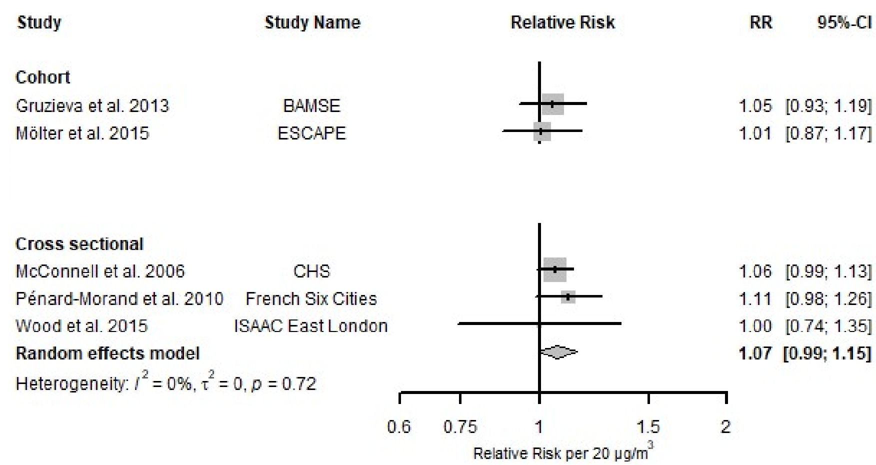
NO_x – Prevalence of active wheeze – Children

Subgroup analysis – smoking adjustment



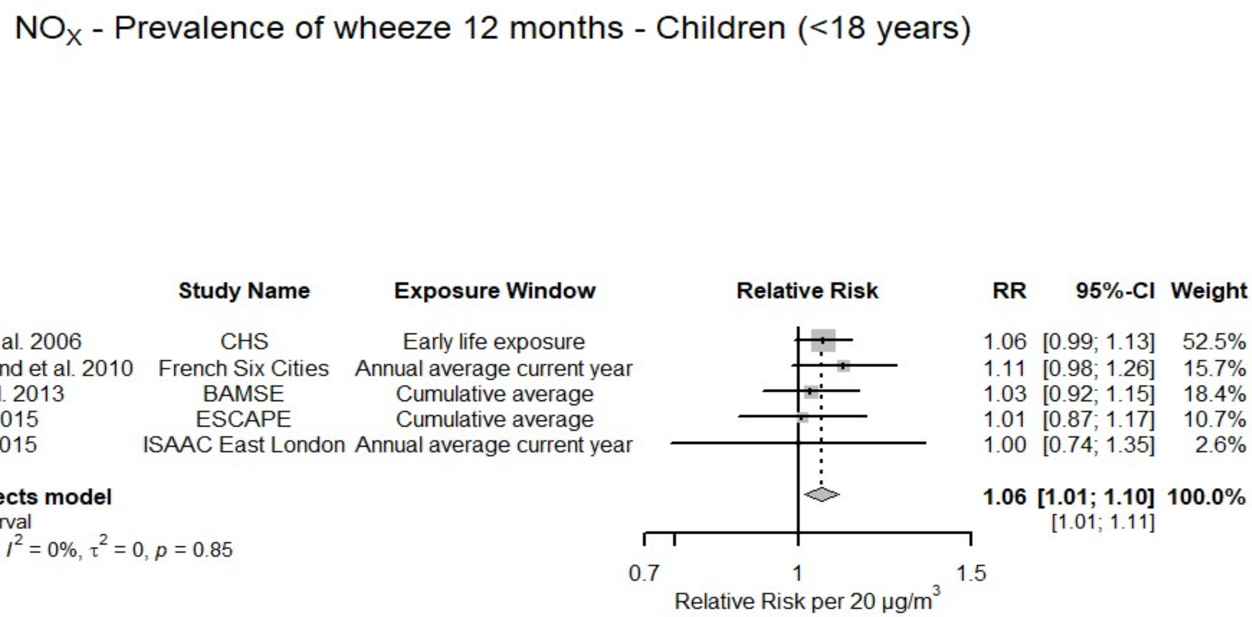
NO$_x$ – Prevalence of active wheeze – Children

Subgroup analysis – study design



NO_x – Prevalence of active wheeze– Children

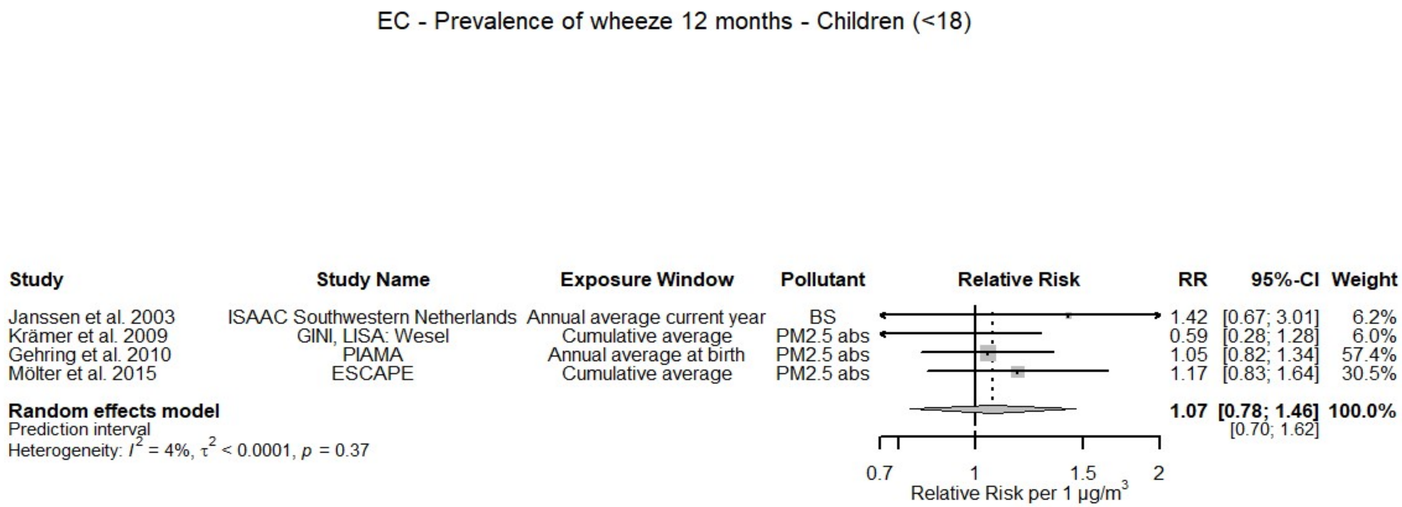
Sensitivity analysis – reverse selection



Recent years > cumulative average > first year of life > at birth > pregnancy

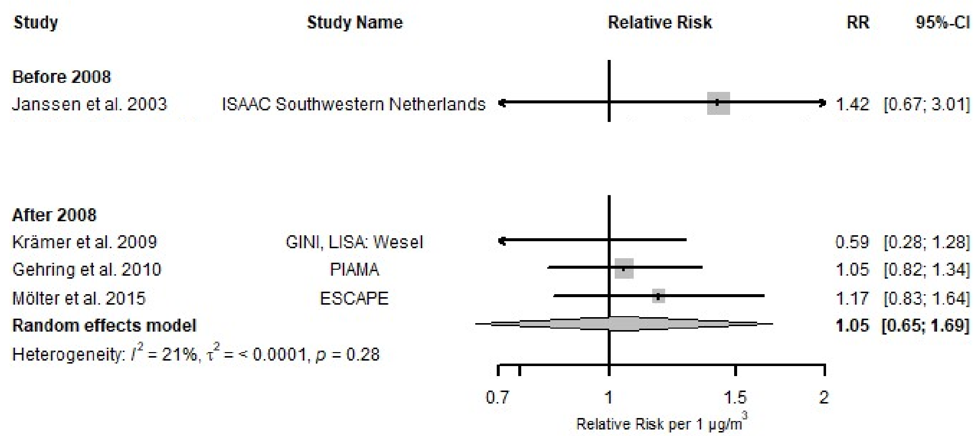
EC - Prevalence of active wheeze – Children

Primary meta-analysis



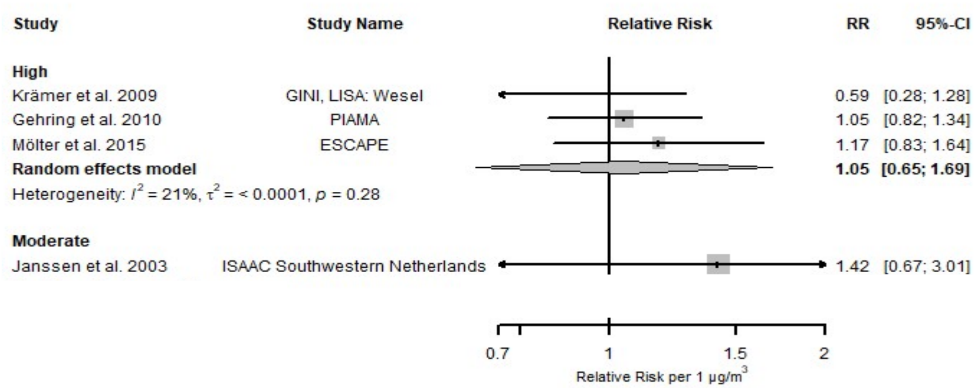
EC – Prevalence of active wheeze – Children

Subgroup analysis – year of publication



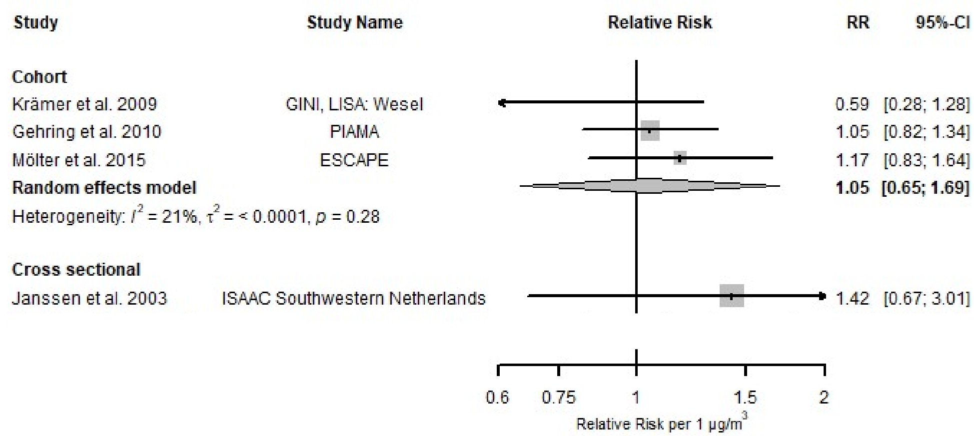
EC – Prevalence of active wheeze – Children

Subgroup analysis – traffic specificity



EC – Prevalence of active wheeze – Children

Subgroup analysis – study design



EC – Prevalence of active wheeze – Children

Subgroup analyses notes:

Subgroup analysis – region

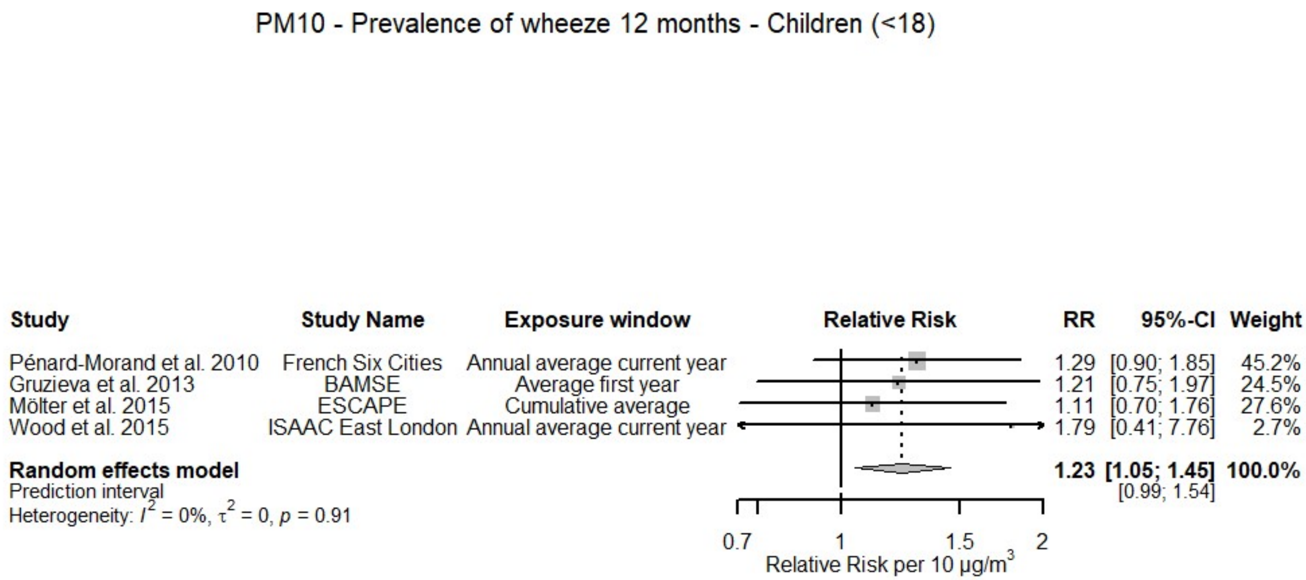
All Western Europe

Subgroup analysis – smoking adjustment

All studies controlled for smoking

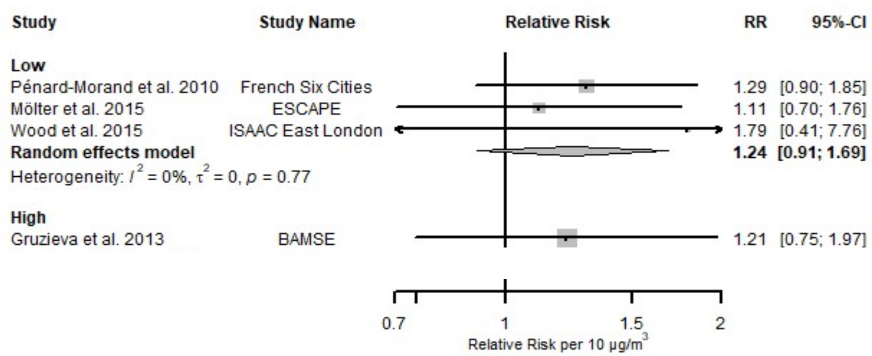
PM_{10} – Prevalence of active wheeze – Children

Primary meta-analysis



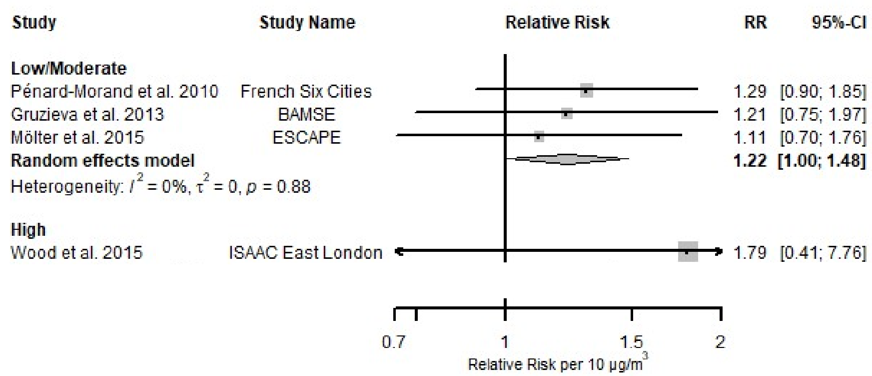
PM_{10} – Prevalence of active wheeze – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low vs high



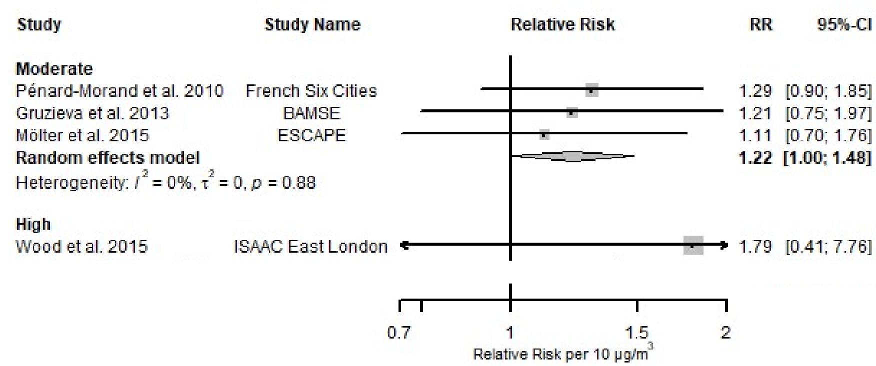
PM_{10} – Prevalence of active wheeze – Children

Sensitivity analysis – risk of bias selection bias domain – low/moderate vs high



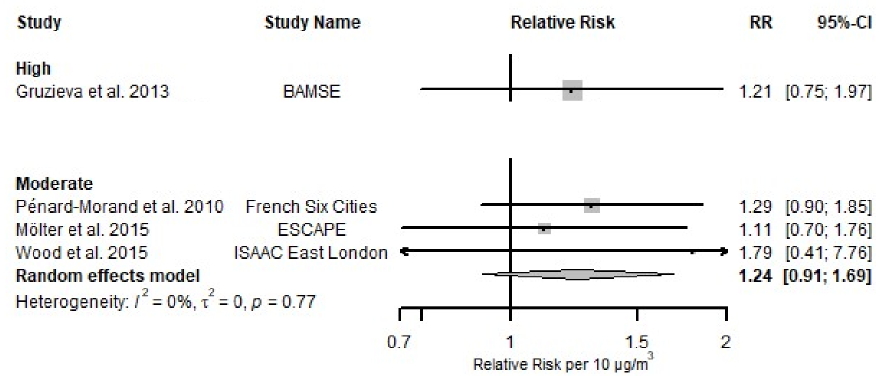
PM_{10} – Prevalence of active wheeze – Children

Sensitivity analysis – risk of bias outcome measurement domain – moderate vs high



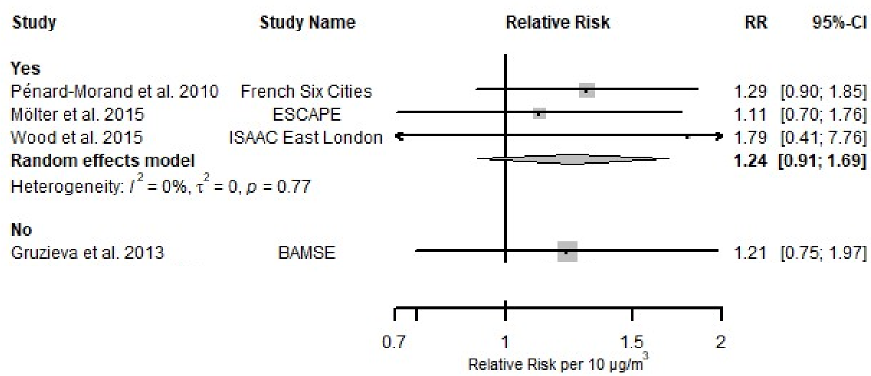
PM_{10} – Prevalence of active wheeze – Children

Subgroup analysis – traffic specificity



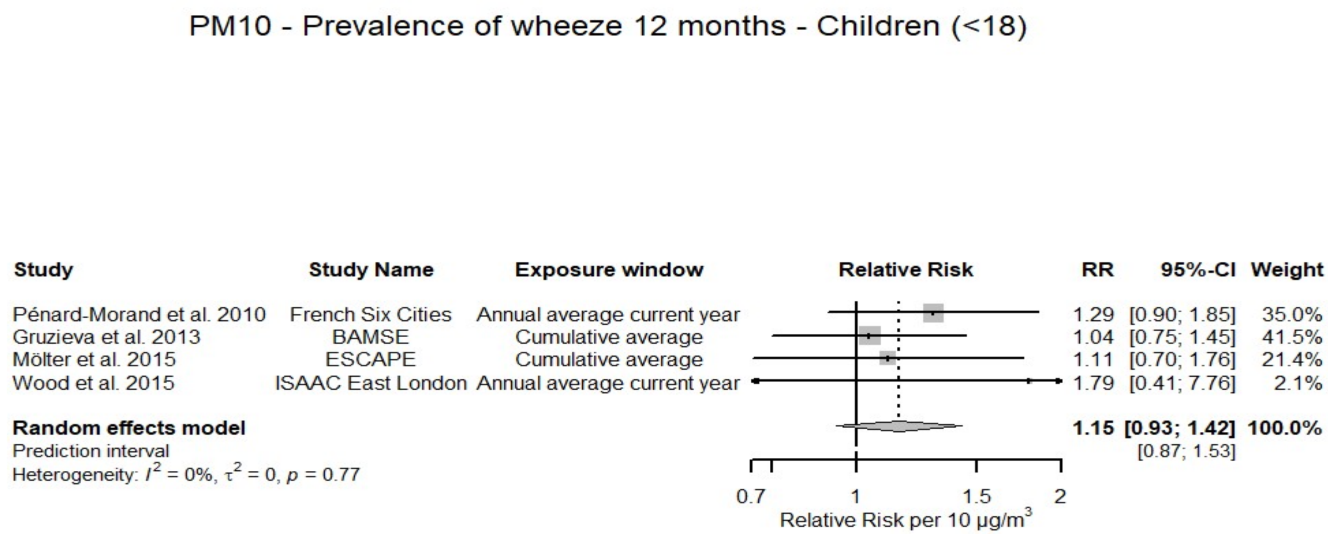
PM_{10} – Prevalence of active wheeze – Children

Subgroup analysis – smoking adjustment



PM_{10} – Prevalence of active wheeze – Children

Sensitivity analysis – reverse selection



Recent years > cumulative average > first year of life > at birth > pregnancy

PM_{10} – Prevalence of active wheeze – Children

Subgroup analyses notes:

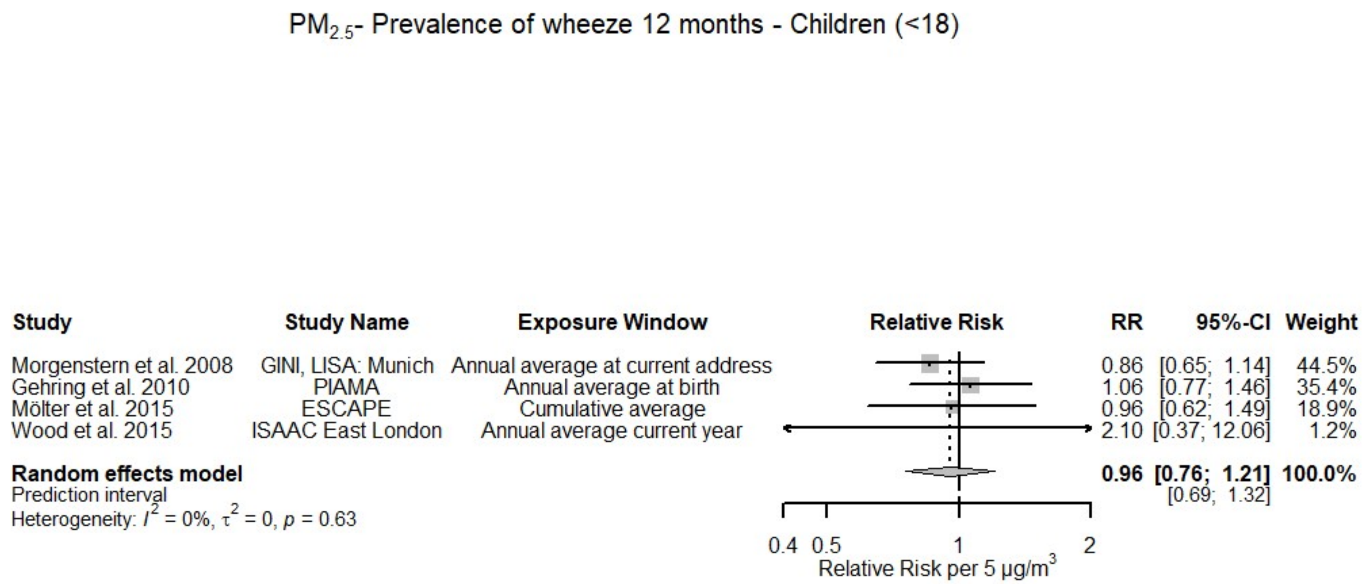
Subgroup analysis – region
All Western Europe

Subgroup analysis – year of publication
All after 2008

Subgroup analysis – study design
Gruzieva 2013 and Molter 2015 cohorts; the other two cross sectional studies

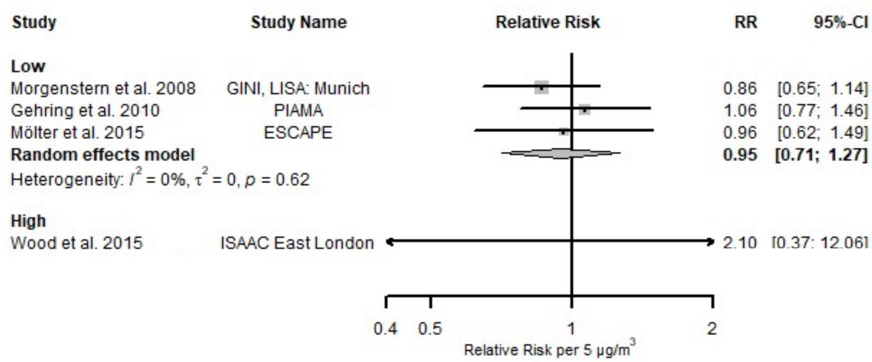
$PM_{2.5}$ – Prevalence of active wheeze – Children

Primary meta-analysis



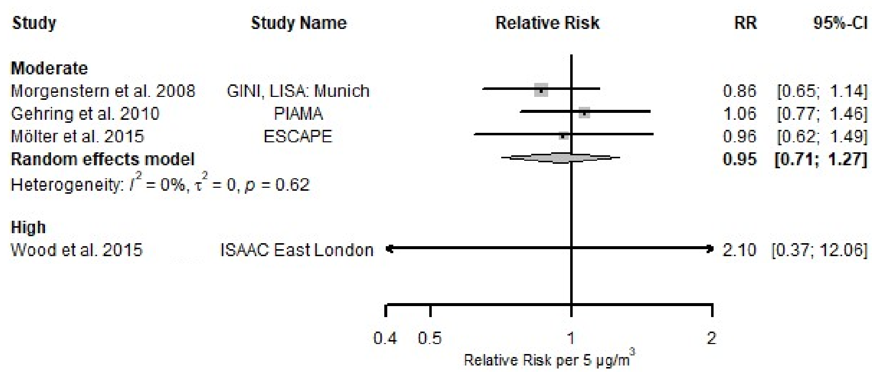
$PM_{2.5}$ – Prevalence of active wheeze – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias selection bias domain – low vs high



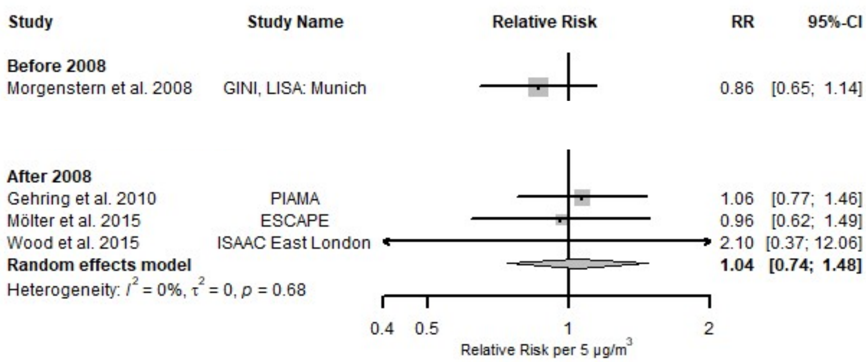
PM$_{2.5}$ – Prevalence of active wheeze – Children

Sensitivity analysis – risk of bias outcome measurement domain – moderate vs high



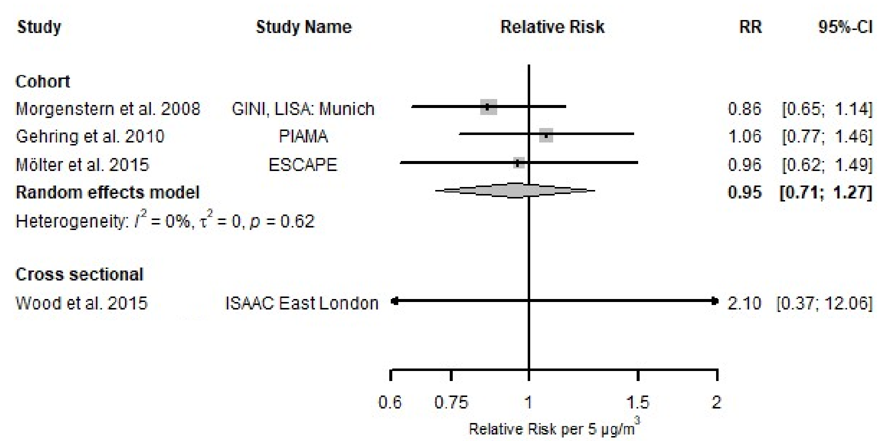
$PM_{2.5}$ – Prevalence of active wheeze – Children

Subgroup analysis – year of publication



$PM_{2.5}$ – Prevalence of active wheeze – Children

Subgroup analysis – study design



$PM_{2.5}$ – Prevalence of active wheeze – Children

Subgroup analyses notes:

Subgroup analysis – traffic specificity

All moderate specificity

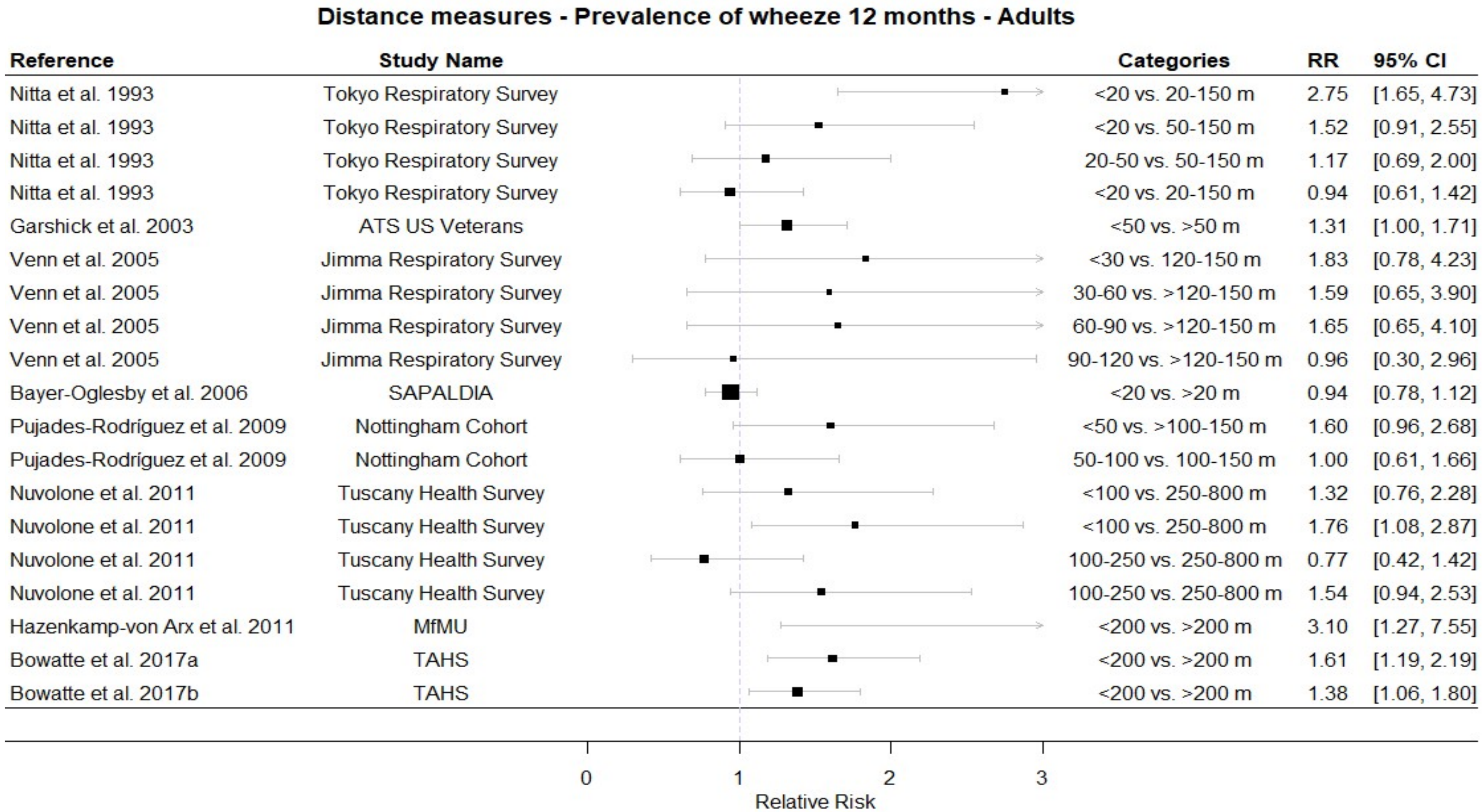
Subgroup analysis – smoking

All yes

Subgroup analysis – region

All Western Europe

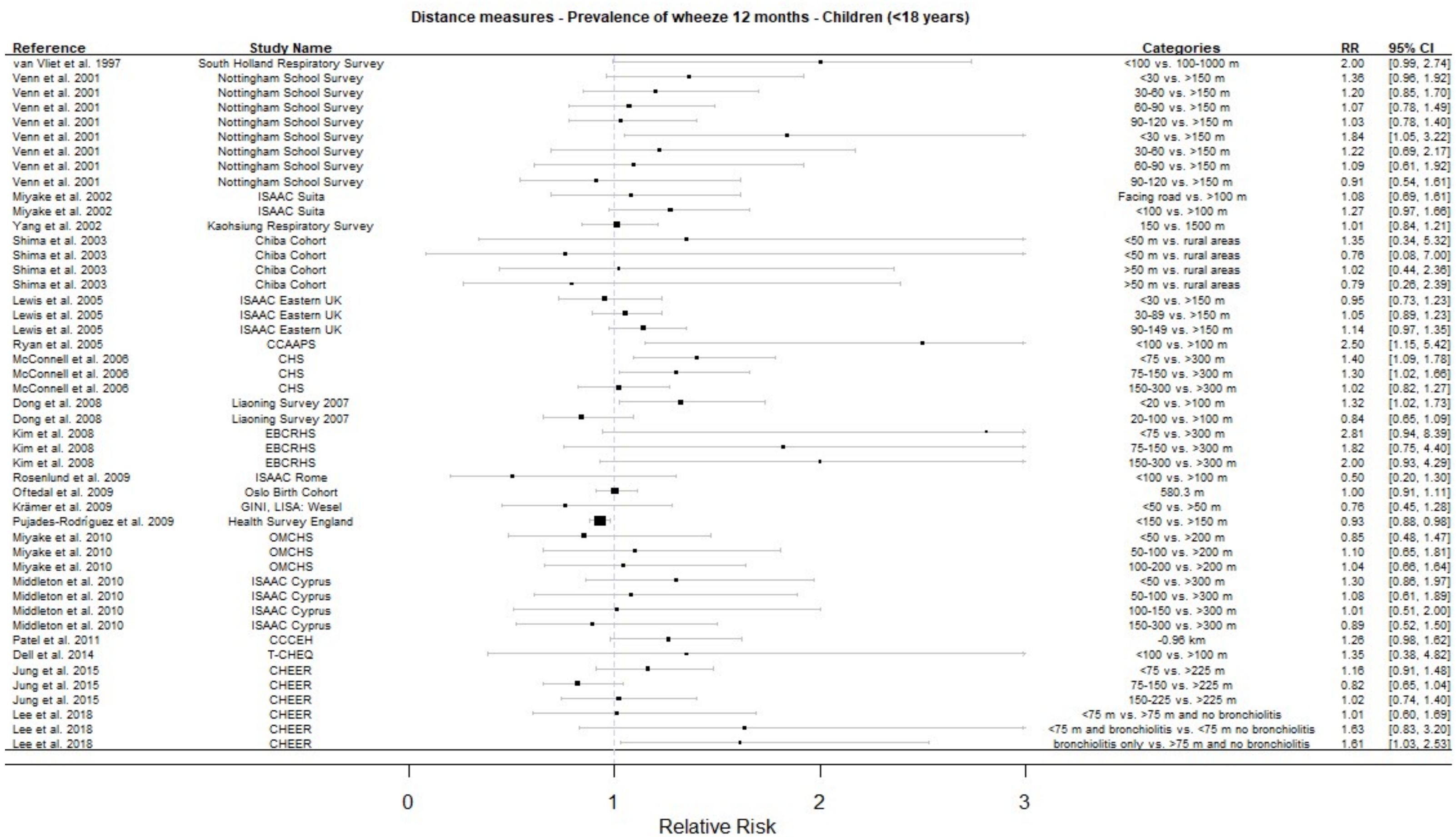
Distance measures - Prevalence of active wheeze – Adults



Reference	Study Name	Categories	RR	95% CI
Nitta et al. 1993	Tokyo Respiratory Survey	<20 vs. 20-150 m	2.75	[1.65, 4.73]
Nitta et al. 1993	Tokyo Respiratory Survey	<20 vs. 50-150 m	1.52	[0.91, 2.55]
Nitta et al. 1993	Tokyo Respiratory Survey	20-50 vs. 50-150 m	1.17	[0.69, 2.00]
Nitta et al. 1993	Tokyo Respiratory Survey	<20 vs. 20-150 m	0.94	[0.61, 1.42]
Garshick et al. 2003	ATS US Veterans	<50 vs. >50 m	1.31	[1.00, 1.71]
Venn et al. 2005	Jimma Respiratory Survey	<30 vs. 120-150 m	1.83	[0.78, 4.23]
Venn et al. 2005	Jimma Respiratory Survey	30-60 vs. >120-150 m	1.59	[0.65, 3.90]
Venn et al. 2005	Jimma Respiratory Survey	60-90 vs. >120-150 m	1.65	[0.65, 4.10]
Venn et al. 2005	Jimma Respiratory Survey	90-120 vs. >120-150 m	0.96	[0.30, 2.96]
Bayer-Oglesby et al. 2006	SAPALDIA	<20 vs. >20 m	0.94	[0.78, 1.12]
Pujades-Rodríguez et al. 2009	Nottingham Cohort	<50 vs. >100-150 m	1.60	[0.96, 2.68]
Pujades-Rodríguez et al. 2009	Nottingham Cohort	50-100 vs. 100-150 m	1.00	[0.61, 1.66]
Nuvolone et al. 2011	Tuscany Health Survey	<100 vs. 250-800 m	1.32	[0.76, 2.28]
Nuvolone et al. 2011	Tuscany Health Survey	<100 vs. 250-800 m	1.76	[1.08, 2.87]
Nuvolone et al. 2011	Tuscany Health Survey	100-250 vs. 250-800 m	0.77	[0.42, 1.42]
Nuvolone et al. 2011	Tuscany Health Survey	100-250 vs. 250-800 m	1.54	[0.94, 2.53]
Hazenkamp-von Arx et al. 2011	MfMU	<200 vs. >200 m	3.10	[1.27, 7.55]
Bowatte et al. 2017a	TAHS	<200 vs. >200 m	1.61	[1.19, 2.19]
Bowatte et al. 2017b	TAHS	<200 vs. >200 m	1.38	[1.06, 1.80]

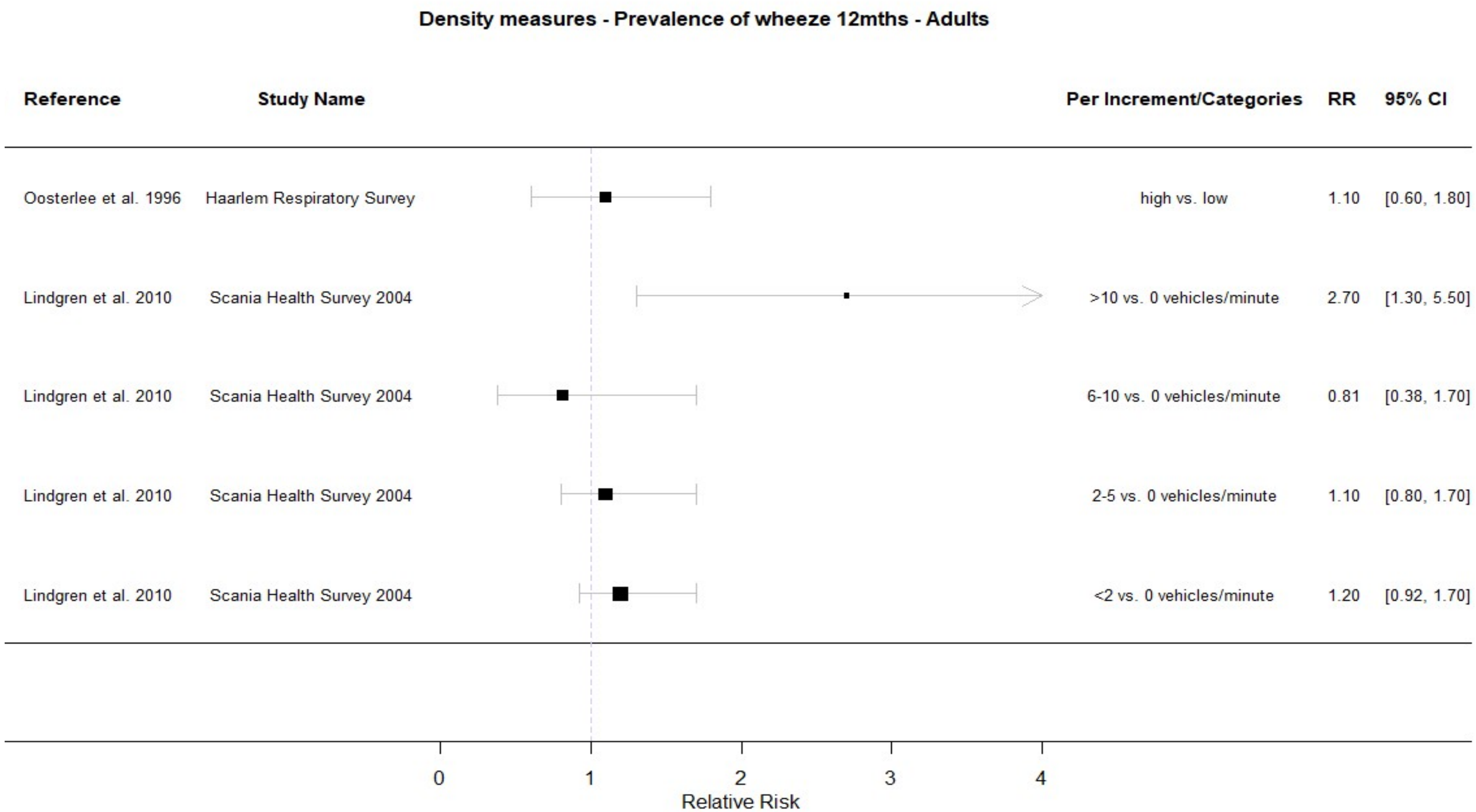
Nitta et al. 1993 – results from different years; Nuvolone et al. results stratified by sex. Bowatte et al. 2017a and b refer to different study designs.

Distance measures - Prevalence of active wheeze – Children

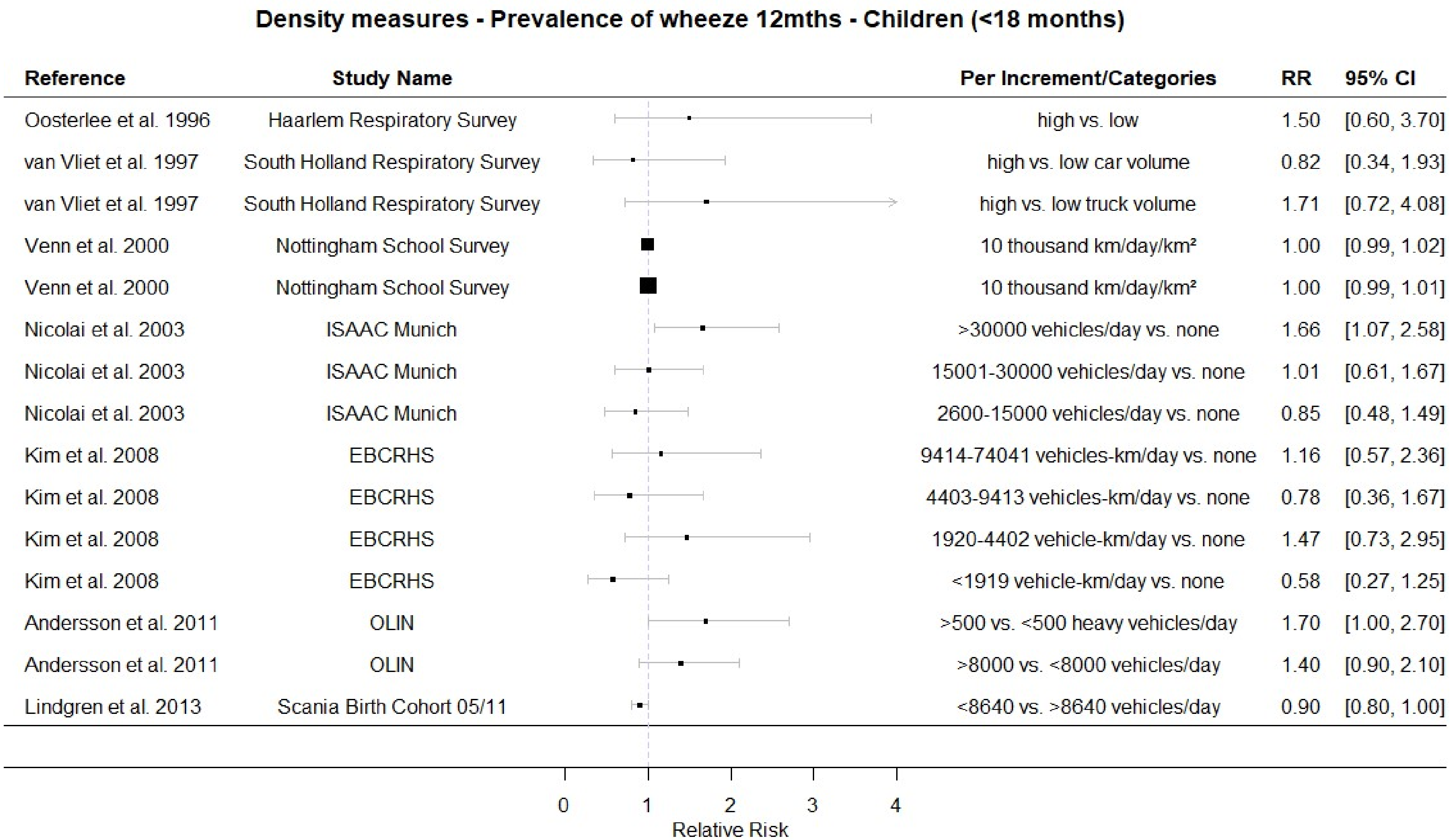


Venn et al. 2001 results stratified by sex; Miyake et al. 2002 results for residence and school; Shima et al. 2003 results stratified by sex

Density measures - Prevalence of active wheeze – Adults



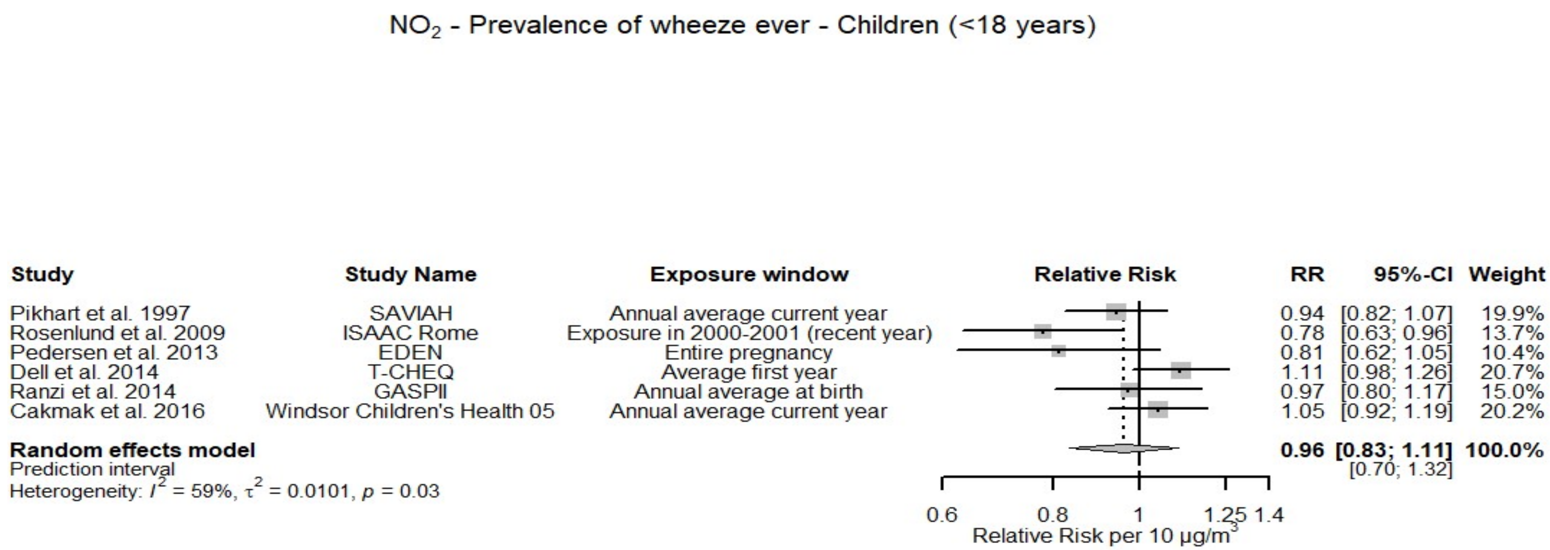
Density measures - Prevalence of active wheeze – Children



9.7 Prevalence of wheeze ever

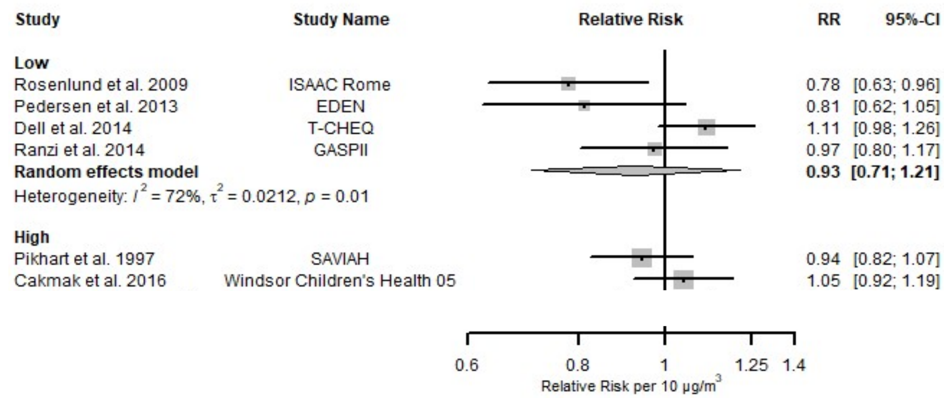
NO_2 – Prevalence of wheeze ever – Children

Primary meta-analysis



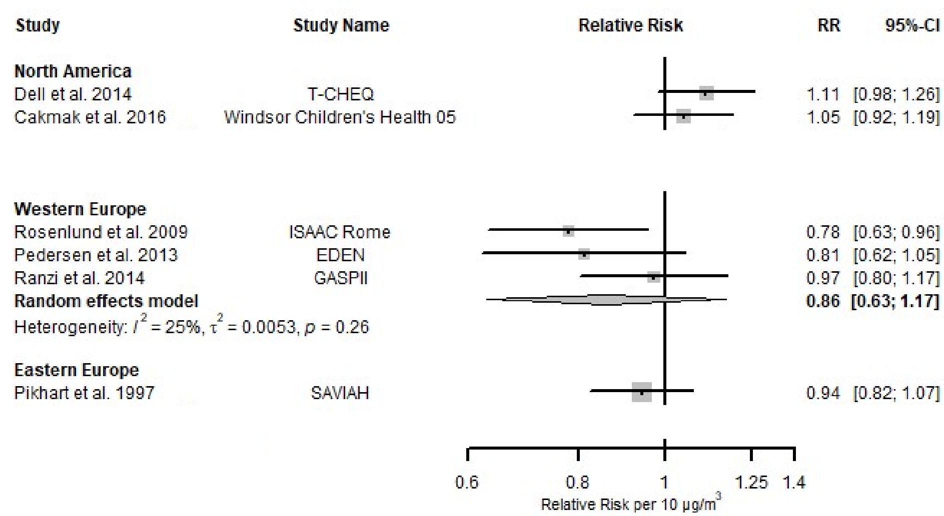
NO_2 – Prevalence of wheeze ever – Children

Plots not shown for risk of bias domains if all studies were rated low or moderate. Sensitivity analysis – risk of bias confounding domain – low vs moderate vs high



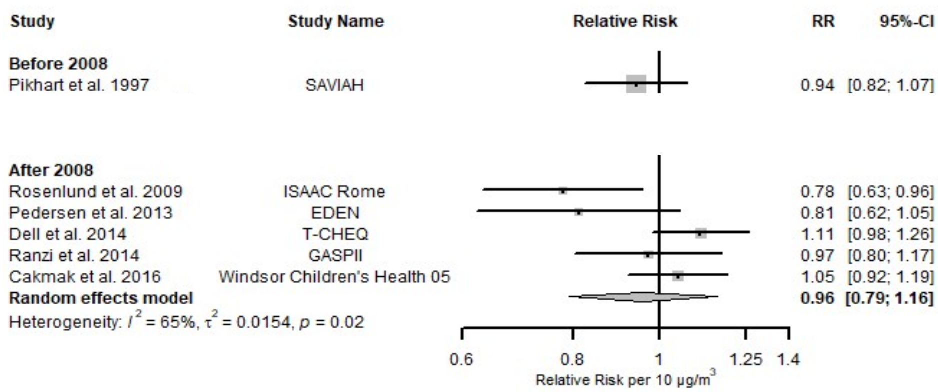
NO_2 – Prevalence of wheeze ever – Children

Subgroup analysis – region



NO_2 – Prevalence of wheeze ever – Children

Subgroup analysis – year of publication

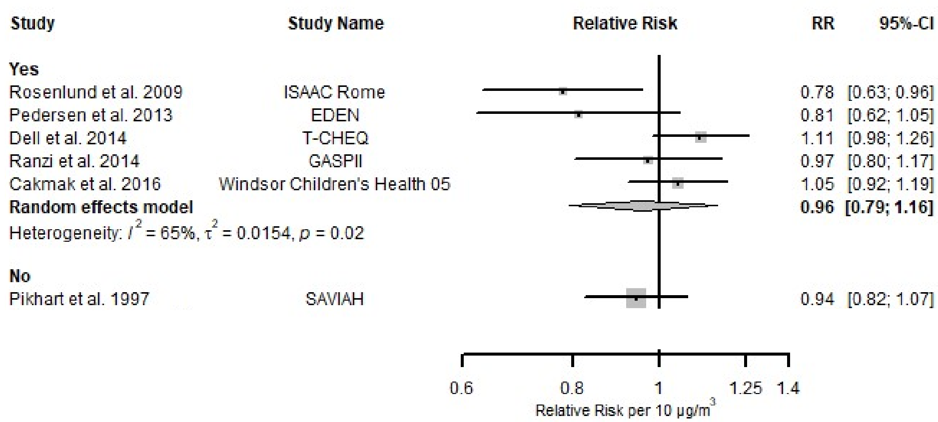


Subgroup analysis – traffic specificity

All high specificity

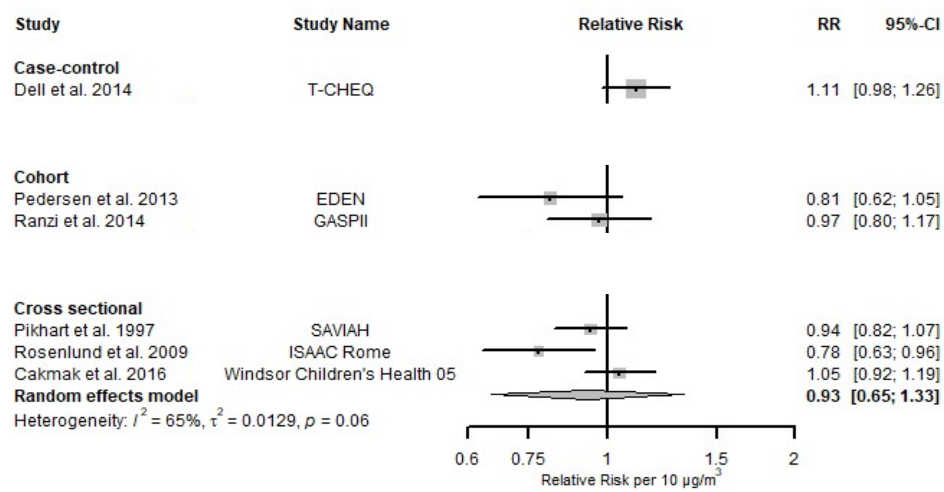
NO_2 – Prevalence of wheeze ever – Children

Subgroup analysis – smoking adjustment



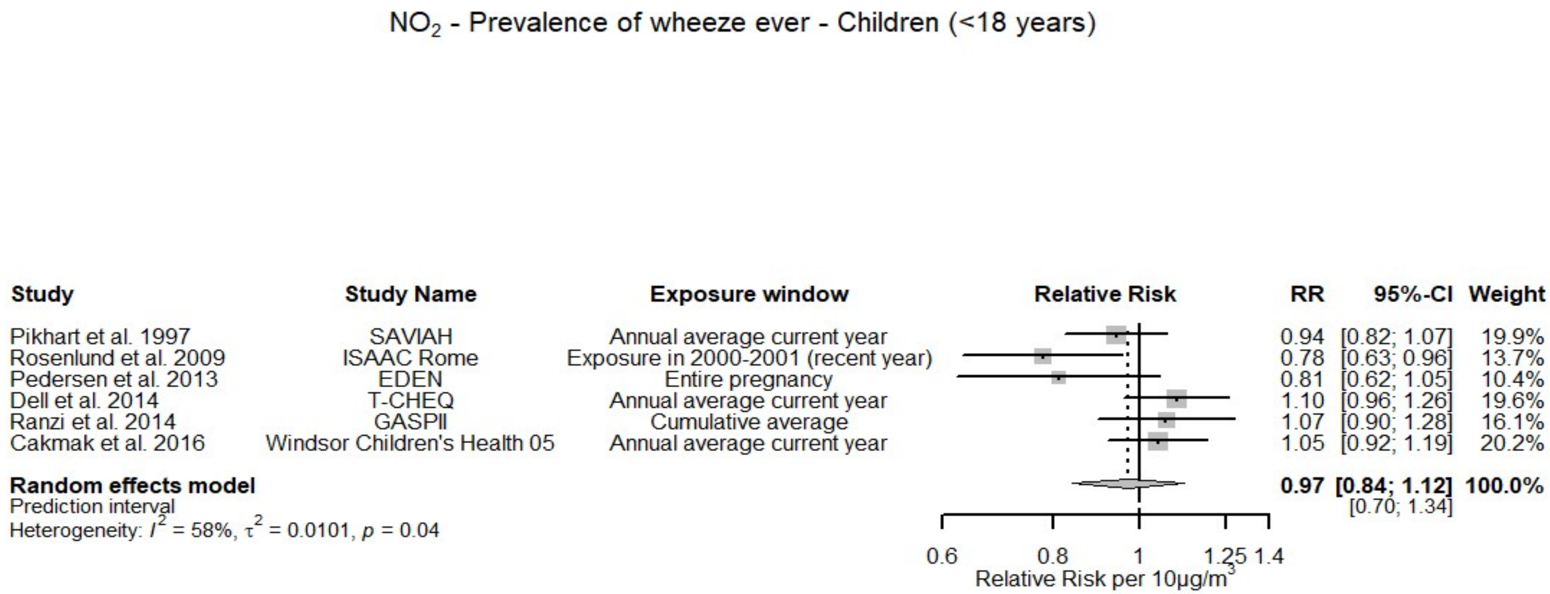
NO_2 – Prevalence of wheeze ever – Children

Subgroup analysis – by study design



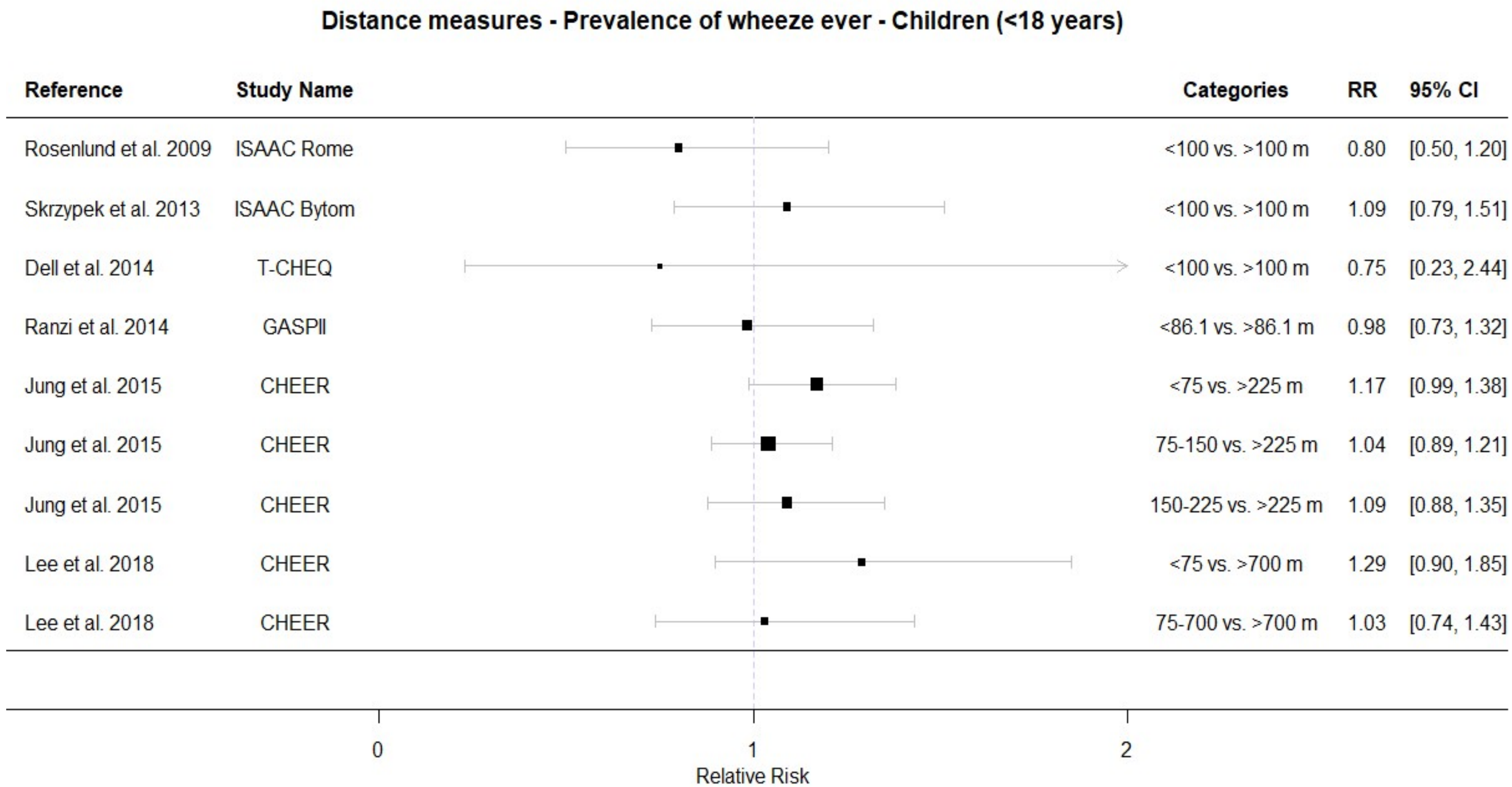
NO_2 – Prevalence of wheeze ever – Children

Sensitivity analysis – reverse selection

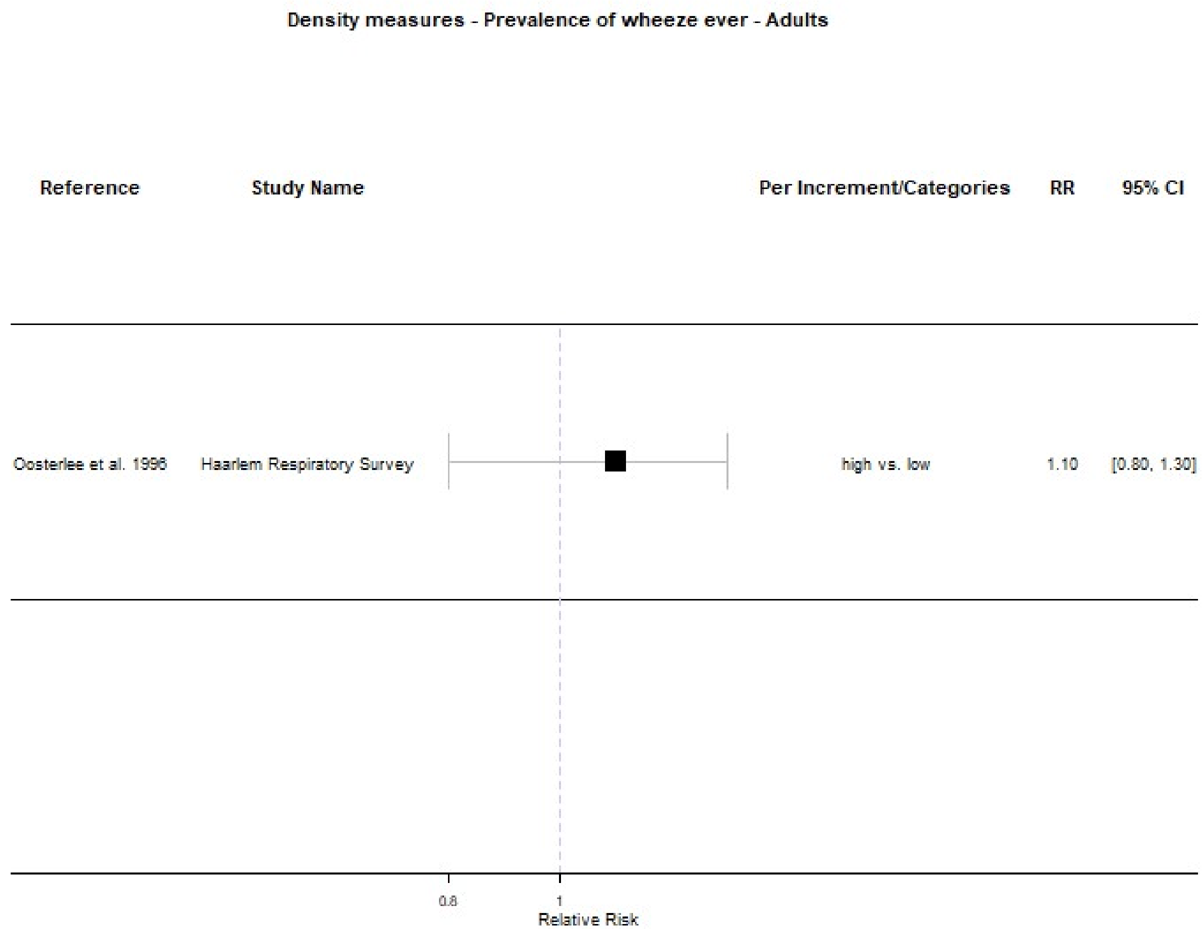


Recent years > cumulative average > first year of life > at birth > pregnancy

Distance measures - Prevalence of wheeze ever – Children



Density measures - Prevalence of wheeze ever – Adults



Density measures - Prevalence of wheeze ever – Children