



# KNOWLEDGE AND FEASIBILITY OF ARTIFICIAL INTELLIGENCE : A PHYSIOTHERAPEUTIC PERSPECTIVE.

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## **Abstract :**

**Background :** As use of AI in healthcare is increasing rapidly it is necessary to assess the knowledge of AI amongst physiotherapist and its feasibility in physiotherapy rehabilitation.

**Objective :** To assess the Feasibility and Knowledge of Artificial Intelligence amongst physiotherapist using a self made questionnaire.

**Methods :** An observational cross sectional study was used. A total of 136 physiotherapist were included in the study. A self made questionnaire consisting of 3 sections was administered to the physiotherapist using Google forms to assess their knowledge of AI and its feasibility in clinical practice.

**Results :** It was found that 64 % physiotherapist had knowledge regarding AI and 70 % physiotherapist thought that AI is a feasible option in physiotherapeutic rehabilitation in India. The p value found was 0.05 and t test value was 2.23 which means that data was significant.

**Conclusion :** Hence this study concludes that there is knowledge and feasibility of Artificial Intelligence amongst physiotherapist. AI must be included in educational curricula in order to improve students understanding of the technology.

**Index Terms :** Artificial intelligence , Physiotherapy, clinicians , academicians, health care , Rehabilitation.

## I. INTRODUCTION

The term artificial intelligence was coined by John McCarthy at a conference held in Dartmouth College in 1955<sup>[1]</sup>

AI is a multidisciplinary field of study that tries to understand, characterize, and replicate intelligence and cognitive processes using computational, mathematical, logical, mechanical, and biological ideas and methods<sup>[2]</sup>

This is a fairly generic and includes a variety of tasks, including abstract reasoning and generalizing about the world, puzzle-solving, goal-setting, moving around in the real world, recognizing objects and sounds, speaking, translating, carrying out social or professional transactions, engaging in creative work (such as writing poetry or art), and operating robots. To keep it simple, though, if you can design a really sophisticated software that, say, exhibits human-like behavior, it can be an AI process. Recent technological advancements have been greatly aided by artificial intelligence<sup>[3]</sup>

Researchers are studying and examining the practical consequences of using such technologies as artificial intelligence (AI) in diverse health care research disciplines nowadays. In rehabilitation, AI has been applied to improve patient care by helping physical therapists (PT) conduct thorough assessments, forecast patients performance, or make diagnoses. More AI applications in healthcare and rehabilitation have been found through study, including problem-solving, x-ray diagnosis, planning therapy protocols, online consultation and physical patient manipulation. These are all essential aspects of professional physical therapy practice that AI can perform. It is important to note that many physical therapy practices might be automated using AI technologies. In the study by Brougham and Haar, futurists have mentioned that by 2025, smart technology, artificial intelligence, robotics, and algorithms may replace a third of the employment that exist today.<sup>[2]</sup>

Growth of AI based technology and research has grown due to three main characteristics which are as follows;- first is the pervasiveness of affordable computation. The second being availability of large data sets, which machine learning algorithms must be trained on. Third is the creation of better programming techniques, among other high-tech algorithms. Practically, AI tools may not completely replace physiotherapist, but they can help them get better outcomes and accuracy in the medical profession.<sup>[4]</sup>

In places like rural and distant areas, where human resources are scarce, AI could be very beneficial. In India, the COVID-19 outbreak was managed with the aid of AI technologies. It has aided in the early detection of COVID-19 cases, the coronavirus's containment, contact tracing, the imposition of quarantines and social seclusion, the tracking of suspects, the tracking of the pandemic, the treatment and remote monitoring of COVID-19 patients, the development of vaccines and medications, and other activities. India faces numerous challenges in implementing AI-powered healthcare. The lack of open sets of medical data, unstructured data sets, interoperability concerns, inadequate analytical tools that could handle big data, restricted funding, poor infrastructure, a lack of AI-trained workers, regulatory flaws, an unsuitable regulatory framework, and issues connected to data privacy are one of the biggest obstacles for AI driven healthcare.<sup>[1]</sup>

In near future the physiotherapy clinical practice would be more patient centered, and the ultimate decisions would be taken up by the patients and not the therapists. Precision in the clinical practice would be greatly improved and errors would be reduced. Evaluation, assessment would be greatly eased because of use of technology like Machine Learning. More than 2 billion people are suffering from chronic diseases like osteoarthritis, stroke, parkinsonism which require physical rehabilitation on regular basis; but physical therapy is expensive and requires a lot of investment of time and money. In new age; pandemics may come, and we need to be ready to face and overcome the challenges imposed by it. AI may prove to be boon by helping and assisting the healthcare sector by reducing its workload and providing excellent healthcare facilities in less time. But physiotherapist lack knowledge regarding the various technologies of AI which may help in improving rehabilitation process and provide better outcome for the patients.<sup>[4]</sup>

The subdomains that make up the field of artificial intelligence are shown in below table :-

TECHNOLOGY	DEFINITION	APPLICATION
NATURAL LANGUAGE PROCESSING ( NLP )	It is the process to comprehend and computationally analyse verbal statements . It involves two sub domains. 1) Natural language generation 2) Natural language Processing	Machine Translation Text Categorisation Information Extraction
MACHINE LEARNING	The use of software algorithms to identify patterns in enormous datasets. Types of Machine Learning:- Supervised learning Unsupervised learning Semisupervised learning Reinforcement learning	Analysis of clusters of data.
DEEP LEARNING	Deep Learning is a collection of machine learning techniques that draws its inspiration from the distributed information processing and transmission seen in a network of biological neurons. Types :- Neural Network Recurrent neural network Conventional neural network	Medical image analysis Developing plan of treatment Detection of the disease
VISION AND PERCEPTION	Image & signal processing algorithms help in processing large amounts of data from images and signals.	human kinematic data or a collection of joint locations
EXPERT SYSTEMS	It helps to resolve issues by reasoning and helps in decision making. •Rule-Based Expert Systems, • Frame-Based Expert Systems, •Fuzzy Logic-Based Expert Systems, • Expert Systems Based on Neural Networks	Solving problems with pre input knowledge Used for reasoning and concept building. Detection and prediction of a condition
ROBOTICS	It is a branch of technology that deals with design, construction , operation and application of robots.	restoration of lost joint motion , assisting, monitoring and analysing of data during treatment.

Figure 1 Subdomains of artificial intelligence [7,8,9,10]

## 1.1 APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN PHYSIOTHERAPY:- [2]

**In Wearable gadgets and mobiles :-** Smart watches and intelligent mobiles are two examples of wearable technology that can be used for gathering contextual data that can be used for rehabilitation and health-related data. This has the benefit of keeping wearers in close proximity for a longer period of time, who can be easily engaged via a touch sensor. Wearable technology is known to have fall detection systems with high-tech sensors that are made to detect falls and inform users, caretakers, and medical staff. In rehabilitation services leveraging AI, a wider range of patient populations can now access health-related information point-of-use tools, clinical decision support tools, medical imaging, and mood and behaviour trackers like pain or incontinence dysfunctions.

**Intelligent virtual agents:-**These are animated computers that contain virtual characters in any form, including those that resemble humans. Software that permits text or chat communication between the virtual image and the person, as well as the ability to interpret, reason, and occasionally express emotions, is planned to be included.

**Application of virtual and augmented reality games for artificial intelligence rehabilitation:-** Virtual reality (VR) allows users to interact with a three-dimensional simulated environment while immersing themselves in it. In the virtual world, it can also be utilized to create a virtual human or other living thing that a person can interact with. To practice and record behavioural reactions for clinical evaluation and therapy objectives. In augmented reality, digitally created VR can be superimposed on a real-time video image of the "true world." This improves the participants style of thinking by making information about the user's immediate environment available for interaction and digital modification. Motor skills, pain management, and stroke rehabilitation have all benefited from the use of virtual reality and augmented reality techniques. Virtual reality (VR) was found to be useful in patients with traumatic brain injury (TBI) , neurocognitive disorders for researching, evaluating, and treating cognitive processes and functional capacities thus providing rehabilitation services, and physically preparing people in health care system. It is also useful post TKR in improvising proprioception.

**Intelligence prosthesis:-** Ossur created the Rheo and the power knees , and both have an AI system built in. He unveiled the first automated mechanical leg , while Ottoock unveiled the Genium X3 that enabled backward walking and offered simple, open mobility during gait training. This intelligent prosthesis has been demonstrated to include seven sensors and four central processing units (CPU), spread throughout the leg's body, which sense and assess data on the user's movement and environment to enable the lower limb to move naturally and in sync. An orthosis for the hand based on a brain-computer interface was developed in 2009 and used a cursor control interface and a simple linear discriminant analysis to classify electroencephalogram signals into three states: right, left, and nil, with associated commands of various hand movements.

**Application of artificial intelligence in wheelchairs:-** In order to enhance patient wellbeing, modern wheelchairs are using artificial neural networks in machine learning and intelligence technologies. The sophisticated wheelchair model is operated by hand signals that make use of the remote control's recurrent neural network. The AI-intend wheelchair proved particularly beneficial for stroke patients after discharge since it lets them do tasks independently without taxing the caregiver and also improves quality of life.

**Physically assistive robotics, orthotics and robotic exoskeletons :-**Robotics are employed in physical rehabilitation training to help elderly people, stroke victims, and transfers of vital medical equipment. Robots have been widely used in helping patients regain motion after strokes, increasing or replacing lost function, and facilitating mobility. By using a rehabilitation robot, therapists can avoid time-consuming training tasks, examine data gathered by the robot during training, and gauge the patient's level of recovery. Orthotics can both induce dynamic motions over the joint's range of motion and support a joint as it transitions from a static to functional posture. The upper extremities are helped to function via robotic exoskeletons. Four control types are frequently taken into account when treating motor or neuromotor function. By promoting neural regeneration, this robotic exoskeleton is useful in the treatment of stroke victims. When a physical therapist is unable to physically assist the patient, rehabilitation robots can be used to observe them at home. When a group of people is receiving the exercises from a therapist, it is also beneficial in easing their load.

**Treadmill-based exoskeleton robots:-** In this kind of rehabilitation robotics attaches to the human body in a wearable way that regulates movement while receiving treatment. Similar to Lokomat exoskeletal robotics, which are primarily utilized for gait training to aid people in performing the walking activity. As a result, during rehabilitation training, a normal gait pattern is necessary as a reference input to the control system, a training objective, and a rehabilitation evaluation standard. In order to help the elderly and people with lower limb problems move around, other treadmill robotics incorporate a weight harness with a lower limb exoskeleton. On the other hand, position control makes sure that the robot can accurately follow the desired location.

## II. RESEARCH METHODOLOGY

### 2.1 POPULATION AND SAMPLE

The target population chosen for the study were mainly physiotherapist . As this studies main focus is to find the knowledge and feasibility of AI amongst physiotherapist.. A sample of ( n=136) was calculated with 95 % confidence level and margin error of 5 % which was achieved in our study.

Following are details regarding the sampling method :-

- 1) Study Design: Observational Cross-sectional study
- 2) Study Type: Survey based
- 3) Target Population: Physiotherapists
- 4) Sample Size: 136
- 5) Sampling Method: Simple Random Sampling



- 6) Sampling Duration: 6 months
- 7) Study Setup: Clinics and Physiotherapy Rehabilitation centres in Pune city and Colleges of Physiotherapy in Pune.

Following is the population criteria :-

#### **INCLUSION CRITERIA:-**

1. Persuade Degree in Physiotherapy (minimum 4½ years)
2. Both male and females are included.

#### **EXCLUSION CRITERIA:**

- 1) Diploma in Physiotherapy (DPTs)
- 2) Physiotherapists not giving consent.
- 3) Physiotherapy Students.
- 4) Physiotherapy Students/Interns perceiving UG Degree course.

#### **2.2 DATA AND SOURCES OF DATA.**

The data was collected using a self made questionnaire consisting of 3 sections and participants had to answer either yes or no. The questionnaire was validated by the experienced physiotherapists in the field of rehabilitation. The review and rating to examine and evaluate each survey question for its relevance, clarity, sequence, and concept was taken from the physiotherapist. Each Physiotherapist comments were thoroughly reviewed to improve accuracy, quality and validity of the survey questions. Before conducting the survey consent of the physiotherapist participating in the survey was taken. An electronic survey was conducted using Google Forms and distributed via WhatsApp, and E-mail in various hospitals and colleges of Pune City. Before distributing the survey minimum sample size was calculated and ( n= 136 ) was found. This indicates that sample size attained in this study ( n= 136 ) was sufficient to detect the effect. In addition the physiotherapists who were contacted were requested to forward the survey among the physiotherapist they know. The Physiotherapists were asked to select an appropriate option from the questionnaire. The data was collected and analyzed and appropriate results was found out.

#### **2.3 STATISTICAL ANALYSIS**

Following the data collection, the data was coded and put into a Microsoft Excel 2019 spreadsheet. A statistician assisted in the analysis of the data.. The demographic features of the sample were described using descriptive statistics in terms of frequencies and percentages. Non parametric Unpaired t test were used to investigate the differences in PT perceptions regarding AI applications in health care and rehabilitation based on demographic characteristics. For statistical significance, a P value of less than  $\leq 0.05$  was considered and found in our study.

## 2.4 DESCRIPTIVE STATISTICS

**Table no 1 : Descriptive statistics of study variables.**

Years of experience	Percentage	Mean (XI)	SD	Variance	Coefficient of variance	P - value	t-test value
0 to 5	68.38 %	2.5	4.07	16.59	80.59	0.05	2.23
5 to 7	8.82 %	7.5					
7 to 10	8.085 %	7.5					
10 to 15	11.02 %	12.5					
15 and 23	3.67 %	19					

A total of 136 participants from different workplace participated in the study. The mean age of participants was 27 years. With regard to respondents gender, 16% participants were male; whereas 84% were female. Most of the participants 63% were working in clinical sectors, mainly at outpatient clinics and hospitals, and 38% were academicians. Nearly 40% of the participants were there who have completed BPT, whereas more than 58% have completed MPT. Only 2% of the participants were PhD qualified. According to years of experience 68% had an experience between 0 to 5 years; about 9% had an experience between 5 to 7 years, nearly 8% had an experience between 7 to 10 years; 11% had an experience between 10 to 15 years, and only 4% had an experience of 15 years and above. The mean experience amongst physiotherapists was 5.05 (S.D 4.07), variance was 16.59 and coefficient of variation was 80.59, p value of the data was (0.05).

In the study females were the majority population. Amongst academicians, male academicians were 4%, female academicians were 33%. In the study majority population was of clinicians, females were 51% but males were 12%. In female clinicians MPTs (Postgraduates) were 21%, whereas BPT were 30% and only 2% were PhD. In male population MPTs (Postgraduates) and BPT were of equal number 8 each i.e 6%.

### **Knowledge of AI Amongst Physiotherapist :-**

There were total of 9 questions in the section of Knowledge of AI; total of 136 participants participated in the survey. Total number of YES obtained was 64%, NO responses in total were 36%, which means more than half of the physiotherapists 64% had knowledge regarding AI. Graph 3 and table 3 represents percentage of knowledge of total population. The results were consistent with those of a study that was conducted in Saudi Arabia by Alsobi et al 2022, which reported moderate knowledge about AI applications in PT's [1].

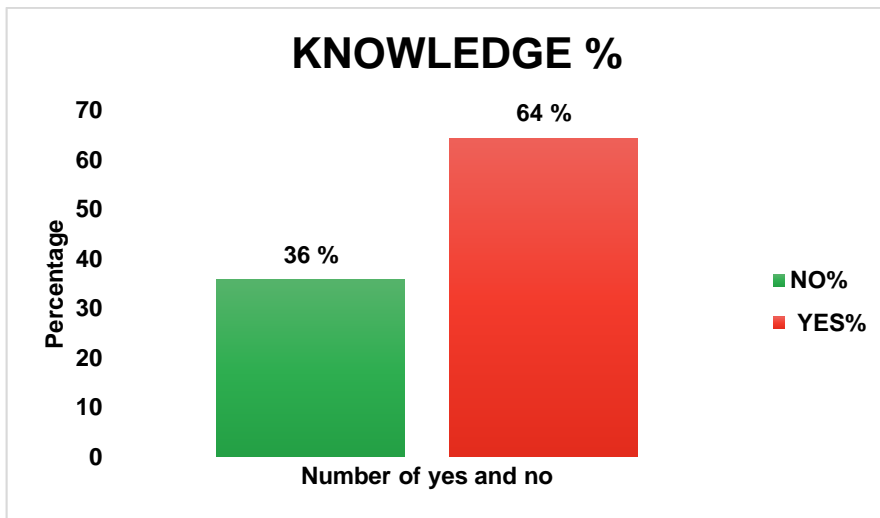
### **Feasibility of AI in general :-**

There were total of 23 questions in the section of Feasibility of AI; total of 136 participants participated in the survey. Total number of YES obtained was 70%, NO responses in total were 30%, which means more than half of the physiotherapists 70% had a view that AI is a feasible option in physiotherapy field. Graph 4 and table no 4 represents total percentage of feasibility of total population.

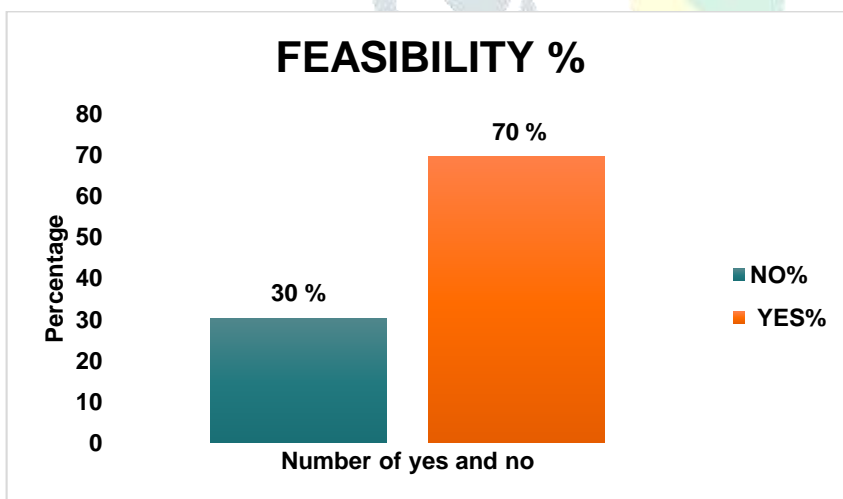
Table no. 2

Physiotherapist	Sample Size (n)	Percentage (YES )%	Sample Size (n)	Percentage (NO) %
knowledge	787	64 %	437	36 %
feasibility	2179	70%	949	30%

Graph 1



Graph 2

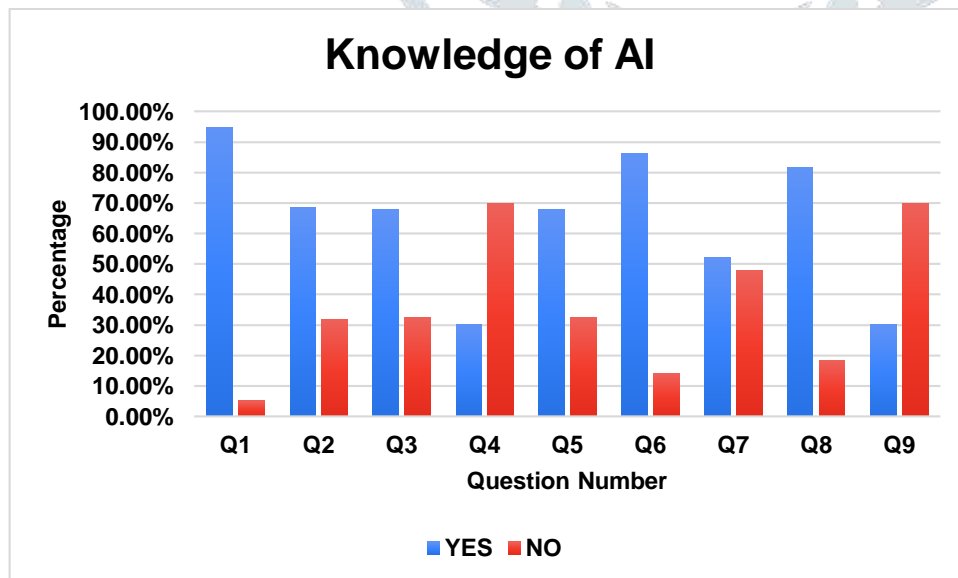


**Interpretation :** Graph 1 shows that 64 % of physiotherapist have knowledge regarding AI. Graph 2 shows that 70 % of physiotherapist think AI is a feasible option in physiotherapeutic perspective.

Table no 3 : Knowledge of AI ( Section 1 )

SR.NO	QUESTIONS	YES %	NO %
1.	Do you know what is artificial intelligence ?	95 %	5 %
2.	Do you know the use of artificial intelligence in assessment, evaluation and rehabilitation in physiotherapy practice?	68 %	32 %
3.	Do you know what is machine learning and its various applications ?	68 %	32 %
4.	Do you know what is natural language processing, Deep learning and expert systems ?	30 %	70 %
5.	Do you know the use of AI in intelligent prosthesis ?	68 %	32 %
6.	Do you know about robotics and its use in rehabilitation?	86 %	14 %
7.	Do you know what is the use of artificial intelligence in treadmill based exoskeleton robots ?	52 %	48 %
8.	Do you know the use of AI in gait analysis ?	82 %	18 %
9.	Do you know the use of ambient intelligence and its applications?	30 %	70 %

Graph 3



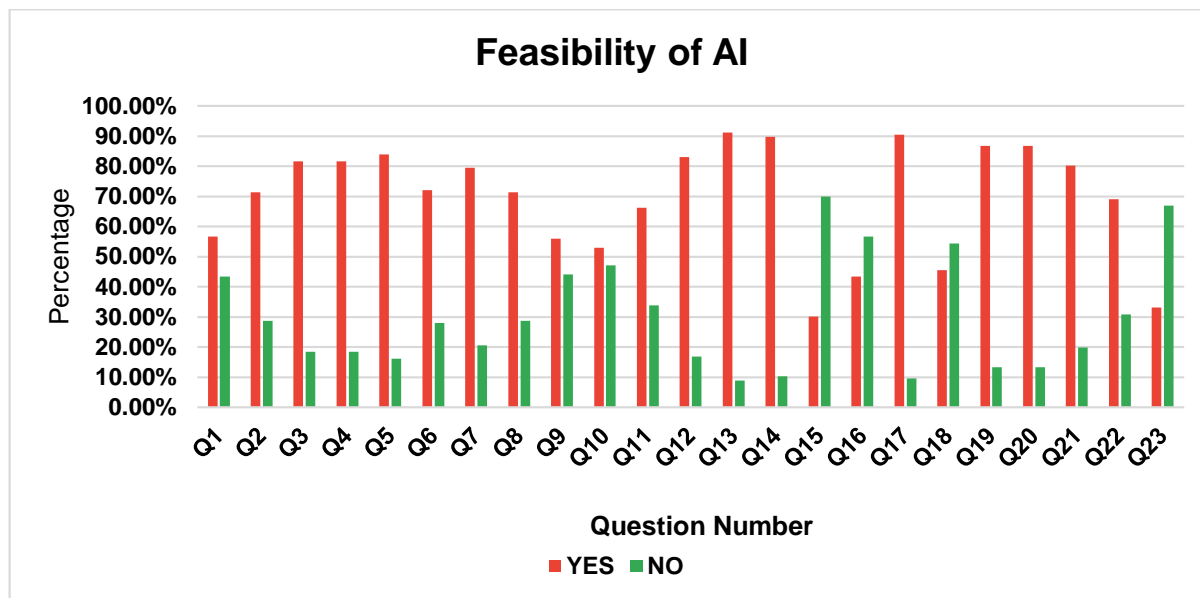
**Interpretation :-** Graph 3 and table no 4 shows percentage distribution of knowledge of AI.



Table no 4 : Feasibility of AI ( Section 2 )

SR NO.	QUESTION	YES	NO
1.	Is artificial intelligence a feasible option for physiotherapeutic rehabilitation in India?	57 %	43 %
2.	Is artificial intelligence effective in assessment and evaluation of patients ?	71 %	29 %
3.	Will artificial intelligence affect outcome measures in physiotherapeutic rehabilitation?	82 %	18 %
4.	Will artificial intelligence affect quality of life of patient?	82 %	18 %
5.	Will artificial intelligence impact clinical practice of a physiotherapist?	84 %	16 %
6.	Will the errors and mishandling of patients by physiotherapist be reduced?	72 %	28 %
7.	Will physiotherapist be able to decide the progression of protocol using artificial intelligence ?	79 %	21 %
8.	Will artificial intelligence be helpful in early diagnosis of a condition?	71 %	29 %
9.	Will artificial intelligence reduce the no. of days required for recovery ?	56 %	44 %
10.	Will artificial intelligence input data be sensitive regarding cultural or societal differences?	53 %	47 %
11.	Is biasing of decision by artificial intelligence to interpretate a set of data possible?	66 %	34 %
12.	Will artificial intelligence affect education system ?	83 %	17 %
13.	Will technological difficulties / glitches be faced in implementation of artificial intelligence in rehabilitation?	91 %	9 %
14.	Do you think special investment is required for implementation of artificial intelligence in rehabilitation in India ?	90 %	10 %
15.	Is artificial intelligence a cost effective source of rehabilitation in India ?	30 %	70 %
16.	Is artificial intelligence a reliable source of rehabilitation in India?	43 %	57 %
17.	Is special training for implementation of AI based machines required ?	90 %	10 %
18.	Will artificial intelligence match the effectiveness of supervised physical therapy in patients?	46 %	54 %
19.	Will artificial intelligence have scope in rehabilitation of various age groups?	87 %	13 %
20.	Is standardization of artificial intelligence based technology required?	87 %	13 %
21.	Will artificial intelligence be effective in pandemic like situations?	80 %	20 %
22.	Should artificial intelligence technology be used as a supplement to traditional treatment approach?	69 %	31 %
23.	Will technology replace physiotherapist in future?	33 %	67 %

Graph 4



**Interpretation :** Table no 4 and graph 4 shows percentage distribution of Feasibility of AI .

### III. DISCUSSION

This study's primary goal was to get a quick overview of PT's knowledge and general opinions and perceptions about the use of AI in healthcare and rehabilitation. This study evaluated several variables, such as gender, experience, industry of employment, and level of education.

To our knowledge, this is one of the study conducted to look at PT' perceptions of AI technology and how they relate to various explanatory factors. The study's conclusions may contribute to our understanding of the reasons to raise PTs awareness of the benefits and applications of AI technology in clinical practice.

In first section of questionnaire i.e knowledge of AI it showed that 95 % PTs know about AI in general , following questions consisted of specific technology of AI and their use in rehabilitation and its individual percentage are represented in graph 3 and table no 3. Most of the PT's know about machine learning which is a finding similarly found in a study in Jordan <sup>[19]</sup> .The usefulness of machine learning and its application in musculoskeletal physiotherapy was reviewed in a literature by Aishwarya chaudhari et al ( 2022 ) <sup>[16]</sup>. Similar results were found where PT's knowledge regarding assessment , and evaluation was found out in our study . Natural language processing , deep learning and expert systems are important technology of AI required in healthcare as analyzed by Pascal muam Mah et al ( 2022 ) in his study. This was also said by Suvarna Ganvir et al in her study <sup>[5]</sup> .But in our study only 70 % PT's didn't have knowledge regarding natural language processing, deep learning and expert systems and ambient intelligence. Ambient Intelligence is another technology which will be very beneficial in future in healthcare as said in by Giovanni Acampora et al ( 2013 ) .

AI is going to be a very useful technology in future in physiotherapy field as rightly said by Suvarna Ganvir et al ( 2022 ) <sup>[5]</sup>. Hence , it is necessary to increase knowledge of AI among physiotherapist.

In section 2 which consisted of Feasibility of AI physiotherapist view regarding AI was found to be 70 % positive . Graph 4 and table no 4 represents section 2 of the questionnaire in terms of percentage. In this study it was found that AI would affect outcome measures and improve quality of life of patient <sup>[2] [5]</sup> In a study by Aishwarya chaudhari et al ( 2022 ) which stated that "Stroke

recovery predictor” is one such application developed by an Indian physiotherapist to predict the extent of recovery of stroke patients based on the duration of hospital stay, duration of stroke and barthel index etc. This can be of great help in guiding rehabilitation process and affect the outcome measure<sup>[16]</sup>. In our research it was also found that 72 % PT's had a view that errors and mishandling will be reduced and productivity and accuracy will be increased in clinical practice which will depend on amount of data available<sup>[16]</sup>.

Similarly, another study found said that AI will have a great impact in clinical practice of physiotherapist as it will help in assessment, evaluation, diagnosis and treatment by using various AI technologies such NLP, VR, machine learning example parkinsonism<sup>[5]</sup><sup>[16]</sup> which was consistent with our data. Education curriculum must include various AI technologies as it will enhance knowledge of AI amongst physiotherapy students and revolutionize education system<sup>[19]</sup> as our study suggests i.e. 84 % believed.

Artificial Intelligence have scope in various age groups 91 % of PT's view is this; AI is implemented in paediatric and geriatric group such as in stroke, parkinsonism, pulmonary hypertension in paediatric age etc.<sup>[17]</sup><sup>[18]</sup>.

Technological difficulties and substantial amount of investment will be required in implementation of AI in India as there is inadequate cloud computing infrastructure and software incompatibility in India and many diagnostic equipment are imported from foreign countries. Particularly in Indian context where data is usually government owned, access of such data by private players for their own use raises a lot of concerns. Cybersecurity is also a major concern. Lot of confidential health information available online across the cloud computing environment poses a risk of data security and hence standardization of AI is required so that unnecessary harm to patient is avoided. Similarly special training will be required for implementation of AI as medical professionals lack skills necessary for its implementation so that sensitive health information is handled carefully and data theft is avoided. Biasing of the data and AI won't be sensitive regarding cultural or societal differences due to skewed data, inadequate infrastructure, diverse population and due to hand written health records in India; also AI will be helpful in pandemic like situations containment of areas, screening of patients, contact tracing, tracking of suspects, treatment and remote monitoring of COVID 19 cases etc these were the findings found in a study by Nirupam Bajpai et al (2021)<sup>[11]</sup>. In our study it was found that 91 % thought that technological difficulties will be faced. Special training and special investment for AI (90 %) implementation will required. Hence, AI is not a cost effective source of rehabilitation in India. 66 % PT's had a view that biasing of data is possible and 53 % thought that AI will be sensitive regarding cultural and societal differences which were the results in contrast to the above study. In pandemic like situations AI will be very useful 80 % PT's had a view. Another result found in our study stated that 82 % of PT's had a view that privacy of patient would be affected because of AI and 87 % thought that standardization of AI is necessary as privacy of patients is a major issue that physiotherapist might face in future<sup>[5]</sup>.

AI can be used as a supplement to traditional treatment in form of assistive devices or treatment such as physically assistive robotics and exoskeletons as seen in a study by Pattanshetty RB et al (2022)<sup>[6]</sup>. The results of our study signifies 69 % PT's agree that AI should be used as a supplement to traditional treatment approach.

Our studies found that 55 % of PT's had a view that AI will not match the effectiveness of supervised physical therapy and AI will not replace physiotherapist in future. The results were consistent with that found in Saudi Arabia<sup>[2]</sup> and in Jordan<sup>[19]</sup>.

## IV. CONCLUSION

- The study concludes that 64 % of physiotherapist had knowledge about Artificial Intelligence.
- It also concludes that 70 % of physiotherapist think that Artificial Intelligence is a feasible option in physiotherapeutic rehabilitation.
- Hence this study concludes that there is knowledge and feasibility of Artificial Intelligence amongst physiotherapist.

## V. LIMITATIONS OF THE STUDY

- Physiotherapist who are Academicians as well as Clinicians this third category can be included.
- The answers of questions had option Yes and No but in many questions physiotherapist needed a third option “ maybe” as they were confused.

## VI. CLINICAL IMPLICATIONS

- 1) AI has been extensively used in Physiotherapy assessment e.g gait analysis with the help of video analysis driven by machine learning. It helps in detection of gait abnormalities and underlying pathology e.g in Parkinsonism.
- 2) AI also helps in early detection of falls who are at risk by constant gait analysis and changes in gait pattern.
- 3) Smartphones and smart watches are very useful in detection of various parameters like pulse, oxygen saturation, falls detection by various sensors and stress levels.
- 4) People with physical or visual limitations can interact verbally with and operate devices with Natural Language Processing (NLP). Eye trackers can be used by respirator users to do the same. It has proven to be quite helpful in life-threatening situations like fall detection and resuscitation. NLP will also help to automatically generate reports, clinical summaries, protocols of treatment , information sheets and prognostication charts.
- 5) Robotics are employed in physical rehabilitation training to help elderly people, stroke victims, and transfers of vital medical equipment. Robots have been widely used in helping patients regain motion after strokes, increasing or replacing lost function, and facilitating mobility. By using a rehabilitation robot, therapists can avoid time-consuming training tasks, examine data gathered by the robot during training, and gauge the patient's level of recovery.
- 6) Dextrous soft robots can be used to provide simple mobilization in patients with Msk dysfunction.
- 7) Machine learning is a technology which can be used in diagnosis, progression of treatment and setting protocols.
- 8) Ambient intelligence can be used in treatment of stroke patients , TBI and assessing intensity of pain by creating real time stimulated environment which respond to human presence and according to individuals needs.

## VII. FUTURE SCOPE OF STUDY

- 1) The education system must include AI and its sub domains in the curriculum to enhance knowledge among students as it will create basic understanding of these technologies and its implementation practically.
- 2) Experimental studies would help PT's in future for better treatment protocols its progression and outcome measures analysis.

## VIII. ACKNOWLEDGEMENT

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