IJPSR (2021), Volume 12, Issue 4 **(Review Article)**

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 10 June 2021; received in revised form, 27 July 2021; accepted, 30 July 2021; published 01 October 2021

ROLE OF ROBOTICS IN HEALTH CARE SYSTEM DURING COVID-19 PANDEMIC

K. Padmini, A. Suvarna and I. Neelam *

Department of Pharm D., CMR College of Pharmacy, Hyderabad - 501401, Telangana, India.

Keywords:

Robots, Health care system, COVID-19 pandemic, Disinfection, Surgical Robots.

Correspondence to Author:
Ms. I. Neelam

Department of Pharm D,
CMR College of Pharmacy,
Hyderabad - 501401, Telangana,
India.

E-mail: Neels.injeti@gmail.com

ABSTRACT: The essential part of robots in the medical services framework is principal to limit an individual to individual contact, defilement, and to guarantee cleaning, disinfection. Robots can be defined as an artificially intelligent physical system that is capable of interrelating with the environment. The term robot was coined from the Czech what "robota" which implies serf/worker. Robots are classified as Receptionist robots, Surgical robots, Ambulance robots, Service robots, Telemedicine robots. During this pandemic, these mechanical frameworks can diminish the danger of irresistible illness transmission among forefront medical services laborers and afterward making it a potential advance to assess, accentuate, screen and treat the patients from a safe distance, accordingly bringing down the responsibility of medical care staff. Robots are all around planned with UV light to sanitize the rooms and even themselves. In the medical care framework, teleoperated robots turn into the medical care laborers eyes, ears, body in the Isolation Ward, which might be dependable during this COVID-19 pandemic. This mechanical innovation will assume a vital part during this basic stage in certain spaces of medical care framework like estimating pulse, oxygen immersion, observing essential signs. A low-cost miniature robot can be easily assembled and controlled via remote and this system includes an active end effector, a passive positioning arm and a detachable swap gripper with integrated force sensing capability. Robot execution in the fight against COVID-19 has acquired positive criticism from medical services laborers for its potential in obstructing disease and is successful in easing clinical specialists from repetitive tasks.

INTRODUCTION: At the end of 2019, a new type of coronavirus pestilence in Wuhan, China, in December. On 11th March 2020 the World Health Organization declared that the breakout of the new coronavirus (severe acute respiratory syndrome coronavirus-2) infection could be considered as a pandemic. This new virus is mainly responsible for respiratory disease. The transmission of this disease is directly through droplets (sneeze), coughs and indirectly through contaminated surfaces or objects as it can survive for several hours.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.12(10).5134-44

This article can be accessed online on www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.12(10).5134-44

In extreme cases, the infected person develops pneumonia which may further lead to death [1]. By the mid of April 2020, more than two million cases of COVID-19 infections have been reported worldwide and over 1600 people have reportedly died from the coronavirus disease WHO, 2020 [2].

On February 20, 2020, a young man in the Lombardy region of Italy was admitted in hospital with atypical pneumonia, which was later demonstrated to be COVID-19 [3]. Till today, around the world, the total no of cases are 164,316,268 and the deaths are viewed by 3,406,027 whereby the recovery of the patients count is up-to 143,093,707 as per WHO. Human coronavirus NL63 (HCoV-NL63) is a species of coronavirus, specifically a Setracovirus, among the Alpha coronavirus genus and it was identified latter in 2004 in a seven-month-old child with bronchiolitis in Netherland.

The structured virus is an enveloped, positive-sense, single-stranded RNA virus that enters into its host cell by binding to ACE [2]. This virus is mainly found in young children, the elderly and immunocompromised patients with severe respiratory illness, including upper and lower respiratory tract [4]. The human coronavirus includes a major group of coronaviruses mainly associated with multiple respiratory diseases, including common cold pneumonia and bronchiolitis. Up to date, six known HCoVs how been identified, mainly HCoV-229E, HCoVn l63, HCoV-OC43, HCoV-HKU1, severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV) of which, four HCoVs (HCoV-229E, HCoV-NL63, HCoV-OC43, and HCoV-HKU1) are circulated around the world in human population and it may contribute to approximately 1/3 of the common cold infections in humans, and in some severe cases these four HCoVs may lead to life-threatening pneumonia and bronchitis [5].

The patients' early cardiovascular diseases/ hypertension diabetes, cancer, chronic respiratory diseases how greater prospect who died due to COVID-19 complications compared to that of patients without any comorbid conditions. The transmission routes of COVID-19 seem to be pre-symptomatic, symptomatic are asymptomatic due to the highly spread double nature of the disease [6]. The first form of treatment is isolation in order to prevent virus transmission. For seriously ill patients, hospitalization is necessary, which includes mechanical ventilation and intubation in intensive care wards, whereas in the case of non-severe patients, they can be treated at home by assuring hydration, frequent fever and cough control, as well as regular nutrition supply. Robots can be characterized as a misleadingly shrewd actual framework that is equipped for interrelating with the environment. A robot can likewise be characterized as a bunch of sensors combined with a bunch of calculations, arranged to convey the information and coordinated in some actual structure to give self-governing activity. The term robot was authored from the Czech word "robota" which implies serf or labourer [7]. The Robotic Industries Association characterized robot as a reprogrammable, multifunctional controller intended to move material parts, devices or specific gadgets through an assortment of modified undertakings [8].

Merriam Webster dictionary" describes robots as an automatic device that performs capacities regularly attributed to people or a machine as people [27]. Using robots in the medical services framework diminishes the correspondence hole between the patients and medical care staff, spreading better medical care to the majority of the population [8]. While the most recent cell phones and PCs can offer a portion of the arrangements, robots may help adherence because of social presence. Historically robots have been created to take dirty, dull, and perilous positions [22]. Robots are chiefly evolved to assign individuals' needs, including physical, intellectual, clinical, mental issues.

A medical services robot is a robot with the object of checking well-being, contributing to a task that is hard to perform because of medical conditions. Health in this sense encases physical as well as mental, enthusiastic, and mental issues. A robot named "Cafero" offers media transmission and monitoring of health as well as cognitive training. Robotics innovations are planned to measure the vital signs and send data to specialists and are engaged with the board of medication [9].

The principal use of robots is impressively in limit individual to individual contact and guaranteeing cleaning and cleansing. Robots will bring down the responsibility of clinical staff and doctors, subsequently improving the effectiveness of large medical care offices. The presentation of clinical robots has remarkably expanded the security and nature of wellbeing in the executives' framework when contrasted with that of manual framework go

to medical services digitization [6]. The First modernly fruitful robot, the Unimate, started activity at a General Motors get-together plant in New Jersey, doing mechanized assignments which are discovered to be risky to people. Robots have a vital spot in the medical care framework.

They can control instruments' expansion in the security, observe the patients and playout some diagnostics [10]. Robots in medical services have helped to do struggle to the functioning covers needed by those in the clinical field. By utilizing telerobotic technology, a continuous correspondence between the specialists and their patients has become efficacious [8]. In advanced mechanics for medical clinic applications, Lanza proposes a shrewd framework that permits a robot to help the specialist and the patient in their day-by-day exercises.

The robot follows the plans given at the planned time and furthermore to picks new ones autonomously. The creators have fostered a model to approve the speculations they have imagined and the functionalities of the framework. The work offers numerous future examination thoughts, particularly in multi-specialist frameworks and advanced mechanics applied to medical care and self-versatile self-governing frameworks [1]. The robot takes over the task from people, for instance (a) Autonomy: Not all medical services robots are independent robots, for instance, careful robots are far off constrained by the expert specialist b) Moral organization: Robots don't seem to have the ability of good thinking are managing dependable hazardous situations [11].

Clinical experts are utilizing robots to convey drugs to patient's and furthermore to quantify their temperature. Robots are utilized as a contact between clinical staff and patients as doctors can communicate with patients from a significant distance using the robot's media interface [12].

During the Covid-19 pandemic, in the hours of most extreme strain on the medical care framework, automated frameworks can lessen the danger of irresistible illness transmission among cutting edge medical services laborers by making it conceivable to assess, stress, and treat the patient's from a protected distance.

These automated frameworks should have been exceptionally adaptable and repurposable to meet the best requirements of everyday difficulties of medical care framework during the COVID-19 pandemic [13]. Robots that incorporate drones, conveyance robots, and administration robots are currently being utilized to direct this COVID-19 pandemic [2].

Another robot by "Guangzhou Institute of Respiratory Health" and "The Shenyang Institute of mechanization" under the Chinese Academy of science was all around intended for OP assortment. Collaboration between the medical services group and patients can be diminished [17].

Wearable and robotic technologies combined with machine insight and self-sufficiency have the brilliant potential to meet the medical services frameworks' needs for the more secure, more hearty and more proficient conveyance of care to everybody, including COVID-19 patients and different patients [28].

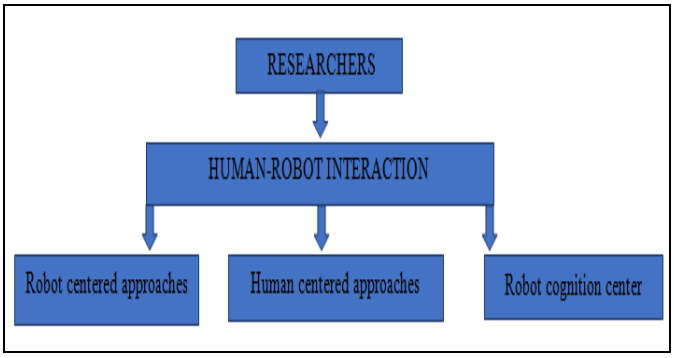
Robots are generally recommended to be conveyed in various situations during the pandemic to help decrease the disease by performing sanitization, monitoring, conveying, food planning and telepresence. Essentially, it is recognized that a few nations have effectively hindered the spread of the pandemic, by utilizing present-day advances, for example, robotic cleaners and facial acknowledgment frameworks, to lead the contact guide and make moves as needs.

A Tele-Robotic Intelligent Nursing Assistant (TRINA) was additionally used to convey nursing occupations, and the outcomes are promising [18]. Also, Wang *et al.* utilized 5G organization and MGIUS-R3 robotic system to perform remote diagnosis. The proposed strategy is doable for lung, heart, and vasculature tests, while the clinical stuff is ensured and asset/result can be effectively shared over the organization [30]. In the COVID-19 pandemic, robots were at first discovered to be especially viable in China for routine or nonroutine errands utilizing bright (UV) for surface sterilization. Robot innovation, notwithstanding, quickly developed with various kinds of robots seeming to oversee COVID-19 in different settings, including emergency clinics, air terminals,

transportation, recreation and beautiful regions, lodgings and in networks by and large.

Fourteen robots were sent to this field medical clinic by the mechanical technology organization Cloud Minds.

They were utilized to clean and sanitize, measure patient temperatures, convey medication and food and engage and comfort patients by imparting and hitting the dance floor with them [2].



CATEGORIZATION OF HUMAN-ROBOTIC INTERACTION

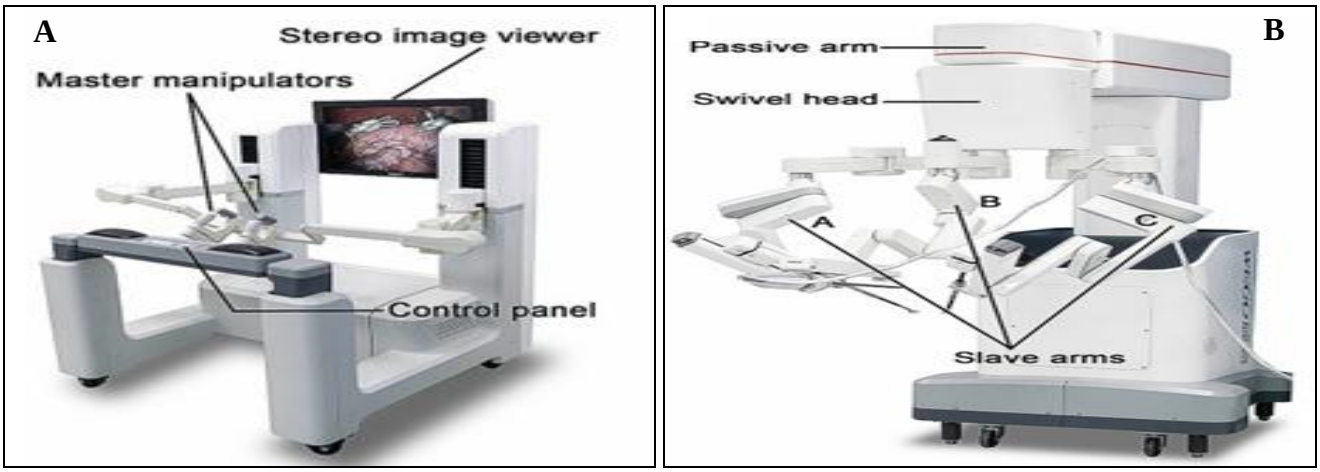


FIG. 1: 5G-POWERED REMOTE ROBOTIC ULTRASOUND DEVICE (DIAGRAMS PROVIDED BY MGI TECH CO., LIMITED) A) THE TECH ROOM WHERE THE OPERATOR MANIPULATES THE ROBOTIC ARM WITH THE SIMULATED ROBOTIC HAND. B) THE PATIENT ROOM FOR SCANNING PATIENTS WITH THE ROBOTIC ARM REMOTELY

Yu *et al.* additionally assessed two instances of patients determined to have COVID-19 by mechanical ultrasound dependent on 5G-fueled innovation 700 km away utilizing MGI robot. The upsides of distant ultrasound examining were exhibited and could turn into a plausible and safe technique for the analysis and evaluation of COVID-19.

The benefits of this strategy and the chance of popularizing it for COVID-19 cases in clinical practice. 5G-controlled transmission innovation could uphold enormous information, distributed computing, and man-made brainpower, adding to different parts of the battle against the epidemic [29].

Classification of Robots: Robots are classified based on various applications in the healthcare system under respective fields. They are receptionist robot area, nurse robots in the hospital area, ambulance robot area, telemedicine robot area, hospitals having robot area, cleaning robot area, spraying robot area, surgical robot area, radiologist robot area, rehabilitation robot area, food robot area, outdoor delivery robot area.

Receptionist Robots: These types of robots are used at hospitals reception to propagate information regarding various units of the hospital and direct the patients and care-takers to the respective physician of their choice.

These types of robots are attractive to children visiting to the hospital and impress them by urging gratifying experiences.

Nurse Robots In Hospital: Robots are becoming popular in the nursing area by offering services 24 / 24 and 7/ 7 at a low cost. These types of robots are meant to aid doctors in the hospital similarly to that of human nurses.

In Japan, several nurses robot such as Paro (AIST, Toyama, Japan), Pepper (Softbank Robotics, Paris, France) is used in order to assist elderly patients by providing therapeutic advancement.

Ambulance Robots: In lifesaving strategies such as medical emergency, Cardiopulmonary resuscitation (CPR), Automated External Defibrillator, these robots can be designed light-weight and strong enough to be transported by a flying drone to the respective emergency location.

Telemedicine Robots: In this type of robot, are mote doctor collects all the physiological parameters and diagnose disease using audio-visual aids. These types of robotic systems are very helpful in remote areas where hospitals and medical staff are not readily available [6].

Service Robots: The main help robot definition was authored in 1993 by the Fraunhofer Institute for Manufacturing Engineering and Automation. Administration robots are utilized for medical procedures, sterilization, co-ordinations, observation, recovery, and endoscopy [12].

Cleaning Robots: These types of robots are used in cleaning the hospital using a dry vacuum or mopping. Search robots are an essential part of disinfecting hospitals to eradicate germs and pesticides and maintain hygiene.

Spraying Robots: These types of robots are widely used in spraying antiseptic mixtures around large outdoor areas. Simultaneously hand sanitizer dispensing robots are invented to lighten infections on human hands and faces [6].

Surgical Robots: Surgical robots with a multi degree of freedom are flexible, precise, reliable systems offering a similar response to that of well-trained human surgeon [6]. Robot-assisted surgery can reduce the risk of contamination, whereas, in the case of contactless remote robots surgery, the spread of pathogen can be averted as it is technically operated [15].

Classification of Robotic Surgery: The classification of robotic surgery it's performed based on the bus an Avenue.

Based on the parts or organs	Neurosurgery	Cardiac surgery
Based on the Avenue	Radiosurgery	Nanorobotics

Innovative surgical Projects: High-performance robotic muscles, anthropomorphic robotic bones [8].

Radiologist Robots: A twin robotic X-Ray (Siemens Healthineers, Henkest Germany) by Siemens is an innovation in radiology that proffer Fluoroscopy angiography and 3D images, and a multitude of X Rays performs it in just one room where the physician is able to look 3D images in real-time as the robot moves in place of a patient.

Rehabilitation Robots: These types of robots are helpful in rehabilitating patients after an accident, and they help aid and treat the disabled, elderly inconvenient conditions of the people. These types of robots help in promoting functional reorganization compensation and regeneration of the nervous system [6]. Robotic Rehabilitation System (RRS) has improved the quality of treatment an increase the therapist productivity [15].

Food Robots: These robots play an integral part in hospitals' kitchens and panniers to supply high-quality food by maintaining hygienic standards. Starting from cooking service to serving, different types of automation and robotic systems have been developed by roboticists.

Outdoor Delivery Robots: These types of robots are helpful in transporting and delivering drugs and blood samples to and from the hospital. Autonomous robots can be operated on the ground and in the air autonomously and with man-in-the-loop operation whereby an operator at a long distance can control them remotely [6].

Micro/ Nano Robots: Advancement in the recent technology in design, fabrication, and operation of micro or nano robots has substantially built up their power, function, and tractability. Micro or nanorobots have the capacity to transport and deliver therapeutic payloads directly to the target site, thereby improving the therapeutic efficacy and reducing the systemic side effects of highly toxic drugs [example: Narrow therapeutic drugs [16].

Low-Cost Miniature Robots to Assist Covid-19 Nasopharyngeal Swab Sampling: A low-cost miniature robot can be easily assembled and controlled via remote, and this system includes an active end effector, a passive positioning arm, and a detachable swap gripper with integrated force sensing capability. The cost of the accessories for building this type of robot is 55USD.

AS the worldwide battle against COVID-19 may keep going for a significant stretch of time with many thousands of nasal swab samplings performed worldwide every day, mechanical helped NP and OP cleaning with distant activity capacity may diminish the danger of contamination the meantime free up staffs for different tasks. Contrasting with human, the robot can be all the more altogether cleaned, and those parts that are in close contact with patients can be dismantled and supplanted [17].

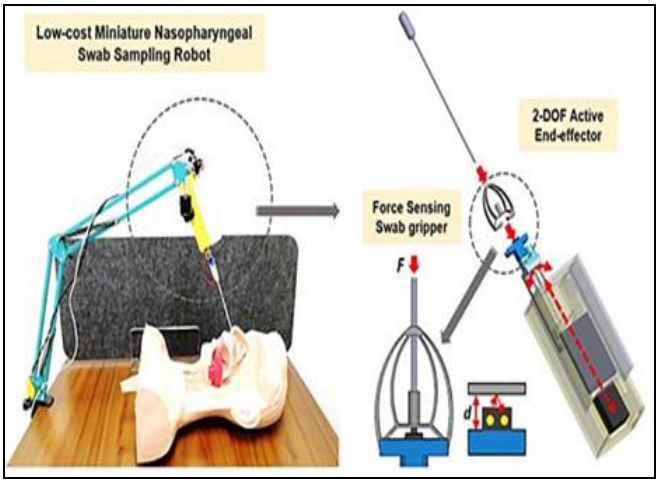


FIG. 2: LOW-COST MINIATURE ROBOT THAT CAN BE REMOTELY CONTROLLED TO ASSIST THE COVID-19 NASOPHARYNGEAL SWAB SAMPLING

Semi-Automatic Oropharyngeal Swab Robot: This type of robots were developed to take swabs test with the patients. A remote camera is armed on the swab robot, which helps the medical staff perform the sampling with a clear vision and close contact with the patients [18].

Urban Robots: Urban robots are a part of the method for switching humans on the ground of efficiency, reliability and cost savings as well as a lengthened potentiality in logistics, social services, healthcare. Coronavirus has created interest in the capability of robotic and mechanization to oversee and police physical distancing and isolate. Likely connection among mechanical technology and metropolitan coronavirus the board incorporates: a) Reducing human to human contact, b) Managing, checking, and controlling development. A focal undertaking of territorialized COVID-19 administration has been guaranteed to control the development and in order to uphold lockdown through human policing and cell phone-based tracking [19].

Teleoperated Robots:

Teleoperated System has Mainly two Sub-systems: They are a) Teleoperation system: Teleoperation framework comprises of a wear-capable introductory movement catch gadget and a double arm communitarian robot (Yu Mi, IRB14000). Utilizing the movement catch gadget, upper appendage movement information of the medical services specialist can be acquired and used to control the robot arm movement distantly. A couple of information gloves are utilized to catch the finger movements and teleoperate the grippers or opposite end effectors of Yu Mi.

Telepresence System: The telepresence framework is accomplished by a tablet PC connected to the front of the teleoperated robot. A Multi-Users Audio/Video Conference System for far-off clinical meetings is created and sent dependent on Web Real-Time Communication (Web RTC). A voice awakens work is created to work with patient's activity and diminishes contact among patient and the robot. Moreover, a profound neuron network is utilized to screen the patient's enthusiastic states by sending on the tablet PC [20]. Tele-robotics ultrasound lowers the potential risk of exposure to SARS-CoV-2. These Tele-mechanical improve admittance to demonstrative ultrasound imaging, increment patient wellbeing, and diminish wellbeing disparities during COVID-19 pandemic [21].

Automated Orrobot Assisted Nasopharyngeal, Oropharyngeal: swabbing may speed up the process, diminish the danger of disease, and this can frequently be tedious as it includes collection, handling, transferring and testing [2].

- Fixed-base controllers" (or arms) are shaped by a succession of connections appended together by joints. Fixed-base controllers have one end fixed to the ground and the opposite end allowed to perform errands in a climate skillfully.
- "Wheeled portable robots" are not focused in a position and rather utilize a wheeled stage to move in a climate.
- "Flying portable robots" make another subset of versatile robots that fly as opposed

to being terrestrial. Flying robots like quadcopters fall in this classification.

- "Legged versatile robots" have enunciated legs that interact with the ground to give headway. Legged robots range from "humanoid robots" (two-legged) to motivated by various legged 8-legged creatures.
- "Mobile controllers" comprise of a fixed-base controller mounted on a wheeled, flying, or legged versatile robot. Portable controllers combine the high portability of a versatile robot and the skill full activity capacity of a fixed-base controller.
- "Wearable robots" are human-worn gadgets that action body signals and show data to the client through bio feedback to help, help, or expand the capacities of the client.
- "Exoskeleton robots" are outside systems worn by people for engine increase and reinforcing the clients' capacities or restore their lost capacities and capacity [28].

TABLE 1: CLASSIFICATION OF ROBOTS AND THEIR EXAMPLES

Classification of Robots	Examples
Receptionist Robots	(a) Pepper robot in a Belgian hospital (b) Din sow 4 robots
Nurse Robots in Hospitals	a) Robear-a robotic bear nurse to lift patients in Japan (b) Din sow robot for elderly entertainment and face-to-face calls (c) Moxi-Nursing robot placing medicines in bins. (d) Robot attendant for hospital care
Ambulance Robots	(a) Ambubot (b) Automated External Defibrillator (AED) for patient recovery (c) Drone carrying a first aid kit (blue) controlled by a smartphone
Telemedicine Robots	(a) RP-VITA: FDA-approved first autonomous telemedicine robot (b) Dr. Paul Casey, taking video calls at Rush University Medical Center (c) Doctor Robot for telemedicine
Serving Robots in Hospital	(a) Chinese hospitals using robots to deliver medicines in a patient's room (b) Panasonic Autonomous Delivery Robots-HOSPI-deployed in a hospital in Singapore (c) TUG autonomous service robot (d) RELAY robot to deliver medicine (e) LoRobot L1
Cleaning Robots	(a) Roomba i7 cleaning robot (b) UVD robot for disinfecting hospital premises (c) Peanut robot for washroom cleaning (d) Swingobot 2000 cleaning robot
Surgical Robots	Da Vinci robotic surgical system
Rehabilitation Robots	Rehabilitation and assistive robots (a) Kinova assistive robotic arm (b) EksoNRexoskeleton
Food Robots	Food robots in a hospital's kitchen for preparing and delivery (a) Robot chef in a Chinese hospital (b) Food delivery robot in hospital (c) Cooki robot to prepare meals (d) Moley-World's first robotic kitchen
Disinfestation Robots	(a) Remote control disinfecting mobile robot in Hangzhou, China (b) Spraying robots to disinfect large residential areas in China (c) A hand sanitizer-dispensing robot in Shanghai
Outdoor Delivery Robots	Outdoor delivery robots (ground based and aerial systems) (a) Flirtey drone robot for delivery of medicine/food/blood samples (b) Starship autonomous delivery robot

Medical Robotic in the Fight against Covid-19: In the profound well-being emergencies exacerbated by the limited financial agony, for example, during the novel Covid pandemic, clinical mechanical, wearable and self-ruling frameworks can be important for the arrangement. These frameworks can help the medical services framework and protect general wellbeing in various manners. For example, robots can be utilized to help forestall the spread of COVID-19 or aid huge scope evaluating for it. Computerized wellbeing arrangements, including telehealth/ telepresence advancements, can empower more viable and more secure medical care administration conveyance. Canny telehealth frameworks can fundamentally lessen the danger of irresistible sickness transmission to bleeding-edge medical care laborers by making it feasible for them to emergency, assess, screen and treat patients from a protected distance. A wheeled telepresence robot conveying a controller can be utilized for virtual up close and personal patient appraisal and empowers the medical services staff to perform indicative testing (*e.g.*, taking a patient's temperature or swab tests) from a protected distance. Working with the curbside screening of patients while medical

services staff stays in an ensured climate, telehealth innovations can reduce contact time among patients and cutting edge medical services laborers and the utilization of PPE during patient admission. Another illustration of the possible utilization of mechanical and self-ruling frameworks is mechanizing manual activities that are work concentrated, tedious and dull to lessen the weight on bleeding edge medical services laborers.

For example, a portable robot can be conveyed to self-rulingly sanitize and clean medical care offices. Medical services conveyance can be made more productive and more secure by utilizing materials dealing with and coordinating robots, particularly on account of taking care of natural/irresistible materials, dispersing PPE and drugs, and preparing/cleaning clinical hardware. Robots can help medical services staff in treating hospitalized patients by empowering more successful medical care conveyance, especially for those patients in disengagement or basic consideration. Notwithstanding the "mechanical plan" of a robot, how it communicates with a human (*e.g.,* a parental figure or a patient) matters when attempting to deliberately arrange different automated answers for the conveyance of different medical care administrations.

The "methodology of actual human-robot cooperation" (HRI), where the human and the robot work in actual direct contact, relies upon whether the robot is wearable, synergistic, teleoperated, or self-sufficient [28].

Others:

- Therapy robot
- Mental commitment robots
- Socially assistive robots
- Surgical assistive robots
- Magnetic resistance guided robotic surgery
- Miniature wireless in vivo robots
- Endo luminal mobile robot
- Spine assisted surgical robot
- robot-assisted telesurgery
- Transatlantic robot-assisted telesurgery
- Da Vinci robotic system
- Video-assisted surgery
- Rehabilitation robots
- Robots to aid elderly
- Service robots for assisting the elderly in mobility and navigation.

Goal of Using Robots In Healthcare System During Covid-19

- To enhance healthcare delivery
- To improve the outcome of the patients
- To improve the quality of life
- To improve the recovery rate and time
- To minimize mortality rate and morbidity rate
- To reduce the rate of infection

Requirement of Using Robots in the Healthcare System: Robots assist doctors and clinical staff in doing intricate and exact undertakings and bring down their responsibility, hence improving the effectiveness of the general medical services offices in this Coronavirus pandemic.

Kinematics and Dynamics: The necessity of kinematics and elements of a clinical robot are application subordinate. Sequential just as equal robots are utilized in different undertakings going from careful and restoration to support robots.

A large portion of the help robots in emergency clinics are variations of versatile robots with a high payload limit yet with restricted levels of opportunity (DOF). In any case, careful robots with multi DOF are adaptable, exact, and dependable frameworks offering comparable execution to that of a very much prepared human specialist with a base mistake edge ordinarily inside millimeters.

Control and Dexterity: To carry out different assignments with high exactness, unwavering quality, and repeatability while limiting the impacts of unsettling outer influences, the control of clinical mechanical technology is a difficult issue. Clinical robots use cutting-edge innovation to do different

assignments needed for cleaning, cleansing, shipping, nursing, restoration and careful applications. Versatile, powerful inserted regulators are by and large executed to control and route such perplexing and lithe robots.

Disinfection: Robots intended for use in medical care and medication has severe cleaning necessities as they should be liberated from germs and microorganisms, which can spread transmittable and infectious sicknesses to different patients. Administration robots should be disinfected every once in a while with the goal that they don't become infective transporters. Cooking robots have their different convention for cleaning, as they are launderable after use.

Administrator Safety: This is one of the superb necessities in clinical mechanical technology as the administrator's wellbeing is vital while taking care of a robot in the clinic premises. It ought to be protected enough for the administrator, clinical staff, and doctor/specialist just as for the patient to have a robot in nearness inside the clinic without representing a danger to anyone.

Robots in emergency clinics are intended to be worked by clinical specialists, clinical specialists, and staff without designing information and investigating abilities. Clinical benefit robots assist patients with prostheses, orthoses, portable amplifiers, and visual prostheses and, along these lines, require simple upkeep techniques.

Force Requirements: To work clinical robots, AC/DC power should be accessible without interference so these basic frameworks can work persistently. Remote force move is likewise being worked on for versatile robots in medical clinics to limit incessant charging requirements.

Cost: Since automated medical care arrangements are required at a huge scope, they should be savvy for simple establishment and widespread accessibility all through the world, including agricultural countries.

Care full automated frameworks are nonetheless very costly arrangements as they offer front-line advances with incorporated top quality video frameworks for apparatus direction and moving by the specialist [6].

TABLE 2: NAME OF THE ROBOTS AND THEIR APPLICATIONS

Name of the Robot	Applications
Cafero	Offers telecommunication monitoring of health as well as cognitive training
Neuromate robot	Stereotactic surgery
Da Vinci robot	Provides visualization, Perform laparoscopic Surgeries, and also minimal invasive cardiac, colorectal, gynecology, head and neck.
Moxi [Diligent Robotics]	Retrieves and brings supplies to hospital rooms and nursing stations, delivers the sample to laboratories
Metal Medics mobile remote presence robots (RP-7 by In Touch Health)	Conducts ward rounds remotely
Tommy (Italy)	Monitor the patients, communicate both visually and acoustically with nurses and doctors in a remote location
Ion (Intuitive surgical)	Performs minimally invasive biopsies deep in the lungs
Mako (Stryker)	Offers partial knee, total hip and total knee operations
NAVIO (Smith and Nephew)	Assist with total Knee replacement procedures
Monarch (Auris Health)	Performs lung endoscopic procedures
ROBODOC (First Surgical Robot)	Hip replacement surgery

Development of Robotic Technology for Healthcare Purposes: Improvement of automated innovation for medical care purposes can be arranged into three areas: clinical, assistive and advanced recovery mechanics. The clinical mechanical technology area incorporates automated frameworks that offer help in clinical cycles of mending (medical procedure) and care (conclusion). Likely, clinical robots for the medical procedure are the most received frameworks in clinical settings. The space-related assistive mechanical technology covers frameworks that help with task-related medical services measures, either to carers or to patients, in care offices. At long last, the restoration mechanical technology space covers a scope of various types of post-usable or post-injury care where the actual direct connection with a robot framework will either improve recuperation or go about as a trade for lost capacity [15].

Challenging Areas of Intervention:

- ✓ Telemedicine and monitoring of patients.
- ✓ Decontamination
- ✓ Sanitization
- ✓ Drugs and food delivery and Goods transportation.

Common Existing Companion Robots

- Huggable
- Pearl
- Paro
- Icat

Applications:

- Robots are mainly used for various tasks such as digitized patient admission, acquisition and monitoring of vital signs.
- It provides companionship to individuals living alone, emotional and mental support by educating them during this pandemic.
- It provides ways to encourage physical activity.
- It help in measuring blood pressure, oxygen saturation
- It even helps individuals with invisible health conditions.
- Other tasks such as op collection, dispensing medications, processing blood tests are carried out by robots.

Barriers:

- No clear draw from experts and patients.
- Appearance of robots and related assumptions and concerns.
- Disruption of the work which is coordinated and appropriated.
- New moral and legitimate difficulties requiring adaptable risk and moral system [23].

There is a need to improve ongoing service robots applications [10]. A couple of arising improvements and different applications in the field [soft robots and robots for catastrophe reaction] that are relied upon to assume significant parts later on gatherings [24]. Robot use in the healthcare system limits the communication gap between the two and spreads better healthcare to a large number of the population [8]. Artificial Intelligence Methods and Machine Learning algorithm have been used many times in-order strengthen the applications of robots. The utilization of robots begins with the trial of patients, where the robot is fit for mass screening to quickly affirm the COVID - 19 cases. The robot is one of the promising gadgets as it furnishes actual functionalities with powerful friendly removing among the patients and the clinical staff [18]. Autonomy and self-adaption of the robotic framework - There is still a great deal of work that need to do on this perspective [1]. Robotic response to COVID-19 has been restricted to very advanced drives, yet these are restricted in useful limit [19]. Robot execution in the fight against COVID-19 has acquired positive criticism from medical services laborers for its potential in obstructing disease and is successful in easing clinical specialists from rehashed undertakings [20]. The cultural effect of robots is fundamental as they may impact the nature of medical care for patients, and the nature of work for guardians and their potential security concerns stay to be addressed [25]. AS PC processors and capacity get quicker and less expensive, and as new advances arise in machine learning and multimodal preparing, a universe of plausibility exists for robots perpetually skilled and agile in the human social environment [26].

ACKNOWLEDGEMENT: We are thankful to the management of CMR College of Pharmacy for providing the facilities and access to online resources for the literature survey to complete this review successfully. We also thank our guide Ms. I. Neelam for her constant support

CONFLICTS OF INTEREST: All authors declared that there are no conflicts of interest.

REFERENCES:

1. Valeria Seidita, Francesco Lanza, Arianna Pipitone and Antonio Chella: Robots as intelligent assistants to face COVID-19 pandemic. Briefings Bioi 2021; 22(2): 823-31.
2. Zeng Z, Chen P and Lew A: From high-touch to high-tech COVID-19 drives robotic adoption. Inter J of Tourism Space 2020; 22: 724-34.
3. Livingston E and Bucher K: Corona virus disease 2019 (covid-19) in italy. Jama 2020; 323(14): 1335.
4. Abdul-Rasool S and Fielding B: Understanding Human corona virus hcov-NL63. Open Virol J 2010; 4: 76-84.

5. Xinyi Lim Y and Ling Ng Y: Human corona viruses: a review of virus – host interactions 2016; 4(3): 26.
6. EKhan ZH, Siddique A and Lee CW: Robotics utilization for healthcare digitization in global covid-19 management. International Journal of Environment Research Public Health 2020; 17(11): 3819.
7. Khan A: Robots in healthcare. A Survey 30:1779-24.
8. Dsouza R, Deborah C, Samuel V and Sunaina A: Evolution of robotics in medical surgeries and health care system a review. International Journal of Applied Engineering Research 2016: 11(23); 11277-98.
9. Robinson H, Macdonald B and Broadbent E: The role of healthcare robots for older people at home. International Journal of Social Robotics 2014; 6(4): 575-91.
10. Holland J, Kingston L and McCarthy C: Service robots in the healthcare sector. Robotics 2021: 10: 47.
11. Carsten Stahl B and Coeckelbergh M: Ethics of healthcare robotics: Towards responsible research and innovation. Robotics and Autonomous Systems 2016; 86: 152-61.
12. Gonzalez-JimenezH: COVID-19 paving the way for robots in healthcare. Health Manag ORG the J 2020; 20(7): 22.
13. Tavakoli M, Carriere J and Torabi A: Robotics for COVID-19: How can robots help health care in the fight against corona virus 2020.
14. Zemmar MA, lozano A and Nelson B: The rise of robots in surgical environments during COVID-19. Nature Machine Intelligence 2020; 2: 566-72.
15. Daniel ona E, Garcia-Haro J, Jardon A and Balaguer C: Robotics in health care: Perspectives of robot-aided interventions in cli pracfor rehabilitation of upper limbs.
16. Jinxing Li, Berta Esteban-Fernandez de Avilla, Wei Gao, Liangfang Zhang and Joseph Wang: Micro/Nanorobots for Biomedicine: Delivery, Surgery. Sen and Deto 2017: 2(4).
17. Wang S, Tang R and Qiao J: Design of low-cost miniature robots to assist the COVID-19 nasopharyngeal swab sampling. DOI:10.1109/TMRB.2020.3036461.
18. Vincent Wang X and Wang L: A literature survey of the robotic technologies during the COVID-19 pandemic. Journal of Manufacturing System 2021; 10: 1016.
19. Chen B, Marvin S and While A: Containing COVID-19 in china: Al and the robotic restructurin gof future cities. SAGE Journals 2020l; 10: 1177.
20. Geng Yang, Honghao Lv, Zhiyu Zhang, Liu Yang, Jia Deng, Siqi You, Juan Du and Huayong Yang: Keep healthcare workers safe: Application of teleoperated robots in isolation ward for COVID-19 prevention and control. Chinese Journal of Mechanical Engineering 2020; 33(1).
21. Adams S and Burbridge B: Telerobotic ultra sound to provide obstetrical ultrasound services remotely during the COVID-19 pandemic. Journal of Telemedicine and Telecare 20965422.
22. Yang G, Jnelson and Murphy R: Combating COVID-19 the role of robotics in managing public health and infectious diseases.
23. Cresswell K and Sheikh A: Health care robotics: Qualitative exploration of key challenges and future directions. Journal of Medi Int Reseah Gate 2018; 20(7).
24. Sdahl T and Kamel Boulos NM: Robots in health and social care. Acomplementary Technology to Home Care and Telehealthcare 2014; 3(1): 1-2.
25. Kyrarini M, Lygerakis F, Rajavenkatanarayanan A, Sevastopoulos C, Nambiappan HR, Chaitanya KK, Babu AR, Mathew J and Makedon F: A survey of robots in. Healthcare 2021; 9(1): 8.
26. Laurel D: Riek. Robotics Technology in Mental Health Care 2016; 185-03.
27. Osborn E, Barrett M and Darzi A: Robots and service innovation in health care 2011; 16(1): 46-50.
28. Mahdi Tavakoli, Jay Carriere and Ali Torabi: robotics, smart wearable technologies and autonomous intelligent systems for healthcare during the covid-19 pandemic. An Ana of the State of the Art and Future Vision 2021; 2(7).
29. Yu RZ, Li YQ, Peng CZ, Ye RZ and He Q: Role of 5G-powered remote robotic ultrasound during the COVID-19 outbreak: insights from two cases. Eur Rev Med Pharmacol Sci 2020: 24(14): 7796-7800.
30. Jing Wang MD, Chengzhong Peng MD, Yan Zhao MD, Ruizhong Ye MD, Jun Hong MD, Haijun Huang MD and Legao Chen MD: Application of a robotic tele-echography system for covid-19 pneumonia. Journal of Ultrasound in Medicine 2021; 40(2): 385-390,
31. Lanza F, Seidita V and Chella A: Agents and robots for collaborating and supporting physicians in healthcare scenarios. J Biomed Inform 2020; 108: 103483.

How to cite this article:
Padmini K, Suvarna A and Neelam I: Role of robotics in health care system during covid-19 pandemic. Int J Pharm Sci & Res 2021; 12(10): 5134-44. doi: 10.13040/IJPSR.0975-8232.12(10).5134-44.