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A WHOLISTIC APPROACH TO ASSESSMENT OF ADAPTATION AND RESILIENCE DURING SPACEFLIGHT

Abstract

Human performance within the context of extreme environments both terrestrially and in outer space continues to lead the frontier of new physiological discoveries, further enhancing the knowledge on limitations of human mind and body systems, the role and activity of adaptation mechanisms, as well as assessment and development of resilience strategies. The acquired knowledge informs the development of innovative prognostic, diagnostic and therapeutic medical tools and resources aboard the spacecraft and in terrestrial medical centres. Despite decades of research and space exploration, the prognostic and diagnostic capacity aboard the spacecraft remains limited and fragmented, while health assessments constitute of questionnaires and collection of nominal physiological parameters, both of which are analyzed retrospectively, upon return to Earth, unless there is an apparent onset of medical contingency which necessitates immediate therapeutic intervention. Even then, the use of the acquired physiological data is limited, as it is being down-sampled to manageable data tuples for clinical evaluation and interpretation. In prior research we proposed the use of a big-data analytics platform, Artemis, for real-time assessment of adaptation during spaceflight. The capability of Artemis to support acquisition, storage and analysis of large volumes of physiological, environmental and activity data presents a great prospect for enhanced medical capacity during long duration spaceflights and deep space exploration. As such, we propose a prototype of an extension of Artemis to further incorporate activity data and mental health evaluations, so as to develop a more wholistic approach to assessment of crew's well-being during spaceflight. The proposed extension would also enable investigation of the team dynamics and how interpersonal relationships influence individual's performance and well-being. From a biomedical monitoring perspective, utilization of Artemis would enable a meaningful use of the acquired physiological data and decrease the need for down-sampling of the data, thereby addressing the limitation of an enormous amount of data loss that persists with current data processing techniques. The proposed prototype will also provide demonstrate its potential as a reliable on-site data warehouse, which would enable persistent, systematic and reliable storage of raw and derived analytics, as well as support the data transfer to the Mission control centres when the connection to do so is available.