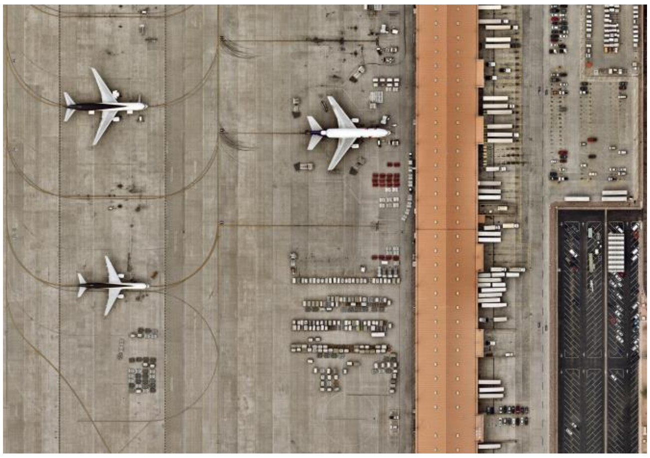

ABSTRACT

An independent review of the health effects of aircraft noise in the draft EIS and measures to protect health

Stephen Conaty * Patrick Harris^
Centre for Health Equity Training Research and Evaluation, UNSW

December 2023

ISBN: 978-1-876504-00-7

Introduction

The Western Sydney International (Nancy-Bird Walton) Airport – Airspace and flight path design, Draft Environmental Impact Statement was released for public exhibition on 24 October 2023. [1]

The Western Sydney Regional Organisation of Councils (WSROC) approached the Centre for Health Equity Training, Research and Evaluation, UNSW to independently review the health component of the EIS to guide their submission and the potential submissions of member councils.

Environmental Impact Statements are usually huge documents and this one is no exception. The size and detail create enormous challenges for members of the public, officers in councils and community organisations to grapple with the sheer volume of material, technical detail, and its interpretation. The rationale for this document is to make the job of interpretation of the EIS (at least the health parts) easier.

Our objective

Our overall objective is to review the appropriateness of the discussion of health effects of aircraft noise in the draft EIS, the measures of exposure (noise measures) chosen and their relevance for health effects, the thresholds for health concern, and proposed control and mitigation.

Our approach

We independently reviewed the literature on the health effects of aircraft noise taking as a starting point the enHealth guideline *The health effects of environmental noise*. [2] We did this because we were familiar with this document, so it was a convenient starting point. We used this to review the appropriateness of health risk assessment which is part of the EIS and is contained in *Technical Paper 12: Human health*. We then go on to comment on the noise metrics and their relevance for health, thresholds for health concern and control and mitigation to protect health.

Scope and Limitations

Our review is of the draft EIS and our consideration is limited to human health effects. The only potential risk considered is overflight aircraft noise. We do not attempt to review any other risk such as changes in air quality which are also discussed at length in the human health risk assessment. We acknowledge the special amenity considerations of overflights of bush and wilderness in the Blue Mountains, but they are not considered here. The documents assessed are limited to *Technical paper 12: Human health* and *Chapter 11: Aircraft noise* and not the entirety of EIS. There is a reliance on the information contained in the EIS and (apart from our review of the literature) no independent capacity to review or estimate new contours, additional populations, additional residences, sensitive locations other than those described in the EIS.

Independent review of evidence for health effects

enHealth review

We took as our starting point the enHealth review *Heath effects of environmental noise* [2] and updated literature searches with a specific focus on health effects of aircraft noise. The enHealth review was published in 2018 and used a series of systematic reviews to assess the strength of evidence for the relationship between environmental noise (from road traffic, rail noise, aircraft noise) and health outcomes. It was conducted at approximately the same time as a more extensive WHO Europe review. There were three health effects considered for which there was an evidence base: sleep disturbance, cardiovascular outcomes and cognitive outcomes. There was extensive literature for each. The kinds of studies that are used to examine health effects from environmental noise are almost always observational studies (i.e. studies comparing people with different levels of exposure to noise and their health effects) with the exception of some laboratory studies (sleep). The body of evidence supporting an association between environmental noise and sleep disturbance was assessed as National Health and Medical Research Council (NHMRC) Grade C (the body of evidence has limitations and care should be taken in interpretation of findings). The body of evidence supporting an association between noise and cardiovascular outcomes was assessed as NHMRC Grade C (the body of evidence has limitations and care should be taken in interpretation of findings). For the relationship between environmental noise and cognition the body of the evidence was assessed as NHMRC Grade D (the body of evidence is weak and findings cannot be trusted). Overall, summary statements in the enHealth review concluded that there was a likely causal relationship between environmental noise and sleep disturbance and environmental noise and cardiovascular outcomes and suggested thresholds of 55 dB Lnight,outside for sleep disturbance and 60 dB LAeq day, 16h for cardiovascular outcomes.

Box: What are all these noise measures?

Each type of noise measure attempts to capture some aspect of our human experience of sound or noise (unwanted sound). Nearly all measure A-weighted sound which is a weighting that reflects human sensitivity to sound, they measure across very short or long (average) time periods over different times of the day and night.

Examples

Lnight is the equivalent continuous A-weighted sound level measured in decibels (dB) at the outside of a house or a building over a specified period during the night, e.g. eight-hour period between 11 pm and 7 am (averaged over a year).

LAeq day, 16 hour is the equivalent continuous A-weighted sound level measured over a 16-hour period, typically 7 am to 11 pm.

Lden is an A-weighted average measure over a 24 hour period with a 12 hour day, a 4 hour evening, and an 8 hour night incorporating a 5 dB penalty for noise in the evening and a 10db penalty for noise at night.

LAmax -a maximum sound pressure level

Updated review of the literature

We supervised a literature review that updated the 2018 enHealth document (which during its development had commissioned systematic literature reviews completed in 2014). This report is included in Appendix 1, and covers literature between 2014 and 2023 across: sleep, CVD, annoyance, cognitive, other health concerns, and control and mitigation. There were 80 new studies included in this new review. The most relevant updates to the literature are narratively summarised here:

Sleep disturbance

Shubert, et al [3]use the LIFE-Adult cohort study in Leipzig Germany to generate relationships between Lnight (aircraft noise) and the proportion who report high sleep disturbance. The study found a much stronger relationship than WHO guidelines. At 45dB 32% of the Leipzig cohort are reporting high sleep disturbance compared to 15% for WHO. This looks to be a high-quality study and it is interesting that it is reporting a much stronger relationship between aircraft noise at night and self-reported sleep disturbance.

Smith et al update the WHO meta-analysis and similarly find a stronger relationship for the relationship between aircraft noise and sleep disturbance than previously reported. [4]

Cardiovascular outcomes

A study by Saucy et al [5] examined night-time noise exposure in the two hours preceding death for 24,886 cardiovascular deaths in Zurich and found associations between aircraft noise and mortality for Ischemic Heart Disease (IHD), Myocardial Infarction (MI), heart failure and arrythmia. This supports the biological plausibility of a relationship between aircraft noise and IHD.

Cognitive outcomes

A very thorough systematic review by Thompson, et al looks at studies in both adults and children. [6] As per the enHealth review it finds weaknesses in the literature but does find moderate support for a relationship between increasing classroom noise and reduced reading comprehension. It also finds support for a relationship between environmental noise and adult cognition.

The EIS health risk assessment of the health evidence

We look briefly below at the health effects as examined in the EIS.

Table 1: Summary of main health effects linked to aircraft noise and their treatment in the draft EIS

Health effect	*Treatment in the draft EIS*	*Quantitative exposure-response function*
Annoyance	As per 6.3.2 discusses annoyance as a reliable and accepted measure. Noise annoyance is derived from standardized surveys. There is a well-accepted relationship between increasing aircraft noise and survey reports of annoyance. By convention the proportion 'highly annoyed' in surveys is reported and a threshold for important effects is often taken to be 10% highly annoyed.	Uses the exposure response function developed by WHO review in 2018 which links Lden (a measure of noise or sound that averages across the day and evening and night) with the proportion of people who are 'highly annoyed'.
Sleep disturbance	Section 6.3.3 accepts the biological plausibility of noise induced sleep disturbance. It argues that the relationship between Lnight and %highly sleep disturbed is best for 'determining actions and outcomes'. % highly sleep disturbed is derived from surveys asking about sleep disturbance.	Uses the relationship between Lnight and the proportion reporting their sleep to be highly disturbed as per WHO 2018.
Cardiovascular outcomes	In section 6.3.4 the health risk assessment selects hospitalisations with ischaemic heart disease as the best measure available.	Uses the WHO 2018 reported relationship between noise (Lden) and hospitalisations with ischaemic heart diseases – a 9% increase for each 10 dB increase in noise (Lden)

Cognitive outcomes	The traditional concern and most of the literature is around various measures of learning in children usually derived from studies in schools. In section 6.3.5 the health risk assessment selects delay in reading and oral comprehension as the most appropriate measure.	Uses the WHO 2018 identified 1-2 month delay in reading and oral comprehension for an increase in noise of 5dB (Lden). There must be some concern around whether this is a robust relationship, but it gives readers an indication of possible health effects.

Does the EIS get the health risks right?

In general, we find the health risk assessment to be sound in that it identifies the hazard, adequately reviews the main health effects, and identifies and measures quantitative health risk using accepted relationships. The authors of the risk assessment nearly always follow the WHO guidance. The health outcomes or endpoints assessed are usefully summarised in Table 6.2 p. 100 of Technical paper 12.

Extent of harm and thresholds for unacceptable health outcomes

There are no explicit statements in the EIS that a particular noise predicted to cause a health effect at a particular level is unacceptable. The task is left to the reader to work this out. However, there are some identified threshold levels that could be argued to be thresholds for unacceptable harm.

Daytime noise

The main measures of relevance are annoyance and cognition. Concentrating on cognition, the EIS uses (as outlined above) an exposure-response function relating aircraft noise to delay in reading and oral comprehension. The body of evidence does suffer from inconsistency, and it is unclear whether there are any truly persistent effects on children's learning. However, it is certainly plausible that cumulative classroom noise may interfere with leaning. A threshold is set so that only daytime average noise above 55dB is predicted to result in any delay to reading and oral comprehension (following WHO a 1-month delay is considered negligible). This relatively high bar (55dB) seems to strike the right balance. Consequently, for almost all schools there is expected to be no reading comprehension delay even out to 2055 aircraft movements. The exceptions are University of Sydney Farms, Greendale, Mamre Anglican School, and Luddenham Public School (see appendix G of Technical paper 12: Human health). Consequently, we would expect that it is only these schools that would merit any mitigation.

Night-time noise

Western Sydney International Airport is a 7 day a week 24-hour operation and the possible harm to health from this continuous operation is one of the chief reasons for focusing carefully on night-time noise. Sleep is important for restoration, productivity and quality of life and disturbance of sleep is linked to more serious health outcomes. Sleep disturbance we consider to be the biggest threat to health.

Technical paper 12 uses as its main measure of sleep disturbance the proportion of people who are 'highly sleep disturbed' (%HSD). This is a measure derived from surveys asking questions about difficulty falling asleep, awakenings during the night and sleep disturbance. These responses are linked to exposure to aircraft noise using the annual cumulative average measure L_{night} . This is measured or calculated at the *façade of a building* from 11 pm to 7 am or 10 pm to 6 am and is a measure widely used internationally.

The other class of measures are event based. They are derived from sleep studies and measure the maximum sound pressure of the aircraft noise at the person's ear. So, these are indoor maximum noise levels of single events and the health effects measured are physiological such as awakenings, sleep stage changes, and movements during sleep.

You would hope that there is an easy and direct translation between these complementary measures, i.e. noise events that result in physiological disturbance and average or cumulative noise measures across the night. However, it is not that easy and straight-forward particularly since the physiological response are indoor measures.

Note that noise thresholds for both kinds of sleep disturbance occur at low levels. A few percent of the population report being highly sleep disturbed at noise levels that are fairly quiet and, similarly, physiological measures of sleep disturbance start to occur at low noise levels. So this is a reason to be cautious in setting any thresholds for noise goals and this is what WHO Europe did in their night noise guidelines when they set 40 db Lnight as the 'night noise guideline values recommended for the protection of public health from night noise'.

Table 2: Thresholds for sleep disturbance

Measure of sleep disturbance	*Threshold for any effect (lowest observable effect)*	*Accepted threshold / guideline level (WHO Europe)*
% highly sleep disturbed (survey report)	35 dBA Lnight	40 dB Lnight (equivalent to 11% highly sleep disturbed)
Sleep change (physiologically measured awakening or sleep stage change)	33-38 dBA Lamax [7]	LAmax 52 dBA (WHO 2009) equivalent to 3.6% probability of awakening [7]

It is important and worthwhile to consider event-based noise at night because it is potentially measuring something different. If there is a very quiet background, there may be multiple clearly audible and disturbing overflight events and yet it is possible that average noise may not exceed an average noise threshold. In addition, even in areas with high background noise (from traffic for example) noise events from ,aircraft can be distinguished. [8] It would be highly useful if an event-based metric like N60, widely used in the EIS, could be used as a threshold and we think it is logical and makes sense that a high number of overflights is likely to cause disturbance to sleep structure. Choosing a threshold for number of events needs some considered work but we would think that more than 10 events above N60 in the 11pm to 5.30 am night period may be a level we need to minimize to protect health.

Who is especially vulnerable to noise?

The Night noise guidelines for Europe discuss this. [8] They comment that children have higher awakening thresholds than adults and are often seen to be less sensitive to night noise. However, their sleep requirement is higher. Elderly people, pregnant women and people with ill health have a more fragmented sleep structure and are more vulnerable to disturbance. Shift workers are at risk because their sleep structure is already stressed.

Suite of noise measures in the EIS and their relevance to health outcomes

These noise measures or metrics are described in Table 11.2 of the EIS and are reproduced below with comments.

Table 3: Noise measures used in the EIS and their relevance for health.

Noise metric	*Description*	*Comment*
ANE	Australian Noise Exposure. A noise metric used in Australia to calculate noise exposure in areas around an	The validation and derivation of the ANE/ANEC/ANEF was based on extensive social surveys as published in the 1970s and early 1980s by Hede

	airport using the concept of an annual average day. Measurement of the aircraft noise expressed using the Effective Perceived Noise Level (EPNdB), which take account of the character (spectral, temporal and spatial) aspects of the noise. Flights between 7pm – 7am, are weighted to account for increased sensitivity of communities during periods of relaxation and sleep.	and Bullen [9] and uses a composite general response outcome and a cut-off. The measure incorporates fear of crashing, negative attitudes to airports and not just noise annoyance. Hede and Bullen considered an equal energy measure sufficient rather than incorporating any Lamax. It is not a health outcome measure and is aligned with annoyance approaches, although its different derivation and validation limits international comparability. An ANEF of 20 is equivalent to 10% of the population 'seriously affected' by aircraft noise.
ANEC	Australian Noise Exposure Concept is a forecast of aircraft noise exposure around an airport, typically to evaluate alternative operating configuration.	
ANEF	Australian Noise Exposure Forecast is an ANEC that has been reviewed and endorsed by Airservices Australia or Defence.	The only contour map with status in land use planning decisions for aircraft noise exposure.
N60	The number of overflight events in a given period at a noise level of 60 dB LAmax at an external building façade.	This is very useful illustrative measure that is relevant for sleep. The generally accepted reduction in noise from the most exposed façade to the bedroom is 20dB with windows closed and 10dB with windows open†. So 60dB outside may be 40dB which will be audible and around or just above the level or threshold where physiological sleep disturbance may occur.
N70	The number of overflight events in a given period at a noise level 70 dB L_{Amax} or above at an external building façade.	A useful illustrative measure because events above 70 dB are loud and interfere with speech, hearing and are relevant for cognitive outcomes.
LAmax	The A-weighted maximum noise level. The highest noise level which occurs from a single overflight or noise event	Useful to know especially if you have an internal bedroom goal to aim for!

Respite	Proportion of days without aircraft overflights	Although achieving respite is one of the operational aims of noise sharing this is still a relatively novel measure and a progressive measure to include. The relevance for 'health' of respite is difficult to determine as there is a limited evidence base. However, we think it is important. What is not well covered in the EIS is the importance of respite at important times such as in the evening, prior to going to sleep, or early morning.

† See Night Noise Guidelines for good discussion of variations around this. There will be considerable variation depending on position of the bedroom in relations to the exposed facade, orientation of windows, etc.

Of interest is that there is not much presentation of internationally used metrics such as Lnight. However, these are output from the models as they are necessary to generate, for example, the proportion highly sleep disturbed.

Population exposure to noise and preferred runway configuration in the EIS

This is really the crux of the EIS. The operational configuration chosen will affect the number of people potentially harmed by aircraft noise. This is well described in the EIS document and can be found in Chapter 11 – Aircraft noise. There are three runway configurations or operations:

- Planes can land from the north-east and take off to the south-west – this is called runway 23 or '23',
- Planes can land from the south-west and take off to the north-east – this is called runway '05',
- Planes can also take-off to and land from the south-west – this is called RRO and is an alternative at night when there are fewer aircraft movements.

The EIS provides in Table 11.4 outlines for seven scenarios with various mixes of the above: no preference, no preference day/RRO night, prefer 05 day/RRO night, prefer 23/RRO night, prefer 05 day and prefer RRO night, prefer 23 day and prefer RRO night, prefer 23 non-peak/no preference peak/RRO night.

In population exposure terms the EIS concludes:

- Prefer runway 23 with RRO at night results in the fewest affected (N70 metric)
- At night both prefer runway 23 and prefer runway 05 with RRO are 'operationally identical' (N60)

The populous areas to the north of the airport in St Clair and Kingswood would be less affected if there were fewer take-offs to the north hence preference for runway 23. In section 11.7.2 it notes that 'the number of night-time noise events in densely populated areas could be reduced by the use of RRO'.

Note figures 11.28 and 11.29 show fairly long extensions of N60 10-19 movement contour northwest into the Blue Mountains and south to the west of Camden using both prefer 05 with RRO and prefer 23 with RRO.

The EIS indicates a number of areas 'where the %HSD is considered to be of potential significance' and highlight Luddenham, Greendale, Silverdale, Wallacia and Kemps Creek.

Equity or fairness (about who is impacted) need to be considered. For instance, running RRO every night may be good for most but will seriously disadvantage people to the south-west of the airport such as in the Oaks, Silverdale, and Cobbitty. So balance and respite need to be brought into the equation.

Hierarchy of controls and mitigation in the EIS

Chapter 11 sections 11.3 and 11.8 outlines the approach to mitigation and management. The section outlines the four fundamental options for mitigation of aircraft noise, namely:

- Reduction of noise at source
- Land use management and planning
- Noise abatement operational procedures
- Operational restrictions

Chapter 11 makes it quite clear that the EIS is focused solely on the third dot point -i.e. noise abatement operational procedures. This includes the planning of flight paths, runway preferences, controlled descent, air traffic control procedures and the like. The main noise abatement operational procedure considered is runway use patterns. These patterns are considered throughout Technical paper 12 and other parts of the EIS and are the fundamental point of consultation. Reduction of noise at source refers to aircraft fleet characteristics and won't be in the power of WSI to change and is not considered further. Operational restrictions refer to placing 'restrictions on aircraft types and time of operation'. It is considered 'off the table' because WSI is a 7 day a week 24-hour airport and there will be no 'curfew'. Nonetheless it is important to consider effective mitigation which could and should include some respite including specific respite at night using some sort of designed noise sharing.

Noise insulation and property acquisition policy

This is a special class of mitigation and accepts that some people and properties will be so badly affected that acquisition and/or noise insulation will be the only acceptable option. The policy is based on the interim 2040 scenario and uses ANEC. The summary table is Table 11.11 which is reproduced below.

Eligibility criteria	**Metric**
Treatments for residential	ANEC 20
Acquisition within ANEC contour	ANEC 40 or case by case
Internal noise objective	50 dB LAmax
Noise level to determine level of noise treatment required	LAmax

The rationale for using the 2040 mid scenario is not very clear. It would make more sense to use the 2055 projection when the single runway is anticipated to reach capacity.

How the EIS can be improved to protect health

Take sleep seriously

As we have argued above and is consistent with the conclusions of technical paper 12 on human health the most important health impacting endpoint is sleep disturbance. There is no doubt that whatever way the airport is operated if aircraft take off and land at night-time there are going to be aircraft overflights and there are going to be many people disturbed at night. The EIS clearly and commendably documents disturbance using the measure % highly sleep disturbed. This should be complemented by an event-based threshold like N60 to identify more clearly residential areas that have severe impacts.

Remedy the mismatch between protections afforded by ANEC and health effects

Sleep disturbance is not an outcome that is adequately captured by the ANEC which is a noise exposure metric with a different derivation and purpose. Examining Figure 6.10 in Technical Report 12 there are a number of residences / receptors which lie outside 2055 ANEC composite and are considered to be 'highly sleep disturbed'. Figure 6.11 and 6.12 also illustrate that this is the case for % highly annoyed and reading delay in children.

Flight respite needs to be rethought and presented differently

Flight respite is a very important consideration that will have a real bearing on people's amenity and health. Although it is difficult to find high quality evidence that supports 'respite' as being health protective, there are some studies and we think there is good reason to believe it is important. The EIS provides commendable detail about the proportion of people at any one location with no flight movements. However, respite may be important at different times of the day and night such as in the late evening when people are trying to fall asleep or in the early hours of the morning when people are resting deeply. There is no discussion of this and no data that can be used to determine this.

Length of night is arbitrary and irregular

Defining the nighttime period as from 11 p.m. to 5.30 a.m. is inadequate. 6.5 hours is inadequate for sleep for most adults. The standard international measure is Lnight which is an 8-hour measure usually from 11pm -7am. Defining the night in this way minimizes the count of overflight events at night. Data should be represented for an 8-hour nighttime period.

Precautionary principle

A major challenge facing the airport is the 24-hour operation. We recommend that the precautionary principle be the standard consideration for all decision making (i.e. to adopt the strictest measures even in the absence of evidence). Further, we recommend that the EIS includes a recommendation for ongoing investment in monitoring and evaluation, supported by taking action where this is found to be required, across the life of the airport.

[i]Disclaimer

The views in this document are the authors' opinions and do not represent the views of their organisations.

Acknowledgements

Thanks to Kunza Rehman, MIPH student from UNSW, who conducted the literature review, Andrew Reid (CHETRE) who assisted in supervision, Alex Morabito, Marshall Day Acoustics who reviewed our use of noise metrics.

Appendix

Updated literature review (attached).

References

1. Commonwealth of Australia: **Western Sydney International (Nancy-Bird Walton) Airport - Airspace and flight path design draft environmental impact statement**. Department of Infrastructure, Transport, Regional Development, Communication and the Arts. Canberra: Commonwealth of Australia; 2023.
2. Commonwealth of Australia: **enHealth guidance - The health effects of environmental noise**. Department of Health. Canberra; 2018.

3. Schubert M, Romero Starke K, Gerlach J, Reusche M, Kaboth P, Schmidt W, Friedemann D, Hegewald J, Zeeb H, Zulke A *et al*: **Traffic-Related High Sleep Disturbance in the LIFE-Adult Cohort Study: A Comparison to the WHO Exposure-Response-Curves**. *Int J Environ Res Public Health* 2023, **20**(6).
4. Smith MG, Cordoza M, Basner M: **Environmental Noise and Effects on Sleep: An Update to the WHO Systematic Review and Meta-Analysis**. *Environ Health Perspect* 2022, **130**(7):76001.
5. Saucy A, Schäffer B, Tangermann L, Vienneau D, Wunderli J-M, Röösli M: **Does night-time aircraft noise trigger mortality? A case-crossover study on 24 886 cardiovascular deaths**. *European Heart Journal* 2020, **42**(8):835-843.
6. Thompson R, Smith RB, Bou Karim Y, Shen C, Drummond K, Teng C, Toledano MB: **Noise pollution and human cognition: An updated systematic review and meta-analysis of recent evidence**. *Environ Int* 2022, **158**:106905.
7. Basner M, McGuire S: **WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Effects on Sleep**. *Int J Environ Res Public Health* 2018, **15**(3).
8. World Heath Organization: **Night Noise Guidelines for Europe**. Copenhagen: WHO Regional Office for Europe; 2009.
9. Hede AJ, Bullen, R.B.: **Aircraft noise in Australia: a survey of community reaction**. National Acoustics Laboratory*.* Canberra; 1982.

APPENDIX

* Stephen Conaty is a Public Health Physician working at South Western Sydney Local Health District

^ Patrick Harris is Acting Director of the Centre for Health Equity, Training, Research and Evaluation (CHETRE), UNSW

<u>Adverse Health Effects of Aircraft Noise – Internship Report</u>

Introduction

Airports are integral to the economic development of a country, and can be seen as major trade, tourism, commercial, transport and employment hubs (de Leeuw et al. 2018). However, the noise generated by aircrafts landing, taking-off and increased overflights has become a major concern for environmental noise pollution (Smith et al. 2022). Thus, with a growing population within Sydney and increasing urban developments, more people are exposed to aircraft noise thereby posing detrimental effects on their health.

It is granted that experiencing a level of noise from either residential, occupational or commercial space is evident, however, chronic exposure to noise can activate the autonomous nervous system and endocrine signalling (Münzel et al., 2018; Kim et al. 2022). Chronic low levels of noise can cause sleep disturbances and communication, thereby triggering subsequent stress and lead to adverse health effects such as sleep, annoyance, cardiovascular diseases and affecting cognitive function (Münzel et al. 2018).

This report aims to summarise and update literature surrounding health effects from aircraft noise following the 2014 Enhealth Guidance that informs noise policy and regulation in Australia. Additionally, it will also highlight suggest approaches and areas for control and mitigation

<u>Scope</u>

This report will evaluate, and review data published between 2014 to 2023 to update the EnHealth Guidance focusing on the association of aircraft noise on relevant human health outcomes including, sleep disturbances, risk of cardiovascular diseases, cognitive function and annoyance. As the previous guidance included all types of environmental noises that may affect health, this report will primarily focus on aircraft noise.

The literature was searched using Medicine and Health databases including PubMed, Scopus and MEDLINE. Other internet searches to review current and primary studies as part of "Grey Literature" were not captured in our database search. The search terms that were used were "Adverse effects of aircraft noise" and "Adverse effects of aircraft noise – prevention and control".

The inclusion and exclusion criteria of the literature is described within the PRISMA flowchart in *figure 1*. Studies were mainly excluded if they were an animal study, did not provide reliable estimates of aircraft noise exposure, grey literature or the results were integrated with road traffic and railway noise. The number of studies surrounding specific health topics was broken into 6 categories sleep, CVD, annoyance, cognitive, other health concerns and control & mitigation in *figure 2.*

Figure 1: PRISMA Flowchart: Number of articles identified and included

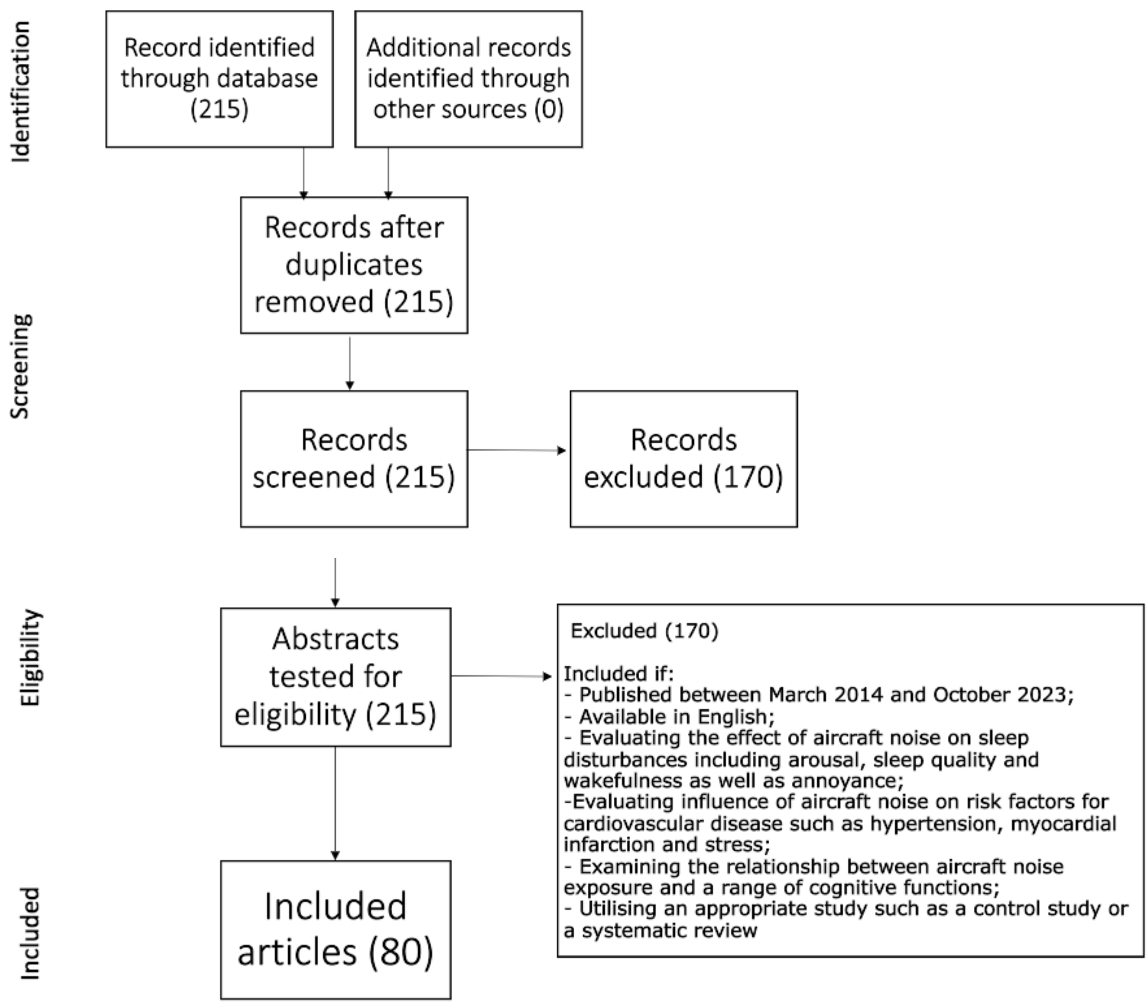

Figure 2: Number of literatures for specific health concerns as a result of aircraft noise

Health Effect/Focus	**Quantity**
Sleep	17
CVD	27
Annoyance	21
Cognitive	6
Other (Type 2 diabetes, Mental Health, Birth)	7
Control and Mitigation	13

<u>Boundaries</u>

Some key limitations while reviewing literature surrounding the health effects of aircraft noise on the population was limitations to the evidence base. This is because for some categories such as sleep and annoyance, most of the literature included self-reported studies with less studies utilising physiological methods such as the measurement of heart rate and body movements. Additionally, variation in study designs, varying noise measures, site of noise exposure assessment and varying confounding variables that are controlled added to the boundaries of conducting a literature search.

Expected Outcomes

Nonetheless, as the Enhealth Guidance was published in 2014, almost 10 years ago, and the growing urbanisation in Sydney, it was important to review current literature surrounding the effect of aircraft noise. Furthermore, the development of a new airport, Western Sydney Airport in Badgery's Creek holds lots of exciting opportunities for the economic development of Australia and opportunities for surrounding communities. Yet, the exposure to a third airport in Sydney may warrant populations exposed to further environmental noises.

Background information

This research was done as part of the Centre for Health Equity Training, Research and Evaluation (CHETRE). As CHETRE's mission is to 'co-create intelligence for better health', with focus around and beyond South-Western Sydney, they are a team that aims to provide leadership and expertise in training, research and evaluation for health equity. Their main work is structure into three streams; Decision support, Local Disadvantage and the Indigenous Health Stream. This is supported by partnerships with state government agencies, South-Western Sydney Local Health District and community organisations.

Project Alignment with CHETRE

CHETRE's Decision Support Stream closely correlates with the research conducted within this report as this stream assesses the impacts of environmental, social, economic and policy change (proposals) on health and health equity (CHETRE, 2018). This report closely focuses on the current findings regarding the health of affected populations as a means to help assess the impact of the development of the new Western Sydney Airport on health equity. Throughout the report's findings, there has been evidence of aircraft noise affecting susceptible groups such as young children, elderly people and women. This is integral to assessing the impact of environmental and economic policy changes on health and health equity as it is our responsibility that the health of all individuals irrespective of age, sex, location and nationality must be considered.

Research and Empirical findings

The literature search conducted was compared to the key findings within the Enhealth Guidance as well as the Western Sydney Airport's Draft Environmental Impact Statement (EIS). This is in the form of a summarised table of all these findings seen in figure 3 in the appendix. This was used as a submission of a report for CHETRE.

Analysis and critical evaluation

This section of the report will evaluate the types of changes that can be implemented to limit the effects on health due to aircraft exposure reference in figure 3.

Suggested Approaches

Aircraft noise exposure is mainly during the departing and approaching of aircrafts for residents living in close vicinity to airports (Pieren et al. 2019). With pre-existing airports, control and mitigation efforts should focus on by managing the acceptance of the airport as a neighbour, noise annoyance at an acceptable level of burden for some residents, implementation of residental green and changes to noise mitigations. Currently, there are limited studies regarding the use of psychological interventions to reduce the reactivity of residents to environmental noise. Therefore, the use of mindfulness has been increasingly attractive when viewing aircraft noise as a negative perception of aircraft may alter the resident's reactive experiences that can affect pre-existing health conditions they may have. Hede explains the mindfulness process as the key efficacy mechanism potentially responsible to reduce reactivity to aircraft noise, in addition to existing mitigation measures (Hede, 2017). Further mitigation efforts include compensation for those who are disadvantaged by the noise distribution including noise insulation via soundproofing windows & wall insulations and reducing indoor sound levels irrespective of the noise source (Vos & Heuben, 2022; Hauptvogel et al. 2021)

Another method for noise control is 'noise respite'. This idea involves variable flight paths enabling residents to experience noise-free times, while other residents experience more noise at the same time and therefore, equally distributes noise throughout the community. This has been introduced in the vicinity of Heathrow airport and Frankfurt airport with temporary closure of two runways hours immediately before and after the night (Hauptvogel et al. 2021). This allowed residents to feel relieved rather than burdened between the hours of 11pm to 5am. (Quehl et al. 2017).nThe importance of flight paths following accurate pathways is necessary for greater control over noise distribution (Hauptvogel et al. 2021; Scatolini & Alves, 2016). As there was an initial 2-week diversion of a flight pattern known as the 'TNNIS Climb' in 2012 due to the U.S Open Tennis matches which was then sustained over a year, studies found an increase in efficiency. However, the automation of flight paths such as the TNNIS Climb may generate flight paths over densely populated neighbourhoods causing serious health conditions (Zafari et al. 2018). Additionally, altering weather conditions may affect the perception of aircraft noise as the weather-dependent differences of A-weighted sound pressure levels are up to 15 dB(A) (Dreier & Vorlander, 2021).

Part of land-use planning should focus on residential green, availability of neighbourhood green spaces and moving water as a means to reduce aircraft noise annoyance. Studies found the soundscape quality of land was improved with the presence of vegetation and moving water as moving water can reduce the saliency of aircraft noise passing over land significantly (Lugten et al. 2018). On the other hand, increasing residential green spaces with vegetation reduced road traffic and railway noise but increased aircraft noise annoyance. Thus, a combination of moving water with accessibility of green spaces and visible vegetation in cities and green spaces in rural areas may reduce the overall annoyance (Schaffer et al. 2020). It is also important to note that the dissatisfaction of living within unaesthetically pleasing environments with inconvenient access to workplace was found to affect annoyance due to aircraft noise while dissatisfaction of greenery within an environment reportedly affected sleep quality (Trieu et al. 2021).

Nonetheless, current literature believes community reactions to transportation noise permits a systematic rationale for aircraft noise regulation (Fidell et al. 2014). Otherwise, more comprehensive quasi-experimental and economic analyses are necessary for aircraft mitigation as the most financially burdening option of building airports far from highly populated areas with high-speed transit is met with a cost of mitigation of billions of dollars (Wang et al. 2022).

<u>Gaps for affected populations</u>

It is important note that the study conducted by Simon et al., reported communities with lower socioeconomic status as well as a higher prevalence of racial minority populations were more often exposed to environmental pollutants. There is limited literature surrounding how aircraft noise exposures are socio-demographically patterned, however, the study reported DNL noise exposures above 45-55 dB(A) were positively associated with groups that have a higher percentage of socially vulnerable population, while there was substantial heterogeneity in these associations. Despite this, this may not be the case for airports internationally, but this study provides a valuable insight for local policy makers (Simon et al. 2022).

Residents surrounding the vicinity of the airport are not the only affected population, rather aircraft operators and workers may be affected too. Concerning reports regarding on- and off-duty airport workers were met with immediate acoustic trauma as without any auditory rest, this could result in permanent hearing loss. For instance, a threshold limit value set by the American Conference of Governmental Industrial Hygienists (ACGIH) of 80 dB(A) for 24-hour noise exposure was exceeded by 93% of study participants (Schaal et al. 2019). Similarly, pregnant workers may be at risk of aircraft flight and require partnership with aerospace medical & antenatal care providers and the aircraft organisation (Story et al. 2022).

Areas for further research

In summary, it is necessary that land-use planning must account for schools located near airports as schools near airports do not provide health learning environments as the exposure to noise exceeds WHO recommended levels for school playgrounds (Seabi et al. 2015).

The Introduction of a curfew or respite is worth considering due to the influence of aircraft on sleep, annoyance and hypertension of the surrounding population and workers as well as the cognitive impairment potential on young children evident. Similarly, a change in flight paths to distribute noise in combination with structural changes such assisted double glazed windows and doors may help mitigate the exposure to aircraft noise.

To conclude, this report provides an overview of the recent literature surrounding key health effects of aircraft noise exposure as well as grounds for further research into additional health effects including type 2 diabetes.

Appendix

Figure 3: Updated Evidence of Health Effects

Health Effect	Enhealth Guidance	Updated Evidence	EIS
Sleep	Exposure to aircraft noise is closely related to a range of sleep disturbances including increased arousals, insomnia symptoms and poorer self-reported sleep quality. Changes to sleep are apparent at maximum sound pressure levels > 50 dB for awakenings, > 55 dB for increased stage 1 light sleep and > 65 dB for a decreased slow wave sleep.	<u>Highly sleep disturbed</u> Significance in highly disturbed sleep with a 10 dB(A) increase in L_{night} (Basner & McGuire, 2018) Higher probability and strong association of sleep disturbances at night with high L_{night} levels (Smith et al., 2022; Rocha et al. 2019) Prevalence of sleep disturbance was 2.61-fold higher in the low exposure group and 3.52-fold higher in the high exposure group than control groups (Kim et al. 2014) Highest risk for noise-related high sleep disturbances is aircraft noises with a 10 dB(A) increase. (Schubert et al. 2023) Proportion of highly sleep disturbed individuals is greater than WHO environmental noise guidelines for the European region risk-exposure curves. (Schubert et al. 2023)	WHO identified a threshold for effects on sleep disturbances which ranged from 40 – 42 dB (A) as L_{night} outside. Section 6.3.3 Sleep disturbance

		<u>Awakening</u> Significant increased probability of awakening for a 10 dB(A) increase in indoor L_{max} (Basner & Mcguire, 2018; Basner et al., 2019) Increased feeling of tiredness with an increase in 10 dB(A) of aircraft noise levels at night (Nassur et al. 2019) Increased self-reported awakenings with maximum aircraft noise levels during sleeping periods (Smith et al. 2020; Rocha et al. 2019) <u>Sleep Disorders</u> Strong association between aircraft noise levels and sleep disorders (Carugno et al. 2018) Reports of insomnia and daytime hypersomnia were approximately 3 times higher in the exposure group than the control group (Kwak et al. 2016). Increased exposure to aircraft DNL noise levels above 55 dB(A) were associated with significant increases in insomnia in children aged 5–17-year-olds (Wang et al. 2022). <u>Duration of sleep & sleep quality</u> Significant association of L_{night} with lower sleep quality & difficulty falling asleep (Rocha et al. 2019) Decrease in overall amount and quality of sleep with an increase of 10 dB(A) L_{night} (Nassur et al. 2019) When L_{night} and DNL ≥ 45 dB(A), 23% increase in shorter sleep duration (Bozigar et al. 2023).	

Annoyance	Annoyance is seen as a potential mediator linking environmental noise exposure to health effects such as hypertension, sleep disturbances and affected cognitive function.	There is a significant association between annoyance from aircraft noise and hypertension risk, where the association between aircraft noise levels and hypertension risk was higher in highly annoyed individuals at an increase of 10 dB(A) L_{night} (Baudin et al. 2020). Adults' probability of moderate to high annoyance increased as the number of aircraft events increased overnight (Quehl et al. 2021) Noise annoyance is strongly associated with mental distress and is a risk factor for sleep disturbances (Beutel et al. 2020). Residents surrounding airports have a significant relationship between annoyance and aircraft exposure as most reported elevated annoyance while those in regions even closer to the airport had twice the proportion of severely annoyed individuals (Baudin et al. 2018; Yokoshima et al. 2021; Carugno et al.2018). Similarly, the portion of highly annoyed participants near airports increased from 8% when noise levels were below 50 dB(A) to 31% when above 60 dB(A) (Lefevre et al. 2020; Welch et al. 2018; Hahad et al. 2018; Hahad et al. 2022).	WHO evaluation of annoyance reported the quality of the evidence for an association between aircraft noise and % HA (percentage of population that is highly annoyed) was moderate. Annoyance is deemed as a less serious health effect than sleep disturbances. Thus, WHO has determined the risk of annoyance to be 10%HA – 10% of the population that is highly annoyed. To be health protective, the absolute risk of aircraft exposure must be close to or below 10% HA. Section 6.3.2

		Risk groups Non-acoustical factors such as noise sensitivity, insulation capacity or attitude to aircraft as “dangerous” significantly impacted the short-term annoyance of children. Children chronically exposed to aircraft noise are also significantly highly annoyed than children in low aircraft settings (Quehl et al. 2021; Nguyen et al. 2020; Weidenfeld et al. 2021). More than 40% of children in school were exposed to more than 55 dB(A) of aircraft noise (Klatte et al. 2017). Women, younger adults and individuals with lower socio-economic status are more susceptible to noise annoyance (Beutel et al. 2020)	

		<u>Changes in flight paths</u> Following a nighttime curfew (11pm – 5am), they found a statistically significant rise in the portion of annoyed subjects with increasing number of flights (Quehl et al. 2017). With a new development of a terminal, the aircraft noise levels L_{den} had a significant increase in annoyance levels (Nguyen et al. 2018). Meanwhile, a study following a sudden decline in noise exposure to a COVID-19 lockdown saw a significant decrease in noise annoyance (Wojciechowska et al. 2022). There have been strict criticisms of the method used for the WHO recommendation of exposure to aircraft noise limited to L_{den} 45 dB(A) to avoid adverse health effects using a prevalence rate of 10% highly annoyed, and instead should be 54 dB(A) (Gjestland 2020). Similarly, the proportion of highly annoyed individuals affected by aircraft noise has been higher than the WHO curve (Starke et al. 2023). While the percentage of highly annoyed people exposed to aircraft noise in Vietnam are almost identical to the European Noise Directive (Gjestland et al. 2015). Closed windows and high-quality windows are a helpful subjective corresponding tool against annoyance and is an important barrier against aircraft noise (Preiseindörfer et al. 2022).	

CVD	Exposure to types of environmental noise such as aircraft noise is linked with a greater risk of cardiovascular disease (CVD) and changes in indicators of cardiovascular health such as blood pressure and heart rate. Consistent findings regarding the effect of aircraft noise, however, the magnitude of associations was small. This is not surprising as environmental noise can be one of many risk factors for CVDs.	<u>Hypertension</u> Increase in aircraft noise levels both day and night were associated with a higher incidence of hypertension (Kourieh et al. 2022) Nighttime exposure is associated with an increase in blood pressure, with studies showing its effects on airport shift workers and nurses (Munzel et al. 2018; Rizk et al. 2016; Kim et al. 2022, Dimakopoulou et al. 2017) For every 10 dB(A) increase in nighttime aircraft exposure, risk for blood pressure increase (Evrard et al. 2018; Itzkowitz et al. 2023; Zeeb et al. 2017). Long-term aircraft noise exposure may increase prevalence of hypertension and accelerate arterial stiffening (Wojciechowksa et al. 2022; Rojek et al. 2019). Some studies found no relationship between aircraft noise and blood pressure levels or prevalence with hypertension, despite using differing noise measures to L_{den}. (Carugno et al. 2018) However, elevated risk among certain subgroups such as lower population density was evident (Nguyen et al. 2023). Residents near airports with noise levels above 55 dB(A) were diagnosed with hypertension and acute MI (Ancona et al. 2014), or increased cases of atrial fibrillation than when compared to levels less than 45 dB(A) (Thacher et al. 2022).	There is sufficient evidence of a causal relationship between exposure to environmental noise and CVD outcomes. They reported a summary of the strength of evidence for cardiovascular effects in available studies as limited evidence for hypertension in children, insufficient evidence for stroke and insufficient evidence in relation to aircraft noise for Myocardial infarction. See section 6.3.4

		<u>Endothelial dysfunction</u> Nighttime aircraft exposure can induce endothelial dysfunction in healthy individuals more evidently than coronary artery disease patients; (Munzel et al. 2018). The impairment of endothelial function in patients as a result of nighttime aircraft noise has increased systolic blood pressure by almost 4 mmHg (Schmidt et al. 2015) <u>Stroke</u> Both daytime and nighttime aircraft exposure above 55 dB(A) have a significantly increased risk for stroke hospitalisations (Hansell et al. 2013). With an increase of 10 dB(A) Lden, there is a 1.3% increase in the risk of stroke for each additional 10dB of aircraft noise (Weihofen et al. 2019)	

		<u>Myocardial Infarction & cardiovascular diseases</u> Night-time aircraft noise can trigger cute cardiovascular mortality and associations with MI, arrhythmia, ischaemic heart diseases and heart failure. (Saucy et al. 2021; Dimakopoulou et al. 2017). Positive associations between noise levels Lden of major airports in France with cardiovascular disease, coronary heart disease and MI (Evrard et al. 2020) Nighttime exposure to aircraft noise affects cardiac function (diastolic dysfunction) with higher number of noise events (Schmidt et al. 2021). Aircraft noise affects MI and CVD hospital admissions (Stansfield 2015, Thacher et al. 2022) However, after a 6-day closure of a London Heathrow airport, there was no significant reduction of emergency department CVD-related admissions (Pearson et al. 2016). Increase in cardiovascular admissions following an increase in aircraft noise over a year (Wang et al. 2022) Sleep disturbances associated with nighttime are risk factors for cardiovascular diseases (Peters et al. 2018)	

Cognitive	Plausible relationship between environmental noise and cognitive performance. Also, it is plausible that environmental noise has an indirect effect on cognition through disturbed sleep. Limited studies (only 2) noting no significant association of aircraft noise with cognitive performance.	High quality evidence for an association between environmental noise and cognitive impairment in middle-to-older adults (Thompson et al. 2021) Moderate quality evidence for an association between aircraft noise and reading & language in children, poorer long-term memory as well as with executive functioning in children (Thompson et al. 2021; Katerina & Paunivoc, 2018) Aircraft noise negatively impacts learners' reading comprehension, low reading & reasoning scores sustained overtime after chronic exposure (Seabi et al. 2015; Baek et al. 2023) Following the relocation of an airport in Munich, high exposure to aircraft noise was associated with cognitive impairment including long-term memory and reading comprehension of 10-year-old-children were no longer present, suggesting effects of noise on cognitive function can be reversed (Stansfield & Clark, 2015) Aircraft noise was associated with decreased school ranking of 8–11-year-old children (Sharp et al. 2014)	Evidence for effects of noise on cognitive performance in children, particularly lower reading performance. Exposure-response relationship identified by WHO is a 1–2-month delay in reading and oral comprehension per 5db increase in Lden. Insufficient evidence of effects on cognitive learning and memory in adults and mental health. See section 6.3.5

Other		Suggestive evidence for an association between aircraft noise and birth outcomes including pre-term birth, low birth weight and congenital abnormalities (Nieuwenhuijsen et al. 2017) Strong evidence of a negative mental health effect of perceived residential noise including aircraft noise (Li et al. 2022). The lack of evidence regarding the mental health and wellbeing domain does not mean there is no evidence, rather, studies of these health effects are unable to account for individual's history of mental health or ability to cope which can over-simplify the relationship between aircraft noise and mental health (Clark & Paunovic, 2018) A 5-dB(A) increase in aircraft noise was associated with greater increase in waist circumference of 1.51 cm (Eriksson et al. 2014; Potera 2014). Aircraft noise exposure ≥ 45 dB (A) was associated with 1-4% more likelihood of type 2 diabetes than those who are unexposed. Further studies should include diabetes when evaluating the burden of disease as a result of aircraft noise (Thacher et al. 2021) Aircraft noise stimulates the release of cortisol, a stress hormone that contributes to obesity measured using waist circumference (Potera, 2014). Statistically significant increases in evening cortisol levels in women with a 10 dB(A) increase in aircraft noise exposure in LAeq, L_{den}& L_{night} (Baudin et al. 2019)	

References

1. Aboud Kourieh, Giorgis-Allemand, L., Liacine Bouaoun, Lefèvre, M., Champelovier, P., Lambert, J., Laumon, B., & Evrard, A.-S. (2022). Incident hypertension in relation to aircraft noise exposure: results of the DEBATS longitudinal study in France. *Occupational and Environmental Medicine*, *79*(4), 268–276. https://doi.org/10.1136/oemed-2021-107921
2. *About Us*. (n.d.). CHETRE. Retrieved December 4, 2023, from https://chetre.org/about-us/
3. Ancona, C., Golini, M. N., Mataloni, F., Camerino, D., Chiusolo, M., Licitra, G., Ottino, M., Pisani, S., Cestari, L., Vigotti, M. A., Davoli, M., Forastiere, F., Gruppo di lavoro SERA, & Gruppo di lavoro SERA. (2014). [Health impact assessment of airport noise on people living nearby six Italian airports]. *Epidemiologia E Prevenzione*, *38*(3-4), 227–236. https://pubmed.ncbi.nlm.nih.gov/25115475/
4. Bach Lien Trieu, Nguyen, T. D., Yasuhiro Hiraguri, Morinaga, M., & Morihara, T. (2021). *How Does a Community Respond to Changes in Aircraft Noise? A Comparison of Two Surveys Conducted 11 Years Apart in Ho Chi Minh City*. *18*(8), 4307–4307. https://doi.org/10.3390/ijerph18084307Baek, K., Park, C., & Sakong, J. (2023). The Impact of Aircraft Noise on the Cognitive Function of Elementary School Students in Korea. *Noise & Health*, *25*(117), 83–91. https://doi.org/10.4103/nah.nah_71_22
5. Basner, M., Clark, C., Hansell, A., Hileman, J. I., Janssen, S., Shepherd, K., & Sparrow, V. (2017). Aviation Noise Impacts: State of the Science. *Noise & Health*, *19*(87), 41–50. https://doi.org/10.4103/nah.NAH_104_16
6. Basner, M., & McGuire, S. (2018). WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Effects on

Sleep. *International Journal of Environmental Research and Public Health*, *15*(3), 519. https://doi.org/10.3390/ijerph15030519

7. Basner, M., Witte, M., & McGuire, S. (2019). Aircraft Noise Effects on Sleep—Results of a Pilot Study Near Philadelphia International Airport. *International Journal of Environmental Research and Public Health*, *16*(17). https://doi.org/10.3390/ijerph16173178
8. Baudin, C., Lefèvre, M., Babisch, W., Cadum, E., Champelovier, P., Dimakopoulou, K., Houthuijs, D., Lambert, J., Laumon, B., Pershagen, G., Stansfeld, S., Velonaki, V., Hansell, A., & Evrard, A.-S. (2020). The role of aircraft noise annoyance and noise sensitivity in the association between aircraft noise levels and hypertension risk: Results of a pooled analysis from seven European countries. *Environmental Research*, *191*, 110179. https://doi.org/10.1016/j.envres.2020.110179
9. Baudin, C., Lefèvre, M., Champelovier, P., Lambert, J., Laumon, B., & Evrard, A.-S. (2018). Aircraft Noise and Psychological Ill-Health: The Results of a Cross-Sectional Study in France. *International Journal of Environmental Research and Public Health*, *15*(8), 1642. https://doi.org/10.3390/ijerph15081642
10. Baudin, C., Lefèvre, M., Selander, J., Babisch, W., Cadum, E., Carlier, M.-C., Champelovier, P., Dimakopoulou, K., Huithuijs, D., Lambert, J., Laumon, B., Pershagen, G., Theorell, T., Velonaki, V., Hansell, A., & Evrard, A.-S. (2019). Saliva cortisol in relation to aircraft noise exposure: pooled-analysis results from seven European countries. *Environmental Health*, *18*(1). https://doi.org/10.1186/s12940-019-0540-0
11. Beutel, M. E., Brähler, E., Ernst, M., Klein, E., Reiner, I., Wiltink, J., Michal, M., Wild, P. S., Schulz, A., Münzel, T., Hahad, O., König, J., Lackner, K. J., Pfeiffer, N., & Tibubos, A. N. (2020). Noise annoyance predicts symptoms of depression, anxiety and sleep disturbance 5 years later. Findings from the Gutenberg Health Study. *European Journal of Public Health*. https://doi.org/10.1093/eurpub/ckaa015

12. Bozigar, M., Huang, T., Redline, S., Hart, J. E., Grady, S. T., Nguyen, D. D., James, P., Nicholas, B., Levy, J. I., Laden, F., & Peters, J. L. (2023). Associations between Aircraft Noise Exposure and Self-Reported Sleep Duration and Quality in the United States-Based Prospective Nurses' Health Study Cohort. *Environmental Health Perspectives*, *131*(4), 47010–47010. https://doi.org/10.1289/ehp10959
13. Brink, Schäffer, Vienneau, Pieren, Foraster, Eze, Rudzik, Thiesse, Cajochen, Probst-Hensch, Röösli, & Wunderli. (2019). Self-Reported Sleep Disturbance from Road, Rail and Aircraft Noise: Exposure-Response Relationships and Effect Modifiers in the SiRENE Study. *International Journal of Environmental Research and Public Health*, *16*(21), 4186. https://doi.org/10.3390/ijerph16214186
14. Carugno, M., Imbrogno, P., Zucchi, A., Ciampichini, R., Tereanu, C., Sampietro, G., Giorgio Barbaglio, Pesenti, B., Barretta, F., Pier Alberto Bertazzi, Angela Cecilia Pesatori, & Consonni, D. (2018). *Effects of aircraft noise on annoyance, sleep disorders, and blood pressure among adult residents near the Orio al Serio International Airport (BGY), Italy. 109*(4), 253–263. https://doi.org/10.23749/mdl.v109i4.7271
15. Clark, C., & Paunovic, K. (2018a). WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Cognition. *International Journal of Environmental Research and Public Health*, *15*(2), 285. https://doi.org/10.3390/ijerph15020285
16. Clark, C., & Paunovic, K. (2018b). 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*, *15*(11), 2400. https://doi.org/10.3390/ijerph15112400
17. Dimakopoulou, K., Koutentakis, K., Papageorgiou, I., Kasdagli, M.-I., Haralabidis, A. S., Sourtzi, P., Samoli, E., Houthuijs, D., Swart, W., Hansell, A. L., & Katsouyanni, K. (2017). Is aircraft noise exposure associated with cardiovascular disease and hypertension? Results from a cohort study in Athens, Greece. *Occupational and*

Environmental Medicine, *74*(11), 830–837. https://doi.org/10.1136/oemed-2016-104180

18. Douglas, O., & Murphy, E. (2016). Source-based subjective responses to sleep disturbance from transportation noise. *Environment International*, *92-93*, 450–456. https://doi.org/10.1016/j.envint.2016.04.030
19. Dreier, C., & Vorländer, M. (2021). Aircraft noise—Auralization-based assessment of weather-dependent effects on loudness and sharpness. *Journal of the Acoustical Society of America*, *149*(5), 3565–3575. https://doi.org/10.1121/10.0005040
20. Eriksson, C., Hilding, A., Pyko, A., Bluhm, G., Pershagen, G., & Östenson, C.-G. (2014). Long-Term Aircraft Noise Exposure and Body Mass Index, Waist Circumference, and Type 2 Diabetes: A Prospective Study. *Environmental Health Perspectives*, *122*(7), 687–694. https://doi.org/10.1289/ehp.1307115
21. Evrard, A.-S., Bouaoun, L., Champelovier, P., Lambert, J., & Laumon, B. (2015). Does exposure to aircraft noise increase the mortality from cardiovascular disease in the population living in the vicinity of airports? Results of an ecological study in France. *Noise and Health*, *17*(78), 328. https://doi.org/10.4103/1463-1741.165058
22. Evrard, A.-S., Lefèvre, M., Champelovier, P., Lambert, J., & Laumon, B. (2016). Does aircraft noise exposure increase the risk of hypertension in the population living near airports in France? *Occupational and Environmental Medicine*, *74*(2), 123–129. https://doi.org/10.1136/oemed-2016-103648
23. Fidell, S., Mestre, V., Schomer, P., Horonjeff, R., & Reid, T. (2014). A systematic rationale for defining the significance of aircraft noise impacts. *The Journal of the Acoustical Society of America*, *136*(3), 1129–1138. https://doi.org/10.1121/1.4892933
24. Gjestland, T. (2020). Recent World Health Organization regulatory recommendations are not supported by existing evidence. *The Journal of the Acoustical Society of America*, *148*(2), 511. https://doi.org/10.1121/10.0001643
25. Gjestland, T., Nguyen, T. L., & Yano, T. (2015). Community response to noise in Vietnam: exposure-response relationships based on the community tolerance level.

The Journal of the Acoustical Society of America, *137*(5), 2596–2601. https://doi.org/10.1121/1.4919309

26. Hahad, O., Beutel, M., Gori, T., Schulz, A., Blettner, M., Pfeiffer, N., Rostock, T., Lackner, K., Sørensen, M., Prochaska, J. H., Wild, P. S., & Münzel, T. (2018). Annoyance to different noise sources is associated with atrial fibrillation in the Gutenberg Health Study. *International Journal of Cardiology*, *264*, 79–84. https://doi.org/10.1016/j.ijcard.2018.03.126

27. Hahad, O., Beutel, M., Michal, M., Schulz, A., Pfeiffer, N., Gianicolo, E., Lackner, K., Wild, P., Daiber, A., & Münzel, T. (2022). [Noise annoyance in the German general population : Prevalence and determinants in the Gutenberg Health Study]. *Herz*, *47*(3), 265–279. https://doi.org/10.1007/s00059-021-05060-z

28. Hansell, A. L., Blangiardo, M., Fortunato, L., Floud, S., de Hoogh, K., Fecht, D., Ghosh, R. E., Laszlo, H. E., Pearson, C., Beale, L., Beevers, S., Gulliver, J., Best, N., Richardson, S., & Elliott, P. (2013). Aircraft noise and cardiovascular disease near Heathrow airport in London: small area study. *BMJ*, *347*(oct08 3), f5432–f5432. https://doi.org/10.1136/bmj.f5432

29. Hauptvogel, D., Bartels, S., Schreckenberg, D., & Rothmund, T. (2021). Aircraft Noise Distribution as a Fairness Dilemma—A Review of Aircraft Noise through the Lens of Social Justice Research. *International Journal of Environmental Research and Public Health*, *18*(14), 7399. https://doi.org/10.3390/ijerph18147399

30. Hede, A. (2017). Using mindfulness to reduce the health effects of community reaction to aircraft noise. *Noise and Health*, *19*(89), 165. https://doi.org/10.4103/nah.nah_106_16

31. Holt, J. B. (2015). Airport Noise and Self-Reported Sleep Insufficiency, United States, 2008 and 2009. *Preventing Chronic Disease*, *12*. https://doi.org/10.5888/pcd12.140551

32. Itzkowitz, N., Gong, X., Atilola, G., Konstantinoudis, G., Adams, K., Jephcote, C., Gulliver, J., Hansell, A. L., & Blangiardo, M. (2023). Aircraft noise and cardiovascular

morbidity and mortality near Heathrow Airport: A case-crossover study. *Environment International*, *177*, 108016. https://doi.org/10.1016/j.envint.2023.108016

33. Kim, C. S., Grady, S. T., Hart, J. E., Laden, F., VoPham, T., Nguyen, D. D., Manson, J. E., James, P., Forman, J. P., Rexrode, K. M., Levy, J. I., & Peters, J. L. (2021). Long-term aircraft noise exposure and risk of hypertension in the Nurses' Health Studies. *Environmental Research*, 112195. https://doi.org/10.1016/j.envres.2021.112195
34. Kim, S. J., Chai, S. K., Lee, K. W., Park, J.-B., Min, K.-B., Kil, H. G., Lee, C., & Lee, K. J. (2014). Exposure–Response Relationship Between Aircraft Noise and Sleep Quality: A Community-based Cross-sectional Study. *Osong Public Health and Research Perspectives*, *5*(2), 108–114. https://doi.org/10.1016/j.phrp.2014.03.004
35. Klatte, M., Spilski, J., Mayerl, J., Möhler, U., Lachmann, T., & Bergström, K. (2016). Effects of Aircraft Noise on Reading and Quality of Life in Primary School Children in Germany: Results From the NORAH Study. *Environment and Behavior*, *49*(4), 390–424. https://doi.org/10.1177/0013916516642580
36. Kwak, K. M., Ju, Y.-S., Kwon, Y.-J., Chung, Y. K., Kim, B. K., Kim, H., & Youn, K. (2016). The effect of aircraft noise on sleep disturbance among the residents near a civilian airport: a cross-sectional study. *Annals of Occupational and Environmental Medicine*, *28*(1). https://doi.org/10.1186/s40557-016-0123-2
37. Lefèvre, M., Chaumond, A., Champelovier, P., Giorgis Allemand, L., Lambert, J., Laumon, B., & Evrard, A.-S. (2020). Understanding the relationship between air traffic noise exposure and annoyance in populations living near airports in France. *Environment International*, *144*, 106058. https://doi.org/10.1016/j.envint.2020.106058
38. Li, A., Martino, E., Mansour, A., & Bentley, R. (2022). Environmental Noise Exposure and Mental Health: Evidence From a Population-Based Longitudinal Study. *American Journal of Preventive Medicine*, *63*(2), e39–e48. https://doi.org/10.1016/j.amepre.2022.02.020

39. Lugten, M., Karacaoglu, M., White, K., Kang, J., & Steemers, K. (2018). Improving the soundscape quality of urban areas exposed to aircraft noise by adding moving water and vegetation. *The Journal of the Acoustical Society of America*, *144*(5), 2906–2917. https://doi.org/10.1121/1.5079310

40. Michaud, D. S., Marro, L., Denning, A., Shackleton, S., Toutant, N., & McNamee, J. P. (2022). *A comparison of self-reported health status and perceptual responses toward environmental noise in rural, suburban, and urban regions in Canada*. *151*(3), 1532–1544. https://doi.org/10.1121/10.0009749

41. Münzel, T., Sørensen, M., Schmidt, F., Schmidt, E., Steven, S., Kröller-Schön, S., & Daiber, A. (2018). The Adverse Effects of Environmental Noise Exposure on Oxidative Stress and Cardiovascular Risk. *Antioxidants & Redox Signaling*, *28*(9), 873–908. https://doi.org/10.1089/ars.2017.7118

42. Nassur, A.-M., Lefèvre, M., Laumon, B., Léger, D., & Evrard, A.-S. (2017). Aircraft Noise Exposure and Subjective Sleep Quality: The Results of the DEBATS Study in France. *Behavioral Sleep Medicine*, *17*(4), 502–513. https://doi.org/10.1080/15402002.2017.1409224

43. Nassur, A.-M., Léger, D., Lefèvre, M., Elbaz, M., Mietlicki, F., Nguyen, P., Ribeiro, C., Sineau, M., Laumon, B., & Evrard, A.-S. (2019). The impact of aircraft noise exposure on objective parameters of sleep quality: results of the DEBATS study in France. *Sleep Medicine*, *54*, 70–77. https://doi.org/10.1016/j.sleep.2018.10.013

44. Nguyen, D. D., Whitsel, E. A., Wellenius, G. A., Levy, J. I., Leibler, J. H., Grady, S. T., Stewart, J. D., Fox, M. P., Collins, J. M., Eliot, M. N., Malwitz, A., Manson, J. E., & Peters, J. L. (2023). Long-term aircraft noise exposure and risk of hypertension in postmenopausal women. *Environmental Research*, *218*, 115037. https://doi.org/10.1016/j.envres.2022.115037

45. Nguyen, T. L., Nguyen, T. L., Morinaga, M., Yokoshima, S., Yano, T., Sato, T., & Yamada, I. (2018). Community response to a step change in the aircraft noise

exposure around Hanoi Noi Bai International Airport. *The Journal of the Acoustical Society of America*, *143*(5), 2901–2912. https://doi.org/10.1121/1.5037567

46. Nguyen, T. L., Trieu, B. L., Hiraguri, Y., Morinaga, M., Morihara, T., & Yano, T. (2020). Effects of Changes in Acoustic and Non-Acoustic Factors on Public Health and Reactions: Follow-Up Surveys in the Vicinity of the Hanoi Noi Bai International Airport. *International Journal of Environmental Research and Public Health*, *17*(7), 2597. https://doi.org/10.3390/ijerph17072597
47. Pearson, T., Campbell, M. J., & Maheswaran, R. (2016). Acute effects of aircraft noise on cardiovascular admissions – an interrupted time-series analysis of a six-day closure of London Heathrow Airport caused by volcanic ash. *Spatial and Spatio-Temporal Epidemiology*, *18*, 38–43. https://doi.org/10.1016/j.sste.2016.03.004
48. Peters, J. L., Zevitas, C. D., Redline, S., Hastings, A., Sizov, N., Hart, J. E., Levy, J. I., Roof, C. J., & Wellenius, G. A. (2018). Aviation Noise and Cardiovascular Health in the United States: a Review of the Evidence and Recommendations for Research Direction. *Current Epidemiology Reports*, *5*(2), 140–152. https://doi.org/10.1007/s40471-018-0151-2
49. Potera, C. (2014). In the Neighborhood: Metabolic Outcomes among Residents Exposed toAircraft Noise. *Environmental Health Perspectives*, *122*(7). https://doi.org/10.1289/ehp.122-a193
50. Preisendörfer, P., Liebe, U., Bruderer Enzler, H., & Diekmann, A. (2021). Annoyance due to residential road traffic and aircraft noise: Empirical evidence from two European cities. *Environmental Research*, 112269. https://doi.org/10.1016/j.envres.2021.112269
51. Quehl, J., Bartels, S., Fimmers, R., & Aeschbach, D. (2021). Effects of Nocturnal Aircraft Noise and Non-Acoustical Factors on Short-Term Annoyance in Primary School Children. *International Journal of Environmental Research and Public Health*, *18*(13), 6959. https://doi.org/10.3390/ijerph18136959

52. Quehl, J., Uwe Müller, & Mendolia, F. (2017). *Short-term annoyance from nocturnal aircraft noise exposure: results of the NORAH and STRAIN sleep studies*. *90*(8), 765–778. https://doi.org/10.1007/s00420-017-1238-7

53. Rizk, S. A. M., Sharaf, N. E., Mahdy-Abdallah, H., & ElGelil, K. S. A. (2014). Some health effects of aircraft noise with special reference to shift work. *Toxicology and Industrial Health*, *32*(6), 961–967. https://doi.org/10.1177/0748233713518602

54. Rocha, S., Smith, M. G., Witte, M., & Basner, M. (2019). Survey Results of a Pilot Sleep Study Near Atlanta International Airport. *International Journal of Environmental Research and Public Health*, *16*(22), 4321. https://doi.org/10.3390/ijerph16224321

55. Rojek, M., Rajzer, M. W., Wojciechowska, W., Drożdż, T., Skalski, P., Pizoń, T., Januszewicz, A., & Czarnecka, D. (2019). Relationship among long-term aircraft noise exposure, blood pressure profile, and arterial stiffness. *Journal of Hypertension*, *37*(7), 1350–1358. https://doi.org/10.1097/hjh.0000000000002060

56. Romero Starke, K., Schubert, M., Kaboth, P., Gerlach, J., Hegewald, J., Reusche, M., Friedemann, D., Zülke, A., Riedel-Heller, S. G., Zeeb, H., & Seidler, A. (2023). Traffic noise annoyance in the LIFE-adult study in Germany: Exposure-response relationships and a comparison to the WHO curves. *Environmental Research*, *228*, 115815. https://doi.org/10.1016/j.envres.2023.115815

57. Saucy, A., Schäffer, B., Tangermann, L., Vienneau, D., Wunderli, J.-M., & Röösli, M. (2020). Does night-time aircraft noise trigger mortality? A case-crossover study on 24 886 cardiovascular deaths. *European Heart Journal*, *42*(8), 835–843. https://doi.org/10.1093/eurheartj/ehaa957

58. Scatolini, F., & Alves, C. J. P. (2016). Background noise analysis in urban airport surroundings of Brazilian cities, Congonhas Airport, São Paulo. *Revista de Saúde Pública*, *50*(0). https://doi.org/10.1590/s1518-8787.2016050006431

59. Schaal, N. C., Salaam, R. A., Stevens, M. E., & Stubner, A. H. (2019). Living at Work: 24-hour Noise Exposure Aboard US Navy Aircraft Carriers. *Annals of Work Exposures and Health*, *63*(3), 316–327. https://doi.org/10.1093/annweh/wxz005

60. Schäffer, B., Brink, M., Schlatter, F., Vienneau, D., & Wunderli, J. M. (2020). Residential green is associated with reduced annoyance to road traffic and railway noise but increased annoyance to aircraft noise exposure. *Environment International*, *143*, 105885. https://doi.org/10.1016/j.envint.2020.105885

61. Schmidt, F. P., Herzog, J., Schnorbus, B., Ostad, M. A., Lasetzki, L., Hahad, O., Schäfers, G., Gori, T., Sørensen, M., Daiber, A., & Münzel, T. (2020). The impact of aircraft noise on vascular and cardiac function in relation to noise event number: a randomized trial. *Cardiovascular Research*, *117*(5), 1382–1390. https://doi.org/10.1093/cvr/cvaa204

62. Schmidt, F., Kolle, K., Kreuder, K., Schnorbus, B., Wild, P., Hechtner, M., Binder, H., Gori, T., & Münzel, T. (2014). Nighttime aircraft noise impairs endothelial function and increases blood pressure in patients with or at high risk for coronary artery disease. *Clinical Research in Cardiology*, *104*(1), 23–30. https://doi.org/10.1007/s00392-014-0751-x

63. Schubert, M., Romero Starke, K., Gerlach, J., Reusche, M., Kaboth, P., Schmidt, W., Friedemann, D., Hegewald, J., Zeeb, H., Zülke, A., Riedel-Heller, S. G., & Seidler, A. (2023). Traffic-Related High Sleep Disturbance in the LIFE-Adult Cohort Study: A Comparison to the WHO Exposure-Response-Curves. *International Journal of Environmental Research and Public Health*, *20*(6), 4903. https://doi.org/10.3390/ijerph20064903

64. Seabi, J., Cockcroft, K., Goldschagg, P., & Greyling, M. (2013). A prospective follow-up study of the effects of chronic aircraft noise exposure on learners' reading comprehension in South Africa. *Journal of Exposure Science & Environmental Epidemiology*, *25*(1), 84–88. https://doi.org/10.1038/jes.2013.71

65. Sharp, B. H., Connor, T. L., McLaughlin, D., Clark, C., Stansfeld, S. A., Hervey, J., Airport Cooperative Research Program, Transportation Research Board, & National Academies of Sciences, Engineering, and Medicine. (2014). Assessing Aircraft Noise Conditions Affecting Student Learning, Volume 1: Final Report. In *National*

Academies Press. Transportation Research Board. https://www.trb.org/Publications/Blurbs/170328.aspx

66. Shigenori Yokoshima, Morinaga, M., Tsujimura, S., Koji Shimoyama, & Morihara, T. (2021). Representative Exposure–Annoyance Relationships Due to Transportation Noises in Japan. *International Journal of Environmental Research and Public Health*, *18*(20), 10935–10935. https://doi.org/10.3390/ijerph182010935
67. Simon, M. C., Hart, J. E., Levy, J. I., VoPham, T., Malwitz, A., Nguyen, D., Bozigar, M., L. Adrienne Cupples, James, P., Laden, F., & Peters, J. L. (2022). Sociodemographic Patterns of Exposure to Civil Aircraft Noise in the United States. *Environmental Health Perspectives*, *130*(2). https://doi.org/10.1289/ehp9307
68. Smith, M. G., Cordoza, M., & Basner, M. (2022). Environmental Noise and Effects on Sleep: An Update to the WHO Systematic Review and Meta-Analysis. *Environmental Health Perspectives*, *130*(7). https://doi.org/10.1289/ehp10197
69. Smith, M. G., Rocha, S., Witte, M., & Basner, M. (2020). On the feasibility of measuring physiologic and self-reported sleep disturbance by aircraft noise on a national scale: A pilot study around Atlanta airport. *Science of the Total Environment*, *718*, 137368. https://doi.org/10.1016/j.scitotenv.2020.137368
70. Stansfeld, S. A. (2015). Noise Effects on Health in the Context of Air Pollution Exposure. *International Journal of Environmental Research and Public Health*, *12*(10), 12735–12760. https://doi.org/10.3390/ijerph121012735
71. Stansfeld, S., & Clark, C. (2015). Health Effects of Noise Exposure in Children. *Current Environmental Health Reports*, *2*(2), 171–178. https://doi.org/10.1007/s40572-015-0044-1
72. Storey, H. M., Austin, J., Davies-White, N. L., Ransley, D. G., & Hodkinson, P. D. (2022). Navigating Pregnancy for Employees in Civilian Rotary-Wing Aeromedicine. *Aerospace Medicine and Human Performance*, *93*(12), 866–876. https://doi.org/10.3357/amhp.6115.2022

73. Thacher, J. D., Poulsen, A. H., Hvidtfeldt, U. A., Raaschou-Nielsen, O., Brandt, J., Geels, C., Khan, J., Münzel, T., & Sørensen, M. (2021). Long-Term Exposure to Transportation Noise and Risk for Type 2 Diabetes in a Nationwide Cohort Study from Denmark. *Environmental Health Perspectives*, *129*(12). https://doi.org/10.1289/ehp9146

74. Thacher, J. D., Poulsen, A. H., Hvidtfeldt, U. A., Raaschou-Nielsen, O., Ketzel, M., Jensen, S. S., Brandt, J., Valencia, V. H., Münzel, T., & Sørensen, M. (2021). Long-term exposure to transportation noise and risk for atrial fibrillation: A Danish nationwide cohort study. *Environmental Research*, 112167. https://doi.org/10.1016/j.envres.2021.112167

75. Thacher, J. D., Poulsen, A. H., Raaschou-Nielsen, O., Hvidtfeldt, U. A., Brandt, J., Christensen, J. H., Khan, J., Levin, G., Münzel, T., & Sørensen, M. (2022). Exposure to transportation noise and risk for cardiovascular disease in a nationwide cohort study from Denmark. *Environmental Research*, *211*, 113106. https://doi.org/10.1016/j.envres.2022.113106

76. Thompson, R., Smith, R. B., Bou Karim, Y., Shen, C., Drummond, K., Teng, C., & Toledano, M. B. (2022). Noise pollution and human cognition: An updated systematic review and meta-analysis of recent evidence. *Environment International*, *158*, 106905. https://doi.org/10.1016/j.envint.2021.106905

77. Ulrike Wissen Hayek, Bertsch, L., Lauper, D., & Pieren, R. (2019). *Improving future low-noise aircraft technologies using experimental perception-based evaluation of synthetic flyovers*. *692*, 68–81. https://doi.org/10.1016/j.scitotenv.2019.07.253

78. Vos, J., & Houben, M. M. J. (2022). Annoyance caused by the low-frequency sound produced by aircraft during takeoff. *The Journal of the Acoustical Society of America*, *152*(6), 3706. https://doi.org/10.1121/10.0016596

79. Wang, S. S., Glied, S., Williams, S., Will, B., & Muennig, P. A. (2022). Impact of aeroplane noise on mental and physical health: a quasi-experimental analysis. *BMJ Open*, *12*(5), e057209. https://doi.org/10.1136/bmjopen-2021-057209

80. Weidenfeld, S., Sanok, S., Fimmers, R., Puth, M.-T., Aeschbach, D., & Elmenhorst, E.-M. (2021). Short-Term Annoyance Due to Night-Time Road, Railway, and Air Traffic Noise: Role of the Noise Source, the Acoustical Metric, and Non-Acoustical Factors. *International Journal of Environmental Research and Public Health*, *18*(9), 4647. https://doi.org/10.3390/ijerph18094647

81. Weihofen, V. M., Hegewald, J., Euler, U., Schlattmann, P., Zeeb, H., & Seidler, A. (2019). Aircraft noise and the risk of stroke. *Deutsches Aerzteblatt Online*. https://doi.org/10.3238/arztebl.2019.0237

82. Welch, D., Dirks, K. N., Shepherd, D., & McBride, D. (2018). Health-Related Quality of Life is Impacted by Proximity to an Airport in Noise-Sensitive People. *Noise & Health*, *20*(96), 171–177. https://doi.org/10.4103/nah.NAH_62_17

83. Wojciechowska, W., Januszewicz, A., Drożdż, T., Rojek, M., Bączalska, J., Terlecki, M., Kurasz, K., Olszanecka, A., Smólski, M., Prejbisz, A., Dobrowolski, P., Grodzicki, T., Hryniewiecki, T., Kreutz, R., & Rajzer, M. (2022). Blood Pressure and Arterial Stiffness in Association With Aircraft Noise Exposure:Long-Term Observation and Potential Effect of COVID-19 Lockdown. *Hypertension*, *79*(2), 325–334. https://doi.org/10.1161/hypertensionaha.121.17704

84. Zafari, Z., Jiao, B., Will, B., Li, S., & Muennig, P. (2018). The Trade-Off between Optimizing Flight Patterns and Human Health: A Case Study of Aircraft Noise in Queens, NY, USA. *International Journal of Environmental Research and Public Health*, *15*(8), 1753. https://doi.org/10.3390/ijerph15081753

85. Zeeb, H., Hegewald, J., Schubert, M., Wagner, M., Dröge, P., Swart, E., & Seidler, A. (2017). Traffic noise and hypertension – results from a large case-control study. *Environmental Research*, *157*, 110–117. https://doi.org/10.1016/j.envres.2017.05.019