14th ICBEN Congress on Noise as a Public Health Problem

Non-auditory effects of noise: an overview of the state of the science of the 2020-2023 period

[1]Elise van Kempen[1], Kerstin Persson Waye[2]

[1] RIVM, Centre for Sustainability, Environment and Health, Bilthoven, The Netherlands
[2] The School of Public Health and Community Medicine, Sound Environment and Health, Institute of Medicine, University of Gothenburg, Sweden

Corresponding author's e-mail address: Elise.van.Kempen@rivm.nl

ABSTRACT

This paper provides an overview of non-auditory effects of noise published since the last ICBEN conference in 2021. The paper focuses on the impact of environmental and occupational noise on cardiovascular and metabolic effects, mental health and dementia.. The paper takes as a point of departure the ICBEN overview of the 2017-2020 period and adds new research from literature searches for peer reviewed journal articles in the large databases during the period 2021- 2023. The aim is to describe recent research achievements, emerging areas of research, remaining gaps of knowledge, and priority areas of future research in the field of non-auditory health effects of noise.

Keywords (3-6): Environmental noise, Occupational noise, Mental health, Dementia, Cardiovascular disease, Metabolic effects

INTRODUCTION

Team 3 focusses on the non-auditory effects of occupational and environmental noise on long-term health outcomes including cardiovascular, physiological and endocrinological, mental health, birth outcomes and early child development and hospital noise effects on staff performance and patient rehabilitation.

The aim for this overview paper is to describe recent research achievements, emerging areas of research, remaining gaps of knowledge, and priority areas of future research in the field of non-auditory health effects of noise. To this end, we have reviewed the literature on noise and health that has been published in the period 2020-2023.

We have chosen to focus on cardiovascular and metabolic outcomes, mental health and dementia as well as describing emerging areas and outcomes to noise in general including both environmental and occupational sources.

METHODS

Our overview contains several steps: firstly all studies were identified that could potentially be included in the review. The identified studies were submitted to selection criteria. Studies that met these criteria were included for data-extraction. For our overview, we applied as much as possible the search and selection criteria developed in the WHO evidence reviews of Clark and Paunovic [1] on mental health and Van Kempen et al [2] on the cardiovascular and metabolic system.

Identification (Arial Bold 11 Italic)

We identified literature published between January 2021 and March 31 2023 about the impact of all noise exposure on mental health and dementia, and literature published between January 2021 and January 2023 about the impact of noise from transportation and wind turbines on (i) the cardiovascular system, (ii) and the metabolic system.

In addition to the applied search terms derived from WHO-evidence reviews of Van Kempen [2] and Clark and Paunovic [1], we also tried to identify studies investigating the effects of occupational noise exposure in relation to mental health. To this end, we adapted the search profiles applied in the WHO-evidence reviews for this purpose. The bibliographic databases that were utilized included PubMed and PsycInfo for mental health and dementia and Scopus MEDLINE, and EMBASE for the cardiovascular and metabolic system. Within each database we screened all English papers in their respective period.

Selection

The publications that were identified by means of the search were screened on suitability for data extraction. In summary, these criteria were: (a) Studies should report on the relationship between noise and exposure or (road, rail or air traffic noise exposure or wind turbine noise exposure), and cardiovascular and/or metabolic disease and/or mental health, or dementia, in populations who were not identified with a certain illness or disorder; (b) With regard to environmental noise exposure, studies should quantify and/or describe the relationship between objective exposure and one or more of the relevant health outcomes. Some exceptions to the criteria of objective descriptions of exposure were allowed, if the study method provided a valuable contribution, which was the case especially for occupational noise exposure, and mental health.

In addition to the WHO evidence reviews, we also selected systematic reviews and meta-analyses that addressed that association between noise exposure and one or more of the outcomes relevant for the current review. For mental health we adopted largely the criteria developed in Clark and Paunovic [1] and added “Dementia (vascular and Alzheimer)” . As in Clark and Paunovic [1], we acknowledge that the term mental health refers to a number of mental health symptoms and often viewed as on a continuum with diagnoses that can be indicative of mental health disorders with various severity. With regard to the cardiovascular and metabolic effects, we extended our selection criteria by also including studies that investigated the association between noise from road, rail, -and air traffic and wind turbines and (i) blood pressure in adults, (ii) additional cardiovascular diseases (including arterial fibrillation, arrythmia, heart failure, arterial stiffness, and BP-related death), (iii) metabolic and cardiovascular risk indicators (including hsCRP, cholesterol, triglycerides, blood glucose, glycated heamoglobin, cortisol in saliva, glomerular filtration rate), (iv) cancer and immunological effects, and (v) respiratory disease. We also (vi) included studies that

investigated the impact of occupational noise exposure.

Data-extraction

From the studies that met the selection-criteria, we extracted the following data: (i) data on general study characteristics; (ii) population characteristics; (iii) exposure assessment; (iv) health outcome assessment, and (v) the results of the study. Due to the restricted time, we were not able to express the results in the same way. E.g. a Relative Risk per 10 dB change in noise level or the change in waist circumference per 10 dB change in noise. This also means that data will not be aggregated as part of a meta-analysis. In contrast to the WHO-evidence reviews we will also not assess the risk of bias per study. Instead, we will look at the quality of the studies in general.

Due to limited space, we decided to mainly present the characteristics of the systematic reviews and single studies. For those who are interested the references of all identified studies can be found in reference list.

RESULTS

Results of the search- and selection process

Table 1 presents a flow of the sum of the search and selection process for the individual outcome groups.

Table 1. Sum of the search and selection process for the individual outcome groups

Phase in the process	**Mental health and dementia**	**Cardiovascular and metabolic outcomes**
Search period	2021-01-01 to 2023-03-31	2021-01-01 to 2023-01-01
Identification	305	274
Additional records identified through other sources	-	1
Records after duplicates removed	304	198
Records excluded	261	114
Full text articles assessed for eligibility	43	84
Full text articles excluded with reasons	7	25
Studies included for data-evaluation	14 reviews and 22 studies (36 references)	8 reviews and 38 studies (58 references)

Cardiovascular and metabolic outcomes: Systematic reviews and meta-analyses

For our overview we included 8 systematic reviews [3-10]. Their characteristics are presented in Table 2. Most of the studies covered by these reviews reported on the impacts of road and/or air traffic noise exposure. Six reviews [3, 4, 6, 7, 9, 10] also included studies that investigated the impacts of rail traffic noise exposure; three reviews [4, 5, 10] included studies

that investigated the impact of occupational noise. Other sources under investigation were traffic noise (n =1) [5], community noise (n=1) [6], and wind turbine noise (n =1) [10]. All reviews focused on adult populations; two reviews also included effects in children [4, 7]. The participating studies in the reviews were published up to June 2022. Except for Rompel et al [6], all reviews included one or more meta-analyses, resulting in numerous exposure-response estimates, usually in the form of a Relative Risk per 10 dB change in noise. In most reviews, the reviewers were able to provide a quality judgment of the individual studies. Tools applied were: the Navigation Guide developed by WHO and ILO, the Newcastle Ottawa Scale, the RoB tool of WHO, and the NTP/OHAT.

Table 2. Overview of the identified systematic reviews on the impact of environmental noise on the cardiovascular and metabolic system

1st author	End of earch period	Studies		Countries*	Pop.**	Noise source(s)‡	Setting±	End point(s)**	Individual study quality	Meta-analysis	Overall quality of evidence
		No	N								
Cai ‘21[3]	Oct ‘20	12	6,304 – 8.6 million	1-8	A	1,2,3	R	1-4	Navigation Guide developed by WHO and ILO	Yes	GRADE
Chen ’21 [4]	Oct ‘19	10	420 – 145,190	1-3, 8-11	AC	1,2,3,4	R, W	5	Newcastle-Ottawa Scale	Yes	NA
Li, ’21 [5]	Dec ‘20	5	304 – 40,041	9, 11-14	A	4, 5	R, W	6-11	Newcastle-Ottawa Scale	Yes	NA
Rompel ’21 [6]	Feb ‘20	28	308 – 4.6 million	1, 3-10, 15-18	A	1,2,3,6	R	5, 12, 13, 14	RoB tool WHO	No	NA
Gui ‘22 [7]	Feb ‘21	12	484 – 412,934	1, 2, 4, 17, 19, 20	AC	1,2,3	R	7, 15-19	NTP/OHAT	Yes	GRADE
Hao ’22 [8]	Apr ‘21	15	6,304 – 8.6 million	1, 2, 4, 6, 19, 21	A	1	R	1-4	Newcastle-Ottawa Scale	Yes	NA
Liu ’22 [9]	Feb ‘22	9	420 – 3,563,991	2, 4, 8, 10, 15	A	1,2,3	R	20	Newcastle Ottawa Scale	Yes	GRADE
Fu ’22 [10]	June ‘22	17	420 – 4,580,311	1-4,6, 8, 10, 18, 19	A	1,2,3,4, 7	R, W	4, 21	Risk of Bias in Non-Randomized Studies or Exposures tool	Yes	GRADE

*Countries: 1 = Sweden, 2 = Denmark, 3 = The Netherlands, 4 = Switzerland, 5 = Spain, 6 = United Kingdom, 7 = France, 8 = Canada, 9 = South-Korea, 10 = Greece, 11 = Taiwan, 12 = United States of America, 13 = Finland, 14 = Iran, 15 = Germany, 16 = India, 17 = Bulgaria, 18 = Italy, 19 = Norway, 20 = Slovakia, 21 = China; ** Pop: Populations: A = Adults, C = Children; ǂ 1 = Road traffic, 2 = Air traffic, 3 = Rail traffic, 4 = Occupational, 5 = traffic, 6 = community, 7 = Wind Turbines; ± Setting: R = residential, W = work ; ** 1= Non-accidental mortality, 2 = mortality due to cardiovascular disease, 3 = mortality due to ischemic heart disease, 4 = mortality due to stroke, 5 = incidence or prevalence hypertension, 6 = risk MEtS, 7 = Incidence or prevalence of obesity, 8 = Incidence or prevalence of elevated blood pressure, 9 = Incidence or prevalence of elevated blood glucose, 10 = Incidence or prevalence of elevated TG, 11 = Incidence or prevalence of low HDL, 12 = Change in blood pressure, 13 = Mortality due to hypertension, 14= Incidence or prevalence of ischemic heart disease, 15 =Change in waist circumference, 16 = change in weight, 17 = Incidence or prevalence of overweight, 18 = change in waist-hip-ratio, 19 = change in BMI, 20 = Prevalence or incidence of diabetes, 21 = Incidence or prevalence stroke; Abbreviations: No = Number of studies, N = Number of participants

Original studies: Cardiovascular and metabolic effects

For our overview we identified and selected 38 studies that investigated the impact of one or more sources of environmental noise and/or occupational noise on one or more cardiovascular and or metabolic end points carried out in 21 different countries across the world. Table 3 presents some characteristics of these studies. The majority were cohort studies; for three of the cohort studies also/only cross-sectional analyses were presented [11-13]. Furthermore, twelve studies had a cross-sectional design [14-25], and one study was an intervention study [26]. Only two studies had an ecological design [27-29]. Sample sizes ranged from 29 to more than 10 million participants. Although, the majority of the studies included both men and women, there were five studies specifically investigating the impact of noise in women [30-37]. Three studies [21, 23, 24] included men only; within these studies the impact of occupational noise was studied. Three studies specifically investigated the impact of noise on children [17, 19, 38].

In the majority of the studies, the impact of road traffic noise exposure was investigated [8, 11, 12, 14-17, 19, 20, 28-35, 38-54]. There were also several studies investigating the impact of noise from rail traffic [13, 16, 19, 35, 39-41, 43-45, 48, 49, 53, 54] and air traffic [15, 16, 27, 35-37, 40, 41, 44, 48, 49, 53, 55]. In six studies [18, 21-24, 56] the impact of occupational noise was studied. Other sources under investigation were wind turbines [20, 26] and recreational noise [16]. Sometimes, studies did not further specify the source as environmental noise [18, 28, 29] or traffic noise [25]. Within the studies a large number of different health end points ranging in clinical relevance were investigated. Despite that several new health end points were investigated, the most investigated health end points remain change in blood pressure (7), hypertension (12), stroke (11), IHD (10), diabetes (7) and cardiovascular disease (5).

Table 3. Characteristics of the identified and selected studies investigating the impact of noise the cardio-metabolic system

Study/first author	Country*	Design‡	Study population		Noise source(s)±	Exposure characterization**	Exposure metric(s) (exposure window(s))	End point(s)
			N	Sex/Age (yrs)				
DNC [30-34]	1	CO	25,660	F, ≥ 44	A	Mo	L_{den} (1, 3, 5 and 23 yr)	1-4 (Inc), 2, 4-14 (mort)
DACS-1 [39]	1	CO	1,938,994	MF, ≥ 60	AB	Mo	$L_{den, most\ exposed\ façade}$, $L_{den, least\ exposed\ façade}$, $L_{night, most\ exposed\ façade}$ (10 yr)	11 (Inc)
DACS-2 [40, 41, 43]	1	CO	3,616,893	MF, ≥ 35	ABC	Mo	$L_{den, most\ exposed\ façade}$, $L_{den, least\ exposed\ façade}$ (1, 5 and 10 yr)	2 (Inc, Mort), 1, 8 (Inc)
DACS-3 [42]	1	CO	1,922,545	MF, ≥ 50	A	Mo	$L_{den, most\ exposed\ façade}$, $L_{den, least\ exposed\ façade}$ (5 yr)	8 (Inc)
DACS-4 [44]	1	CO	2,538,395	MF, ≥ 50	ABC	Mo	$L_{den, most\ exposed\ façade}$, $L_{den, least\ exposed\ façade}$ (5 and 10 yr)	3, 7 (Inc)
Chiu '21 [26]	2	RM/IS	29 (1,259 measurements)	MF, 20-80	D (LFN)	Me	Ratio of low-frequency to high frequency power (LF/HF)	15 (Cha)
CBS [45]	3	CO	10,481,566	MF, ≥ 30	AB	Mo	L_{den}	2, 4, 5, 7, 9, 16-18 (Mort)
UK-Biobank-a [11]	4	CS	451,132	MF, 40-69	A	Mo	L_{den}, L_{night}	19-22 (Cha), 23 (Prev)
UK-Biobank-b [8, 46]	4	CO	342,566	MF, 40-69	A	Mo	L_{den}, $L_{Aeq24hr}$, L_{night} (1-yr)	2, 7, 8 (Inc), 5, 6 (Mort)
ATS [47]	5	CO	1,087,110	MF, ≥ 35	A	Mo	L_{den}	2, 7, 24 (Inc)
HCREHS [14]	6	CS	5,441	MF, ≥ 25	A	Mo	L_{den}	23 (Prev)
MGHS [15]	7	CS	403	MF, ≥ 30	AC	Mo	Not clear	25-30 (Cha)
SERA/SERA-FA [16]	5	CS	517	MF, 37-72	ABCE	Mo, Me	L_{day}, L_{night}	23 (Prev), 19 (Cha)
DMBR [35]	1	CO	629,254 pregnancies	F, ~20-40	ABC	Mo	$L_{den, most\ exposed\ façade}$, $L_{den, least\ exposed\ façade}$ (1^{st} trimester, entire pregnancy, 1 and 5 yr preceding pregnancy)	31 (Inc)
Brazil [27]	8	ECO	3,532,210	MF, ≥ 20	C	Mo	L_{dn}	2, 6, 7 (Mort)
NordSound-a [48, 49]	1, 9	CO	135,951	MF, ≥ 25	ABC	Mo	L_{den} (1 and 5 yr)	2, 7 (Inc)
NordSound-b [56]	1, 9	CO	78,389	MF, ≥ 35	F	Me, Mo	L_{Aeq8h} (1 yr)	2 (Inc)
FLESH [17]	10	CS	395	MF, 14-15	A	Mo	L_{den}	32-36 (Cha)
KORA F4-a [12]	11	CS	2,883	MF, 55-74	A	Mo	Maximum $L_{Aeq24hr}$	37 (Prev)
KORA F4-b [12]	11	CO	1,192	MF	A	Mo	Maximum $L_{Aeq24hr}$	20, 37-41 (Inc)

KORA F4/FF4 [50]	11	CO	423	MF, 62-81	A	Mo	$L_{Aeq24hr}$, L_{night}	42 (Inc)
HELIX [38]	4, 12, 13, 14	CO	4,279	MF, 4-5	A	Mo	L_{den}	19 (Cha)
QICDSS [28, 29]	15	ECO	1,065,414	MF, ≥ 45	A, G	Mo, Me	L_{den}, $L_{Aeq24hr}$, L_{night} (1 yr)	2, 7 (Inc)
TMC [18]	16	CS?	1,610	MF, 18-70	FG	Me	Lex	23 (Prev)
IFC-CNR [51]	5	CO	985,022 PYs	MF, 0-85	A	Mo	L_{night}, L_{day}	2, 7, 16, 19 (Mort, Inc)
ALPINE [19]	5, 17	CS	1,251	MF, 8-12	AB	Mo	$L_{den,\ most\ exposed\ façade}$ (1-yr)	19 (Cha)
1000BRAINS [52]	11	CO?	574	MF, 56-85	A	Mo	L_{den}, L_{night} (1-yr)	43 (Cha)
NHS [36]	7	CO	63,245	F	C	Mo	L_{dn}	23 (Inc)
NHS-II [36]	7	CO	98,938	F	C	Mo	L_{dn}	23 (Inc)
WHI [37]	7	CO	18783	F, 50-79	C	Mo	L_{dn}, L_{night}	23 (Inc)
DEBATS [55]	12	CO/RM	1,210	MF, ≥ 18	C	Mo	L_{den}, $L_{Aeq24hr}$, L_{day}, L_{night}	19 (Cha), 23 (Prev, Inc)
FWT [20]	6	CS	684	MF, 19-94	AD	Mo, Me	$L_{Aeq,7\text{-}22hr}$ $L_{Aeq,\ WT/SPL}$	6, 8, 12, 13, 39 (Prev)
Rahmani ‘22 [21]	18	CS	103	M?	F (City bus drivers)	Me	L_{eq}	19, 15 (Cha)
SNC [53]	19	CO	4,136,220	MF, ≥ 30	ABC	Mo	$L_{den,\ most\ exposed\ façade}$	2,3, 6, 7, 44 (Mort)
EpiVib [13]	9	CS	5,381	MF, 18-80	B	Mo	L_{den} (1 yr)	8 (Inc?)
Wang ‘22 [22]	20	CS	4,746	MF	F(automobile facility)	Me	L_{Aeq8hr}	23 (Prev)
Wu ‘22 [23]	20	CS	4,856	M	F (automobile facility)	Me	L_{Aeq8hr}	23 (Prev)
Zhou ‘22 [24]	20	CS	1,527	M	F (automobile facility)	Me	L_{Aeq8hr}	23 (Prev)
Guha ‘23 [25]	21	CS	154	MF, ~20-60	H	Me	Frequency (Hz)	23 (Prev)
DNHS [54]	1	CO	286,151	MF, ≥ 16	AB	Mo	$L_{den,\ most\ exposed\ façade}$, $L_{den,\ least\ exposed\ façade}$ (5 and 10 yr)	8 (Inc)

*Country: 1 = Denmark, 2 = Taiwan, 3 = The Netherlands, 4 = United Kingdom, 5 = Italy, 6 = Finland, 7 = United States of America, 8 = Brazil, 9 = Sweden, 10 = Belgium, 11 = Germany, 12 = France, 13 = Greece, 14 = Spain, 15 = Canada, 16 = Ghana, 17 = Austria, 18 = Iran, 19 = Switzerland, 20 = China, 21 = India; ǂDesign: RM = repeated measurements, IS = Intervention study, CO = Cohort, CS = Cross-sectional study, ECO = Ecological study; ± Noise source(s): A = Road traffic, B = Rail traffic, C = Air traffic, D = Wind turbines, E = Recreational, F = Occupational, G = Environment, H =Traffic; ** Exposure characterization: Mo = Modelling, Me = Measurements; ǂǂ Outcome: 1 = arterial fibrillation, 2 = Cerebrovascular disease or stroke, 3 = heart failure, 4 = COPD, 5 = all-cause mortality / non-accidental mortality, 6 = cardiovascular disease, 7 = Ischeamic heart disease (incl angina pectoris and acute myocardial infarction), 8 = diabetes (type 2), 9 = respiratory disease, 10 = ALRI, 11 = dementia, 12 = psychiatric disease, 13 = all cancers, 14 = breast cancer, 15 = heart rate variability, 16 = circulatory disease, 17 = lung cancer, 18 = neurodegenerative disease, 19 = Blood pressure, 20 = Triglycerides, 21 = Glycated haemoglobin, 22 = C-reactive protein, 23 = Hypertension, 24 = acute vascular events, 25 = Visceral adipose tissue volume, 26 = BMI, 27 = subcutaneous Adipose Tissue volume, 28 = VAT-SAT ratio, 29 = subsequent change in VAT volume, 30 = amygdalar activity, 31 = Gestational diabetes mellitus, 32 = Hair cortisol concentration, 33 = leucocytes, 34 = neutrophils, 35 = monocytes, 36 = lymphocytes, 37 = Metabolic syndrome, 38 = decreased HDL-levels, 39 = elevated blood pressure, 40 = elevated waist circumference, 41 = elevated fasting glucose, 42 = Distal sensimotor polyneuropathy, 43 = Segregation index, intra-network (sensimotor network, dorsal attention, limbic network, frontoparietal network), 44 = blood pressure-related mortality, and prev = prevalence, inc = incidence, mort = mortality, cha = change

Mental health and dementia: Systematic reviews and meta-analyses

For our overview we included 14 reviews [57-71]. The reviews had the following main approaches:

a) Health and mental health among children [57, 60, 66]. Of these, Terzakis [66] focused on the association of different noise indicators and non-auditory effects on children;
b) Dementia and cognitive impairment [63, 64, 70];
c) Environmental pollution inclusive noise and mental health [65, 67-69]. Of these, Rojas Rueda et al. [65] consisted of a comprehensive umbrella review of meta analyses;
d) Health (inclusive mental health in low and middle income countries [58]; and
e) Finally two reviews of how subjective perception of noise and other pollutions link to mental health [62, 71].

Original studies: Mental health and dementia

For our overview we identified and included 22 studies that investigated the impact of one or more sources of environmental or occupational noise on one or more mental health outcomes and/or mental health. The studies were performed in 16 different countries across the world. Table 4 presents characteristics of these studies.

Eight of the studies had a longitudinal design or were cohort studies; for one of these also cross-sectional analyses were presented. Furthermore, 13 studies had a cross-sectional design and one study was an intervention study. Sample sizes ranged from 40 to 1.938 994 participants. Although, the majority of the studies included both men and women, there were one study of pregnant females and one occupational study including only men. Also, another occupational study had a large dominance of male participants [72]. Five studies specifically investigated or also included the impact of noise or environmental exposures on children.

In the large majority of studies, the impact of road traffic noise exposure was investigated. Some studies also included rail, aircraft, industry and wind turbines. Two studies investigated “community or residential noise”. In three studies the impact of occupational noise was studied. Within the studies investigating mental health, a large variety of measures were used.

Strengths and Difficulty Questionnaire (SDQ) were adopted by four studies with child/ adolescent populations, however in some of these studies also other measures were used such as Child Behavior Check List (CBCL), and ICD codes. Among the adult population some studies used Depression Anxiety Scale (DASS-21), Kessler Psychological Distress Scale (KPDS), Patient Health Questionnaire PHQ, General Health Questionnaire GHQ (for subclinical mental health), mental disorders including symptoms of Nerves, Anxiety, Tension or Depression (NATD), Generalized Anxiety Disorder-7 (GAD-7), the WHO-5 wellbeing index, or other measures being referred to as mental wellbeing, mental disorders, or psycho-social health. Only one, albeit large study, studied all dementia and subtypes. For all cause dementia they used primary or secondary diagnoses from health registry data (1), or at least one prescription of an antidementia drug (donepezil, rivastigmine, galantamine, or memantine) registered in the National Prescription Registry, Denmark (method 2), or both. For subtype diagnoses, specific diagnoses of Alzheimer’s disease, vascular dementia, and Parkinson’s disease related dementia was considered. In addition to mental health and dementia, a number of different health end points often related to insomnia, were sometimes also investigated.

Table 4. Characteristics of the identified and selected studies investigating the impact of noise on mental health (outcomes).

1st author	Country*	Design‡	Study population (N)	Sex/age (yrs)	Noise source(s)	Exposure characterization**	Other exposures	Exposure metric(s) (exposure window(s)	End point(s)
					Residential studies				
Bao '22[73]	20	CS	3,236	M,F 7-13	Road	Mo	NO_2	L_{day}, L_{night}, (L_{dn}	SDQ,
Bloemsma '22 [74]	3	CO	3,059	M,F, 11, 14, 17, 20	Road, Rail	Mo	i.e NDVI; NO_2; PM_{10}; $PM_{2.5}$	L_{den}	Mental Health Invent (MHI-5)
Cantuaria '21 [39]	1	CO	1,938,994	M,F, >=60	Road, Rail	Mo	$PM_{2.5}$; NO_2; green space; urbanity	10 year L_{den}, L_{night} max and min facade	All dementia, subtypes
Essers '22 [75]	14	CO	534 and 7,424	M,F 18 months - 9	Road	Mo		L_{den}	SDQ, CBCL; CPRS; ADHD sympt (DHD-DSM-IV)
Faiyetole '21 [76]	24	CS	402	M,F>18	Aircraft	Me, SLM		LC peak dB;	Psycho-social health Qs,
Gilani '22 [77]	21	CS	4,525	M,F	Road	Mo		L_{night}	Insomnia; Mental health (DASS-21)
Gomm '23 [78]	19	CS	5,729	M,F	Road	Mo + perceived burden of stressors	Air pollution, green	Geodata SonBASE dataset, annual average street traffic flow	GHQ (subclinical MH)
Hao '22 [79]	20	CS	334,986	M,F (40-69)	Road	Mo	$PM_{2.5}$	CNOSSOS -EU	Mental disorders (NATD)
Huang '23 [71]	20	CS	1,772	M,F	Road	vehicle density (VVI), traffic intensity SP acoustic quality	NDVI, GVI, $PM_{2.5}$; air pollution, perceived air pollution		Mental wellbeing
Jigeer '22 [80]	20	CS	2,018	F pregnant	Residential noise	LUR Land use regression, Me	green space, $PM_{2.5}$	<65 dBA- vs high >65 dBA;	SAS; CES-D prenatal anxiety, depression
Lan '22 [81]	3	CS	358	M,F	Road, rail, WT	Mo; STAMINA; GPS tracks (50-100m)	NDVI, blue space, $PM_{2.5}$, crowdedness		GAD-7 (anxiety)

Li ‘22 [82]	23	CO	31,387	M,F	Road, air, rail, industry	SP frequency; obj (distance + pop density)		impact of change, distance and density	36-item, Survey; Kessler Psychological Distress
Lin ‘23 [83]	2	CS	125,221	M,F (30-79)	Road	Mo, LUR; adj annual, by me	$PM_{2.5}$	$L_{eq\ 24}$ annual, 1/3 oct band spl	Report diagnosed depression
Monazzam ‘22 [84]	18	CS	822	M,F	Road	sampling based on noise Mo		L_{dn}, L_{night}, L_{day}	Kessler Psychological Distress
Raess ‘22 [85]	8	CS, CO	3,385 3 yrs, and 1,546 6 yrs	M,F 3 and 6	Community	Me, + Mo	NDVI	L_{den}; L_{night}	SDQ; PRIDI; CBCL; IDELA
Roberts ‘21 [86]	3	CS	393	M,F	Road	Mo (STAMINA) GPS tracking	NDVI, blue space, $PM_{2.5}$	L_{den}	PHQ-9, Depressive symptoms
Tangermann ‘22 [87]	19	Co	886	M,F (10-17)	Road	Mo		L_{den}, L_{night}, L_{day}, Intermittency ratio; events	SDQ
Turunen ‘21 [88]	6	CS	1,411		WT	distance proxy for noise			reported health, medication
Wang ‘22 [89]	7	CS	468,815	M,F (5-64)	Aircraft	Mo; Flight pattern data		L_{dn}; before and after a move of flightpaths	ICD codes; insomnia, depression, mood disorder, emotional disorders, emergency visits
					Occupational studies				
Bertrais ‘22 [90]	12	CO	15,776	M,F	Noise	NA	long hours, shift, fumes,toxic, biomech	Unspecific,	WHO-5 Wellbeing index
Darabi ‘22 [91]	18	CS	40 exposed and 40 non exposed	M	Occupational noise	Noise dosimetry during shift	cement dust, silica (NIOSH 0600, NIOSH 7601)	8h noise dose; high 98.9 vs low 49.8	Depression Anxiety Stress Scales (DASS-21); blood samples for oxidative stress
Kwon ‘21 [72]	22	CO	48,476	M (39,086) F (9,390)	Occupational noise	Self reported exposure frequency	vibration, temperature	sever expos (3/4 time- all the time)	Depression , anxiety

*Country: 1 = Denmark, 2 = Taiwan, 3 = The Netherlands, 4 = United Kingdom, 5 = Italy, 6 = Finland, 7 = United States of America, 8 = Brazil, 9 = Sweden, 10 = Belgium, 11 = Germany, 12 = France, 13 = Greece, 14 = Spain, 15 = Canada, 16 = Ghana, 17 = Austria, 18 = Iran, 19 = Switzerland, 20 = China, 21 = India; 22= Korea, 23 = Australia, 24=

Nigeria. ‡Design: IS = Intervention study, CO = Cohort, CS = Cross-sectional study, Exposure characterization: Mo = Modelling, Me = Measurements; ‡‡ SP = Self perceived

DISCUSSION and CONCLUSION

Findings of the studies will be presented during the conference.

REFERENCES

1. Clark C, Paunovic K, *WHO Environmental noise guidelines for the European Region: a systematic review on environmental noise and quality of life, wellbeing and mental health.* International Journal of Environmental Research and Public Health, 2018. **15**(11): p. 2400.
2. Kempen E van, Casas M, Pershagen G, Foraster M, *WHO Environmental noise guidelines for the European Region: A systematic review on environmental noise and cardiovascular and metabolic effects: A summary.* International Journal of Environmental Research and Public Health, 2018. **15**(2): p. 379.
3. Cai Y, Ramakrishnan R, Rahimi K, *Long-term exposure to traffic noise and mortality: A systematic review and meta-analysis of epidemiological evidence between 2000 and 2020.* Environmental Pollution, 2021. **269**.
4. Chen F, Fu W, Shi O, Li D, Jiang Q, Wang T, Zhou X, Lu Z, Cao S, *Impact of exposure to noise on the risk of hypertension: A systematic review and meta-analysis of cohort studies.* Environmental Research, 2021. **195**.
5. Li W, Ruan W, Yi G, Chen Z, Wang D, *Association of noise exposure with risk of metabolic syndrome: Evidence from 44,698 individuals.* Diabetes Research and Clinical Practice, 2021. **178**: p. 108944.
6. Rompel S, Schneider A, Peters A, Kraus U, *Sex/gender-differences in the health effects of environmental noise exposure on hypertension and ischemic heart disease— A systematic review.* International Journal of Environmental Research and Public Health, 2021. **18**(18).
7. Gui SY, Wu KJ, Sun Y, Chen YN, Liang HR, Liu W, Lu Y, Hu CY, *Traffic noise and adiposity: a systematic review and meta-analysis of epidemiological studies.* Environmental Science and Pollution Research Int, 2022. **29**(37): p. 55707-55727.
8. Hao G, Zuo L, Weng X, Fei Q, Zhang Z, Chen L, Wang Z, Jing C, *Associations of road traffic noise with cardiovascular diseases and mortality: Longitudinal results from UK Biobank and meta-analysis.* Environmental Research, 2022. **212**(Pt A): p. 113129.
9. Liu C, Li W, Chen X, Liu M, Zuo L, Chen L, Chen H, Xu W, Hao G, *Dose-response association between transportation noise exposure and type 2 diabetes: A systematic review and meta-analysis of prospective cohort studies.* Diabetes Metabolism Research and Reviews, 2022: p. e3595.
10. Fu W, Liu Y, Yan S, Wen J, Zhang J, Zhang P, Zou L, *The association of noise exposure with stroke incidence and mortality: a systematic review and dose-response meta-analysis of cohort studies.* Environmental Research, 2022. **215**: p. 114249.
11. Kupcikova Z, Fecht D, Ramakrishnan R, Clark C, Cai YS, *Road traffic noise and cardiovascular disease risk factors in UK Biobank.* European Heart Journal, 2021. **42**(21): p. 2072-2084.
12. Voss S, Schneider A, Huth C, Wolf K, Markevych I, Schwettmann L, Rathmann W, Peters A, Breitner S, *ENVINT-D-20-01309: Long-term exposure to air pollution, road traffic noise, residential greenness, and prevalent and incident metabolic syndrome: Results from the population-based KORA F4/FF4 cohort in Augsburg, Germany.*

Environment International, 2021. **147**.
13. Vincens N, Persson Waye K, *Railway noise and diabetes among residents living close to the railways in Västra Götaland, Sweden: Cross-sectional mediation analysis on obesity indicators.* Environmental Research, 2022. **212**(Pt B): p. 113477.
14. Okokon EO, Yli-Tuomi T, Siponen T, Tiittanen P, Turunen AW, Kangas L, Karppinen A, Kukkonen J, Lanki T, *Heterogeneous Urban Exposures and Prevalent Hypertension in the Helsinki Capital Region, Finland.* International Journal of Environmental Research and Public Health, 2021. **18**(3).
15. Osborne MT, Naddaf N, Abohashem S, Radfar A, Ghoneem A, Dar T, Wang Y, Patrich T, Oberfeld B, Tung B, Pitman RK, Mehta NN, Shin LM, Lo J, Rajagopalan S, Koenen KC, Grinspoon SK, Fayad ZA, Tawakol A, *A neurobiological link between transportation noise exposure and metabolic disease in humans.* Psychoneuroendocrinology, 2021. **131**.
16. Petri D, Licitra G, Vigotti MA, Fredianelli L, *Effects of exposure to road, railway, airport and recreational noise on blood pressure and hypertension.* International Journal of Environmental Research and Public Health, 2021. **18**(17).
17. Verheyen VJ, Remy S, Bijnens EM, Colles A, Govarts E, Martin LR, Koppen G, Bruckers L, Nielsen F, Vos S, Morrens B, Coertjens D, De Decker A, Franken C, Den Hond E, Nelen V, Covaci A, Loots I, De Henauw S, van Larebeke N, Teughels C, Nawrot TS, Schoeters G, *Long-term residential exposure to air pollution is associated with hair cortisol concentration and differential leucocyte count in Flemish adolescent boys.* Environmental Research, 2021. **201**: p. 111595.
18. Baffoe PE, Duker AA, Senkyire-Kwarteng EV, *Assessment of health impacts of noise pollution in the Tarkwa Mining Community of Ghana using noise mapping techniques.* Global Health Journal, 2022. **6**(1): p. 19-29.
19. Dzhambov AM, Lercher P, Markevych I, Browning MHEM, Rüdisser J, *Natural and built environments and blood pressure of Alpine schoolchildren.* Environmental Research, 2022. **204**.
20. Radun J, Maula H, Saarinen P, Keränen J, Alakoivu R, Hongisto V, *Health effects of wind turbine noise and road traffic noise on people living near wind turbines.* Renewable and Sustainable Energy Reviews, 2022. **157**.
21. Rahmani R, Aliabadi M, Golmohammadi R, Babamiri M, Farhadian M, *Body physiological responses of city bus drivers subjected to noise and vibration exposure in working environment.* Heliyon, 2022. **8**(8): p. e10329.
22. Wang J, Zhang P, Wang Y, Wang H, Gao Y, Zhang Y, *Association of occupational noise exposure with hypertension: A cross-sectional study.* Journal of Clinical Hypertension (Greenwich), 2022.
23. Wu X, Li C, Zhang X, Song Y, Zhao D, Lan Y, Zhou B, *The Impact of Occupational Noise on Hypertension Risk: A Case-Control Study in Automobile Factory Personnel.* Frontiers in Cardiovascular Medicine, 2022. **9**: p. 803695.
24. Zhou B, Lan Y, Bi Y, Li C, Zhang X, Wu X, *Relationship Between Occupational Noise and Hypertension in Modern Enterprise Workers: A Case-Control Study.* International Journal of Public Health, 2022. **67**: p. 1604997.
25. Guha AK, Gokhale S, *Urban workers' cardiovascular health due to exposure to traffic-originated PM(2.5) and noise pollution in different microenvironments.* Science of the Total Environment, 2023. **859**(Pt 1): p. 160268.
26. Chiu CH, Lung SCC, Chen N, Hwang JS, Tsou MCM, *Effects of low-frequency noise from wind turbines on heart rate variability in healthy individuals.* Scientific Reports, 2021. **11**(1).
27. Roca-Barceló A, Nardocci A, de Aguiar BS, Ribeiro AG, Failla MA, Hansell AL, Cardoso MR, Piel FB, *Risk of cardiovascular mortality, stroke and coronary heart mortality associated with aircraft noise around Congonhas airport, São Paulo, Brazil: a small-area study.* Environmental Health: A Global Access Science Source, 2021. **20**(1).
28. Yankoty LI, Gamache P, Plante C, Goudreau S, Blais C, Perron S, Fournier M,

Ragettli MS, Fallah-Shorshani M, Hatzopoulou M, Liu Y, Smargiassi A, *Manuscript title: Long–term residential exposure to environmental/transportation noise and the incidence of myocardial infarction.* International Journal of Hygiene and Environmental Health, 2021. **232**.
29. Yankoty LI, Gamache P, Plante C, Goudreau S, Blais C, Perron S, Fournier M, Ragettli MS, Hatzopoulou M, Liu Y, Smargiassi A, *Relationships between long-term residential exposure to total environmental noise and stroke incidence.* Noise and Health, 2022. **24**(113): p. 33-39.
30. Andersen ZJ, Cramer J, Jørgensen JT, Dehlendorff C, Amini H, Mehta A, Cole-Hunter T, Mortensen LH, Westendorp R, So R, Li S, Hoffmann B, Loft S, Bräuner EV, Ketzel M, Hertel O, Brandt J, Jensen SS, Christensen JH, Geels C, Frohn LM, Backalarz C, Simonsen MK, Lim YH, *Long-term exposure to road traffic noise and air pollution, and incident atrial fibrillation in the Danish nurse cohort.* Environmental Health Perspectives, 2021. **129**(8).
31. Cole-Hunter T, Dehlendorff C, Amini H, Mehta A, Lim YH, Jørgensen JT, Li S, So R, Mortensen LH, Westendorp R, Hoffmann B, Bräuner EV, Ketzel M, Hertel O, Brandt J, Jensen SS, Christensen JH, Geels C, Frohn LM, Backalarz C, Simonsen MK, Loft S, Andersen ZJ, *Long-term exposure to road traffic noise and stroke incidence: a Danish Nurse Cohort study.* Environmental Health, 2021. **20**(1): p. 115.
32. Lim YH, Jørgensen JT, So R, Cole-Hunter T, Mehta AJ, Amini H, Bräuner EV, Westendorp RGJ, Liu S, Mortensen LH, Hoffmann B, Loft S, Ketzel M, Hertel O, Brandt J, Jensen SS, Backalarz C, Simonsen MK, Tasic N, Maric M, Andersen ZJ, *Long-Term Exposure to Air Pollution, Road Traffic Noise, and Heart Failure Incidence: The Danish Nurse Cohort.* Journal of the American Heart Associaton, 2021. **10**(20): p. e021436.
33. Liu S, Lim YH, Pedersen M, Jørgensen JT, Amini H, Cole-Hunter T, Mehta AJ, So R, Mortensen LH, Westendorp RGJ, Loft S, Bräuner EV, Ketzel M, Hertel O, Brandt J, Jensen SS, Christensen JH, Sigsgaard T, Geels C, Frohn L. M, Brborić M, Radonić J, Sekulic MT, Bønnelykke K, Backalarz C, Simonsen MK, Andersen ZJ, *Long-term air pollution and road traffic noise exposure and COPD: The Danish Nurse Cohort.* European Respiratory Journal, 2021. **58**(6).
34. Cole-Hunter T, So R, Amini H, Backalarz C, Brandt J, Bräuner EV, Hertel O, Jensen SS, Jørgensen JT, Ketzel M, Laursen JE, Lim YH, Loft S, Mehta A, Mortensen LH, Simonsen MK, Sisgaard T, Westendorp R, Andersen ZJ, *Long-term exposure to road traffic noise and all-cause and cause-specific mortality: a Danish Nurse Cohort study.* Science of the Total Environment, 2022. **820**: p. 153057.
35. Thacher JD, Roswall N, Damm P, Hvidtfeldt UA, Poulsen AH, Raaschou-Nielsen O, Ketzel M, Jensen SS, Frohn LM, Valencia VH, Münzel T, Sørensen M, *Transportation noise and gestational diabetes mellitus: A nationwide cohort study from Denmark.* International Journal of Hygiene and Environmental Health, 2021. **231**: p. 113652.
36. Kim CS, Grady ST, Hart JE, Laden F, VoPham T, Nguyen DD, Manson JE, James P, Forman JP, Rexrode KM, Levy JI, Peters JL, *Long-term aircraft noise exposure and risk of hypertension in the Nurses' Health Studies.* Environmental Research, 2022. **207**.
37. Nguyen DD, Whitsel EA, Wellenius GA, Levy JI, Leibler JH, Grady ST, Stewart JD, Fox MP, Collins JM, Eliot MN, Malwitz A, Manson JE, Peters JL, *Long-term aircraft noise exposure and risk of hypertension in postmenopausal women.* Environmental Research, 2023. **218**.
38. Warembourg C, Nieuwenhuijsen M, Ballester F, de Castro M, Chatzi L, Esplugues A, Heude B, Maitre L, McEachan R, Robinson O, Slama R, Sunyer J, Urquiza J, Wright J, Basagaña X, Vrijheid M, *Urban environment during early-life and blood pressure in young children.* Environment International, 2021. **146**: p. 106174.
39. Cantuaria ML, Waldorff FB, Wermuth L, Pedersen ER, Poulsen AH, Thacher JD, Raaschou-Nielsen O, Ketzel M, Khan J, Valencia VH, Schmidt JH, Sørensen M,

Residential exposure to transportation noise in Denmark and incidence of dementia: National cohort study. British Medical Journal, 2021. **374**.
40. Sørensen M, Poulsen AH, Hvidtfeldt UA, Münzel T, Thacher JD, Ketzel M, Brandt J, Christensen JH, Levin G, Raaschou-Nielsen O, *Transportation noise and risk of stroke: a nationwide prospective cohort study covering Denmark.* International Journal of Epidemiology, 2021. **50**(4): p. 1147-1156.
41. Thacher JD, Poulsen AH, Hvidtfeldt UA, Raaschou-Nielsen O, Brandt J, Geels C, Khan J, Münzel T, Sørensen M, *Long-Term Exposure to Transportation Noise and Risk for Type 2 Diabetes in a Nationwide Cohort Study from Denmark.* Environmental Health Perspectives, 2021. **129**(12): p. 127003.
42. Sørensen M, Poulsen AH, Hvidtfeldt UA, Brandt J, Frohn LM, Ketzel M, Christensen JH, Im U, Khan J, Münzel T, Raaschou-Nielsen O, *Air pollution, road traffic noise and lack of greenness and risk of type 2 diabetes: A multi-exposure prospective study covering Denmark.* Environment International, 2022. **170**: p. 107570.
43. Thacher JD, Poulsen AH, Hvidtfeldt UA, Raaschou-Nielsen O, Ketzel M, Jensen SS, Brandt J, Valencia VH, Münzel T, Sørensen M, *Long-term exposure to transportation noise and risk for atrial fibrillation: A Danish nationwide cohort study.* Environmental Research, 2022. **207**.
44. Thacher JD, Poulsen AH, Raaschou-Nielsen O, Hvidtfeldt UA, Brandt J, Christensen JH, Khan J, Levin G, Münzel T, Sørensen M, *Exposure to transportation noise and risk for cardiovascular disease in a nationwide cohort study from Denmark.* Environmental Research, 2022. **211**.
45. Klompmaker JO, Janssen NAH, Bloemsma LD, Marra M, Lebret E, Gehring U, Hoek G, *Effects of exposure to surrounding green, air pollution and traffic noise with non-accidental and cause-specific mortality in the Dutch national cohort.* Environmental Health: A Global Access Science Source, 2021. **20**(1).
46. Zuo L, Chen X, Liu M, Chen L, Xu W, Chen H, Dong S, Wei Y, Li L, Peng S, Hao G, *Road Traffic Noise, Obesity, and the Risk of Incident Type 2 Diabetes: A Cohort Study in UK Biobank.* International Journal of Public Health, 2022. **67**: p. 1605256.
47. Magnoni P, Murtas R, Russo AG, *Residential exposure to traffic-borne pollution as a risk factor for acute cardiovascular events: a population-based retrospective cohort study in a highly urbanized area.* International Journal of Epidemiology, 2021. **50**(4): p. 1160 - 1171.
48. Roswall N, Pyko A, Ögren M, Oudin A, Rosengren A, Lager A, Poulsen AH, Eriksson C, Segersson D, Rizzuto D, Andersson EM, Aasvang GM, Engström G, Jørgensen JT, Selander J, Christensen JH, Thacher J, Leander K, Overvad K, Eneroth K, Mattisson K, Barregård L, Stockfelt L, Albin M, Ketzel M, Simonsen MK, Spanne M, Raaschou-Nielsen O, Magnusson PKE, Tiittanen P, Molnar P, Ljungman P, Lanki T, Lim YH, Andersen ZJ, Pershagen G, Sørensen M, *Long-Term Exposure to Transportation Noise and Risk of Incident Stroke: A Pooled Study of Nine Scandinavian Cohorts.* Environmental Health Perspectives, 2021. **129**(10): p. 107002.
49. Pyko A, Roswall N, Ögren M, Oudin A, Rosengren A, Eriksson C, Segersson D, Rizzuto D, Andersson EM, Aasvang GM, Engström G, Gudjonsdottir H, Jørgensen JT, Selander J, Christensen JH, Brandt J, Leander K, Overvad K, Eneroth K, Mattisson K, Barregard L, Stockfelt L, Albin M, Simonsen MK, Tiittanen P, Molnar P, Ljungman P, Solvang Jensen S, Gustafsson S, Lanki T, Lim YH, Andersen ZJ, Sørensen M, Pershagen G, *Long-Term Exposure to Transportation Noise and Ischemic Heart Disease: A Pooled Analysis of Nine Scandinavian Cohorts.* Environmental Health Perspectives, 2023. **131**(1): p. 17003.
50. Herder C, Zhang S, Wolf K, Maalmi H, Bönhof GJ, Rathmann W, Schwettmann L, Thorand B, Roden M, Schneider A, Ziegler D, Peters A, *Environmental risk factors of incident distal sensorimotor polyneuropathy: Results from the prospective population-based KORA F4/FF4 study.* Science of the Total Environment, 2023. **858**(Pt 3): p. 159878.

51. Bustaffa E, Curzio O, Donzelli G, Gorini F, Linzalone N, Redini M, Bianchi F, Minichilli F, *Risk Associations between Vehicular Traffic Noise Exposure and Cardiovascular Diseases: A Residential Retrospective Cohort Study.* International Journal of Environmental Research and Public Health, 2022. **19**(16).
52. Glaubitz L, Stumme J, Lucht S, Moebus S, Schramm S, Jockwitz C, Hoffmann B, Caspers S, *Association between Long-Term Air Pollution, Chronic Traffic Noise, and Resting-State Functional Connectivity in the 1000BRAINS Study.* Environmental Health Perspectives, 2022. **130**(9).
53. Vienneau D, Saucy A, Schäffer B, Flückiger B, Tangermann L, Stafoggia M, Wunderli JM, Röösli M, for the SNC study group, *Transportation noise exposure and cardiovascular mortality: 15-years of follow-up in a nationwide prospective cohort in Switzerland.* Environment International, 2022. **158**.
54. Sørensen M, Hvidtfeldt UA, Poulsen AH, Thygesen LC, Frohn LM, Khan J, Raaschou-Nielsen O, *Long-term exposure to transportation noise and risk of type 2 diabetes: A cohort study.* Environmental Research, 2023. **217**: p. 114795.
55. Kourieh A, Giorgis-Allemand L, Bouaoun L, Lefèvre M, Champelovier P, Lambert J, Laumon B, Evrard AS, *Incident hypertension in relation to aircraft noise exposure: results of the DEBATS longitudinal study in France.* Occupational and Environmental Medicine, 2022.
56. Thacher JD, Roswall N, Lissåker C, Aasvang GM, Albin M, Andersson EM, Engström G, Eriksson C, Hvidtfeldt UA, Ketzel M, Khan J, Lanki T, Ljungman PLS, Mattisson K, Molnar P, Raaschou-Nielsen O, Oudin A, Overvad K, Petersen SB, Pershagen G, Poulsen AH, Pyko A, Rizzuto D, Rosengren A, Schioler L, Sjöström M, Stockfelt L, Tiittanen P, Sallsten G, Ögren M, Selander J, Sorensen M, *Occupational noise exposure and risk of incident stroke: a pooled study of five Scandinavian cohorts.* Occupational and Environmental Medicine, 2022. **79**(9): p. 594-601.
57. Baird A, Candy B, Flouri E, Tyler N, Hassiotis A, *The Association between Physical Environment and Externalising Problems in Typically Developing and Neurodiverse Children and Young People: A Narrative Review.* International Journal of Environmental Research and Public Health, 2023. **20**(3).
58. Chen Y, Hansell AL, Clark SN, Cai YS, *Environmental noise and health in low-middle-income-countries: A systematic review of epidemiological evidence.* Environmental Pollution, 2023. **316**: p. 120605.
59. Coon DW, Gómez-Morales A, *Modifiable Risk Factors for Brain Health and Dementia and Opportunities for Intervention: A Brief Review.* Clinical Gerontology, 2023. **46**(2): p. 143-154.
60. Dohmen M, Braat-Eggen E, Kemperman A, Hornikx M, *The Effects of Noise on Cognitive Performance and Helplessness in Childhood: A Review.* International Journal of Environmental Research and Public Health, 2022. **20**(1).
61. Fernandes A, Ubalde-López M, Yang TC, McEachan RRC, Rashid R, Maitre L, Nieuwenhuijsen MJ, Vrijheid M, *School-Based Interventions to Support Healthy Indoor and Outdoor Environments for Children: A Systematic Review.* International Journal of Environmental Research and Public Health, 2023. **20**(3).
62. Gong X, Fenech B, Blackmore C, Chen Y, Rodgers G, Gulliver J, Hansell AL, *Association between Noise Annoyance and Mental Health Outcomes: A Systematic Review and Meta-Analysis.* International Journal of Environmental Research and Public Health, 2022. **19**(5).
63. Huang L, Zhang Y, Wang Y, Lan Y, *Relationship Between Chronic Noise Exposure, Cognitive Impairment, and Degenerative Dementia: Update on the Experimental and Epidemiological Evidence and Prospects for Further Research.* Journal of Alzheimer's Disease, 2021. **79**(4): p. 1409-1427.
64. Meng L, Zhang Y, Zhang S, Jiang F, Sha L, Lan Y, Huang L, *Chronic Noise Exposure and Risk of Dementia: A Systematic Review and Dose-Response Meta-Analysis.* Frontiers in Public Health, 2022. **10**: p. 832881.
65. Rojas-Rueda D, Morales-Zamora E, Alsufyani WA, Herbst CH, AlBalawi SM, Alsukait

R, Alomran M, *Environmental Risk Factors and Health: An Umbrella Review of Meta-Analyses.* International Journal of Environmental Research and Public Health, 2021. **18**(2).
66. Terzakis ME, Dohmen M, Kamp I van, Hornikx M, *Noise Indicators Relating to Non-Auditory Health Effects in Children-A Systematic Literature Review.* International Journal of Environmental Research and Public Health, 2022. **19**(23).
67. Tortorella A, Menculini G, Moretti P, Attademo L, Balducci PM, Bernardini F, Cirimbilli F, Chieppa AG, Ghiandai N, Erfurth A, *New determinants of mental health: the role of noise pollution. A narrative review.* International Review of Psychiatry, 2022. **34**(7): p. 783-796.
68. Ventriglio A, Bellomo A, di Gioia I, Di Sabatino D, Favale D, De Berardis D, Cianconi P, *Environmental pollution and mental health: a narrative review of literature.* CNS Spectrums, 2021. **26**(1): p. 51-61.
69. Zaman M, Muslim M, Jehangir A, *Environmental noise-induced cardiovascular, metabolic and mental health disorders: a brief review.* Environmental Science and Pollution Research Int, 2022. **29**(51): p. 76485-76500.
70. Zhao YL, Qu Y, Ou YN, Zhang YR, Tan L, Yu JT, *Environmental factors and risks of cognitive impairment and dementia: A systematic review and meta-analysis.* Ageing Research Reviews, 2021. **72**: p. 101504.
71. Huang D, Tian M, Yuan L, *Do objective and subjective traffic-related pollution, physical activity and nature exposure affect mental wellbeing? Evidence from Shenzhen, China.* Science of the Total Environment, 2023. **869**: p. 161819.
72. Kwon D, Kwak K, Baek K, Chi Y, Na S, Park JT, *Association between physical hazardous agent exposure and mental health in the Korean working population: the 5th Korean Working Conditions Survey.* Annals of Occupational and Environmental Medicine, 2021. **33**: p. e33.
73. Bao WW, Xue WX, Jiang N, Huang S, Zhang SX, Zhao Y, Chen YC, Dong GH, Cai M, Chen YJ, *Exposure to road traffic noise and behavioral problems in Chinese schoolchildren: A cross-sectional study.* Science of the Total Environment, 2022. **837**: p. 155806.
74. Bloemsma LD, Wijga AH, Klompmaker JO, Hoek G, Janssen NAH, Lebret E, Brunekreef B, Gehring U, *Green space, air pollution, traffic noise and mental wellbeing throughout adolescence: Findings from the PIAMA study.* Environment International, 2022. **163**: p. 107197.
75. Essers E, Pérez-Crespo L, Foraster M, Ambrós A, Tiemeier H, Guxens M, *Environmental noise exposure and emotional, aggressive, and attention-deficit/hyperactivity disorder-related symptoms in children from two European birth cohorts.* Environment International, 2022. **158**: p. 106946.
76. Faiyetole, A.A., J.T. Sivowaku, *The effects of aircraft noise on psychosocial health.* Journal of Transport & Health, 2021. **22**: p. 1-19.
77. Gilani TA, Mir MS, *A study on road traffic noise exposure and prevalence of insomnia.* Environmental Science and Pollution Research Int, 2022. **29**(27): p. 41065-41080.
78. Gomm S, Bernauer T, *Are actual and perceived environmental conditions associated with variation in mental health?* Environmental Research, 2023. **223**: p. 115398.
79. Hao G, Zuo L, Xiong P, Chen L, Liang X, Jing C, *Associations of PM2.5 and road traffic noise with mental health: Evidence from UK Biobank.* Environmental Research, 2022. **207**: p. 112221.
80. Jigeer G, Tao W, Zhu Q, Xu X, Zhao Y, Kan H, Cai J, Xu Z, *Association of residential noise exposure with maternal anxiety and depression in late pregnancy.* Environment International, 2022. **168**: p. 107473.
81. Lan Y, Roberts H, Kwan MP, Helbich M, *Daily space-time activities, multiple environmental exposures, and anxiety symptoms: A cross-sectional mobile phone-based sensing study.* Science of the Total Environment, 2022. **834**: p. 155276.
82. Li A, Martino E, Mansour A, Bentley R, *Environmental Noise Exposure and Mental*

Health: Evidence From a Population-Based Longitudinal Study. American Journal of Preventive Medicine, 2022. **63**(2): p. e39-e48.
83. Lin JY, Cheng WJ, Wu CF, Chang TY, *Associations of road traffic noise and its frequency spectrum with prevalent depression in Taichung, Taiwan.* Frontiers in Public Health, 2023. **11**: p. 1116345.
84. Monazzam MR, Shamsipour M, Zaredar N, Bayat R, *Evaluation of the relationship between psychological distress and sleep problems with annoyance caused by exposure to environmental noise in the adult population of Tehran Metropolitan City, Iran.* Journal of Environmental Health Science and Engineering, 2022. **20**(1): p. 1-10.
85. Raess M, Valeria Maria Brentani A, Flückiger B, Ledebur de Antas de Campos B, Fink G, Röösli M, *Association between community noise and children's cognitive and behavioral development: A prospective cohort study.* Environment International, 2022. **158**: p. 106961.
86. Roberts H, Helbich M, *Multiple environmental exposures along daily mobility paths and depressive symptoms: A smartphone-based tracking study.* Environment International, 2021. **156**: p. 106635.
87. Tangermann L, Vienneau D, Hattendorf J, Saucy A, Künzli N, Schäffer B, Wunderli JM, Röösli M, *The association of road traffic noise with problem behaviour in adolescents: A cohort study.* Environmental Research, 2022. **207**: p. 112645.
88. Turunen AW, Tiittanen P, Yli-Tuomi T, Taimisto P, Lanki T, *Self-reported health in the vicinity of five wind power production areas in Finland.* Environment International, 2021. **151**: p. 106419.
89. Wang SS, Glied S, Williams S, Will B, Muennig PA, *Impact of aeroplane noise on mental and physical health: a quasi-experimental analysis.* BMJ Open, 2022. **12**(5): p. e057209.
90. Bertrais S, HÉRault N, Chastang JF, Niedhammer I, *Multiple psychosocial work exposures and well-being among employees: prospective associations from the French national Working Conditions Survey.* Scandinavian Journal of Public Health, 2022. **50**(4): p. 419-423.
91. Darabi F, Keshavarzi M, Abdullah MN, Dehghani F, Khanjani N, Yousefinejad S, Khajehnasiri F, Zamanian Z, *Evaluation of oxidative stress and biochemical biomarkers, and psychological parameters in cement plant workers.* Toxicology and Industrial Health, 2022. **38**(1): p. 29-40.