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## A Prominent but Often Overlooked Risk Factor: Air Pollution



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Recent figures uphold air pollution as one of the major concerns of the century. Following the most comprehensive collection of global air quality data to date, the World Health Organization (WHO) recently revealed that while 80% of the inhabitants of the United States and Canada breathe air that complies by WHO recommendations, this figure drops to nearly zero in Asia and the Middle East. Furthermore, the data suggests that air pollution results in the death of 7 million people annually, mainly in developing nations (WHO, 2018). A major air pollutant is particulate matter (PM), whose levels have been closely associated to morbidity and mortality rates (Anderson, 2009; Chen et al., 2007;

Dockery, 1993). PM is constituted of microscopic particles suspended in the air, with sizes ranging from hundreds of micrometers to mere nanometers. The smaller the particle, the further it can travel through the lungs and invade the respiratory system, causing respiratory and cardiovascular diseases and other ill effects (EPA, 2018).

10 - 15  $\mu\text{g}/\text{m}^3$  20 - 25  $\mu\text{g}/\text{m}^3$  30 - 35  $\mu\text{g}/\text{m}^3$  40 - 45  $\mu\text{g}/\text{m}^3$   
15 - 20  $\mu\text{g}/\text{m}^3$  25 - 30  $\mu\text{g}/\text{m}^3$  35 - 40  $\mu\text{g}/\text{m}^3$  45 -  $\mu\text{g}/\text{m}^3$



PM2.5 levels in a part of Hamra during weekdays in the morning (data collected in summer of 2017)

In Lebanon, several studies have reported PM levels in the country over the past decades. They have found that ambient levels in the greater Beirut area consistently exceed the WHO guidelines (Daher et al., 2013; Kouyoumdjian and Saliba, 2005; Massoud et al., 2011; Nakhle et al., 2015; Saliba et al., 2004; Waked et al., 2012). Furthermore, it was reported that yearly averages in Beirut city exceeded the WHO recommendations by up to 273% for PM10 (particles with diameter less than 10  $\mu\text{m}$ ) and around 100% for PM2.5 (particles with diameter less than 2.5  $\mu\text{m}$ ) (Massoud et al., 2011). However, most of the reported PM levels correspond to ambient (high-altitude) concentrations, whereas concentrations in urban (low-altitude) environments are expected to be even



higher, indicating that human exposure to hazardous substances is even more dire than currently believed (Vardoulakis et al, 2014).

The mechanisms through which particulate matter bring about ill effects are still not fully understood. A recently investigated mechanism suggests that PM induces the formation of reactive oxygen species (ROS) in the human body, especially upon the presence of soluble transition metals as constituents of PM (Bates et al., 2015). In that context, it was found that not only is the level of PM in Beirut high, but also the ROS activity of fine particles is 2.3 times greater than that measured in Los Angeles, California (Daher et al, 2013). This further implies that citizens of the region are more prone to the health hazards of PM than elsewhere in the world.

As such, there are several health peculiarities in Lebanon and the Middle East that could be potentially attributed to the higher levels and the higher malicious content of PM in the region. For instance, in Lebanon the daily PM10 and PM2.5 concentrations have been associated with increased respiratory and cardiovascular emergency hospital admissions (Nakhle et al, 2015). On the larger regional scale, coronary heart diseases were found to appear more prematurely in Middle Eastern countries than in Western populations (Zeidan et al., 2016). Moreover, the Gulf RACE and INTERHEART studies have found that patients in the Middle East experience heart attacks at an average of 10-12 years earlier than Western counterparts (Shaloob, 2017). While these could be attributed to a variety of risk factors, including hypertension and unhealthy lifestyles, the potential contribution of the severe air pollution in the region to these health issues is not to be overlooked.

The major sources of pollutant emissions in Lebanon have been reported to be traffic, dust from paved roads, oil and diesel-fueled combustion for power production, and waste incinerators (Saliba et al., 2018). As such, local efforts should be employed to control these sources and mitigate the deteriorative effects that they entail on human health and that have placed Lebanon on the global map among the most heart disease-challenged countries worldwide (Shaloob, 2017).

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