Project HeatSafe: Heat Adaptation Strategies for Construction Workers in Singapore

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Introduction

Excessive workplace heat exposure induces heat strain that can compromise workers' health, safety and productivity [1,2]. These risks are expected to increase in the coming decades due to rising global temperatures and humidity, thus prompting the need for effective and practical strategies to protect workers against the negative heat-health impacts. Various solutions for managing workplace heat exposure are available, but empirical evidence supporting their effectiveness in occupational settings is limited [3]. We therefore examined the effectiveness and practicality of a scalable and low-cost intervention on reducing the heat strain of construction workers in Singapore.

Methods

Thirty-three male construction workers [age (mean±SD): 31±7 years] were monitored on two separate work days – with (INT) and without (CON) the intervention – in a randomized and counterbalanced order. The intervention comprised (i) heat stress education, (ii) three 15-min scheduled breaks, (iii) provision of cold water, and (iv) optimized work attire (Fig. 1). Physiological [body core (T_c) and skin (T_{sk}) temperatures, heart rate], perceptual (thermal perceptions and perceived exertion), physical (grip strength) and activity (step count) measures were obtained. Focus group discussions were conducted at the end of the profiling to understand workers' perceptions towards the intervention.

Figure 1. Components of the intervention. (A) Heat stress education delivered via a narrated video, (B) scheduled rest breaks in the shade, (C) provision of cold water, and (D) work attire with enhanced heat dissipation properties.

Results and discussion

Mean T_c, T_{sk}, heart rate, perceptual measures and grip strength over the shift were similar between conditions (all P>0.05). However, total step count was higher (by 1060 steps or 9%) during the intervention (P<0.05) (Fig. 2). Focus group discussions revealed positive perceptions towards the intervention, which workers reported was practical and effective for keeping them cool. Workers suggested the lack of management support and potential productivity losses as barriers to implementation of the intervention.

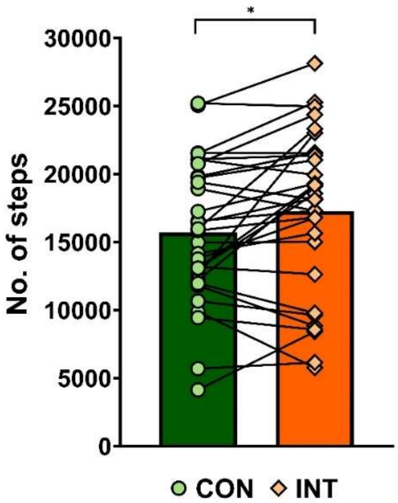

Figure 2. Mean number of steps taken during the work shift during the control (CON) and intervention (INT) conditions (n=31). Data are presented as means with individual values. *Denotes statistical significance between conditions (P<0.05).

Conclusion

An intervention focusing on workers' heat stress knowledge, rest breaks, hydration, and attire did not reduce the heat strain of construction workers; however, it was associated with higher step counts, potentially suggesting an increase in work productivity. The intervention was also well-received by workers. Our findings indicate that a multi-component heat adaptation intervention is feasible at construction sites in Singapore and may benefit workers. However, anticipated barriers that may prevent effective implementation must first be addressed.

References

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