MEDICAL OPTIMIZATION NETWORK FOR SPACE TELEMEDICINE RESOURCES

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INTRODUCTION

Long-duration missions beyond low Earth orbit introduce new constraints to the space medical system. Beyond the traditional limitations in mass, power, and volume, consideration must be given to other factors such as the inability to evacuate to Earth, communication delays, and limitations in clinical skillsets. As NASA develops the medical system for an exploration mission, it must have an ability to evaluate the trade space of what resources will be most important. The Medical Optimization Network for Space Telemedicine Resources (MONSTR) was developed over the past year for this reason, and is now a system for managing data pertaining to medical resources and their relative importance when addressing medical conditions.

METHODS

The MONSTR web application with a Microsoft SQL database backend was developed and made accessible to Tableau v9.3 for analysis and visualization. The database was initially populated with a list of medical conditions of concern for an exploration mission taken from the Integrated Medical Model (IMM), a probabilistic model designed to quantify in-flight medical risk. A team of physicians working within the Exploration Medical Capability Element of NASA's Human Research Program compiled a list diagnostic and treatment medical resources required to address best- and worst-case scenarios of each medical condition using a terrestrial standard of care and entered this data into the system. This list included both tangible resources (e.g. medical equipment, medications) and intangible resources (e.g. clinical skills required to perform a procedure). The physician team then assigned criticality values to each instance of a resource, representing the importance of that resource to diagnosing or treating its associated condition(s). Medical condition probabilities of occurrence during a Mars mission were pulled from the IMM and imported into the MONSTR database for use within a resource criticality-weighting algorithm.

DISCUSSION

The MONSTR tool is a novel approach to assess the relative value of individual resources needed for the diagnosis and treatment of medical conditions. Future work will add resources for prevention and long term care of these conditions. Once data collection is complete, MONSTR will provide the operational and research communities at NASA with information to support informed decisions regarding areas of research investment, future crew training, and medical supplies manifested as part of any exploration medical system.