

MEDICAL RISK ESTIMATES AND CLINICAL CAPABILITY NEEDS FOR A LONG DURATION ARTEMIS MISSION

W. Thompson¹, D. Goodenow¹, D. Hilmers², J.G. Steller³, D. Levin³, A. Anderson⁴, E. Stratton³, A. Nelson³,
E. Kerstman³, L. Boley⁴, J. Lemery^{5,6}, K. Lehnhardt^{2,6}, B. Easter^{5,6}

¹ NASA Glenn Research Center, ² Baylor College of Medicine, ³ University of Texas Medical Branch and
KBR, ⁴ KBR, ⁵ University of Colorado School of Medicine, ⁶ IPA – NASA Johnson Space Center

BACKGROUND

Human exploration spaceflight missions to the Moon and Mars present unprecedented challenges for in-mission medical care. Compared with the ISS, the greater distance from Earth will mean increased mission durations, communication delays, limited to no resupply opportunities, and significant limitations on the evacuation of ill or injured crew. Spacecraft mass, volume, and power will be curtailed while higher demands will be placed on the crew's knowledge, skills, and abilities.

In this higher risk environment, it is important to: a) quantitatively estimate human system risk attributable to medical conditions, a process known as Probabilistic Risk Analysis, and b) use these estimates to inform medical system design.

IMPACT (Informing Mission Planning via Analysis of Complex Tradespaces) is a PRA and medical trade space analysis tool developed by NASA to advance exploration mission medical system design. IMPACT v1.0 improves upon and will soon replace NASA's existing tool, the Integrated Medical Model, with: a novel evidence base baselined to exploration environments; an expanded list of 119 medical conditions; a significant increase in the number of medical resources that can be utilized and in the flexibility of their use; and the modelling of time lost performing mission-specific tasks due to medical conditions.

DISCUSSION:

This abstract will present IMPACT estimates of medical system risk and clinical capability needs for an extended duration Artemis mission of approximately 9 months, with phases including outbound transit, 3 months on the Lunar Gateway space station, 3 months on the Lunar surface with EVAs, 3 months on Gateway (simulating the return phase of a Mars mission), and transit back to Earth. Medical system risk estimates include loss of crew life (LOCL), consideration of medical evacuation (known as return to definitive care – RTDC), and an estimate of crew time lost due to medical conditions (Task Time Lost – TTL). The presentation will also describe the medical conditions that are the greatest drivers of risk as well as the clinical capabilities and resources that have the largest effect on risk.