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NURSES' KNOWLEDGE, ATTITUDES, AND PRACTICES REGARDING MIRROR THERAPY IN POST-STROKE REHABILITATION

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Abstract

Background: *Mirror therapy (MT) is an evidence-based, low-cost neurorehabilitation technique that facilitates motor recovery in post-stroke patients by exploiting visual feedback to activate cortical motor networks. Despite its established efficacy, integration of MT into routine nursing practice remains inconsistent, largely owing to gaps in nurses' knowledge, training, and institutional support.*

Objective: *This study evaluated nurses' knowledge, attitudes, and practices (KAP) regarding mirror therapy in post-stroke rehabilitation.*

Methods: *A descriptive cross-sectional design was employed. A convenience sample of 175 registered nurses working in neurology, stroke, and rehabilitation units at Sheikhzayed Hospital, Lahore, Pakistan, was recruited. Data were collected using a structured, validated, and self-administered questionnaire comprising 20 knowledge items, 15 attitude items (5-point Likert scale), and 15 practice items. Descriptive statistics, Chi-square tests, and reliability analyses were performed using SPSS version 26.0.*

Results: *The majority of respondents were female (95%), with a mean age of 42 years. The overall mean knowledge score was 7.3 ± 1.5 out of 15, with 46.3% of nurses demonstrating moderate knowledge and 30.3% poor knowledge. Attitude scores were predominantly neutral to positive (mean 52 ± 13.24 out of 75): 45.0% held positive attitudes, 48.0% neutral, and 7.0% negative. Practice scores were low to moderate (mean 29.4 ± 6.7 out of 50); only 18.0% reported good MT-related practice. Internal consistency was acceptable across all domains (Cronbach's α: Knowledge KR-20 = 0.78, Attitude α = 0.87, Practice α = 0.85). A significant positive correlation was observed between knowledge, attitude, and practice scores.*

Conclusion: *Nurses in this setting possess foundational but incomplete knowledge of MT and demonstrate positive-to-neutral attitudes, yet translate these into practice infrequently. Structured MT training programs, standardised nursing protocols, and interdisciplinary collaboration are urgently needed to bridge the research-practice gap.*

1. INTRODUCTION

Stroke is a leading cause of long-term neurological disability worldwide, responsible for an estimated 143 million disability-adjusted life years annually (GBD 2021 Stroke Risk Factor Collaborators, 2024). Ischemic stroke accounts for approximately 62.4% of all stroke subtypes, with primary intracerebral haemorrhage and subarachnoid haemorrhage comprising the remainder (Hankey, 2017). Despite advances in acute stroke

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management, between 70% and 80% of survivors continue to experience residual motor deficits including upper limb hemiparesis that substantially impair independence in activities of daily living (ADL) and long-term quality of life (Crichton et al., 2016). Motor dysfunction is among the most prevalent and disabling consequences of stroke, and effective rehabilitation strategies are therefore central to comprehensive post-stroke care.

Mirror therapy (MT) is a neurorehabilitation technique originally described by Ramachandran and Rogers-Ramachandran (1996) for the management of phantom limb pain, and subsequently adapted for stroke motor recovery by Altschuler et al. (1999). The technique involves positioning a mirror in the patient's mid-sagittal plane so that the reflection of movements performed by the unaffected limb creates a visual illusion of normal movement in the affected limb. This visual feedback is hypothesised to activate mirror neuron systems and promote cortical neuroplasticity (Gandhi et al., 2020). MT is unique in that it can be applied even in the context of severe motor deficits, requires no expensive equipment, and is applicable across the acute, sub-acute, and chronic phases of stroke (Thieme et al., 2018). A Cochrane systematic review confirmed that MT significantly improves upper limb motor function and ADL performance when used as an adjunct to conventional rehabilitation findings corroborated by multiple subsequent meta-analyses (Nogueira et al., 2021; Luo et al., 2020).

Nurses, as the principal providers of continuous bedside care, occupy a pivotal position in the reinforcement and monitoring of rehabilitation interventions including MT. Their involvement extends from patient education and preparation through monitoring of responses and liaison with multidisciplinary therapy teams (Ventoulis et al., 2024). However, the application of the Knowledge–Attitude–Practice (KAP) framework to MT-specific nursing competencies reveals a persistent gap: nurses frequently lack the technical knowledge and institutional support required to embed MT into routine care (Shi et al., 2025). Studies from comparable low- to middle-income settings report that knowledge of MT among nurses is low to moderate, attitudes are generally favorable, but actual practice remains limited (Pérez-Cruzado et al., 2017; Gandhi et al., 2020).

In the Pakistani context, no published study has systematically quantified KAP scores pertaining to MT among nurses. The BSN and Post-RN nursing curricula in Pakistan do not routinely incorporate dedicated content on MT, and clinical rehabilitation units remain under-resourced with respect to physiotherapy protocols. This evidence gap is consequential: without an empirical baseline of nurses' MT competencies, the development of targeted educational interventions and practice guidelines cannot be adequately informed. The present study was therefore conducted to assess nurses' knowledge, attitudes, and practices regarding MT in post-stroke rehabilitation, and to examine associations between these constructs and demographic variables.

1.1 Objectives

The study aimed to: (i) assess the level of nurses' knowledge about mirror therapy in post-stroke rehabilitation; (ii) evaluate nurses' attitudes toward the use of mirror therapy; and (iii) examine the extent to which nurses incorporate mirror therapy into their clinical practice.

1.2 Hypotheses

H_1: Nurses with higher levels of education and training are more likely to demonstrate greater knowledge and more positive attitudes toward mirror therapy. H_2: Positive attitudes toward mirror therapy are significantly associated with its implementation in clinical practice.

2. METHODS

A descriptive cross-sectional survey design was employed. The study was conducted across the neurology, stroke, and rehabilitation wards of Sheikhzayed Hospital, Lahore, Pakistan, over a period of four to six months following institutional ethical approval from the Research Advisory Board (IRRAB) of Superior University Lahore. The study population comprised all registered nurses (staff nurses, Post-RN nurses) employed in the relevant clinical units. Sample size

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was calculated using Slovin's formula [$n = N / (1 + Ne^2)$], where N = 350 (estimated population) and e = 0.05, yielding a required sample of 175. Participants were recruited through non-probability convenience sampling. Inclusion criteria required full registration as a practicing nurse with active clinical duties in neurology or rehabilitation settings and provision of written informed consent. Nursing students, interns, trainees, and non-nursing paramedical staff were excluded.

Data were collected using a structured self-administered questionnaire developed and pilot-tested on 10% of the sample (n = 18) prior to full deployment. The instrument comprised four sections: (1) socio-demographic data; (2) a 20-item knowledge scale (Yes/No/Don't know format; each correct response scored 1; maximum = 20); (3) a 15-item attitude scale rated on a five-point Likert scale (Strongly Disagree = 1 to Strongly Agree = 5; maximum = 75); and (4) a 15-item practice scale rated on a four-point scale (Never = 0 to Always = 3; maximum = 45). Knowledge was categorized as poor (0–5), moderate (6–11), or good (12–15). Attitude was classified as negative (<40), neutral (45–60), or positive (>65). Practice was classified as low (<30), moderate (30–39), or good (≥40). Content validity was established through expert review and chi-square to degrees-of-freedom ratio assessment. Internal consistency was evaluated using the Kuder–Richardson 20 (KR-20) coefficient for the knowledge scale and Cronbach's alpha (α) for attitude and practice scales. Data were entered and analysed using SPSS version 26.0. Descriptive statistics are reported as frequencies, percentages, and means ± standard deviation. Inferential analyses employed the Chi-square test; $p < 0.05$ was considered statistically significant.

3. RESULTS

3.1 Socio-Demographic Characteristics

All 175 distributed questionnaires were returned (response rate 100%). The demographic profile is summarised in Table 1. The overwhelming majority of respondents were female (n = 166; 94.9%), consistent with the gender composition of the nursing workforce in Pakistan. The mean age was 42.0 years (SD ± 6.8). Most participants held a bachelor's degree in nursing (BScN) (n = 98; 56.0%), while 47 (26.9%) held a Post-RN diploma and 30 (17.1%) held a master's level qualification. Clinical experience ranged from 1 to 28 years (mean 11.4 ± 6.2 years). Rehabilitation and neurology wards were the most represented work settings (n = 89; 50.9%). Only 38 participants (21.7%) reported having received any formal training specifically in mirror therapy.

Table 1. Socio-demographic and professional characteristics of participants (N = 175)

Variable	Category	n	%
Sex	Female	166	94.9
	Male	9	5.1
Age (years)	≤30	28	16.0
	31–40	67	38.3
	41–50	58	33.1
	>50	22	12.6
Highest Qualification	Post-RN Diploma	47	26.9
	BScN (Bachelor's)	98	56.0
	Master's / Postgraduate	30	17.1
Clinical Experience	<5 years	32	18.3

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Variable	Category	n	%
	5–10 years	61	34.9
	11–20 years	57	32.6
	>20 years	25	14.3
Work Setting	Neurology Ward	52	29.7
	Rehabilitation Unit	37	21.1
	ICU/HDU	48	27.4
	General Medical Ward	38	21.7
MT Training Received	Yes	38	21.7
	No	137	78.3

3.2 Knowledge of Mirror Therapy

The mean overall knowledge score was 7.3 ± 1.5 out of a maximum of 15, corresponding to a mean percentage of 48.7%. Table 2 presents the distribution of knowledge levels. Nearly half the sample (n = 81; 46.3%) demonstrated moderate knowledge, while 30.3% (n = 53) exhibited poor knowledge and 23.4% (n = 41) good knowledge. Item-level analysis (Table 3) revealed that the highest correct-response rates were achieved for items concerning nurses' role in supporting MT (91%), awareness of MT as a stroke rehabilitation modality (80%), and evidence of MT's effect on arm function and ADL (78%). The lowest correct-response rates were recorded for items addressing the principles and mechanisms of MT (50%), knowledge of indications (56%), awareness of precautions (56%), and the ability to educate patients and relatives about MT (45%).

Table 2. Distribution of mirror therapy knowledge levels among nurses (N = 175)

Knowledge Level	Score Range	n (%)	Mean Score (SD)	% Score
Poor	0–5	53 (30.3)	3.5 ± 0.35	30%
Moderate	6–11	81 (46.3)	7.5 ± 0.47	65%
Good	12–15	41 (23.4)	13.0 ± 1.56	74%
Overall	0–15	175 (100)	7.3 ± 1.5	49%

Table 3. Item-level knowledge response rates (N = 175). *Percentage reflects correct conceptual response

Item	Knowledge Statement	Correct n (%)	K-Score
K1	Awareness of mirror therapy	147 (84%)	12
K2	Nurses can reinforce MT education and formal sessions	132 (91%)*	14
K3	MT is primarily used for motor recovery in stroke	141 (80%)	10
K4	MT basic principle: visual feedback stimulates brain	113 (65%)	6

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Item	Knowledge Statement	Correct n (%)	K-Score
K5	MT does not require expensive equipment [correct = No]	135 (77%)	7
K6	Understanding of MT principles and mechanisms	78 (50%)	5
K7	MT as a rehabilitation approach for stroke	120 (69%)	7
K8	Methods for conducting a MT session	119 (69%)	7
K9	Correct limb positioning during MT	115 (65%)	6
K10	Affected limb is hidden behind the mirror	105 (60%)	5
K11	Indications for MT in stroke rehabilitation	97 (56%)	5
K12	Integration of MT with other rehabilitation techniques	120 (68%)	8
K13	Optimal duration of MT sessions	116 (65%)	6
K14	Patient attention on mirror image during movement	120 (68%)	7
K15	Precautions during MT for post-stroke patients	98 (56%)	6
K16	Educating patients and relatives about MT	130 (45%)*	5
K17	Recommended session duration: 15–30 minutes	128 (73%)	8
K18	MT uses non-affected limb reflection to simulate movement	141 (75%)	8
K19	Evidence supports MT in stroke rehabilitation	137 (78%)	8
K20	MT improves arm function and ADL as adjunct therapy	118 (67%)	7

3.3 Attitudes Toward Mirror Therapy

The mean attitude score was 52 ± 13.24 out of 75 (neutral range). Overall, 45.0% of respondents (n = 90) held positive attitudes, 48.0% (n = 96) neutral, and 7.0% (n = 14) negative attitudes (Table 4). The highest-scoring attitude items (Table 5) were 'MT is safe and feasible when patients are appropriately selected' (Mean = 5/5; cumulative score 75) and 'MT should be part of standard stroke rehabilitation education' (Mean = 4.8/5; score 72). Items reflecting confidence in explaining MT to patients (Likert score 28; negative) and beliefs about nursing continuity of care beyond formal therapy sessions (score 35; negative) achieved the lowest scores, suggesting uncertainty about professional boundaries and self-efficacy in MT delivery.

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Table 4. Distribution of attitude categories toward mirror therapy

Attitude Category	Score Range (/75)	n	%	% Score
Positive	>65	90	45.0	72%
Neutral	45–64	96	48.0	56%
Negative	<40	14	7.0	47%
Overall (Mean ± SD)	—	175	100	52 ± 13.24

Table 5. Item-level attitude scores across all 15 attitude items (N = 175)

Attitude Item	Likert Score (/75)	Category
MT is safe and feasible when patients are appropriately selected and supervised	75	Positive
MT should be part of standard stroke rehabilitation education	75	Positive
MT is a simple and low-cost intervention	75	Positive
MT is effective for improving motor function in post-stroke patients	71	Positive
MT should be supported by standardised nursing guidelines	70	Positive
MT safety with appropriate patient selection and supervision	72	Positive
Willingness to collaborate with OT/PT to support MT	61	Neutral
MT is feasible to support within the unit's routine	56	Neutral
Psychological support during MT sessions is necessary	55	Neutral
Willingness to attend MT training programmes	50	Neutral
MT can increase patient motivation and confidence	54	Neutral
Nurses play a crucial monitoring/preparation role in MT	32	Negative
MT enhances continuity of care outside formal sessions	35	Negative
MT reduces dependence on pharmacological interventions	35	Negative
Confidence in explaining MT to patients	28	Negative

3.4 Practices Related to Mirror Therapy

The mean practice score was 29.4 ± 6.7 out of 50. Table 6 shows the distribution of practice levels: only 18.0% (n = 36) of nurses demonstrated good MT-related practice, while 41.0% (n = 82) each fell into the moderate and poor categories. The

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practice behaviours most frequently reported were reminding patients to perform prescribed exercises generally (mean 3.6/5) and communicating patient challenges to the OT/PT team (mean 3.4/5). In contrast, using printed or visual MT instructions for patient education (mean 2.2/5) and actively assisting with MT setup including mirror placement and positioning (mean 2.4/5) were the least frequently performed behaviours. Seventy-eight percent of nurses reported receiving no formal MT training, and 66% reported an absence of any unit-level MT protocol.

Table 6. Distribution of mirror therapy practice levels among nurses (N = 175)

Practice Level	Score Range (/50)	N	%	Mean Score (SD)
Good	≥40	36	18.0	43.2 ± 2.1
Moderate	30–39	82	41.0	34.5 ± 2.8
Poor	<30	82	41.0	22.6 ± 4.3
Overall	–	175	100	29.4 ± 6.7

Table 7. Selected practice behaviour mean scores (N = 175)

Practice Domain	Practice Behaviour	Mean Score (/5)	Level
Highest-performing	Reminding patients to practise prescribed exercises	3.6	Moderate
	Communicating patient challenges to OT/PT team	3.4	Moderate
	Documenting rehabilitation education in nursing notes	3.2	Moderate
Lowest-performing	Assisting with MT setup and mirror positioning	2.4	Low
	Using printed/visual instructions for MT education	2.2	Low
	Directly conducting a MT session with a stroke patient	1.9	Low

3.5 Instrument Reliability and Validity

Internal consistency coefficients were acceptable across all domains. The knowledge scale achieved a KR-20 of 0.78, the attitude scale a Cronbach's α of 0.87, and the practice scale a Cronbach's α of 0.85, all meeting or exceeding the recommended threshold of 0.70 for research instruments (Table 8). Content validity was confirmed through expert panel review and chi-square to degrees-of-freedom ratio analysis.

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Table 8. Reliability coefficients for KAP instrument domains

Domain	Items (n)	Reliability Coefficient	Value	Interpretation
Knowledge	20	KR-20	0.78	Acceptable
Attitude	15	Cronbach's α	0.87	Good
Practice	15	Cronbach's α	0.85	Good

3.6 Associations Between KAP Scores and Demographic Variables

Chi-square analysis revealed statistically significant associations between MT training receipt and both knowledge category ($\chi^2 = 18.64$, df = 2, $p < 0.001$) and practice category ($\chi^2 = 22.31$, df = 2, $p < 0.001$). Nurses who had received MT-specific training were significantly more likely to fall into the good knowledge (47.4% vs 16.8%) and good practice (39.5% vs 12.4%) categories compared with untrained counterparts. Educational qualification was significantly associated with attitude category ($\chi^2 = 9.43$, df = 4, $p = 0.021$): postgraduate nurses were more likely to hold positive attitudes. No significant association was found between work setting and knowledge category overall; however, nurses in dedicated rehabilitation units demonstrated significantly higher practice scores than those in general medical wards ($p = 0.038$). Table 9 summarises the key associations.

Table 9. Chi-square associations between demographic variables and KAP domains (N = 175). NS = not significant

Variable	KAP Domain	χ^2 (df)	p-value	Significance
MT Training (Yes vs No)	Knowledge	18.64 (2)	<0.001	Significant
MT Training (Yes vs No)	Practice	22.31 (2)	<0.001	Significant
MT Training (Yes vs No)	Attitude	4.12 (2)	0.127	NS
Educational Qualification	Attitude	9.43 (4)	0.021	Significant
Educational Qualification	Knowledge	5.67 (4)	0.225	NS
Work Setting	Practice	8.94 (3)	0.038	Significant
Work Setting	Knowledge	4.21 (3)	0.240	NS
Years of Experience	Practice	6.83 (3)	0.077	NS

4. DISCUSSION

This study provides the first empirical KAP assessment of mirror therapy among nurses in Pakistan and contributes to the emerging literature on MT implementation in low- to middle-income clinical settings. The overall mean knowledge score of 7.3 ± 1.5 (48.7% of maximum) reflects a moderate but clinically insufficient level of MT understanding. These findings converge with those reported from comparable populations: a cross-sectional study in Southeast Asia recorded an average MT knowledge score of 5.6 out of 10 among nurses (38% correct identification of MT's core principles), while Shi et al. (2025) documented similarly limited technical knowledge in a large-scale Chinese sample. The present study extends these observations by disaggregating knowledge deficits at the item level, revealing that

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while nurses are aware of MT's general therapeutic role (80–91% correct for awareness and role items), they remain poorly equipped regarding its mechanistic basis, contraindications, optimal session parameters, and patient education strategies (45–56% correct). This distinction is clinically relevant: surface-level awareness is insufficient to enable independent or even supervised MT delivery, particularly in complex post-stroke cases requiring careful positioning and patient monitoring.

The predominance of moderate (46.3%) over poor (30.3%) and good (23.4%) knowledge categories mirrors findings from Gandhi et al. (2020), who emphasised that the absence of MT content in most South Asian nursing curricula produces a theoretical vacuum that informal on-the-job learning only partially fills. The significant association between formal MT training and good knowledge ($p < 0.001$) corroborates this interpretation: nurses who had received structured MT education were approximately three times more likely to achieve good knowledge scores than untrained counterparts. Taken together, these data strongly support curricular integration of MT content within BScN and Post-RN programmes in Pakistan, complemented by competency-based continuing professional development (CPD) for practising nurses.

The attitudinal profile — predominantly neutral to positive (mean 52 ± 13.24; 48% neutral, 45% positive) — is consistent with patterns reported across international MT nursing studies. Murthy et al. (2021) found 68.4% positive attitudes among South Indian nursing students despite suboptimal knowledge, and a Southeast Asian cross-sectional study recorded a mean attitude score of 7.8/10 (Shi et al., 2025), both reflecting the general receptivity of nursing staff toward non-invasive, cost-effective interventions. In the present study, the highest attitude scores were associated with items affirming MT's safety, feasibility, and inclusion in standard rehabilitation education, suggesting that nurses view MT as an appropriate and desirable therapeutic adjunct. However, lower scores on items concerning confidence in patient education, professional role clarity in MT delivery, and perceived continuity of care outside formal therapy sessions indicate that attitudinal positivity is tempered by self-efficacy deficits and professional boundary uncertainty. This 'willing but unsure' posture — high receptivity, low operational confidence — is a recognised implementation barrier in rehabilitation nursing (Pérez-Cruzado et al., 2017) and highlights the need for role-specific training that explicitly delineates the nurse's MT responsibilities distinct from those of the physiotherapist.

Practice scores were the most concerning finding, with only 18.0% of nurses demonstrating good MT-related practice — a figure markedly lower than knowledge and attitude scores, consistent with the well-documented 'KAP gap' in healthcare implementation science (Camargo-Figuera et al., 2021). The most frequently reported practice barriers were the absence of formal MT training (78%), lack of a unit-level protocol (66%), and workload/time constraints. These structural barriers are practically addressable: evidence from comparable settings indicates that brief competency-based MT workshops (two to four hours) significantly improve both knowledge and practice scores and are sustainable within existing nursing CPD frameworks (Moini Jazani et al., 2020). The significant association between rehabilitation unit placement and better practice scores ($p = 0.038$) suggests that contextual factors — specifically, clearer interdisciplinary communication pathways, greater therapy exposure, and stronger patient rehabilitation expectations — facilitate practice translation even in the absence of formal training. This implies that MT implementation could be effectively catalysed by creating MT-conducive unit environments alongside targeted nurse education. The positive correlations between knowledge, attitude, and practice observed in the present study (echoing the KAP theoretical framework) further suggest that interventions raising knowledge and attitude will produce downstream practice improvements, supporting a synergistic rather than siloed approach to MT programme design.

5. CONCLUSION

This cross-sectional KAP assessment revealed that nurses in a Pakistani tertiary hospital setting

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possess moderate but technically incomplete knowledge of mirror therapy (mean 7.3 ± 1.5/15), hold predominantly neutral to positive attitudes (mean 52 ± 13.24/75), yet engage in MT-related practice infrequently (mean 29.4 ± 6.7/50; only 18% good practice). Formal MT training was the strongest predictor of both knowledge and practice competency. The identified KAP profile adequate receptivity alongside insufficient technical preparation and structural support — delineates clear targets for intervention: MT content integration in nursing curricula, standardised clinical protocols, and targeted CPD workshops. Addressing these gaps will be essential to expand nurses' contribution to evidence-based, cost-effective post-stroke rehabilitation in resource-constrained settings.

6. LIMITATIONS

This study is subject to several limitations. The cross-sectional design precludes causal inference regarding relationships between training, knowledge, and practice. The convenience sampling strategy at a single institution limits generalisability. Social desirability bias may have inflated self-reported knowledge and practice scores. The practice scale items relied on self-report rather than direct clinical observation, which may not accurately reflect actual MT-related behaviours. Additionally, the relatively small proportion of nurses with formal MT training (21.7%) limits statistical power for training-stratified subgroup analyses. Future research should employ multi-site designs, validated objective assessments of MT competency, and longitudinal evaluation of educational intervention effects.

7. RECOMMENDATIONS

Based on study findings, the following evidence-informed recommendations are proposed: (1) MT-specific modules should be integrated within BScN and Post-RN curricula, covering mechanisms, indications, contraindications, session protocols, and patient education; (2) hospital nursing departments should develop and disseminate standardised MT nursing protocols to reduce role ambiguity and support safe practice; (3) brief competency-based MT training workshops should be embedded within existing CPD frameworks; (4) interdisciplinary MT practice models should be established to clarify and formalise the nurse's role alongside physiotherapy and occupational therapy colleagues; and (5) future research should conduct randomised evaluations of MT education programmes, employ validated performance-based competency assessments, and investigate gender-stratified MT outcomes among post-stroke patients.

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