Crew Medical Training to Progressively Enable EIMO

Jay Lemery, MD[1], Dana Levin, MD MPH[2], Arian Anderson, MD[1] Michael Krihak, Ph.D.[4], Kurt Berens[4], David Hilmers, MD EE MPH MSEE[3,5]

[1]University of Colorado, School of Medicine
[2]University of Texas Medical Branch
[3]Baylor College of Medicine
[4]KBR, Inc.
[5]Translational Institute for Space Health

Background. Onboard medical capabilities have greatly expanded over the history of the US space program. Newly identified space-related medical conditions, technological advances, and longer mission durations have led to an increasing need for on-demand medical expertise. Lengthy communications delays, lack of resupply and evacuation opportunities on exploration-class missions place an ever-increasing burden on the crew to provide medical care. Having adequate knowledge, skills, and abilities (KSA) available is an essential component of successful Earth Independent Medical Operations (EIMO). Without appropriate crew training and KSA, cutting-edge medical equipment has little value. Presumably, the crew will include a qualified physician; however, if the physician is incapacitated, a non-physician crew medical officer (CMO) will be needed. While more crew time is needed for medical training, there will be concomitant increases in preflight training demands for vehicle system management, operations, science, and contingencies. In truly independent operations, onboard resources such as just-in-time training, mixed reality, decision support tools, and AI-enabled chatbot "consultants" will be needed to augment KSA.

Overview. Because of crew time constraints, topical priorities must be determined for preflight training. Curricula should be developed that emphasize management of conditions with relatively high incidence and morbidity/mortality. Defining the required KSA levels to treat each condition is essential, but all crewmembers should have basic lifesaving skills. Procedural and diagnostic training on live patients and simulators should be prioritized over classroom lectures. Crews must be trained with onboard equipment, resources, mixed reality, and AI-based decision support tools. Mission simulations should include medical problems with/without ground support and with appropriate communication delays. Certification guidelines for each level of KSA must be established. Skills rapidly decay for non-physician CMO's; both pre-flight and in-flight refresher training will be needed. During spaceflight just-in-time training, simulations, and onboard CME with crew physician can help retain skills.

Discussion. Medical technology, simulation design, mixed reality, and AI are advancing at a dizzying rate. Recognizing the severe constraints on crew time, it is critical that astronaut training is highly efficient and adapted to keep pace with new innovations both pre-flight and during exploration missions. These challenges will be discussed during this panel session.