The Integrated Medical Model – A Risk Assessment and Decision Support Tool for Human Space Flight Missions

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Introduction

The Integrated Medical Model (IMM) is a decision support tool that is useful to space flight mission planners and medical system designers in assessing risks and optimizing medical systems. The IMM employs an evidence-based, probabilistic risk assessment (PRA) approach within the operational constraints of space flight.

Methods

Stochastic computational methods are used to forecast probability distributions of medical events, crew health metrics, medical resource utilization, and probability estimates of medical evacuation and loss of crew life. The IMM supported the International Space Station (ISS) Program by updating current ISS PRA estimates of probabilities of medical evacuation and loss of crew life. The IMM also has the capability to optimize medical systems based on vehicle mass and volume constraints. Initial validation analyses of IMM outputs indicate that medical events, medical resource utilization, and the probabilities of medical evacuation and loss of crew life are accurately forecasted.

Discussion

The IMM has provided valuable information to the ISS program regarding risks of evacuation and loss of crew life. This information can be used to develop mitigation strategies for ISS missions. Future ISS crew transfer missions and exploration missions will have more significant mass and volume constraints applied to the medical system. Appropriate allocation of medical resources will be critical to mission success. Therefore, IMM capability of optimizing medical systems based on specific crew and mission profiles will be advantageous to medical system designers.

Conclusion

The IMM is a decision support tool that can provide accurate estimates of the impact of medical events on human space flight missions. It can be used to develop mitigation strategies and optimized medical systems for specified space flight missions.

Learning Objectives

The audience will learn how an evidence-based decision support tool can be used to assess risk, develop mitigation strategies, and optimize medical systems for specified space flight missions.