

Space Adaptation Back Pain 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	4	3	3	4	4	3

Comments and limitations:

General comments. Back pain that occurs during the initial transition to microgravity (space adaptation back pain or SABP) is a common complaint of astronauts. It is characterized by a nagging, dull pain that usually involves the lumbar paravertebral muscles and is relieved by flexion into a fetal position and the use of mild analgesics. Although SABP usually is mild and subsides after the first week in microgravity, it may recur later. The precise mechanism and spinal structures responsible for SABP are uncertain, but evidence supports the hypothesis of spinal lengthening as the most likely etiology. It was this reviewer's experience that while SABP can be bothersome, it does not affect the performance of flight duties or directly impact mission objectives. The definition is somewhat vague, at best. The differences between mild, moderate and severe cases are quite subjective. There are likely to be many cases of SABP that go unreported as they may be quite mild. The best case is considered to be back awareness to mild back discomfort. The worst case is moderate to severe back pain.

2. Incidence. As SABP is unique to the transition to the microgravity environment, only spaceflight data was used to calculate the composite incidence. The most recent LSAH data with

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updates to the HSRB in 2020 showed 438 events in 871 person-missions. Person-mission is used for the incidence distribution instead of person-years as each crewmember experiences one transition from unit gravity to microgravity per mission, no matter what the duration of the spaceflight. The best case/worst case probability is somewhat subjective but is based on reporting by astronauts who experienced SABP. Of these 86% described the pain as “mild” and 14% characterized it as “moderate” or “severe”, yielding a BC/WC probability of 86%/14%. The clinical phase durations were based on a worst case of 12 days duration. RTDC and LOCL probabilities were both determined to be 0, given that SABP is self-limited and has never resulted in evacuation. 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 terrestrial 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 only occurs during the first five days of spaceflight. In the future, it may also apply during gravity well operations.

6. Limitations

- There are no data regarding untreated scenarios since there has been treatment available on all space missions to date.
- The difference between best case and worst case is very subjective and not well defined.
- There are likely to be many cases of SABP that go unreported as they may be quite mild.

Reviewed by:

David C. Hilmer