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Mini Review

Understanding the Life Experience in Space Settlements with Inpatients and Social Sciences

Jianxun Shen*

Key Laboratory of Earth and Planetary Physics, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China

ABSTRACT

Plans to send crews to other celestial bodies, particularly the Moon and Mars, are put into action by a number of space agencies. Thus, it is an imminent research theme to study the daily life experience of future space migrants. The inpatient department is an outstanding analog of isolated and confined environments such as the real space settlements. Partially supported by external sources, the inpatient department can be deemed an ecosystem that is not fully self-sustainable, and thus it is the analog of the early stage of space settlement developments when in-situ resource utilization systems are not completely developed. Medical anthropology and sociology can significantly contribute to the understanding of the body, mental, and social reproduction within the in-hospital space analog ecosystem. Various potential issues during the development of space settlements can be inspected and predicted with the practice of well-established topics in medical social sciences, including medicalization, ecology and new diseases, subjectivity and identity, embodiment and narrative, acculturation, alienation, functionalism and new social institutions, biopolitics, and STS (Science, Technology, and Society). The combined applications of astrobiology and medical social sciences will bring unprecedented opportunities to the development of both disciplinary regimes and possibly the society itself.

Keywords: Confinement; In-hospital; Medical anthropology; Medical sociology; Space analog

INTRODUCTION

Space settlements are likely the future trend for national technological and engineering developments. Plans to send crews to other celestial bodies, particularly the Moon and Mars, are put into action by a number of space agencies. Recently, the Artemis program led by the USA is an international human spaceflight program that returns humans to the Moon and builds a Base Camp to support a long-term lunar accommodation by 2024. In this program, a lunar foundation habitation module and in situ resource utilization systems will be built [1]. Launching the orbiting Martian Space Station, Martian moon stations, and Mars surface stations for astronauts are also scheduled from 2025s to the 2040s. Human migration to space will no longer be a distant future. The daily life experience, physiological and psychological problems, and social constructions will be the real issues for pioneering migrants.

Accordingly, it is an imminent research theme to study the daily life experience of future space migrants [2]. It is important to determine the relationship between astrobiology and social sciences to make the multidisciplinary realm more reachable to a diversity of audiences [3]. Previous analog settlement studies are performed in purposefully established space analog habitats in extreme environments, such as Arctic regions, isolated islands, and deserts [4,5]. One of the most inspiring space analog environments is the prison as proposed by Charles Cockell's research team: prisons as relatively closed space settlements of space analog environments for humans are nominated, and the prison population is involved to investigate human society and culture shifts during space habitation [6]. However, the space

Correspondence to: Jianxun Shen, Key Laboratory of Earth and Planetary Physics, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China, Email: shenjxun@mail.iggcas.ac.cn

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analog habitat projects in extreme environments require some large-scale experiments with human subjects and are relatively less ethical [7]; and the prison space analog project does not include people suffering from illnesses. Galvanized by the UK Centre for Astrobiology prison base and the life Beyond education projects [6], the author advocates that the confined and repressed living conditions of the inpatient departments with the special in-hospital timetable and diurnal cycle are space analog environments, and the combined investigations of astrobiology and medical social sciences (primarily medical anthropology and medical sociology) should be carried out to inspect long-term space living experience.

IN-HOSPITAL SPACE ANALOG

Astrobiologists and space healthcare workers care about humans' life in isolated and confined environments. Getting trained in astrobiology and medical anthropology, the author argues that the inpatient department is an outstanding analog of this type of environment, and the ward can be a possible unit for each living room for space accommodations. An inpatient department is a division of a healthcare facility where patients are subject to medical conditions that require appropriate care and attention [8]. Not only health workers but also patients themselves should pay the attention. The inpatient setting is a partially self-sustainable ecosystem similar to prison space analog environments and extra-terrestrial colonial foundations. Inpatient division is a semi-closed living system that is an ideal analog to the early stages of space settlement when in-situ resource utilization systems are not fully developed and outside supplements are still necessary [9].

Rehabilitation including physical and psychological aspects of citizens is a crucial concern after space migration. This process is of great interest in astrobiology and medical anthropology. Besides confined environment and rehabilitation, therapeutic demand on other planets is also taken into account. The developments of space settlements from dependence to independence and their waste management are similar to those of hospitals in history: hospitals gradually detach from personal or family clinics and pharmacies, gradually forming relatively independent facilities; reclamation of large volumes of medical waste is different from conventional methods [10]. The methodology of medicine is additionally similar to astrobiology as they cover both the strictness of natural sciences and the caring of humanities and social sciences [11]. Due to the similarity of environments and developments, by investigating the life in inpatient departments, we may catch a sight into the experience in space settlements. Using theories and frameworks of medical anthropology/sociology, we can view it from many unfamiliar but useful angles.

Moreover, the advantages of inpatient departments over other space analog habitats and prisons are that:

- These studies take abnormal health conditions and therapeutic needs into consideration.
- Interview conversations with humanity care in an ethnographical style improve patients' in-hospital experience, and concurrently astrobiologists acquire wanted information.
- These projects are more cost-effective, convenient, and ethical than volunteer recruitments-based space analog habitat projects.
- These astrobiology investigations can take advantage of the well-established disciplinary realm of medical anthropology/sociology.

SOCIAL PARADIGMS OF MEDICINE IN ASTROBIOLOGY

Fortunately, the in-hospital experience of inpatients is an important and developed research theme of medical anthropology/sociology [12]. In-hospital experience is a reproduction process of both body conditions and social relations. Medical anthropologists and medical sociologists can significantly contribute to physical, psychological, and social reproduction within the in-hospital space analog ecosystem. Various potential issues during the development of space settlements can be inspected and predicted with the practice of popular topics in medical anthropology/sociology, including medicalization, ecology and new diseases, subjectivity and identity, embodiment and narrative, acculturation, alienation, functionalism and new social institutions, biopolitics, STS (Science, Technology, and Society), etc.

Medicalization is a broadly used concept in social sciences that describes the phenomena when non-medical conditions are treated as medical conditions [13]. Space colonization can be a process that is medicalized due to its nature of an interplanetary displacement of human bodies, the impairment of which is generally treated by medicine. Even on Earth, new ecological conditions can lead to new health issues and even diseases. Not to say on another planet. Medical anthropologists and sociologists scrutinize how people tackle a new ecosystem and associated medicine-related problems. Space migrants may suffer from space environments both physically and psychologically. The time system such as year, season, month, week, and day becomes very different. A new view of time will be perceived. Within isolated and confined accommodations, mental problems are inevitable. Space settlers could face the feelings of isolation, loneliness, depression, and astraphobia. On the other hand, extreme conditions (e.g., microgravity, ionizing radiation, hypo magnetic field, and circadian rhythm changes) likely cause motor and cognition dysfunctions, cardiovascular diseases, sleep disorders, osteoporosis, and so on [14]. These space health concerns are not hazy anymore but imminent.

Space colonization is additionally related to acculturation that reshapes a mature collective ideology. The settlement on other planets or moons requires astronauts to adjust their original worldviews. Simultaneously, they are also the founders of new space settlements who lay the foundation of extra-terrestrial societies. They can create new vocabularies, new types of communications, and new social rules that may not evolve on Earth. Likewise, inpatients can share some common words that can be unusual in a healthy life. Subject to similar pains and sufferings, the inpatient population shows more sympathy for each other and progressively builds a consensus view.

As for macrosocial aspects, one of the most important social theories, structural functionalism, will be expanded by space colonization. This theory stresses the necessity of healthy functions and interactions of different social institutions. Conventional social institutions can be succeeded by a space society, and new social institutions can be additionally constructed. The relationship and balance between institutions will be innovated. Another macrosocial perspective, biopolitics, that inspects the social and biological beings shaped by geography, medicine, and social norms helps to understand the strategy in space accommodations and associated health problems that govern life [15]. As one of the most cutting-edge advances, space colonization is closely related to the STS theme, which explores the linkage and interaction between science, technology, and society. Science and technology are the absolute necessity for space travel and will lead to a new establishment of new types of societies. On the other hand, space societies will surely be full of science and technology.

Space explorers are outside the reach of restrictions from Earth and in some sense have more freedom. However, they are less free in another sense given the surroundings full of danger. This contradictory condition is very similar to the relationship between inpatients and the in-hospital environment: inpatients are freer from social requirements but have to stay in limited areas and obey patient rules. While a patient is required to be a good patient [16], space migrants are required to be responsible pioneer astronauts. Inpatients help astrobiologists understand the rules and social functions that space settlers may establish or encounter.

DISSCUSSION

Future of astrobiology in hospitals and societies

Both body and language are not only a process but also a purpose themselves, partially reflecting both the internal self (subjectivity) and the external symbolic sign (identity) in societies where individuals are nurtured [17]. Thus, embodiment and narrative are paths to a coherent account that bridges the past, present, and future events, as well as depicts one's instinctive, sensed, and enlivened bodily experiences. They both reflect the self-exposure of subjectivity and identity [18]. For example, pioneering space migrants are deemed heroes by the public (identity) but can be sufferers to themselves (subjectivity) due to a variety of physical and mental impairments and the alienation from the Earth's community, Heroes or victim that is the question. Since the body is the direct medium of life experience, the body acts as the reification of socio-political symbols in space, expanding the embodiment in social sciences on other celestial bodies.

To understand and address space migration problems, embodiment and narrative as tools to transmit essential information and emotion through body and language can be recorded from inpatients to present possible scenarios that may actually occur in future space settlements. Inpatients' appeals through narratives may provide insightful thoughts or even potential solutions for space colonization projects. More than that, addressing the new social norm on other celestial bodies helps understand and expand the concepts, social theories, and frameworks in medical anthropology and sociology. Accordingly, astrobiology and social sciences collide and complement each other mutually.

CONCLUSION

This article proposes novel space analog, in-hospital environments, and suggests that space settlements can be greatly benefited from medical social sciences. As sending crews to outer space for long-term expeditions and accommodations is no longer a distant future, humans' life experience there is a forthcoming research topic to inspect. The in-hospital environment is advantageous over space analog habitats built in extreme environments and prisons in various aspects. Inpatients and in-hospital activities are vital astrobiology research themes and ought to be paid attention to in the future. The combined applications of astrobiology and medical social sciences will provide insights into potential astrobiological-social issues in space settlements and will bring unprecedented opportunities to the development of both disciplinary regimes and possibly human societies on Earth.

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