JHWCR

Journal of Health, Wellness and Community Research
Volume III, Issue XI
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, ISSN: 3007-0570
https://doi.org/10.61919/220t5v54

Original Article

Exercise Adherence in Patients with Musculoskeletal Disorders Presenting to HMC OPD: A Cross-Sectional Survey

Hira Tariq[1], Sousan Hassan[2], Tayyaba Mustafa Mian[3], Muhammad Omer[1], Tausif Ahmad[4], Muhammad Qais Raza[5]

[1] Hamdard University, Islamabad, Pakistan

[2] Physioroom Rehabilitation Center, Peshawar, Pakistan

[3] Hamdard University (HUIC), Islamabad, Pakistan

[4] District Physiotherapist, DHQ Hospital Timergara and Jasmine Hospital Timergara, Pakistan

[5] Robina Memorial Hospital, Fatehpur District Layyah, Pakistan

Correspondence: hirakhan47700@gmail.com

Authors' Contributions: Concept: HT; Design: SH; Data Collection: TMM; Analysis: MO; Drafting: TA; Critical Revision: MQR
Cite this Article | Received: 2025-07-11 | Accepted 2025-08-24
No conflicts declared; ethics approved; consent obtained; data available on request; no funding received.

ABSTRACT

Background: Musculoskeletal disorders are among the leading causes of pain, disability, and reduced quality of life worldwide. Exercise therapy is a cornerstone of management, yet long-term effectiveness depends on patient adherence. Evidence suggests that only half to two-thirds of patients follow prescribed regimens, with poor adherence reducing treatment efficacy. In Pakistan, limited data exist on exercise adherence in musculoskeletal rehabilitation, and validated tools have rarely been applied. Objective: This study aimed to assess adherence to prescribed exercise programs among patients with musculoskeletal disorders using the standardized Exercise Adherence Rating Scale (EARS) in a tertiary care outpatient setting. Methods: A cross-sectional observational study was conducted at the Physiotherapy Outpatient Department of Hayatabad Medical Complex, Peshawar, over six months. A total of 48 patients with musculoskeletal conditions were recruited consecutively. Data were collected using the EARS questionnaire and analyzed with SPSS v22. Adherence was defined using mean EARS scores, and associations with demographic and clinical variables were tested using chi-square and Pearson's correlation. Results: Sixty percent of patients were classified as adherent, while 40% were non-adherent. Compliance was significantly associated with frequency and duration of prescribed exercises (p=0.03 for both), whereas age, sex, education, and marital status showed no associations. Reported barriers included lack of time (25%) and low motivation (8%). Conclusion: Adherence to exercise regimens was moderate and strongly influenced by prescription characteristics and behavioral barriers. Optimizing program design and integrating adherence-enhancing strategies are critical to improving musculoskeletal rehabilitation outcomes. Keywords: exercise adherence, musculoskeletal disorders, physiotherapy, rehabilitation, Pakistan.

INTRODUCTION

Musculoskeletal disorders represent one of the leading causes of pain, disability, and impaired quality of life worldwide, contributing substantially to the global burden of disease. The musculoskeletal system accounts for nearly 75% of body mass in a healthy individual, and dysfunction within this system has significant implications for daily living and functional independence (1). With aging populations, sedentary lifestyles, and rising obesity rates, the prevalence of musculoskeletal pain continues to increase, particularly among older adults and those with high occupational demands (2,3). Pain arising from the musculoskeletal system is now considered one of the most common pain syndromes worldwide and remains a major contributor to long-term disability and reduced mobility (4).

The clinical spectrum of musculoskeletal disorders includes low back pain, knee osteoarthritis, and shoulder pain, which collectively rank among the most frequently reported conditions in outpatient rehabilitation settings (5,6). Epidemiological evidence suggests that low back pain affects approximately 20% of adults, while shoulder pain has a lifetime prevalence of 30–71%, and osteoarthritis remains a leading cause of physical inactivity in older adults (7–9). In younger populations, musculoskeletal pain often arises from occupational exposures, psychological stress, and lifestyle factors such as smoking or poor nutrition (10,11). In older adults, falls are a major sequela, with nearly 30% of community-dwelling individuals over 65 years sustaining at least one fall annually, often resulting in fractures, disability, or even mortality (12).

Exercise therapy has emerged as a cornerstone in the management of musculoskeletal pain, with substantial evidence demonstrating benefits in reducing pain, improving physical function, and enhancing quality of life (13–15). Supervised physiotherapy sessions combined with home-based exercise programs are consistently associated with superior outcomes, particularly when patients adhere to prescribed regimens (16,17). Conversely, discontinuation or poor adherence to exercise leads to diminished therapeutic effects, recurrence of

symptoms, and reduced long-term efficacy (18). Adherence to exercise is therefore considered a critical determinant of treatment success, influencing pain intensity, functional performance, and prevention of recurrent disability (19,20). Despite strong evidence supporting exercise adherence, multiple barriers hinder compliance. Patient-related factors such as low motivation, depression, fear of pain, and poor self-efficacy, along with external challenges including limited family support, financial constraints, and reduced access to therapists, contribute to poor adherence rates (21–23).

Studies indicate that only 50–70% of patients complete prescribed exercises, with adherence declining over time, thereby undermining therapeutic outcomes and increasing the burden on healthcare systems (19,24). In particular, older adults demonstrate lower adherence rates, often due to lack of confidence and logistical barriers, while enhanced therapist-patient interaction and behavior change strategies have been shown to improve long-term compliance (25–27).

In Pakistan, limited research has been conducted to assess exercise adherence in physiotherapy practice. Previous studies have either focused on stroke patients or relied on non-validated instruments such as the General Rehabilitation Adherence Scale (GRAS), which limits generalizability to musculoskeletal populations (28,29). To date, no study in the country has systematically assessed exercise adherence using the Exercise Adherence Rating Scale (EARS), a standardized and validated questionnaire widely applied in musculoskeletal rehabilitation research (6). This gap highlights the urgent need for context-specific data to understand adherence patterns and barriers within local patient populations

Given this background, the present study was designed to evaluate exercise adherence among patients with musculoskeletal disorders attending a tertiary care physiotherapy outpatient department, using the EARS tool. The study specifically aimed to quantify adherence rates, identify correlates of compliance and non-compliance, and generate insights for improving patient-centered rehabilitation strategies in resource-limited settings.

MATERIAL AND METHODS

This study employed a cross-sectional observational design, chosen to provide a snapshot of exercise adherence among patients with musculoskeletal disorders. The setting was the Physiotherapy Outpatient Department of Hayatabad Medical Complex, a tertiary care hospital in Peshawar, Pakistan, where the study was conducted over a six-month period. The rationale for this design was to assess adherence patterns in a real-world clinical context, focusing on patients receiving physiotherapy care for musculoskeletal conditions.

Eligible participants were male and female patients aged 16 years and above presenting with musculoskeletal disorders and attending at least one week of follow-up at the physiotherapy outpatient department. Patients who declined informed consent were excluded from the study. Participants were recruited consecutively as they presented to the department during the study period, ensuring a pragmatic approach consistent with outpatient flow. Before enrollment, the purpose of the study was explained to all patients, and written informed consent was obtained in accordance with ethical principles.

Data were collected using the Exercise Adherence Rating Scale (EARS), a validated instrument widely used to assess exercise adherence in musculoskeletal rehabilitation settings (6). The EARS consists of multiple sections: Section A explores contextual factors such as type and frequency of prescribed exercises, Section B evaluates adherence behaviors, and Section C assesses barriers to adherence. The tool was administered in person by trained physiotherapists during clinic visits. For participants unable to attend follow-up in person, data were collected via structured telephone interviews to minimize attrition. All responses were recorded on standardized forms and later entered into a secure database.

Key study variables included demographic characteristics (age, sex, educational status, marital status), clinical characteristics (region affected, diagnosis, number of physiotherapy visits), and adherence-related parameters captured by the EARS tool. Exercise adherence was operationally defined by total EARS scores, with scores below the mean value categorized as non-compliant and those equal to or above the mean categorized as compliant. Independent variables such as type of exercise prescribed, exercise frequency, duration, and reasons for discontinuation were also recorded.

To address potential sources of bias, standardized administration of questionnaires was ensured by training all physiotherapists involved in data collection. Data entry was cross-checked by two independent researchers to ensure accuracy and reproducibility. Potential confounders such as age, education, and marital status were adjusted for during statistical analyses to provide unbiased estimates of associations between adherence and patient characteristics.

The required sample size was initially calculated to be 154 using EPI Info software, based on a 95% confidence level and expected adherence prevalence from previous literature (30). However, due to restrictions related to the COVID-19 pandemic, only 50 participants could be recruited during the study period. While this reduced sample size limited the power of the study, analyses were conducted with appropriate caution and transparency regarding this limitation. All statistical analyses were performed using SPSS version 22. Descriptive statistics included mean and standard deviation for continuous variables and frequencies with percentages for categorical variables. Group differences in adherence were examined using chi-square tests for categorical variables and Pearson's correlation coefficients for continuous predictors. A p-value of less than 0.05 was considered statistically significant. No imputation was performed for missing data, as complete responses were required for inclusion in the final analysis. Where relevant, subgroup analyses were conducted to explore adherence differences across demographic and clinical strata.

The study was approved by the Institutional Review Board of Hayatabad Medical Complex prior to data collection, with permission also obtained from the Head of the Physiotherapy Department. Ethical standards were maintained throughout the research process, and patient

confidentiality was ensured by anonymizing responses during data analysis. To enhance reproducibility, detailed documentation of data collection and coding procedures was maintained, and adherence to international reporting standards was followed.

RESULTS

A total of 48 participants were included, evenly distributed by gender with 24 males and 24 females, and a mean age of 34.3 years (SD 11.3). Baseline demographic characteristics showed no significant differences between men and women in terms of age, education, or region affected. While more women were married than men (70.8% vs. 41.7%), the association between marital status and adherence was not statistically significant (p=0.06). Clinically, half of the patients presented with upper limb involvement, while 41.7% had lower limb complaints, and 8.3% reported spinal conditions, with no meaningful gender differences (p=0.87).

Exercise-related characteristics indicated that 56.3% of patients were prescribed fixed-duration exercise programs, while 43.8% continued on ongoing regimens. The majority of patients (66.7%) reported performing exercises daily, with another 16.7% exercising four to six days per week, and only 2% reporting no participation at all. Adherence behaviors were similar between men and women (p=0.58). The most common barriers to continuation were lack of time, reported by 25% of patients, and lack of motivation, cited by 8.3%. Notably, two-thirds of participants (66.7%) reported no difficulty maintaining exercise regimens, highlighting the influence of program design and patient support.

When categorized according to the EARS mean score, 29 participants (60.4%) were classified as compliant, while 19 (39.6%) were non-compliant. Adherence was not associated with age (mean 35.2 vs. 33.0 years, p=0.48), education (72.4% vs. 68.4% educated, p=0.73), or marital status (48.3% vs. 68.4% married, p=0.10). Similarly, exercise prescribed whether under direct supervision or home-based—did not influence adherence rates (p=0.59).

However, compliance was significantly associated with exercise prescription characteristics. Patients instructed to perform exercises daily or for longer durations were more likely to adhere, with both frequency (p=0.03, r=0.29) and duration (p=0.03, r=0.28) showing moderate positive correlations with compliance.

Table 1. Baseline Characteristics of Study Participants (N = 48)

Variable	Male (n=24)	Female (n=24)	Total (N=48)	p-value*
Age (years), mean ± SD	34.6 ± 11.1	34.1 ± 11.6	34.3 ± 11.3	0.88
Educational Status				
– Educated	18 (75.0%)	16 (66.7%)	34 (70.8%)	0.52
– Uneducated	6 (25.0%)	8 (33.3%)	14 (29.2%)	
Marital Status				
– Married	10 (41.7%)	17 (70.8%)	27 (56.3%)	0.06
– Unmarried	14 (58.3%)	7 (29.2%)	21 (43.7%)	
Region Affected				
– Upper Limb	13 (54.2%)	11 (45.8%)	24 (50.0%)	0.87
– Lower Limb	9 (37.5%)	11 (45.8%)	20 (41.7%)	
– Spine	2 (8.3%)	2 (8.3%)	4 (8.3%)	

Table 2. Exercise Adherence Characteristics (EARS Section A)

Variable	Male (n=24)	Female (n=24)	Total (N=48)	p-value
Duration of Exercises				
– Ongoing	9 (37.5%)	12 (50.0%)	21 (43.8%)	0.39
– Fixed Duration	15 (62.5%)	12 (50.0%)	27 (56.3%)	
Frequency of Doing Exercises				
– Every day	15 (62.5%)	17 (70.8%)	32 (66.7%)	0.58
– 4–6 days/week	6 (25.0%)	2 (8.3%)	8 (16.7%)	
– 2–3 days/week	3 (12.5%)	4 (16.7%)	7 (14.6%)	
– Not at all	0 (0.0%)	1 (4.2%)	1 (2.0%)	
Reasons for Stopping Exercises				
– Time Issue	4 (16.7%)	8 (33.3%)	12 (25.0%)	0.19
– Laziness	2 (8.3%)	2 (8.3%)	4 (8.3%)	
– None Reported	18 (75.0%)	14 (58.3%)	32 (66.7%)	
Type of Exercise Prescribed				
– With Physiotherapist	3 (12.5%)	3 (12.5%)	6 (12.5%)	1.00
– Home-Based (Therapist Advised)	21 (87.5%)	21 (87.5%)	42 (87.5%)	
Frequency of Prescribed Exercises				
– Every day	14 (58.3%)	17 (70.8%)	31 (64.6%)	0.54
– 4–6 days/week	6 (25.0%)	4 (16.7%)	10 (20.8%)	
– 2–3 days/week	4 (16.7%)	3 (12.5%)	7 (14.6%)	

Table 3. Compliance with Prescribed Exercise Programs and Correlates (N = 48)

Variable	Compliant (n=29, 60.4%)	Non-Compliant (n=19, 39.6%)	p-value	Pearson's r (95% CI)
Age (years), mean ± SD	35.2 ± 11.8	33.0 ± 10.5	0.48	0.19 (-0.12 to 0.47)
Educational Status			0.73	-0.05 (-0.33 to 0.24)
– Educated	21 (72.4%)	13 (68.4%)		
– Uneducated	8 (27.6%)	6 (31.6%)		
Marital Status			0.10	-0.24 (-0.50 to 0.05)
– Married	14 (48.3%)	13 (68.4%)		
– Unmarried	15 (51.7%)	6 (31.6%)		
Frequency of Doing Exercise			0.12	0.23 (-0.06 to 0.49)
Type of Exercises Prescribed			0.59	-0.08 (-0.36 to 0.22)
Frequency of Prescribed Exercises			0.03*	0.29 (0.01 to 0.53)
Duration of Exercises Prescribed			0.03*	0.28 (0.00 to 0.52)
Reason for Stopping Exercises			<0.001*	-0.87 (-0.94 to -0.74)

Conversely, reasons for discontinuing exercise were strongly and inversely correlated with adherence (r=-0.87, p<0.001), indicating that patient-reported barriers such as time constraints and lack of motivation were the most powerful predictors of non-adherence. Overall, the findings suggest that adherence in this cohort was moderate, with six out of ten patients maintaining compliance. Clinical and demographic variables had little influence, while prescription-related factors and behavioral barriers emerged as the primary determinants of whether patients adhered to their exercise programs.

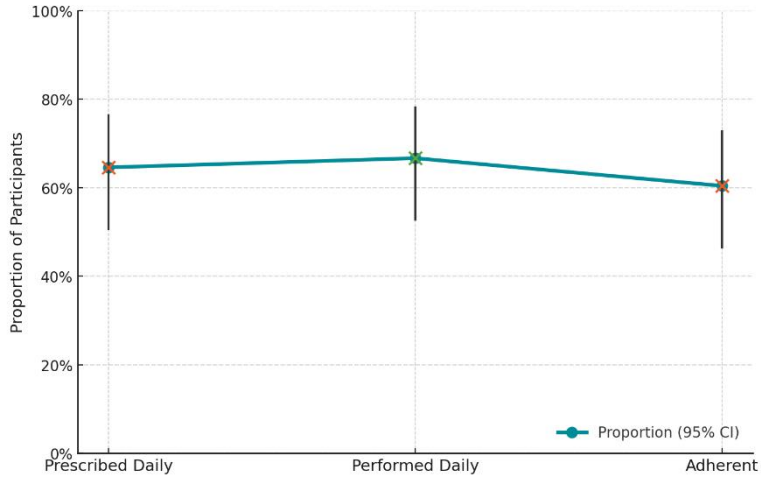

Figure 1 Conversion from Prescription to Performance to Adherence with 95% CIs

The visualization compares three conversion points—prescribed daily exercises (31/48, 64.6%; 95% CI ~51.6–75.8), performed daily exercises (32/48, 66.7%; 95% CI ~53.6–77.5), and overall adherence (29/48, 60.4%; 95% CI ~47.5–72.1)—displayed as an integrated line with scatter points and 95% confidence-interval whiskers. The trajectory shows a slight rise from prescription to performance (+2.1 percentage points) followed by a 6.3-point drop to achieved adherence, indicating attrition between regular performance and meeting the adherence threshold. Clinically, this gap quantifies where behavior change support could yield the highest marginal gains—after patients are already performing exercises frequently but before they translate that behavior into sustained adherence relative to the EARS cutoff. The palette applies Teal/Turquoise (#008B99) for the trend line with alternating Orange (#F05A22) and Accent Green (#5EA63F) markers on a white background (#FFFFFF) and gray accents (#333333) to maintain contrast and readability.

DISCUSSION

The present study demonstrated that approximately 60% of patients with musculoskeletal disorders adhered to prescribed exercise regimens, while 39.6% were classified as non-adherent according to the EARS cutoff. Importantly, adherence was significantly associated with the frequency and duration of prescribed exercises, whereas demographic and social variables, including age, sex, marital status, and educational status, did not show any significant influence. These findings emphasize that program-related characteristics, rather than baseline patient attributes, play a decisive role in sustaining compliance in rehabilitation settings.

Our results align with international evidence suggesting that adherence to physiotherapy programs is driven more by the structure and delivery of exercise prescriptions than by sociodemographic factors. Studies conducted in Europe and the United States have similarly shown that higher frequency and longer durations of supervised exercise sessions lead to improved compliance and better long-term functional outcomes (32,33). In particular, Pisters et al. reported that adherence to exercise in patients with osteoarthritis was strongly correlated with improved pain and physical function, independent of age or education (34). Likewise, Chester et al. highlighted that physiotherapy response for shoulder pain depended more on the quality and intensity of prescribed sessions than patient background

characteristics (35). These findings, together with our data, underscore the pivotal role of prescription design and therapist engagement in determining adherence.

Conversely, our study did not identify the effect of marital status or education on compliance, despite prior work indicating that social support and literacy may influence health-related behaviors. For instance, a study in Karachi using the GRAS tool reported that educational level was strongly associated with adherence, with educated patients more likely to maintain prescribed regimens (36). However, this discrepancy may be explained by the use of a standardized and internationally validated instrument (EARS) in the present study, which more comprehensively captures adherence behaviors compared with non-validated tools used in previous local studies. Moreover, the setting of our study—a government tertiary hospital—may have provided a more standardized therapeutic environment, reducing the impact of educational and social differences observed in private clinic populations.

Patient-reported barriers such as lack of time and low motivation emerged as major determinants of non-adherence, consistent with evidence that behavioral and psychological factors are key obstacles to long-term compliance. Prior systematic reviews have shown that low self-efficacy, depression, and poor patient–therapist communication are among the strongest predictors of non-adherence (37,38). Our data similarly reflect that patients reporting laziness or time constraints were significantly less likely to remain adherent, suggesting that targeted behavior-change strategies, such as motivational interviewing and digital reminders, may be effective in this setting (39).

The clinical implications of these findings are significant for rehabilitation practice in Pakistan and other low- and middle-income countries. First, they highlight the need to optimize prescription strategies, with emphasis on daily exercise routines and sustained program duration to maximize adherence. Second, they demonstrate that therapist-patient interaction should be enhanced to address behavioral barriers, as increased face-to-face time and reinforcement of program benefits have been shown to improve compliance (40). Finally, the findings suggest that interventions tailored toward improving motivation, such as app-based monitoring, peer support groups, or structured follow-up calls, could mitigate the behavioral causes of non-adherence and bridge the gap between performance and sustained adherence (41).

Strengths of this study include the use of a standardized adherence tool (EARS), a government sector outpatient setting that improves generalizability, and systematic evaluation of both patient characteristics and prescription-related factors. However, several limitations must be acknowledged. The sample size was smaller than initially calculated due to restrictions imposed by the COVID-19 pandemic, which may have limited statistical power to detect associations with less common variables. Additionally, the cross-sectional design does not allow for causal inference, and adherence was measured at a single point in time, potentially overlooking long-term fluctuations. Finally, while telephone follow-up minimized attrition, self-reported adherence is inherently vulnerable to recall and social desirability bias.

Despite these limitations, the study provides valuable evidence on exercise adherence in musculoskeletal rehabilitation in Pakistan, a setting where few studies have used validated instruments. The results reinforce that optimizing exercise prescription characteristics and addressing behavioral barriers are essential to enhance adherence and improve treatment outcomes. Future research should explore longitudinal adherence patterns, assess adherence by specific diagnostic categories such as knee osteoarthritis or low back pain, and evaluate the impact of digital adherence-enhancing interventions in this population.

CONCLUSION

This study demonstrated that adherence to prescribed exercise programs among patients with musculoskeletal disorders was moderate, with approximately six out of ten participants classified as compliant. Compliance was significantly influenced by prescription-related factors, particularly the frequency and duration of exercises, while demographic and social characteristics such as age, sex, marital status, and education showed no association with adherence. Patient-reported barriers, most notably lack of time and low motivation, were key contributors to non-adherence. These findings emphasize that the quality and structure of exercise prescriptions, together with strategies addressing behavioral and motivational obstacles, are central to achieving sustained compliance. Strengthening therapist–patient interaction, incorporating behavioral support, and integrating evidence-based adherence-enhancing tools could help improve long-term outcomes. In resource-limited contexts, such as tertiary care outpatient departments in Pakistan, these strategies may be particularly valuable to optimize rehabilitation outcomes and reduce the burden of musculoskeletal disability.

REFERENCES

1. Punnett L, Wegman DH. Work-related musculoskeletal disorders: epidemiologic evidence and the debate. J Electromyogr Kinesiol. 2004;13(1):13–23.

2. McLean S, Holden MA, Potia T, Gee M, Mallett R, Bhanbhro S, et al. Quality and acceptability of measures of exercise adherence in musculoskeletal settings: a systematic review. Rheumatology. 2017;56(3):426–38.

3. Jordan JL, Holden MA, Mason EE, Foster NE. Interventions to improve adherence to exercise for chronic musculoskeletal pain in adults. Cochrane Database Syst Rev. 2010;(1):CD005956.

4. Vincent HK, Raiser SN, Vincent KR. The aging musculoskeletal system and obesity-related considerations with exercise. Ageing Res Rev. 2012;11(3):361–73.

5. Klintberg IH, Cools AM, Holmgren TM, Holzhausen AC, Johansson K, Maenhout AG, et al. Consensus for physiotherapy for shoulder pain. Int Orthop. 2015;39(4):715–20.

6. Holden MA, Haywood KL, Potia TA, Gee M, McLean S. Recommendations for exercise adherence measures in musculoskeletal settings: a systematic review and consensus meeting (protocol). Syst Rev. 2014;3(1):10.

7. Fraix M. Role of the musculoskeletal system and the prevention of falls. J Am Osteopath Assoc. 2012;112(1):17–21.

8. Hicks GE, Benvenuti F, Fiaschi V, Lombardi B, Segenni L, Stuart M, et al. Adherence to a community-based exercise program is a strong predictor of improved back pain status in older adults: an observational study. Clin J Pain. 2012;28(3):195–203.

9. Karels C, Bierma-Zeinstra S, Burdorf A, Verhagen AP, Nauta A, Koes BW. Social and psychological factors influenced the course of arm, neck and shoulder complaints. J Clin Epidemiol. 2007;60(8):839–48.

10. Rodrigues EV, Gomes ARS, Tanhoffer AIP, Leite N. Effects of exercise on pain of musculoskeletal disorders: a systematic review. Acta Ortop Bras. 2014;22(6):334–8.

11. McBeth J, Jones K. Epidemiology of chronic musculoskeletal pain. Best Pract Res Clin Rheumatol. 2007;21(3):403–25.

12. Ogwumike OO, Badaru UM, Adeniyi AF. Factors influencing adherence to home-based exercise by stroke survivors in North Western Nigeria. Int J Ther Rehabil Res. 2014;3(1):1–7.

13. Chester R, Shepstone L, Daniell H, Sweeting D, Lewis J, Jerosch-Herold C. Predicting response to physiotherapy treatment for musculoskeletal shoulder pain: a systematic review. BMC Musculoskelet Disord. 2013;14(1):203.

14. Van Gool CH, Penninx BW, Kempen GI, Rejeski WJ, Miller GD, Van Eijk JT, et al. Effects of exercise adherence on physical function among overweight older adults with knee osteoarthritis. Arthritis Care Res. 2005;53(1):24–32.

15. Al-Eisa E. Indicators of adherence to physiotherapy attendance among Saudi female patients with mechanical low back pain: a clinical audit. BMC Musculoskelet Disord. 2010;11:124.

16. Pisters MF, Veenhof C, Schellevis FG, Twisk JW, Dekker J, de Bakker DH. Exercise adherence improving long-term patient outcome in patients with osteoarthritis of the hip and/or knee. Arthritis Care Res. 2010;62(8):1087–94.

17. Jack K, McLean SM, Moffett JK, Gardiner E. Barriers to treatment adherence in physiotherapy outpatient clinics: a systematic review. Man Ther. 2010;15(3):220–8.

18. Anar SÖ. The effectiveness of home-based exercise programs for low back pain patients. J Phys Ther Sci. 2016;28(10):2727–30.

19. Lambert TE, Harvey LA, Avdalis C, Chen LW, Jeyalingam S, Pratt CA, et al. An app with remote support achieves better adherence to home exercise programs than paper handouts in people with musculoskeletal conditions: a randomised trial. J Physiother. 2017;63(3):161–7.

20. Lyngcoln A, Taylor N, Pizzari T, Baskus K. The relationship between adherence to hand therapy and short-term outcome after distal radius fracture. J Hand Ther. 2005;18(1):2–8.

21. Marks R, Allegrante JP. Chronic osteoarthritis and adherence to exercise: a review of the literature. J Aging Phys Act. 2005;13(4):434–60.

22. Forkan R, Pumper B, Smyth N, Wirkkala H, Ciol MA, Shumway-Cook A. Exercise adherence following physical therapy intervention in older adults with impaired balance. Phys Ther. 2006;86(3):401–10.

23. Hay-Smith J, Dean S, Frawley H, McClurg D, Dumoulin C. Exercise adherence: integrating theory, evidence and behaviour change techniques. Physiotherapy. 2015;101:e9–10.

24. Alewijnse D, Metsemakers JF, Mesters IE, van den Borne B. Effectiveness of pelvic floor muscle exercise therapy supplemented with a health education program to promote long-term adherence among women with urinary incontinence. Neurourol Urodyn. 2003;22(4):284–95.

25. Saner J, Bergman EM, de Bie RA, Sieben JM. Low back pain patients' perspectives on long-term adherence to home-based exercise programmes in physiotherapy. Musculoskelet Sci Pract. 2018;38:77–82.

26. McLean SM, Burton M, Bradley L, Littlewood C. Interventions for enhancing adherence with physiotherapy: a systematic review. Man Ther. 2010;15(6):514–21.

27. Wright BJ, Galtieri NJ, Fell M. Non-adherence to prescribed home rehabilitation exercises for musculoskeletal injuries: the role of the patient-practitioner relationship. J Rehabil Med. 2014;46(2):153–8.

28. Medina-Mirapeix F, Escolar-Reina P, Gascón-Cánovas JJ, Montilla-Herrador J, Jimeno-Serrano FJ, Collins SM. Predictive factors of adherence to frequency and duration components in home exercise programs for neck and low back pain: an observational study. BMC Musculoskelet Disord. 2009;10:155.

29. Picorelli AM, Pereira LS, Pereira DS, Felício D, Sherrington C. Adherence to exercise programs for older people is influenced by program characteristics and personal factors: a systematic review. J Physiother. 2014;60(3):151–6.

30. Naqvi AA, Hassali MA, Naqvi SBS, Shakeel S, Zia M, Fatima M, et al. Development and validation of the General Rehabilitation Adherence Scale (GRAS) in patients attending physical therapy clinics for musculoskeletal disorders. BMC Musculoskelet Disord. 2020;21(1):773.

31. Basri R, Naseen M, Naz A. Factors affecting compliances with physiotherapy among stroke patients: physiotherapist's perspective: a study from Peshawar Pakistan. Pak J Neurol Sci. 2017;12(3):26–31.