

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medical Care for Humans in Space (3)

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FACTORS INFLUENCING SURGICAL PROCEDURES IN SPACEFLIGHT ENVIRONMENTS

Abstract

Substantive yet limited research has been conducted on the impact of the space environment on the feasibility, adaptability, and modifications required for medical procedures. Current procedures are limited to those affecting orbital stations, and emerging missions to the moon, Mars, and beyond have yet to decide on mission lengths, crew size, and mission support facilities that are necessary to develop and test medical procedures. Given the importance of rapid medical responses for the widely varying situations of spaceflight, it is imperative that consideration be given to the factors that will influence the medical decision-making process for future missions.

This paper investigates the key factors that will influence surgical procedures in space, assessed as the most decisive medical procedure for human spaceflight missions. Factors identified are in two categories: environmental and mission. Environmental factors are further subdivided into gravity, acceleration, and radiation, with a predominant emphasis on gravity. Mission factors include mission duration, onboard medical capacity, distance from reasonable relief stations, and communication availability and latency to medical professionals. The combination of the three environmental factors and four mission factors covers most crewed missions currently in consideration, where the research covers how each factor will influence surgical decision-making.

The understanding of the factor analysis is demonstrated in three hypothetical case studies in the conclusion, where a lunar village, in-transit spacecraft, and a Martian station are evaluated to validate the findings in the body of the research. The paper extends the potential use of this research as a guiding framework for designing onboard medical systems and emergency decision-making procedures for future human spaceflight missions.