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Review Article

Role of remote presence robot in healthcare facilities

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Article History	Abstract
Received on: 28-07-2010 Revised on : 10-08-2020 Accepted on : 04-09-2020	This article is focused mainly on the role of the remote presence robot in health care facilities. This article has a view of the advantages, disadvantages, objectives, uses of RPRT in health care settings, and in different departments, and precautions to be taken while using RPR. In recent decades the usage of remote presence robots has been used in many clinical settings like ICU, emergency departments, medical, surgical, neurological units, and operating rooms. Remote presence robot technology RPRT, is an advanced robotics device technology that enables health care professionals to provide real-time clinical services to patients. This has been increasing in both outpatient and inpatient settings. RPRT in medical education can teach the professional curriculum to students in an interactive way as teachers do. RPR can even enable teachers to teach and interact with students remotely. The world's first hospital to introduce remote presence robots in the university of California, Los Angeles in its neurosurgery intensive care unit. The application of RPRT will increase doctor access for patients, families, and hospital staff in clinical care settings.
Keywords Remote Presence Robot, Geriatrics, Paediatrics, ICU, Telepresence, COVID-19.	
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Introduction

Robots are being in usage in recent decades changing the shape of the future. The robot usage has eloped the physical man power tools into automation ,reducing the workflow and prompt delivery of products . Usage went beyond the human imagination occupying facility in every reachable fields. Physical robots are multi-tasking, volatile and some can auto-navigate, communicate either with increased additional effective features. Remote presence technology provide real time clinical services remotely, providing the sense of virtual reality. Medical robots have been used successfully in various settings for many different types of care. Some evidence reports of deployment in intensive care units (ICU), medical and surgical bed units, cardiac catheterization laboratories, emergency departments (ED), operating rooms (OR), psychiatric services, and neurology clinics. Telepresence technology is a robotic technology that provides stimuli to user senses which makes them to feel as they are having an effect in another place or location through videoconferencing screen seated on a moving base.

Remote presence technology is a advanced robotics device that enables healthcare professionals to provide real time clinical services to the patient. It is also called as medical telepresence robot or hospital telepresence robot. In the healthcare sector substantial increase in usage of robots is necessary when it comes to geriatrics . RPRT (remote presence robot technology) is also being used remote assessments, initiation of treatment and reduce the need of transport in ill paediatric patients [1]. Robotic Tele presence viewed valuable in critically ill patients admitted in SICU (surgical intensive care unit) and facilitated in decrease cost of ICU(intensive care) [2,3]. Telemedicine has been increasing in both out patient and in-patient settings. Benefits of telepresence in neonatal intensive care unit have already been demonstrated [4]. Specifically, the application of telemedicine has proven very useful in various health department from diagnosing of a disease to discharge of a patient and patient counselling later. At some extent, remote presence robots helps clinicians to extend capabilities for rational therapy . surgical remote presence have different clinical tasks (e.g.,

removing tissue inside the body through minimal access techniques, implanting radioactive pellets in prostate tumours via brachytherapy). In some cases, patient management methods have shown safe and effective in using remote presence robots [5]. Installing tele presence system in robot can interact with patients, move around in different wards, ease of accessibility between patient and healthcare professional. RPRs do facilitates and utilisation medical education ,enabling potentiality in academics .

Advantages

- It helps to address distance and time barriers in providing healthcare services in rural areas.
- Provides home care assistance for geriatrics.
- It helps in establishing effective non-verbal communication, facial expression, body language; voice can be visible through visual communication.
- Physicians can monitor the patients who have recently been discharge from hospital. (shorter hospitalisation)
- Experts eliminate travel times in emergency situations when each minute results in saving the millions of brain cells.
- It helps to save money and time
- No need of human visit to any other settings (mostly helpful in quarantine facilities).
- It allows you to have an instant presence wherever you want.
- Reduce the need for costly patient transportation out of the community for medical services.
- It offers great visual interaction.
- Facilitates in medical education.

Disadvantages

- Its high resolution telepresence system requires more investments which increases expenditure of the company.
- It requires sufficient bandwidth to have feel of physical presence.
- Stationary cameras are setup in predetermined rig, which confines people to the area covered by stationary cameras.

Objectives In Usage Of Remote Presence Technology Healthcare

- (1) Safety: avoiding harm to patients from the care that is intended to help them;
- (2) patient-centred: providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions;
- (3) promptness: reducing common and harmful delays;
- (4) Efficient and effectiveness :avoiding underuse and misuse, respectively and to avoiding waste of equipment, supplies, ideas, and energy;

- (5) equitable: providing care that does not vary in quality because of personal characteristics such as sex, ethnicity, geographic location, and socioeconomic status.

Use Of Tele Presence Robots At Health Care Settings

1.Ward rounds by Health care professionals may kill important information.

The circulation of any kind of information to every room in each floor can consume a lot of time if it is done by any healthcare professionals. The RPR can travel to each and every room for distribution of the information directly to the patient bed.

2.Human perception cannot maintain accuracy in stress conditions

The routine of work everyday in hospital settings of both out and in patient must to keep a record. Exhaust work conditions , stress full environment could error in the accuracy in record maintenance . Therefore we replace human labour with robot. This robot is flexible, portable and a versatile solution for delivering essential requirements and to preserve errorless records .

3. Work cannot be done if Health care profesional is ill health.

Work cannot be accomplished in emergency conditions promptly if any of HCP is fallen ill health . so,a telepresence robot is the only best thing than actually being there when HCPs are not well [1-5].

4.Remote temperaure monitoring

Temperature measurement is now a basic and fast screening method for detection of corona virus at entry points of various public places, such as airports, rail stations, office buildings etc. A recent advancement in tele presence ,chinese tech developed baidu which has capable to read and register temperatures(37.3 degrees celcius or higher) of humans by harnessing infrared and face detection technologies .baidu can check 200 people per minute with a margin error of 0.05 degrees celsius[14].

5.Remote consultation between patients and medical professionals

To minimise contagious contact or person to person contact , robots are equipped with thermometers and cameras which can take patients vitals and diagnose patient with the illness from a safer zone [15].

6.Sterilization of room with ultraviolet light

Scaling up the global demand , disinfectant robots are deployed across hospitals.robots are designed and fixed with UV-C lamps to reduce healthcare associated infections in hospitals. Users can monitor the progress through remote-control system. These robots have used to

clean patient rooms and the ICU with UV light claiming to rid of the residual micro-organisms [16].

7.Delivery of medicines and food

Specially designed two wheeled droids, with a refrigerator, can navigate the halls of the hospital voluntarily providing a contact less distribution of medicines and food to the infected patients. The robot can save much resources since it doesn't need personal protection equipment/measures taken by doctors and nurses. This system helped achieving prompt delivery of essentials to the patients without contacting[17].

8.Replace hospital reception staff with robots

Israeli company developed a three feet robot called temi which features a touchscreen, navigation system, amazon's alexa technology, sound system and some more applications which can help in direct communication and answer questions to patients and family members[18].

Use Of Rpr In Different Departments

Remote Presence Robots In Medical Education

The use of remote telepresence robots in education is helping students learn better and is making education accessible to those who cannot access it due to different circumstances. RPRs can reduce transactional distance (td) by adding connected learning environments. Robots in education can teach preferred curriculum to students in interactive way as teachers can do. Louise Racine, suggest that use of remote presence robots is found to be innovative method in easy delivery of nursing tutorial[6]. Remote robots increase the access to medical education, palpable impact on clinical training and increase in patient care.[7] The impact of remote presence robotic system during anatomy laboratory sessions on student and surgeon reported a positive feedback experience and claimed to be beneficial in emergency situations [8]. J. Bell [9] studied the incarnation of distant students in hybrid teaching, from videoconferencing to the use of the telepresence robots. It appears robot getting closer to a feeling of physical presence. Remote presence robots by enabling teachers to teach and interact with students remotely. The conclusions of these works should allow to enable telepresence learning at universities level, tertiary hospital settings. the use of RPRs in transmitting of all kind of medical knowledge from first aid to most intensive surgeries can be access from metropolitan cities /developed countries to the remote location/ under developed countries across the globe.

Tele Presence In Pediatrics

The "store and forward" type of telemedicine used in many fields of medicine, mainly observed in post operative surgeries. The growing pediatric and neonates cases would lead to increase the use of telemedicine. In emergency situations when the on-site neonatologist is

unavailable the probability of inappropriate interventions, inaccurate information would be high due to unreliable information, limited recommendations made through telephone. telemedicine technology can provide with the direct visualisation and auditory information about the patient and may ease the decision making process for the health care professionals. In diagnostics, use of tele-echocardiography has been used by pediatric cardiologists[10],[11] provide prompt recommendations for therapeutic usage. As for neonatal care, there is a prominent need in tele-medicine at remote areas. Robotic Telemedicine Improves parental satisfaction, also may decrease in length of hospitalisation and health care costs. A Garingo et al, stated the use of mobile tele presence robots for neonates in the nicu is feasible [12].

Role Of Telepresence Robots In Covid-19 Management

The telepresence robot is a great remedy for telemedicine, especially when dealing with patients who may have come into contact with infectious diseases for example like pandemic covid-19. TPR facilitates healthcare staff in real time to work with the patients in much more safe and efficient without direct contact. The infectious nature of COVID-19, makes it necessary for telepresence robots to be used to reduce the chances of infection. The initial customer feedback is encouraging but more thorough evaluation is needed [13]. the usage of personal protective equipment is minimal with help of remote presence robots. In such severe pandemic situations the role of robots will play a crucial role in avoiding direct contact, rapid movement and response within the infected area reducing time delay. A minimal sterilization is needed.

Robotic Tele Presence In Geriatrics

In these contemporary days ageing population are facing space in physical and cognitive assistance due to staff deficit. Introduction of tele-presence for health services is an interesting field not only aiding elder feel alone no more but also providing care with much lowest paying for medical care in hospital, for medical purpose can be called Telemedicine. Tele-presence robots have been successfully used in accompanying elderly people to minimise loneliness problem and play etiological role in physical and mental health problems [21]. A specialised robot, called MARTA, had been introduced for *Multidimensional Assessment of telepresence Robo T for older Adults* which showed significance role[19]. In recent report the UN request governments to take measures to protect the elderly and ensure they can age with good health and dignity. Further more the installation of tele presence system onto the wheel chair of the elderly has improved tele-operation much easier and promising applicable in health care and elder care[20]. the use of remote presence robot in geriatric areas will bring a new hope for lonely patients in view of remote support and

facilitates easy accessibility with the nursing or other HCPs.

Precautions To Be Taken While Using Rpr

- Most incidents of injury occur during activities such as maintenance, programming, and adjustment of robots, to avoid such incidents.
- Avoid free standing posts- which create ‘pinch points’ where an unsuspecting worker can become trapped between post and robots arm.
- Be aware about safety rails, chains, ropes and floor markings.

Conclusion

RPRT(remote presence robot technology)and it's use in healthcare system is been discussed about advantages, disadvantages, objectives in usage and role of RPR in different departments. The instructor credibility is crucial to the overall treating experience, it is significant to improve the usability of the remote presence robot platform for both the physician and the Patient. The major disadvantages are it requires more investment and sufficient bandwidth. High-efficiency and accurate path planning turned the RPR into a smart “postman”. In addition, the software structure enables multiple instructors to treat with one robot. The further improvements is to apply the remote presence robot to all departments of healthcare system for different levels of treatment. To further improve the performance of existing version of the RPR, it is needed to record and analysis patient's outcome against treatment. If necessary, special modifications can be applied to RPRs depending on the situation. Such as mental retardation, blindness or deaf Patients, remote presence robots can make adjustments in their information communication devices to suit different user needs. At the same time, due to the unique advantages in companionship of robots, remote presence robots may provide more help to disabled patients. At last,further research should be done to extend the use of remote presence robot and to know advantages and disadvantages in area of medical settings.

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