Committee on Space Research (COSPAR) response to United Nations Office of Outer Space Affairs Questionnaire (A/AC.105/1202, Annex III, para. 13 and appendix).

Q1: Please describe existing or planned formal cooperative agreements another institutional arrangements (memorandums of understanding, letters of agreement, frameworks of collaboration, etc.) between the health sector and other sectors directly involved in space activities at the national level.

COSPAR believes that this needs to be addressed at the national levels from various member states. In Germany, the German Aerospace Center (DLR) has launched an initiative called "Space-to-Health" where various space stakeholders and applied Industries are brought together in a network to address health related topics under the umbrella of space setting. In the U.S., NASA has many such initiatives under the domain of the International Space Station (ISS) and covers health topics such as delivery of cancer treatment, vaccine development, advance water purification technology, to name a few.

In addition, in the USA, a Notice of Memorandum of Understanding between NIH and NASA Concerning Laboratory Animal Welfare (NOT-OD-20-095) was issued in April, 2020 covering NASA-funded animal research both in space and in ground-based setting. The Policy requires institutions to establish and maintain proper measures to ensure the appropriate care and use of all animals involved in research, research training, and biological testing activities. Institutions receiving PHS funding through grants, contracts, or cooperative agreements for research involving vertebrate animals are required to comply with the Policy.

The United Nations Office for Outer Space Affairs Program on Space Applications provides capacity building in the areas of telehealth and tele-epidemiology (landscape epidemiology), assists Member States to use satellite remote sensing, global positioning, GIS and satellite communications to integrate ecological, environmental and habitation data into models for disease surveillance and control activities. The Program regularly organizes or contributes to workshops, conferences and training program on leveraging space for global health.

Q2: Please provide recommendations regarding the establishment of a dedicated platform for effective coordination among United Nations entities, other international organizations and relevant actors on space and global health issue.

Recommendation 1: Informal online meeting of the Space and Global Health Working Group on COVID-19.

Recommendation 2: Establishment of a repository on space research and global health documents.

Recommendation 3: COSPAR should engage WHO and UN to create a taskforce to discuss and co-ordinate global health issues.

Q3: Please describe existing or planned policy-enabled environmental and governance mechanisms for removing barriers to the effective use of space-based technologies in support of global health.

NASA has released a list of ISS research that has benefited human health at its website: https://www.nasa.gov/mission_pages/station/research/benefits/human_health.html

Unfortunately, not much is known in the removal of barrier, both physical and political, in the effective transfer of space based technologies in support of global health at the moment.

Q4: Please describe existing or planned policies on open data-sharing and participatory approaches to developing and improving access to geospatial information relevant to global health.

Several approaches are currently available on data sharing, including:

- Open-access journals
- Geo-spatial Information Science:
- https://www.tandfonline.com/toc/tgsi20/current?gclid=CjwKCAiAqJn9BRB0EiwAJ1SztYs4HpjYodi_bI5bvp58PuJz2_SuQ2QsempbNrKDgd6odSTG01-DTBoCjv8QAvD_BwE Global Health Observatory data repository: https://apps.who.int/gho/data/view.main
- Geo-Spatial Data Resources: https://www.cdc.gov/dhdsp/maps/gisx/resources/geo-spatial-data.html

However, we are not aware of any existing policy governing such data sharing endeavors.

Q5: Please describe existing or planned efforts related to the geotagging of all assets relevant to health systems, including health information systems.

The CORONA Crisis demonstrates that good examples are: international coordination of the corona App, exchange of testing methods, etc.

Q6: Please describe existing or planned intersectoral coordination and cooperation for effective international, regional, national and subnational capacity-building activities relevant to the application of space science and technology in the field of global health.

Currently, the overwhelmingly majority of space science is “research only”. In the medical sector, global pharmaceutical players are slow to embrace space application due to the rigorous safety requirements and the long duration from conceptual development to experimental stage in space.

In the subnational level, the Center of Space Medicine and Extreme Environments in Germany (www.charite-in-space) at the Charité University Medicine in Berlin currently embarks on the MYOTONES project sponsored by the Ministry of Economy Affairs and Energy. This program investigates changes in muscle properties in astronauts during spaceflight and in healthy participants in bed rest without and with exercise as countermeasure using non-invasive Myoton technology with a digital palpation device (MyotonPRO). The findings have the potential to merge into future health management and collaboration and memorandum of understandings exist between the National Health/Occupational Health Sector such as clinics, hospitals and emergency workers.

In addition, in China and in cooperation with the China Manned Space Agency, the Institute of Environmental Systems Biological Research at the Dalian Maritime University is developing a microfluidic

system for in-orbit monitoring of space radiation using biomarkers in peripheral blood lymphocytes. The system can be used as an astronaut on-orbit radiation damage assessment and early warning system, and provide the basic data of medical prevention and protection.

Q7: Please describe existing or planned mechanisms to engage educational institutions and other capacity-building mechanisms in motivating young health professionals to acquire skills and abilities required to efficiently use advantages provided by space technology, science and applications at an early stage in their careers.

In the U.S., NASA has several outreach programs for K-4, K5-8 STEM program, K-12 educator programs as well as college and university level science programs to promote and engage young minds in capacity building effort. https://www.nasa.gov/stem/highereducation/index.html

Q8: Please describe existing or planned mechanisms to better integrate space-derived data and information into decision-making processes related to global health, and to harmonize and share such data.

In our response to Q4, we have stated the various data-sharing mechanisms to enrich and to promote space derived data in global health. A possible future mechanism to make space science better integrated into industry is to encourage more applied research in global health.

Q9: Please describe how space technology and applications are integrated into health-related emergency planning and management and disaster management plans.

Satellite technology in weather forecast, global warming, emergency disaster management are some of the prime examples.

Satellite and GPS applications in telemedicine and rescue effort, emergency medicine support in remote and hard to reach areas.

Q10: Please describe key activities, reference documents and plans relevant to the topic “Space for global health”.

In 2015, the UN set up an expert group on space and global health in which the WHO collaborated with several national space agencies including the Canadian Space Agency, the European Space Agency, the Japan Aerospace Exploration Agency, the National Aeronautics and Space Administration, the Russian Federal Space Agency and the UN Office for Outer Space Affairs. As such, there is already a rich body of literature and document available on the subject.

Please check out: http://dx.doi.org/10.2471/BLT.15.030815

More recently, just before the global COVID-19 pandemic erupted, Kevin Conole, senior program specialist at NASA and head of the U.S. delegation to the 2020 Committee on the Peaceful Uses of Outer Space (COPUOS) meeting in Vienna laid out the multidimensional contributions of how space research and technologies significantly improve public health. https://vienna.usmission.gov/2020-copuos-stsc-u-s-on-nuclear-power-sources-in-outer-space-3/

In the European Space Agency, 3D printing human tissue technologies are being developed in Germany that could help to keep astronauts healthy all the way to Mars. In this program, the first bioprinted skin using human blood plasma as a nutrient-rich platform are constructed by scientists from the University Hospital

of Dresden Technical University together with its industrial partners OHB System AG and life sciences specialist Blue Horizon. In addition, bone samples involved printing human stem cells with a similar bio-ink composition, with the addition of a calcium phosphate bone cement as a structure-supporting material, which is subsequently absorbed during the growth phase

https://www.esa.int/Enabling_Support/Space_Engineering_Technology/Upside-down_3D-printed_skin_and_bone_for_humans_to_Mars