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Future and current space missions: including and expanding all aspects of human life on-board and in other worlds (1)

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MEDICAL CARE DURING EXPLORATION-CLASS MISSIONS AND TERRESTRIAL BENEFITS

Abstract

Introduction: Human spaceflight beyond LEO bring concerns about how healthcare will be delivered in space. Medical concepts including telemedicine and medical autonomy are being developed to compensate for the important communication delay and the impossibility of emergency return during Mars mission. Remote communities on Earth are also coping with limitations closely related to space exploration: absence of specialist, limited medical equipment, expensive or impossible emergency transportation to urban centers. Innovations in terms of medical systems for spaceflight are therefore directly related to the advancement of healthcare delivery system on Earth to ensure, not only access to healthcare but also a more uniform standard of care. **Methodology:** Manned exploration scenarios to the Moon and Mars were analyzed in order to outline the main components regarding the development of medical concepts for crew safety. The Advanced Astronaut Medical Support (ADAMS) concept, developed by the Operational Space Medicine group at the Canadian Space Agency, was taken as a concept of reference for medical care during space missions. In parallel, Canadian remote communities' healthcare system was studied to demonstrate how space medicine innovations could fulfill important gaps in terrestrial healthcare delivery system. **Discussion:** Mission profile, space environment, communication delay, availability of technologies and the probability of illness' occurrence will influence the requirements in terms of onboard medical equipment. Intelligent medical technologies and appropriate communication infrastructure will be progressively implemented as the mission operations are getting more complex, e.g. Mars missions. The ADAMS concept is an integrative approach of medical care including technologies, decision support, training and communication requirements. In addition, it is predicted that telemedicine and decision support tools developed for space utilization will improve the access to care as well as the standard of care in remote communities on Earth by allowing remote consultation with specialists, assistance in decision making and avoidance of costly and unnecessary transportation to urban centers. **Conclusion:** Northern Canada and Mars have many elements in common; no conventional medical facilities are in place, access to care is not guaranteed and standard of care varies greatly amongst remote locations. Strategies for healthcare delivery in remote regions, whether on Earth or other planetary bodies, should include telemedicine and medical autonomy components. It is foreseen that improvements in telemedicine technologies and in decision support tools will improve crew safety on exploration-class missions and increase the access to standardized healthcare services in remote communities.