International Journal of Yoga, Physiotherapy and Physical Education
www.sportsjournal.in
ISSN: 2456-5067
Received: 16-12-2025, Accepted: 15-01-2026, Published: 30-01-2026
Volume 11, Issue 1, 2026, Page No. 33-40

# Knowledge, attitude and practice of robotic technology in neurophysiotherapist for neurophysiotherapy rehabilitation

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**Abstract**

**Background:** Introduction Robotic technology has opened new therapeutic approaches as an innovative tool in neurorehabilitation, which offers repetitive task-specific, high-intensity training for individuals with neurological pathologies. Even though it is widely accepted all around the world, but its knowledge and usage remain limited to neuro physiotherapists in India. This research was to evaluate the knowledge, attitude and practice (KAP) level of robotic technology among Neurophysiotherapists in Mumbai & Navi-Mumbai.

**Method:** An observational cross-sectional study was undertaken in 100 postgraduate neuro-physiotherapists with the application of a self-designed and expert validated questionnaire through e-platforms. The questionnaire had three components: knowledge, attitude and practice which were analysed by descriptive statistics in Micro soft Excel 2021.

**Results:** 65 of the respondents reported a high level of familiarity with robotic technology and technique (only 32% had formal education). People were familiar with devices, such as Lokomat (78%) and ReWalk (54%), and had a strong desire for either advanced training (79%). Attitude scores Overall, attitudes were positive; respondents generally felt that robot therapy is beneficial to the patient and more precise than other types of therapies. Yet, robotics use was low; 63 [28%] rarely or never used robotics. Key barriers to implementation were high cost (69%), technical maintenance problems (52%) and lack of training (36%) The most common conditions for which robotics was used were stroke (70%) and spinal cord injury (52%).

**Conclusion:** Cognition and use A favourable attitude towards robotics is shown by neurophysiotherapists, with good knowledge of robotic technology but limited practical application faced with financial, technical and educational barriers. The study highlights the importance of standardized training schemes, increased availability and cost-effective development of novel technologies to support implementation of robotics in neurorehabilitation.

**Keywords:** Robotic technology, neurorehabilitation, knowledge attitude and practice, physiotherapy, neurophysiotherapist, rehabilitation robotics, India

## Introduction

"A re-programmable, multifunctional manipulator designed to move parts or specialized devices through variable programmed motions for the performance of a variety of tasks" is the definition of a robot given by the Robot Institute of America [1]. "The integration of enabling technologies and attributes embracing manipulators, mobility, sensors, computing (IKBS, AI) and hierarchical control to result ultimately in a robot capable of autonomously complementing man's endeavors in unstructured and hostile environments." is another definition of advanced robotics that they provided [1].

Robotic systems can concentrate on a variety of approaches, including challenge-based (exercises involving more difficult tasks or challenges), assistive (like the exercises that physiotherapists implement), haptic stimulation (related to the practice of daily life activities), and coaching (help, motivation, and promotion of motor skills learning) [4].

Rehabilitation usually takes place in four stages. To determine the type and extent of impairment, the patient must first undergo an assessment. Secondly, to guide treatment, the therapist must establish goals and create an intervention to help achieve them. Third, the intervention needs to be put into practice, which frequently means practicing motions with assistance repeatedly. After the intervention, the patient needs to be evaluated, and the next round of goals needs to be established. Decades ago, it was realized that robotics may help and expedite the rehabilitation process [5].

Neurorehabilitation is an advanced medical procedure that minimizes functional alterations and aids in recovery from injuries to the nervous system. The goal of neurorehabilitation is to increase patient independence by emphasizing their abilities and dispositions [1]. To stimulate neuronal plasticity and muscle activation synergy through targeted repetitive motor coordination exercises, robotic and electromechanical systems are built for rehabilitation purposes [3].

Robots possess levels of speed, accuracy, power, and endurance over time that are not possible for humans to match, making them ideal for accurate quantitative measurements of physical attributes across a broad range of variance. In contrast, humans possess traits like flexibility and adaptation, communication without the need for a code, high-level information processing, and the ability to identify and respond to weak and otherwise undetected major sensory inputs. These traits are not present in robots [7].

When it comes to high intensity and frequency of exercise, robotic rehabilitation is superior to traditional care. It can also generate more appropriate movements and forces during training and continuously monitor exercise performance to more effectively match the level of treatment to the patient's needs [2].

Rehabilitation robots are commonly classified into two groups based on their mechanical structures: exoskeleton (Exo) and end-effector (EE). The joints of EE robots, which are attached to patients at a single distal point, are not identical to those of humans. Since Exo robots are attached to patients at several sites and have joint axes that mirror those of humans, they resemble human limbs [6]. Through telerehabilitation, automation of therapy may allow for the simultaneous treatment of numerous patients possibly even remotely in the comfort of their own homes [5].

In 1989, a new chapter in the history of neurorehabilitation robotics began with the construction of the MIT-MANUS, which had its first clinical testing in 1994.With the creation of the Lokomat in 1994, advancements in lower extremity rehabilitation robots were initiated. This device employed robotic gait orthosis in conjunction with body weight supported treadmill-training [7].

## Methodology

### Study Design and Setting

The current research design of the cross-sectional study was applied to assess the knowledge, attitude, and practice among neurophysiotherapists on the use of technology of robotics. The research was conducted in Mumbai and Navi Mumbai, and a total of 100 people were selected for participation using the snowball sampling technique. The research included neurophysiotherapists working in several clinical environments such as hospitals, private clinics, rehabilitation centers, patients' home settings, and academic and research institutions.

### Data Sources and Study Population

The study population was clinical physiotherapists with specialization in neurorehabilitation having at least one year of clinical experience. Physiotherapists of both genders were included in the study. Physiotherapy students, interns, and unwilling participants were excluded. Information was collected by a self-designed questionnaire that was expert-validated. The questionnaire had three domains to collect information regarding knowledge, attitude, and practice regarding robotic technology in neurorehabilitation. The investigator prepared a questionnaire prior that was then built-in google forms for electronic dissemination through various social media and email. Each participant also received an information sheet and a consent form before participation. The responses were recorded and analysed using Microsoft Excel 2021 through descriptive statistics.

### Ethical Considerations

Study has been approved by Institutional Ethics Committee of TMV's Lokmanya Tilak College of Physiotherapy, Kharghar. The participants received an explanation regarding the goals and procedure of the study before data collection. All participants provided written and informed consent. Participation was non-compulsory and the participants' data were kept confidential and anonymous during the study.

### Outcome measures

A Self-made questionnaire (using yes or no questions and a 5-point Likert scale) validated by experts made using online survey tool (google forms) which was circulated through online survey platform such as WhatsApp, email etc.

The survey consists of demographic details (name, age, contact details) along with three domains which includes questions related to knowledge, attitude and practice

### Statistical Analysis

### Demographic Details

**Table 1:** Sex Wise Distribution of The Respondents

| Gender | Number | Percentage |
|---|---|---|
| MALE | 24 | 24% |
| FEMALE | 76 | 76% |

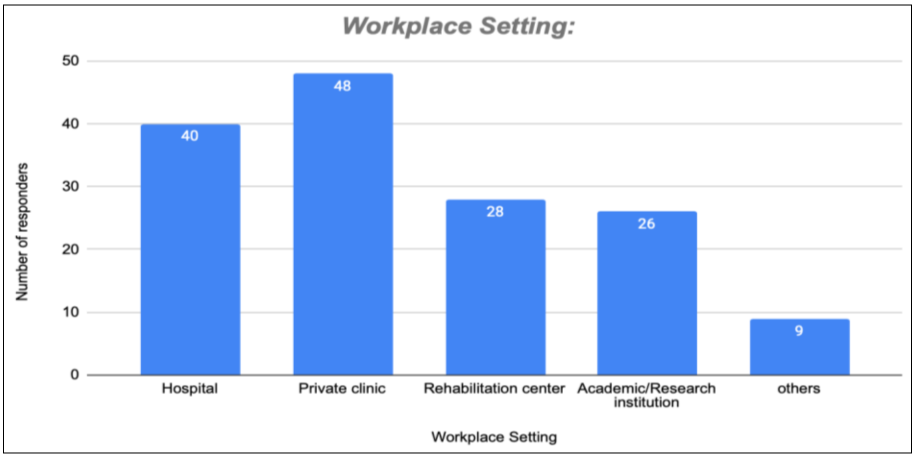
**Interpretation:** Majority of the respondents were female (76%)

**Table 2:** Age Wise Distribution of The Respondents

| Age Range | Number | Percentage |
|---|---|---|
| 20-29 | 75 | 75% |
| 30-39 | 22 | 22% |
| 40-49 | 3 | 3% |

**Interpretation:** Majority of the respondents belonged to age group of 20-29(75%)

### Knowledge




**Graph 1:** Distribution of Workplace Settings Among Respondents

**Interpretation:** Most respondents were employed in private clinics (48) and hospitals (40), indicating these as the primary settings where robotic technology in neurorehabilitation is encountered. Rehabilitation centres (28) and academic/research institutions (26) also contributed notably, while a smaller number reported working in other setups (9) which included NGOs, home rehabilitation, freelancing etc.

**Table 3:** Distribution of Respondents According to Familiarity with The Concept of Robotic Technology

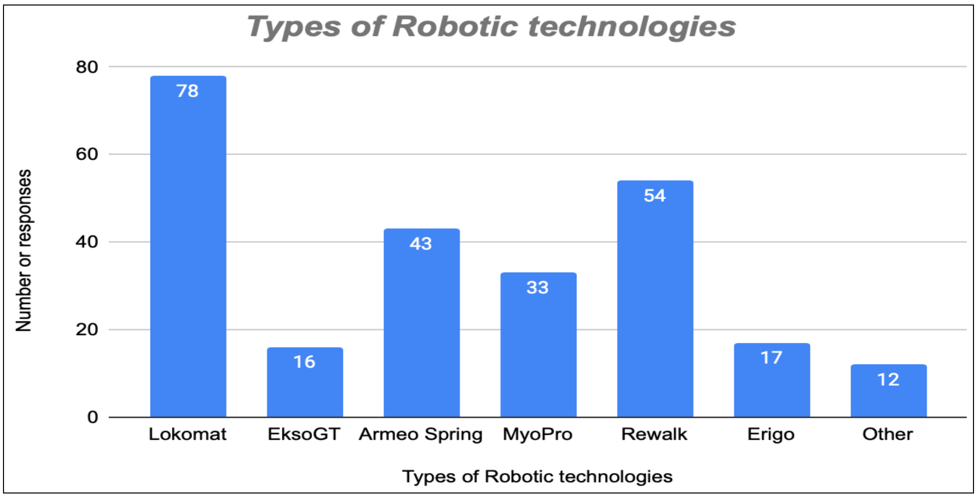
| | Number | Percentage |
|---|---|---|
| Very familiar | 65 | 65% |
| Neutral | 32 | 32% |
| Very unfamiliar | 3 | 3% |

**Interpretation:** Most respondents (65%) were very familiar with robotic technology in neurorehabilitation, while 32% were neutral and only 3% very unfamiliar, indicating generally high awareness.

**Table 4:** Distribution of Respondents Based on Receiving Formal Training or Education in Robotic Technology

| | Number | Percentage |
|---|---|---|
| YES | 32 | 32% |
| NO | 68 | 68% |

**Interpretation:** Most respondents (68%) reported not having received formal training in robotic technology, while only 32% have.



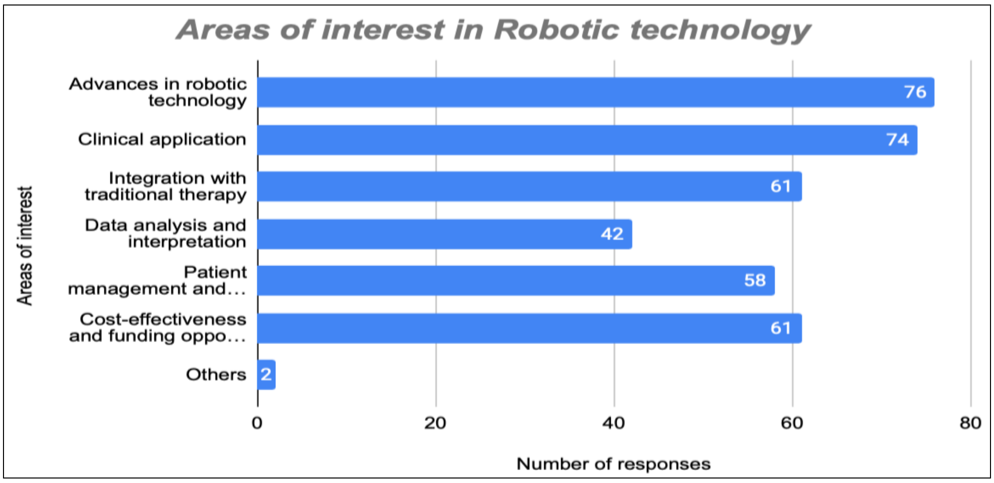

**Graph 2:** Types of Robotic Technologies Known to Respondents

**Interpretation:** Lokomat (78) and ReWalk (54) were the most recognized technologies, followed by Armeo Spring (43) and MyoPro (33). Awareness of Erigo (17) and EksoGT (16) was relatively low. In the 'Other' category (12), Rymo was most frequently cited.

**Table 5:** Respondents' Interest in Advanced Training on Robotic Technology

| | Number | Percentage |
|---|---|---|
| YES | 79 | 79% |
| NO | 8 | 8% |
| MAYBE | 13 | 13% |

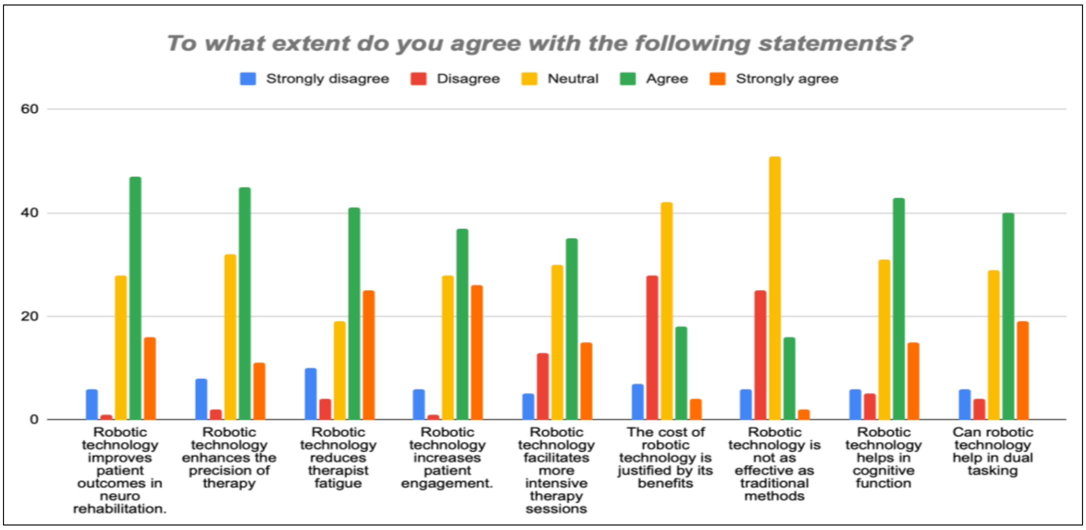
**Interpretation:** Most respondents (79%) expressed interest in receiving further training on robotic technology in neurophysiotherapy, highlighting a strong demand for professional development in this area. A smaller proportion (13%) were uncertain, while only (8%) indicated no interest.




**Graph 3:** Preferred Areas of Learning in Robotic Technology By The Respondants

**Interpretation:** Clinical application (76) and advances in robotic technology (79) were the most selected areas of interest. Integration with traditional therapy (65) and cost-effectiveness/funding (62) were also frequently noted, while patient management and safety (58) and data analysis/interpretation (44) received moderate attention. Only 2 participants mentioned other areas.

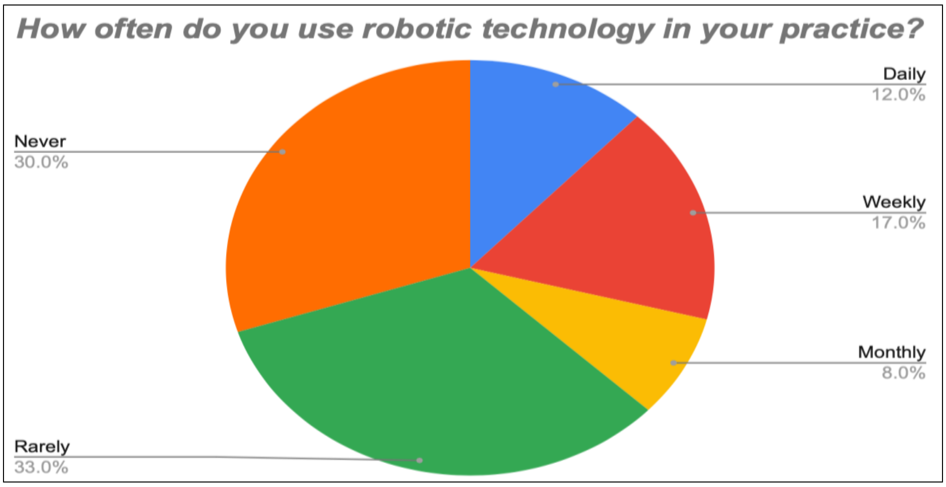
### Attitude




**Graph 4:** Attitude Towards Robotic Technology

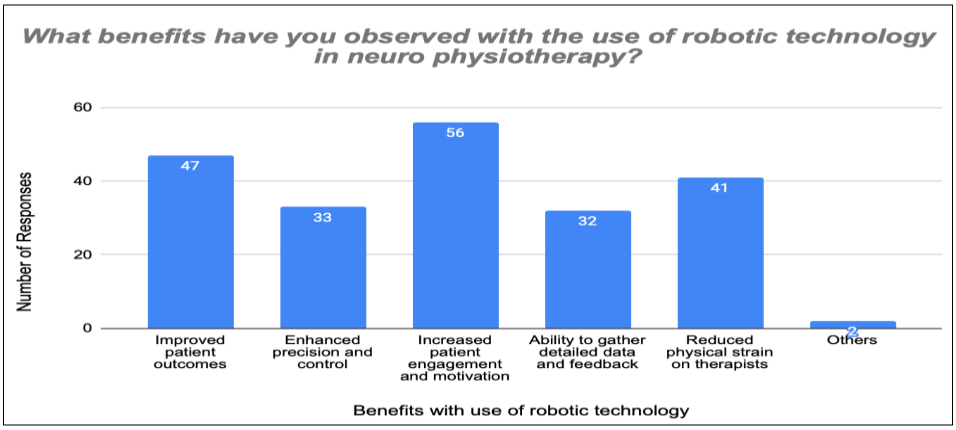
**Interpretation:** A large proportion agreed or strongly agreed that robotics improves patient outcomes, enhances therapy precision, increases engagement, and facilitates intensive sessions. However, opinions were mixed regarding its ability to reduce therapist fatigue, justify costs, and match the effectiveness of traditional methods. Responses related to cognitive function and dual tasking were more neutral, indicating areas where further evidence and training may be needed.

### Practice



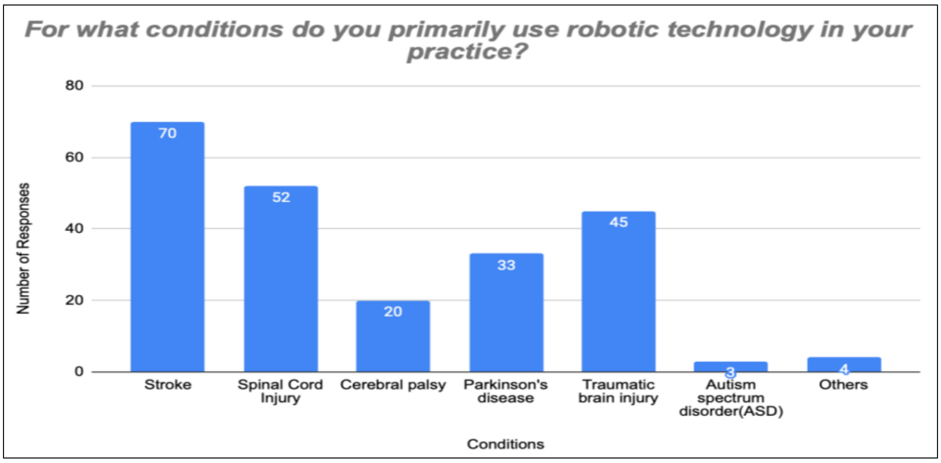

**Graph 5:** Frequency of Robotic Technology Use in Practice

**Interpretation:** Most respondents reported limited use of robotic technology, with 33 using it rarely and 30 never. Only a small proportion reported weekly (17) or daily (12) use, while monthly use was minimal (8). This indicates that although awareness is high, the actual frequency of clinical application remains low.



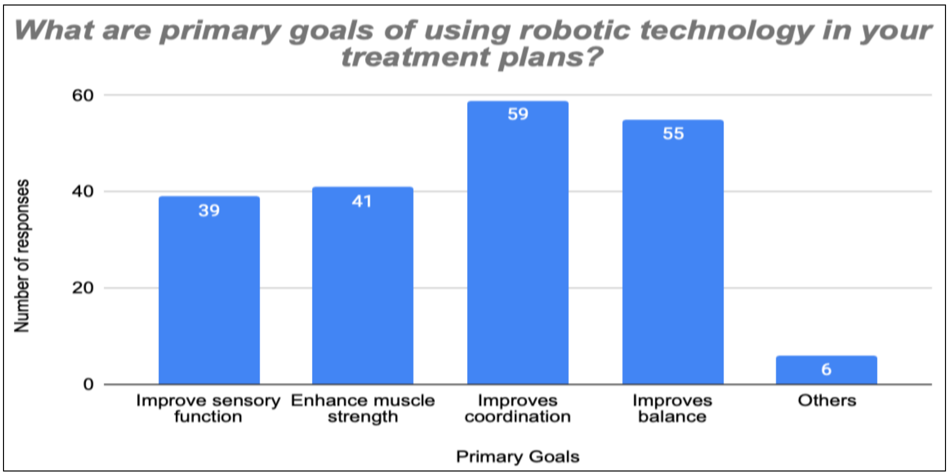

**Graph 6:** Graph Representing Observed Benefits of Robotic-Assisted Therapy

**Interpretation:** Increased patient engagement and motivation (56) was the most frequently reported benefit, followed by improved outcomes (47) and reduced therapist strain (41). Data collection/feedback (32) and enhanced precision (33) were also recognized, while only 2 respondents mentioned other benefits. This highlights that robotic technology is valued most for its role in motivating patients and improving clinical results, along with reducing therapist workload.



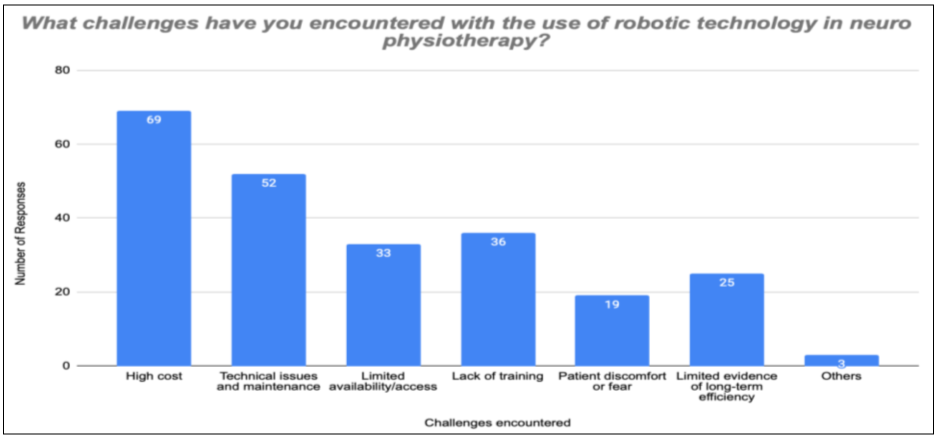

**Graph 7:** Conditions Where Robotic Technology Is Applied in Practice

**Interpretation:** Stroke (70) was the most common condition for which robotic technology was used, followed by spinal cord injury (52) and traumatic brain injury (45). Parkinson's disease (33) and cerebral palsy (20) were also notable, while use in ASD (3) and other conditions (4) which included conditions like GBS, Cerebellar Disorders etc.



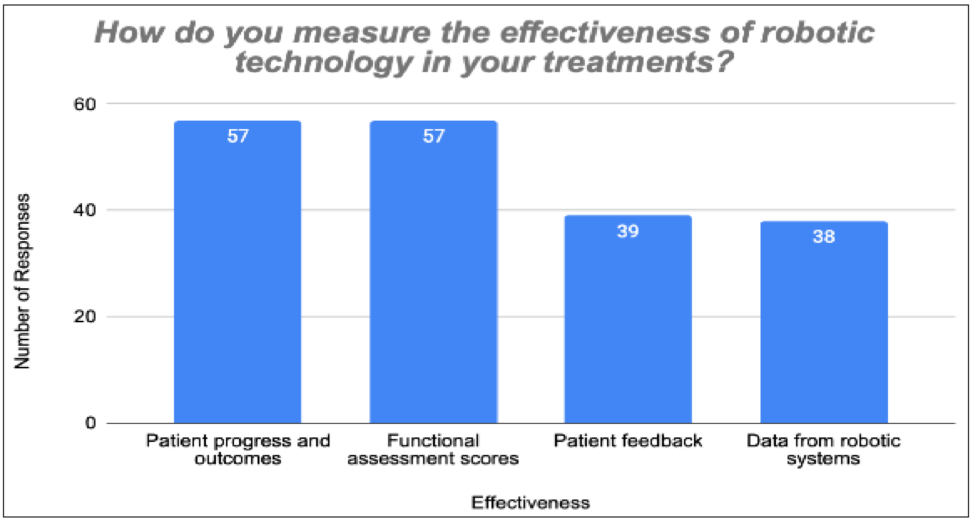

**Graph 8:** Primary Goals of Using Robotic Technology in Treatment Plans

**Interpretation:** The most frequently reported goals were improving coordination (59) and balance (55), followed by muscle strength (41) and sensory function (39). A smaller number of respondents (6) highlighted additional goals such as cognition, ADL training, gait improvement, and enhancing patient confidence.




**Graph 9:** Respondents' Challenges in Using Robotic Technology

**Interpretation:** High cost (69) was the most frequently reported challenge, followed by technical issues and maintenance (52). Lack of training (36) and limited availability/access (33) were also significant barriers. Concerns about long-term efficacy (25) and patient discomfort/fear (19) were less frequent, while a few participants (3) noted other challenges.




**Graph 10:** Measuring the Effectiveness of Robotic Technology in Treatments

**Interpretation:** Functional assessment scores (57) and patient progress/outcomes (57) were the most used measures of effectiveness. Patient feedback (39) and robotic system data (38) were also important. This suggests that effectiveness is primarily evaluated through standardized assessments and clinical outcomes, supplemented by patient-reported feedback and device-generated data.

**Discussion**

The study's objective was to assess the knowledge, attitude and practice (KAP) of robotic technology by postgraduate neurophysiotherapists in relation to its use in neuroscience rehabilitation. The results indicate a great potential interest and favourable attitude, but also a big gap between knowledge and practice. This step describes these discoveries in depth, contrasts them with current literature, examines barriers and enablers and delineates future research lines for clinical implementation

**Knowledge of Robotic Technology**

Our findings show that a large majority (65%) of physiotherapists were "very familiar" with robotic technology and 3% were "very unfamiliar". This indicates that robot technology is no longer something new in physiotherapy, at least awareness-wise. The most recognized devices were Lokomat (n=78) and ReWalk (n=54), then ArmeoSpring (n =43) and MyoPro (n =33). This agrees with an international literature, where Lokomat and ReWalk are some of the most researched and clinically implemented rehabilitation robots for gait and mobility training [6, 3].

However, although the familiarity was high, only 32% of responders received formal training in robotic technology. Among previous studies, the absence of formal training has been cited as one of the primary obstacles to adoption. Aggogeri *et al.* [10] stressed that insufficient training decreased the efficiency of robot application and therapists' confidence in including them in practise. Gassert and Dietz5 also stated that the lack of solid educational models is a limiting factor for the safe and effective clinical use of rehabilitation robotics.

International studies echo these findings. In India, for instance, a cross-sectional survey found low awareness levels among physiotherapists and "lack of trained personnel" heeded the first list of perceived barriers to adoption [12]. Our study, therefore, reiterates about the good level of knowledge among neuro-physiotherapists (postgraduates) in India and at the same time very strong recommendations for training-based interventions.

**Attitudes Toward Robotic Technology**

Most participants agreed or strongly agreed that robotic rehabilitation leads to better patient outcomes, allows for more precise therapy and promotes patient engagement. One interesting discovery was identifying robotics as an enabler for intense therapy. That is consistent with more general evidence from systematic reviews and meta-analyses that suggest robotic systems can deliver 'the right dose' of therapy better than could be achieved by physical or occupational therapists providing conventional treatment [11, 2].

However, opinions were more mixed regarding cognitive benefits, dual-tasking and whether robotics could substitute or compete with conventional therapy. This ambiguity is consistent with the findings of Laut *et al.* [5], who emphasised that robotics may not confer benefit in all domains of rehabilitation despite offering clear gains in some outcomes. Furthermore, concerns regarding cost-benefit persist. Astrakhantsev) Price is a concern - so far three robots, marketed by Diaton, Nisa and Surgiti succeeded that the main problem with most of the robotic systems available today would be the low cost (in purchase, instrumentation for operation or both). In our study, many respondents questioned if robotic costs are justifiable like an Indian based survey which reported 70% felt high cost were major stumbling block [12].

It is however interesting that, when prompted, 79% of the respondents reported they would be interested in further training; indicating that despite reservations physiotherapists view robotics as a skill worthy. This eagerness for professional development is an opportunity that academic institutions and policy makers can seize by implementing formal certification programs.

**Practice of Robotic Technology**

Although knowledge and attitudes were encouraging, there was a wide gap from practice. More than half of the sample had little or never use robotic technology, while a minority was daily or weekly users. This mismatch is a signature finding of our study—it reminds us, once more, of the literature's well-recognized chasm between knowing and doing.

Clinical diagnoses Most frequently cited indications for the use of robotics were stroke (70 respondents), spinal cord injury (52), and traumatic brain injury (45). This is in line with literature globally, where stroke is the most common condition for which robot-assisted rehabilitation is applied [7, 4]. There's a reason for this: robot-assisted therapy has consistently been shown to foster meaningful gains in upper extremity motor performance, gait and activities of daily living among people with stroke [13, 14].

Reported advantages were enhanced patient engagement and motivation (56), better clinical results (47) as well as reduced therapist burden (41). These are in line with Cochrane reviews demonstrating that the ROBOTIC rehabilitation not only improves function and motor recovery but also reduces physical strain of therapists^11. But obstacles including cost (69 respondents), technical issues (52) and lack of training (36) are persisting. To ensure equal opportunity, participants emphasized that future robotic technologies must be more affordable, include biofeedback, and be widely accessible.

**Limitations and Future Directions**

This study was informative although rather limited:

The sample was limited to postgraduate physiotherapists and findings may not be generalised across other professions.

Since it is a cross-sectional study, it does not allow the causality relationship between knowledge, attitude and practice to be verified.

There may have been a bias of interest in responding, i.e., more interested parties had probably responded.

Future research should focus on:

Panel studies for evaluation of KAP trends.

HETEROGENEITY VARIABILITY, such as s undergraduates, occupational therapists, and rehabilitation nurses.

Cost effectiveness studies for the Indian health system.

Home-based robotic rehabilitation has been suggested to provide a scalable approach for resource poor settings^18.

**Conclusion**

This research found that there is high knowledge and favourable attitudes about the use of robotic technology by neurophysiotherapists in neurorehabilitation, however, its utilization is relatively low due to barriers such as cost, training opportunities and availability. The results highlight the importance of training, access and supportive policies if the knowledge-to-practice gap is to be closed. Participants also highlighted that future robotic systems need to be more low-cost as well as provide biofeedback, in addition to being accessible and available for all.

**Abbreviations**

**IKBS:** Intelligent Knowledge based system
**AI:** Artificial Intelligence
**EO:** Exoskeleton
**EE:** End Effector
**BWSTT:** Body weight supported treadmill training
**PRISMA:** Preferred Reporting items for systematic reviews and meta-analysis

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