

IMPLICATIONS OF PASSENGER ANXIETY AND MOTION SICKNESS FOR COMMERCIAL SUBORBITAL SPACEFLIGHT

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Introduction

- Concern about anxiety during a flight causing disruption or putting the mission, vehicle, or crew at risk
- Concern about motion sickness adversely impacting mission enjoyment for individual and fellow passengers
- Study designed to evaluate layperson responses to centrifuge-simulated spaceflight
- Goals:
 - identify predictive indicators for anxiety in commercial spaceflight participants
 - develop methods to prevent mission-impacting events.

Methods

- 148 subjects (70% men, 30% women)
- Varied training lengths and exposures
 - 2-7 centrifuge runs over 0.5 to 2 days
 - Culminating in 2 simulated suborbital spaceflights
- Two cohorts received dedicated anxiety-mitigation training
- All cohorts completed pre- and post-spins questionnaires
- Test monitors observed subjects for signs of anxiety and motion sickness during their experience



Pre-spin Questionnaires

- All subjects were administered a series of personality, motion sickness, and anxiety questionnaires before participation.
 - Multiple Affect Adjective Checklist-Revised (MAACL-R)
 - Motion Sickness Susceptibility Questionnaire Short-form (MSSQ)
 - Zuckerman-Kuhlman Personality Questionnaire (ZKPQ)
 - International Personality Item Pool (short version) for Neuroticism, Extraversion, and Openness (IPIP-NEO)
 - State-Trait Anxiety Inventory (STAI)
- All 5 tests were administered prior to participation but no answer was considered exclusionary.
- The STAI was repeated the morning of the subjects' final (or only) day of centrifuge exposures.

Results Overview

- Total of 148 subjects participated in centrifuge trials
- Test monitors identified 29 subjects as concerning for anxiety
- Overall, 10 subjects opted out of one or more run or limited their G-exposure
- Training length was not associated with subjects withdrawing from participation
- **Motion sickness was significantly associated with non-completion of the centrifuge runs**

Motion Sickness Susceptibility

- Pre-participation MSSQ scores were significantly higher in subjects identified as concerning compared to those that demonstrated no evidence of anxiety.
 - MSSQ average percent likelihood of motion sickness:
 - concerning: $33.1 \pm 29.0\%$
 - not concerning: $19.5 \pm 19.3\%$, df 146, $P=0.02$

Methods of Feedback

- Various means were used to obtain feedback from subjects:
 - Oral feedback in group setting
 - Oral feedback in one-on-one setting
 - Written feedback after completion of all spins
- Private, written format was the most likely method in which test subjects reported anxiety-related symptoms.

Discussion

- Unknown whether the correlation between motion sickness and anxiety will hold true in commercial spaceflight
- Close observation and intervention during training for an upcoming space flight will be critical to lessening the risks from inflight anxiety
- Written, private reporting may be the most reliable means of identifying issues during training and before a space flight
- **Enabling SFPs to develop a strong trust relationship with training and medical personnel will likely improve the ability to identify participants at risk before anxiety or motion sickness become detrimental to the flight experience**

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Questions