

Letter to the Editor

Severe Outbreaks of Respiratory Syndromes Following Autumn Rainfall in Khuzestan, Iran

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“If you would not bring infection and disease upon your selves, and on your wives and little ones, change the air you breathe; change it many times in a day, by opening your windows”.¹ *Charles Darwin*

For many years, the Khuzestan Province in West southern Iran has been exposed to various ambient air pollutants the most important sources of which were known to be dust and industrial pollutants. Following the early rainfall during the autumn of 2013, a severe outbreak of respiratory syndromes occurred in the province which was more severe in Ahvaz, Khuzestan Province. These respiratory syndrome outbreaks also reoccurred in 2014 and 2015.

At the night of November 1, 2013, Ahvaz witnessed the first autumn rainfall and in a few hours emergency wards encountered an overcrowded of patients with respiratory symptoms, particularly airway hyper-responsiveness, bronchospasm, shortness of breath and cough. This unusual and unexpected number of patients gradually increased, and before sunrise, in less than 10 hours after rainfall, over 2600 patients were admitted to emergency wards across the province. Over the following days, the number of patients with respiratory symptoms declined compared to its initial peak, but with subsequent rainfalls over the next 10 days, overcrowds of respiratory cases were reported again in ERs. By November 20, 2013, 20,000 patients had been registered in ERs with respiratory symptoms, of whom 93% received clinical care on an outpatient basis and were discharged with rapid relief of symptoms and 7% were hospitalized due to severity of the disease.

Similar incidents were repeated in 2014 and 2015. In 2014, between October 17 and November 2, nearly 10,400 patients with respiratory problems had visited the emergency wards after

the first autumn rainfall in the Khuzestan province. In 2015, this number reached 26,400, between October 28 to November 10 in less than two weeks. More than 60% of these people had not reported respiratory symptoms before, and with regard to place of residence, more than three-quarters of the cases with respiratory symptoms were from Ahvaz, the capital city and metropolitan area of the province. Demographically, most patients were middle-aged individuals. Even among people who had stayed home or indoors, the symptoms started shortly after opening the windows.

It is likely that airborne allergens in combination with rainfall had a major role in the pathogenesis of these respiratory symptoms.² Pollen is one of the most abundant outdoor allergens.³ It has been suggested that air pollutants such as SO₂, CO, dust, smoke, volatile organic compounds, and heavy metals can lead to increased allergenicity of some pollens. Moreover, some studies have shown that during the pollen season, there is an increase in respiratory syndromes in areas highly exposed to motor vehicle and industrial pollutants.⁴⁻⁶ Also, it has been mentioned that storm, lightning and rain can be associated with epidemics of asthma in patients with pollen-related allergies.⁷⁻⁹ In humid conditions or during thunderstorms, each pollen grain may burst into 700 miniscule particles due to osmotic and electric shocks.¹⁰⁻¹² These small particles, 0.5 to 2.5 microns in size, can reach deep into lower airways and cause bronchospasm and bronchial asthma symptoms.^{13,14}

There are various assumptions regarding the autumn respiratory incidents of 2013–2015 in the Khuzestan Province. Most probably, the synergistic effect of ambient dust and pollen on one hand and the pollution caused by industry on the other is the reason for the recent events. In other words, the combination of ambient air pollution from natural sources (such as dust and pollen) and pollutants from anthropogenic sources (such as O₃, NO_x, SO₂ and PM₁₀) created a group of amplified factors which cause airway hyper-responsiveness and bronchospasm in many even healthy individuals.

We suggest that humidity along with metal ions, absorbed by the exterior layers of the pollens, makes them even more hazardous.

Meteorologically, the Khuzestan province and particularly Ahvaz has a long period of hot months from May to October, and a short period of cold from December to February. Due to the long summer, the municipality decided to plant a new generation of plants which were resistant to saline soil and demanded less water. Now, *Conocarpus erectus* is one of the most abundant species in the green spaces of Ahvaz city.

Although raining is a cleaning mechanism for ambient air, in

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dusty cities such as Ahvaz, agglomeration of pollutants (O_3 , NO_x , SO_2 , PM_{10} , CO, heavy metals, PAH_s, HAP_s, anions and cations) at the beginning of fall and shortly before the start of the first rain, along with air inversion, creates a hazardous situation for residents.

It is possible that incompatible vegetation or the abundance of non-native plants in an industrial environment is the main reason for the recent respiratory incidents in Khuzestan province. Perhaps, in industrial areas with more apparent air pollution, plant pollens can cause more respiratory emergencies than other environments. This research team is planning more detailed epidemiological studies to verify this hypothesis.

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