**SUPPLEMENTAL MATERIAL**

We examined an increase in CBT ≥ 1.5°C as a second measure of risk of HRI. Physiologists concur that the normal CBT remains in a fairly narrow band, with 36.8°C ± 0.5°C being optimal.[1,2] A CBT above 36.8 + 1.5°C is likely to result in deteriorating metabolic and organ functions.[2] The ACGIH suggests a narrower range of 1°C above a set-point of 37°C.[3] The change in CBT was defined as the difference between the base temperature and the maximum of the 3-minute moving median and was always positive. The base temperature was the first reading of the day after the CBT had stabilized within 0.03°C over the previous readings. The CBT scans were screened to ensure this designation was appropriate and not physiologically improbable. In contrast to the subjects included in the main analysis of elevated CBT, 12 additional subjects had good quality CBT scans that read consistently higher or lower than normal ranges of CBT, so could be used for change of CBT but not for absolute values.

Clothing score was included in the final model for increased CBT, unlike elevated CBT. The variable construction is outlined in Supplemental Table 1, following Cal/OSHA recommendations for workers’ clothing (wide-brimmed hat; loose-fitting, light-colored clothing; and minimal layers), and based on staff observation.

Supplemental Table 1: Clothing score

|  |  |  |
| --- | --- | --- |
| Variable | Source | Definition |
| Clothing score | A clothing inventory recorded all articles of clothing worn except underwear.  Headgear:  0 for a wide-brimmed hat  1 for anything else (bandana(s), beanie, no head covering)  Tops (4 possible – T-shirt, long-sleeve shirt, sweatshirt, jacket):  0 for light-colored  1 for dark-colored  0 for loose-fitting  1 for tight-fitting  0 for one layer  1 for more than one layer  Pants:  0 for light-colored  1 for dark-colored  0 for loose-fitting  1 for tight-fitting | Scale constructed based on Cal/OSHA recommendations (brimmed hat; loose, light-colored clothing; minimal layers).  The constructed clothing scale ranged from 0 to 12. Lower score indicates indicate a ‘better’ outfit.  0-3: low  4-5: medium  >5: high |

Of the 32 participants who experienced an increase in CBT ≥ 1.5°C (Supplemental Table 2), only one was female (p < 0.0001). Similar to elevated CBT, workers are at higher risk of increased CBT if they are employed directly by the farm (p = 0.006) and if their hydration level decreased (p < 0.0001). In contrast to elevated CBT, consuming fewer total beverages was not significantly associated with increased CBT although the dehydration variables were significant (continuous percent change and dichotomous 1.5% percent change in body weight). The risk of increased CBT was positively associated with the mean work rate (p = 0.0005) and with the median WBGT (p = 0.004). BMI and education level were not significant, although clothing was associated with increased CBT.

Supplemental Table 2: Univariate associations with ≥ 1.5°C increase in CBT

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Characteristic | All (n = 519) | Change in CBT < 1.5°C (n = 487) | Change in CBT ≥ 1.5°C  (n = 32) | p-value |
| Mean (SD) | Mean (95% CI) | Mean (95% CI) |
| Age (y) | 38.7 (12.2) | 38.5 (37.4 – 39.5) | 42.8 (37.9 – 47.8) | 0.05 |
| BMI | 28.9 (4.6) | 29.0 (28.5 – 29.4) | 28.3 (26.8 – 29.8) | 0.44 |
| Total consumed (oz) | 100.9 (64.1) | 99.9 (94.3 – 105.4) | 116.3 (85.3 – 47.2) | 0.29 |
| Total consumed per hour (oz/h) | 11.7 (7.5) | 11.6 (10.9 – 12.2) | 14.1 (10.6 – 17.6) | 0.16 |
| Total hydration deficit (oz) | -70.5 (68.2) | -71.9 (-77.9 – -65.8) | -50.6 (-82.1 – -19.0) | 0.09 |
| Hydration deficit of water (oz) | -86.9 (67.2) | -88.2 (-94.1 – -82.3) | -67.7 (-98.4 – -37.0) | 0.10 |
| % change in weight | -0.54 (0.84) | -0.497 (-0.57 – -0.42) | -1.143 (-1.48 – -0.88) | < 0.0001 |
| Work rate (cpm) | 337.7 (195) | 330.0 (312 – 348) | 452.6 (390 – 515) | 0.0005 |
| Work in agriculture (y) | 14.4 (12.0) | 14.3 (13.2 – 15.3) | 15.9 (11.6 – 20.1) | 0.47 |
| Shift length (h) | 8.71 (1.49) | 8.74 (8.61 – 8.87) | 8.30 (7.79 – 8.82) | 0.11 |
| WBGT (°C) | 25.8 (3.37) | 25.7 (25.4 – 26.0) | 27.5 (26.0 – 28.9) | 0.004 |
|  | n (%) | n (%) | n (%) | p-value |
| Sex: Male  Female | 334 (64)  185 (36) | 303 (62)  184 (38) | 31 (97)  1 (3) | < 0.0001 |
| Immigrant: No  Yes | 43 (8)  476 (92) | 40 (8)  447 (92) | 3 (9)  29 (91) | 0.82 |
| Hiring: Farmer  FLC | 250 (48)  269 (52) | 227 (47)  260 (53) | 23 (72)  9 (28) | 0.01 |
| Pay type: Hourly  Piece Rate | 399 (77)  120 (23) | 375 (77)  112 (23) | 24 (75)  8 (25) | 0.80 |
| Rest breaks: > 1  0-1 | 465 (90)  54 (10) | 436 (90)  51 (10) | 29 (91)  3 (9) | 0.84 |
| Dehydration (change in body weight):  < 1.5%  ≥ 1.5% | 460 (89)  59 (11) | 438 (90)  49 (10) | 22 (69)  10 (31) | 0.0003 |
| 1Education:  ≤ 6th grade  > 6th grade | 131 (47)  149 (53) | 121 (47)  139 (53) | 10 (50)  10 (50) | 0.77 |
| HRI knowledge: Low  Moderate-Good | 275 (53)  244 (47) | 261 (54)  226 (46) | 14 (44)  18 (66) | 0.28 |
| Previous HRI: No  Yes | 246 (47)  273 (53) | 230 (47)  257 (53) | 16 (50)  16 (50) | 0.76 |
| Clothing level:  Low  Medium  High | 121 (23)  244 (47)  153 (29) | 118 (24)  221 (45)  147 (30) | 3 (9)  23 (72)  6 (19) | 0.01 |

1Approximately 54% of participants reported the number of years completed in school.

The multiple logistics model of characteristics associated with increased CBT is described in Supplemental Table 3. Gender was excluded as there was only one woman with increased CBT. For the complete set of data (all temperatures), (AOR [95% CI]) median WBGT (1.23 [1.09 – 1.39]) and mean work rate (1.004 [1.002 – 1.006]) were independently associated with increased CBT, similar to elevated CBT and with similar estimates. Unlike elevated CBT, age (1.05 [1.02 – 1.08]), clothing level medium vs low (4.13 [1.15 – 14.85]), and hydration status (2.74 [1.07 – 7.02]) were statistically associated with an increased CBT. After restricting the model to workers who experienced high-heat days, clothing and hydration status were no longer associated with increased CBT but the AOR increased for median WBGT (1.61 [1.16 – 2.23]) and mean work rate (1.007 [1.003 – 1.01]).

Supplemental Table 3: Association of risk factors and increased CBT across environmental temperatures

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | All temperatures | | Maximum ambient temperature ≥ 35°C | |
| n with ≥ 1.5°C increase in CBT/ participant n (%) | 32/519 (6.2%) | | 16/173 (9.3%) | |
| Variable | AOR | 95% CI | AOR | 95% CI |
| Age (y) | 1.05 | 1.02 – 1.08 | 1.08 | 1.003 – 1.11 |
| WBGT (°C) | 1.23 | 1.09 – 1.39 | 1.61 | 1.16 – 2.23 |
| Work rate (cpm) | 1.004 | 1.002 – 1.006 | 1.007 | 1.003 – 1.010 |
| Clothing level 1 v 0 | 4.13 | 1.15 – 14.85 | 10.14 | 0.76 – 135.70 |
| Clothing level 2 v 0 | 1.86 | 0.43 – 8.13 | 7.95 | 0.53 – 119.70 |
| Dehydrated | 2.74 | 1.07 – 7.02 | 2.80 | 0.58 – 13.48 |

**SUPPLEMENTAL REFERENCES**

1. Folk G, Riedesel ML, Thrift DL. Principles of integrative environmental physiology. Bethesda, Maryland: Austin and Winfield; 1998. 547 p.

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3. American Conference of Governmental Industrial Hygienists. Threshold limit values and biological exposure indices for chemical substances and physical agents and biological exposure indices. Cincinnati, OH: American Conference of Governmental Industrial Hygienists; 2014.