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ORIGINAL REPORT

NON-ADHERENCE TO PRESCRIBED HOME REHABILITATION EXERCISES FOR MUSCULOSKELETAL INJURIES: THE ROLE OF THE PATIENT-PRACTITIONER RELATIONSHIP

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Objective: **To identify which factors best explain non-adherence to home rehabilitation exercises (HRE) for patients with musculoskeletal injuries.**
Design: **Cross-sectional study.**
Methods: **Participants ($n = 87$) aged 17–91 years completed questionnaires measuring demographic and injury-related information, self-efficacy, personality, health locus of control, patient-practitioner relationship, optimism, health value and adherence to HRE. In addition, each participant's attending physiotherapist assessed the participant's adherence and effort during the appointment.**
Results: **A hierarchical regression with 3 steps (step 1: disposition; step 2: cognitive factors; step 3: patient-practitioner relationship) and adherence to HRE as the dependent variable was conducted. The factors in step 3 were the most significant and explained 16% ($p < 0.001$) of the variance in adherence to HRE. In addition, a high score for patient neuroticism was found to correlate with poor adherence to HRE.**
Conclusion: **These preliminary results suggest that the patient-practitioner relationship is the best predictor of adherence to HRE, and that improving patient perception of the clinician's productivity, communication of information and trust during consultations may improve adherence to HRE.**

Key words: adherence; rehabilitation; physiotherapy; patient-practitioner relationship.

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INTRODUCTION

The rationale for research into patient adherence with medication adherence includes improved health and reduced negative financial, physical and emotional consequences within society (1, 2). Research into this area has been prolific, with investigations focussed on factors predictive of adherence or non-adherence (NA), and the assessment of specific interventions to improve NA (3, 4). The rationale for studying adherence to prescribed home rehabilitation exercises (HRE) is the same, yet, surprisingly, there is a dearth of published research into factors related to adherence to HRE (5) and even less into successful interventions (6).

The reported rates of NA are similar (medication 50% (1, 2) vs HRE 50–65% (5, 7)), but HRE is reported to be a less efficacious treatment method compared with medication (6). Nevertheless, given that many patients are prescribed HRE for musculoskeletal conditions such as low-back pathology and pain (which is reported to affect up to 60% of people within society (8)), there is a need for better understanding of NA in these patients.

Systematic reviews of the literature on adherence suggest that individual cognitive and coping styles and poor patient-practitioner relationships (PPR) are some of the best predictors of NA across a range of behaviours (e.g. 1, 9), yet information pertaining to the effect sizes of such constructs have not been reported. However, a meta-analysis (10) suggests that poor physician communication increases the risk of NA by up to 19%. Disposition has rarely been assessed as a predictor of NA.

Disposition, cognitive/coping style, patient-practitioner relationships and non-adherence

It would seem unusual that dispositional factors, such as neuroticism (marked by low emotional stability and increased anxiety) and optimism (marked by positive expectancies for future events), have rarely been assessed as predictors of adherence to medication or HRE, given their links to health and mortality (e.g. 11, 12), goal achievement (e.g. exercise, academic success), withdrawing from responsibilities, such as school, when neuroticism is high (13) and disengagement from goal pursuits when optimism is low (14). Despite scant research, neuroticism has shown associations with low adherence to HRE (15), and optimism with increased rates of medication adherence (16, 17). Further research into disposition may identify those patients who are more likely not to adhere to treatment.

Cognitive and coping styles encompass numerous domains, with many reporting self-efficacy of treatment to improve health, self-efficacy for the individual to *perform* the behaviour (e.g. 18, 19), and internal locus of control (e.g. 20, 21) as having strong links with rates of medication and, to a lesser extent, HRE NA. Studies suggest that self-efficacy mediates the relationships between both social support and

health literacy with NA to medication (18, 19). One study reports that participants with low self-efficacy were 7.4 times more likely to not adhere to prescribed medication regimens (19). Levenson (22) proposed that 3 factors contribute to a person's locus of control: internal (individuals are responsible for their own outcomes), chance (that outcomes are controlled by chance or fate), and powerful others (individuals of higher authority are responsible for outcome). Research suggests that participants with higher internal locus of control scores were more likely to report less bodily pain and to return to work more quickly following vocational rehabilitation (21) and to require significantly fewer days to achieve 90º knee extension following knee surgery (22). Despite the interest and positive findings associated with health attribution, there has been little research focussing on a separate, but related, issue; the value that a person places upon their health, and intuitively, this would appear to be related to motivation to adhere to HRE.

Research in physiotherapy settings has focussed mainly on predictive factors of NA, including: demographic information, disposition, coping styles, injury type and severity (5, 7, 23) and, to a lesser extent, PPR (5), self-efficacy to complete the HRE (24), and poor adherence to clinic-based activities (8). Further research into the effect of PPR on NA appears necessary, given findings suggesting that this may be one of the most promising areas for intervention in medication adherence (25–28).

The Sport Injury Rehabilitation Adherence Scale (SIRAS; 29), which is completed by the therapist, is most commonly used as a means of assessing patient adherence within clinic settings, and some have found it useful for predicting adherence to HRE (8).

Purpose of study

Our selection of possible predictors of NA was informed by incorporating variables that are known to influence NA to medicine, but that have not been adequately generalized to HRE (i.e. self-efficacy, locus of control, PPR), and those that would appear to be related to adherence to HRE but have not been assessed (i.e. disposition, health value). The aim of the present investigation was to determine which individual variables (i.e. neuroticism, psychoticism, extraversion, optimism, health value, self-efficacy, locus of control, and PPR) were the most important predictors of NA. A further aim was identify which areas (i.e. disposition, cognitive coping styles or PPR) could best explain NA to HRE and further, what the contributions of cognitive coping style and PPR were after controlling for disposition. Based on the information garnered primarily from the literature on medication adherence (e.g. 1, 9, 15–17), we hypothesized that the PPR and the dispositions optimism and neuroticism would be strong predictors of adherence to HRE, but given the dearth of available evidence, we could not specify which of these predictors would be most important. These aims were devised to provide an empirical evidence base for future intervention.

METHODS

Participants

Based on the effect size of a similar study (27) that used linear regression analyses and assessed a similar set of psychological and patient-practitioner measures to assess adherence to prophylactic medication, we used G*Power 3.1.2 software to determine that, with an effect size of 0.30, and α and power set at 0.05 and 0.80, respectively, we required a sample size of at least 69 to detect a significant effect in our largest regression model.

Participants ($n = 100$) were recruited from physiotherapy clinics serving inner-city and regional Victoria, Australia between March and September 2011. Of these, 13 were missing entire scales and were not used in data analysis, leaving $n = 87$ (female: 62). Seventy-one participants reported their age, ranging from 17 to 91 years, (mean 43.77 years (standard deviation (SD) 17.57)). Participants were recruited by invitation from their attending physiotherapist, receptionist, or responded to flyers displayed in clinic waiting areas. Participants were asked "Would you be interested in participating in a study that seeks to identify why people do, or do not, complete their HRE?"

Participants within the study self-reported inclusion criteria that they were: (*i*) currently attending a physiotherapy clinic for musculoskeletal injuries; and (*ii*) had been prescribed take-home exercises supplementing their treatment at the clinic. As an incentive to participate, those who provided a contact phone number were entered into a raffle, and were eligible to win 1 of 13 small prizes.

Institutional ethics approval was obtained from La Trobe University and all procedures were carried out in accordance with the conditions of this approval (FHEC 11/R18).

Measures

Demographic and adherence questionnaire. The demographic and adherence questionnaire measured information including age, sex, marital status, level of education, profession and participation in organized or non-organized sport. In addition, information specifically relating to the participant's injury was measured with single-item questions about injury acquisition, seriousness, prognosis, perceived pain, and social support.

Individual adherence (IndAdh) was measured using 3 questions devised for this study based on the SIRAS questionnaire, as follows: "Do you perform all the exercises that your rehabilitation clinician has set for you?" with a dichotomous yes/no response (100/0), followed by "How much effort do you put into your exercises?" using a 4-point Likert scale with responses ranging from 1 (a lot of effort), to 4 (no effort), followed by "What percentage of your exercises do you complete?" using a response scale requiring a circled response from 0% to 100% in intervals of 20%. Where necessary, the responses from these items were altered to scores out of 100 to ensure that each item was equally weighted (i.e. 1 = 100, 2 = 66, 3 = 33, 4 = 0) and the mean of the scores from the 3 questions was calculated to determine each individual's IndAdh score. Higher scores indicate adherence to the HRE.

General Self-Efficacy Scale – Modified. Self-efficacy was measured using the General Self-Efficacy Scale (GSE) (30). The GSE measures a participant's confidence in their ability to respond to environmental demands and challenges. The scale consists of 10 items with a 4-point Likert response scale, ranging from 1 (not at all true) to 4 (exactly true). In line with Schwarzer's recommendations (30), the GSE was modified to be specific to the HRE by the addition of phrases such as "in my rehabilitation". Cronbach's alpha has been reported as 0.82 (30) (current study 0.93). Higher scores indicate greater self-efficacy to complete HRE.

Eysenck Personality Questionnaire. The Eysenck Personality Questionnaire Revised – Short form (EPQR-S) (31) has 3 subscales: neuroticism (Neuro), extraversion (Extra), and psychoticism (Psych),

each including 12 items with a dichotomous yes/no response (32). The EPQR-S has displayed strong internal consistency; Cronbach's α is 0.80 for neuroticism (current study 0.83), 0.88 and 0.84 for extraversion (current study 0.90) and 0.62 and 0.61 for psychoticism (current study 0.25) (32). Higher scores indicate higher levels of the dispositional trait.

Multidimesional Health Locus of Control Scale. The Multidimensional Health Locus of Control – Form A (MHLC) (33) scale measures an individual's perception of 3 factors that determined their health outcomes; Internal (Internal), Chance (Chance) and Powerful Other (Powerful) factors. The scale comprises 18 items, including 6 items per subscale. Responses were rated from 1 (strongly agree) to 6 (strongly disagree). Cronbach's alpha for both form A and B range from 0.60 to 0.75 (34) (current study 0.54–0.73). Higher scores indicate a higher level of the control style.

Medical Interview Satisfaction Scale. The Medical Interview Satisfaction Scale (MISS) (35) assessed the PPR within the physiotherapy consultation by measuring client satisfaction with medical appointments with their attending practitioner. In the current study, the MISS was modified to be applicable within the context of a physiotherapy consultation, by substituting words such as "doctor" and "illness" with "physiotherapist" and "injury". The MISS consists of 25 items, with 3 subscales, "Affect" assesses the client's perceived emotional trust and security towards their physiotherapist; an example question includes "After talking to the physiotherapist, I felt much better about my problems". The second scale measures the client's satisfaction with productivity within the consultation ("Behavioural"), including questions such as "the physiotherapist looked into all the problems I mentioned". The third scale assesses the client's satisfaction in relation to communication and presentation of information during consultations ("Cognitive"), including questions such as "I feel I understand pretty well the physiotherapist's plan for helping me". The Cronbach's alpha for each subscale are reported as; Affective (0.86) (current study 0.89), Behavioural (0.87) (current study 0.65) and Cognitive (0.87) (current study 0.91) (35). Higher scores indicate higher levels of satisfaction in each area.

Life Orientation Test. The Life Orientation Test (LOT) (36) measures an individual's generalized optimism. The LOT consists of 12 items requiring participants to provide a response from 1 of 5 values, ranging from A (I agree a lot) to E (I disagree a lot). Cronbach's alpha of 0.76 has been reported (36) (current study 0.82). Strong test-retest reliability within a 4-week period was also associated with the scale (0.79) (36). Higher scores correspond with increased dispositional optimism.

Health Value Scale. The Health Value Scale (HV) (37) consists of 4 items aimed at measuring the value that an individual placed on their health. Each item required the participant to select a response from a 7-point scale, ranging from 1 (strongly agree) to 7 (strongly disagree). Internal consistency was identified at a Cronbach's alpha of 0.67 (current study 0.67). Higher scores indicate a greater concern for one's health.

Sports Injury Rehabilitation Adherence Scale. The Sports Injury Rehabilitation Adherence Scale (SIRAS) (29) measured patient involvement within clinical rehabilitation as assessed by the practitioner. The scale consists of 3 items measuring their client's intensity of completed exercise, frequency of following advice and openness to change, using a 5-point response scale, ranging from 1 (minimum) to 5 (maximum). Research asserts a Cronbach's alpha of 0.82 (current study 0.76) (29). Inter-rater reliability (0.82) and test-retest reliability (0.76) have also been demonstrated as adequate (29). Similar to IndAdh the SIRAS was also converted to provide a score out of 100, with higher scores suggesting that the participant is more adherent during the treatment session.

Procedure

Physiotherapy and rehabilitation clinics throughout suburban and rural Victoria were approached ($n = 45$) to participate within the current study, with 16 clinics volunteering to participate (35.5%). Clinics that agreed to participate were provided with materials. Volunteering clients from the participating clinics were provided with a questionnaire pack to be completed and returned via reply-paid envelope. Clinicians were also asked to complete a SIRAS corresponding to each questionnaire pack immediately after the participant's consultation. The SIRAS was then paired with the participant questionnaires via a matching code placed on the materials.

Data analyses and screening

We used SPSS Version 17.0 software for all statistical analyses. Pearson correlation was used to assess relationships between key variables, and one-sample *t*-tests were used to assess differences between sample and normative data. Cohen's *d* was used to assess the effect sizes of these comparisons. Two hierarchical regressions were conducted, with dispositional variables entered at step 1, cognitive variables at step 2, and practitioner factors at step 3. The dependant variables were SIRAS and IndAdh.

The SIRAS, Affective and Cognitive scales were substantially negatively skewed, with *z* scores above 3.29 units. These variables were reflected and transformed using square root and natural logarithmic transformations. To assist reader interpretation, the direction of association of these variables has been re-adjusted to their actual state.

RESULTS

Sample characteristics

Pearson bivariate correlations revealed no significant relationships between age, sex, injury severity, prognosis, sport or exercise participation, social support or pain tolerance with either of the 2 adherence measures (i.e. IndAdh, SIRAS). The SIRAS scores were not related to the IndAdh scores. Education was related to SIRAS scores however, $r = 0.23$, $p = 0.02$, indicating that those with higher education were perceived by therapists as more adherent. IndAdh was not related to education. Item 1 of the IndAdh subscale revealed that 89% of participants reported completing all prescribed exercises. For item 2, 87% of participants checked responses 1 and 2 on the 4-point Likert scale, which assessed how much effort they put into their exercises (ranging from a lot of effort to no effort) and for item 3, 73% reported completing at least 80% of their exercise, which was at odds with the response to item 1. Sample characteristics were computed and illustrate participant attributes (Table I).

Comparisons with normative data were undertaken to provide context to the relationships that would be investigated (Table II).

While many of the *t* scores would suggest differences between sample and normative means, this may be attributable to the large normative *N*. As indicated by Cohen (38) *d* scores of 0.25, 0.5 and 0.8 are said to relate to low, medium and large effects, respectively. Considering this information, we decided that medium effect sizes that were significant at $\alpha = 0.01$ constituted clinical differences. Only the LOT scores were above 0.5, suggesting that the sample data did not differ substantially from the normative with the exception of significantly lower levels of optimism. The attained Cronbach's alpha scores were similar to those reported previously, the Psych scale was particularly low, however, and caution is advised when interpreting information derived from this variable.

Table I. *Sample characteristics (*n = *87)*

Variable	%
Age	
<40 years	39
40–50 years	21
>50 years	40
Education	
<High-school	3
High-school graduate	52
>High-school	45
Marital status	
Single	31
Married/de facto	42
Divorced	28
Injury seriousness	
Not serious	7
Mildly serious	35
Serious	37
Very serious	21
Pain due to injury	
No pain	15
Minor pain	58
Substantial pain	21
A lot of pain	6
Injury prognosis	
Good prognosis	34
Reasonable prognosis	30
Unsure prognosis	22
Bad prognosis	14

The SIRAS (mean 88.35, SD 12.00) and IndAdh (mean 72.29, SD 22.52) variables were converted to scores out of 100 and, as anticipated, suggest that the practitioners rated clinic-related as anticipated, the practitioners report of clinic related adherence was higher than the participants report of at-home adherence.

Primary analyses

Two hierarchical regressions were conducted, with dispositional variables entered at step 1, cognitive variables at step 2, and practitioner factors at step 3. The dependant variables were SIRAS and IndAdh. As the overarching goal of this research is to inform possible intervention to improve NA, we considered it prudent to use hierarchical regression to enter those constructs least amenable to change first and those most amenable last. The rationale for this decision is that if disposition uniquely explains a large portion of adherence variance, and other constructs (i.e. cognitive variables, PPR) do not add significantly to the model after disposition has been controlled for, the case for intervention in other areas, although amenable to change, is weak. The first regression used SIRAS as the dependant variable and steps 1, 2 and 3 explained only 7%, 5% and 3%, respectively, of the variance in the SIRAS scores, with none of the steps achieving statistical significance (i.e. significant R^2 change). The results for the second regression were more promising (Table III).

Table II. *Calculated t, d and Cronbach's alpha statistics for sample data (*n = *87)*

	Sample	Normative comparison			
Scale	Mean (SD)	Mean (SD)	*n* [ref]	*t*	d
GSE	31.29 (5.93)	29.48 (5.13)	1,594 [15]	3.25**	0.33
Extra	8.11 (3.75)	6.67 (3.35)	374 [17]	3.79**	0.40
Neuro	5.58 (3.44)	6.95 (3.33)	374 [17]	–3.67**	0.40
Psych	2.35 (1.36)	1.88 (1.74)	374 [17]	2.48*	0.30
Internal	25.79 (4.92)	26.44 (5.61)	1,206 [20]	–1.05	0.12
Chance	17.53 (5.18)	16.96 (6.05)	1,206 [20]	0.86	0.10
Powerful	18.20 (6.65)	20.22 (6.64)	1,206 [20]	–2.74*	0.30
Affective	4.30 (0.64)	4.25 (0.82)	150 [22]	0.49	0.07
Behavioural	3.89 (0.69)	4.29 (1.30)	150 [22]	–2.67*	0.38
Cognitive	4.27 (0.66)	3.91 (1.56)	150 [22]	2.06	0.30
LOT	13.30 (6.80)	21.41 (5.22)	4,309 [25]	11.72**	1.42
HV	5.22 (1.34)	4.44 (1.87)	326 [26]	3.72**	0.48
SIRAS	13.25 (1.93)	12.56 (1.82)	45 [14]	1.30	0.24

*$p<0.05$, **$p<0.001$.
GSE: General Self-Efficacy Scale; LOT: Life Orientation Test; HV: Health Value Scale; SIRAS: Sport Injury Rehabilitation Adherence Scale.

Table III illustrates that the variables entered at both steps 1 (disposition) and 3 (practitioner factors) significantly improved the explanation of variance with HRE. The cognitive factors entered at step 2 did not. Of the 4 dispositional variables entered in the model, high scores on Neuro were clearly most associated with NA to HRE. Although the subset of cognitive variables did not make a significant contribution, it is worthwhile noting the relatively strong positive unique correlation (i.e., sr^2) of GSE with HRE. After controlling for disposition and cognitive factors in earlier steps, the practitioner factors made strong contributions to the prediction of HRE, with the Behavioural component most strongly associated, but with strong relationships also recorded for Cognitive and Affect variables. The model with all 12 variables predicting HRE was also significant; $R^2=0.37$, F (12, 74) = 3.60, $p<0.001$.

DISCUSSION

The findings of this study indicate that patients are most likely to adhere to HRE when they perceive a positive relationship

Table III. *Hierarchical regression depicting the contributions of dispositional (step 1), cognitive (step 2) and practitioner factors (step 3) to self-reported adherence to take-home physiotherapy exercises*

	Final summary			Step summary	
Predictor	Beta	*r*	*sr*	R^2 ch	*p*-value
Step 1				0.19	0.002
Neuro	–0.23	–0.35	–0.17		
Psych	–0.04	0.09	–0.03		
Extra	–0.07	0.01	–0.06		
LOT	0.01	–0.34	0.01		
Step 2				0.02	0.805
Powerful	0.05	–0.06	0.04		
Internal	0.06	0.14	0.05		
Chance	–0.07	–0.14	–0.06		
HV	–0.11	0.03	–0.09		
GSE	0.15	0.27	0.12		
Step 3				0.16	0.001
Affect	0.20	0.07	0.12		
Behavioural	0.52	0.37	0.37		
Cognitive	0.30	0.13	0.19		

GSE: General Self-Efficacy Scale; LOT: Life Orientation Test; HV: Health Value Scale.
Dependant variable: IndAdh; R^2 ch: R^2 change.

with their physiotherapist. In particular, the results suggest that self-reported adherence (IndAdh) is higher when patient perception of behavioural, cognitive and affective elements of the relationship are positive. These PPR subscales relate to how satisfied the client is with the productivity, communication of information and trust in the practitioner during the appointment, respectively. Additional significant variables were neuroticism and self-efficacy, with more neurotic patients reporting higher NA and those low in self-efficacy for the HRE tasks reporting higher NA. It is worthwhile noting that self-efficacy reports (GSE) were categorized as a cognitive element in the hierarchical regression, but some might argue that self-efficacy for HRE is a product of a positive PPR. It was also interesting to observe that neuroticism was related to NA, but that optimism did not appear to increase adherence as expected. This may be attributable to significantly low levels of optimism reported from this sample. In short, our results suggest that neurotic clients were more likely to be NA and that this was compounded by poor patient perceptions of their clinician.

We also found a positive correlation between clinician perception of adherence (SIRAS) and education, but not between education and self-reported adherence (IndAdh), while others found a positive correlation between education and NA (25). We did not find a relationship between lower age and NA, which has been reported by many in the literature on medication adherence (e.g. 27, 29), but which is consistent with the literature on HRE adherence (23). The factors relating to how a person valued their health, their injury severity, and their participation in exercise or sport were not associated with NA on any of the adherence measures, which is at odds with research within the physiotherapy domain (5, 23). Similar to previous research, the SIRAS information did not predict IndAdh scores (8).

That the PPR variables were most associated with rates of NA corroborates the findings of studies of adherence with medication (e.g. 27, 40) and HRE (23), which point to this factor as a likely candidate for intervention studies hopeful of reducing NA in HRE.

A promising finding from the present investigation is that the patient-practitioner factors were the most related to individual reports of HRE, and these interactions are potentially modifiable. Unlike many of the constructs assessed in this study (e.g. demographics, disposition, pain, prognosis, health value, etc.), patient-practitioner perceptions are amenable to change, as practitioners can seek to modify their approach within consultations. A strength of this study is that a hierarchical regression was used, which enabled the contribution of the PPR to be assessed after controlling for dispositional and cognitive coping styles. That this set of variables was still significant after these measures were entered points to the magnitude of the finding.

The current study is not without its limitations, however, and these include that that the cross-sectional design limits causal attributions between variables, and the sample, which appeared more adherent than that reported in the small amount of literature available (1, 5), may overestimate the adherence behaviour of the population (28). The sample size, and that the participants were predominantly female, may also limit the generalizability of the findings, but power was not an issue given the large effect sizes and statistically significant results attained for the full regression models. The IndAdh questions were constructed for the present study and, as such, the psychometric properties are not validated. We opted not to use the non-validated questions available in the field, as these assessed factors such as ice usage, and abstinence from activities, which may have impacted and confounded interpretation. Instead, we chose to follow the formula used in the highly validated SIRAS measure and asked questions about adhering to the prescribed frequency and intensity of the HRE. That the majority of data was attained via self-report, however, is a shortcoming of the design. In terms of the promising findings with the patient-practitioner variables, it is worth noting that we did not ask about the duration of this relationship and this may be an important factor that others should seek to assess. Finally, we collected information on pain associated with injury, seriousness of injury and prognosis for injury, but we did not gather data on the injury type that required HRE, or information assessing whether participants were receiving separate similar treatments from health professionals and, as such, could not assess whether adherence was related to these factors.

Other researchers (28) have suggested that gender, age and practitioner's race may provide useful information, as these factors may be more strongly linked to patient perceptions of the practitioner's communication than the communication *per se*. We concur, and would further recommend gathering objective data on the time and geographical locations of appointments, as these may also impact on patient perceptions.

Conclusion and implications for practice

Of the many constructs (e.g. demographic, dispositional, cognitive coping styles, etc.) assessed in this study, we found that the PPR best explained self-reported adherence to HRE.

It has been argued that some rehabilitation clinicians may falsely believe that the treatment they prescribe patients is ineffective and requires modification due to NA to HRE (1, 2, 5). Thus it would appear important to seek to improve rates of NA for this population and to improve our understanding of the factors that foster NA. The present investigation builds on the limited knowledge base for adherence to HRE and presents a case for seeking to improve the PPR and highlights in rank order that perceived progress in the clinical setting, communication and information sharing and trust of the practitioner as areas for improvement. While few investigations have sought to assess the efficacy of different forms of intervention to HRE (5, 8), the literature on medication adherence has shown a shift from patient-focussed intervention (e.g. reminders, patient education and counselling) to clinician-focussed intervention, which includes improving patient-clinician communication (39, 40). Some of these interventions are showing promising results and it is hoped that these effects generalize to rehabilitation exercises.

While the PPR successfully predicted adherence to HRE in this study, further empirical investigation is warranted to cor-

roborate these findings. In the meantime, there would appear to be no harm in seeking to improve patient perceptions of clinician communication and behaviour. This may be fostered in the higher education and clinical sectors that train and educate such practitioners (28).

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