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COMMENTARY

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Hypertension, a linchpin between environmental noise exposure and the development of cardiovascular disease?

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Abstract

Environmental noise exposure has been considered one of the most common hazards worldwide, especially in the workplace environment, and could produce a variety of health issues. Some epidemiological evidence supports the association between occupational noise exposition and a high risk for hypertension and cardiovascular diseases. Wang et al. has conducted an observational cross-sectional study using occupational data of 4746 workers, 32.4% were exposed to high occupational noise. These exposed individuals had a moderate increase in the risk for hypertension (adjusted odds ratio [OR], 1.30; 95% confidence interval [CI], 1.05–1.62). The subgroup analyses showed that the relationship between noise and hypertension prevalence was stronger in young participants (OR, 1.70; 95% CI, 1.21–2.40). Noise exposure activates the sympathetic and endocrine systems producing an increase in blood pressure and the changes in other biological risk factors. Moreover, a recently published study showed that oxidative stress and DNA damage were significantly higher in subjects exposed to noise. Emotional stress reactions and unconscious physiological stress could also be potential mechanisms for hypertension. Finally, physiological stress caused by noise exposure may also increase indulgence in unhealthy behaviors, such as smoking and alcohol consumption, and indirectly result in an increased risk of hypertension and cardiovascular diseases. Previously published studies showed relationships between environmental noise exposure (including road traffic, railway, and aircraft noises) and the development of hypertension and cardiovascular diseases. Thus, the study by Wang et al. emphasizes the importance of environmental control in the prevention of cardiovascular diseases, not only in the workplace but also outside it.

KEYWORDS
cardiovascular disease, environmental noise, hypertension, occupational noise

Cardiovascular diseases are the leading cause of morbidity and mortality worldwide, including low-, middle-, and high-income countries. At the individual level, risk factors for the development of cardiovascular diseases, such as hypertension, diabetes, dyslipidemia, and smoking, have been widely identified and the relationships acceptably quantified. On another hand, the impact of environmental sources of cardiovascular risk (beyond diet, tobacco, and physical activity) has been less well-defined. Environmental noise exposure has been considered one of the most common hazards worldwide, especially in the workplace environment, and could produce a variety of health issues, both auditory and nonauditory.[1] Some epidemiological evidence supports the association between occupational noise exposition and a high risk for hypertension and cardiovascular diseases. A cross-sectional study, including 6307 participants of the National Health and Nutrition Examination Survey 1999–2004, showed that subjects chronically exposed to high occupational noise had a two to three-fold increased prevalence of angina pectoris and myocardial infarction.[2] A blood pressure increase could be a plausible link between noise exposition and the development of cardiovascular disease, since several studies have shown a significant association between occupational noise and hypertension prevalence and incidence. In this regard, the study by Wang et al., published in this issue of the *Journal of Clinical Hypertension*, has provided new evidence supporting the relationships between noise exposition and hypertension.[3]

The authors conducted a cross-sectional study using occupational data of 4746 workers (median 43 years old, 73.4% men) of an aircraft manufacturing enterprise placed in Xi'an, China. They defined 85 dB as the cut point to categorize occupational noise exposure as high or low levels; 32.4% were exposed to high occupational noise. These exposed individuals had a moderate increase in the risk for hypertension (adjusted odds ratio [OR], 1.30; 95% confidence interval [CI], 1.05–1.62). The subgroup analyses showed that the relationship between noise and hypertension prevalence was stronger in young participants (OR, 1.70; 95% CI, 1.21–2.40).[3]

The results of this study are concordant with some but not all previously published studies. Although several studies have reported significant relationships between noise exposure and hypertension,[4–8] some recent studies have shown only limited evidence of harmfulness.[9–11] The inconsistency between studies may be due to differences in the work environment and psychosocial factors, such as exposure time, the use of hearing protection devices, job stress, and social support. Also, differences in traditional risk factors for hypertension were not systematically analyzed in some studies. However, a systematic review and meta-analysis of 43 epidemiological studies concluded that exposure to high occupational noise (>85 dBA) produces a moderate increase in hypertension risk.[12] Furthermore, a recently published cohort study, performed on more than 12000 normotensive workers, showed that the exposure to severe noise was associated with a moderately increased risk of hypertension incidence (adjusted hazard ratio (HR) 1.28, 95% CI 1.11–1.47).[13] Thus, the study by Wang et al., in conjunction with previous studies, reasonably supports that high occupational noise exposure may play a role in hypertension development.

There are plausible pathophysiological explanations for the relationships between environmental noise and the development of hypertension and cardiovascular diseases. Noise exposure activates the sympathetic and endocrine systems to affect the humoral and metabolic states of the human organism, producing an increase in blood pressure and the changes in other biological risk factors (such as blood lipids and glucose levels). Moreover, a recently published study showed that oxidative stress was significantly higher in subjects exposed to noise. Remarkably, in this study, noise was an independent predictor of DNA damage.[14] Emotional stress reactions and unconscious physiological stress could also be potential mechanisms for hypertension.[15] Moreover, physiological stress caused by noise exposure may also increase indulgence in unhealthy behaviors, such as smoking and alcohol consumption, and indirectly result in an increased risk of hypertension and cardiovascular diseases.

Although interesting, the study by Wang et al.[3] has some limitations that should be pointed out. First, participants exposed to high noise were more likely to be men, current smokers, drinking, and had greater BMI and less high level of education, all variables related to higher risk for hypertension. However, the higher risk remains significant after the adjustment of some of these covariates. Second, the results are not adjusted for the use of a hearing protection device. Third, the possibility of white-coat or masked hypertension was not considered. Finally, and more important, it is an observational cross-sectional study that shows association but not causality. A cohort study designed to evaluate hypertension incidence in normotensive workers should be necessary for a more definitive conclusion.

Beyond these limitations, the study by Wang et al.[3] emphasizes the importance of environmental control in the prevention of cardiovascular diseases, not only in the workplace but also outside it. Previously published studies showed relationships between environmental noise exposure (including road traffic, railway, and aircraft noises) and the development of hypertension and cardiovascular diseases.[16,17] Remarkably, this association becomes evident at lower values of exposition than those described for occupational exposition (~65 dB). Therefore, these findings should be considered in future interventions for the prevention and management of hypertension. The American Heart Association, in a position paper regarding primordial and primary prevention of cardiovascular disease, highlights the importance of policy and environmental changes, making the healthy choice the easy choice to live.[18] The development of social and environmental conditions favorable to health is necessary to achieve this aim. In this context, political actions aimed at controlling sources of occupational and environmental contamination by noise should be specifically considered.

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CONFLICT OF INTEREST

The author has no competing interests.

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