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July 2018

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Recommended Citation

Khan, M., Wasay, M. (2018). Environment, pollution and stroke. *JPMA. The Journal of the Pakistan Medical Association.*, 68(7), 984-985.

Available at: https://ecommons.aku.edu/pakistan_fhs_mc_med_neurol/182

Environment, pollution and stroke

Maria Khan,¹ Mohammad Wasay²

Stroke causes more than 6 million deaths each year and leaves behind an even greater number with significant disability.¹ A number of modifiable risk factors like diabetes, hypertension, sedentary lifestyle etc. have been identified over the years and strategies to prevent the condition are strongly encouraged at the global level. Amongst some of the recent discoveries, is the influence of environment on cardiovascular health. One aspect of this, which is environmental pollution is considered the third largest contributor to Disability Adjusted Life Years (DALYs) due to stroke.²

Human environments are complex because they are affected by a number of factors such as geography, climate, social structures, and individual choices. The influence of environment on the occurrence of stroke is supported by observations like the seasonal and diurnal variation seen in stroke incidence, and the fact that individuals from certain geographies are more prone to getting strokes. These factors in turn affect lifestyle choices such as diet and physical activity, which have long been recognized as important modifiable risk factors for cardiovascular disease. The built environment is also an important influence on an individual's health. For example presence of greenery in the neighborhood, levels of noise pollution,³ congested living and opportunities for promoting active lifestyle may all influence cardiovascular health. Yet another aspect to be considered is of environmental pollution, including air, water and noise pollution which is increasingly being recognized as an important risk factor for cardiovascular disease including stroke.

Of all the potential environmental risk factors, the one that has received the most attention, is air pollution. According to the Global burden of disease study, 2013,⁴ air pollution accounted for almost 30% of global stroke burden, with low and middle-income countries (LMICs) being more severely affected. In South Asia and sub-Saharan Africa, 40% of Disability Adjusted Life Years (DALYs) due to stroke, were

attributable to air pollution. Another alarming finding from the study was the contribution of household air pollution (HAP) from incomplete combustion of fossil fuel in the LMICs. Both short term⁵ and long term⁶ exposure to particulate air pollution has been recognized as independent risk factor for myocardial disease, stroke and heart failure.

The proposed mechanism for this increased risk is a pro-atherogenic state induced by these pollutants. There is oxidative stress on vascular endothelium, that leads to endothelial dysfunction and some changes in the lipoproteins as well. These in turn promote formation of thrombus.⁷ Another mechanism suggested by other studies is an increase in the sympathetic drive which in turn leads to vasoconstriction and increase in blood pressure.

Similarly, there is now growing epidemiological evidence that certain metals that have no biological role in the human body, can potentiate the atherosclerotic process leading to an increase in the risk of cardiovascular disease.⁸ These include lead, arsenic, cadmium and mercury. These elements due to industrial pollution find themselves into the drinking water supply or at times, into the bodies of certain fish and from there they enter human bodies and augment processes that cause cardiovascular disease including effects on blood pressure, endothelial function and carbohydrate and lipid metabolism.

Environmental risk factors for stroke and cardiovascular diseases are more prevalent in developing countries as compared to developed world. Pakistan, like most countries in epidemiological transition, suffers from a number of these environmental risks. According to a recent World Health Organization report,⁹ Pakistan's urban air pollution is amongst the most severe in the world. This report highlighted that Karachi, the biggest metropolitan city is the fifth most polluted city in the world, followed by Peshawar and Rawalpindi. The urban development is mostly unregulated and there has been an exponential rise in the number of vehicles on the streets. Vehicular emissions, industrial emissions and the burning of solid wastes on the streets are all contributing to an increase in outdoor air pollution. To

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make things worse, the household air pollution due to burning of biomass solid fuels continues to pose a significant health threat.¹⁰ In addition, a number of studies from various parts of the country,¹¹ have been published indicating that untreated wastewater from urban and industrial sources cause soil pollution and are a threat to human health.

Considering the attributable fraction of environmental pollution on cardiovascular health including stroke, it is only wise to focus attention on a risk factor that is so ubiquitous that any intervention at that level is likely to produce huge impacts. A number of policies have been drafted in the past to curb pollution, including Pakistan Clean Air program and Pakistan pollution charges. There is a need to first, measure environmental pollution accurately and then to implement the existent policies besides drafting new ones to reduce vehicles on the roads, improve the quality of fuel, curb industrial pollution and to improve garbage disposal. The role of urban green spaces is also being recognized in enhancing physical activity and reducing cardiovascular disease risk and all future urban planning should incorporate these. Future health research needs to focus on better categorizing the risks that various environmental factors pose to inform better policies.

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