**BHP Grief Reaction 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: 2*

   ***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*<br>*Composite Incidence and Level of Confidence* | *Table 3, 4 BC/WC*<br>*Loss of Crew and probability* | *Table 4 - Clinical Phase 1, 2 durations*<br>*Table 5 – CP 2 Loss of Crew* | *Table 4 – RTDC %*<br>*Table 6 – RTDC Loss of Crew* | *Table 4 – Loss of Crew Life %*<br>*Table 7 – Loss of Crew Life, Loss of Crew* | *Table 8 – TI* |
|---|---|---|---|---|---|---|
| *Score* | *2* | *2* | *3* | *2* | *3* | *3* |

Comments and limitations:

1. **General comments.** This CLiFF characterizes grief reactions that are secondary to a personal loss that may arise during spaceflight. The most likely scenario is that a crewmember would receive news of the death of a family member or close friend. It is also possible during an exploration mission that the death of a fellow crewmember might occur that would affect the survivors. To date, all deaths that have occurred during spaceflight were associated with the catastrophic loss of the entire crew, so this circumstance is felt to be much less likely than the loss of a family member back on earth. Acute grief normally causes some emotional and somatic distress but generally does not require treatment. When grief becomes prolonged or complicated, it can lead to hostility, insomnia, social withdrawal and decreased performance that affects mission objectives. In such cases, labelled "grief disorder", counselling or even pharmacotherapy may be required. There have been no documented reports of grief reaction leading to grief disorder during spaceflight. This is a new CLiFF that is a refinement of the IMM CLiFF that dealt with behavioral emergencies as a single entity, and the IMM CLiFF was not categorized by behavioral pathology. The best case is considered to be a grief reaction that resolves within one year without any significant impact on mood, sleep or interpersonal functioning or need for significant intervention. PRN Sleep aids and/or behavioral

health intervention, increased behavioral health countermeasures could be used as treatment options. The worst case is persistent or complicated grief that causes significant difficulty to recover from the loss. This condition causes significant distress or decline in areas including but not limited to work performance, sleep, interpersonal dynamics and requires long-term pharmacologic therapy (minimum 6 months) and/or behavioral health intervention. Related conditions covered in other CLiFFs include adjustment disorder, anxiety, psychotic depression, depression without psychosis, personal relationship problems and sleep disturbance. These conditions may, and often do, coexist.

2. **Incidence.** There are no reports of grief reactions during spaceflight. The best available analog to spaceflight that reported incidents of psychotic depression was a Polaris submariner study by Tansey (1979) done in the 1960's and 1970's. This population has some similarities to astronauts. Submariners are screened prior to entry at the Naval Submarine School to assess their ability to adjust to both the school and subsequent submarine service. The close quarters, underwater environment, and long patrols are also similar to exploration space missions. The paper reported four cases of "situational reaction" (considered equivalent to grief reaction by subject matter experts) over the course of more than 21,000 person years, so the incidence in a screened population is very low, as expected. The BC/WC probability split was based on a terrestrial study that estimated that 7-10% of bereaved individuals will develop prolonged grief disorder. This was used to calculate a BC/WC probability of 90-93%/7-10%. The best case clinical phase durations were based on the BC definition and could resolve spontaneously or last up to one year. The worst case CP2 times were based on the shortest time generally needed to stabilize grief disorder (6 months) and up to one year. The best case return to definitive care (RTDC) and Loss of crew life probabilities were considered to be zero based on terrestrial studies. The treated and untreated worst case probabilities for RTDC have a range of 9-49%, showing the uncertainty in the efficacy of treatment. The worst case Loss of crew life was as high as 18% based on the increased risk of suicide found in widowers within the first 6 months of experiencing a loss. The probability density curve that was derived appears to be a reasonable representation of the data present

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**. The incidence of this medical condition will probably remain fairly constant over the course of the mission as a death, either terrestrially or during flight, could occur at any time. The sense of grieving may be more intense later in a mission when combined with other psychologic stressors that peak during the third quarter of a mission.

6. **Limitations**

- There is a paucity of published data relating specifically to grief reaction as defined by this CLiFF due to the lack of classification of behavioral problems by DSM diagnostic category in the spaceflight literature.
- The Tansey study, which was used to calculate the incidence of grief reaction, reported "situational reaction" and not grief reaction specifically. However, it was felt by subject matter experts that it was appropriate to assume that the two descriptions are equivalent.

- There is some overlap between this condition and other BHP CLiFF conditions, including anxiety, adjustment disorder, major depression and sleep disturbance. These conditions may, and often do, coexist.
- Due to the multifactorial nature of the process of grief after experiencing significant loss, it is difficult to estimate the probability of the crew developing more serious forms of grief such as prolonged grief disorder. This characteristic of grief reaction thereby makes terrestrial incidence and WC/BC probability data less indicative of spaceflight data.
- "Worst case incidence refractory to therapy" does not have a clear definition when used in this specific condition. Therefore, using "refractory to therapy" as part of the surrogate for RTDC is not clear, and therefore not informative in estimating RTDC probability.

Reviewed by:

David C. Hilmers