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RISK OF CARDIOMETABOLIC DISEASE IN ADULTS EXPOSED TO TRANSPORTATION NOISE: A SYSTEMATIC REVIEW AND META-ANALYSIS

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ABSTRACT

Background: Exposure to transportation noise is thought to contribute to the development of cardiometabolic diseases. A meta-analysis published by van Kempen et al. in 2018 collected and aggregated studies published up to 2015 on this subject. However, since then, many studies have been published. Material and methods: A systematic review of the literature was carried out using the PRISMA framework. Subsequently, a meta-analysis was performed. Our research covered the period from January 1, 2014, to August 30, 2022. Risk of bias was assessed using the ROBINS-E tool and quality of evidence was measured by taking into account the GRADE reporting system. The cardiometabolic outcomes considered were hypertension, cardiovascular morbidity and mortality, stroke, myocardial infarction, obesity and diabetes. Results: The literature review identified 39 studies that were included in the meta-analysis. The quality of evidence ranged from high to very low due to some risk of bias in study designs, discrepancies in study populations and some imprecision in estimated effects. Conclusion: The results confirm the findings of the review by van Kempen et al., although the size of some of the effects was revised slightly downwards. In addition, a clear improvement in the precision of the estimates leads to more robust results. ***Keywords:*** *Cardiometabolic Diseases - Transportation Noise - Literature review - Meta-Analysis*

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1. INTRODUCTION

Over the past 30 years, the prevalence of cardiometabolic disease in the population has increased dramatically. It is estimated to have doubled since the 1990s and now affects over 500 million people worldwide [1]. This makes it one of the leading causes of death worldwide (about 31% of all-cause mortality) [2].

Numerous experimental studies on animal models and humans have demonstrated that transportation noise might contributes to the development of cardiometabolic disorders [3], through two biological pathways. First, through 1) noise-induced sleep disturbances and their consequences: fatigue, irritability, concentration difficulties, reduced physical activity [4-5] but also through 2) chronic inflammatory effects and the cascade of metabolic disturbances associated with these phenomena [6-8].

As more than half of European citizens are exposed to noise levels considered harmful to health [9] and as the costs of cardio-metabolic diseases can weigh heavily on health systems, it is important to quantify the avoidable part of this environmental factor.

Based on the meta-analysis by van Kempen et al. (2018) on cardiometabolic effect of environmental noise [10], the WHO has published guidelines recommending a significant reduction in environmental noise levels, especially with regard to transportation noise [11]. Despite the increasing number of studies on the subject, the authors of this meta-analysis concluded that there was a need to expand the evidence base with more longitudinal and cohort studies.

A large number of epidemiological studies has been published since this review. We therefore carried out a systematic review of the literature and then a meta-analysis including studies for adults exposed to transportation noise

(aircraft, road traffic and railway noise), published between the end of 2014 (end of van Kempen et al. (2018) [10] study period) and 2022. The following health outcomes were considered: hypertension, cardiovascular disease (morbidity and mortality), myocardial infarction, stroke, diabetes and obesity. We finally provided the effect of these new studies on the evolution of the quality of evidence.

2. METHODS

The research strategy was detailed in the PROSPERO 2022 protocol: CRD42022353441 following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist [12] and can be found in full here: https://www.crd.york.ac.uk/PROSPEROFILES/353441_STRATEGY_20220813.pdf

Searches were conducted in English (but without language restrictions or search filters) over the period 2014–2022. We included studies of populations over 18 years of age, exposed to transportation noise (aircraft, road traffic, and railway noise) at their main residence. We included studies with measured or modelled noise exposure. We included studies using the following nois indicators: -energetic (Lden, Lday, Levening and Lnight) or -evenemential: (LAmax, or NAseuil).

The following health outcomes were considered: hypertension, cardiovascular disease (morbidity and mortality), myocardial infarction, stroke, diabetes and obesity.

The inclusion and exclusion criteria, explained in detail in the protocol, were consistent with those of van Kempen et al. (2018) [10] and use the PECOS (population, exposure, comparator, outcome, study design) [13].

We investigated the following databases: Pub Med, Scopus, Web of Science and Embase. We completed this search with an investigation of the grey literature using Google Scholar (first 500 results) [14], and a search of the abstracts of papers presented at the International Commission on the Biological Effects of Noise (ICBEN) and Internoise congresses over the same period.

Risk of bias in the studies was evaluated using the risk of bias instruments for non-randomised exposure studies (ROBINS-E) [15].

Meta-analysis was performed when possible. The analyses were carried out with Revman 5 and the sensitivity analyses were performed with R.

A GRADE assessment of the quality of evidence was performed for each effect studied [17].

3. RESULTS

Finally, 1299 articles were found. We excluded 1072 articles that did not meet the selection criteria. One hundred and eighty-four articles were selected on the basis of full text. Thirty-nine were finally included in the systematic review.

The results will be presented at the conference.

4. DISCUSSION

The quantity and quality of studies have increased significantly, compared to the period covered by van Kempen et al (2018) [10] and since the publication of the latest WHO guidelines [11] on environmental noise.

The results confirm the findings of the review by van Kempen et al. [10], although the size of some of the effects was revised slightly downwards. In addition, a clear improvement in the precision of the estimates leads to more robust results.

6. CONFLICTS OF INTEREST

None to declare.

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