SUBJECTIVE SLEEP QUALITY FROM SHUTTLE MISSIONS

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OBJECTIVES
It is well known that sleep is reduced in spaceflight. Given that sleep is intimately tied to performance, safety, health, and well being, it is critical to characterize the hindrances to sleep in space, so that countermeasures can be implemented. Lessons learned from current spaceflight can be used to inform the development of space habitats and mitigation strategies for future exploration missions.

The purpose of this study was to implement a survey and one-on-one interview to capture Shuttle crewmembers’ subjective assessment of the various factors that interfered with their achieving good sleep during their missions. Strategies that crewmembers reported improved their subjective sleep quality during spaceflight were also discussed. The collected information was used to provide crewmembers with operational recommendations and has informed the development of a proposal for a similar effort with ISS astronauts.

METHODS
Astronauts who have flown Shuttle missions since the 2003 Columbia tragedy were recruited for the study. These included Shuttle flyers from the single 2005 mission, STS-114, through astronauts returning from STS-130, in February 2010. A total of 76 flyers were interviewed; 66 also completed a survey. Interviews were conducted one-on-one with trained representatives from NASA Space Medicine and Behavioral Health and Performance. Recordings of the interviews were transcribed, yielding over 4000 lines of data. The purpose of the interview data analysis was to conduct frequency counts and identify whether there were recurring ‘themes’ that emerged in response to questions. Two BHP scientists, trained on content analysis and frequency coding, individually reviewed the interview questions and the responses that were given, to determine categories for coding the responses to each question. Discrepancies were reviewed with additional team members until consensus on the appropriate way to categorize the responses to each question was achieved. The responses were then separately coded within each of the questions by counting the number of times a response was given.

RESULTS
Factors that relate to “falling asleep in space” and “staying asleep in space” were evaluated using the survey and interview data. When asked what kept them from falling asleep, 21% of responses given indicated that difficulty falling asleep was a non-issue, whereas 79% of responses were related to hindrances. “Thinking / active mind” was reported as a primary hindrance to sleep onset; workload/timeline/schedule issues were identified as hindrances to sleep in 11% of the responses. Other hindrances to sleep that were identified included unfamiliarity with the environment (10%) and obtrusive lighting (4%). These factors were discussed in additional detail by crewmembers.

When asked to discuss factors that may have awakened them from sleep during the mission, 20% of crewmember responses indicated that difficulty staying asleep was a non-issue, while 80% of crewmember indicated otherwise. Issues related to “physical discomfort” were reported as a primary hindrance (16% of responses), while other issues included shuttle-related noises (16%), unexplained awakenings (14%) and crewmember disturbances (13%).

Of the 76 crewmembers interviewed, 29 (43%) indicated they felt fatigue effects during their mission. Some crewmembers identified strategies which helped mitigate these effects, such as ‘looking over one another’s’ work.

DISCUSSION
Findings from this investigation have helped to identify potential needs for practice and research (i.e. stress management). While the present study yielded insight into crewmembers’ subjective experiences, investigations utilizing objective measures are needed, particularly given evidence that indicates that individuals tend to overestimate the amount of sleep they’ve gotten and underestimate the negative effects of sleep on their performance. Lessons learned from this investigation are also being used to shape the implementation of an upcoming study of sleep quality in ISS astronauts.