US Army Hypobaric Chamber Exposure: Descriptive Epidemiology of Adverse Events, 2014-2016

A. K. Vargo, C. A. Myatt, D. J. Preczewski, J. J. Pavelites, S. J. Gaydos
US Army School of Aviation Medicine, Fort Rucker, Alabama

INTRODUCTION:

- US Army School of Aviation Medicine (USASAM) has conducted altitude physiology training for military air crew since the early 1970s (Fig. 1)
  - On average, USASAM completes 50-60 chamber flights per year, with up to 16 students per flight
  - Flights up to 25,000ft allow students to experience the effects of high altitude and hypoxia
- There are inherent physiologic risks with this training, including Decompression Sickness (DCS)
- To date there is no comprehensive medical model to determine with certainty whether an individual will develop an adverse event during high altitude exposure (Conkin, 2013)
- Despite standardization of training and high USASAM training throughput, an extensive review of historical data for adverse events has not been conducted
- **This retrospective epidemiologic study sought to stimulate further inquiry into the safety of chamber flights in aviation training**

METHODS:

- Historical training records were retrieved through an IRB exemption for FY 2014-2016
- De-identified data, maintained at USASAM, were reviewed for:
  - Incidence of evolved gas dysbarism (DCS Types 1 or 2)
  - Adverse physiologic event (Phys)
  - Early discontinuation (D/C) of flight profile prior to reaching 25,000ft

RESULTS:

- 2395 student training records were reviewed
  - 2134 males, 259 females, 2 undocumented gender
  - Ages: 18 to 70 years (military and civilian aircrew)
  - Three flight profiles: IV (Fig. 2), IV + RD (rapid decompression), V; 1208, 768, 419 students respectively
- Of all students trained, records indicate:
  - **Zero DCS events**
  - 60 total events (2.51%): 48 males, 12 females
    - **All physiologic events were minor** and most were identified as trapped gas dysbarism of the ears, teeth, or sinuses
    - Eight of the 51 Phys were female and four of the nine D/C profiles were female
    - Of the 2134 males, 2.01% and 0.23% experienced Phys and D/C, respectively; of the 259 females, incidence of these events were 3.09% and 1.54% (Fig. 3)
    - By age, Phys events were highest in the largest groups: ages 24-29 years and 30-35 years (Fig. 4)

Figure 1. USASAM Hypobaric Training

DISCUSSION:

- This pilot study provides summary observational data and descriptive epidemiology of hypobaric chamber training-related adverse events
- The absence of DCS events and the rare occurrence of minor physiologic insults is reassuring with regards to the safety of the USASAM altitude training program
- Limitations:
  - Non-standardized record keeping and event recording, to include non-descriptive events (e.g. “reactor”)
  - Post-chamber flight follow-up typically limited to same-day
- Possible future research:
  - Statistical testing to determine the significance of age and gender differences in rates of events
  - Comparing rates of events with other services or federal agencies
  - Using this study as a basis for longitudinal studies to track age and gender differences
  - Process Improvement Project to better standardize reporting

CONCLUSION:

Preliminary data suggests the USASAM hypobaric chamber training program is low risk, most likely due to the altitude restriction of 25,000ft, education, and medical prescreening involved with chamber operations.

DISCLOSURE:

I have no financial relationships to disclose.

REFERENCES:

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2. Stepanek J, Webb JT. Physiology of decompressive stress. In: Davis JR, Johnson R, Stepanek J, Fogarty JA, editors. Fundamentals of aerospace medicine. 4th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2008.
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Figure 2. Chamber Flight Profile (Type IV)

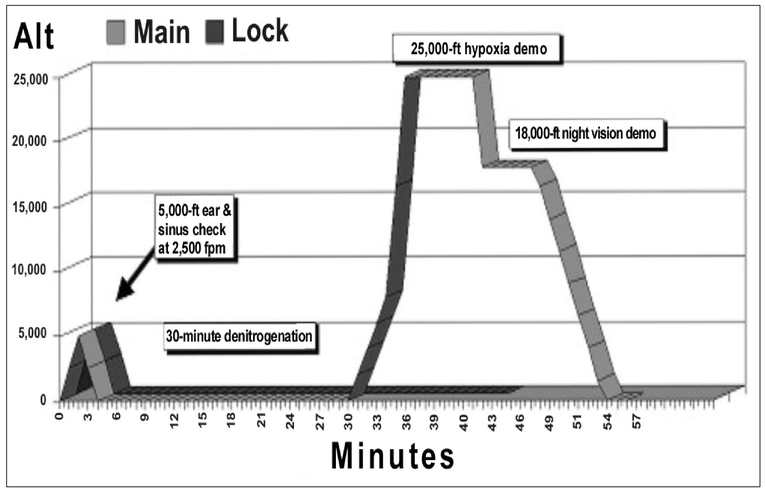

Figure 3. Incidence of Adverse Events by Gender

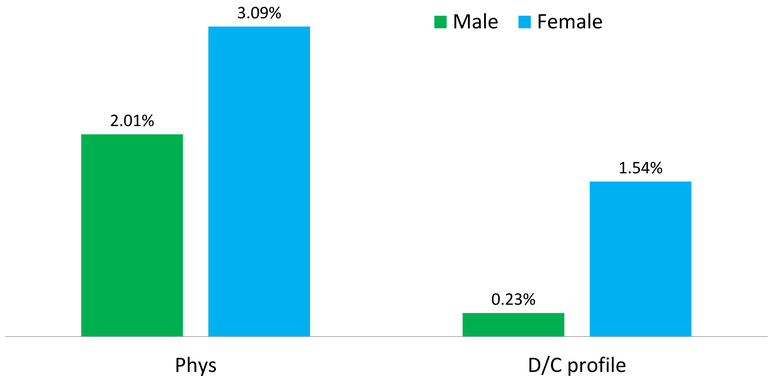

Figure 4. Adverse Events by Age