July 2019 Update from the Field: Heat Stress

Heat-Related Illness in Midwestern Hispanic Farmworkers: A Descriptive Analysis of Hydration Status and Reported Symptoms. (2019). Culp K & Tonelli S. *Workplace Health & Safety*, 67, 168-178.
Heat-related illness (HRI) is a largely undocumented phenomenon in Midwestern Hispanic migrant and seasonal farmworkers in the United States. Frequently, the physiological burden of crop production is overlooked while workers are in the fields. We completed a mixed-methods study using a cross-sectional survey among migrant and seasonal farmworkers about their experience with HRI symptoms (N = 148) and conducted an intensive surveillance on a smaller group of workers (N = 20) in field trials (N = 57 trials) using a chest-strapped multi-parameter monitoring wearable sensor (MPMWS) that measured skin/ body temperature, heart and breathing rate, kilocalories burned per hour, and provided a physiological intensity (PI) score. The field trials were conducted across three classes of climate conditions and three PI score categories. We found that those in the uncomfortable category (PI score > 4.0) had a statistically significant (F ratio = 16.41, p <.001) higher body temperatures (M = 100.05°F) than those with a mild PI (range = 0-5) score ≤ 2.5 (M = 99.56°F) or moderate PI score > 2.5-4 (99.84°F). We also found that those in the uncomfortable climate condition category had a higher mean heart rate and breathing rate than those working under mild and moderate field trials.

Physical Activity and Common Tasks of California Farm Workers: California Heat Illness Prevention Study (CHIPS). (2018). Mitchell DC, Castro J, Armitage TL, Tancredi DJ, Bennett DH, & Schenker MB. *Journal of Occupational and Environmental Hygiene*, 15(12), 857-869.
Farm workers are at risk of heat related illness (HRI), but their work rates that contribute to HRI have not been objectively assessed. The CHIPS study collected accelerometer data and characterized the physical activity of major farm tasks. Demographic information, work characteristics, and accelerometer data were collected from 575 farm workers in California. Each participating worker contributed measurements over one work shift. An Actical accelerometer was attached securely to a belt worn at the hip. Data were collected at one-minute intervals throughout the work shift. A total of 13 major work-task categories were defined. The mean physical activity counts per minute (cpm) and percentage of the shift spent at moderate and/or vigorous levels of activity were described for each task. Multiple linear regression models were constructed to determine the worker and environmental characteristics contributing to the physical activity level. Mean levels of physical activity ranged from 700 cpm (workers who carry produce) to a low of 150 cpm "ground pruners" who tend low-level plants, with an overall mean of 345 cpm or "light" activity (2 to ≤ 3 metabolic equivalents). The environmental temperature was the major factor associated with physical activity. A 10°C increase in the median temperature reduced the mean cpm by 135 (95% CI = 87, 193). Age and the tasks of sorting, ground pruning, and harvesting low-level crops were also negatively and independently associated with mean cpm. Incentivized (piece rate) pay, multi-task work, and irrigator work were positively associated with cpm. An interaction was found between piece rate and sex. Men's activity significantly increased ($p < 0.001$) by a mean of 95 cpm, (95% CI = 38.3, 150.7) if they were paid by the piece, but there was a non-significant association with women's activity level. Workers conducting multiple tasks, irrigators, men, and those earning incentivized (piece rate) pay had higher adjusted mean physical activity levels and are likely at increased risk of heat-related illness on hot days.

Classification of Heat-Related Illness Symptoms Among Florida Farmworkers. (2018). Mutic AD, Mix JM, Elon L, Mutic NJ, Economos J, Flocks J, Tovar-Aguilar AJ, & McCauley LA. *Journal of Nursing Scholarship*, 50(1), 74-82.
Background: Farmworkers working in hot and humid environments have an increased risk for heat-related illness (HRI) if their thermoregulatory capabilities are overwhelmed. The manifestation of heat-related symptoms can escalate into life-threatening events. Increasing ambient air temperatures resulting from climate change will only exacerbate HRI in vulnerable populations. We characterize HRI symptoms experienced by farmworkers in three Florida communities. **Methods**: A total of 198 farmworkers enrolled in 2015–2016 were asked to recall if they experienced seven HRI symptoms during the previous work week. Multivariable logistic regression was used to estimate odds ratios (ORs) and 95% confidence intervals (CIs) for the association between selected sociodemographic characteristics and reporting three or more symptoms. Latent class analysis was used to identify classes of symptoms representing the HRI severity range. We examined sociodemographic characteristics of the farmworkers across the latent classes. **Results**: The mean age

(±SD) of farmworkers was 38.0 (±8) years; the majority were female (60%) and Hispanic (86%). Most frequently reported symptoms were heavy sweating (66%), headache (58%), dizziness (32%), and muscle cramps (30%). Females had three times the odds of experiencing three or more symptoms (OR = 2.86, 95% CI 1.18–6.89). Symptoms fell into three latent classes, which included mild (heavy sweating; class probability = 54%), moderate (heavy sweating, headache, nausea, and dizziness; class probability = 24%), and severe (heavy sweating, headache, nausea, dizziness, muscle cramps; class probability = 22%). **Conclusions**: Farmworkers reported a high burden of HRI symptoms that appear to cluster in physiologic patterns. Unrecognized accumulation of symptoms can escalate into life-threatening situations if untreated. Our research can inform interventions to promote early recognition of HRI, on-site care, and appropriate occupational health policy. Administrative or engineering workplace controls may also reduce the manifestation of HRI.