Increasing Self-Efficacy to Support the Health and Resiliency of Texas Workers in Extreme Heat and Cold Environments

Krishna Kisi, PhD[1], Johnny Vasallo[2], and Manusheela Pokharel, PhD[2]

[1]Department of Engineering Technology and [2]Department of Communication Studies, Texas State University

BACKGROUND

- Heat stress and cold stress are two common forms of environmental stressors that can adversely affect workers' health and productivity.
- According to the Texas Department of State Health Services (2023), approximately 279 people died in 2022 due to Texas' rising exposure to extreme heat.
- Heat stress can negatively affect cognitive performance, impairing decision-making, reducing attention span, and decreasing memory (Parsons 2014).
- To navigate the concerns of occupational safety in extreme temperatures, this study adopts Badura's (1977) self-efficacy model, a theoretical framework that establishes the concept of self-efficacy as the central role when interpreting and analyzing changes derived from avoidant and fearful behaviors

RESEARCH OBJECTIVES:

- Determine how extreme temperature training influences workers' self-efficacy and proactive behaviors in responding to heat and cold stress conditions
- Explore how incorporating multicultural messaging into training programs affects engagement, self-efficacy, and behavioral intentions among workers from diverse cultural backgrounds
- Determine the effects of information sharing on enhancing workplace safety, reducing incidents, and fostering a culture of safety within organizations

HYPOTHESES

- H1: Extreme temperature training will increase workers' (a) self-efficacy, (b) information sharing, and (c) behavioral intention in extreme heat and cold conditions.
- H2: Self-efficacy significantly predicts workers' behavioral intentions in extreme heat and cold conditions
- H3: After extreme temperature training, people are more likely to share information, which can predict a major improvement in how they act in very hot or cold situations.

METHOD

- ✓ Study was approved by Texas State IRB # 8834
- ✓ Questionnaire survey conducted in 2023 for data collection and analysis
- ✓ 135 participants (Mage = 43.27 ; SD = 18.50; Average= 18-64) were recruited from Texas workers who participated in free OSHA safety training organized by Texas State University, supported by the U.S. Department of Labor
- ✓ Approximately 84% of the participants were male
- ✓ Pre-test surveys were conducted before the training intervention, then two hours long in-person training on extreme temperature Heat stress and Cold stress) was provided. After the completion of training, post-test survey was conducted.
- ✓ The presentation also included information about employee rights, statistics regarding the cause of outdoor fatalities, whistleblowing, heat and cold stress causes and prevention, signs and symptoms of illness related to heat and cold stress, emergency responses, and techniques regarding physiological monitoring within extreme climates.
- ✓ For hypothesis H1 testing, Paired T-test was carried (comparing pre- and post-training scores)
- ✓ For hypotheses H2 and H3 testing, linear regression model for predicting behavioral intentions based on self-efficacy and information sharing as conducted.

Texas workers are getting training about extreme temperatures (Heat and cold stress) for this research.

RESULTS

Hypothesis H1 Test Result: T-Test

- There was a significant increase effect for the pre-test and post-tests of:
  - Self-efficacy in extreme heat (Pre-training: M =3.12, SD = 0.61; Post-training M= 3.63, SD = 0.48), $t(129) = 6.86$, $p < .001$, information sharing (Pre-training: M =3.04, SD = 0.72; Post-training M= 3.57, SD = 0.56), $t(129) = 6.48$, $p < .001$, and behavioral intentions in extreme heat stress (Pre-training: M =3.37, SD = 0.72; Post-training M= 3.57, SD = 0.51), $t(129) = 5.33$, $p < .001$.

  - Self-efficacy in extreme cold (Pre-training: M =2.93, SD = 0.69; Post-training M= 3.60, SD = 0.52), $t(129) = 8.15$, $p < .001$, information sharing (Pre-training: M =3.04, SD = 0.72; Post-training M= 3.57, SD = 0.56, $t(129) = 6.48$, $p < .001$, and behavioral intentions in extreme cold stress (Pre-training: M =3.36, SD = 0.54; Post-training M= 3.68, SD = 0.46), $t(129) = 4.64$, $p < .001$.

Hypothesis H2 Test Result: Regression

- The results suggest the model significantly predicted workers' behavioral intent to enact self-efficacy behaviors in heat stress learned in the extreme temperature training: $F(2, 128) = 90.39$, $p < .001$.
- From the data, self-efficacy related to heat stress was a significant predictor of behavioral intention related to heat stress, $t(128) = 4.71$, $p < .001$
- For every increase of 1 in self-efficacy related to heat stress, workers reported an increase of 0.36 in behavioral intention in extreme heat conditions (95% CI: 0.21, 0.52)

- A study using simple linear regression showed a strong link between the confidence gained from such training and workers' intentions in cold conditions, with a significant statistical result ($F(1, 122) = 71.61$, $p < .001$).
- As reflected by the analysis, self-efficacy related to cold stress was a significant predictor of workers' behavioral intention regarding cold stress, $t(122) = 8.46$, $p < .001$
- The analysis indicated that for every increase of 1 in self-efficacy related to cold stress, workers' behavioral intention is predicted to increase by 0.54 (95% CI: 0.42, 0.67).

Hypothesis H3 Test Result: Regression

- Information sharing was a significant predictor of workers' behavioral intention regarding heat stress, $t(129) = 7.89$, $p < .001$
- The analysis indicated that for every increase of 1 in self-efficacy related to heat stress, workers' behavioral intention is predicted to increase by 0.33 (95% CI: 0.34, 0.58).

- Information-sharing was a significant predictor of workers' behavioral intention regarding cold stress, $t(122) = 6.93$, $p < .001$.
- The analysis indicated that for every increase of 1 in self-efficacy related to cold stress, workers' behavioral intention is predicted to increase by 0.43 (95% CI: 0.31, 0.55)

CONCLUSIONS

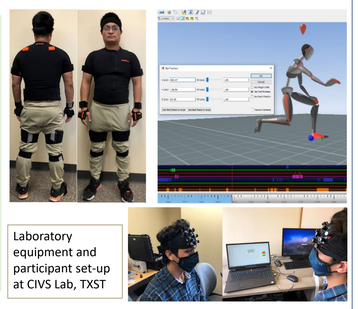
- **Improved Response to Extreme Temperatures:** The findings demonstrate a significant connection between improved self-efficacy and the ability to actively respond to extreme temperature challenges, which could reduce the risk of injuries.
- **Inclusivity through Multicultural Messaging:** Incorporating diverse cultural messages in training engages and empowers marginalized groups, addressing climate change risk perception disparities and making training more effective across different demographics.
- **Critical Role of Information Sharing:** Promoting transparency and whistleblowing enhances workers' willingness to share safety information, improving workplace safety and health outcomes.
- **Importance of Targeted Training Interventions:** Grounded in Bandura's self-efficacy theory, the study highlights the value of specific training interventions in boosting workers' responses to extreme environmental conditions.
- **Contribution to Health and Resilience Efforts:** The research contributes to the dialogue on health initiatives, self-efficacy, and climate change adaptation strategies, highlighting the necessity for continued research into the dynamics of fear, information sharing, and behavior within organizational settings.

IMPLICATIONS & FUTURE DIRECTIONS

- **Enhancing Workplace Safety and Health:** Targeted training for extreme temperatures is crucial for reducing workplace injuries and improving health outcomes, highlighting the need for policies that mandate such training across industries. Future research will focus on interdisciplinary approaches to develop more effective training and adaptation strategies.
- **Policy and Regulation Enhancement**: Highlight the need for comprehensive training and information-sharing policies. Future directions include researching the effectiveness of training in diverse climates to guide policy adaptations.
- **Cultivating Organizational Cultures**: Stress the significance of organizational cultures that promote safety and transparency. Investigate the impact of extreme temperatures on mental health and integrate these findings into training programs.
- **Climate Change Adaptation**: As climate change increases the frequency of extreme temperature events, there's an urgent need for workforce adaptation strategies. Future research will conduct longitudinal studies assessing the long-term effects of training on workers' health, productivity, and the sustainability of behavioral changes, which are critical for developing comprehensive climate change adaptation strategies.

Ongoing Research:

- Effect of extreme temperature on physical fatigue and mental fatigue study is at the pilot test phase assisted by a doctoral student and two master's students. Additional resources for recruiting undergraduate students and participants are needed for data collection.
- Gait kinematics and plantar pressure assessment among construction roofers to educate and train best practices (Pilot test under way but seeking additional funding for student workers and grant writing)



Laboratory equipment and participant set-up at CIVS Lab, TXST

REFERENCES

- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191
- Texas Department of State Health Services (DSHS). (n.d.). Retrieved December 3, 2023, from https://www.dshs.texas.gov/
- Parsons, Ken. *Human heat stress*. CRC press, 2019.