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The Use of Space Technologies for Public Health

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SYNOPSIS

The global pandemic hampered progress toward achieving the UN Sustainable Development Goal 3 on Good Health and Well-being. Space technologies offer solutions for catching up. In this regard, Southeast Asian nations have effectively utilised both basic and sophisticated space technologies to advance their public health initiatives.

COMMENTARY

With only six years remaining, the United Nations has much work to do to reach its 2030 Agenda for Sustainable Development goals. Some strides made toward achieving the UN Sustainable Development Goal (SDG) 3 on Good Health and Well-being have either stalled or regressed in the wake of the global COVID-19 pandemic.

This is disconcerting, more so because SDGs do not operate in silos and can contribute to the advancement or setback of other SDGs. To compensate for the loss of time, opportunities, and resources, it is necessary to play catch up, and space technologies can help with this effort.

Space and Public Health

Space technologies have been linked to health purposes since the 1960s when the United Nations tackled health systems during its UNISPACE Conference in 1962. A thematic session on biology and medicine highlighted the significant impact of "cosmic research" on advancing these fields.

The same agenda gained momentum in UNISPACE 1982, with the addition of a new item on life sciences, including space medicine. During UNISPACE 1999, a Millennium Declaration (adopted in 2000) was formed to improve public health services in

collaboration with space-based services, focusing on areas such as telemedicine and the management of infectious diseases.

In 2001, an Action Team on Public Health was formed under the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS). Since then, a Scientific and Technical Subcommittee (STSC) has bolstered expertise on space and public health, holding a regular General Assembly, building a Space and Global Health Platform, and establishing a Space and Global Health Network (SGHN) based in Geneva, Switzerland.

Global Health Issues and Space Solutions

There are pressing public health problems that can be resolved through space technologies.

For one, space technologies can help the UN achieve its Immunisation Agenda for 2030 (IA2030), which envisions that all individuals, regardless of location or age, should experience the full advantages of vaccines for good health and well-being. In 2022, the number of children who did not have a single dose of vaccine (14.3 million) had risen compared to pre-pandemic figures (12.9 million in 2019).

Across many countries, a common denominator for zero-dose children is that they live in remote, rural areas. Space technologies can enhance immunisation campaigns in these regions as satellite imagery can map travel times, population distribution, health facilities and catchment areas, making it easier to plan for and execute vaccination efforts.

Integrating geospatial technologies with health data makes resource deployment, monitoring, and evaluation more effective.

Another UN SDG 3 target is to eliminate epidemics of AIDS, tuberculosis, malaria, and tropical diseases while mitigating the spread of hepatitis, water-borne diseases, and other communicable diseases.

To combat infectious diseases, the European Space Agency started its project Waterborne Infectious Diseases and Global Earth Observation in the Nearshore (WIDGEON) in 2021. WIDGEON aims to harness Earth observation (EO) data to address health-related issues.

In Ernakulam District, Kerala, India, satellite data augments on-site monitoring of beaches near fishing villages. A “sanitation app” for smartphones was also built, which actively maps sanitation conditions to build community resilience, especially during natural disasters.

The project also combined EO data with Artificial Intelligence (AI) methods to uncover intersections of environmental factors, sanitation conditions, and occurrences of waterborne communicable diseases. The European Space Agency refers to this information as AIDEO (Artificial Intelligence and Earth Observation data), which was used to develop a model that could predict 16 days in advance where the West Nile virus, a mosquito-borne disease, could re-emerge based on EO data.

During the COVID-19 pandemic, El Salvador launched its Dr ISSS Online telemedicine programme. Using space technologies, it remotely provided telemedicine, an emergency hospital transport system, and videoconferences between subspecialties. Between 2020 and 2023, the programme extended medical assistance to 233,579 patients and gave out 1,125,931 prescriptions.

El Salvador's case highlights that while newer space technologies may be costly for less developed countries, older applications like telemedicine remain vital for access to healthcare. While few telemedicine providers harness space technologies, basic satellite communications bring public health benefits and faster disaster response times.

Space Applications for Public Health in Southeast Asia

Several Southeast Asian nations apply space technologies to advance their public health.

Thailand employs basic satellite and ground station data to monitor air pollution, which has caused an estimated 32,000 premature deaths in the country. The Thais created Life Dee, a mobile app integrating air pollution monitoring with health features.

Life Dee provides navigation to the nearest healthcare facilities and information on caring for one's health. The project was a collaboration between the Thai Department of Health and the Geo-Informatics and Space Technology Development Agency (GISTDA) of the Thai Ministry of Higher Education, Science, Research and Innovation, showcasing that collaboration between two agencies can surpass independent efforts.

The Philippines uses the Moderate Resolution Imaging Spectroradiometer (MODIS), a satellite-based sensor for earth and climate measurements to monitor urban heat health risks. This measures public and planetary health threats, as extreme heat is linked to human-induced climate change.

Data are collected through Google Earth Engine, which offers free, ready-to-use public data for non-commercial use and research projects. This shows that researchers and agencies in countries with minimal resources can still harness data to identify changes, chart trends, and measure variations on the Earth's surface that are crucial for public health solutions.

In 2019, Myanmar began collaborating with the United States National Aeronautics and Space Administration (NASA) in forecasting malaria outbreaks from space. This project, which is still ongoing despite the military coup in February 2021, is critical not just for Myanmar but also worldwide, as emerging drug-resistant strains in Southeast Asia can negate global efforts to eradicate the disease. NASA banked on its state-of-the-art spatial technologies, expertise in geospatial risk modelling, and experience in predicting wildfires in the US to anticipate and pre-empt malaria outbreaks in Myanmar.

Singapore is working on an Earth observation mission with the United Kingdom. The project integrates electronic propulsion technology, AI, quantum-enabled sensors, and

compact timing mechanisms, making up a low-earth-orbit constellation. This technological fusion helps tackle air pollution and weather forecasting.

The project involves Singapore's Office for Space Technology & Industry (OSTIn), the Agency for Science, Technology, and Research (A*Star), the National University of Singapore, Nanyang Technological University, the UK's universities of Southampton and Portsmouth, and the UK's Space South Central, demonstrating the capacity of partnerships among various stakeholders.

Southeast Asia's use of space technologies underscores the value of basic infrastructure, free resources, and collaboration for public (and even planetary) health. These investments are achievable and exemplary. Other nations can emulate Southeast Asia's approach, while technologically advanced countries like Singapore can expand space infrastructure, partnerships, and advanced systems for broader public health applications.

Going Forward

The above examples demonstrate how space technologies can significantly enhance public health initiatives, particularly in remote and underserved areas.

Going forward, policymakers, non-government organisations, and international bodies should allocate resources to leverage space technologies to bridge gaps in healthcare access worldwide.

Governments should facilitate interagency partnerships and promote and incentivise collaboration among international organisations, the private sector, and even academia to tap into expertise, resources, and funding.

Investing in education, training, and facilities to build technical skills can better harness space's capacity to improve health. Brain gain can be leveraged by inviting foreign experts to train local scientists and students, resulting in skills and technology transfer.

Finally, engaging and participating in the UN's Space and Global Health Network will benefit countries through capacity building, information sharing, and the establishment of valuable networks.

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