THE STRESS OF FIREFIGHTING
IMPLICATIONS FOR LONG-TERM HEALTH OUTCOMES

Dr Luana Main
Jenni Raines, Paul Della Gatta, Alex Wolkow, Rod Snow, & Brad Aisbett
STRESS RESPONSE

CARDIOVASCULAR RESPONSE
↑ HR & BP
↑ BREATHING RATE

HORMONAL RESPONSE
↑ CATECHOLAMINES
↑ CORTICOSTEROIDS

↑ ANXIETY / IRRITABILITY

Inflammatory Cytokines
• Acute phase response
• Pro and anti-inflammatory
• Impact:
  • Central nervous system
  • Physical symptoms
  • Auto-immune/ inflammatory diseases
SO WHAT?

• Long term health implications
  – CVD
  – Depression
  – PTSD
  – Post viral / chronic fatigue
  – ...

EXPOSURE

• Intermittent physical work\textsuperscript{1,2}
• Heat\textsuperscript{3-4}
• Smoky\textsuperscript{5}
• Dust and pollutants\textsuperscript{6}
• Toxic chemicals\textsuperscript{7}
• Excessive noise\textsuperscript{8}
• Inadequate recovery\textsuperscript{9}
• Sleep disruptions\textsuperscript{10}
• Psychological stress\textsuperscript{11}
AIMS

1) investigate whether an inflammatory response was mounted following a day of wildfire suppression tasks

2) investigate the effect of a repeated day of wildfire suppression tasks on the same inflammatory markers

METHODS

12 male firefighters (29 ± 11 yr)

2 consecutive days of live-fire prescribed burn operations in Ngarkat National Park, SA

Standard PPC was worn throughout as per agency guidelines

Approval for the project was obtained from the Deakin Ethics committee for Human Research

Informed written consent was obtained prior to commencement
METHODS

• Blood samples – antecubital vein (10 mL)

0 h          live-fire prescribed burn tasks          12 h          14 h

Daily briefing                                  Return to staging area

• Selection of cytokines analysed:

IL-1β, IL-2, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12p70, IL-13, IFNγ, GM-CSF, & TNFα

RESULTS

IL-1β = important mediator of stress response

IL-7 = key role in modulating the immune response
RESULTS

IL-5 = anti-inflammatory coordination of white-blood cells
IL-10 = anti-inflammatory modulates the inflammatory response
• TNFα = together with IL-1B & IL-6 associated with the acute-phase response

RESULTS

• Day 1: increase of 96%
• Day 2: decrease of 15%
NEXT STEPS

KEY TAKE HOME POINTS

- Wildfire suppression = inflammatory response
- The impact of different stressors needs to be investigated further
- The impact of repeated days needs to be investigated further
- Need to optimise and ensure adequate recovery time between shifts
- Reducing the risk of mal-adaptation of our stress response
- Safeguarding the long term health of our personnel
REFERENCES

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RESULTS – WITHIN DAY

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RESULTS – BETWEEN DAYS

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AWAKE, SMOKY AND HOT

- **Student:** Alex Wolkow
- **Stressor/s:**
  - Physical work, long work hours & extended wakefulness
- **Aim:** to investigate the interactions of intense, intermittent physical labour, long working hours and sleep deprivation on firefighters health.
- **Justification:**
  - Known mood disturbances, behavioural changes and altered immune function.
  - The interactive and cumulative effect of these stressors on a firefighters health and wellbeing is poorly understood.
AWAKE, SMOKY AND HOT

• Stressor: Exposure to smoke
• Aim: to examine the impact of working in smoky conditions on inflammatory markers
• Justification:
  – To date there are no reliable laboratory markers for carbon monoxide poisoning
  – Short term exposure to carbon monoxide is associated with an acute inflammatory response
  – Further research is required to assess if there is an accumulation effect

AWAKE, SMOKY AND HOT

• Student: Sarah Jefferies
• Stressor/s:
  – Physical work in the heat
• Aim: to examine the impact of working in the heat on inflammatory markers
• Justification:
  – Significant elevations in plasma pro-inflammatory cytokine levels in heat stroke patients upon hospitalisation.
  – There is still the inability to predict, diagnose and treat the aetiology of heat stroke
  – The acute-phase response may be involved in the pathology of heat stroke