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Short Communication

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Nuclear-Driven Diagnostic Technique in Treating COVID-19

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The novel Coronavirus Disease 2019 (COVID-19), also known as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS- CoV-2; formerly called 2019-nCoV), has now become a public health emergency of international concern [1]. The first known case of coronavirus was identified at the end of last year in Wuhan City, Hubei Province, China, after that it transmitted all over the world promptly and infected large population emerging as a severe epidemic that causes severe respiratory syndrome in humans. With the virus cropping up far beyond the country's borders, the WHO declared a global emergency, its first such designation since declaring H1N1 influenza a pandemic in 2009. The virus is still spreading its tentacles with more than two million people having tested positive for COVID-19 [2].

Amidst the global COVID-19 pandemic, nuclear medicine is having its time to shine. Nuclear technologies have medical applications that will help combat COVID-19. As the outbreak has now become a global pandemic, nuclear tools and technologies can be employed to support efforts of policy makers, the medical community, and society at large to manage the crisis and its aftermath, that is, detection, prevention, response, recovery and to accelerate research related to this virus. Physics-based techniques have always played a huge role in the field of structural biology, such as to study the structure and function of biological macromolecules, through X-ray crystallography and other spectroscopic processes. Nuclear physics has its own importance in treatment of various diseases. Nuclear medicine is used in diagnosing and treating a variety of diseases, including cancer, heart, lung and kidney conditions as well as infectious diseases by injecting a radiolabeled molecule as a biomarker and thus nuclear-assisted tests can be used to detect the novel coronavirus and track its transmission paths. Nuclear medicine, which relies on the use of radioactive drugs or Radiopharmaceuticals (RPs) for either diagnostic or therapeutic purpose, has rapidly become a crucial medical field. Nuclear-derived techniques, such as RT-PCR, are important tools in the rapid detection and characterization of viruses, like the one causing COVID-19.

The International Atomic Energy Agency (IAEA) along with Food and Agriculture Office (FAO) has also sought to advance the idea of Real-Time Reverse Transcription-Polymerase Chain Reaction (RT-PCR). This chain reaction is highly efficacious, given the precise laboratory technique deployed in "detecting, tracking, and studying the coronavirus" [3]. This RT-PCR technique enables to detect and pinpoint this coronavirus precisely within hours in humans, along with animals which may host the virus. This method can also provide more information about the exposure and transmission trails of the virus. The IAEA is also providing its support to fourteen countries situated in Africa, Asia, Latin America and the Caribbean to tackle the coronavirus outbreak. It is offering diagnostic kits, equipment as well as training in nuclear-driven diagnostic technique. This international agency is providing diagnostic kits, equipment and training in nuclear-derived detection techniques to countries that need assistance in tackling the worldwide spread of the novel coronavirus causing COVID-19. For instance, in China, industrial irradiation facilities were made available for the treatment of medical supplies, not only to destroy the coronavirus, but also to disinfect and sterilize medical supplies to remove any other virus or bacteria and in Russia, irradiation facilities have sterilized 7,853,480 medical masks (as of April 28), as well as 151,000 portable lab kits to test for COVID-19.

The RT-PCR technique was originally used in nuclear labs as "radioactive isotope markers to detect targeted genetic materials". Later, it was refined and the advanced version of RT-PCR replaced the isotopic tagging with special marking-mostly, and thus enabling it to procure instant results. Now, scientists can detect the definite presence of genetic materials in any pathogen, including virus. While the IAEA has offered this technique to all its members yet several of these countries apparently do not have sufficient training and, therefore, need to be trained. The RT-PCR takes three hours to deliver the result whereas the other traditional techniques which are used by majority of the countries, take seven to eight hours for detection of the virus. Notably, the pandemic has propelled countries to invent better equipment that give more accurate results in a shorter timeframe. However, IAEA's offer, given the ability of its processes to effectively detect, track and study the virus, can perhaps be the most vital force multiplier in the battle against COVID-19.

In this context, many countries are using this nuclear-derived technique of detection, which IAEA claims to be the only certain tool to detect the virus [4]. Moreover, the agency has also received requests from many other countries for the supply of test kits, protective equipment and tools. Arguably, this institutional creativity has become a much-desired necessity at the international level [5]. The widespread use of radiopharmaceuticals (RPs) in nuclear medicine makes it clear that their reliable supply is crucial in upholding high medical standards across the globe. While a group of around 20 RPs, such as technetium-99m (Tc-99m) which is the most widely used medical isotope, have become indispensable, research is ongoing on others which may prove to be highly innovative and a big evolutionary step in modern personalized medicine. Developed countries have easy access to radioisotopes and equipment and thus, many aspects of nuclear medical applications are available in these parts of the world. But, the story is often different in emerging markets, where advancements in nuclear medicine are currently difficult to apply [6]. However, it is too early to predict how long it will take to develop drugs or vaccines for SARS-CoV-2.

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