Subjective Sleep Experience During Shuttle Missions

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OBJECTIVES

It is now known that for many astronauts, sleep is reduced in spaceflight. Given that sleep is intimately tied to performance, safety, health, and well being, it is important to characterize factors that hinder sleep in space, so 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 interviews to capture Shuttle flyers' subjective assessment of the factors that interfered with a "good nights sleep" during their missions. Strategies that crewmembers reported using to improve their sleep quality during spaceflight were also discussed. Highlights from the interview data are presented here.

Astronaut Gregory Johnson, STS-134

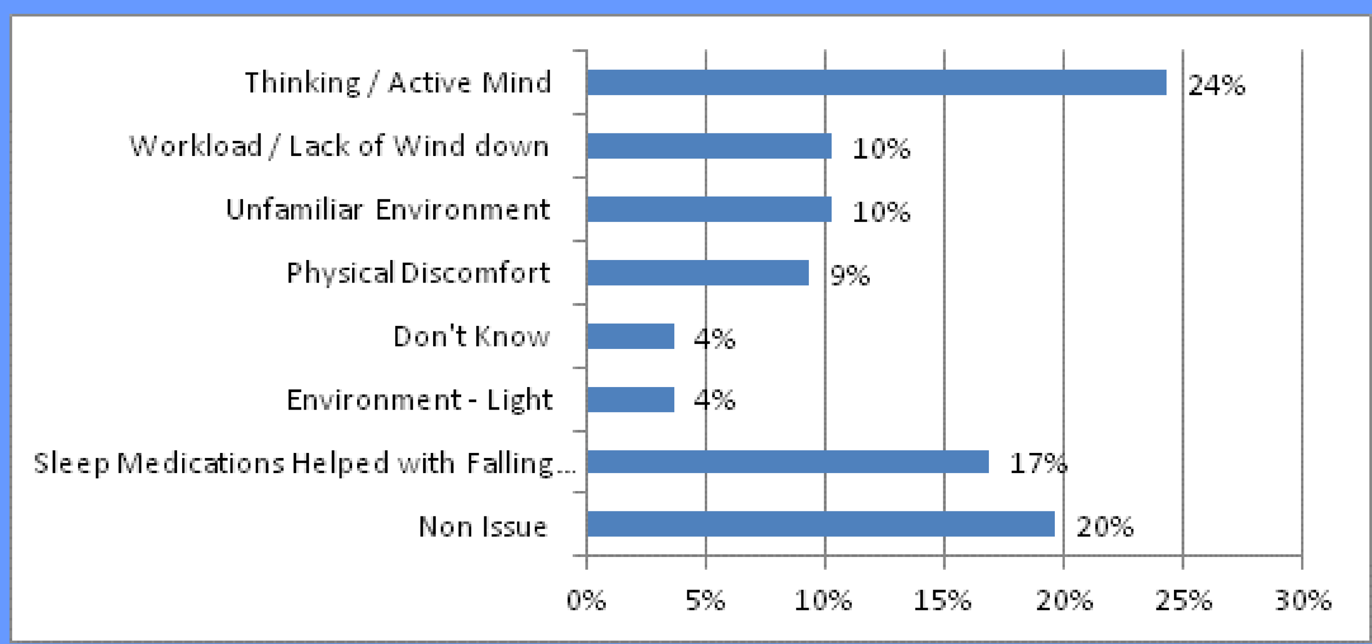
METHODS

Astronauts who have flown Shuttle Missions (starting with the single 2005 mission, STS-114, through astronauts returning from STS-130, in February 2010) were recruited for the study. 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. Responses were then separately coded within each of the questions by counting the number of times a reply was given.

HINDRANCES TO SLEEP

When crewmembers were asked to discuss factors that may have kept them from falling asleep during the mission, 21% of their responses indicated that difficulty falling asleep was a non-issue, whereas 79% of their responses were about hindrances to sleep onset, as shown in Figure 1. "*Thinking / active mind*" was reported as a primary hindrance to sleep onset; 21% of the responses revealed that "thinking" about upcoming tasks, concerns or anxiousness about the mission, or other concerns, hindered sleep; 4 out of 26 related to "excitement." Workload, timeline, and schedule issues were identified as hindrances to sleep in 11% of the responses.

Figure 1 "Discuss what kept you from falling asleep during your mission"



ENVIRONMENTAL FACTORS

Light "leakage" reportedly hindered sleep for some individuals. When asked if light affected their sleep in space, 27% of crewmembers responded that light was not an issue , while 38% discussed wearing eye masks and 6% mentioned that light intrusion hindered sleep. Unanticipated noises were also identified as causes for sleep disturbances. Opinions related to eye masks and ear plugs varied, indicating that ground testing these devices prior to flight (and offering a variety on orbit) is preferred.

When asked to discuss how crowdedness affected their mission, many participants responded that crowdedness wasn't an issue. "Spreading out" to other locations (on the flight deck and on the ISS) helped minimize the number of crewmembers in the middeck (less CO_2 buildup, roomier), but other crews noted advantages to all sleeping on the middeck, which allowed those who were awake earlier than others, to visit the flight deck. Planning ahead and communication were discussed as key aspects of ensuring optimal sleep location under the circumstances.

FATIGUE EFFECTS

Over half of the crewmembers indicated they perceived no fatigue effects. Close to half of the crew members, however, mentioned they were aware of fatigue during their mission. Of responses given, 8% mentioned making fatigue-related mistakes and 14% indicated they noticed cognitive slowing. Twenty one percent of those responding stated their performance would have improved if they hadn't been fatigued.

When asked about fatigue effects on the crew (n = 63), 33% of crewmembers indicated it had no impact, whereas %66 discussed effects that were present during the mission but were mostly managed. Some crewmembers elaborated on psychosocial effects of fatigue, noting increased irritability, tenseness, anger, impatience.

Strategies for managing fatigue effects included:

- •Remaining aware of potential fatigue effects (i.e. performance decrements);
- •Awareness of potential effects in others (such as irritability) to help offset crew conflict;
- •Closely working with other crewmembers to "back up" one another on tasks;
- •Working through tasks more slowly;
- •Adhering to processes (i.e. checklists) to prevent fatigue-related errors; and
- •Protecting scheduled sleep times.

Importantly, despite the intense workload experienced by many coupled with the reported the lack of sleep, crewmembers successfully completed their tasks and their mission. Maintaining such a pace beyond two weeks, however, may yield negative effects on performance, psychosocial interactions, and well-being. Additional information regarding results of this study will be made available in a NASA Technical Report later this year.

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