

Clinical and economic benefits of implementing a diagnostic-led, technology-enabled physiotherapy care model: a practice-based observational study using USFDA listed wearable device - PHEEZEE

Abstract

Background: Conventional physiotherapy assessments rely heavily on subjective clinical judgment, which may limit patient's understanding, adherence, and long-term continuity of rehabilitation. Integrating objective movement diagnostics at the initiation of care may enhance patient engagement and service sustainability, and rehabilitation completion rates.

Objective: To describe and evaluate a diagnostic-led physiotherapy care model incorporating objective movement assessment, with a focus on patient awareness, adherence, retention, and economic impact.

Methods: This single-center, practice-based observational study included 120 patients with orthopaedic, peripheral nerve, geriatric musculoskeletal, and selected stable neurological conditions. All patients underwent a structured diagnostic session consisting of clinical history, record review, and objective movement assessment using the Pheeze medical device, followed by individualized counselling and protocol-driven rehabilitation. Descriptive analyses were conducted for patient distribution, patient retention, and revenue outcomes.

Results: The following patient portfolio was observed during the study: Orthopaedic conditions - 51.7%, patients with nerve pathologies (23.3%) and geriatric Musculoskeletal conditions (18.3%). The diagnostic-led model was associated with reduced therapy dropout (10%) compared with conventional practice estimates 10-73%.¹ Primary diagnostic assessments generated a revenue of INR 240,000, while improved patient retention contributed an estimated INR 456,000 in additional therapy revenue, yielding a total incremental revenue of INR 670,000 during the observation period.

Conclusion: A diagnostic-first physiotherapy model integrating objective movement and muscle function assessment improves patient's understanding of their clinical ailment, adherence, retention, and clinic's financial sustainability. This model offers a scalable, evidence-informed framework for outpatient rehabilitation practice.

Keywords: physiotherapy diagnostics, objective movement assessment, muscle function, economic impact, rehabilitation adherence, patient retention, health service delivery, digital devices, artificial intelligence (AI)

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Abbreviations: MSK, musculoskeletal; AI, Artificial intelligence

Introduction

Physiotherapy and rehabilitation play a central role in restoring movement, functional capacity, and quality of life across orthopaedic, neurological, and geriatric populations. With the rising burden of musculoskeletal disorders, age-related functional decline, and lifestyle-associated movement impairments, outpatient physiotherapy services have become a critical component of contemporary healthcare delivery. Despite advances in therapeutic techniques, initial patient evaluation in many outpatient settings remains largely subjective, relying on visual observation, manual testing, and clinician experience. While clinically valuable, such approaches limit quantification, reproducibility, and effective communication of impairment severity and recovery progression. A key challenge associated with subjective assessment is inadequate patient understanding of their underlying movement dysfunction. When patients are unable to clearly

comprehend the root cause of their pain or functional limitation, expectations regarding recovery often become misaligned. This frequently results in poor adherence to prescribed therapy programs and premature self-discharge with incomplete recovery. Many patients discontinue physiotherapy once they experience partial symptomatic relief and perceive themselves to be "good enough," despite not achieving optimal functional outcomes or long-term movement efficiency. Contemporary rehabilitation frameworks increasingly emphasize the importance of objective assessment, structured patient education, and data-driven clinical decision-making to enhance both clinical outcomes and service efficiency. Patient attrition in outpatient physiotherapy is multifactorial and remains a persistent concern. A lack of perceived value or progress is one of the most cited contributors. Physiotherapy outcomes are often gradual rather than immediate, leading some patients to become discouraged and conclude that treatment is ineffective. Unrealistic expectations for rapid recovery or a "quick fix" further exacerbate disengagement when improvements do not align with anticipated timelines. In

addition, competing medical priorities or the emergence of new health conditions may prompt patients to deprioritize physiotherapy, even when ongoing rehabilitation is clinically indicated. Patients may also discontinue care once they feel sufficiently educated to continue exercises independently, underestimating the importance of professional supervision, progression, and correction.

Evidence from outpatient physiotherapy literature indicates substantial early and overall attrition. Approximately 20% of patients discontinue therapy within the first three visits,^{2,3} often before meaningful therapeutic engagement occurs. More broadly, nearly 65% of patients fail to complete their full authorized course of care,⁴ with condition-specific studies reporting self-discharge rates as high as 55% in chronic musculoskeletal conditions such as knee osteoarthritis and low back pain.⁵ Beyond clinical implications, patient attrition carries significant economic consequences. Missed appointments, early discontinuation, and incomplete plans of care have been shown to result in revenue losses of up to 50.6% for outpatient physiotherapy clinics,⁶ directly impacting operations and financial sustainability, especially in small and single-practitioner centers, and may indirectly compromise care quality by limiting resources available for service enhancement and innovation. To address these clinical and operational gaps, Startoon Labs implemented a diagnostic-led physiotherapy care model in which objective movement assessment forms the cornerstone of evaluation, patient counselling, and individualized treatment planning. This model integrates the Pheeze powered diagnostics system to quantify joint movement, functional performance, and endurance parameters, enabling data-driven clinical decisions and structured patient education from the initial visit. The present study documents the design, implementation, and observed clinical and economic outcomes of this diagnostic-led physiotherapy model within a routine outpatient setting, with a focus on its potential to improve patient engagement, adherence, and overall effectiveness and value of care.

Material and methods

Study Design and Setting

This was a single-center, practice-based observational study conducted at a one-bed outpatient physiotherapy clinic (Startoon Labs - Pheeze Assessment and Physiotherapy Center), India.⁷

Patient population

Over 120 consecutive patients were evaluated during the observation period.

Clinical categories included:

- Orthopaedic conditions
- Peripheral nerve pathologies
- Geriatric musculoskeletal conditions
- Selected stable neurological cases

Exclusion criteria:

- Emergency conditions
- Medically advised non-mobility
- Contraindications to active assessment

Patients were recruited through walk-in visits, referrals, and community-based screening programs conducted at events.

Diagnostic-led care model

Initial Diagnostic Session: All new patients underwent a standardized diagnostic session comprising:

- Documentation of chief complaints and functional limitations
- Detailed medical and rehabilitation history
- Review of medical records and imaging (where available)
- Objective movement and muscle performance assessment using Pheeze

Assessments were condition-specific and included joint kinematics, muscle activity patterns, functional task performance, gait parameters, and endurance measures as clinically appropriate. Each diagnostic session was billed at INR 2,000 and each therapy session is charged INR 1,000 (Figure 1).

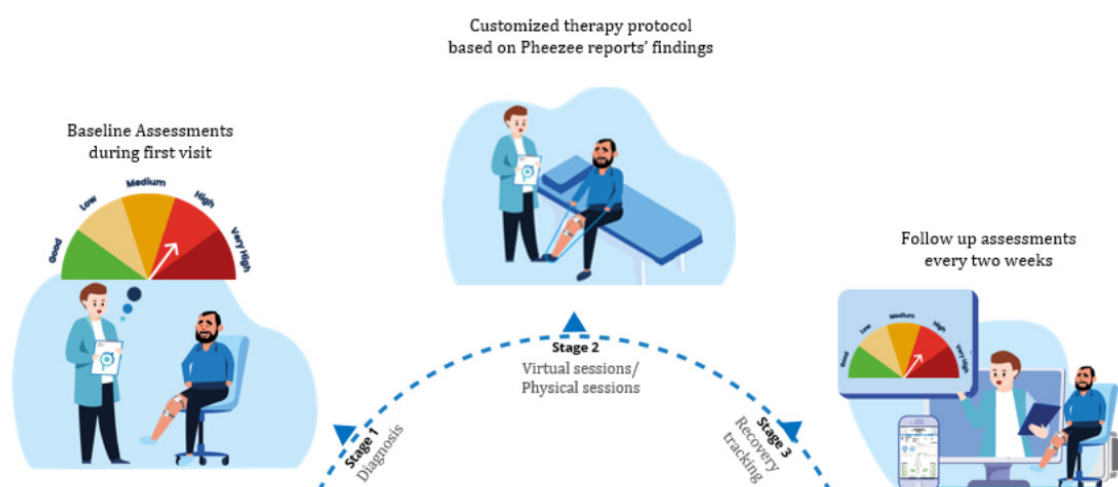


Figure 1 Diagnostic led physiotherapy care model.

Patient counselling and treatment planning

Objective data was used for structured counselling addressing:

- Identification of primary movement and muscle impairments
 - Explanation of root causes using objective data visualization
 - Expected recovery timelines and functional milestones
 - Customized rehabilitation protocols
 - Indicators for referral or medical escalation
- Consequences of non-adherence

Therapy and reassessment

(Figure 2) Following counselling, patients were enrolled into individualized therapy programs. Based on diagnostic findings, approximate therapy duration was estimated, typically ranging from 15 days to 3 months. Therapy packages were usually provided for one month, with reassessment planned at the end of the therapy duration. Reassessment using the same objective measures was typically performed at 2-4 weeks to track progress and guide clinical decision-making. Depending on recovery trajectory, patients were advised to continue supervised therapy or transition to self-paced home exercise programs. Typically extending for one month with reassessment.



Figure 2 Pheeze assessment test report.

Outcome measures and analysis

Outcomes were analysed descriptively and included:

- Patient distribution by clinical category
- Therapy initiation and completion rates
- Reassessment completion
- Revenue generated from diagnostics
- Additional therapy revenue associated with improved retention

Results

The study revealed some promising results, as shown in tables below.

Table 1 shows the visitor statistics in detail. From Table 2 it is seen that orthopaedic conditions constituted the largest cohort, followed by peripheral nerve and geriatric musculoskeletal cases. Neurological conditions represented a smaller, selectively included group.

Table 1 Clinic visitor statistics

Clinic visitor statistics	No of patients
Total enquiries	200
First consultation with diagnostic test	120
Patients who started therapy packages	80
Patients who completed therapy	80
Patients who underwent reassessment	80
Patients reporting partial or complete recovery	80
Patients who needed continued care by clinician at clinic or home	20
Patients who needed self-care at home	30
Patients who adhered to continued care	45

Table 2 Patient categories

Clinical category	Number of patients (n)	Percentage (%)
Orthopaedic conditions	62	51.7
Peripheral nerve pathologies	28	23.3
Geriatric musculoskeletal conditions	22	18.3
Selected stable neurological conditions	8	6.7
Total	120	100

Patient distribution by clinical category

Revenue impact

- Diagnostic assessments (n ≈ 120): INR 240,000
- Additional therapy revenue due to improved retention: INR 240,000
- Diagnostic re-assessments (n ≈ 120): INR 190,000
- Total incremental revenue: INR 670,000

Patient awareness and adherence

Patients demonstrated improved understanding of movement impairments and rehabilitation goals following diagnostic counselling.

Objective visualization of movement deficits facilitated clearer expectation setting and increased confidence in the treatment plan.

Patient retention and dropout

Compared with widely reported outpatient physiotherapy attrition benchmarks-where early dropout rates approach 20% within the first three visits and overall self-discharge rates range between 55–70%-the diagnostic-led care model demonstrated a substantially reduced therapy dropout rate of approximately 10% during the observation period. From the results of the study, it was noted that early dropout rates within the first two to three visits was reduced to 0% (from the prevalent standard of 20%), showing improved early-stage patient engagement, adherence and commitment to the prescribed physiotherapy care plan [6]. Improved retention was attributed to enhanced patient understanding of their condition, clearer expectation setting through objective data visualization, and structured counselling at the initiation of care (Table 3).

Table 3 Impact on Patient Retention, Dropouts and Clinic's revenue

Outcome metric	Conventional practice benchmark	Diagnostic-led model	% Change
Overall patient retention	~30%	~90%	200%
Early dropout (≤3 visits)	~20%	0%	100%
Total practice revenue	INR 720,000 (estimated with assumption of INR 6000 revenue per patient)	INR 1,416,000	96.70%

Percentage Improvements Observed with the Diagnostic-Led Care Model

Discussion

This practice-based observational study demonstrates that integrating objective movement diagnostics at the initiation of physiotherapy care may meaningfully address two persistent challenges in outpatient rehabilitation: high patient attrition and financial inefficiency. High dropout rates in physiotherapy are well documented, with up to 70% of patients failing to complete their prescribed course of care and more than half self-discharging before achieving clinical goals in chronic musculoskeletal conditions. Early attrition-often occurring within the first three visits-represents a critical failure point in patient engagement and expectation management. The findings of the present study suggest that a diagnostic-led approach may mitigate this early disengagement by improving patient comprehension of movement dysfunction, prognosis, and the rationale for continued therapy. Objective movement assessment enabled clinicians to translate clinical impairments into quantifiable, visual, and patient-comprehensible data, facilitating realistic goal setting and reinforcing the value of continued participation. The observed reduction in early dropout from approximately 20% to 0%, and overall attrition to approximately 10%, compares favourably with conventional outpatient benchmarks reported in the literature. From a health service delivery perspective, improved retention also translated into measurable economic benefits. Patient attrition-including no-shows and early discontinuation-has been associated with revenue losses exceeding 50% in outpatient clinics. In contrast, the diagnostic-led model not only reduced attrition but also enabled

ethical monetization of clinical expertise through structured diagnostic assessments and follow-up re-evaluations. The combined effect resulted in a total incremental revenue of INR 670,000 during the observation period, without increasing session volume per day or compromising care quality. These findings support the premise that objective diagnostics function as both a clinical and operational lever, enhancing patient adherence while improving financial sustainability. Importantly, this model aligns with contemporary rehabilitation principles emphasizing transparency, patient education, and outcome tracking, and may be particularly relevant for small or resource-constrained outpatient practices.

Limitations

- i. Single-center observational design
- ii. Absence of a conventional-assessment control group
- iii. Revenue and adherence outcomes based on practice-level estimates

Future multicentred studies incorporating validated clinical outcome measures and controlled comparisons are warranted.

Conclusion

A diagnostic-led physiotherapy care model incorporating objective movement assessment improves patient understanding, adherence, retention, and economic sustainability. This approach offers a scalable and clinically meaningful framework for integrating technology into routine outpatient rehabilitation, particularly in orthopaedic and geriatric populations.

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Conflicts of interest

The authors declares that there are no conflicts of interest.

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