

Heat Stress in a Changing Workforce

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CRICOS No. 00213J

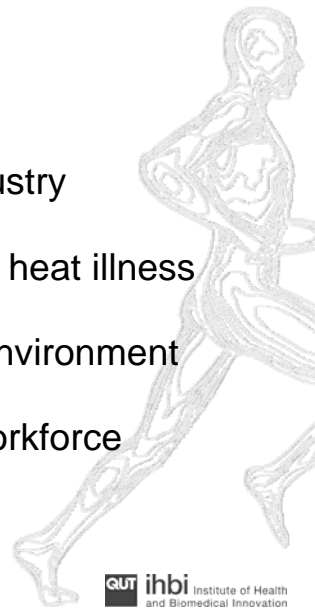


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Presentation Outline

- ❖ Heat illness in the mining industry
- ❖ Considerations for preventing heat illness
- ❖ Guidelines for work in a hot environment
- ❖ Implications for the current workforce

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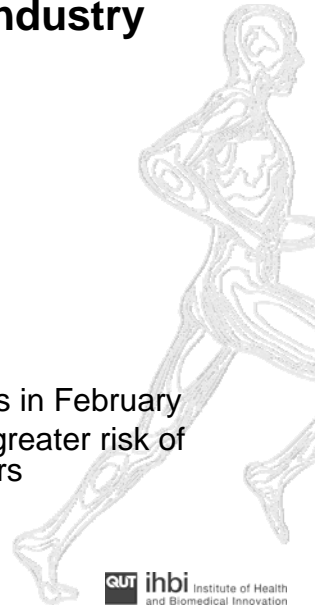


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Heat Illness in the Mining Industry

- ❖ Heat illness
 - Heat cramps
 - Heat exhaustion
 - Heat stroke

- ❖ Heat exhaustion (Donoghue et al., 2000; 2004)
 - 43 cases per million man hours
 - 147 cases per million man hours in February
 - Australian miners at 256 times greater risk of heat exhaustion than U.S. miners



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Thermal Balance

- ❖ Body temperature remains at $\sim 37^{\circ}\text{C}$

- ❖ Heat Gain
 - Metabolic heat
 - Environment

- ❖ Heat loss
 - Radiation
 - Conduction
 - Convection
 - evaporation

Heat Loss

Two avenues for heat loss during heat stress:

- ❖ Skin blood flow
- ❖ Evaporation of sweat

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Considerations for Preventing Heat Illness

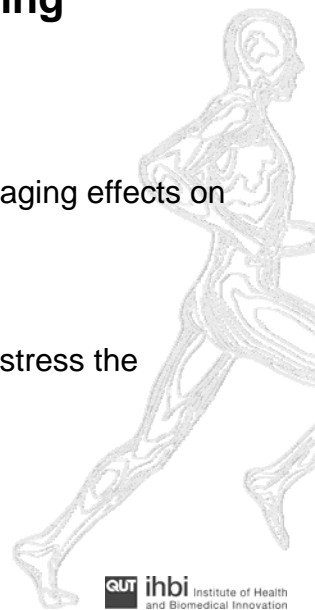
Individual Characteristics

- Fitness, body composition, and aging effects on heat loss

Environment

- Factors contributing to the heat stress the individual is exposed to

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Individual Characteristics Influencing Heat Tolerance

Aerobic Fitness

- Lower heart rates
- Higher sweat rates

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Individual Characteristics Influencing Heat Tolerance

Body Composition

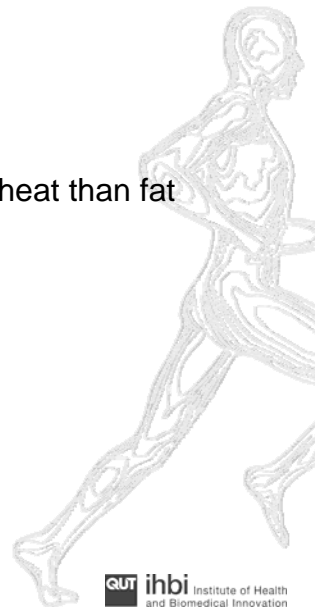
- Muscle tissue can store more heat than fat tissue

Aging

- Reduced skin blood flow
- Reduced sweat gland function

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Heat Stress at Mine Sites

Heat stress describes all the elements in the working situation that promote heat gain

Metabolism, Clothing, & Environment

- ❖ Surface Mining
 - High temperature and humidity
 - Working in direct sunlight
 - Close to machinery
- ❖ Underground Mining
 - Geothermal Gradient
 - Autocompression

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Guidelines for Work in a Hot Environment

AIOH (2002) & ISO 7243
(1989)

- ❖ Wet Bulb Globe Temperature (WBGT)
- ❖ A limit of 30°C WBGT is recommended
- ❖ This is commonly exceeded at mine sites

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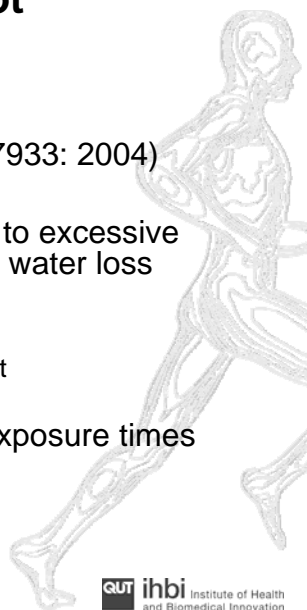
Guidelines for Work in a Hot Environment

Predicted Heat Strain model (ISO 7933: 2004)

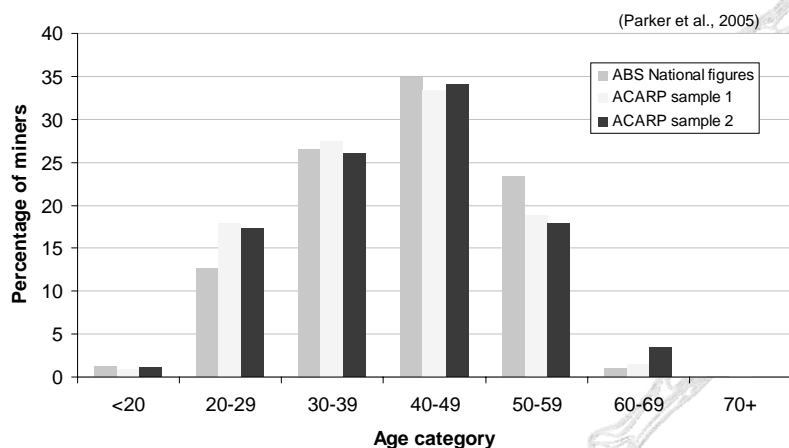
- ❖ Evaluate conditions likely to lead to excessive increases in body temperature or water loss
 - Core temperature rising above 38°C
 - Water loss less than 3% body weight
- ❖ Determine maximum allowable exposure times

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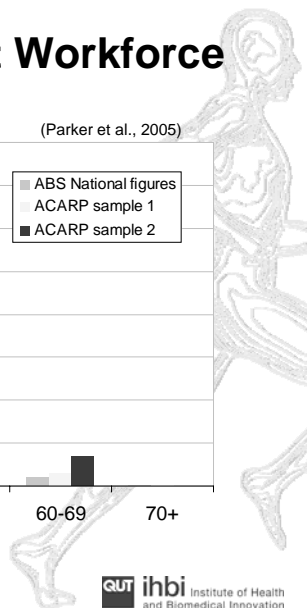


Implications for the Current Workforce



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Implications for the Current Workforce

(Brake & Bates, 2002)

Aerobic Fitness (VO ₂ max)	37.7 ml/kg/min (31.1 - 47.4)
Body Mass Index	27.5 (23 - 33)

- ❖ Potential exists for cases of heat illness to increase in the mining population

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Summary

- ❖ Heat stress is a concern for the mining industry
- ❖ Current guidelines focus on the environmental influences to heat stress and less on the individual response
- ❖ Aging, fitness and body composition should be considered to promote zero harm for all mine workers

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Acknowledgements

 **GOLDING**

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zinc

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resources
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