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| **Title:** | ZODIAC Respiratory Disease Phenotype Observatory |
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| **Abstract:** | Medical imaging plays a crucial role in diagnosing and monitoring infectious diseases, and the COVID-19 pandemic has highlighted the critical role of chest imaging, including computed tomography (CT) scans and baseline X ray analysis, in the early stages of the disease. Medical imaging technologies, such as computed tomography (CT), can detect lesions smaller than 0.5 mm and assess activity without the need for a biopsy. This enables the identification of specific disease characteristics in each patient. However, the analysis of the complex images generated by these technologies can be challenging to the naked eye.Radiomics, a method for extracting large-scale imaging data from medical imaging studies like CT and X ray scans, utilizes data-characterization algorithms to identify disease findings that are not visible to the naked eye. This approach can be complemented by emerging fields such as artificial intelligence (AI), machine learning (ML), and deep learning to identify patterns of lung involvement in COVID-19 patients. The International Atomic Energy Agency (IAEA) has initiated a project with the aim of identifying specific characteristics associated with different virus variants and determining if there are any epidemiological and clinical differences in the development of disease complications and specific medical imaging manifestations in several respiratory infectious diseases. |

1. **Challenge**

Recent pandemics of the respiratory system were first detected in their clinical representation and described with imaging. Post-hoc analysis revealed that precious months could have been won, since phenotypes were present in the population months before their detection.

1. **IAEA response**

By 2026 The ZODIAC Respiratory Disease Phenotype Observatory will be collecting a continuous stream of imaging- and associated clinical data of patients with respiratory disease from around the world. The daily intake will be 10.000 X rays/5.000+ CT scans and corresponding clinical data, with an unprecedented diverse coverage of disease activity, patient populations, and treatment paths in healthcare systems around the world, revealing geographic diversity, and common trajectories of diseases, their severity, and their treatment.

In an intensely interconnected world, this Observatory will be the basis for a world-wide early detection and rapid response system for newly emerging respiratory disease.

1. **Objective**

To increase our resilience to pandemic diseases as well as our understanding of all diseases affecting the respiratory system which will result in a dramatic jump, as the Observatory becomes a growing R&D hub for specialists around the globe, with international governance under the auspices of IAEA/UN.

Continuous ML analysis of this stream will detect the emergence of new disease phenotypes at the earliest possible time point, based on a minimal number of cases. The goal is to enable timely warning and the reaction to contain an outbreak.

The mechanism that will be used to develop the ZODIAC Respiratory Disease Phenotype Observatory will be through a [Coordinated Research Project](https://www.iaea.org/services/coordinated-research-activities) (CRP). CRPs bring together research institutions from developing and developed Member States to collaborate on research and development projects of common interest. Each established CRP consists of a network of R&D institutes that work in close coordination, with the IAEA playing a coordination and sponsorship role. This CRP will have a duration of four years initially. After that, the Observatory will become a permanent IAEA Programme as a global repository of images and hub for AI applications in the health domain.

1. **Countries participating in the CRP**

Austria, Brazil, Cuba, Colombia, Egypt, France, Germany, Guatemala, India, Korea, Lebanon, Mexico, Netherland, Pakistan, Paraguay, Philippines, South Africa, Thailand, Tunisia, and the United Kingdom.

In cooperation with: Amazon Web Services, University of Vienna Medical School, Radboud University, Fraunhofer MEVIS Digital Medicine Foundation, Contextflow.

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