INSPIRE22: PHYSIOLOGICAL MONITORING DURING ANTARCTIC EXPEDITION

Data Collection Methods and Lessons Learnt

Authors: Capt A Smith, Surg Lt S. Capella, Sqn Ldr M. Eager, Maj H Crosby, Maj N Taylor.

Background

In the winter of 2022, the Interdisciplinary South Pole innovation and research expedition (INSPIRE22) studied 9 healthy subjects skiing from the edge of the Antarctic landmass to the South Pole via the Messner route.

Methodology Justification:

When deciding which wearable technology to use in a study, the environmental, power/recharging requirements and participant interaction to identify the most appropriate modalities to use in conjunction with what wearable device offers.

The three determining factors in choosing the data collection methods were:[1]

- Low psychological and physical demand on participants
- Stable and reliable devices in extreme environments
- Simple processes for participants.

The three wearable devices chosen were:

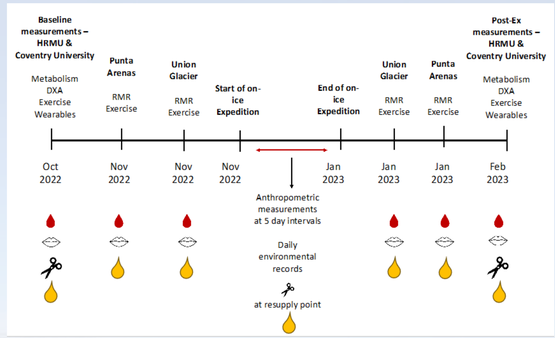
- Oura ring: worn overnight
- GENEActiv: continuous, non-dominant arm
- Polar Verity Sense: worn during activity.

Additional Methods complementing physiological monitoring

Pre-expedition sea-level control data including DEXA scans were obtained at Human Metabolic Research Unit (HMRU), Coventry University and Royal Military Academy Sandhurst (RMAS) in the 6 weeks prior to the expedition.

Key data collection elements were:

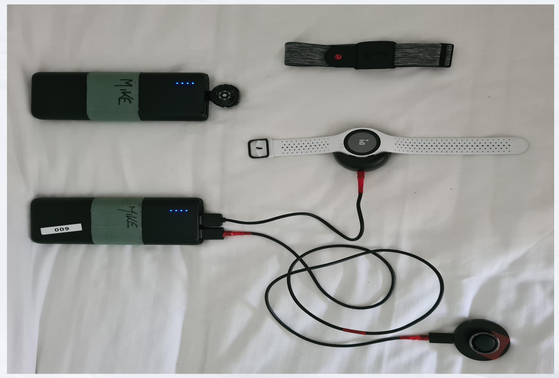
- Completion of daily expedition dietary and perceived exertion log
- Morning body weight and skin fold thickness every 5 days
- Continuous wear of GENEActiv
- Wearing Oura ring every night; data stored on Oura App
- Wear Polar Verity Sense while skiing
- Completing Ice-Q and Positive and Negative Affect Schedule (PANAS-SF) questionnaires every 7 days
- Urine and saliva samples every 15 days
- Hair sample on day 30



INSPIRE22 research protocol timeline



INSPIRE22 tent setup. After skiing for 7 hours a day the team set up camp and then conducted research



Some of the physiological monitoring considered for the research and power requirements

Issues and deviation from protocol

- Polar Verity Sense: Only used in Chile as the power requirement was too much for participants to manage.
- GENEActive data collection reduced during latter stage of expedition as second device stored buried in snow.

Key lessons:

1. KISS: consistency of data capture correlated with lower task complexity.
2. Understanding the limitations of the extreme environment enhances data collection success.
3. Engaging with participants early to get buy in to the research process.

Future opportunities

1. As wearable monitoring battery life improves, research and use for monitoring patients could be considered.
2. Research to understand normal physiology in extreme environments using wearable technology.[2]
3. Wearable physiological monitoring could be used to optimize performance and recovery in extreme environments.

References

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2. Hattersley J, Wilson AJ, Gifford RM, Cobb R, Thake CD, Reynolds RM, Woods DR, Imray CHE. Pre- to post-expedition changes in the energy usage of women undertaking sustained expeditionary polar travel. J. Appl. Physiol. 126(3):681-690, 2019.

Further information

Ethical approval: Ministry of Defence Research Ethics Committee. (2125/MODREC/22)

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