

Space Adaptation Insomnia CLIFF Peer Review

1. *Strength of evidence presented in CLIFF in modeling the characteristics and mission impact of this medical condition within the spaceflight environment?*

Score: 3

Grading Scale:

4 - *Confident*

3 - *Somewhat confident*

2 - *Neutral*

1 - *Somewhat unconfident*

0 - *Not confident*

2. How confident are you that these data accurately represent the spaceflight environment?	Tables 1, 2 Composite Incidence and Level of Confidence	Table 3, 4 BC/WC Loss of Crew and probability	Table 4 - Clinical Phase 1, 2 durations Table 5 – CP 2 Loss of Crew	Table 4 – RTDC % Table 6 – RTDC Loss of Crew	Table 4 – Loss of Crew Life % Table 7 – Loss of Crew Life, Loss of Crew	Table 8 – TI
Score	3	3	3	4	4	3

Comments and limitations:

1. General comments. This CLIFF examines insomnia that occurs within the first five days after orbital insertion. Difficulty initiating sleep, maintaining sleep, and non-restorative sleep that are associated with the transition to microgravity make insomnia one of the most commonly reported medical conditions, particularly in first-time fliers. The excitement of launch and insertion into space, busy schedules during the first days on orbit, fluid shifts, unfamiliar sleeping accommodations, and a novel environment all play a role making high quality sleep difficult to achieve during this time. Insomnia may be vehicle dependent. In small spacecraft where there may be excessive light, noise, and little privacy, insomnia may be more common than in spacecraft that are more voluminous and have individual sleep quarters. As a result of insomnia occurring upon entry into space, as well as throughout the flight, hypnotic agents are among the most commonly used medications by astronauts. The best case is considered to be Insomnia occurring within the first 5 days of spaceflight that is mild and is effectively treated with appropriate crew scheduling/sleep-shifting and sleep-aids. The worst case is Insomnia within the first 5 days of spaceflight that is severe or refractory to treatment with appropriate crew scheduling/sleep-shifting and sleep-aids.

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2. Incidence. LSAH data that collected the inflight reports of insomnia (381 events over 807 person-missions) was used to calculate the incidence. This data was derived primarily from ISS missions. Since docking with the ISS usually takes place on mission day 3 or before, ISS crews will spend some of the space adaptation period (5 days) on the station. Since ISS sleep quarters are much more conducive to restorative sleep, the rates of insomnia in the first five days may be lower than they would be on a smaller vehicle in which the first five days are spent in a cramped cabin. Thus, the incidence may be underestimated. The best case/worst case probabilities used LSAH inflight data, in which there were 15 worst case scenario space adaptation insomnia events among a total of 381 events. This results in an estimated worst case percentage of 4% (15/381) and an estimated best case percentage of 96% (366/381). The clinical phase durations are based on observational data that show the best case usually lasts from 0 to 72 hours while the worst case may last the entire 5 days or 120 hours. Both RTDC and LOCL probabilities were considered to be zero given the medical condition definition. The probability density curve that was derived appears to be a reasonable representation of the data presented.

3. Clinical phase data. I am in agreement with the clinical phase 1 duration entered in this CLIFF. This data was compiled by a team of expert clinicians, and I was involved in the discussions leading to the calculation of the clinical phase duration. CP2 was supported by spaceflight evidence.

4. Task impairment. The analysis was performed and reviewed by a separate team of expert clinicians. I am aware of the methods that were used but did not directly participate in the discussions.

5. Dependence on mission phase or duration of mission. This medical condition is dependent on mission phase as it only occurs during the first five mission days.

6. Limitations

- This data was derived primarily from ISS missions. Since docking with the ISS usually takes place on mission day 3 or before, ISS crews will spend some of the space adaptation period on the station. Since ISS sleep quarters are much more conducive to restorative sleep, the rates of insomnia in the first five days may be lower than they would be on a smaller vehicle in which the first five days are spent in a cramped cabin. Thus, the incidence of insomnia may be underestimated.
- The data used study only a limited number of subjects and use specific vehicle and mission profiles. Future missions may differ in terms of vehicles and mission profiles.
- The clinical phase II durations for this CLIFF were all taken from the prior IMM CLIFF which are based on LSAH data. The ExMC composer/editor of this CLIFF did not have access to that primary source, but felt after looking through multiple other sources that these estimates for duration were reasonable given that they are spaceflight specific.

Reviewed by:

David C. Hilmers