Effects of Occupational Heat Exposure on Traffic Police Workers in Ahmedabad, India

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EXECUTIVE SUMMARY

One of the most concerning environmental effects of climate change is rising levels of extreme heat, which already poses serious risks in many parts of the world. Climate change scenarios modeled by the IPCC Fifth Assessment Report project rising temperatures and an increase in frequency and intensity of heat waves in the coming decades (IPCC 2014). Cities and urban areas experience higher levels of heat exposure due to the urban heat island (UHI) effect, in which temperatures in urban areas are, on average, several degrees higher than those found in surrounding areas. In rapidly urbanizing cities, the influx of heat trapping-materials like concrete and black tar roofs and heat-creating activity like construction and car traffic contribute to the UHI, exposing residents and workers to extremely high temperatures.

South Asia is a subtropical region characterized by high average summertime temperatures. Heat exposure poses a significant risk for residents in subtropical and tropical regions, particularly those in cities and urban settings. There is serious concern for South Asian cities, which, over the past several decades, have experienced an overall increase in heat waves, accompanied by an increase in heat-related deaths. As one of the fastest growing cities in India, Ahmedabad exemplifies how South Asian cities and climate are co-evolving in ways that amplify both the severity of heat stress and the vulnerability of urban populations (Luber and Prudent 2009).

Vulnerability to heat stress is highly differentiated by age, socioeconomic status, and occupation. Workers who endure hot conditions outside, without access to shade, or sufficient water, are at increased risk of heat strain and heat stroke. Workers in low- and middle-income tropical countries are likely at highest risk of excessive heat exposure due to the combined effect of dense urban growth and projections of substantial temperature increases due to global climate change, which exacerbate the warming effect of UHI.

Despite improvements in traffic control measures, rapid industrialization and increasing traffic in developing countries has and will continue to worsen outdoor temperature, noise, and air pollution exposures in urban roadside environments. As a result, traffic-related environmental exposures are eliciting increasing concerns among the public health research and policy community. Traffic police personnel face multiple occupational hazards since they are continuously and simultaneously exposed to vehicular emissions, noise from vehicle honking, and harsh weather conditions.

This paper is a preliminary report from a pilot study conducted in Ahmedabad, Gujarat assessing environmental heat exposures among a highly vulnerable occupational cohort of traffic police during the summer months of June and July 2015. This ongoing research project is conducted in partnership with Ahmedabad City Traffic Police Department as well as the Indian Institute of Public Health, Gandhinagar and the Natural Resources Defense Council.

The study presented here reflects three primary objectives: (1) to measure heat exposures among traffic police on duty in order to assess heat-related vulnerability in this occupational cohort, (2) to use survey methods to evaluate prevalence of heat-related symptoms in officers and obtain worker-derived data concerning heat stress and adaptation measures, and (3) to gain practical information to prepare for a larger prospective cohort study.

In June and July 2015, we collected weekly heat exposure data using area and personal temperature monitoring at four different traffic junctions. We enrolled a convenience sample, consisting of 16 traffic police (four participants that work at each of the four traffic junctions) who volunteered to participate in the study. We administered a baseline survey at the start of the study and prospectively followed up with the officers to capture prevalence of heat-related symptoms over the study period.

This pilot assessment has highlighted health impacts due to excessive heat exposure and indicates that occupational heat stress exposure resulting from outdoor work at traffic junctions is likely to have implications for adverse health outcomes. We observed a general trend that as temperature indicators (i.e. WBGT, ambient temperature) decreased over the study period, heat-related symptoms consistently decreased. This association could be quantitatively explored in future study by modeling the probability of prevalence of heat-related symptoms as a function of various temperature exposure predictors. Moreover, further assessment is needed to refine this relationship between quantitative assessments of exposure and physiological responses.

WBGT levels ranged from 28.2 to 36.1 °C during the study period. Traffic police workers who participated in this study were exposed to WBGT levels higher than the recommended TLV as per ACGIH guidelines even beyond the hottest months of the season. Given that the end of June and July are generally considered the cooler part of the heat season, these trends should be further explored. We observed a general trend that as temperature indicators decreased over the study period, heat-related symptoms consistently decreased.

Comparison between three separate temperature predictors over the study period highlights significant differences between each estimate. We observed the largest differences in average daily temperature (up to 7°C) between ambient temperature measured by dataloggers and ambient temperature measured at the airport Our findings are consistent with the urban heat island phenomenon, implying that airport measurements by the Indian Meteorological Department may not accurately capture heat exposures among individuals that work in and alongside high-density traffic junctions. Our findings suggest that heat-measuring instruments with data-logging capability worn by individuals provide the most accurate reflection of actual ambient temperature exposures and variability among traffic police workers. These results also indicate that compared to the general population, traffic police personnel may experience higher heat exposures and are thus may be at higher risk for related adverse health effects. As a result, our exposure data represents a high vulnerability scenario that can be extended to other drivers and passengers in open vehicles i.e. rickshaws, outdoor workers like street vendors and construction workers, as well as slum dwellers.

High traffic load during particularly high commuting hours and lack of sufficient staff on duty restrict worker's ability to take rest and hydration breaks. Furthermore, not all traffic junctions were equipped with shaded break areas and/or water canteens designated for workers. In addition to variation in cooling resources, our observations of four different junctions indicate high variability between traffic junctions in terms of traffic density and heat-contributing infrastructure. Due to a small sample size consisting of temperature data from 5 full work shifts at each worksite, these differences, however, did not significantly change overall WBGT measurement ranges between worksites. In addition to heat, other significant workplace stressors that should be addressed include air pollution, noise from honking, and prolonged standing position.

Experiences from this pilot study support our understanding the feasibility of the proposed methodology and highlight significant changes that will be implemented for follow-up research with this occupational cohort. This paper concludes with study design improvements informed by these field-based experiences as well as implications for data dissemination and policy strategies. This report as well as results from future study will be provided to the Commissioner of the City Traffic Police in order to suggest interventions that may be targeted to this occupational group.

This study demonstrates the need to work toward strategies to protect workers from the negative health and productivity effects of heat exposure under current conditions. The current measures by the City Traffic Department are insufficient and highly variable across junctions.

Based on questionnaire responses, we identify multiple strategies to protect traffic police from heat exposures. These include:

- Provisioning of an umbrella for shade and properly shaded rest areas at each intersection
- Providing cool jackets, lightweight shoes, quality goggles for each staff member
- Rotation of personnel standing directly in the heat, and oral rehydration at junctions
- Operationalizing formal water canteen and/or personal water bottles and oral rehydration