A STUDY ON EVALUATING AWARENESS OF INNOVATIVE TECHNOLOGY APPLICATIONS IN HEALTHCARE INDUSTRY IN INDIA

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Abstract:

The Indian health-tech market is expected to grow at a CAGR of 39% and touch US$ 50 billion by 2033 as per Indian Brand Equity Fund (IBEF) Report. The advancements in the Indian Healthcare industry paved the way for the innovative technologies to be used and promoted by the healthcare sector. The purpose of conducting this research study is to evaluate the awareness of new technologies used in the healthcare industry. The technique used in this study is one sample t-test. The findings of the study indicated that the awareness of Telemedicine, Block chain (used for accuracy of patient data), Augmented reality, 3D printing, Virtual Reality, Bioprinting, Wearables (smart watch), Internet of medical things (IOMT), Precision medicine, Symptom checker chatbots, Nano medicine and Artificial Intelligence have high awareness among the patients suffering from various diseases. Whereas CRISPR Therapeutics, Robotics and Data breach prevention have low awareness among the patients suffering from various diseases. The Future research studies can be conducted to determine which technology is most preferred by the healthcare workers and also to validate the awareness levels among the patients in India.

Keywords: *Innovative Technologies in Healthcare, Internet of Medical Things (IOMT) Nano Medicine, Block chain, Robotics in Healthcare.*

Introduction:

Medicine has existed since the olden times; people used herbs and various other plants to cure a disease or heal wounds. In ancient times, the medicine practised in India was through Hakim or Vaid, who provided Ayurveda medicines to heal any ailment or condition. The medical sector has kept evolving with the increase in education and technical advance this sector has

achieved great heights. The sector, also known as the healthcare sector, can be defined as the enhancement of health through diagnosis, prevention, therapy, surgery, medicaments, refinement or curing of diseases, mental illness, physical illness, injuries, etc., in humans. Healthcare has a broad branch with medicine, nursing, pharmacy, radiology, physical therapy, dentistry, cosmetology, various therapist physical and mental therapists, etc. The purpose of healthcare is to provide primary care needed to the patient suffering from any form of illness or disease. The healthcare sector is one of the largest employment sectors, and to take care of billions of people, it requires millions to provide primary, secondary or tertiary care to the patients.

Artificial Intelligence (AI) supported technologies have been increasingly used in healthcare organisations to provide better care services with more resource efficiency. The knowledge-intensive healthcare industry has many opportunities for innovation because to AI-based technologies such intelligent robots, machine learning, and natural language processing. (Lee &Yoon 2021). Remote Healthcare, also called telehealth, is one the innovative technologies of the medical world where people can get the required health help by sitting in the comfort of their homes and consulting a doctor online using the Internet using the various telehealth application or videoconferencing where a doctor is connected to the patient and after consultation, the details about the health scare gives an appropriate course of prescription and treatment.

The collection of hardware, software, and medical device connections made possible by the Internet is collectively called the "internet of medical things." Transmitting and retaining a lot of data is simple when several medical equipment are connected to the Internet. Large amounts of data can be used to identify urgent or persistent issues. (Karthika, 2022). "Nano medicine" refers to applying nanoparticles, Nanorobots, or other nanoscale materials in the medical field. One of the most exciting areas in medicine is Nanomedicine. Targeted drug delivery and cancer treatment are made possible by Nanomedicine. Smart wearables are one of the significant advances in modern medicine. Every age group is using smartwatches at a rapid rate. Many software firms, including Apple, Samsung, and Fitbit, are market leaders in smartwatches.

IoMT stands for the Internet of Medical Things, which refers to the interconnected network of medical devices and healthcare systems that collect, transmit, and analyse health data for improved patient care and monitoring. Artificial intelligence, or AI, is a subfield of computer science that focuses on creating intelligent machines that can carry out activities that ordinarily

call for human intellect. Remote Healthcare also known as telehealth or telemedicine, refers to the provision of healthcare services and medical consultations from a distance using technology and telecommunications. Wearables refers to a small electronic device or accessory that can be worn on the body, often equipped with sensors and connected to other devices or networks, to track and monitor various aspects of health, fitness, or other data. VR and AR: VR (Virtual Reality) is a technology that immerses users in a simulated, computer-generated environment, while augmented reality (AR) projects digital data or virtual objects over the physical surroundings.

A subset of data analytics called predictive analysis uses statistical methods and machine learning algorithms to anticipate and predict future events based on patterns and trends in past data. Nanomedicine refers to the application of nanotechnology in the field of medicine, enabling precise diagnosis, treatment, and prevention of diseases at the molecular and cellular levels. Bioprinting is a cutting-edge technology that uses 3D printing techniques to create functional, three-dimensional living tissues and organs. This research aims to evaluate new technologies used in the healthcare industry to understand the advancement in the sector.

Literature Review:

1 **Farouk, A. et al. (2020).** The authors researched the Blockchain platform for industrial healthcare, intending to understand the vision and the future opportunities attached to it. Introducing blockchain technology in the healthcare sector has a huge opportunity to improve the security and information management of the industry. The entire data of healthcare can be analysed and transmitted and can also be preserved for future reference. The data can be secured and have a privacy factor involved. The author concludes the research by stating that there are merits and demerits attached to the application of blockchain technology in the healthcare sector. The authors further believe that healthcare data is sensitive and requires a lot of care and time. Also, the blockchain technology developed must be a perfect fit with the standard and requirements of the healthcare sector.

2 **Coventry, L., & Branley, D. (2018).** A huge opportunity exists to improve clinical outcomes and change care delivery with the widespread deployment of electronic healthcare technologies. The security of medical data and apparatus, however, is a major worry. Medical equipment now has more access to current computer networks, which has led to new cybersecurity vulnerabilities. Due to its extensive supply of

valuable data and weak defences, the healthcare industry is a top target for cybercrime. Healthcare technologies, despite having a substantial impact on our population's health, are vulnerable to security concerns due to their interconnection, accessibility, outdated systems, and lack of attention to cybersecurity. Healthcare technology include a vast amount of private and valuable data, despite the fact that patient care has historically gotten more focus.

3   **Dhagarra, D. et al. (2020).** The authors researched the impact of trust and privacy concerns on accepting technologies in the healthcare sector. The paper examined people's behavioural intention towards adopting and taking technologies for healthcare. The authors believe that all the technological advancement in the healthcare industry is familiar, yet significantly fewer studies are available on the said topic. The research used the SEM model to conceptualise and validate the hypotheses. The outcome of this analysis indicated that perceived ease of use and usefulness, trust and privacy concern is the most undeviating factor that predicts the patient's behaviour towards acceptance of technologies.

4   **Chellaiyan, V. G. et al. (2019).** The authors researched telemedicine in India and where the country stands in the telemedicine world. The authors explained the meaning of telemedicine and how it has been gaining popularity among citizens. The authors also believe that the growth of telemedicine has been due to the enormous support and help of NASA and ISRA. India set up the National Telemedicine Taskforce in 2005 to help the citizens and keep track of telemedicine prescriptions. The authors conclude the study by stating that although telemedicine is a type of solution to the health problem that may arise, it is not the solution to all medical issues. The authors also feel that although the telemedicine initiative is vast and has been running for the past decade, it is yet to attain its full extent. There is still a need for awareness surrounding telemedicine as it is still not being advertised enough for the citizens to get attracted towards its use.

5   **Coccia, M. (2020).** The author researched the emerging applications of deep learning technologies being used in cancer imaging. The author points out that this technology helps pathologists to view the problem correctly, analyse it and inform the patient at the early stages of the growth of cancer, which will further lead to better treatment plans and help in the survival of the patient suffering from the disease. Deep learning

technology is so far being used for lung, breast and thyroid cancers. The author concludes the study by stating that although deep earning applications are helping the world, it is still to achieve validation and generalisation.

6 **Mohan, S. et al. (2019).** The authors researched "effective heart disease prediction using hybrid machine learning techniques". The authors point out that the identification of heart disease is not easy as various risk factors have to be considered before predicting heart disease, factors such as cholesterol levels, diabetes, pulse rate, high blood pressure, etc., the Hybrid Random Forest with Linear Model is a technique whose main objective is to predict the heart disease accurately. The results of this analysis indicated that HRFLM has a much more accurate heart disease predictor than the pre-existing methods.

Objectives of the Study:

- To study and understand the awareness levels of the innovative technologies amongst the patients in India.
- To establish a connect among the various technology drivers and their usage among the patients and the healthcare workers.

Hypothesis:

Ho: The awareness of new technologies used in healthcare industry among the patients is low (Mean score ≤ 3)

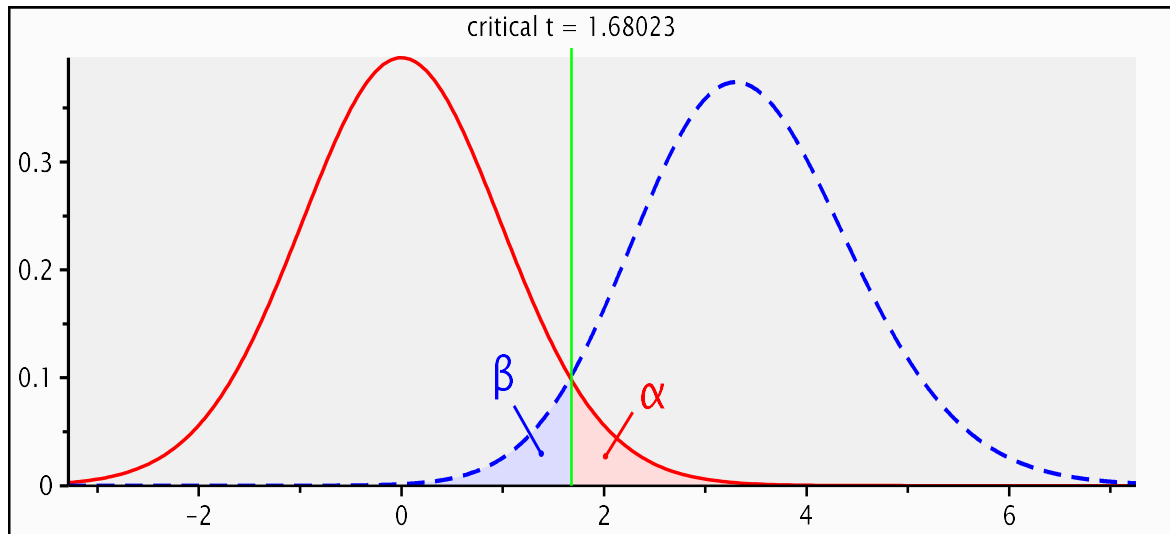**H1:** The awareness of new technologies used in healthcare industry among the patients is high (Mean score > 3)

4.0 Health care Industry Model
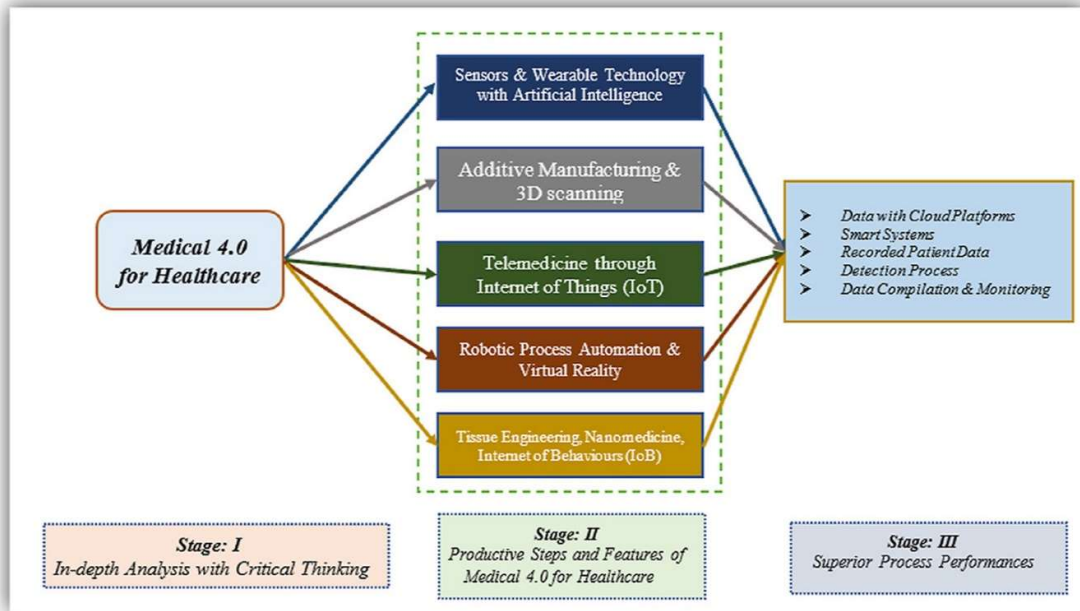
Research Methodology:

The Primary Research carried out included a Structured Questionnaire that has been designed to be administered on a sample of 200 respondents (patients suffering with different ailments) Descriptive research design has been used for this research study. The sample size selected for the study is 200 Patients suffering from various diseases (heart, kidney, liver, lungs, cancer, etc).

The Sampling technique used for this research study is non - probability purposive sampling. Parametric one sample test has been used using R studio software. (As per required sample to run one sample t-test one tailed=45) The secondary research for the study has been drawn from peer reviewed journals, magazine and newspaper articles and internet articles.

Data Analysis:

The Data Analysis has been done using the sample t test. The interpretation of the data findings reveal that the patients and the healthcare workers were aware of most of the innovative technologies, however, some technologies like Robotics and Data Breach Protection have exhibited low awareness levels.

One sample t test

Items	t – statistics	P – value	H1: Awareness of New technology used in healthcare industry among the patients> 3
Telemedicine (Remote medical care through technology)	20.98	0.000	High Awareness
Block chain (used for accuracy of patient data)	19.87	0.000	High Awareness
Augmented reality (facilitating improved medical visualization, training, and patient care)	18.00	0.000	High Awareness
Robotics (robotic systems and technologies to assist in medical procedures, surgery, rehabilitation, and patient care)	- 19.22	1	Low Awareness
3D printing (three-dimensional physical objects, such as medical devices, prosthetics, and even human tissues or organs, using additive manufacturing technology)	18.98	0.000	High Awareness
Virtual Reality (enhances healthcare through immersive experiences for training, education, and patient care)	17.21	0.000	High Awareness
Bioprinting (advancing regenerative medicine, transplantation, and drug testing)	20.45	0.000	High Awareness
Wearables (smart watch)	20.11	0.000	High Awareness
Internet of medical things (IOMT) (Interconnected medical devices, sensors, and systems that collect and exchange healthcare data via the internet)	18.77	0.000	High Awareness
Precision medicine (Personalized healthcare based on individual factors)	19.44	0.000	High Awareness

CRISPR (Gene-editing technology for precise DNA modifications)	– 20.01	1	**Low Awareness**
Symptom checker chatbots (Chatbots for symptom checking)	19.66	0.000	**High Awareness**
Data breach prevention (Safeguarding healthcare data from unauthorized access or breaches)	-18.29	1	**Low Awareness**
Nano medicine (nanoparticles and nanoscale materials are utilized for diagnostic, therapeutic, and preventive purposes)	17.23	0.000	**High Awareness**
Artificial Intelligence (a computer systems that can perform tasks and make decisions similar to human intelligence)	19.83	0.000	**High Awareness**

Data Interpretation:

Parametric one sample t – test (one tailed) is applied to examine significant problem extracted though the exploratory research. It is seen that p – value < 0.05 and t statistics > 1.96 for Telemedicine, Block chain (used for accuracy of patient data), Augmented reality, 3D printing, Virtual Reality, Bioprinting, Wearables (smart watch) , Internet of medical things (IOMT) , Precision medicine , Symptom checker chatbots, Nano medicine and Artificial Intelligence have high awareness among the patients suffering from various diseases. Whereas CRISPR, Robotics and Data breach prevention have low awareness among the patients suffering from various diseases.

Scope for Future Research:

This research study primarily focusses on identifying the innovative technologies awareness levels among the patients; however, the ranking of the awareness levels has not been undertaken in this research study. Future research scholars can develop a scale to measure the ranking of various technologies and identify the awareness levels of each technology, accordingly the findings can bring out how the awareness levels can be improved for each technology.

Conclusion:

Telemedicine, blockchain for accuracy of patient data, augmented reality, 3D printing, virtual reality, bioprinting, wearables such as smartwatches, the Internet of Medical Things (IOMT), precision medicine, symptom checker chatbots, nanomedicine and artificial intelligence are highly recognized and understood by patients. These technologies have likely gained prominence due to their visible impact on patient care, ease of access, and widespread media coverage. Patients are aware of the potential benefits they offer, such as remote consultations, improved data security, enhanced diagnostics and treatment planning, personalized medicine, advanced biomedical applications and emphasizes the potential of AI to reshape the healthcare landscape, empowering patients with knowledge and fostering transformative advancements in medical practices.
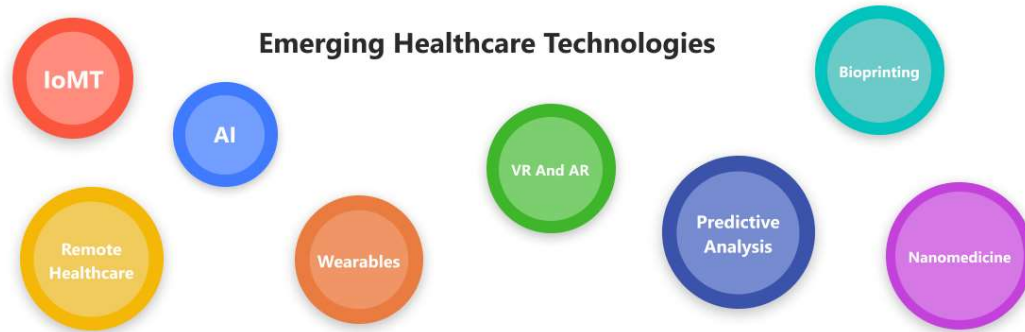
However, this research study also reveals that patients have relatively low awareness when it comes to CRISPR therapeutics, gene editing, robotics in healthcare, and data breach prevention. These emerging technologies may still be in the early stages of development or have limited exposure to the general public. Additionally, their complex nature and potential ethical implications may contribute to the lack of awareness among patients. To promote wider understanding and adoption of these technologies, it is crucial for healthcare providers, researchers, and the media to educate patients about their benefits, risks, and ethical considerations. By fostering increased awareness, patients can become better informed and actively engage in discussions and decision-making processes related to these cutting-edge technologies, ultimately leading to improved healthcare outcomes.

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Appendix:

Source: https://www.neoito.com/blog/healthcare-technology-trends/