Skin Abrasion 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*	*2*	*3*	*3*	*3*	*3*

Comments and limitations:

1. **General comments.** Skin abrasion occurs when forces applied to the skin compromise the epithelium. This can occur by scraping, blunt injuries, such as falls, or the application of shear forces. Lacerations, which are tears in the skin, usually involve deeper layers of the skin and often result in bleeding. Lacerations are covered in a separate CLIFF. One might expect that in microgravity operations, where g-forces are not a factor, the prevalence of abrasions would be less common than on earth. However, epidermal thinning has been observed during longer missions which makes the skin more vulnerable to this type of injury. During EVA operations, abrasions occur frequently with the constant contact between skin and the cooling garment/EVA suit. Abrasions during EVA is also the subject of a separate CLIFF. Most abrasions are considered minor injuries that do not require any medical treatment in most terrestrial scenarios. Since many abrasions are of minor consequence, they may go unreported, whether in space or on earth. The best case is defined as a mild abrasion(s) resolving spontaneously or requiring minimal intervention while the worst case is a moderate to severe abrasion(s) requiring additional intervention.

2. **Incidence.** Two studies of astronaut-reported abrasions were used to determine the composite incidence. The two sources pull data from independent data sets yet the resultant incidences are very close to each other. The two sources were combined in the data analysis to create a composite incidence. It is likely that very minor abrasions have not been left unreported in the past which could lead to a small underestimate of the true value. The best case/worst case probabilities used data from a previous CLIFF in which 4 of 29 events fell under the worst-case definition. The clinical phase durations, RTDC and LOCL probabilities are supported by terrestrial evidence, and I am in agreement with their calculation. Both RTDC and LOCL probabilities were considered to be zero for both best and worst case, 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 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 dependent on mission phase as the incidence may be higher during surface operations which are under partial-g conditions. An update for IMPACT 2.0 may be required to account for this. EVA operations are covered in a separate CLIFF.

6. **Limitations**

- Under-reporting for this condition could have occurred during past space missions due to subtle abrasions that were not of clinical consequence. This may result in underestimation of the incidence.
- The authors did not have access to the original LSAH data and thus there was a dependence on already published sources to delineate between EVA-related and non-EVA events.
- After extensive literature searches performed by the editors for this condition, no studies were found that informed hospitalization rates, likely a result of this condition's mostly benign consequences.
- This medical condition is dependent on mission phase as the incidence may be higher during surface operations which are under partial-g conditions. An update for IMPACT 2.0 may be required to account for this.

Reviewed by:

David C. Hilmers