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Ambush in the Air: Dust-Related Diseases

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Abstract: Air pollution has long been a serious problem since it harms human health. Dust storms happen a lot all throughout the Earth system. These kinds of important events happen a lot in dry areas. How many particles are in the air during a dust storm is a big aspect of how it impacts people's health. They move pollutants, biological materials, and particles downstream over great distances. These kinds of things appear to be happening more often in certain regions of the globe but less often in others. Predictions say that this trend will continue since climate change is causing land use to rise and soil moisture levels to fall. Research has connected dust storms to a number of health issues, notably in the Middle East. These include respiratory difficulties, cardiac problems, conjunctivitis, skin irritation, measles, coccidioidomycosis, conjunctivitis, coccidioidomycosis, and transportation accidents.

Keywords: Particulate Matter, Nickel, Bronchiolitis, Decreased Soil Moisture, Heavy Metal

Introduction

The presence of harmful chemicals or compounds, including biologically derived substances, in the atmosphere at concentrations that are harmful to human health is known as air pollution [1]. Dust and dust storms are among the air pollutants, and the health problems they cause include breathing difficulties and impaired vision. In addition, dust contains harmful metals that may cause cancer and harm other organisms such as plants and animals, potentially leading to other serious diseases [2]. The origin of pollution in dust is typically attributed to soil contamination with heavy metals resulting from agricultural and industrial practices, including the use of pesticides, battery production, textiles, rubber, food processing, and oil refining [3] which can manifest as dust during intense seasonal storms. Throughout the world, sand and dust storms are frequent natural occurrences [4]. They are found in dry lands, which make up almost half of the planet's landmass. These are not new or accidental phenomena. Airborne dust particles in certain dust storms are tiny [5]. Currently, The main places that generate dust are subtropical deserts, semi-arid or semi-humid locations, and dry soil that is hit by strong winds at particular periods of the year [6]. Most places where dust comes from are in the northern hemisphere, especially in the arid and semi-dry deserts that run from northern China to West Africa. Researchers showed that dust storms with toxic metals in them might induce asthma, bronchitis, lung cancer, and neurological issues [7]. Researchers have shown a connection between strong dust storms in Mediterranean countries and a persistent escalation in asthma symptoms [8]. Consequently, deleterious heavy metals may have enduring adverse effects on health, regardless of whether ingested via food, breathed, or absorbed transdermally [9]. Because dust particles and sandy dust storms vary in size, they can be more harmful, making them important elements in assessing the health effects of heavy metal

pollution [10]. Furthermore, dust can migrate between regions and then build on soils and water bodies, presenting health risks to humans [11]. The aim of this paper is to illuminate the impacts of of heavy metals based on dust particles associated of human health.

Dust Storm

Dust storms, a specific manifestation of dust phenomena, are generally induced by turbulent winds, such as convective haboobs, which elevate substantial quantities of dust from arid terrains and diminish visibility to under 1 kilometer [12]. In many dry and arid places around the world, dust storms are becoming more common, resulting in significant damage and catastrophes every year [13]. As a result, dust storms have garnered more attention lately [14]. Scientists have shown how several facets of human existence are impacted by dust storms [15]. Dust storm particles have an impact on the ecology, human health, agricultural output, and weather. There is evidence that mineral aerosols can lessen the acidity of precipitation and have an impact on cloud formation and precipitation. Furthermore [16], dust storms have been found to produce a high density and diversity of plant pollens and microorganisms [17]. Dust storms not only threaten the ecology but also directly and indirectly affect human and public health [18]. Nearly all dust storm particles, or airborne particles (PM), can reach the respiratory system because of their tiny size; bigger particles are frequently deposited in the upper respiratory tract [19].

Airborne heavy metals

Heavy metal contamination can come from a number of local sources, such as industry, agriculture, road traffic, and the burning of fossil fuels, even though soils naturally contain these metals [20]Particulate matter (PM) levels in the air, especially the very hazardous heavy metals associated with PM, are another major health concern [21]. Because of their toxicity and mobility, heavy metals like copper, cadmium, and Nickel are typically associated with dangerous issues and pollution, especially when they are present in dissolved form. Any of these heavy metals present at extremely high levels are dangerous to humans. These heavy metals are not biodegradable, which makes cleanup more challenging. Recognizing, understanding, and controlling this heavy metal pollution in the environment are essential. Table 1 shows information about heavy elements.

Heavy Metals	Sources	Pathogenic Form	Biological Risk	Citation
chromium(Cr)	gasses, volcanic dust, plants, animals, rocks, and soil	Cr VI	Skin allergies, lung and nasal malignancies, and bronchial asthma	[22]
Cadmium (Cd)	minerals such as sulfate, chloride, carbonate, and hydroxide salts, as well as water and soil.	Cd	Inhaling subchronically Both the kidneys and the lungs (emphysema, bronchiolitis, and alveolitis) may suffer negative consequences from exposure to cadmium and related substances.	[23]

Lead (pb)	Vehicle exhaust, the burning of fossil fuels, companies that use lead compounds and alloys, and lead mining all contribute to the emission of lead into the atmosphere. from wood burning, coal burning in power station, soils, and aviation fumes.	Pb	Lead poisoning can cause both acute and long-term effects, including as damage to the kidneys, brain, reproductive organs, and central nervous system.	[24]
Nickel (Ni)	Aqueous nickel comes from the solubilization of nickel compounds in soils, volcanic eruptions, weathering of rocks, and biological activity.	Ni $NiCl_2$, $NiSO_4$ Ni_3S_2, NiO	tumors of the nasal cavity and lungs	[25]

How Dust Storms Affect Human Health

Dust storms and their effects on health are emerging as a significant public health concern. In the Earth system, dust storms are ubiquitous. These are large-scale and often occurring occurrences in drylands [26]. A significant factor in dust storms' impact on health is the quantity of suspended particles they include [27]. They carry biological items, contaminants, and particles downstream over considerable distances. Some places in the globe seem to be having more of these events, while others are having them less frequently. Some forecasts [28] say that this tendency could continue because of climate change, which is making the soil less wet and making land usage more important. Exposure to dust has been related to respiratory, heart, lung, eye, skin, and joint disorders, as well as illnesses including measles, coccidioidomycosis, conjunctivitis, and transportation accidents [29], [30].

The Journey of ultrafine particles in human

The lung is where PM0.1 first interacts. The lung's surface area has been estimated to be greater than 100 m2 18, however this is often calculated using light microscopy to measure linear intercepts with a 1-µm probe [31]. The lung's broad surface is easily reached by PM0.1 and their hazardous payload. They then enter other organs via the lung vasculature, either freely in the lymph and vasculature or through mobile cells, causing direct damage to distant organs [32].

Iraq and dust storms

One of the Middle East's most afflicted nations in terms of sand and dust storms is Iraq. Over the past ten years, the incidence has been much more frequent, and this trend is continuing [33]. Sand and dust storms can be local or regional phenomena. However, the former occurs more frequently than the latter. The regional event often includes a portion of Syria, crosses Iraqi territory toward Kuwait and Saudi Arabia and/or the Arabian Gulf, and, less commonly, reaches Iran [34]. Despite being regional storms, the former have a more detrimental effect on human health and result in larger financial losses than local storms [35]. In addition to environmental changes including desertification, land degradation, and marsh drying, one of the primary causes of sand and dust storms is the region's changing climate,

particularly the sharp decline in the yearly rate of precipitation [36].

The most effective local causes include military activities and careless driving, particularly in the Iraqi Southern Desert. To combat this issue and reduce the frequency of dust storms, prudent management of water resources through the use of unconventional resources and the use of appropriate irrigation techniques can be very beneficial [37].

In the spring of 2022, there were several dust storms in Iraq, particularly in Baghdad. Due to Iraq's position in a huge desert region, these storms are a natural meteorological occurrence, but they are notable for their ferocity, which can have detrimental effects on health and cause air traffic disruptions and airport closures. The recent decrease in rainfall in Iraq and its surrounding nations is responsible for the increasing intensity of these dust storms [38]. The source regions of these dust storms include northeastern Syria, eastern Jordan, northern Saudi Arabia, and many sites in Iraq, according to satellite image analysis [39].

How to Guard Against Dust Storms

Although sand and dust storms are essential to the Earth system, they also pose a number of risks to the sustainability of human society's environment and economy. One of the most crucial awareness requirements for dust storm reduction and safety

Preventive actions for the environment:

- Expand windbreaks and tree planting to the greatest extent feasible.
- Plant hardy plants and bushes to prevent erosion.

Preventive measures for oneself and at home

- Particularly for those with asthma and the elderly, stay indoors during dust storms.
- Put on goggles and a protective mask to shield your eyes
- Drink lots of water to keep your body and respiratory system hydrated, and wash your face and nose often to clear your respiratory tract.

Conclusion

According to the study's conclusions, dust storms have a major negative influence on public health. Preparing for, responding to, and mitigating these environmental hazards should receive more attention in order to lessen their detrimental effects on health.

References

[1] I. Manisalidis, E. Stavropoulou, A. Stavropoulos, and E. Bezirtzoglou, “Environmental and health impacts of air pollution: A review,” *Frontiers in Public Health*, vol. 8, p. 14, 2020.

[2] S. S. Shetty, D. Deepthi, S. Harshitha, S. Sonkusare, P. B. Naik, and H. Madhyastha, “Environmental pollutants and their effects on human health,” *Heliyon*, vol. 9, no. 9, 2023.

[3] A. Roy, A. K. Jha, A. Kumar, T. Bhattacharya, S. Chakraborty, N. P. Raval, and M. Kumar, “Heavy metal pollution in indoor dust of residential, commercial, and industrial areas: A review of evolutionary trends,” *Air Quality, Atmosphere & Health*, vol. 17, no. 4, pp. 891–918, 2024.

[4] A. Darvishi Boloorani, M. Soleimani, R. Papi, N. Neysani Samany, P. Teymouri, and Z. Soleimani, “Sources, drivers, and impacts of sand and dust storms: A global view,” in *Dust and Health: Challenges and Solutions*. Cham, Switzerland: Springer International Publishing, 2023, pp. 31–49.

[5] S. Maji and S. Sonwani, “Nature of sand and dust storm in South Asian region: Extremities and environmental impacts,” in *Extremes in Atmospheric Processes and Phenomenon: Assessment, Impacts and Mitigation*. Singapore: Springer Nature Singapore, 2022, pp. 113–139.

[6] K. Raispour, M. Khosravi, T. Tavousi, and M. Sharifikiya, “The influence of the polar front jet stream on the formation of dust events in the southwest of Iran,” *Air Quality, Atmosphere &*

Health, vol. 9, no. 1, pp. 15–23, 2016.

[7] S. M. Awadh, "Impact of North African sand and dust storms on the Middle East using Iraq as an example: Causes, sources, and mitigation," *Atmosphere*, vol. 14, no. 1, p. 180, 2023.

[8] R. Goswami and N. Neog, "Heavy metal pollution in the environment: Impact on air quality and human health implications," in *Heavy Metal Toxicity: Environmental Concerns, Remediation and Opportunities*. Singapore: Springer Nature Singapore, 2023, pp. 75–103.

[9] M. Soleimani-Sardo, M. Shirani, and V. Strezov, "Heavy metal pollution levels and health risk assessment of dust storms in Jazmurian region, Iran," *Scientific Reports*, vol. 13, no. 1, p. 7337, 2023.

[10] B. I. Jaafar and S. A. Kadhum, "Impact of particle size on heavy metal contamination in human health from sandstorms in Iraq," *Journal of Trace Elements and Minerals*, vol. 6, p. 100108, 2023.

[11] N. J. Middleton, A. S. Goudie, and G. L. Wells, "The frequency and source areas of dust storms," in *Aeolian Geomorphology*. London, U.K.: Routledge, 2020, pp. 237–259.

[12] G. Shepherd, E. Terradellas, A. Baklanov, U. Kang, W. Sprigg, S. Nickovic, *et al.*, *Global Assessment of Sand and Dust Storms*. Nairobi, Kenya: United Nations Environment Programme, 2016.

[13] A. S. Goudie, "Dust storms: Recent developments," *Journal of Environmental Management*, vol. 90, no. 1, pp. 89–94, 2009.

[14] D. W. Griffin and C. A. Kellogg, "Dust storms and their impact on ocean and human health: Dust in Earth's atmosphere," *EcoHealth*, vol. 1, no. 3, pp. 284–295, 2004.

[15] J. F. Kok, T. Storelvmo, V. A. Karydis, A. A. Adebiyi, N. M. Mahowald, A. T. Evan, *et al.*, "Mineral dust aerosol impacts on global climate and climate change," *Nature Reviews Earth & Environment*, vol. 4, no. 2, pp. 71–86, 2023.

[16] S. A. Jasim, M. J. Mohammadi, I. Patra, A. T. Jalil, M. Taherian, U. Y. Abdullaeva, *et al.*, "The effect of microorganisms (bacteria and fungi) in dust storm on human health," *Reviews on Environmental Health*, vol. 39, no. 1, pp. 65–75, 2024.

[17] J. E. Salvaggio, "Inhaled particles and respiratory disease," *Journal of Allergy and Clinical Immunology*, vol. 94, no. 2, pp. 304–309, 1994.

[18] H. Aghababaeian, A. Ostadtaghizadeh, A. Ardalan, A. Asgary, M. Akbary, M. S. Yekaninejad, and C. Stephens, "Global health impacts of dust storms: A systematic review," *Environmental Health Insights*, vol. 15, p. 11786302211018390, 2021.

[19] A. K. Chopra, C. Pathak, and G. Prasad, "Scenario of heavy metal contamination in agricultural soil and its management," *Journal of Applied and Natural Science*, vol. 1, no. 1, pp. 99–108, 2009.

[20] L. T. Popoola, S. A. Adebanjo, and B. K. Adeoye, "Assessment of atmospheric particulate matter and heavy metals: A critical review," *International Journal of Environmental Science and Technology*, vol. 15, no. 5, pp. 935–948, 2018.

[21] A. L. Holmes, S. S. Wise, and J. P. Wise, "Carcinogenicity of hexavalent chromium," *Indian Journal of Medical Research*, vol. 128, no. 4, pp. 353–372, 2008.

[22] Ankush, Ritambhara, S. Lamba, Deepika, and R. Prakash, "Cadmium in environment—An overview," in *Cadmium Toxicity in Water: Challenges and Solutions*, pp. 3–20, 2024.

[23] M. S. Collin, S. K. Venkatraman, N. Vijayakumar, V. Kanimozhi, S. M. Arbaaz, R. S. Stacey, *et al.*, "Bioaccumulation of lead (Pb) and its effects on human: A review," *Journal of Hazardous Materials Advances*, vol. 7, p. 100094, 2022.

[24] A. Graziani, M. Carretti, G. Berti, G. Bonaccorsi, C. Doccioli, C. Saieva, and S. Caini, "Nickel in biological samples in association with cancer risk: A systematic literature review," *Current Epidemiology Reports*, vol. 12, no. 1, p. 9, 2025.

[25] C. Zucca, R. Fleiner, E. Bonaiuti, and U. Kang, "Land degradation drivers of anthropogenic sand

and dust storms," *Catena*, vol. 219, p. 106575, 2022.

[26] H. Aghababaeian, A. Ostadtaghizadeh, A. Ardalan, A. Asgary, M. Akbary, M. S. Yekaninejad, and C. Stephens, "Global health impacts of dust storms: A systematic review," *Environmental Health Insights*, vol. 15, p. 11786302211018390, 2021.

[27] S. Nazari, M. Kermani, M. Fazlzadeh, S. A. Matboo, and A. R. Yari, "The origins and sources of dust particles, their effects on environment and health, and control strategies: A review," *Journal of Air Pollution and Health*, vol. 1, no. 2, pp. 137–152, 2016.

[28] A. Sadeghimoghaddam, H. Khankeh, M. Norozi, S. Fateh, and M. Farrokhi, "Investigating the effects of dust storms on morbidity and mortality due to cardiovascular and respiratory diseases: A systematic review," *Journal of Education and Health Promotion*, vol. 10, no. 1, p. 191, 2021.

[29] X. Zhang, L. Zhao, D. Q. Tong, G. Wu, M. Dan, and B. Teng, "A systematic review of global desert dust and associated human health effects," *Atmosphere*, vol. 7, no. 12, p. 158, 2016.

[30] D. E. Schraufnagel, "The health effects of ultrafine particles," *Experimental & Molecular Medicine*, vol. 52, no. 3, pp. 311–317, 2020.

[31] X. Jia, "Human lung cell responses caused by roadside particle type," thesis, Simon Fraser Univ., Faculty of Sciences, Burnaby, BC, Canada, 2019.

[32] V. Sissakian, N. Al-Ansari, and S. Knutsson, "Sand and dust storm events in Iraq," *Journal of Natural Science*, vol. 5, no. 10, pp. 1084–1094, 2013.

[33] S. M. Awadh, "Impact of North African sand and dust storms on the Middle East using Iraq as an example: Causes, sources, and mitigation," *Atmosphere*, vol. 14, no. 1, p. 180, 2023.

[34] K. Lane, K. Charles-Guzman, K. Wheeler, Z. Abid, N. Graber, and T. Matte, "Health effects of coastal storms and flooding in urban areas: A review and vulnerability assessment," *Journal of Environmental and Public Health*, vol. 2013, no. 1, p. 913064, 2013.

[35] N. Adamo, N. Al-Ansari, V. Sissakian, K. Jehad Fahmi, and S. Ali Abed, "Climate change: Droughts and increasing desertification in the Middle East, with special reference to Iraq," *Engineering*, vol. 14, no. 7, pp. 235–273, 2022.

[36] S. M. Awadh, "Impact of North African sand and dust storms on the Middle East using Iraq as an example: Causes, sources, and mitigation," *Atmosphere*, vol. 14, no. 1, p. 180, 2023.

[37] S. A. Khidher, "Dust storms in Iraq: Past and present," *Theoretical and Applied Climatology*, vol. 155, no. 6, pp. 4721–4735, 2024.

[38] R. Al Zubi, T. E. Gill, J. A. Lee, K. Ardon-Dryer, and T. Kandakji, "Spatiotemporal analysis of sand and dust emission point sources detected from satellite imagery in Syria, Jordan, and Iraq," *Science of the Total Environment*, vol. 949, p. 175157, 2024.

[39] World Health Organization, *Prevention of Allergy and Allergic Asthma*, Geneva, Switzerland: World Health Organization, 2003.