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Evaluation of Subjective Heat Strain using A Questionnaire among Transport Workers – A Pilot Study

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ABSTRACT

Introduction: *Exposure to excessive heat at workplace is commonly encountered with multitude of health and social impacts. Workers experience a wide range of health impacts like heat exhaustion, heat cramps etc resulting in reduced performance and health related illnesses. Because of the inter-individual differences in tolerating heat, it is important to know the view of the workers regarding the heat stress.*

Aim: *To qualitatively evaluate the transport workers perception using a standardized questionnaire regarding the heat stress and its health impacts.*

Materials and Methods*: transport workers (n = 12, apparently healthy male drivers) employed in Chennai were interviewed using standardized HOTHAPS questionnaire. Area Heat stress assessments were measured using Quest Temp WBGT monitor.*

Results*: Heat stress measurements (WBGT) ranged from 28.1 - 32^{o}C during the period of December 2012 in Chennai, South India. Almost 80% of the study participants felt that hot weather affected their performance substantially, 50% gave H/O muscle cramps, excessive sweating & thirst, 8% gave H/O severe heat exhaustion & syncope whereas 40% felt heat stress affected their productivity & income.*

Discussion: *This study has highlighted the subjective feelings of the workers regarding the social and health impacts of heat stress. Even though only 8% of the study participants gave H/O syncope it is a very crucial finding because of the magnitude of risk involved. Implementation of interventions and health education will be effective if done in conjunction with knowledge of the workers perception regarding their work environment. Qualitative measurement of workers perception is an effective method to evaluate the heat stress along with the environmental measurements.*

Key words: *Heat stress, Perception, Productivity*

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INTRODUCTION

The potential effects of global Climate Change (CC) on human health are large and diverse[1]. It has direct and indirect impacts on several sectors like energy, economy, agriculture, tourism and health[2].

The impacts of CC on human health are being studied extensively in the general population[3] whereas the working population has received minimal attention in spite of evidences of negative impacts in the labour market[4].

The relationship between CC and Occupational Safety and Health (OSH) has been characterized under seven categories namely (1) increased ambient temperature, (2) air pollution, (3) ultraviolet exposure, (4) extreme weather, (5) vector-borne diseases and expanded habitats, (6) industrial transitions and emerging industries; and (7) changes in the built environment[5].

The major reason that working people are a vulnerable group is because of internal heat produced when muscles are used during work. The combination of heat stress, dehydration and physical activity impose challenge for physical adjustment, with potential risk of ensuing heat related injuries and disorders[6].

More than 700 million workers are exposed to heat stress and more than 1.4 billion workers are exposed to extra urban heat load, particularly being outdoors[7].

Exposure to excessive heat at workplace is commonly encountered with multitude of health and social impacts especially in tropical or sub-tropical, low and middle income countries[8] with Asia being projected to get one of the greatest increases of heat exposures in the future[9].

Outdoor and indoor heat loads are increasing due to global Climate Change impairing the health and productivity of millions of workers worldwide[10].This has been shown to result in estimated current loss of US$ 300B and projected loss of US$ 2500B by 2030[11].

The impacts is more in countries like India which are already too hot leading to inability to work to one's fullest potential for many days of the year[12]. India is a growing economy with working age group forming the 63.6% with more than 90% working in the informal sectors .Around 68% of Indian workers are not insured[13].

Added to this, the diversity in Indian climate systems necessitates more research in this field to improve scientific understanding of these complex interactions and to improve the ability to identify, prevent, and respond to the more serious potential health consequences[14].

Air temperature, radiant temperature, humidity, air movement along with metabolic heat generated by human activity and the nature of clothing worn by a person provide six fundamental factors that affect human response to thermal environments[15].

Heat stress response is not uniform among all the workers. Construction workers, factory labourers, manual labourers who work outdoors e.g., police officers, street vendors, drivers etc are population at risk for heat stress[16]. Statistics from National Crime Record Bureau (NCRB) show that out of 4.4 lakh accidents in India during 2011, 35,870 in the month of November and 41,000 occurred in the month of May even though the number of vehicles on the road was less during May due to closure of colleges and schools[17] . Drivers in urban areas are always under constant high stress for time factor, safety of the passengers, pedestrians and also to avoid accidents [18]. Driving has become a challenge in urban areas due to increase in number of vehicles, improper roads, inadequate planning of city design, lack of traffic sense & neglect of traffic rules.

There are individual differences among workers in tolerating heat [19]. The subjective heat strain (perception) assessment is very crucial for the measurement of individual differences in heat strain[14]. Hence it is important to know the view of the workers regarding the subjective heat strain.

Objectives: To qualitatively evaluate the subjective heat strain and its health impacts among transport workers using a standardized questionnaire.

MATERIALS AND METHODS

This study was approved by Institutional ethics committee of Sri Ramachandra University. This study was carried among transport workers employed in Chennai. Informed consent was obtained from study participants (n=12 apparently healthy male drivers) and they were interviewed using standardized HOTHAPS questionnaire on personal details, exposure details and their perceptions of health impacts due to heat stress. Area Heat stress assessments were measured using Quest Temp WBGT monitor.

RESULTS

Heat stress measurements (WBGT) ranged from 28.1 - 32^{o}C during the period of December 2012 in Chennai, South India. Almost 80% of the workers felt that hot weather was a problem and it affected their performance substantially. Around 50% of workers complained of muscle cramps, excessive sweating and thirst. 8% of workers gave a history of severe heat exhaustion, and syncope. 40% of workers felt heat stress impacted their work as they have to avail more leave due to excessive heat and thereby affected their productivity and income (Table 1).

Table 1: Individual differences in Subjective heat strain parameters

Subjective heat strain parameters	Percentage
Fall in Performance	80%
H/O Muscle cramps, Excessive sweating & thirst	50%
H/O Severe heat exhaustion & syncope	8%
Avail more leave due to excessive heat resulting in reduced income	40%

DISCUSSION

This was a pilot study to evaluate the subjective heat strain using a questionnaire among transport workers. Almost 80% of the study participants felt that hot weather affected their performance substantially, 50% of them gave history of (H/O) muscle cramps, excessive sweating & thirst, 8% gave H/O severe heat exhaustion & syncope whereas 40% felt heat stress affected their productivity & income .Even though only 8% of the study participants gave H/O syncope it is a very crucial finding because of the magnitude of risk involved.

This study has highlighted the subjective heat strain of the transport workers in Chennai, one of the coastal cities in India during the month of December which is not a summer month.

This study also serves as an indicator of prediction of more subjective heat strain possibly aggravated during summer with more temperature and high humidity levels in a coastal city like Chennai. Drivers are more likely to experience significantly reduced levels of comfort at high temperatures compounded by high humidity and lack of breeze leading to irritability, changes in behavior like increased sense of carelessness and road rage resulting in increased risk for accidents.This study also provides insight in to the subjective feelings of the drivers regarding the social and health impacts of heat stress. Qualitative measurement of workers perception is an effective method to evaluate the heat stress along with the environmental measurements. Implementation of interventions and health education will be effective if done in conjunction with knowledge of the workers perception regarding their work environment.

Future scope for the study:

To conduct the same study in summer and to look for any difference in subjective heat strain. To repeat the study in a larger sample size involving other group of workers in transport industry. To include more occupational sectors in our study based on the

feasibility and compare the difference in subjective heat strain. To assess the effects of intervention wherever possible.

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REFERENCES

1. Christine, M. and Jessup et al. Climate Change, Human Health, and Biomedical Research: Analysis of the National Institutes of Health Research Portfolio. *Environmental Health Perspectives.* (2013) http://dx.doi.org/10.1289/ehp.1104518
2. Dash, S. K. and Kjellstrom, T. , Workplace heat stress in the context of rising temperature in India. *Current Science*. **101(4):** (2011).
3. Séguin, J., Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptative Capacity.2008; 546, Health Canada, Ottawa.
4. Harrington, J.M., Research priorities in occupational medicine: a survey of United Kingdom medical opinion by the Delphi technique. *Occup Environ Med.* **51:** 289–94 (1994).
5. Schulte, P.A. and Chun, H., Climate change and occupational safety and health: establishing a preliminary framework. *J Occup Environ Hyg.* **6(9):** 542-54 (2009).
6. Wildeboor, J. and Camp, J., Heat stress, its effects and control. *AAOHN Journal*. **41:** 268-274 (1993).
7. Lucy Cotterill, Tord Kjellstrom, Simon Hales, Sarah Bierre .Exploring the experiences of and responses of heat among workers in the sheep shearing industry. *Proceedings of the 15th international conference on environmental ergonomics*, Queenstown (NZ), Feb 11th to 13th, 2013.
8. Asian-Pacific Newsletter on Occupational Health and Safety. **18(3):** December 2011.
9. Gerd Jendritzky, Birger Tinz. The thermal environment of the human being on the global scale. *Glob Health Action*. 2009; 2: 10.3402/gha.v2i0.2005.
10. Tord Kjellstrom, Sabine Gabrysch, Bruno Lemke, and Keith Dear .The 'Hothaps' programme for assessing climate change impacts on occupational health and productivity: an invitation to carry out field studies. *Glob Health Action*. 2009; 2: 10.3402/gha.v2i0.2082.
11. Climate Vulnerability Monitor, A Guide to the Cold Calculus for a Hot Planet. DARA report 2012.
12. Bruno Lemke and Tord Kjellstrom. Work loss from heat stress in the USA : current trends and future predictions. *Proceedings of the 15th international conference on environmental ergonomics*, Queenstown (NZ), Feb 11th to 13th, 2013.
13. ILO Global Employment Trends 2011 http://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/@publ/documents/publication/wcms_150440.pdf
14. Joshua Rosenthal, Christine Jessup, Sarah Felknor MS, Michael Humble, Farah Bader, Kenneth Bridbord. International environmental and occupational health: From individual scientists to networked science Hubs. *American Journal of Industrial Medicine.* **55(12):** 1069–1077 (2012).
15. Parsons K. 2nd ed. New York: CRC Press; 2002. Human thermal environments: the effects of hot, moderate and cold environments on human health, comfort and performance.
16. Climate Change Report 2011. www.exec.gov.nl.ca/exec/cceeet/publications/climate_change.pdf
17. Times of India, Chennai, Bennett Coleman & Co, ltd. Dated 13 05 2013.
18. Mohd. Rasheeduddin Imran, B. Syamala Devi. Study of Changes in Cardiovascular

and Cerebrovascular Risk Factors due to Stress Using Physiological and Biochemical Profiles in Professional Urban Bus Drivers. *International Journal of Recent Trends in Science and Technology*, **6(2):** pp 98-103 (2013).

19. Karin LUNDGREN, Kalev KUKLANE, Chuansi GAO, Ingvar HOLMÉR. Effect of heat stress in working population when facing a climate change. *Industrial Health* **51:** 3-15 (2013).