Health in the Heat: Combating Heat Stress at Surface Mines

Safety and Health – Everyone's Business

Andrew Hunt, Ian Stewart, and Tony Parker

QUT ihbi Institute of Health and Biomedical Innovation

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Enhancing Health @ Downer EDI mining

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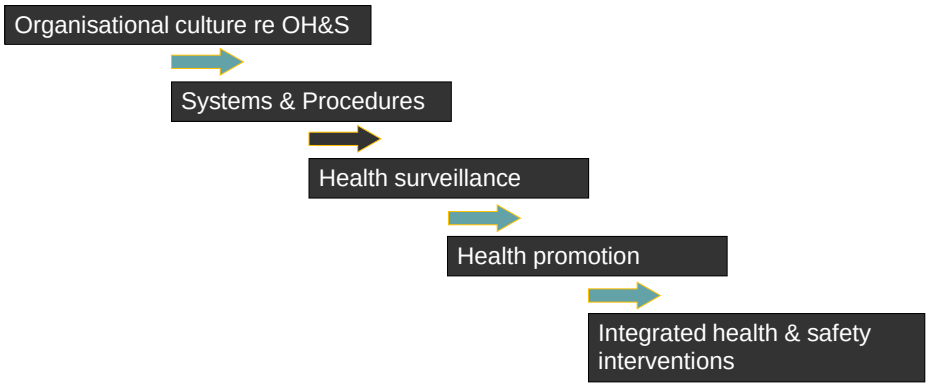
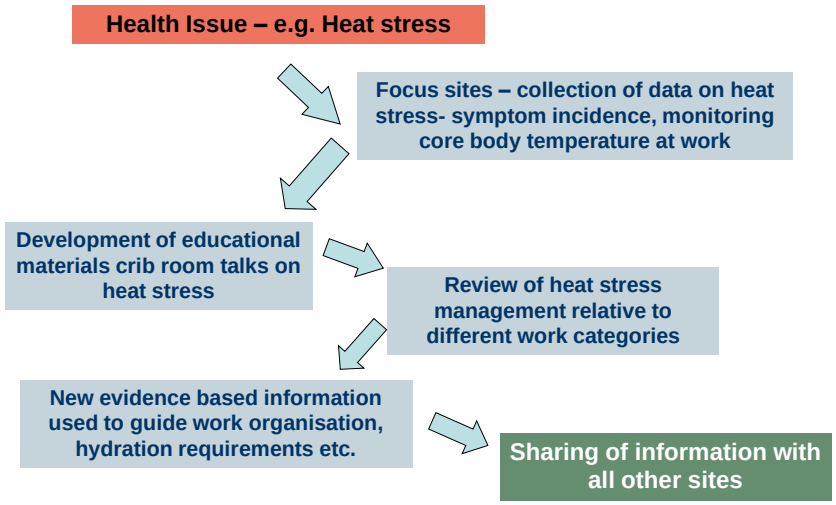
Enhancing health – Integration of health & safety systems



Enhancing Health @ Downer EDI Mining - Integrating Health & Safety systems

Unique & innovative concepts in development of holistic evidence based occupational health program

The Research Process



Heat Stress

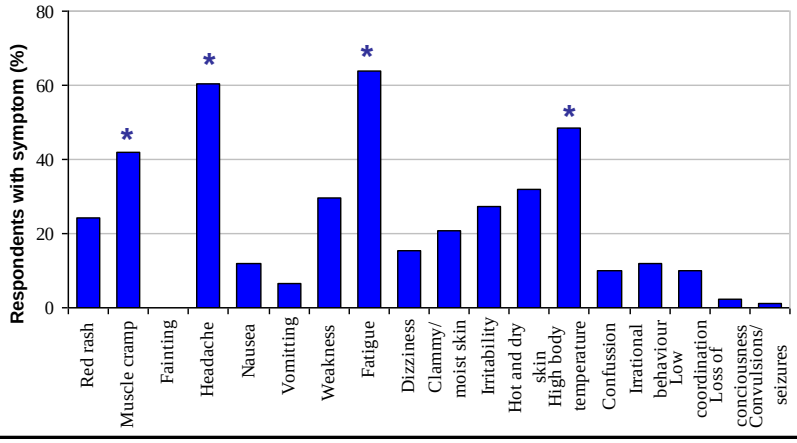
- The Environment
  - Air temperature
  - Humidity
  - Radiant heat
  - Wind speed
- The body
  - Physical demand of work tasks
- Protective clothing
- Risks to Health
  - Reduced work capacity
  - Increased risk of accident
  - Dehydration
  - Heat illness

Collecting Information about Heat Illness Symptoms

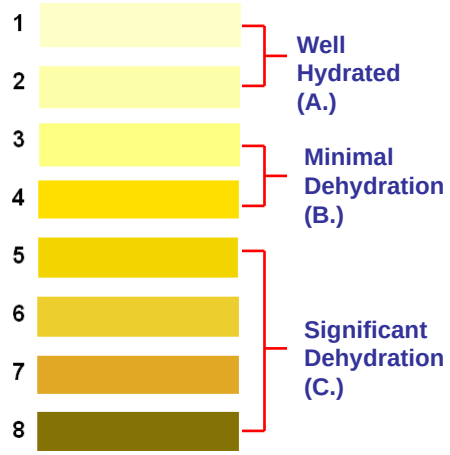
- 91 miners completed a heat stress questionnaire
  - Symptoms of heat illness in 12 months, and symptom frequency
  - Self report Age, Height, Weight, and Recreational Physical Activity
  - Average Urine Colour

Heat Illness Symptoms among Surface Miners

- 87 % reported at least one symptom.
- 81 % of symptoms reported more than once.
- Average number of symptoms 4.2.



Hydration Status and Heat Illness



	Minor Symptoms (%)	Moderate Symptoms (%)
A.	34	16
B.	60	64
C.	6	20

Risk of moderate symptoms was:

- **1.9** times greater for minimally dehydrated (B)
- **3.7** times greater for significantly dehydrated (C)

Armstrong, L.E., et al. Urinary indices of hydration status. *Int J Sport Nutr. 4:265-279, 1994.*

Risk Factors for Heat Illness

- Body Composition
  - Average Body Mass Index = **28.0**

BMI	Classification
18 – 24.9	Healthy weight
25 – 29.9	Overweight
30.0 or higher	Obese

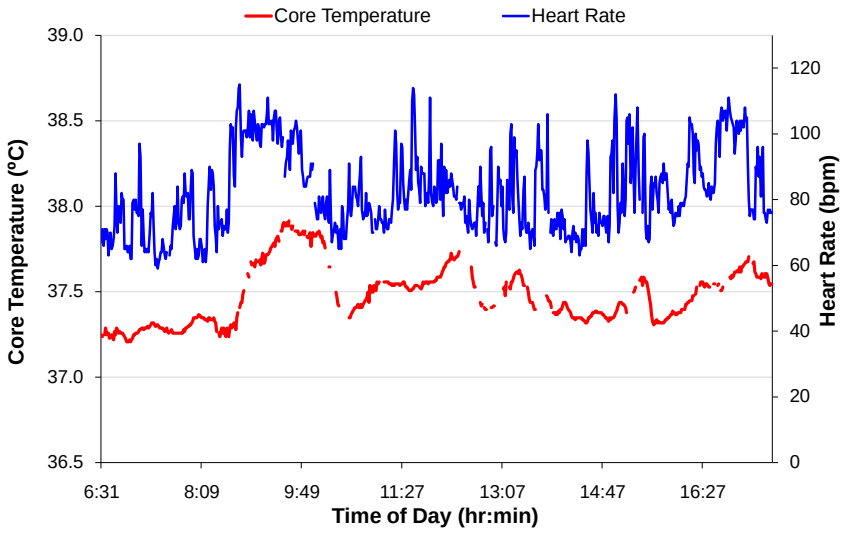
- Physical Activity
  - Recommended 150 minutes per week

Activity level	% miners
Sedentary	39.8
Insufficient	44.3
Sufficient	15.9

Monitoring Heat Strain

- 15 Blast crew personnel monitored
- Body temperature (38.0 or 38.5 ºC Limit)
- Heart rate
- Urine specific gravity (1.020 Limit)

Heart Rate and Body Temperature



Body Temperature

- Average mean and maximum core temperature was 37.46 ± 0.14 and 38.00 ± 0.20 ºC respectively.

		6 – 10 am	10 - 2 pm	2 – 6 pm
Average Core Temperature (^{0}C)	Mean	37.37	37.42	37.57
Maximum Core Temperature (^{0}C)	Maximum	37.99	38.19	38.44

Hydration Status and Heat Illness Symptoms

		Pre-shift	Mid-shift	Post-shift
Urine Specific Gravity	Mean	1.023	1.023	1.024
	Maximum	1.031	1.029	1.033

USG ≥ 1.020 in over 80 % of urine samples at all three time points

- Heat Illness Symptoms on shift
  - 73 % thirsty
  - 60 % felt tired
  - 33 % weakness
  - 20 % cramps
  - 20 % nausea

Summary of Findings

- Surface miners experience symptoms of heat illness.
- Experience of symptoms is related to hydration status.
- Most workers are dehydrated before and during their shift.
- Core body temperature is elevated during work tasks.
- The average workers body composition and fitness are potential risk factors for lower heat tolerance.

Recommendations

- Increase awareness of heat stress and heat illness symptoms
- Monitoring hydration status
- Acclimatisation
- Fitness and body composition

Increasing Awareness

- Education and Training
  - Potential heat exposure situations
  - Early recognition of heat illness symptoms
  - Prevention of heat illness
  - Importance of hydration
- QUT's Workforce health innovation team is investigating methods of education that effectively promote behaviour change.

Hydration Monitoring

- Urine specific gravity
  - Start of shift limit of 1.020
  - End of shift limit of 1.030
- Workers who exceed these limits should be encouraged to re-hydrate.

Fluid Intake

- Aim to start shift well hydrated, and replace fluids lost through sweating.
- Drink small amounts regularly, don't wait to feel thirsty.
- Include carbohydrate / electrolyte beverages.

Acclimatisation

- Acclimatisation results in lowered heat strain and improved tolerance to work in the heat.
- The majority of the benefits from acclimatisation will occur within 1 – 2 weeks of exposure.
- A gradual progression of work tasks and exposure to heat

Body Composition and Fitness

- Maintaining a healthy lifestyle:
  - 150 minutes exercise per week
  - A healthy and balanced diet should consist of food from all food groups:
    - Vegetables
    - Breads and cereals
    - Fruits
    - Dairy
    - Meats

Summary

- Many surface miners have experienced symptoms of heat illness during their work
- Dehydration is common among workers and is a risk factor for experiencing symptoms
- Recommendations to improve health and safety while working in the heat include:
  - Education and training
  - Hydration monitoring
  - Acclimatisation
  - Healthy lifestyle

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