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DEVELOPMENT OF ASTRONAUTS' NON-TECHNICAL SKILLS TAXONOMY FOR MEDICAL EVENT MANAGEMENT ON FUTURE LONG DURATION EXPLORATION MISSIONS

Abstract

Purpose: Unexpected medical events during long-duration space missions may compromise crew health and mission success, as there is no option of premature return to Earth and communication is delayed. The high acuity, low frequency nature of medical events mirrors those occurring in terrestrial surgical environments. Surgical non-technical skills (NTS) including situation awareness, leadership and team coordination, have been shown to improve patient safety by reducing performance errors and the risks of unexpected events. This study aims to develop a NTS taxonomy and behavioral marker system to support medical event management during future long duration exploration missions.

Methodology: A Delphi method was implemented to determine the specific NTS essential for astronaut crews. An expert panel of n=28 participants comprised of astronauts, physicians, health researchers, human factors scientists, simulation experts, and space medicine specialists was recruited. Panel members ranked potential impact of NTS on the management of 30 events identified from NASA's Space Medicine Exploration Medical Condition List using a visual analogue scale. Panelists were assigned to four parallel groups, to discuss the NTS required to manage one of the highly ranked medical events. A spacecraft themed simulator was designed and built, where four medical scenarios were filmed to test the fidelity of these skills. These videos will be subjected to psychometric analysis in the next stage of the project.

Results: Panelists rated smoke inhalation, penetrating eye injury, seizure and pneumothorax as most likely to benefit from adroit NTS. Over 100 NTS were identified in the management of these events. After several iterative rounds of discussion, a taxonomy of 20 essential NTS was identified and mapped to NASA's existing Space Flight Resource Management training framework. For example, under the category 'information exchange', specific behavioral skills identified were (i) gathering information, (ii) recognizing something is wrong, (iii) providing situation assessment updates, (iv) communicating with other crew members, and (iv) communicating with mission control centre. Other training elements will be presented.

Conclusion: This taxonomy is the first medically-focused NTS taxonomy for long duration spaceflight that reflects an innovative application of an existing validated tool from surgery called the Non-Technical Skills for Surgeons (NOTSS) system. Future research will test the reliability of the taxonomy using video scenarios filmed in a medically themed spacecraft simulator. Our guiding model is that deliberate focus on NTS can improve outcomes in spaceflight medical events, as in surgery, and reduce the overall health risk on long duration exploration missions.