

## Climate Change Implications on Occupational Health and Productivity in Tropical Countries: Study Results from India

**Authors :** Vidhya Venugopal, Jeremiah Chinnadurai, Rebekah A. I. Lucas, Tord Kjellstrom, Bruno Lemke

**Abstract :** Introduction: The effects of climate change (CC) are largely discussed across the globe in terms of impacts on the environment and the general population, but the impacts on workers remain largely unexplored. The predicted rise in temperatures and heat events in the CC scenario have health implications on millions of workers in physically exerting jobs. The current health and productivity risks associated with heat exposures are characterized, future risk estimates as temperature rises and recommendations towards developing protective and preventive occupational health and safety guidelines for India are discussed. Methodology: Cross-sectional studies were conducted in several occupational sectors with workers engaged in moderate to heavy labor (n=1580). Quantitative data on heat exposures (WBGT°C), physiological heat strain indicators viz., Core temperature (CBT), Urine specific gravity (USG), Sweat rate (SwR) and qualitative data on heat-related health symptoms and productivity losses were collected. Data were analyzed for associations between heat exposures, health and productivity outcomes related to heat stress. Findings: Heat conditions exceeded the Threshold Limit Value (TLV) for safe manual work in 66% of the workers across several sectors (Avg.WBGT of  $28.7^{\circ}\text{C}\pm 3.1^{\circ}\text{C}$ ). Widespread concerns about heat-related health outcomes (86%) were prevalent among workers exposed to high TLVs, with excessive sweating, fatigue and tiredness being commonly reported by workers. The heat stress indicators, core temperature (14%), Sweat rate (8%) and USG (9%), were above normal levels in the study population. A significant association was found between rise in Core Temperatures and WBGT exposures ( $p=0.000179$ ) Elevated USG and SwR in the worker population indicate moderate dehydration, with potential risks of developing heat-related illnesses. In a steel industry with high heat exposures, an alarming 9% prevalence of kidney/urogenital anomalies was observed in a young workforce. Heat exposures above TLVs were associated with significantly increased odds of various adverse health outcomes (OR=2.43, 95% CI 1.88 to 3.13, p-value =  $<0.0001$ ) and productivity losses (OR=1.79, 95% CI 1.32 to 2.4, p-value = 0.0002). Rough estimates for the number of workers who would be subjected to higher than TLV levels in the various RCP scenarios are RCP2.6 =79%, RCP4.5 & RCP6 = 81% and at RCP 8.5 = 85%. Rising temperatures due to CC has the capacity to further reduce already compromised health and productivity by subjecting the workers to increased heat exposures in the RCP scenarios are of concern for the country's occupational health and economy. Conclusion: The findings of this study clearly identify that health protection from hot weather will become increasingly necessary in the Indian subcontinent and understanding the various adaptation techniques needs urgent attention. Further research with a multi-targeted approach to develop strategies for implementing interventions to protect the millions of workers is imperative. Approaches to include health aspects of climate change within sectoral and climate change specific policies should be encouraged, via a number of mechanisms, such as the "Health in All Policies" approach to avert adverse health and productivity consequences as climate change proceeds.

**Keywords :** heat stress, occupational health, productivity loss, heat strain, adverse health outcomes

**Conference Title :** ICESCC 2015 : International Conference on Earth Science and Climate Change

**Conference Location :** Montreal, Canada

**Conference Dates :** May 16-17, 2016