Remote Extra Terrestrial Healthcare: A View from India

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Breaking with tradition, this editorial from India, in the official mouthpiece of the European Federation for Medical Informatics, is truly an example of how the world is shrinking. A paradox, the inhabitants of the planet, however are expanding their reach, albeit slowly. The recent announcement by ISRO (Indian Space Research Organisation) that India would be embarking on a Human Space Program Gaganyaan, scheduled for launch in December 2021 has excited hard core telehealth enthusiasts in India. India will now be the fourth country in the world, after Russia, USA and China, to launch a manned space flight. Monitoring in real time, the health parameters of the three Vyomanuts (Indian synonym for astronauts) travelling on a Low-Earth- Orbit mission at an altitude of 300-400 km for 5 to 7 days would indeed literally be an "out of the world" task. We have less than 39 months to get our act together. Travelling @ 27,000 km/h, the spacecraft will complete one orbit around the earth every 90 minutes. Even for India, where every sixth human in the planet lives, the sky is no longer the limit! We are on our way to become the fourth country in the planet to send humans into outer space.

As of June 17th 2018, 561 individuals from over 40 countries have been in outer space in over 1,230 space flights, with a total of 46,947 person days in space from 1961. 17 nonfatal yet severe medical emergencies have been documented during spaceflights. Several private organisations have announced plans to commence space tourism. When billionaire Yusaku Maezawa a private citizen, takes his planned trip around the Moon with SpaceX Big Falcon Rocket in 2023, with some of his staff, several health issues need to be addressed. The trip to Mars of course will be an extraordinary challenge to the human body. Astronauts work on tasks for which they have trained for years. Huge amounts of time, money and effort have been invested in the mission and nobody can afford for an astronaut to be grounded or for a mission to be aborted due to ill health. Space tourists are less likely to be in the "super health" expected of professional astronauts.

Manned space missions do pose health risks before, during and post flight for crew members onboard a spacecraft or station. There are communication challenges for medical doctors monitoring them from the ground. Physical and mental changes, related to adaptation to space environment need to be monitored, in real-time. Changes in clinical parameters and management of unexpected medical emergencies need to be addressed and prepared for. Removing the effect of Earth's gravitational force alters all organic functioning. Space motion sickness, characterized by impairment of performance, nausea, vomiting and a diffuse malaise, occurs in astronauts and lasts for the first 72 hours of a space mission. Normal process of bone formation and resorption is disturbed.

Medical challenges and care during space missions include attention to space pharmacology, nutrition, immunology, countermeasures to withstand microgravity and attention to aerospace physiology. Disturbances in response of the human body may lead to hypoxia, visual illusions, spatial disorientation and decompression sickness. Loss of bone mass and muscle tone occur in astronauts who spend months in the microgravity of a space station. In-flight medical, physiological and psychological changes during a space mission could include space motion sickness (vestibular system), cardiopulmonary changes, intraocular pressure changes, and elongation of the spine, back pain, lack of sleep, circadian rhythm alteration, decreased food consumption, psychological stress and orthostatic intolerance. Dressing becomes difficult due to weightlessness (the correct term is microgravity not Zero gravity). Food and drink may float away. Shaving would be restricted. Disposable clothes would be replaced every three days. Washing would be with wet towels. Solid human would be collected, compressed and stored for later disposal not recycled.

Considering that "Space doctors" are few and far between it is perhaps relevant to identify their competencies. They should have a passion to follow one's dream, single-mindedness, determination and the will to succeed, obsession to be ultra-precise, keep calm under pressure, have problem-solving skills, patience and perseverance, ability to work as part of a close-knit team, mental and physical robustness, communication skills and an adventurous spirit. Interdisciplinary health support during a space mission with precise, continuous, real time documentation of defined health parameters during a space flight is critical.

The Vyomanuts selected will have to be in super health. They will have to work for a very long time in extreme environments, simulated to be, as close to outer space. They will have to be well

trained in health care including giving IV injections, CPR, being familiar with defibrillators etc. Providing remote health care of the highest standard in outer space pre supposes a passionate dedicated team with domain expertise in space medicine, space nutrition, space pharmacy, space nursing, biomedical engineering, Health related ICT and so on.

Getting such a team together all with a "Made in India" stamp will do wonders for the morale of all the 13,000 individuals who will be part of this mega event. The 1.5 Billion US$ earmarked for this project will certainly yield rich dividends in creating a new mindset that we have the potential to be "better than the best". More important there will be many, many spin offs which will have a major application in exponentially increasing the role of Health Care IoT. Smart Health will no longer be a hyperbole. The Human Space Program Gaganyaan will ensure this. All of these aspects still require further study and understanding, and perhaps the Gaganyaan mission can also inspire and motivate Indian researchers to address these issues.

What has human space travel got to do with Medical Informatics? In March 2014 the Government of India procured a SNOMED CT license for India and offered it for all healthcare professionals and vendors of India at no cost, with a view to promote adoption and implementation by the private sector. India has joined the global effort to develop, maintain, and enable the use of SNOMED CT. Medical informaticians in India could not have foreseen that this standardized, multilingual vocabulary of clinical terminology would need to include health conditions, peculiar to outer space. It is a complement to the founding fathers of Snomed CT that they were already future ready. I am told (not being a domain expert myself) that the electronic exchange of clinical health information currently containing more than 300,000 medical concepts and divided into hierarchies as diverse as body structure, clinical findings and pharmaceutical/biological products has provision to include geographic location as well. I am now sure that in my life time, there will be occasions at least for the few "space doctors" in India to add "Space" when they classify the various health issues that may be encountered by the Vymonauts. Spaceflight-associated neuro-ocular syndrome (SANS) is just one example of how SNOMED CT will get new additions in the future.

Many of us are afraid of the future and cling desperately to the present not realizing that we have already become the past. The future is always ahead of schedule. As Mark Twain once remarked "the future ain't what it used to be". Space travel will no longer be the exclusive prerogative of a few super powers. Who knows I may even be alive to see my grandchildren being assigned a code when they come back to terra firma to recover from their radiation induced fatigue and weakness!