The ESA-NASA ‘CHOICE’ Study: Winterover at Concordia Station, Interior Antarctica, as an Analog for Spaceflight-Associated Immune Dysregulation


BACKGROUND

For ground-based space physiological research, the choice of analog must carefully match the system of interest. Antarctica winter-over at the European Concordia Station is potentially a ground-analog for spaceflight-associated immune dysregulation (SAID). Concordia missions consist of prolonged durations in an extreme/dangerous environment, station-based habitation, isolation, disrupted circadian rhythms and international crews.

The ESA-NASA ‘CHOICE’ study assesses innate and adaptive immune, viral reactivation and stress factors during Concordia winterover deployment. Initial data obtained from the first winterover (2009 mission; ‘n’ of 6) will be presented. To date, not all samples have yet been analyzed. Here, only data will be preliminary presented for those parameters where sample/data analysis is completed.

CONCORDIA BASE, DOME C, HIGH ANTARCTICA PLATEAU

Concordia base is located on Dome C, Antarctica (figure 1). The vast majority of Antarctic bases are coastal. Concordia is one of only 3 interior bases. The isolation and environmental conditions for interior bases are more extreme than for coastal bases. Specific conditions that make winterover at Concordia Station potentially a superior spaceflight analog are as follows:

Environmental factors:
- Difficult travel in/out
- Extreme isolation, even greater than ISS
- Altitude 3200m (10,500 ft)
- Air pressure 645hPa (mbar)
- 12-13% Vol% of O2
- Lack of CO2 in air
- Lack of light (increases oxidative metabolism)
- Relative humidity 3-5%
- Snowfall ~1cm/yr
- History of circadian rhythm dysregulation

Human factors:
- Station-based lifestyle
- Isolation, confinement for prolonged duration
- Limited communication capability
- International crew, multiple languages
- Sleep/wake cycles disrupted
- Actual deployment with associated stress
- Winterover crew: 12 (February-November)
- Summer crew: ~50 (November-February)

METHODS

- All NASA general immune and viral assessment methods used for this study (and data within this presentation) were performed as previously described.
- Aviation and Space Environmental Medicine, 2009 May, 80(5 Suppl): A37-44.

ASSAYS

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<td>In-vitro DTH</td>
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*data included in this presentation

SAMPLING SCHEDULE

Based on preliminary data, alterations in immune population distribution and function appear to persist during Antarctic winterover at Concordia Station. Some of these changes are similar to those observed in astronauts, either during or immediately following spaceflight. Others are unique to the Concordia analog. Based on some initial immune data and environmental conditions, Concordia winterover may be an appropriate analog for some flight-associated immune changes. Completion of the full data compliment will be required for final study conclusions.

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