

Thoracic/Lumbar Spine Fracture 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	2	2	3	3	3	3

Comments and limitations:

1. General comments. Vertebral fractures in a terrestrial environment are usually due to conditions such as osteoporosis, falls, excessive compressive axial forces such as in a motor vehicle accident, or some type of physical injury. There have been no vertebral fractures reported during spaceflight. Although it is well known that accelerated bone loss occurs during spaceflight, it is assumed that the forces required to create a thoracolumbar fracture are not present during microgravity operations. Therefore, the risk of this type of fracture during microgravity operations is considered to be zero and will only be applied to surface EVA operations.

2. Incidence. As stated above, the probability of a thoracolumbar spine fracture in microgravity was assumed to be zero. The probability distribution for the incidence during a six-hour surface EVA was calculated using a terrestrial study of Swedish patients under the age of 60 presenting with this type of fracture. The resulting incidence proportion (per EVA) is extremely low. The best case/worst case probabilities, clinical phase durations, RTDC and Loss of crew life probabilities are supported by terrestrial evidence, and I am in agreement with their calculation. The probability density curve that was derived appears to be a reasonable representation of the data presented. However, given the

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large sample size of the study used to calculate the incidence, the small standard deviation most likely overestimates the confidence we have in the assigned value.

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 is applied only during surface EVA operations and is thus dependent on mission phase.

6. Limitations

- There is no spaceflight data for this CLIFF. The terrestrial environment that was used as a surrogate does not correlate well to that of EVA's on the lunar or Martian surface, but probably represents an upper bound.
- Because of the large sample size, the study used to compute the composite incidence most likely overestimates the confidence we have in the assigned value.
- Under-reporting for this condition could have been significant during past space missions due to subtle disease that may not have been apparent to the crew. This may result in underestimation of the incidence.

Reviewed by:

David C. Hilmer