

HBKU Flagship Research Grant Program 3rd Cycle– Project Highlight

Project Title: Environmental Health in Urbanised Arid Regions: Assessing the Effects of Natural Dust and Anthropogenic Pollution on Pulmonary and Cardiovascular Functions

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Executive Summary

Air pollution is one of the most important components of environmental health risks worldwide accounting for more than 1 in 8 deaths globally. Quantifying the health impacts of air pollution can guide policies, reduce the burden of disease and save lives. Most of the studies to date have focused on traffic related air pollution and were conducted in regions of the world dominated by anthropogenic and biogenic mixtures of pollutants largely in the USA and Europe lacking representation of exposure to conditions experienced in our desert region, where a mixture of natural dust and anthropogenic pollution from rapid urbanisation and regional industrial activities dominate.

This integrated HBKU multidisciplinary research project aims to investigate the acute impacts of dust and anthropogenic pollution on human health in urbanised arid regions focusing on respiratory, cardiovascular and inflammatory effects in healthy adults. It employs *an established randomised two-way exposure crossover study design* to investigate and compare the acute (short term) respiratory and cardiovascular effects of environmental exposure of healthy adult volunteers in two environmentally distinct regions in Qatar (background desert vs. urban background locations). Dust and air pollution samples will be collected at the same locations on the days of exposure and used for toxicology assessment on lung and cardiovascular cell lines. The novelty of this project stems from its regional and local relevance, which is subject to intense photochemical reaction processes, as well as the relatively higher levels of particulate matter pollution due to the natural dust background.

Expected Outcome

This project will deliver the first systematic evidence of human health impacts of natural and human-made pollution mixtures in our region through a real-life human exposure study in contrasting environments coupled with mechanistic understanding of the effects through cell-line toxicology assessment. Findings from this research will provide answers to multiple recent WHO and international calls for evidence on the impacts of dust on human health in the Middle and East arid regions, contributing to filling a critical knowledge gap in our region and will be highly relevant to informing local and regional regulatory and policy development to mitigate the impacts of dust and air pollution on human health. They will also inform the global understanding of the effect of natural dust on the burden of disease in source regions and how anthropogenic pollution may alter dust impacts, ultimately contributing to setting more regionally representative health-based air quality guidelines.

Flagship Area, keywords, tags:

Sustainable and Resilient Cities, Environmental Health, Air Quality, Dust, OMICS, Exposure

A map of HBKU-QEERI air quality research network. The locations used for contrasting exposure assessment in this project are Al-Shahaniya (ASH, desert location) and Al Thumama (ATS, urban location).

