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Exploring rural hospital admissions for diarrhoeal disease, malaria, pneumonia, and asthma in relation to temperature, rainfall and air pollution using wavelet transform analysis

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Abstract

Background: Climate variables impact human health and in an era of climate change, there is a pressing need to understand these relationships to best inform how such impacts are likely to change. **Objectives:** This study sought to investigate time series of daily admissions from two public hospitals in Limpopo province in South Africa with climate variability and air quality. **Methods:** We used wavelet transform cross-correlation analysis to monitor coincidences in changes of meteorological (temperature and rainfall) and air quality (concentrations of PM_{2.5} and NO₂) variables with admissions to hospitals for gastrointestinal illnesses including diarrhoea, pneumonia-related diagnosis, malaria and asthma cases. We were interested to disentangle meteorological or environmental variables that might be associated with underlying temporal variations of disease prevalence measured through visits to hospitals. **Results:** We found preconditioning of prevalence of pneumonia by changes in air quality and showed that malaria in South Africa is a multivariate event, initiated by co-occurrence of heat and rainfall. We provided new statistical estimates of time delays between the change of weather or air pollution and increase of

hospital admissions for pneumonia and malaria that are addition to already known seasonal variations. We found that increase of prevalence of pneumonia follows changes in air quality after a time period of 10 to 15 days, while the increase of incidence of malaria follows the co-occurrence of high temperature and rainfall after a 30-day interval. Discussion: Our findings have relevance for early warning system development and climate change adaptation planning to protect human health and well-being.