



Healthcare state in Mars research: evaluation of Mars Desert Research Station

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Abstract

The Mars Society's Mars Desert Research Station provides analog planetary research. In this Martian analog, some research teams develop a most quants of research in different issues, like medicine. This area is an important field for human crew and Martian environmental studies. Medical care and first aid will allow the assessment of health risks and homeostasis of the crew during the journey, the space conquest and also in the simulation. During the Crew 169 rotation it has been observed basics and inadmissible deficiencies for First Aid and measures of protection and human prevention making the crew in permanent risk during the analogous Martian simulation. Hence, responsibility for medical care lies with both the space institution and those responsible for each Crew. Each simulation will require a rigorous selection of members who must have skills in medical care and contribute to the success of spatial simulation. Given that the Martian research analogue constitutes a key element in the preparation of explorations that allow anticipating solutions, the importance of health care should be an ethical imperative for all institutions responsible for spatial exploration with order to safeguard the integrity of the crew.

Introduction

Currently, many countries are focusing their interest in space research, mainly for the future and possible conquest of Mars (1). As proposed in recent studies (2) on the former Martian habitability, different space agencies are committed to the Martian conquest that has been inevitably becoming a "future" reality for humanity.

In that sense, organizations like Space X and NASA are developing many studies and technologies with different visions of its execution, but with one objective: conquering Mars. NASA for example has demonstrated the health risks of an extended space journey (One-Year Mission Research) by referring to these findings as a problem for space exploration (3). It is that exposure to weightlessness and radiation is permanent risks during space travel, in addition to the likely shortage of drinking water and breathable air during the trip and during the stay on Mars. Undoubtedly, these problems compose current challenges for this space project to be successful (4,5).

For this event, which will represent a more conquest of man in the universe, currently analog planetary research developed. The analog planetary research is the development and testing of multidisciplinary scientific strategy in simulated space or planetary environments for the applications of crewed space explorations missions providing advantages to space science, technology development and society entire (6).



The Martian analogs are places distributed around the world that have similar conditions to Mars, there are different places that have these conditions worldwide (i.e.: Rio Tinto in Spain, Atacama in Chile, Alice Spring in Australia, Pampas de la Joya in Peru, among others). However, most of these investigations are developed in the Mars Desert research Station (MDRS) in Utah, USA. Over the past two decades in this Martian simulator have conducted studies in various fields of space research, allowing the members of each Crew, from all over the world to test their interdisciplinary research in various fields of science. Which are expected to create an ideal environment for the future space travel, as Sean Blair points out, "the quest to conquer the planet and Red Planet starts in Earth" (7). In that sense, The Mars Society, the company in charge of MDRS, selects, trains and enables the development of scientific knowledge in astrobiology and space science (8). For medical sciences, various crews have developed activities in the MDRS to permit evaluation of health risks and global homeostasis of the crew highlighting the health challenges of space travel against the postmodern technological change (9-12). Nevertheless, mostly these investigations have focused on issues specific health during extravehicular activities (EVA's), within the occupational hazards Dwell (HAB), specific health problems such as perception risk by the crew, telemedicine and health-chronic risks.

Medical Science represents an important field for human crew and Martian environmental studies. First aid is the immediate assistance receiving any rough or suddenly ill person, this activity allows preserve life and general well-being of health. This highly valued activity aims to prevent further harm, promote recovery and principally preserve life (13) Activities and tools of First Aids allow saving the lives of the crew immediately and before any difficulties developed during the trip, stay and spatial and Mars exploration, and during simulations like Martians. All this equipment life support needs to be proof breakdowns and with high efficiency, each of these components then are the level of medical care during the Martian simulations now, and during the later conquest of space.

During the rotation of the Crew 169 in the MDRS (First Latin American crew made up of researchers from Colombia, Argentina, Costa Rica and Peru) were descriptively assessed medical care Martian base analog MDRS. Its follow from this observational analysis found inadmissible and basics deficiencies for First Aid and measures of protection and human prevention that violate the universal principles of health, thus making the crew in permanent risk during the analogous Martian simulation.

Viewpoint

Health care should be an ethical imperative for all institutions responsible for spatial exploration with order to safeguard the integrity of the crew; this will allow the optimality crewmembers during simulation and future Martian conquest ensuring the success of the space mission.

To achieve this, you must evaluate long-term indicators of circadian performances, biochemical and systemic markers, nutritional status, orientation and "possible" dementia astronauts, the engine state, psychological state, simulating medical emergencies, the symbiosis between the crew and saprophytes and "Martians" microorganisms, among others (14-17).

While the ability to improvise will be one major skills during Mars exploration, in Medicine in general, and in primary health care and First Aids in particular, errors cannot be allowed. The hostile environments will generate potential and inevitable accidents and problems will all problematic from an angle of vision. Moreover, under this situation what we can do? Mars will be no care systems, no paramedic system to control the unfavorable situation and seek medical aid could last long until sent to Mars (the delay in message transmission and receipt of responses from Mission Control) (14).

In this scenario, the traditional medical help is unavailable for this medical care and First Aid will allow assuage possible problems during the space mission. For this purpose must have a thorough understanding of the physiological and mental changes and possible infections, diseases and unfavorable risks.

This hazardous scenario could happen during space travel and/or during the colonization of the planets. The Health Implications must be considered at every stage of the Martian conquest a priori, should then discuss all possible causes of error and risks to astronauts (which according to NASA are: medical emergencies, radiation events, exposure to micrometeorite or debris, and system malfunction and failure), each protocols require design and advanced medical training for each crewmember (16).

The Crew will need skills in medical care and performance in each crewmember's first aid. From the evidence of robotic exploration it is known that constant exposure to radiation and chronic effects of microgravity play a key role in the success of the Martian conquest (17,18).

Without doubt, for this "new space milestone" is a challenge for humanity, bioastronautics also plays a key role in explaining the effects of gravity on the affected organisms (at the cellular level and systemic level) (19).

The power to live in hostile environments in the universe and Mars is currently in finding and developing new solutions to these problems, however, the truth is that we are still far from having applied the analysis in all cases which could be obtained from it not only useful if not of real significance for space exploration and conquest Martian results.

Much of the success of this global spatial objective development come planetary analog research. In these research centers are carried out multidisciplinary activities with a common goal: the solution of problems a priori, for a posteriori events. Research in Martian Analogs for example directly impacts on the discovery of new key technologies in the preparation of space explorations that anticipates solutions through EVAs efficient and cost-effective solutions. During the development of research in the Martian simulators must ensure medical care and success of first aid for each crewmembers. The responsibility for health care lies with both spatial institution and those responsible for each Crew (Health and Safety Officer). Some limitations that have been observed on First Aid during the rotation of the Crew 169 make up the obligations and the remains for The Mars Society can assure an integral simulation of quality and with few risks, as stipulated in its statutes. This leads me to demand for a permanent quality in the Martian simulation. To do this, a rigorous selection of the members of each team must be made, that they have First Aid skills, that the medications are not expired and that they are available to solve problems of each member of the crew, that medical tools and devices are functional and will save the lives of crew members (Figure 1).



Figure 1. Elements of the medical care system in the Martian analog base Mars Desert Research Station. a) Bandages, b) First Aid kit, c) Expired medications, d) Dental First Aid kit (Temparin™, DenTek, Maryville, TN, USA), e) Digital blood pressure monitor, f) Poison suction device.

Finally, we believe that these space advances in medical science, which have large investments in each country, should reflect improvements to health care in communities around the world. These space technology developments should be consistent with the global reality, a reality that confronts social, environmental and health challenges. The direct impact of the development of new technologies must have applications in societies, as international partners can improve Global Public Health.

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