Determinants of citation in the literature on diesel exhaust exposure and lung cancer: a citation analysis

SUPPLEMENT

Text S1. Protocol deviations

The study methodology including the data-analysis plan was pre-registered in our study protocol of 7 June 2018 (https://hdl.handle.net/10411/G8MPEI). Deviations from this protocol are described below.

- Health outcome

We had planned to investigate the hypothesis Diesel Exhaust Exposure – Bladder Cancer, but that network would have been too small for a proper citation analysis. We had also planned to expand our network by including publications on lung cancer as well. However, this would result in two overlapping subnetworks, with sometimes contradicting study outcomes (e.g. supportive for bladder cancer but non-supportive for lung cancer). This would be potentially confusing, therefore we decided to focus only on the lung cancer outcome.

- Abstract reporting

Consequently, we no longer needed to score *abstract reporting* in the data-extraction phase of the study. Lung cancer is always or almost always reported in the abstract, so there would be hardly any variation in this variable, and we cannot use it as a potential determinant of citation in our analyses.

- Check on matching algorithm for 'exotic' names

The first author names in four publications were spelled in different ways (references 60, 61, 66 and 93 in Text S5). The matching algorithm depends on the name of the first author. We manually checked the reference lists of all the (later) publications to see if these four publications had been cited (in whatever spelling format), and checked if this was coded correctly in our dataset. That turned out to be the case, despite the variation in spelling.

- Empty reference lists

Two publications (references 24 and 70 in Text S5) had empty reference lists in Web of Science Core Collection, while the publications did have reference lists. We checked these references and corrected for this omission by adding the following lines to the Stata syntax:

```
replace citation = 1 if (authorciting == "emmelin" & yearciting == 1993) &
( (authorcited == "garshick" & yearcited == 1988) | (authorcited ==
"gustavsson" & yearcited== 1990) )

replace citation = 1 if (authorciting == "pfluger" & yearciting == 1994) &
( (authorcited == "boffetta" & yearcited == 1988) | (authorcited ==
"boffetta" & yearcited== 1990) )
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- Citing bias

The analysis on citing bias was not performed, due to lack of resources, the small number of systematic reviews, and our earlier experience that the results were difficult to interpret.

- Study outcome / conclusion

We did not score the statistical significance and direction of the study outcome. We decided this because of the large number of analyses that turned out to have been performed in many of the studies, on sub-groups, with or without latency time, and with several dose-response relationships. It was difficult to summarise all these analysis results in one variable, and it would have let to difficulties in the interpretation as well. Instead, we focused only on the study conclusion. See Text S3 for more information.

- Methodological quality indicators

There was a huge variation in study quality of the empirical publications in this network. Each of these methodological quality indicators could provide a justified reason to cite one publication over the other. Therefore, we tried to measure these quality indicators as completely as possible, and to adjust for them in the sub-network analyses.

- Sub-network analyses

We skipped the citation analysis on the full network adjusted for study design (as proxy for quality). Instead, we analysed how empirical reviews are cited by any other type of publication, both crude and adjusted. This latter type of analysis allows to adjust for the *all the* quality indicators (including sample size, type of assessment, type of diesel and smoking adjustment). This would not be possible in the main analysis, as the latter indicators could only be defined for empirical publications.

- Concordance analyses

Concordance analyses are not reported in the main text to improve its readability. They are instead reported in here:

Where applicable, we calculated whether the cited and the citing publications had the same characteristics (*concordance*). This would for instance be the case if supportive publications would prefer to cite other supportive publications, and if non-supportive publications would prefer to cite other non-supportive publications. If citation would be based on the concordance of study conclusion, it would be another measure of citation bias. To test if concordance on several characteristics has an impact on the likelihood of citation, univariate and adjusted (for study design) fixed-effects logistic regression analyses were applied.

The results are shown in the table below. It shows that publications with one or more authors in common tended to cite each other ('self-citation'), and also, to a lesser extent, publications with a corresponding author from the same continent.

Concordance odds ratios (95% CI's) for the likelihood of being cited, all types of publications included, N = 96, n = 4317).

Determinant	Crude OR	Adjusted OR *
Study Conclusion (conc. vs. not, n = 3364)	1.2 (1.0 – 1.5)	1.2 (1.0 – 1.4)
Article Type (conc. vs. not)	0.4 (0.3 – 0.5)	
Funding Source (conc. vs. not, n = 1669)**	0.8 (0.6 – 1.0)	0.7 (0.5 – 0.9)
Publisher (conc. vs. not, n = 3953)	1.1 (0.8 – 1.4)	1.1 (0.9 – 1.5)
Author Affiliation (conc. vs. not, n = 4152)	1.1 (0.9 – 1.3)	1.0 (0.8 – 1.2)
Author Gender (conc. vs. not, n = 3705)***	1.1 (0.9 – 1.3)	1.1 (0.9 – 1.3)
Author Continent (conc. vs. not)	1.7 (1.5 – 2.0)	1.8 (1.5 – 2.1)
Self-citation (yes vs no)	3.9 (2.8 – 5.5)	4.1 (2.9 – 5.7)

* adjusted for study design of cited publication; ** publications without reported funding source excluded from analysis; *** publications with unclear author's gender excluded from analysis; **N**: number of publication. **n**: number of potential citation paths. **conc**: concordant

Text S2. Search strategy and inclusion criteria

We applied the following search query on the Web of Science Core Collection (WoSCC): *((diesel) and (exhaust or "particulate matter" or microparticles or emissions or exposure)) AND ((cancer or carcino* or neoplasm or tumo*))***.** The search was performed by BD on 11 June 2018. Publications investigating the association between diesel exhaust exposure and lung cancer were included. This includes publications that assessed diesel exhaust exposure by proxy of job occupation. Only English language publications with document type Article, Review or Letter were included. Editorials were excluded, as well as publications with an ecological design or with non-human subjects. Selection was performed in three steps: first based on title, then on abstract and finally on full-text.

Text S3. Data extraction

Most variables are described in the main document. Here follows some additional information for some of the variables.

Study conclusion was based on the authors' conclusion on the DEE - LC hypothesis, and had the following outcomes: 1. supportive (positive association); 2. no association; 3. unclear association (no conclusion can be drawn based on the included evidence); 4. mixed (supportive in some subgroup(s), no association in other subgroup(s)); or 5. no conclusion on DEE – LC was stated. In the analyses, supportive publications were compared with non-supportive publications, that either reported to have 2. no association or 3. unclear association. If the authors of a publication only stated that there is an association between DEE and LC in the expected direction, we scored the publication as supportive. If they additionally stated that it remains unclear whether DEE causes lung cancer, we scored it as non-supportive (unclear association).

Type of exposure assessment. Many of the early studies assessed exposure by means of job proxy. Later on more sophisticated methods were employed. We distinguished between four types of assessment: 1) job title, 2) participants' self-assessment, 3) quantified estimate based on a static job-exposure matrix (without time component), or by an industrial hygienist, and 4) quantified estimate based on dynamic job-exposure matrix (with time component), taking into account changes over time in diesel exposure and participants' job or working hours.

Type of diesel exhaust exposure changed over time due to improved diesel motor and fuel technology, leading to less exhaust containing fewer harmful particles. Roughly three types of diesel exhaust have been differentiated in the literature: traditional (up to

1988), transitional, and new technology diesel (2006 and after) (22, 23). To study the present-day carcinogenicity of diesel exhausts, it makes more sense to focus on newer (and potentially less carcinogenic) types of diesel exhaust rather than the old ones (13). Similarly, one might argue that publications on newer types of diesel exhaust are more relevant to cite to. We extracted the exposure period and used it to code type of diesel exposure as 'traditional' or 'mix of traditional and transitional'. Publications on newer diesel types were not yet available. One might argue that type of diesel exhaust exposure is as an indicator of study relevance rather than study quality, but for the purpose of readability we consider it as an indicator of study quality as well. After all, both the relevance and the quality of a study would justify the citation of one publication over the other.

Gender of the corresponding author was assessed by first name, with help of www.genderchecker.com; if first name was not given, other articles of the same author were searched, and the profile of the author at the university or at www.researchgate.com was checked.

Time to citation was the number of years between the publication date of the cited publication and the submission date of the citing publication. This variable was not used as determinant of citation, but to determine the dataset of potential citation paths: only citation paths with a positive value for *time to citation* were considered a **potential citation**, and only potential citations were included in our dataset. So even if the citing publication was submitted only one day after the citing publication was published, it would be considered a potential citation. In addition, this variable was used to create the graph on the likelihood of citation over time (Figure 2a in the main document).

As *publication date* we used either the online publication date or the paper publication date, whichever was first. The average duration from submission to publication was 10 months in this network. For 48 publications the *submission date* was not stated. In these cases, it was estimated by subtracting 10 months from the publication date.

Source of funding. The scoring of source of funding is not as straight-forward as it seems. The name of the funding organisation can be quite deceiving, as well as its status as a non-profit organisation. For example, the E.U.G.T. - the Europäische Forschungseinrichtung für Umwelt und Gesundheit im Transportsektor e.V., or European Research Group on Environment and Health in the Transport Sector -, was a legally independent organisation funded by Volkswagen, BMW, and Daimler. The name, though, sounds very neutral, and its legal status 'e.V.' does not suggest it is a commercial entity either. Its mission statement is also quite misleading. According to a secondary source, its mission statement is to investigate and document, without prejudice, the consequences of traffic for man and environment (https://www.trouw.nl/samenleving/volkswagen-zette-mens-in-als-proefkonijn~a4ab8fa5/). (The organisation itself has been disbanded and the website no longer exists, so we had to rely on secondary sources.)

Therefore, to score the funding source, we checked the organisations' website, and other online sources to retrieve additional information. If the organisation was known as a non-profit organisation, but received funds from for-profit organisations, we scored it as for-profit (or as both for-profit and non-profit).

Specificity. The specificity of a study depends on several issues: the aim of the study; whether the link with diesel exhaust exposure is made (or motor exposure but

diesel exposure is more *specific*), the number of determinants / job occupations unrelated to diesel exposure, the number of health outcomes other than lung cancer. In case of reviews, we also take the type of studies (epidemiological vs animal / in-vitro studies) into account, and how much space is focused on mechanisms or background information on diesel composition or regulations. If the study is only on the relationship between diesel exhaust exposure and lung cancer, it is scored as 4. For each of the issues above in which the study does not fit our purposes, a point was subtracted from the score.

Authority. Authority was calculated for each author and each year separately, by counting the number of within-network citations to all publications in which the author had been involved. As the number of citations is likely to increase each year, so does the author's authority. Because we were interested in the authority at the moment of citation, the authority value of a cited publication also depends on the publication year of the citing publication. In case of multiple authors, we used the authority value of the author with the highest authority in that year.

Text S4. Dependent variable *citation*

Our dependent variable, whether a potential citation had occurred or not, was determined by the built-in algorithm of CitNetExplorer. This algorithm makes use of reference lists that can be downloaded from the Web of Science Core Collection. It links the reference lists of the publications in the network with the actual publications in the network. If possible, this linkage was done by DOI, the unique Digital Object Identifier assigned to most present-day publications; otherwise it was based on a combination of first author's surname, first author's first initial, publication year, volume number and first page number. For more information on the linkage algorithm, see van Eck NJ, Waltman L. CitNetExplorer: A new software tool for analyzing and visualizing citation networks. Journal of Informetrics. 2014;8(4):802-23.

Text S5. References of included literature on the DEE – LC hypothesis.

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Table S1. Top 5 of publications (above) and authors (below) within network, based on the number of received citations up to 2017.

Article rank	Publication's first author	Title	Year	Nr. of received citations (% of potential citations)
1	Bhatia	Diesel exhaust exposure and lung cancer	1998	34 (57%)
2	Garschick	A retrospective cohort study of lung-cancer and diesel exhaust exposure in railroad workers	1988	34 (36%)
3	Boffetta	Diesel exhaust exposure and mortality among males in the American-cancer-society prospective-study	1988	30 (32%)
4	Lipsett	Occupational exposure to diesel exhaust and lung cancer: A meta-analysis	1999	28 (53%)
5	Gustavsson	Lung-cancer and exposure to diesel exhaust among bus garage workers	1990	26 (30%)

Author rank	Author	Affiliation	Country	Nr. of received citations (= authority)
1	Paolo Boffetta	The Tisch Cancer Institute and Institute for Translational Epidemiology, Mount Sinai School of Medicine in New York. International Prevention research Institute.	USA France	116
2	Eric Garshick	Pulmonary and Critical Care Medicine Section, VA Boston Healthcare System, Boston, Massachusetts. Channing Division of Network Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts.	USA	112
3	T. J. Smith	Exposure, Epidemiology and Risk Program, Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts.	USA	108
4/5	Francine Laden	Channing Division of Network Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts Exposure, Epidemiology and Risk Program, Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts. Department of Epidemiology, Harvard School of Public Health, Boston, Massachusetts.	USA	72
4/5	Jamie E. Hart	Channing Division of Network Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts, USA	USA	72

Table S2. All characteristics of the publications in the network on the DEE – LC hypothesis.

Characteristic	Category	N publications	n potential citations	n actual citations (%)
Study Conclusion	supportive	51	2294	450 (20%)
	no association	9	529	76 (14%)
	unclear association	25	916	115 (13%)
	mixed	2	116	17 (15%)
	not reported	9	462	20 (4%)
Publication Type / Study Design	Empirical	74	3455	552 (16%)
	case-control	34	1378	228 (17%)
	cohort	40	2077	324 (16%)
	Review	22	862	126 (15%)
	narrative review	17	721	60 (8%)
	systematic review	5	141	66 (47%)
	with meta-analysis	4	131	64 (49%)
Specificity	very broad	15	824	41 (5%)
	broad	19	1482	157 (11%)
	specific	27	1069	217 (20%)
	very specific	25	942	263 (28%)
Sample Size	low (< 2500)	23	1116	130 (12%)
(cat; for empirical publications)	medium (2500 – 10000)	23	1101	167 (15%)
	high (=> 10000)	28	1238	255 (21%)
Conclusive title	no	90	3967	640 (16%)
	yes	6	350	38 (11%)
Type of Disel Exhaust Exposure	mostly traditional	47	2929	427 (15%)
	traditional & transitional	27	526	125 (24%)
Type of Exposure Assessment	Job Title or Self-Reported	38	2094	232 (11%)
	by job title	28	1632	151 (9%)
	by questionnaire	10	462	81 (18%)
	JEM or Hygienist	36	1361	320 (24%)
	by hygienist or JEM	19	879	211 (24%)
	by JEM, with time component	17	482	109 (23%)
Smoking Adjustment	no	26	1488	215 (14%)
	yes	48	1967	337 (17%)
Funding Source	exclusively non-profit	46	1968	374 (19%)
	exclusively for-profit	9	294	61 (21%)
	both profit and non-profit	5	158	30 (19%)
	not reported / unclear	36	1897	213 (11%)
Number of Authors	1 - 2	25	1422	144 (10%)
	3 – 5	42	1869	329 (18%)
	=> 6	29	1026	205 (20%)

Number of Affiliations	1	26	1422	132 (9%)
	2	28	1556	244 (16%)
	=> 3	42	1339	302 (23%)
Number of References	< 30	22	1003	124 (13%)
	30 - 50	44	2027	319 (16%)
	=> 50	30	1287	235 (18%)
Journal Impact Factor	< 2	30	1334	170 (13%)
	2 – 4	19	497	160 (32%)
	=> 4	19	442	140 (32%)
	not available	28	2044	208 (10%)
Publisher	Wiley-Blackwell	28	1433	192 (13%)
	BMJ	27	664	62 (9%)
	Elsevier	12	144	18 (13%)
	Taylor & Francis	5	282	36 (13%)
	Lippincott Williams & Wilkins	9	234	55 (24%)
	Biomed Central	4	-	-
	Oxford University Press	11	459	91 (20%)
	other	19	1101	224 (20%)
Gender	male	64	3134	499 (16%)
	female	25	853	155 (18%)
	unclear	7	330	24 (7%)
Affiliation	university	36	1715	263 (15%)
	government	30	1068	197 (18%)
	industry	11	385	49 (13%)
	other	19	1149	169 (15%)
Continent	Europe	41	2078	266 (13%)
	Scandinavia	20	1185	157 (13%)
	North-America	47	2165	408 (19%)
	Asia / Australia	8	74	4 (5%)
Authority	low		1438	123 (9%)
	medium		1486	235 (16%)
	high		1393	320 (23%)
Conclusive title	no		4159	614 (15%)
	yes		158	64 (41%)
Total		**96**	**4317**	**678 (16%)**

Notes. JEM Job-Exposure Matrix. BMJ British Medical Journal

Table S3. Odds ratios (95% CI's) for the likelihood *of empirical publications* to be cited *by reviews* (n = 900).

Publication characteristics, study outcome	**Crude OR**	**Adjusted OR ***
Study Conclusion (supportive vs non-supportive, n = 767)	**1.5 (1.1 – 2.1)**	1.2 (0.8 – 1.8)

Publication characteristics, methodological quality indicators	**Crude OR**	**Adjusted OR**
Study Design (cohort vs case-control)	1.0 (0.8 – 1.4)	1.4 (0.9 – 2.1) **
Sample Size (ref: low)		
medium	1.2 (0.8 – 1.8)	1.5 (1.0 – 2.3) ***
high	**2.1 (1.5 – 3.1)**	**2.6 (1.6 – 4.1)** ***
Type of diesel exposure (mix vs trad.)	1.4 (0.9 – 2.1)	1.0 (0.7 – 1.6) ***
Type of Exposure Assessment	**2.6 (1.9 – 3.6)**	**2.8 (2.0 – 3.9)** ***
(JEM vs job/self-reported)		
Smoking Adjustment (yes vs no)	1.3 (0.9 – 1.7)	1.2 (0.8 – 1.9) ***

Publication characteristics, other	**Crude OR**	**Adjusted OR ***
Conclusive Title (yes vs no)	****	****
Specificity (ref: very low)		
low	**2.4 (1.4 – 3.9)**	**2.2 (1.3 – 3.7)**
high	**7.9 (4.6 – 14)**	**7.8 (4.2 – 14)**
very high	**11 (6.3 – 19)**	**10 (5.2 – 20)**
Funding Source (ref: exclusively non-profit)		
for-profit	1.4 (0.8 – 2.3)	1.3 (0.7 – 2.2)
not reported	**0.6 (0.5 – 0.9)**	0.8 (0.5 – 1.1)
Number of Authors (ref: 1-2)		
3 - 5	**2.3 (1.5 – 3.4)**	**2.0 (1.2 – 3.1)**
>= 6	**1.9 (1.2 – 2.9)**	1.2 (0.7 – 2.0)
Number of Affiliations (ref: 1)		
2	**2.4 (1.6 – 3.5)**	**2.6 (1.7 – 4.0)**
>= 3	**2.6 (1.7 – 3.8)**	1.4 (0.8 – 2.3)
Number of References (ref: <30)		
30 - 50	1.3 (0.9 – 1.8)	1.2 (0.8 – 1.8)
>= 50	1.1 (0.7 – 1.7)	1.1 (0.7 – 1.7)

Journal characteristics	**Crude OR**	**Adjusted OR ***
Journal Impact Factor (ref: 0-2, n = 442)		
2 – 4	1.3 (0.7 – 2.2)	1.8 (0.9 – 3.7)
>= 4	**4.2 (2.5 – 7.1)**	**5.3 (2.8 – 10)**

Author characteristics	**Crude OR**	**Adjusted OR ***
Gender (female vs male, n = 827)	1.4 (1.0 – 1.9)	**2.1 (1.4 – 3.1)**
Continent (ref: Europe)		
North-America	**1.6 (1.2 – 2.1)**	1.0 (0.7 – 1.4)
Asia / Australia	**0.2 (0.0 – 0.9)**	0.2 (0.0 – 1.1)
Type of Affiliation (ref: university)		
government	1.1 (0.8 – 1.6)	1.1 (0.7 – 1.6)
industry	****	****
other	1.0 (0.7 – 1.4)	0.7 (0.5 – 1.2)

Citation characteristics	**Crude OR**	**Adjusted OR ***
Self-Citation (yes vs no) *****	2.7 (1.0 – 7.3)	2.3 (0.8 – 6.7)
Authority (ref: low)		
medium	**6.0 (3.7 – 9.8)**	**5.5 (3.4 – 9.0)**
high	**10 (6.2 – 17)**	**7.0 (4.1 – 12)**

These analyses are performed on the subnetwork of *cited* empirical publications and *citing* reviews, in order to check whether empirical evidence is selectively being picked up by reviews. Results should be interpreted tentatively, as the results are based on a relatively low number of citation paths. ***** adjusted for Study Design, Log Sample Size, Type of Diesel Exhaust Exposure, Type of Expsure Assessment, and Smoking Adjustment. ****** adjusted for Type of Diesel Exhaust Exposure, Type of Exposure Assessment, and Smoking Adjustment. ******* not adjusted for itself. ******** fewer than 5 publications per determinant level. ********* analysed with a fixed-effects logistic regression. **supportive study conclusion:** authors' conclusion is supportive for harmful association between diesel exposure and lung cancer. **non-supportive study conclusion:** authors conclude there is no association or that association is unclear. **vs**: versus. **N**: number of publications. **n**: number of potential citation paths. Statistically signficant odds ratios are reported in bold.

Table S4. Sensitivity analyses on odds ratios (95% confidence intervals) for the likelihood to be cited, without the four most cited publications.

Publication Characteristics	Complete Network		Subnetwork of Cited Empirical Publications		
study outcome	**n**	**crude OR**	**n**	**crude OR**	**adjusted OR ***
Study Conclusion (supportive vs non-supportive)	3439	**1.3 (1.1 – 1.6)**	2716	**1.5 (1.2 – 1.9)**	1.1 (0.8 – 1.5)

Publication Characteristics	Complete Network		Subnetwork of Cited Empirical Publications		
methodological quality indicators	**n**	**crude OR**	**n**	**crude OR**	**adjusted OR**
Publication Type (empirical vs review)	4017	**2.0 (1.5 – 2.7)**			
Study Design (ref: case-control) **	4017		3268		
cohort		**0.8 (0.6 – 1.0)**		**0.8 (0.6 – 1.0)**	0.9 (0.6 – 1.2)
narrative review		**0.4 (0.3 – 0.6)**			
systematic review		0.7 (0.2 – 2.4)			
Sample Size (ref: low) ***			3268		
medium				**1.4 (1.1 – 1.9)**	**2.0 (1.5 – 2.7)**
high				**1.9 (1.4 – 2.4)**	**2.8 (2.0 – 4.0)**
Type of Diesel Exhaust Exposure (mix vs traditional) ***			3268	**2.1 (1.6 – 2.8)**	**1.6 (1.2 – 2.1)**
Type of Exposure Assessment *** (JEM vs job/self-reported)			3268	**3.1 (2.5 – 3.9)**	**3.0 (2.4 – 3.8)**
Smoking Adjustment (yes vs no) ***			3268	**1.3 (1.1 – 1.7)**	1.1 (0.8 – 1.4)

Publication Characteristics	Complete Network		Subnetwork of Cited Empirical Publications		
other	**n**	**crude OR**	**n**	**crude OR**	**adjusted OR ***
Conclusive Title (yes vs no)	4017	0.7 (0.5 – 1.1)	3268	****	****
Specificity (ref: very low)	4017		3268		
low		**2.0 (1.4 – 3.0)**		**2.2 (1.5 – 3.3)**	**2.2 (1.4 – 3.3)**
high		**6.4 (4.4 – 9.2)**		**8.9 (6.0 – 13)**	**7.5 (4.8 – 12)**
very high		**7.4 (5.0 – 11)**		**9.5 (6.3 – 14)**	**8.9 (5.5 – 15)**
Funding Source (ref: exclusively non-profit)	4017		3268		
for-profit		1.3 (1.0 – 1.7)		1.3 (1.0 – 1.8)	1.1 (0.8 – 1.6)
not reported		**0.4 (0.4 – 0.6)**		**0.5 (0.4 – 0.6)**	**0.5 (0.4 – 0.7)**

Number of Authors (ref: 1-2)	4017		3268		
3 - 5		**2.1 (1.7 – 2.8)**		**2.1 (1.5 – 2.8)**	**1.5 (1.0 – 2.0)**
>= 6		**2.7 (2.0 – 3.5)**		**2.6 (1.9 – 3.6)**	**1.4 (1.0 – 2.1)**
Number of Affiliations (ref: 1)	4017		3268		
2		**1.5 (1.2 – 2.0)**		**2.2 (1.7 – 3.0)**	**2.3 (1.7 – 3.2)**
>= 3		**2.8 (2.2 – 3.7)**		**3.6 (2.7 – 4.7)**	**1.8 (1.3 – 2.6)**
Number of References (ref: <30)	4017		3268		
30 - 50		1.2 (0.9 – 1.5)		1.3 (1.0 – 1.7)	**1.4 (1.1 – 1.9)**
>= 50		1.3 (1.0 – 1.6)		**1.5 (1.1 – 2.0)**	**1.5 (1.1 – 2.0)**

Journal Characteristics	**Complete Network**		**Subnetwork of Cited Empirical Publications**		
	n	**crude OR**	**n**	**crude OR**	**adjusted OR ***
Journal Impact Factor (ref: 0-2)	2066		1649		
2 – 4		**2.8 (2.0 – 3.8)**		**2.5 (1.7 – 3.5)**	**2.4 (1.6 – 3.7)**
>= 4		**3.8 (2.7 – 5.3)**		**4.3 (3.0 – 6.1)**	**3.7 (2.5 – 5.6)**

Author Characteristics	**Complete Network**		**Subnetwork of Cited Empirical Publications**		
	n	**crude OR**	**n**	**crude OR**	**adjusted OR ***
Gender (female vs male)	3687	**1.5 (1.2 – 1.9)**	3008	**1.3 (1.0 – 1.6)**	**1.7 (1.3 – 2.2)**
Continent (ref: Europe)	4017		3268		
North-America		**1.2 (1.0 – 1.5)**		**1.4 (1.1 – 1.7)**	0.8 (0.7 – 1.1)
Asia / Australia		**0.3 (0.1 – 0.8)**		**0.1 (0.0 – 0.6)**	**0.1 (0.0 – 0.5)**
Type of Affiliation (ref: university)	4017		3268		
government		**1.5 (1.1 – 1.9)**		1.3 (0.9 – 1.5)	1.2 (0.9 – 1.7)
industry		1.0 (0.7 – 1.5)		****	****
other		1.1 (0.8 – 1.4)		1.1 (0.8 – 1.4)	0.8 (0.6 – 1.1)

Citation Characteristics	**Complete Network**		**Subnetwork of Cited Empirical Publications**		
	n	**crude OR**	**n**	**crude OR**	**adjusted OR ***
Self-Citation (yes vs no) *****	4017	**4.3 (3.1 – 6.2)**	3268	**3.9 (2.7 – 5.6)**	**2.6 (1.8 – 3.9)**
Authority (ref: low)	4017		3268		
medium		**2.3 (1.8 – 3.1)**		**3.3 (2.4 – 4.6)**	**3.0 (2.2 – 4.2)**
high		**4.6 (3.4 – 6.1)**		**5.8 (4.2 – 8.1)**	**3.6 (2.5 – 5.2)**

NOTE. Analyses are performed on the complete network but without publications ranked 1 to 4 in Table S1.
* adjusted for Study Design, Log Sample Size, Type of Diesel Exhaust Exposure, Type of Expsure Assessment, and Smoking Adjustment.
** adjusted for Type of Diesel Exhaust Exposure, Type of Exposure Assessment, and Smoking Adjustment. *** not adjusted for itself.
**** fewer than 5 publications per determinant level. ***** analysed with a fixed-effects logistic regression. **supportive study conclusion:** authors' conclusion is supportive for harmful association between diesel exposure and lung cancer. **non-supportive study conclusion:** authors conclude there is no association or that association is unclear. **vs**: versus. **N**: number of publications. **n**: number of potential citation paths. Reviews were included in the subnetwork, but only as citing publications. Statistically signficant odds ratios are reported in bold.

Table S5. Explorative analysis on the association between source of funding and methodological quality indicators for empirical publications.

Quality indicator	Odds ratio (95% confidence interval)
Study design (cohort vs. cross-sectional)	0.9 (0.2 – 3.4)
Sample size (highest vs. lowest tertile)	0.6 (0.1 – 3.1)
Type of exposure assessment (JEM vs. job/self-reported)	9.4 (1.1 – 81)
Type of diesel exhaust exposure (mix vs. traditional)	1.9 (0.5 – 7.7)
Smoking adjustment (yes vs. no)	0.4 (0.1 – 1.6)

NOTE. Odds ratios are based on fixed-effects logistic regression of the quality indicators on source of funding. (So, the quality indicators serve as *dependent* variable and the source of funding as *independent* variable.) Odds ratios bigger than 1 signify a positive relationship between for-profit funding and higher quality.

Table S6. Sensitivity analyses on the association between source of funding and study conclusion, adjusted for methodological quality indicators.

Odds ratio adjusted for:	Odds ratio (95% confidence interval)
(crude odds ratio)	8.2 (1.9 – 36)
Study design	6.4 (1.4 – 30)
Log sample size	4.9 (1.0 – 24)
Type of exposure assessment	17 (1.5 – 176)
Type of diesel exhaust exposure	5.9 (1.1 – 31)
Smoking adjustment	4.8 (1.0 – 23)

NOTE. Due to the small sample it was not possible to adjust for all quality indicators simultaneously. Odds ratios are based on fixed-effects logistic regression of study conclusion on source of funding. Odds ratios bigger than 1 signify a positive relationship between for-profit funding and non-supportive study conclusion.

Figure S1. Development of citation bias over time.

The first publication in our network was published in 1988. So in 1999 the network was 11 years old, and 29 years old in 2017. This graph depicts how citation bias develops over time, by limiting the network to the publications that are published in each of the consecutive calendar years. Citation bias within this network is remarkably stable, with crude odds ratios oscillating mostly between 1.5 and 1.75. Adjusted odds ratios are adjusted for study design. The odds ratios relate to the odds of supportive publication being cited relative to the odds of non-supportive publications (with no or unclear association) being cited. Before 1999, regression analyses are unreliable (not enough data points).