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Corona Crisis-Levaraging Scientific Research and Innovation (Corona Rapid Testing Kits, Robotics, Uses of Artificial Intelligence and 3d Printing Technology)

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ABSTRACT: Coronavirus SARS-CoV-2 is passing major challenges for healthcare system and medical institutions worldwide. 5 top diagnosis tests for coronavirus pandemic are XCR diagnostic SENS DX, APERIOMICS & MIRXES, GENMARK.

To prevent spread of coronavirus inside hospital and other public places, it is essential to keep surface disinfected, but the manual cleaning is process is dangerous that's why it is a perfect task for autonomous disinfection robots this time we take a look at robotic disinfectant solution, artificial intelligence and 3D printing technologies in this article.

KEYWORDS: - Corona rapid testing kits, Robots, Uses of artificial Article intelligence & 3D printing technology.

I. INTRODUCTION

As a Coronavirus (COVID-19) pandemic continues to spread in India and across the whole World. Many testing methods are now available for COVID-19 like SARS-COV-2, N protein IgM and IgG antibodies, serology tests. There are differences in the amount of testing conducted across nations, and this variability is also likely to impact reported facility rates.

Robots can help to decrease human interaction and suppress COVID-19 transmission. Robots are mainly designed to be used in isolated wards in hospitals.

The robots disinfect the used items by patients infected by COVID-19 or quarantine peoples during this pandemic. We will talk about the role of robots around the world in this article.

Artificial intelligence is required to support healthcare services by evaluating various technologies, preparing us for COVID-19 prevention and control, as well as other pandemics. In the COVID-19 pandemic, we have found many major applications of artificial intelligence.

3D printing is viewed as a solution in this time of pandemic due to medical equipment shortage. In this article we will discussed about application of 3D printing in COVID-19 pandemic.

COVID-19 testing can identify SARS-COV-2 virus. RT-PCR isothermal nucleic acid amplification and those that detect antibodies generated in response to infection are methods that detect virus presence. Diagnosis and surveillance of the population can be done by Detection of antibody (serology test).

There are two categories of the test, (a) Some look for the presence of virus EG- RT- PCR test. (b) Some look for antibodies that arise when the body is attacked by Virus.¹

AI (Artificial Intelligence) saves a lot of time. The use of this technology can save money while providing a better understanding of the different formulation and process parameters. In pharmaceutical technology use of AI has increased over the years. AI used in drug discovery.

II. BEST DIAGNOSTIC TESTING KITS

1. XCR Diagnostics-Quantitative polymerase chain reaction (q-PCR): -

To reduce the spread of viral infection during a pandemic, rapid diagnosis is important. The solution targets nucleic acid such as qPCR. Most qPCR assays have three targets; ORF, E-gene, and N- gene. XCR Diagnostics, based in the US, provides simple, easy-to-use molecular diagnostic solutions. Xtreme Chain Reaction, their patented technology,



takes qPCR's sensitivity to Point of Care. They are developing a COVID-19 diagnostic test in response to the global COVID-19 pandemic.

2. Genmarkdx – multiplex diagnostics

Simultaneous testing of several diagnostic solutions for a large variety of pathogens.

This allows clinicians to search for a large number of pathogens in the sample and allows viral or bacterial outbreaks to be identified early. These solutions precisely detect the presence of the pathogen during this pandemic. It is a Canadian company that provides multiplex molecular diagnostic kits. Their sensor technology minimizes the chances of sample contamination based on competitive DNA hybridization and electrochemical detection.

3. Sens -DX – Ultrasensitive Electrode

The novel COVID-19 Infection causes the same symptoms as the flu or other viral illnesses, such as coughing and fever. The devices like thermometer and oximeter help people monitor these symptoms at home. To determine the cause of symptoms Ultrasensitive electrodes, allow home diagnostic tests.

Poland based start SENS DX develops a digital diagnostic solution that enables remote healthcare. To detect the presence of bacteria and viruses, The Start-Up uses ultrasensitive electrodes modified with biological content. Their SENS DX flu virus detection kit identifies the virus at an early stage. The start-up is working on the development of a COVID-19 ultrafast diagnostic test.

4. Micro RNA Diagnostics

A false–negative would mean that an infected individual continues to spread the virus. While false-positive individuals in the hospital potentially picking up the risk of infection. Two solution combines nested quantitative PCR primer and micro RNA– specific reverse transcriptase primers. Diagnostic test kits for COVID-19 have recently been mass-produced.²

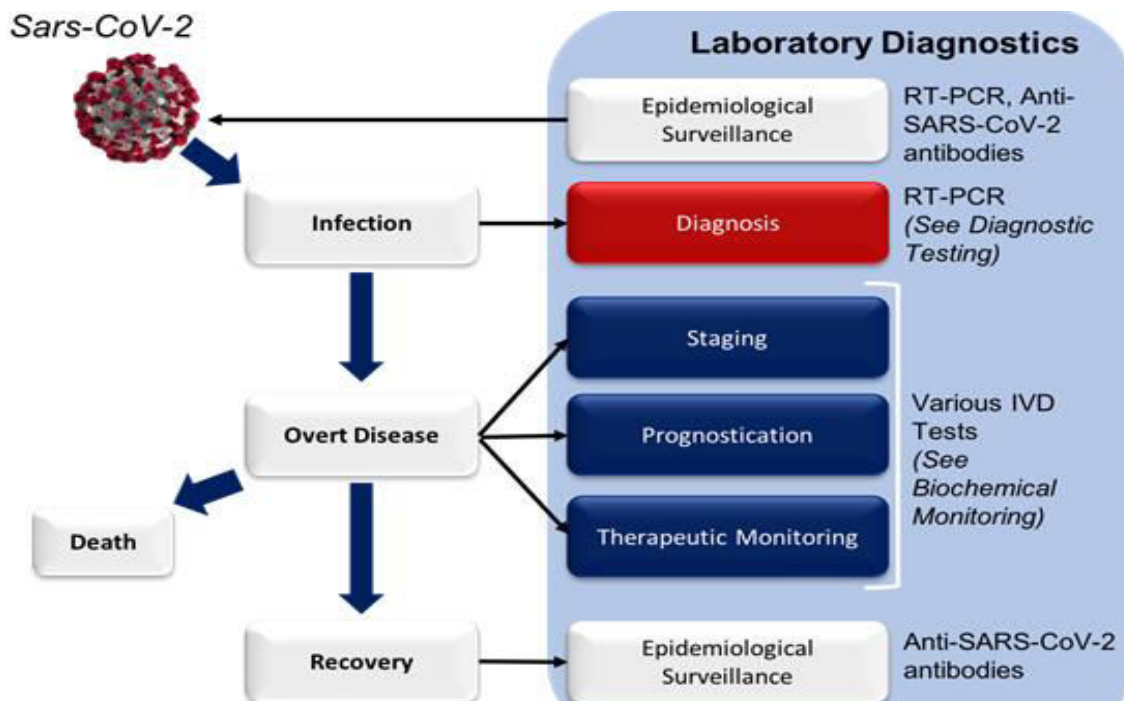


Fig1. Laboratory medicine in COVID-19.

2.2 Testing methods: -

Different methods of testing are being experimented for COVID-19 is as follows,

- A) PCR based
- B) Antigen\ Antibody test
- C) Serology test

A. *Polymerase chain reaction (PCR): -*

There is only RNA not DNA in viruses such as SARS-COV-2. When a respiratory sample is gathered from an individual being examined with some chemicals, which extracts the sample's only RNA. RT-PCR (The reverse transcription-polymerase chain reaction) is a technique that transforms the extracted RNA into DNA using reverse transcription and then uses PCR to amplify the DNA component if it matches the SARS-COV-2 genetic code. The real-time method is preferred due to its advantages. RT technology is a fairly expensive method. It requires an RNA extracting machine, a laboratory and a trained person. Sometimes it can take 4 hours, to test for the presence of a virus from one batch.

The cost of components and chemicals is also high. The test can be done on a respiratory sample obtained by various methods like nasopharyngeal swab or sputum sample also from saliva. RT-PCR with throat swab is only performed in the 1st week of the disease. Later it is not reliable because the virus can disappear in the throat it continues to multiply in the lungs and in 2nd week the sample can be taken from deep airways by suction catheter or sputum. The FDA recommends that saliva testing can be as effective as throat and nasal swabs.^{3,4,5}



Fig 2. Nasopharyngeal swab test for COVID-19.

B. *Antigen/antibody test*

An antigen is a part of a pathogen that elicits an immune response. The antigen tests look for the protein from the surface of the virus. In case of coronavirus, these are usually protein from surface spikes, and a nasal swab is used to collect the sample. and exposing that to paper strips that contain artificial antibodies design to bind to the coronavirus antigen. And present antigen will bind to the antibody and gives a visual readout.

The process takes less than 30 minutes, and gives the spot result, and doesn't require any expensive equipment, and a trained person.

This is a very sensitive method that can detect a small amount of infection. This test is highly accurate, but there is a chance of a false negative. Therefore, negative results by antigen may need to be confirmed with PCR⁶

c. *Serology test*

In serology tests rely on drawing blood, and can identify people who wear infected and have already recovered from COVID-19. Most of these tests are in the research stage of development.



IgM & IgG antibody production is a part of an immune response to infection. According to the FDA IgM antibodies to SARS-COV-2 are detectable in few days after infection in blood samples, and IgG antibodies are detectable after 10-14 days after infection.^{7,8}

Figure 4 represents the serology test performed by using following steps

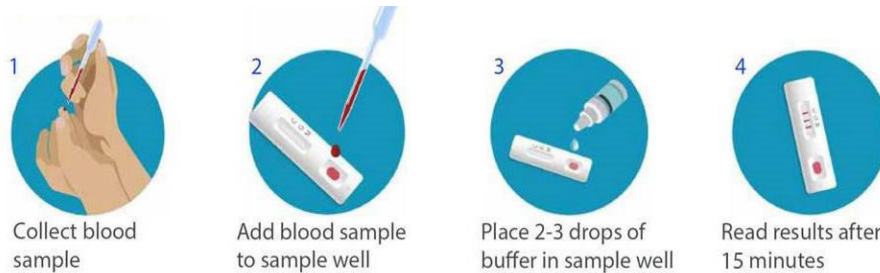


Fig 4. Steps involved in serology test

III. ROBOTS AND ARTIFICIAL INTELLIGENCE

During the COVID-19 crisis, the most significant things should be worker health and safety. To provide services, care to those quarantined, help to fight, or practicing social distancing. many companies from different countries are rolling out robots and drones. Artificial intelligence (AI) is applied in daily lives in a variety of ways. AI also contributed to dealing with the COVID-19 pandemic.

Robots

Robots are going to replace many humans in their job, a futurist Martin Ford, written about the way robots will be integrated into the economy in the coming few years, and also companies expanding how they use robots for social distancing. Companies make robots for cleaning and sanitizing products or areas, and also UVD robots in china and Europe shipped its machine to hospitals.⁹

Robots around the world in COVID-19

Near about 20 countries around the world are using robots in COVID-19 pandemic. The ground and aerial robots are paying a notable role in crisis. In hospitals, physicians and nurses, receptionists and even family members use robots to communicate from a safe distance with patients in real-time. Public work and public safety department are using robots to spray disinfectant, and also drones are using for identified infected citizens, and enforce the social distancing restrictions.¹⁰

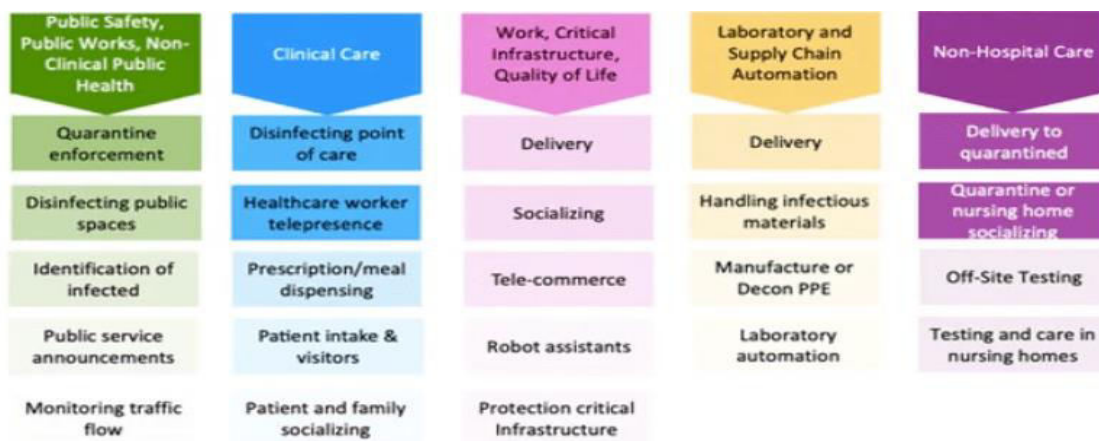


Fig 5. Role of robots in COVID 19 crisis around the world



Artificial intelligence (AI): -

Medical industry is looking for the new technologies to monitor and control the spread of COVID-19 pandemic.

The technology that can easily monitor the speed of COVID-19 is AI, which is also helpful in monitoring this infection and identifying a patient at high risk.

The AI used in following applications: -

- A. Early diagnosis of the COVID-19 infection
- B. Monitoring the treatment
- C. Projection of cases and mortality rate
- D. Contact tracing of individuals
- E. Drug and vaccine development
- F. Used in disease prevention
- G. Reducing the workload of healthcare workers.
- H. Analyze data in the support public policy¹¹
- I. Validate the model existing system.
- J. Code check apps
- K. Improve confidence in recommendation.

Medical and hospital care AI is being support and help those making decision. AI can minimize the paperwork and save time. AI plays a vital role In recognizing and proposing the development of a vaccine for COVID-19. This technology is used for proper screening, analyzing, tracking, prediction of current patient. The significant application is applied to tracked confirmed data, recovered patient data, and death cases due to COVID-19.

Machine learning- based technologies are playing substantial role in response to COVID-19 crisis. In hospitals AI used for scanning faces to check temperature, or seeking to track the spread of individual data. In general AI can replicate what human can't do easily and more consistently like read CT scan, cameras, detect faces accurately, which human can't do.

4. 3D PRINTING

3D printing is very useful in creation of equipment and part used in varies industry. The 1st 3D printed respirator has been developed in Spain. In the COVID-19 pandemic 3D painting industry make equipment and printing part that are short supply in fight against this novel COVID-19. Copper 3D has put online an open source file for 3D printable N-95 masks. Toyota is building face shield to speed up manufacturing of ventilators.

3D printing, with production times improving, has come a long way in recent years.COVID-19 is disrupting the supply chain and the 3D printing community is stepping in to help, causing a lack of essential medical equipment. One of biggest issues right now is the lack of available tests for COVID-19, they are manufactured by 3D printers and software's.¹²

3D printing procedure to produce urgent personal protective equipment (PPE), reusable FFP3 respirators, including a mask, a hand-free door opener, and bracket clasp that can be adjusted. To make a 3D printed version of ventilator valves in Italy, the 3D printing company used reverse engineering. In conclusion, the value of how 3D printing leads to supporting and saving people from COVID-19 cannot be denied.

V. CONCLUSION

The current situation challenges how to utilize best testing kits during COVID-19 outbreaks. Innovative approaches to testing should be considered the medical community and public health should recognize both the benefit and limitations of testing kits.

In the near future the installation of robots will gain momentum and will play important role in health care profession, and helps to complete daily tasks and providing better care services.

It also helps in patient monitoring during COVID-19. AI is an upcoming and beneficial method for detecting early infection due to COVID-19.

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