

3rd Annual Collaborative Solutions for
Safety in Sport National Meeting

**Wet Bulb Globe Temperature
FAQs**



Environmental Monitoring Indices

- Wet bulb globe temperature (WBGT)
- Air temperature
- Relative humidity
 - Sling psychrometer
- Heat index
 - OSHA chart



How are they different?

Wet Bulb Globe Temperature

- Invented in 1950s for the US Army and Marine Corps
- Wet Bulb Temperature (T_w)
 - Humidity, (Wind)
- Globe Temperature (T_g)
 - Solar radiation, (Wind)
- Dry Bulb Temperature (T_d)
 - Air temperature

$$\text{WBGT} = 0.7T_w + 0.2T_g + 0.1T_d$$

Budd GM. Wet-bulb globe temperature (WBGT)--its history and its limitations. *J Sci Med Sport Sports Med Aust.* 2008;11(1):20-32.

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How are they different?

Sling Psychrometer

- Two thermometers mounted together in the same device.
- Calculates the difference between:
 - Ambient temperature
 - Wet-bulb thermometer
- Measures relative humidity
 - Allows clinician to then derive heat index



\$50- \$100/unit

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How are they different?

Heat Index

- Heat Index is **how hot it feels** when relative humidity is factored into the ambient temperature.
- Heat Index is created based on shady, light-wind conditions.
 - Not full sunshine
 - Not strong-wind
- Number may NOT be reliable under extreme heat conditions

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How are they different?

Heat Index

- Assumptions of Heat Index
 - Shaded
 - (full sun can increase Heat Index by 15°F)
 - 5'7", 147 lbs
 - Long pants and short sleeve shirt
 - Walking at 3 mph



Football helmet

Football uniform

High physical demand



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Why WBGT?

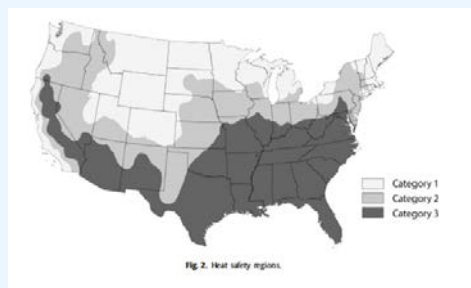
- WBGT is a more comprehensive representation of environmental conditions
 - Solar radiation & wind speed are factored into the equation
- Devised to account for physical activity

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Regional Specificity

- Regional specific guideline by Grundstein et al. (2015)
- Quantifying locally oppressive conditions



Grundstein A, Williams C, Phan M, Cooper E. Regional heat safety thresholds for athletics in the contiguous United States. *Appl Geogr.* 2015;56:55-60.

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On-Site vs. Weather Station Data

- Distance between the activity venue and weather station
 - Geographical consideration
- Time of the day that the reading was taken
- Differences in topography
- Influence from playing surface?
 - May or may not influence the value

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Which device should I use?

- What do you use currently?
 - Does it measure wet bulb globe temperature?
- Example: Kestrel 5400 Heat Stress Tracker
 - \$479-599
 - Activity modification alert
 - Bluetooth

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Adapting scientific evidence to our practice

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Georgia State High School Association Example

- Developed data-driven heat acclimatization guideline
 - Investigated the incidents rate of exertional heat illness pre-policy adaptation (2009-2011) and post-policy adaptation (2012-2014)
- Experts also developed activity modification guideline to go with the heat acclimatization guideline

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GHSA WBGT Guideline

WBGT READING (°F)	ACTIVITY GUIDELINES & REST BREAK GUIDELINES
Under 82.0	Normal activities; Provide at least three separate rest breaks each hour of minimum 3 minutes each during workout
82.0-86.9	Use discretion for intense or prolonged exercise; watch at-risk players carefully; Provide at least three separate rest breaks each hour of a minimum of four-minute duration each
87.0-89.9	Maximum practice time is two hours. For Football: players restricted to helmet, shoulder pads, and shorts during practice. All protective equipment must be removed for conditioning activities. For all sports: Provide at least four separate rest breaks each hour of a minimum of four minutes each
90.0-92.0	Maximum length of practice is one hour, no protective equipment may be worn during practice and there may be no conditioning activities. There must be 20-minutes of resh breaks provided during the hour of practice
Over 92.1	No outdoor workouts; Cancel exercise; delay practices until a cooler WBGT reading occurs

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