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Heat, humidity and health impacts: How causal diagrams can help tell the complex story

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The global health burden associated with exposure to heat is a grave concern and is projected to further increase under global warming. While physiological studies have demonstrated the role of humidity alongside temperature in exacerbating heat stress for humans, epidemiological findings remain conflicted to date. Understanding the intricate relationships between heat, humidity, and health outcomes are crucial for future adaptation and mitigation. This project introduces 'directed acyclic graphs' (DAGs) as causal models to elucidate the analytical complexity in observational epidemiological studies focusing on humid heat related health impacts. DAGs are employed to delineate implicit assumptions often overlooked in such studies, depicting humidity as a confounder, a mediator, or an effect modifier. The complexities arising from using composite heat-stress indices such as wet-bulb temperature, emphasizing the limitations induced in extracting individual effects of humidity are also portrayed through DAGs. Theoretical generalisations for regression models corresponding to each of the causal assumptions are also discussed. The goal of the study is not to prioritize one causal model, but to explicitly discuss the potential causal models suitable for representing associations between heat, humidity, and related health impacts. In the process, we highlight the implications of selecting one model over another. The project aims to inspire further quantitative studies on the topic and motivate researchers to explicitly characterize the assumptions underlying the analytical models with DAGs, facilitating accurate interpretations of the findings. This extends beyond analysing the role of humidity in heat-related health impacts, encompassing similarly complex research questions associated with other compound events.