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Space and global health

Draft report of the Working Group on Space and Global Health on the work conducted under its multi-year workplan

Prepared by the Chair of the Working Group

I. Introduction

1. The Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space endorsed, at its fifty-fifth session, in 2018, the agreement of its Working Group of the Whole to establish a new item on the agenda of the Subcommittee, entitled "Space and global health". The Committee on the Peaceful Uses of Outer Space, at its sixty-first session, also in 2018, welcomed the establishment of the new agenda item and agreed that a working group under the item on space and global health should be convened, with Antoine Geissbühler (Switzerland) as Chair. The Committee also agreed that the Chair of the newly established working group, together with the Secretariat, would present to the Subcommittee at its fifty-sixth session a proposal for a multi-year workplan for the working group, taking into account the role of the Expert Group on Space and Global Health, which had been established in 2014 and had held four meetings in the period 2015–2018.

2. The Committee, at its sixty-second session, in 2019, endorsed the following multi-year workplan under the item "Space and global health" for the period 2019–2022:

2019 Agree on methods of work and workplan.

Develop a questionnaire, to be circulated by the Secretariat, to elicit the contributions of States members of the Committee, international intergovernmental and non-governmental organizations with permanent observer status with the Committee, United Nations entities, the Group on Earth Observations, the World Organization for Animal Health, the International Federation of Red Cross and Red Crescent Societies and

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Doctors Without Borders on experiences and practices in the use of space science and technology for global health, and on practices and initiatives, current or planned (concepts, science, capacity-building and operations) in the use of space (technology, applications, practices and initiatives) in support of global health and for attaining the health-related Sustainable Development Goals of the 2030 Agenda for Sustainable Development.

2020 Review contributions received in response to the questionnaire. Hold a general exchange of views on possible existing gaps in national, regional and international capacities in using space science and technology and their applications for global health.

Prepare possible contributions by the Working Group to the Working Group on the "Space2030" Agenda of the Committee.

The Chair of the Working Group to prepare a draft set of recommendations on specific topics of interest within the health and space domains that could provide an orientation for analysing possible existing gaps in national, regional and international capacities in using space science and technology and their applications for global health, taking into account the "Space2030" agenda, with a view to presenting those recommendations to the General Assembly in the form of a draft resolution.

The Secretariat to continue to invite contributions to the questionnaire.

The Chair of the Working Group to prepare a first draft of the report of the Working Group to the Subcommittee.

2021 Review the draft set of recommendations presented by the Chair of the Working Group on current uses of space (technology, applications, practices and initiatives) in support of global health.

The Chair of the Working Group to submit a first draft of the report of the Working Group to the Subcommittee and a corresponding draft resolution to be submitted to the General Assembly.

2022 Review and finalize the report of the Working Group to the Subcommittee, and review and finalize a draft resolution, to be considered for endorsement by the Committee with a view to its adoption by the General Assembly.

Determine whether the workplan should be extended to cover potential future work. If the workplan is not extended, discontinue the Working Group.

3. The present report provides an overview of the work and findings of the Working Group under its multi-year workplan. The document has been prepared on the basis of contributions to the work of the Working Group and additional research undertaken by the Chair of the Working Group and by the Secretariat, including on the work carried out in the framework of the Action Team on Public Health of the Committee on the Peaceful Uses of Outer Space (action team 6), the action team 6 follow-up initiative, the Expert Group on Space and Global Health, and thematic priority 5 (Strengthened space cooperation for global health) of the fiftieth anniversary of the United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50), and in line with Sustainable Development Goal 3, relating to good health and well-being.

II. Importance of the use of space technologies and space-based information and systems in the global health domain

4. As the coronavirus disease (COVID-19) pandemic unfolds and countries respond, global cooperation, concerted action and innovative approaches to solve

health problems are needed to complement traditional good practices in the health sector in order to enable a better response to this and other global health threats. Such approaches include the use of space science and technology for health promotion, health protection, surveillance and health-care delivery in remote areas using telemedicine and tele-health services. Space science and technology provide innovative research platforms for advancing medical knowledge and spin-offs for the development of health-care equipment, operational activities and procedures. Space-based data and technologies foster connectivity in health emergencies, and the integration of space-derived information in health-care systems constitutes an important component of digital health, supports the mapping of populations, the treatment of diseases, the distribution of medication, transportation systems and water supply and sanitation, and facilitates the monitoring of trends in air quality and health-related environmental factors. A table featuring the relationship between space activities and global health is contained in annex I to the present report.

5. E-health is a generic term used to refer to all digital health-related information. Telemedicine and teleconsultations, electronic health records and hospital and health information systems, e-prescriptions and computer-assisted imaging are examples of modalities in e-health. In its resolution 58.28, the World Health Assembly stressed that e-health was “the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research”. Recently, the notion of e-health has been expanded to include the concept of digital health, which is understood as the field of knowledge and practice associated with the development and use of digital technologies to improve health.

6. Tele-health and telemedicine applications make use of computer and telecommunications technologies, including satellite communications, to bring medical experts into virtual contact with patients or doctors in remote and rural areas, thus avoiding costly relocation to hospitals in urban areas. Telemedicine also benefits from innovative spin-offs of technologies developed for human spaceflight to perform health-care activities, including remote diagnosis and tele-surgery.

7. Tele-epidemiology combines the use of information from satellite-based platforms to investigate and forecast outbreaks and the re-emergence of infectious diseases. The use of remote sensing has significantly advanced the possibility of tracking and visualizing the real-time evolution of local outbreaks and epidemics and mapping critical public health infrastructure and environmental influences on the epidemics. In tele-epidemiology, space-derived information in combination with geographic information and global navigation satellite technologies has increasingly been used to study disease epidemiology and enables the increased use of spatial analysis to identify the ecological, environmental, climatic and other factors that can have a negative effect on public health or that can contribute to the spread of certain diseases.

8. Satellite communications are essential for tele-health and for the management of epidemics in cases involving natural or human-made disasters. Early warning and disaster preparedness rely on data that are collected by satellites and validated by fieldwork. Such data products, when incorporated into a geographical database, could be used to develop spatial models for predicting high-risk areas. In the area of health protection, space technology is well suited to the dynamic nature of outbreaks and epidemics of infectious diseases and can be employed by a diverse community of partners to provide information and develop models to support outbreak awareness, preparedness, response and control strategies.

9. Space stations and their terrestrial analogues serve as platforms for health studies. The unique characteristics of outer space have led to the development of orbiting laboratories. The International Space Station, where humans live and work in an isolated and remote location and conduct microgravity research, is the most notable example. Space life sciences are an important aspect of the work done by

astronauts during space missions, during which microgravity research is conducted and physiological changes are observed in the human body. Furthermore, technology development for human spaceflight is significant and includes a wide range of areas of expertise, including advancements in rocket propulsion, space vehicles, composition of materials, and robotic technologies, as well as innovations to deal with the challenges of working in isolated and remote locations.

III. Historical background

10. Biology and medicine were the focus of the fifth thematic session of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE), held in Vienna in August 1968. The session confirmed that biology and medicine played a leading role in cosmic research, in particular in connection with manned spaceflight; and that the results of space research and of the general development of space science exerted a considerable influence on the progress of biology and medicine as disciplinary sciences, as well as on their general practical aspects.

11. At the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE II), held in Vienna in August 1982, it was noted that space represented a new and powerful research environment for biology and medicine, as factors such as microgravity, access to the cosmic spectrum of radiations and a virtually infinite source of near-vacuum had not been encountered by living organisms throughout their terrestrial existence and evolution, and living organisms displayed varying degrees of tolerance of each factor.

12. Pursuant to General Assembly resolution 40/162, adopted in 1985, the Subcommittee started its consideration of the agenda item on life sciences, including space medicine. The item remained on the agenda of the Subcommittee until 1999, when the structure of the agenda was reviewed in preparation for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), held in Vienna in July 1999. The outcome document of UNISPACE III recognized the importance of space science and space applications for the fundamental knowledge of health and other areas, and the major contribution that space science and technology made to the well-being of humanity and specifically to economic, social and cultural development, and declared that action should be taken to improve public health services by expanding and coordinating space-based services for telemedicine and for controlling infectious diseases.

13. To follow up on the recommendations of UNISPACE III, the Action Team on Public Health of the Committee on the Peaceful Uses of Outer Space (action team 6) was officially created in 2001. The preliminary and final reports of the Action Team, co-chaired by Canada and India, are contained in document A/59/174, annex V, appendix IV, and document A/AC.105/C.1/L.305. In 2012, building on its work thus far, the Action Team set up an initiative led by the University of Koblenz-Landau in Germany and known as the action team 6 follow-up initiative.

14. From 2000 to 2013, issues related to the work of the Action Team and to its follow-up initiative were considered by the Subcommittee and its Working Group of the Whole. In 2014, the Subcommittee agreed on the establishment of a focused expert group on space and global health to consider issues related to the use of space technology for public health, noting that no Secretariat services would be required for that expert group. The Expert Group on Space and Global Health was co-chaired by Pascal Michel (Canada) and Antoine Geissbühler (Switzerland) and held its meetings from 2015 to 2018. The mandate and three-year workplan of the Expert Group, endorsed by the Subcommittee, is contained in document A/AC.105/1088, annex I, para. 7. The work of the Expert Group is reflected in its reports (A/AC.105/C.1/2015/CRP.29, A/AC.105/C.1/2016/CRP.21, A/AC.105/C.1/2017/CRP.28 and A/AC.105/C.1/2018/CRP.17).

15. Strengthened space cooperation for global health was one of the seven thematic priorities of UNISPACE+50 (A/71/20, para. 296), which was held in 2018 to commemorate the fiftieth anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space. The United Nations/World Health Organization (WHO)/Switzerland Conference on Strengthening Space Cooperation for Global Health, organized jointly by the Office for Outer Space Affairs, WHO and the Government of Switzerland, with the support of the European Space Agency (ESA), and held in Geneva in August 2017, was a flagship conference under this thematic priority (see A/AC.105/1161). The UNISPACE+50 process led to the establishment of the Working Group on Space and Global Health.

IV. Summary of the work conducted by the Working Group under its multi-year workplan

16. In February 2019, the newly established Working Group on Space and Global Health agreed on its workplan (A/AC.105/1202, annex III, appendix I), and noted that the workplan provided a structured pathway towards enhancing national capacities in harnessing the contribution of space to the global health agenda. The Working Group also agreed on the questionnaire regarding policies, experiences and practices in the use of space science and technology for global health that would be circulated by the Secretariat to States members of the Committee and international intergovernmental and non-governmental organizations (A/AC.105/1202, annex III, appendix II).

17. Consequently, in 2019 and 2020, the Office for Outer Space Affairs sent invitations requesting responses to the questionnaire. Responses were received from the following States and organizations: Algeria, Australia, Japan, Philippines, Thailand and European Union (A/AC.105/C.1/117); Russian Federation and Switzerland (A/AC.105/C.1/117/Add.1); Canada (A/AC.105/C.1/117/Add.2); Australia, Germany, Japan, Mexico, Paraguay and Turkey (A/AC.105/C.1/119); Hungary, India, Committee on Space Research, Economic and Social Commission for Asia and the Pacific, and Space Generation Advisory Council (SGAC) (A/AC.105/C.1/119/Add.1); Argentina, Colombia, Egypt, Malaysia, Peru, Saudi Arabia, International Telecommunication Union (ITU) and United Nations Environment Programme (A/AC.105/C.1/119/Add.2); Bolivia (Plurinational State of) and Bulgaria (A/AC.105/C.1/119/Add.3); and Indonesia (A/AC.105/C.1/2021/CRP.25).

18. On the basis of the responses to the questionnaire, the Chair of the Working Group, with substantive support from the Secretariat, prepared an analysis of experiences and capacities in using space science and technology and their applications for global health (A/AC.105/C.1/2021/CRP.7).

19. On the basis of the analysis of responses to the questionnaire (as contained in document A/AC.105/C.1/2021/CRP.7), as well as previous recommendations made in relation to space and global health, the Chair of the Working Group developed a set of draft recommendations (A/AC.105/C.1/2021/CRP.8). Subsequently, at the fifty-eighth session of the Scientific and Technical Subcommittee, in 2021, the Working Group agreed on the set of recommendations prepared by the Chair regarding policies, experiences and practices in the use of space science and technology for global health (A/AC.105/1240, annex III, para. 7).

20. At its meeting in 2019, the Working Group noted that the University of Koblenz-Landau (Germany) would help the Working Group in setting up a shared information resource to promote the development of free and open educational resources on space and global health. That resource would provide an additional source of information and would be set up in coordination with the establishment of the web page for the Working Group by the Office for Outer Space Affairs.

21. At its meeting in 2020, the Working Group agreed to prepare recommendations as to the role and structure of the globally accessible platform, whose establishment

was recommended under UNISPACE+50 thematic priority 5 (see A/AC.105/1172, para. 74 (b)).

22. The work of the Working Group benefited from the following scientific and technical presentations delivered during the sessions of the Scientific and Technical Subcommittee in the period 2019–2021: (a) “Tele-epidemiology: which contribution for Earth observation satellite data; CNES activities in tele-epidemiology”, by the representative of France; (b) “Australian initiatives for capacity-building and knowledge translation from space technologies to global health”, by the representative of Australia; (c) “Japan’s activities for global health”, by the representative of Japan; (d) “Knowledge transfer from space medicine to global health on Earth”, by the representative of Brazil; (e) “SGAC space medicine and life science project group; views and activities”, by the observer for SGAC; (f) “Geospatial applications in health crisis management: a knowledge translation experience and road map”, by the representative of Australia; (g) “Australian initiatives in digital health during the pandemic crisis and after”, by the representative of Australia; (h) “Spatial information technology and disease prevention and control in China”, by the representative of China; (i) “Space chemistry and global health: drug development against COVID-19 in space”, by the representative of Hungary; (j) “Space technology applications in India with relevance to COVID-19”, by the representative of India; (k) “Space medicine for Earth medicine: 60 years since the first human space flight”, by the representative of the Russian Federation; (l) “Copernicus and COVID-19: the European Union Earth Observation Programme initiatives”, by the observer for the European Union; (m) “Thromboembolism in space and its implications on COVID-19 research on Earth”, by the observer for CANEUS International; (n) “An evaluation of Earth observation as a potential tool to forecast and manage resources during the COVID-19 pandemic”, by the observer for SGAC; and (o) “The role of space during pandemics”, by the observer for ISU.

23. The Working Group also benefited from presentations delivered in the context of the informal consultations, on the themes “Cosmos and medicine”; “The journey of exploration: where medicine meets Mars”; “Advancing health-related Sustainable Development Goals through space science, technology and applications”; “Space applications for global health”; “Community of practice: space for health” “Geographic information system-enabled global crisis management solution – a knowledge translation from Australia to Canada”; “Optimizing the allocation of health resources through realistic geospatial modelling”; on the wiki resource being developed by the University of Koblenz-Landau under the mandate of the Working Group; and on the theme “Advances in space medicine applied to pandemics on Earth”.

24. In response to the COVID-19 pandemic, the Working Group held an informal online meeting on 12 June 2020. The meeting included presentations on the following topics: “Space derived applications for contact tracing and senior care in the COVID era”, “Development of GPS-tailored questionnaires to derive measures for psychological support during the corona crisis”, “Knowledge transfer from space medicine to contain epidemics and pandemics” and “GHEID, a platform for knowledge-sharing about implementation and evaluation of digital health”.

25. A dedicated workshop on knowledge management and sharing was held on 15 June 2021 with the objectives of sharing existing practices and experiences in collaborative knowledge management in the domains of space and health and presenting and discussing a set of cases involving the use of collaborative knowledge management to be implemented on the space and health globally accessible platform. In order to stimulate the discussion and highlight ongoing activities involving knowledge management and sharing, as well as related challenges, presentations were delivered on the following topics: “Why space?”; “Current activities in environmental, vector-borne diseases in Argentina: identifying strengths and weaknesses”; and “Assessing risk of thrombosis in space and how it helps in assessment of clinical risk of thrombosis on Earth: perspectives and update from the ESA topical team”.

26. The Working Group held an intersessional meeting on 1 December 2021 to advance the work on the globally accessible platform and make preparations for the activities scheduled for the final year of the workplan of the Working Group for the period 2019–2022. At the meeting, participants reviewed a draft resolution based on the recommendations endorsed by the Scientific and Technical Subcommittee at its fifty-eighth session, in 2021, and discussed the initial steps in designing the globally accessible platform.

V. Review of responses to the questionnaire on policies, experiences and practices in the use of space science and technology for global health

27. In February 2019, the Working Group agreed on the questionnaire regarding policies, experiences and practices in the use of space science and technology for global health that would be circulated by the Secretariat to States members of the Committee and international intergovernmental and non-governmental organizations (A/AC.105/1202, annex III, appendix II).

28. The questionnaire included questions on existing or planned formal cooperative agreements and other 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 and sought 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 issues.

29. An analysis of responses on cross-sectoral linkages received from 24 States and six organizations demonstrated examples of effective cooperation between the health sector and other sectors involved in space-related issues at different levels and between various actors, including governmental agencies, such as space agencies, ministries of health, ministries of information and communications technology, ministries of environment, and disaster management authorities, as well as medical organizations and research institutions.

30. In a number of countries, at the time of providing responses to the questionnaire, there were no formal collaborative arrangements. In such cases, cooperation between the health sector and other sectors directly involved in space activities at the national level was carried out through science and technology projects or other joint activities and initiatives. In countries with existing formal arrangements, cooperation had been formalized through a range of bilateral instruments, such as cooperation notes, memorandums of understanding, umbrella memorandums of understanding with supporting letters of agreement, and cooperation agreements.

31. One model example of multi-stakeholder coordination at the national level was the establishment of a dedicated inter-institutional body that facilitated collaboration among multiple national authorities. A broader although less formal mechanism that allowed the involvement of a wider range of stakeholders beyond government authorities was a network and corresponding communication platform that established cross-sectoral ties and initiated and consolidated synergies between the space and health sectors through the intensive exchange of knowledge and ideas. In some cases, the development of a national space programme was listed either as a prerequisite for formalizing inter-agency cooperation or as a mechanism in itself, providing a backbone for formalizing inter-institutional linkages.

32. Responses also highlighted the instrumental role of space strategies and policies that had already been adopted in connecting the space and health domains. Thematically, the existing or planned cooperative agreements and other institutional arrangements could be grouped in the following broad areas: connectivity to telemedicine and hospital networks; mapping of health resources and serving communities in remote areas; tele-epidemiology and public health, including in the

areas of air quality, climate change and environmental pollution, vector-borne diseases and COVID-19; space life sciences; and management of disasters and health emergencies.

33. Responses demonstrated that having a dedicated coordination platform was regarded as a welcome development for the health sector, however, it was not advisable to create any new institutions to serve as platforms for coordination. Instead, it was recommended that more effective use be made of existing institutions, including WHO, the Working Group on Space and Global Health, the Asia-Pacific Economic Cooperation forum, the GEO Health Community of Practice and other international organizations focusing on the importance of using space-based technologies and applications to promote global health. With regard to the Working Group on Space and Global Health, it was stressed that the Working Group should comprise representatives from both national space agencies and health agencies.

34. The importance of the involvement of WHO, as a specialized agency of the United Nations that deals with global health issues, was highlighted in view of that organization's functions and its experience in tackling public health challenges in various social settings and contexts. It was suggested that the dedicated platform could be linked to the activities of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), or could be patterned on the ITU-WHO partnership on e-health, which provided a policy framework to assist States in building capacities for the development of an e-health national strategy plan.

35. With regard to United Nations system-wide coordination, it was proposed that the Inter-Agency Meeting on Outer Space Activities, as a mechanism with a proven track record of bringing together United Nations entities to discuss matters related to the use of space technologies in their activities, as evidenced in its special report on the use of space science and technology within the United Systems for global health (A/AC.105/1091), could explore modalities for closer cooperation and coordination between the Office for Outer Space Affairs and WHO. It was recommended that regular consultations be carried out among the key stakeholders, such as the Office for Outer Space Affairs, WHO and the Food and Agriculture Organization of the United Nations. Alternatively, the establishment of a United Nations centre for collaboration on space and global health could create a bridge between the work of the Office and WHO.

36. The dedicated platform could be used to foster coordination on space and global health issues among Member States, United Nations entities, international organizations and other relevant actors; share best practices, success stories and lessons learned; issue alerts; pool existing capacity in space and global health and tie that capacity in with the skill sets of health professionals; create conditions for effective, cross-disciplinary work and comparative research; raise awareness; and provide access to capacity-building.

37. The platform could address the following areas: the full disaster management cycle; various aspects of environmental health (for example, air quality and health, climate change, chemical safety, water quality, basic sanitation and zoonotic diseases); monitoring the implications and effects of the COVID-19 pandemic (for example, by means of Earth observation by satellite) and adapting to life with the coronavirus (for example, through the use of space-enabled telemedicine); and space-related spin-offs and innovations.

38. It was recommended that the dedicated platform be supported by a centralized online tool to share and access data and methodologies in real time; serve as a repository for health and space documents; incorporate artificial intelligence systems, such as big data, to create maps of health risks and land use and other maps, as well as to monitor the emergence of outbreaks; and be used to discuss programmes, issues and updates that represent a valuable knowledge base for improving the response of governments. Such a tool should not be used commercially, given its humanitarian

role, and should enable permanent, unrestricted and timely access by all actors. The online tool could be managed by a secretariat.

39. As part of the questionnaire, respondents were asked to 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. Identified barriers in that regard included the lack of scientific research on the subject, fragmented communication among actors in the fields of health, space and applied science, the limited use of satellite data as a result of accessibility, utilization capacity and data quality, the trustworthiness of information and the limited awareness of the work that is being done in that field at the international and national levels.

40. In a number of countries, centralized coordination mechanisms were in place to address the barriers and strengthen governance in the space sector to support and improve national and global health coordination. In order to ensure the effective use of space technology in various sectors, including public health, States had established or were establishing national space programmes. Such programmes involved the stocktaking of current and future capabilities, resources and needs; the identification of priorities and opportunities; cross-sectoral coordination; the establishment of specialized training programmes and the alignment of research programmes with national needs; and other strategic components. Respondents recognized that, to ensure the more effective use of space data for global health, legal and administrative arrangements needed to be made first.

41. In the questionnaire, respondents were asked to 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. Responses showed that youth-oriented capacity-building mechanisms existed in the form of school, college and university science programmes, space-related research and development opportunities, online courses, collaboration projects, training programmes and seminars, conferences, and outreach and awareness-raising events.

42. Respondents were also asked to describe how space technology and applications were integrated into health-related emergency planning and management, and disaster management plans. Respondents recognized the important role that space technologies played in emergency response by contributing to monitoring and reporting, situational awareness at the national level, warning products and integrated risk assessments, as well as planning and management of responses at the national level. Space data and technology were used to provide emergency medical support in remote and hard-to-reach areas, generate health warnings, analyse risk scenarios, enable the creation of rapid response maps, maps of affected populations and epidemiological maps of specific diseases, carry out detailed damage assessments, provide support for emergency communication, support rescue efforts, evaluate the situation at emergency sites and identify sites that were most appropriate for reconstruction efforts and for resilient health facilities.

43. Respondents were also asked to provide an overview of existing and planned practices and initiatives in the current uses of space (technology, applications, practices and initiatives) in support of global health and identify gaps, if any.

44. Among the gaps in the area of telemedicine and tele-health identified by respondents were the limited uptake of information technology (for example, computer equipment and radiological and hospital information systems) in medical organizations, especially those at the community level and those located outside large population centres; the low level of competence of most medical staff (such as technicians, surgeons and radiographers) in the use of digital technologies and information systems in health care and for medical diagnosis, in particular diagnostic radiology; the lack of harmonized data-sharing standards among the various manufacturers of medical equipment (for example, equipment for diagnostic

radiology); technical issues such as connectivity and maintenance, in particular in peripheral locations, and the need for coordination among all stakeholders.

45. In tele-epidemiology and environmental health, the effective application of Earth remote sensing techniques and data to combat communicable diseases was hampered by limited access to data, and data limitations. Many satellites either did not make it possible to generate high-quality information at the regional level or were not capable of generating data in thermal infrared spectral bands. In cases where data were available, there was an opposite challenge: how to pick out from the terabytes of data the values of key indicators that could be used for epidemiological analysis and modelling. In addition, the lack of a relevant regulatory framework, insufficient financial and human resources, the lack of necessary infrastructure (in particular at the regional level) and the need for an international framework to facilitate the formal use by government institutions of such information sources in decision-making currently made it impossible to realize the full potential of benefits offered by space technology.

46. Additional limitations included limited awareness among health workers of the benefits of space for health and limited awareness among space experts of the needs of the health sector, a lack of space-related knowledge and skills among health workers and the absence of cooperation between the health and space domains. In the field of space life sciences, there was a need for an international collaboration platform to advance research and development in the field. In disaster management and emergency response, there was a need to raise awareness of existing space-based technologies and how they are used in practice, enhance mechanisms for inter-agency, inter-organizational and interdisciplinary cooperation, design new, and enhance existing, software and systems that actively use space-based technologies to obtain timely forecasts of health-related events, and enhance early warning systems for health-related emergencies.

47. In addition to providing responses relating to the four main areas of technology, applications, practices and initiatives, respondents identified the need to pay attention to the necessary structural and technical regulations for the different frequency band models used in satellite communications in order to ensure a minimal impact on human health, and the importance of planetary biosafety (planetary protection), which was aimed at preventing the biological contamination of both Earth and other celestial bodies.

48. Respondents also described existing or planned policies on open data-sharing and participatory approaches to developing and improving access to geospatial information relevant to global health; existing or planned efforts related to the geotagging of all assets relevant to health systems, including health information systems; 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; and 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; and provided information on key activities, reference documents and plans relevant to the topic “Space for global health”.

VI. Recommendations regarding policies, experiences and practices in the use of space science and technology for global health

49. On the basis of the responses to the questionnaire regarding policies, experiences and practices in the use of space science and technology for global health received from States members of the Committee and international intergovernmental and non-governmental organizations, and guided by the recommendations of the United Nations/WHO/Switzerland Conference on Strengthening Space Cooperation for Global Health, held in Geneva from 23 to 25 August 2017 as a flagship conference

under UNISPACE+50 thematic priority 5, the Chair of the Working Group prepared a draft set of recommendations on topics of interest within the health and space domains. The following recommendations were agreed by the Working Group and endorsed by the Scientific and Technical Subcommittee at its fifty-eighth session, in February 2021.

Policy development for strengthened collaboration between the space and global health sectors

Recommendation 1. United Nations entities, intergovernmental organizations and national Governments are encouraged to pursue effective coordination in all key space activities relevant to global health, including telecommunications, global navigation satellite systems, remote sensing and geographic information systems, and space life science and technology development.

Recommendation 2. Formal cooperative agreements are encouraged between health authorities and space authorities at the national level.

Recommendation 3. Member States are encouraged to establish policy-enabled environment and governance mechanisms, with due consideration of legal and ethical issues, for removing barriers to the effective use of space-based technologies, including telemedicine solutions.

Policy development for strengthened data accessibility and sharing

Recommendation 4. Member States are encouraged to promote open data-sharing policies and participatory approaches to developing and improving access to all geospatial information relevant to global health, whenever possible.

Recommendation 5. Member States are encouraged to enable organizational and technical interoperability to facilitate the development and implementation of space-based science and technology in the health sector.

Development and implementation of applications of space solutions for global health

Recommendation 6. United Nations entities and intergovernmental organizations should support the wider development and application of space solutions for global health, public health and the individual health needs of Member States. This could be achieved by encouraging the implementation of a broader range of space solutions for sustainable development and could include public-private partnerships.

Recommendation 7. Member States and participating entities are encouraged to advance their efforts related to the geotagging of all assets relevant to health systems, including health information systems, and make them available to further the attainment of health goals.

Recommendation 8. Member States are encouraged to conduct appropriate drills and exercises to benchmark their operational preparedness and response capacities and capabilities for the appropriate use of space technologies in responding to global health events.

Knowledge management and sharing

Recommendation 9. A dedicated platform should be established for effective coordination on space and global health issues among United Nations entities, other international organizations and relevant actors.

Recommendation 10. All key activities, reference documents and plans relevant to space for global health activities by United Nations entities should be monitored and compiled, including those of the World Health Organization and other international organizations, States members of the Committee as well as, as far as possible, non-governmental organizations and other non-governmental actors. The annual compilation of activities will serve as a reference to identify and discuss gaps and

opportunities and will be shared broadly in an effort to raise awareness and promote cooperation among relevant actors in this domain.

Recommendation 11. An engagement strategy should be developed to analyse and assess current actors' roles and interests in the domain of space and global health. The engagement strategy is expected to be used to help to promote synergy, complementarity, cooperation and coordination among all actors.

Capacity-building activities

Recommendation 12. Intersectoral coordination and cooperation should be enhanced 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. Actors engaging in such activities should consider follow-up mechanisms aimed at strengthening the sustainability of the activities.

Recommendation 13. Member States are encouraged to engage learning institutions and other capacity-building mechanisms in motivating young health professionals, at an early stage, to acquire space-related skills and abilities.

Recommendation 14. Capacity-building events, to be organized by United Nations entities and other relevant actors, should be promoted, with the objective of further promoting awareness of and engagement with regard to the important contribution of space science and technology among actors applying the One Health approach. Those efforts will be aimed at increasing the number of organizations and of other actors in the health domain that are actively engaged in using space science and technology.

Review of the workplan

Recommendation 15. With attention to the broad needs expressed over the years in the field of space and global health and taking into account future evolving needs, including with respect to global pandemics, the Working Group will, at the fifty-ninth session of the Subcommittee, review its terms of reference and consider whether it is necessary to extend its workplan.

50. At its fifty-seventh session, in 2020, the Scientific and Technical Subcommittee endorsed the agreement of the Working Group to prepare recommendations as to the role and structure of the globally accessible platform (A/AC.105/1224, annex III, para. 12), the establishment of which was recommended under UNISPACE+50 thematic priority 5. In follow-up to that recommendation, the Working Group, at its meetings in 2021, considered the initial elements of the space and health globally accessible platform, as contained in annex II to the present report, and agreed that the Chair of the Working Group should develop the design and a proof of concept of the platform. The Working Group held a series of intersessional meetings on 12 June 2020, 15 June 2021 and 1 December 2021 to advance its work on the globally accessible platform.

Annex I

The relationship between space activities and global health applications at a glance

		Individual health	*Individuals and communities*		*Population health*	
Key health activities		Medical practice	Health services	Medical research	Prevention and control of infectious and chronic diseases	Global health security
Key space activities		Telemedicine	Tele-health	Health sciences	Tele-epidemiology	Disaster management
Satellite activities	**Telecommunications**	▪ Specialist ▪ Second opinion ▪ Remote monitoring ▪ Tele-diagnostics ▪ Tele-consultation ▪ Peer-to-peer ▪ Tele-robotics	▪ Professional training ▪ Community health worker training ▪ Community health education ▪ Tele-education ▪ Peer-to-peer training	▪ Knowledge transfer	▪ Data dissemination through centres of expertise ▪ Water levels and waterborne diseases ▪ Emergency communication for outbreak and pandemic management	▪ Flexible and deployable capacities ▪ Strategic planning, coordination and communication among relief workers, coordination sites, experts and individuals
	Global navigation satellite systems and geographic information systems	▪ Routing medical emergencies	▪ On-site contextual information ▪ Health services optimization		▪ Geographic occurrences of diseases ▪ Location of sources of infection and pollution ▪ Tracking animals as disease sentinels	▪ Detailed site information ▪ Coordination of response worker location
	Remote sensing of the Earth and the atmosphere				▪ Tracking disease and risk factors ▪ Vector-borne diseases (malaria) ▪ Airborne disease, including as a result of dust or air pollution (e.g. asthma) ▪ Waterborne diseases (e.g. cholera) ▪ Food security	▪ Disaster mapping (before and after) ▪ Planning and response ▪ Emergency tele-epidemiology
Human space flight	**Space life science**			▪ Knowledge of the human body (e.g. ageing) ▪ Infection prevention		
	Technology development	▪ Digital applications		▪ Point-of-care medicine		

Note: The table is not intended to be comprehensive and there may be additional contributions of space activities to global health; the table is to be completed with information from national experts.

Annex II

Initial elements of the space and health globally accessible platform

Background

- The establishment of a globally accessible platform was recommended under thematic priority 5 (Strengthened space cooperation for global health) of the fiftieth anniversary of the United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50) (see A/AC.105/1172, para.74 (b)).
- Three recommendations on knowledge management and sharing are included in the draft recommendations of the Working Group on Space and Global Health (A/AC.105/C.1/2021/CRP.8, recommendations 9, 10 and 11).

Key design elements of the globally accessible platform

- The platform provides both an online knowledge management platform and a hybrid (in-person and online) community management platform, aimed at supporting knowledge sharing, decision-making and capacity-building.
- The platform leverages existing open platforms, including the World Health Organization (WHO) Digital Health Atlas,[1] the open WHO platform,[2] the Global Earth Observation System of Systems platform,[3] the Office for Outer Space Affairs platform[4] and the wikiversity platform.[5]
- The knowledge management platform provides the following functionalities: formal knowledge representation in the space and global health domain; data collection tools; machine-assisted multilingual document indexing and annotation; data curation and quality control tools; and data analytics and visualization tools.
- The community management platform provides tools, processes and facilities for the holding of meetings for the work of communities of practice and for knowledge dissemination and the hosting of hybrid events.
- The community management platform is managed in collaboration with the Office for Outer Space Affairs, WHO, the Group on Earth Observations, the International Telecommunication Union and the World Meteorological Organization.

Proposed implementation and sustainability strategies

- Build upon an existing knowledge management platform rather than building a new tool from scratch.
- Team up with knowledge management experts and domain experts, in particular academic partners, to configure the knowledge management platform.
- Invest most of the sustainable resources in the collection of documents and the timely updating of the document database, as well as the quality assurance of data curation.
- Team up with existing conveners and meeting organizers for the hosting of community management activities to be held both in person and online.

[1] www.digitalhealthatlas.org/.
[2] https://openwho.org/.
[3] https://earthobservations.org/geoss.php.
[4] www.unoosa.org/oosa/en/ourwork/copuos/stsc/gh/index.html.
[5] https://en.wikiversity.org/wiki/Space_and_Global_Health.