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Expert Review

Turbulence and Effects on Health in the Specific Situation of Exposure to Air Pollution

Quinton De Cruse*

Centre for Psychiatry, Wolfson Institute of Preventive Medicine, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, Charterhouse Square, London EC1M 6BQ, UK

*Corresponding Author's E-mail: Quintondecruse@edu.in

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Abstract

Understanding the relative impact of environmental noise on health in comparison to other environmental stressors is crucial for public health policy and planning. The main environmental stressor that contributes to cardiovascular morbidity and mortality is air pollution. The associations between environmental noise and air pollution and health are examined in this narrative review of studies. Included were studies of mortality, cognitive outcomes, myocardial infarction, stroke, and hypertension. After adjusting for air pollution, the findings suggest that there are independent effects on cardiovascular outcomes of environmental noise from road traffic, aircraft, and, in fewer studies, railway noise. Air pollution is the primary environmental causes of disability adjusted life years lost (DALYs), according to comparative burden of disease studies. In Europe, environmental noise ranks second in terms of DALYs, and the DALYs it caused were greater than those caused by lead, ozone, or dioxins. In conclusion, environmental noise should be considered an independent contributor to health risk in planning and health impact assessments. It plays a distinct and significant role in ill health in contrast to air pollution.

Keywords: Environment, Noise, Transport, Polluted air, Prevalence of disease, Aircraft, Vehicle traffic, Cohort research

INTRODUCTION

Children's and adults' health can be impacted by a wide range of environmental stressors. The development of appropriate therapeutic and preventative measures can be influenced by knowing which pollutants have the greatest impact on health (Boni MF et al., 2020). Numerous large-scale studies on the relationship between environmental noise and health have been conducted over the past ten years. In parallel, research on the health effects of air pollution has been published. Understanding the relative contributions of noise exposure and air pollution to health has also been of interest due to the fact that transportation sources like road traffic are responsible for both noise exposure and air pollution. Recent research has added to the body of evidence regarding the connection between noise and health by demonstrating convincing health impacts in terms of hypertension, the risk of ischaemic heart disease, and mortality in addition to effects on sleep and noise annoyance. Understanding the relative contribution of these various environmental stressors to health outcomes would be helpful for the purposes of health impact assessment and public health. This paper examines the evidence that environmental noise exposure, particularly road, rail, and aircraft noise, has a health impact in relation to air pollution (Latinne A et al., 2020)(Andersen KG et al., 2020).

DISCUSSION

The study search was conducted as a narrative review without a time limit. This required conducting a preliminary search on PubMed for "noise, air pollution, and health (Lau SKP et al., 2007) (Ge XYet al., 2013)." The term "health" was

not further defined in this initial search, but the majority of the studies that were found pertain to cardiovascular disease. Since noise, in contrast to air pollution, has not been linked to this health outcome, there were no studies on respiratory disease. Access to recent noise and health reviews and additional papers discovered by citation tracking added to this. At first, additional searches were conducted for "environmental noise and climate change," "environmental noise and pesticides," "environmental noise and heavy metals," and "endocrine disrupting chemicals." There were very few relevant papers on climate change, heavy metals, chemicals that disrupt the endocrine system, and noise and pesticides. There was insufficient evidence in these papers to determine the relative health effects of noise and these environmental stressors. As a result, only studies on environmental noise and air pollution exposure have been the focus of this paper. In this paper, "environmental noise" is defined as noise from airplanes, trains, and traffic on roads—the primary sources of outdoor noise analyzed in these studies. Studies of hearing loss and occupational studies have been excluded. Assessments of environmental noise and air pollution as well as health outcomes were found in 25 primary research studies (Lelli D et al., 2013)(Lin XD et al., 2017). In order to facilitate comparison, the characteristics and outcomes of studies on the relationship between exposure to noise and air pollution, hypertension, atherosclerosis, ischaemic heart disease, stroke, and mortality have been compiled. Studies on children's cognition and blood pressure as well as environmental noise and air pollution are presented. Adult cognitive outcomes and mental health are also briefly discussed. The representativeness of the population, objective measurement of exposures to noise and air pollution, adequate adjustment for confounding factors, and objective measurement of health outcomes were all considered when determining the quality of the primary studies (Rihtaric D et al., 2010)(Tao Y et al., 2019).

The majority of the studies examined here use noise modelling methods to evaluate noise exposure. Noise that models generate A" weighted energy-equivalent sound levels based on noise sources, the models taking into account the acoustic characteristics of environments where noise travels from the source to a receiver. In order to estimate sound levels at the receiver and produce noise contour maps, a calculation method that takes into account the characteristics of the environment is used. Lden (weighted averages for day, evening, and night with a 5 dB penalty for evening exposure and a 10 dB(A) penalty for night-time exposure) is typically used to describe outdoor exposures at building facades that are the most exposed (Gouilh MA et al., 2011).

When it comes to modeling air quality, two main approaches are utilized. In order to estimate an emission source's contribution to air pollution, dispersion modeling attempts to replicate atmospheric conditions like wind speed and temperature. By employing monitored levels of pollutants as dependent variables in multiple regression analyses, land use regression models characterize individual locations' exposure to air pollution. Traffic and topography are examples of independent variables. This method has the advantage of being able to account for local site-specific variables.

The engine and the contact between tires and the ground are the primary sources of road traffic noise, and the engine's exhaust pollutes the air. Noise from aircraft can come from the engines as well as the aircraft's frame. It is most noticeable when aircraft are landing or taking off as well as when they are making noise on the ground. The engines of an aircraft contribute to air pollution. Vibration and the train's contact with the track, the locomotive engine, and the train's resistance to the wind all contribute to rail noise, which is frequently accompanied by vibration. Rather than trains powered by electricity, the sources of air pollution are train engines, which typically run on diesel fuel.

Understanding how closely the two exposures are connected is an important factor to take into account when trying to separate the links between exposure to noise and air pollution and health. Strong correlations between the two exposures may make it harder to separate out the effects of each, whereas weak or inconsistent correlations may allow the exposures to be geographically separated, making it easier to connect them to health outcomes. A correlation between road traffic noise and PM10 was as low as 0.16 in a Swiss study, while the Pearson correlation between PM10 and nighttime rail noise was 0.37. A road traffic noise study found a moderate correlation between NOx and Lden (Spearman's r = 0.62) . Despite the fact that vehicles used in road traffic are a source of both noise and air pollution, many studies have shown that community studies rarely show strong correlations between the two; Modeled road traffic noise levels and land use regression modelled air pollutants did not have a strong correlation in a study of metropolitan Vancouver. Black carbon and noise exposure had the strongest correlations (Spearman's r = 0.44), while PM2.5 had the weakest (Spearman's r = 0.14). Sound levels and air pollution have not been found to be adequately accounted for by proximity measures to major roads. However, the strongest correlations were found between road traffic noise measured at night rather than during the day and air pollutants. In the Multi-Ethnic Study of Atherosclerosis and Air Pollution (MESA Air) study, two-week NO2, ultrafine particles, and 5 min "A" weighted sound pressure levels were measured in 105 locations near major roads in nine US communities. However, the correlations between sound levels and NO levels were not particularly strong (r = 0.20–0.60). Major road downwind correlations were stronger (r = 0.53–0.74) than upwind correlations. Air pollution is more likely to be affected by weather than by noise, which is more likely to change over time. However, interfering buildings and noise barriers will have a greater impact on indoor noise exposure, and access to a quieter part of a building for bedrooms and living rooms will alter

indoor noise sure.

RESULTS

In order to compare the relative contributions of various pollutants, the overall burden of disease caused by a variety of environmental pollutants has been evaluated and contextualized. Air pollution, noise, a variety of chemical environmental contaminants, and radioactivity are all included in the majority of these studies on the effects of environmental stressors. The fourth Dutch National Environmental Outlook was used to integrate estimates of life expectancy, quality of life, and the number of people affected in the initial efforts to assess the burden of disease caused by environmental pollutants on the population of the Netherlands. This allowed for an evaluation of the number of years of healthy life lost as a result of environmental pollutants. They estimated that environmental factors were responsible for 60% of Disability Adjusted Life Years Lost (DALYs), while noise was responsible for 24% and indoor air pollution was responsible for 6%. They estimated that particulate air pollution was responsible for 169,000 deaths annually, of which 17,700 were attributed to noise-related annoyance, 10,990 to noise-related sleep disturbance, 50 to noise-related ischaemic heart disease (IHD), and 10 to noise-related mortality. Overall, the reviewed studies indicate independent associations between cardiovascular outcomes and mortality, as well as evidence for noise impacts on cognitive outcomes in children and air pollution, as well as independent associations between environmental noise from road traffic, aircraft, and rail and air pollution. European studies show that, when it comes to the burden of disease, air pollution ranks higher than environmental factors, particularly in terms of mortality. However, environmental noise ranks second in terms of disease burden and may be more to blame for poorer quality of life. Compared to other significant environmental pollutants like lead, ozone, and dioxins, environmental noise also accounts for more lost life years.

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None

CONFLICT OF INTEREST

None

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