

Air pollution and allergy in Malaysia: The need for evidence and action

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ABSTRACT

There is a scarcity in both epidemiological studies and forecast models on the impact of air pollution on respiratory allergic responses in Malaysia. The quantification of baseline allows for an understanding of the severity of the impact and target areas for intervention. High-quality forecasts not only provide information for the assessment of potential outcomes but also the dissemination of public health warnings, such as the application of mobile-based early warning systems. There is a need for a data repository system that facilitates research on such studies. However, a call for more evidence should not put a pause on actions and future plans that will help reduce pollution emission and exposure to air pollutants as there are sufficient evidence to indicate that air pollutants impact health.

Keywords: Air pollution; allergy; epithelial barrier hypothesis; Malaysia; planetary health; pollutants

1. Introduction

Air pollution is not a modern phenomenon. As early as 2400 years ago, there are documented evidence of concern that air pollution causes various illness [1]. Increasing emissions of pollutants globally and the continuous advancement of ground-based and remote sensing technology have allowed better quantification of episodic air pollution events as well as the increasing background pollutant levels over several decades. The Great London Smog (United Kingdom) in 1952 and an earlier lethal haze event in Donora (1948, United States) highlighted the adverse health impacts of unregulated emissions. There have been many studies carried out since then to quantify the impact of a specific air pollutant on health. There are numerous evidence that air pollutants such as particulate matter and tropospheric ozone causing or exacerbating respiratory-related illnesses [2, 3].

In Malaysia, transboundary haze episodes characterized by high particulate concentrations from biomass burning are recurring events despite calls for more stringent regional regulatory control and enforcement [4, 5]. Haze events have been shown to cause immediate and delayed effects on mortality with >10,000 respiratory mortality events recorded during a total of 88 haze days between the years 2000 and 2007 [6]. Episodic events such as these highlight the challenges involved in achieving

pollution control targets, even when the emission source is known. Secondary pollutants that are formed via photochemical reactions, such as ozone, increase the difficulty in tracking, and, hence controlling, primary emission sources in some cases. In addition to emissions and pollutant transport, meteorology can also affect pollutant distribution, such as the influence of Madden Julian Oscillation on ozone, and the monsoonal winds on particulate matter [7, 8].

2. Impact of air pollution on allergy in Malaysia

Although the study of air pollution and its link to health is not new, there is still interest in further understanding pathways of exposure and impact, as well as quantifying impact for a target population such as elderly people or those who are atopic. Correlation studies between ambient air pollution concentration and population hospital admissions may have to disregard the effect of confounding factors such as genes, level of personal exposure, personal habits such as smoking, and actual composition of pollutants during exposure due to limitations in data availability. Large amounts of financial resource, manpower and time are required to collect such data whether through air pollution monitoring instruments, patient surveys, or location tracking apps. Although modeling or more specifically forecast models are a potential solution, the majority of mature and emerging models only focus on quantifying exposure or combined respiratory reactions [9, 10]. There are exceptions, however, such as the works published on allergic rhinitis and asthma but the studies do not focus on cohorts in Malaysia [11, 12].

Despite such limitations, there are quite a number of studies that have been conducted in Malaysia to study the impact of air pollution on health. There have been more studies within the last decade alone as highlighted by an earlier review published in 2003 [13] which referenced several articles that mostly focused on the impacts of haze, whereas a more recent review on air pollution and health published in 2020 discussed a collection with a more diverse range of studies published within the last decade that included specific target populations and non-haze days [14]. Although there is an increase in overall evidence for the case of air pollution affecting human health, there are

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relatively few studies that focus on asthma or respiratory illness [15, 16] including a review paper on indoor air pollution and respiratory impact on children in Malaysia which only included six works within a 10-year period [17]. No reference was made in the review by Usmani et al. [14] on allergy and its link to air pollution in Malaysia. This lack of clinical or statistical evidence for cohorts in Malaysia is also highlighted by studies focusing on allergic response in the Asia Pacific region whereby neither of the work by Pawankar et al. [18, 19] included reference to studies related to allergic response to patients in Malaysia. This is a cause for concern given the impact of climate change or air pollution and its expected impact on respiratory allergy. Increased respiratory allergy among urban populations compared to rural communities [20] is an additional risk factor given that more than half of the world's population is living in cities [21].

3. Way forward

Hence, epidemiological studies would be necessary to accurately ascertain the prevalence of allergic diseases in Malaysia, as they can offer a means of predicting the future burden of noncommunicable diseases (NCD), given that allergic diseases are the earliest manifestation of NCD. This needs urgent attention now as the current climate change, pollution of air, water, and soil, with biodiversity loss, would complicate allergic diseases and other NCDs. While many advances in recent years have led to precision and personalized medicine toward the treatment of allergic diseases, however, efforts in primary prevention are far from satisfactory. The impact of environmental pollution, including air pollution, has in the last three decades led to research on pathomechanisms to explain the rise of allergic and autoimmune diseases. One hypothesis recently described is the epithelial barrier hypothesis, which embraces the hygiene and biodiversity hypotheses with linkage to defects of our epithelial barrier and accompanying microbial dysbiosis [22]. Further research using this concept would potentially offer ways in primary prevention of allergic, autoimmune, and other chronic inflammatory diseases and/or NCD.

Research along this hypothesis would entail a long and arduous journey and should not preclude the more fundamental epidemiological studies as previously alluded, as this is always the critical step to propagate research, including that in planetary health. A repository of location-specific clinical data in Malaysia will facilitate such research. A repository of archived data from piecemeal clinical research and near-real-time hospitalization will broaden the viability of conducting such research. It will also enable potential involvement in global scale initiatives such as the MAIA (Multi-Angle Imager for Aerosols) Investigation, which aims to not only map particulate matter distribution but also exposure and risk to health [23]. Concurrently, although more evidence on the impact of exposure to populations in Malaysia is necessary, there should not be a delay in taking action for reducing air pollution emissions and personal exposure to pollutants. Governance and enforcement are crucial, but these are not the only ways to move forward. A study in Korea indicated that there was statistically significant reduction on number of hospitalizations related to respiratory illness by 16.4% due the use of Wireless Emergency Alert, a mobile-based warning system on health outcomes related to airborne particulates [24]. Hence, there needs to be a more focused approach from the scientific community to communicate the evidence and possible solutions to a broader community so that a larger population will make a conscious decision to reduce both their emissions and personal exposure.

Conflict of interest

The authors have no financial conflicts of interest.

Author contributions

Conceptualization and writing: FA, Writing: AHAL, Review and feedback: JM

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