

Supplementary Material

APPENDIX A: Search strategy

1) PubMed:

1. ("infant, newborn"[MeSH Terms] OR "infant"[MeSH Terms] OR "child, preschool"[MeSH Terms] OR "newborn"[Text Word] OR "infant"[Text Word] OR "preschool child"[Text Word] OR "infant newborn"[Text Word])
2. ("Environmental Pollution"[MeSH Terms] OR "Environmental Exposure"[All Fields] OR "Occupational Exposure"[MeSH Terms] OR "Occupational Exposure"[All Fields] OR "Prenatal exposure"[All Fields] OR "Maternal exposure"[All Fields] OR "Paternal exposure"[All Fields] OR "Residential exposure"[All Fields] OR "household exposure"[All Fields] OR "domestic exposure"[All Fields] OR "Indoor exposure"[All Fields] OR "Outdoor exposure"[All Fields] OR "air pollution"[MeSH Terms] OR "particulate matter"[MeSH Terms] OR "nitrous oxide"[MeSH Terms] OR "sulfur dioxide"[MeSH Terms] OR "volatile organic compounds"[MeSH Terms] OR "ozone"[MeSH Terms] OR "nitrates"[MeSH Terms] OR "sulfates"[MeSH Terms] OR "nitrogen oxides"[MeSH Terms] OR "carbon dioxide"[MeSH Terms] OR "carbon monoxide"[MeSH Terms] OR "methane"[MeSH Terms] OR "quinones"[MeSH Terms] OR "polycyclic aromatic hydrocarbons"[MeSH Terms] OR "hydrocarbons"[MeSH Terms]) NOT ("tobacco products"[MeSH Terms] OR ("tobacco"[All Fields] OR "products"[All Fields]) OR "tobacco products"[All Fields] OR "tobacco"[All Fields] OR "nicotiana"[MeSH Terms] OR "nicotiana"[All Fields] OR "tobacco s"[All Fields] OR "tobaccos"[All Fields] OR "smoke"[MeSH Terms] OR "smoke"[All Fields] OR "smokes"[All Fields] OR "smoked"[All Fields] OR "smokes"[All Fields] OR "smoking"[MeSH Terms] OR "smoking"[All Fields] OR "smokings"[All Fields] OR "smokings"[All Fields])

3. (("central nervous system neoplasms"[MeSH Terms] OR ("central"[All Fields] AND "nervous"[All Fields] AND "system"[All Fields] AND "neoplasms"[All Fields]) OR "central nervous system neoplasms"[All Fields] OR "Brain" OR "spinal cord" OR "Neuroblastoma" OR "Wilms tumor" OR "Wilms tumour" OR "Lymphoma" OR "Hodgkin lymphoma" OR "non-Hodgkin lymphoma" OR "Germ cell" OR "Soft tissue" OR "Rhabdomyosarcoma" OR "Retinoblastoma" OR "osteosarcoma" OR "sarcoma" OR "Hepatoblastoma" "Neoplasms"[Mesh] OR "cancer*" OR "cancerous" OR "carcinoma" OR "neoplasm*" OR "tumor*" OR "tumour*" OR "malignan*" OR ("brain neoplasms"[MeSH Terms] OR ("brain"[All Fields] AND "neoplasms"[All Fields]) OR "brain neoplasms"[All Fields]) OR "central nervous system neoplasms"[MeSH Terms] OR ("central"[All Fields] AND "nervous"[All Fields])) NOT ("chemotherapy"[All Fields] OR "drug therapy"[MeSH Terms] OR ("drug"[All Fields] OR "therapy"[All Fields]) OR "drug therapy"[All Fields] OR "chemotherapies"[All Fields] OR "drug therapy"[MeSH Subheading] OR "chemotherapy"[All Fields]))
4. ("epidemiology"[MeSH Subheading] OR "epidemiology"[All Fields] OR "incidence"[All Fields] OR "incidence"[MeSH Terms] OR "incidences"[All Fields] OR "incident"[All Fields] OR "incidents"[All Fields])
5. (((longitudinal studies[MeSH Terms])OR (case control studies[MeSH Terms]) OR (cohort studies[MeSH Terms])) NOT ((meta analysis[MeSH Terms]) OR (case reports[MeSH Terms])))
6. #1 AND #2 AND #3 AND #4 AND #5

2) Scopus:

((TITLE-ABS-KEY ("air pollut") AND TITLE-ABS-KEY (*child* OR newborn OR infant OR neonat* OR preschool) AND TITLE-ABS-KEY ("brain tumor" OR "brain cancer" OR "central nervous system neoplasm" OR "CNS neoplasm" OR "CNS tumor" OR medulloblastoma OR astrocytoma OR ependymoma OR glioma))

3) EMBASE:

1. 'air pollution':ti,ab,kw OR 'air pollutant':ti,ab,kw OR 'particulate matter':ti,ab,kw OR 'nitrous oxide':ti,ab,kw OR 'sulfur dioxide':ti,ab,kw OR 'volatile organic compound':ti,ab,kw OR ozone:ti,ab,kw OR nitrate:ti,ab,kw OR sulfate:ti,ab,kw OR 'nitrogen oxide':ti,ab,kw OR 'carbon dioxide':ti,ab,kw OR 'carbon monoxide':ti,ab,kw OR methane:ti,ab,kw OR 'quinone derivative':ti,ab,kw OR 'polycyclic aromatic hydrocarbon':ti,ab,kw OR hydrocarbon:ti,ab,kw
2. child:ti,ab,kw OR childhood:ti,ab,kw OR newborn:ti,ab,kw OR infant:ti,ab,kw OR pediatric:ti,ab,kw OR 'preschool child':ti,ab,kw
3. 'brain tumor':ti,ab,kw OR 'brain cancer':ti,ab,kw OR 'central nervous system tumor':ti,ab,kw OR 'central nervous system cancer':ti,ab,kw OR medulloblastoma:ti,ab,kw OR astrocytoma:ti,ab,kw OR 'ependymoma OR glioma':ti,ab,kw
4. #1 AND #2 AND #3

4) Google Scholar

"air pollution" AND "CNS tumors" AND "children"

5) Cochrane Central Register of Controlled Trials (CENTRAL)

("air pollution" OR "air pollutant") AND (child OR children OR childhood OR pediatric OR infant OR newborn OR preschool) AND ("brain tumor" OR CNS "tumor")

APPENDIX B: Tables 1-5

Table 1. Demographic characteristics of case-control studies.

AUTHOR/YEAR	COUNTRY	AGE RANGE	MATCHING FACTORS	ADJUSTING FACTORS
Peters et al., 1981	United States	<10 years old	Sex, race, and year of birth (within 3 years). Social class was matched by first attempting to locate a control among friends of the case.	Sex, race, year of birth and social class.
Feychting et al., 1998	Sweden	<15 years old	Year of birth, lived in the same parish during the year of diagnosis, or, if the case had moved before the diagnosis was made, during the last year before the move, and lived near the same power line as the case	Magnetic field exposure Socioeconomic status
Kaletsch et al., 1999	Germany	<15 years old	Age and sex	Degree of urbanization
Savitz & Feingold, 1989	United States	0-14 years old	Age (+/-3 years), sex, telephone exchange area, and had stayed in their home from the time of the case's diagnosis to the time of the interview.	Sex, age, year of diagnosis, single-family versus multiple occupancy residence, residence in or out of Denver at birth, residential mobility from birth to diagnosis, mother's age, father's education, per capita income, mother's smoking during pregnancy, and wire code at the time of diagnosis
Raaschou- Nielsen et al., 2001	Denmark	0-15 years old	Study, age, sex, and calendar period	Urban development, geographic region, type of residence, electromagnetic fields, mother's age, and birth order
McKinney et al., 2003	England, Wales, Scotland	0-14 years old	Sex, age (month and year of birth), and geographical area (at diagnosis)	Social class, level of exposure by time point

Cordier et al., 2004	Australia, France, Israel, Canada, Italy, Spain, United States	0-19 years old	Randomly selected controls from the general population were either pair-matched (six centers) or frequency-matched (three centers) to cases by sex and year of birth (or by age at one center)	Center, sex, and age at diagnosis of the child (0-4, 5-9, 10-14, or >15 years), parental age, number of years of schooling, tobacco smoking
Reynolds et al., 2004	United States	<5 years old	birth date, sex	Race/ethnicity, age, sex
Heck et al., 2013	United States	0-5 years old	Year of birth: Controls were frequency-matched to cases by year of birth	Child's year of birth Mother's and father's race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic (any race), or other/not specified) Mother's education (≤ 8, 9-< 12, 12, 13-15, or ≥ 16 years) Mother's country of birth (United States, Mexico, or other) Parity (0, 1, ≥ 2) Method of payment for prenatal care (private insurance vs. other payment methods, including self-pay and government programs) Neighborhood socioeconomic index (derived using principal components analysis from seven census tract-level indicators of socioeconomic status)
Huoi et al., 2014	Germany, France, and United Kingdom	0-15 years old	Age and Sex	Country, Child's year of birth, Parental educational level

Danysh et al., 2016	United States	<5 years old	Year of birth	Maternal race/ethnicity, education, area-level poverty, and birth year
García-Pérez et al., 2016	Spain	0-14 years old	Year of birth, sex, and autonomous region of residence	Confounders: Socioeconomic status, percentage of illiteracy, percentage of unemployed, and percentage of total crop surface around the residence as a proxy for pesticide exposure.
Von Ehrenstein et al., 2016	United States	0-6 years old	Controls were randomly selected from California birth rolls and frequency matched (20:1) by year of birth to all childhood cancer cases for the same time period.	Mother's race/ethnicity, mother's age, source of payment for prenatal care, maternal education, mother's parity, urban or rural area, born in the USA or not, child sex, preterm birth or not, measure of socioeconomic status (SES).
Park et al., 2017	United States	0-6 years old	Year of birth	Traffic pollution (particulate matter), birth year, socioeconomics-index, mother's age, mother's education, rural/urban status, and child's sex
Raaschou-Nielsen et al., 2018	Denmark	0-15 years old	sex, age and calendar time	Degree of urban development (seven categories based on number of inhabitants), geographical region (eight regions of Denmark), type of residence (three categories of proportion of time lived in a one-family house), electromagnetic fields (three categories; calculated fields, 24 mother's age (five categories) and birth order (four categories).
Volk et al., 2019	Denmark	0-19 years old	age, sex	Family socioeconomic status (SES), birth order (1, 2, and 3 or later), parity at the time of diagnosis (index date) of the child (1, 2, and 3 or more children), maternal and paternal age at the time of birth of the index child (< = 25, 26–28. 29–33, and 34 years or older), and birthplace of the index child in Denmark (rural, small town, and urban)

Hvidtfeldt et al., 2020	Denmark	0-19 years old	Sex and date of birth	Age, sex, calendar time, parental age, birth weight, number of biological siblings, parental education, and parental disposable income
Volk et al., 2020	Denmark	0-19 years old	age, sex	Family socioeconomic status (SES), birth order (1, 2, and 3 or later), parity at the time of diagnosis (index date) of the child (1, 2, and 3 or more children), maternal and paternal age at the time of birth of the index child (≤ 25 , 26–28, 29–33, and 34 years or older), and birthplace of the index child in Denmark (rural, small town, and urban), maternal smoking

Table 2. Demographic characteristics of cohort studies.

AUTHOR/YEAR	COUNTRY	AGE RANGE	MATCHING FACTORS	ADJUSTING FACTORS
Hauri et al., 2013	Switzerland	0-15 years old	N/A	Age, sex, parents' socioeconomic status, background gamma radiation, period effects, and birth order.
DelRiscoKollerud et al., 2014	Norway	0-15 years old	N/A	Model I: paternal and maternal education and annual family income Model II: child's sex, birth weight, congenital malformations and parity
Ortega-García et al., 2017	Spain	<15 years old	N/A	N/A
Lavigne et al., 2017	Canada	0-6 years old	N/A	Maternal age at delivery, Maternal cigarette smoking anytime during pregnancy, infant sex, parity, urban/rural place of residence, and socioeconomic status.
Spycher et al., 2017	Switzerland	0-15 years old	N/A	This study adjusted for sex, year of birth, education, crowding, neighborhood, socioeconomic status, birth order, birth weight, background ionizing radiation, electromagnetic fields from radio and TV transmitters, and the distance to the nearest highway, petroleum refinery, petrol station, motor vehicle, and service station.
Kreis et al., 2022	Switzerland	<16 years old	age and year of birth	Neighborhood socio-economic position, level of urbanization, and background ionizing radiation.

Abbreviations:

N/A – Not Applicable.

Table 3. Correlation between characteristics of case-control studies, types of CNS tumor and Effect estimate.

AUTHOR/YEAR	TIMING OF EXPOSURE	AIR POLLUTANTS	AGE RANGE (YEARS OLD)	CNS TUMOR	CASES	CONTROLS	EFFECT ESTIMATE (95% CI)	
Kaletsch et al., 1999	Postnatal	Radon	0-15	Not specified	41	209	OR 3.85 (1.26, 11.81)	
Peters et al., 1981	Parental (occupational)	Chemicals, dust, fumes	< 10	Astrocytoma, medulloblastoma, oligodendroglioma	98	92	RR* 3.19 (1.30, 7.87)*	
Cordier et al., 2004	Parental (occupational)	PAH	0-19	Astroglial, PNET, other glial tumors	1218	2223	OR* 1.0 (0.7, 1.4)*; OR** 1.3 (1.1, 1.6)*	
Danysh et al., 2016	Parental (occupational); Prenatal	Traffic-related pollution	< 5	Astrocytoma, ependymoma, JPA, medulloblastoma, PNET	315	1575	OR ^a 1.23 (0.97, 1.57)*; OR ^a 1.30 (1.01, 1.67)*	
von Ehrenstein et al., 2016	Prenatal; Postnatal	Metals, PAH, solvents, VOC	< 6	Astrocytoma, medulloblastoma, PNET	183	30569	Astrocytoma: Lead† OR*** 1.22 (0.89, 1.67); ortho-Dichlorobenzene† OR [†] 1.42 (0.64, 3.16) Medulloblastoma: Benzo[g,h,i]perylene† OR*** 1.94 (1.20, 3.14); Indeno[1,2,3-cd]pyrene† OR [†] 1.61 (0.91, 2.83);	PNET: Acetaldehyde† OR*** 2.30 (1.44, 3.67); 1,3-Butadiene† OR [†] 3.15 (1.57, 6.32)
García-Pérez et al., 2016	Postnatal	Metals, PAC, pesticides, POP, solvents, VOC	0-14	Intracranial & intraspinal GCT	174	3342	Intracranial & intraspinal GCT: effect estimate in the supplementary material; no association mentioned in the text	
Volk et al., 2019	Parental (occupational); Prenatal; Postnatal	DME	< 19	Astrocytoma, ependymoma, medulloblastoma	1929	46844	OR* 1.31 (0.99, 1.74)*; OR** 0.97 (0.84, 1.12)*	

Volk et al., 2020	Parental (occupational); Prenatal; Postnatal	Dust exposures (paper, textile, wood)	< 19	Astrocytoma, ependymoma, medulloblastoma	1929	46844	OR* 2.28 (1.22, 4.26)*; OR** 1.24 (1.00, 1.53)*	
Savitz & Feingold, 1989	Postnatal	Benzene	0-14	Not specified	61	262	OR 1.7 (0.8, 3.9)	
Feychting et al., 1998	Postnatal	Motor vehicle exhaust (NO ₂)	0-15	Not specified	33	128	RR 1.04 (1.00, 1.08)	
Raaschou-Nielsen et al., 2001	Prenatal; Postnatal	Benzene, NO ₂	< 15	Astrocytoma, ependymoma, medulloblastoma	740	2220	RR*** 0.99 (0.95, 1.02); RR**** 0.98 (0.94, 1.01)	
McKinney et al., 2003	Parental (occupational); Prenatal; Postnatal	Dust, fumes, particulate hydrocarbons, solvents	< 14	Not specified	687	6435	Wood dust: OR** 0.46 (0.22, 0.99); all other pollutants: no statistical significance	
Heck et al., 2013	Prenatal; Postnatal	Traffic-related pollution	< 5	Astrocytomas, ependymoma, IIET, medulloblastoma, PNET	649	80224	PM _{2.5} - Astrocytoma: OR ^a 0.90 (0.61, 1.34); Ependymoma: OR ^a 1.26 (0.72, 2.21); IIET: OR ^a 1.18 (0.78, 1.80);	Medulloblastoma: OR ^a 1.76 (0.91, 3.38); PNET OR ^a 1.05 (0.55, 2.00)
Reynolds et al., 2004	Parental (occupational); Prenatal; Postnatal	Benzene	< 6	Not specified	746	1492	OR ^r 1.03 (0.75–1.43); OR ^t 1.22 (0.87–1.70)	
Huoi et al., 2014	Parental (occupational)	Asbestos, crystalline silica, DME, metals, PAH	0-15	Astrocytoma, CNS embryonal tumors, ependymomas	1361	5500	OR** ^d PAH 0.84 (0.5, 1.25); DME 0.90 (0.58, 1.40); asbestos 0.70 (0.28, 1.77); silica 0.68 (0.32, 1.45); metals 0.27 (0.03, 2.11) - OR** ^d	PAH 1.07 (0.84, 1.36); DME 0.90 (0.74, 1.08); asbestos 1.05 (0.84, 1.32);

							silica 0.84 (0.64, 1.10); metals 1.05 (0.83, 1.32)
Park et al., 2017	Prenatal; Postnatal	Dichloromethane	< 6	Astrocytoma, ependymoma	105	1182	OR**** 1.06 (0.91, 1.25)*; OR ^{1a} 0.95 (0.79, 1.14)*;
Raaschou-Nielsen et al., 2018	Prenatal; Postnatal	Benzene	< 15	Astrocytoma, ependymoma, medulloblastoma	476	5428	Astrocytoma: OR*** 1.0 (0.8,1.3); OR**** 1.0 (0.7, 1.3); Ependymoma: OR*** 0.6 (0.3,1.0); OR**** 0.5 (0.3, 1.0); Medulloblastoma: OR*** 1.3 (1.0, 1.9); OR**** 1.3 (0.9, 1.8)
Hvidtfeldt et al., 2020	Prenatal; Postnatal	BC, NO ₂ , PM _{2.5}	0-19	Astrocytomas and Other Gliomas, CNS Tumors Overall, ependymomas, IIET	5045	18179	BC: OR ^a 0.95 (0.82,1.09)*; NO ₂ : OR ^a 0.99 (0.91,1.08)*; PM _{2.5} : OR ^a 0.92 (0.74,1.15)*

1 **Abbreviations:**

2 CI - Confidence Interval

3 RR -Risk Ratio

4 OR - Odds Ratio

5 GCT,- Germ Cell Tumor

6 IIET - Intracranial & Intraspinal Embryonal Tumors

7 IIN - Intracranial & Intraspinal Neoplasms

8 JPA - Juvenile Pilocytic Astrocytoma

9 PNET - Primitive Neuroectodermal Tumor

10 BC - Black Carbon

11 DME - Diesel Motor Exhaust

12 NO₂ - Nitrogen Dioxide

13 PAC - Polycyclic Aromatic Compounds

14 PAH - Polycyclic Aromatic Hydrocarbons

15 PM_{2.5} - Particulate Matter < 2.5 µm

16 POP - Persistent Organic Pollutants

17 VOC - Volatile Organic Compounds

18 ^a adjusted; ^u unadjusted; ^d around time of diagnosis; ^r road density (90th+ percentile);

19 ^t traffic density (90th+ percentile); * mothers' exposure; ** fathers' exposure; *

20 prenatal; ** postnatal; ¹ first year of life; ⁺ CNS overall; [†] highest effect

21 Colors indicate the degree of associations: positive [green], conflicting [lavender],

22 or no [blue] associations

Table 4. Correlation between characteristics of cohort studies, types of CNS tumor and Effect estimate.

AUTHOR/YEAR	TIMING OF EXPOSURE	AIR POLLUTANTS	AGE RANGE (YEARS OLD)	CNS TUMOR	CASES	COHORT	EFFECT ESTIMATE (95% CI)
Lavigne et al., 2017	Prenatal; Postnatal	NO ₂ , PM _{2.5}	0-6	Astrocytoma	208	2.350.898	HR (PM _{2.5}) 1.40 (1.05, 1.86) - 1st trimester of pregnancy; HR (NO ₂) 1.55 (1.02, 2.37) - 3rd trimester of pregnancy
DelRiscoKollerud et al., 2014	Postnatal	Radon	0-15	Not specified	427	712.674	HR ^a (Per 100 Bqm ³) 1.09 (0.92, 1.29)
Hauri et al., 2013	Postnatal	Radon	0-15	Not specified	258	1.287.354	HR ^a (Per 100 Bqm ³) 1.19 (0.91, 1.57)
Kreis et al., 2022	Postnatal	Benzene, NO ₂	< 16	Astrocytoma, IIET	669	3.493.769	HR (Benzene) 0.93 (0.76, 1.13)*, HR (NO ₂) 0.96 (0.84, 1.09)*
Ortega-García et al., 2017	Postnatal	Industry-related pollution	< 15	Not specified	146	259.083	SIR: 0.98 (0.66, 1.40)
Spycher et al., 2017	Parental (occupational)	Benzene	0-15	Gliomas, unspecified CNS tumors	566	2.129.264	HR ^{**a} : 0.40 (0.13, 1.26), HR ^{***a} 0.89 (0.57, 1.40)

^a adjusted; * mothers' exposure; ** fathers' exposure; * CNS overall;

Abbreviations:

CI -confidence interval

HR - hazard ratio

IIET- intracranial & intraspinal embryonal tumors

NO₂ - nitrogen dioxide

PM_{2.5} - particulate matter < 2.5 µm

PM₁₀ - particulate matter < 10.0 µm

SIR - Standardized Incidence Ratio

Colors indicate the degree of associations: positive [green], conflicting [lavender], or no [blue] associations.

Table 5. Overall quality assessment.

AUTHOR/YEAR	STUDY TYPE	NEWCASTLE-OTTAWA SCALE (NOS)*				STUDY QUALITY INTERPRETATION
		SELECTION	COMPARABILITY	OUTCOME/EXPOSURE	RESULT	
Peters et al., 1981	Case-control	★★★★	★★	★★★	9	GOOD
Savitz & Feingold, 1989	Case-control	★★★★	★★	★★	8	GOOD
Feychting et al., 1998	Case-control	★★★★	★	★★★	8	GOOD
Kaletsch et al., 1999	Case-control	★★★	★	★★	7	GOOD
Raaschou-Nielsen et al., 2001	Case-control	★★★★	★★	★★	8	GOOD
McKinney et al., 2003	Case-control	★★★★	★★	★★★	9	GOOD
Cordier et al., 2004	Case-control	★★★	★★	★★	7	GOOD
Reynolds et al., 2004	Case-control	★★★★	★★	★★★	9	GOOD
Heck et al., 2013	Case-control	★★★★	★★	★★★	9	GOOD
Hauri et al., 2013	Cohort	★★★★	★★	★★★	9	GOOD
DelRiscoKollerud et al., 2014	Cohort	★★★★	★★	★★★	9	GOOD

Huoi et al., 2014	Case-control	★★★★	★★	★★★	9	GOOD
Danysh et al., 2016	Case-control	★★★★	★★	★★	8	GOOD
García-Pérez et al., 2016	Case-control	★★★	★★	★★	7	GOOD
von Ehrenstein et al., 2016	Case-control	★★★	★★	★★★	8	GOOD
Lavigne et al., 2017	Cohort	★★★★	★★	★★★	9	GOOD
Ortega-García et al., 2017	Cohort	★★★	-	★★	5	FAIR
Park et al., 2017	Case-control	★★★★	★★	★★★	9	GOOD
Spycher et al., 2017	Cohort	★★★★	★★	★★★	9	GOOD
Raaschou-Nielsen et al., 2018	Case-control	★★★	★★	★★★	9	GOOD
Volk et al., 2019	Case-control	★★★★	★★	★★	8	GOOD
Hvidtfeldt et al., 2020	Case-control	★★★★	★★	★★	8	GOOD
Volk et al., 2020	Case-control	★★★★	★★	★★★	9	GOOD
Kreis et al., 2022	Cohort	★★★★	★★	★★★	9	GOOD

*A study can be scored a maximum of four stars within the Selection domain, three stars in the Exposure/outcome categories. A maximum of two stars can be given for Comparability.