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Ethics and practicality of childbirth in space

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Abstract

Spacefaring childbirth represents a significant milestone towards transforming humanity into a multi-planet species. This article delves into the ethical, practical, and technical considerations of childbirth in space, emphasizing the adaptability of midwifery, potential challenges, and legal aspects. By addressing these factors, we aim to contribute to the expansion of human civilization beyond Earth.

Keywords: Space; Childbirth; Multi-planet; Pioneering; Midwifery; Ethics

1. Introduction

The concept of spacefaring childbirth is essential for establishing sustainable human colonies on Mars and the Moon. Exploring the practicality of natural childbirth in space counters skeptics and supports the growth of human civilization beyond Earth. Midwifery, the oldest profession, has continuously adapted to meet various environmental demands throughout history.

1.1. Principles and Ethical Considerations

- Ethics: Ethics is paramount, surpassing all other considerations. Ensuring ethical practices in space childbirth is crucial to maintaining the integrity of the mission.
- Life Safety: The safety of the neonate, mother-astronaut, and the medical team is paramount. Protocols must be established to address potential complications during childbirth in space.
- Financial Security: Ensuring the financial security of the investors is necessary to sustain long-term space missions. Proper planning and risk assessments are vital to protect investments.
- Loyalty: Adherence to respectful, ethical, and law-abiding statements is fundamental. All participants must commit to upholding the highest standards of conduct.
- Privacy: Avoiding the publication or disclosure of financial, technical, and personal information is essential to protect the privacy of the mother and the integrity of the mission.

2. Relevant Data and Statistics

2.1. Informed Consent

- Obtaining informed and voluntary written consent from the mother-astronaut is essential. The mother-astronaut, being welleducated in midwifery, law, medical engineering, aerospace engineering, and ultralight p iloting, is aware of the consequences of her actions.

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- There is no justification for needlessly putting a human being at risk. The project adheres to this principle, ens uring that lives are not unnecessarily endangered. The confidence in the project's benefits outweighs potentia l risks (1-16).

2.2. Research and Privacy

- Research on the fetus is conducted only if it yields positive and useful results for the fetus or mother, with wri tten consent from both parents.
- Research that benefits future generations of infants and children is considered ethical, provided it does not ha rm the current infant/child participant.
- Privacy must be respected, refraining from activities the mother considers invasive.

2.3. Complications and Risk Factors

Childbirth complications leading to maternal death can occur even in well-equipped hospitals. A study in Iran showed that 11.25% of maternal deaths occurred at home, and 88.75% in hospitals. Therefore, it is not unfair to consider space childbirth as inherently more dangerous, provided proper equipment, facilities, and specialists are available. The Maternal Mortality Ratio (MMR) in 2021 was 158.8 deaths per 100,000 live births, and 157.1 in 2020. Globally, the MMR declined by 34% from 339 deaths per 100,000 live births in 2000 to 223 deaths per 100,000 live births in 2020 (WHO).

2.4. Legal Considerations

Currently, no laws prohibit pregnancy in space for private travelers. The citizenship and identity of a baby born in spa ce can be determined based on the principles of jus soli (right of soil) and jus sanguinis (right of blood). Article VIII of t he Outer Space Treaty states that a state retains jurisdiction over objects and personnel launched into outer space.

2.5. NASA's Role

NASA has been at the forefront of space exploration for decades, conducting groundbreaking research and missions th at have expanded our understanding of the universe. NASA's expertise in space medicine, life support systems, and hu man physiology will be invaluable in developing protocols for spacefaring childbirth. Collaborations between NASA an d private companies like SpaceX can accelerate the development of safe and effective space childbirth practices. NASA' s studies on the effects of microgravity on human physiology have provided critical insights that will inform the protoc ols for childbirth in space.

2.6. SpaceX's Contributions

SpaceX, founded by Elon Musk, has revolutionized space travel with its innovative technologies and ambitious goals. SpaceX's Falcon 9 and Falcon Heavy rockets have demonstrated the potential for reusable launch vehicles, significantly reducing the cost of space missions. The upcoming Starship spacecraft, designed for interplanetary travel, will play a crucial role in establishing human colonies on Mars. SpaceX's commitment to making humanity a multi-planetary species aligns perfectly with the goals of spacefaring childbirth. The company's advancements in spacecraft design and life support systems will be instrumental in supporting safe childbirth in space.

Elon Musk's Vision

Elon Musk envisions a future where humans are a multi-planetary species, with Mars as the primary destination for colonization. His dream of establishing a self-sustaining colony on Mars by the 2060s involves developing advanced life support systems, habitats, and transportation infrastructure. Musk's vision emphasizes the importance of creating a safe and sustainable environment for future generations, including the possibility of childbirth in space. Musk's ambitious goals for Mars colonization include building habitats that can support human life, with provisions for medical facilities to handle childbirth and other medical emergencies (17-25).

2.7. Functional Requirements

- Safe delivery in accordance with WHO standards and embryo growth to the blastocyst stage according to IVF standards. Ensuring the health and safety of the mother and infant is paramount.
- Launch two spacecraft: one with necessary equipment, and another with a pregnant midwife-astronaut and medical team. Coordination of multiple spacecraft launches is essential to support the mission.

- Return the mother-
  astronaut, neonate, and IVF cells to Earth after the mission. Ensuring safe reentry and recovery of all participa nts and materials is critical **[Table1]**.

SpaceX's Dragon Recovery Vessel: Megan, Shannon (formerly GO Searcher) for crew recovery (1)**.**

Table 1 Technical Details

Date	Vehicle	Payload	Orbit
Launch 1	Falcon 9 Full Thrust (Falcon 9 v1.2)	Cargo Dragon	LEO/ISS
Launch 2	Falcon 9 Full Thrust (Falcon 9 v1.2)	Crew Dragon	LEO/ISS

3. Conclusion

3.1. Mission Objectives

3.1.1. Primary Objectives

- Successful delivery of the first human baby in space. This milestone will demonstrate the feasibility of natural childbirth in a space environment.
- Determine the effects of different gravity levels on human embryo development. Studies will investigate how microgravity and varying levels of gravity influence prenatal development.
- Compare and study short-term and long-
  term outcomes for babies born under different conditions. This includes assessing health outcomes for babies born on Earth, in space, and through IVF processes (1).

3.1.2. Secondary Objectives

- Create knowledge of human reproduction in space. This will contribute to the broader understanding of how space conditions affect human biology and reproduction.
- Develop space medicine knowledge. Insights gained from space childbirth will inform medical practices for sp ace exploration and potential colonization efforts.
- Promote permanent human habitation in space and multi-
  planetary survival. Safe childbirth in space is a critical step toward sustaining human populations on other pla nets (1).

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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