Assessing the influence of treating therapist and patient prognostic factors on recovery from axial pain

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Background: Limited research exists regarding the influence of a treating physical therapist on patient recovery (deemed therapist effects). Recent randomized clinical trials data provide an indication of small therapist effects for manual therapy; however, the extent to which therapist effects exist in the average outpatient facility is not clear. Moreover, patient-related prognostic factors, like fear-avoidance or pain duration, are important to consider since these may also influence the extent of therapist effects.

Objective: To assess therapist effects and the influence of patient prognostic factors on recovery from axial pain in an outpatient orthopedic physical therapy facility.

Methods: Clinical data were collected from consecutive patients with musculoskeletal neck and low back pain. Patient outcomes included pain intensity (visual analog scale) and functional measure (CareConnections functional outcomes index) scores. Therapist effects estimates and the influence of intake fear-avoidance (fear-avoidance beliefs questionnaire) and pain duration (days) were examined using multilevel linear or regression modeling.

Results: A total of 258 patients (160 females; mean age 46.4 ± 14.9 years) completed physical therapy and the required outcome measures. Five physical therapists (1–13 years of experience, mean 5.8 years) provided treatment. Therapists effects did not exist for discharge pain intensity or function after accounting for intake scores ($P > 0.05$). Further, therapist experience did not influence patient outcomes. Patient prognostic factors of fear-avoidance and pain duration did not influence therapists effects on the same patient outcome measures ($P > 0.05$).

Discussion: Preliminary findings suggest that there are no major differences in patient outcome based on either the individual therapist (therapist effect) or therapist experience in this type of PT setting. Established prognostic factors had no influence on therapist effects for this cohort. Future analyses should consider intrinsic therapist factors (beliefs, equipoise), specific treatment parameters (dosage, type), and other patient prognostic factors (psychological, age, expectation, satisfaction) to further elucidate the influence of therapist effects.

Keywords: Therapist effects, Fear-avoidance, Pain, Function

Introduction

A common aim of clinical research is to identify 'treatment effects', or the variability in patient outcomes based on the treatment provided. Less common is the identification of 'therapist effects', or the variability in outcomes based on the therapist providing the treatment. The majority of therapist effects studies are from psychotherapy professions like clinical psychology, where therapists account for between 0 and 18% of variability in patient outcomes.^{1–7} Quantifying therapist effects (based on a

percentage of variability) is important as it provides a numerical estimate of just how much the therapist influences outcomes. Additionally, it provides an opportunity to identify specific therapist factors that may contribute to therapist variability. These factors can be either extrinsic (e.g. age, experience, education) or intrinsic (e.g. treatment preference, values) to the therapist. Studies of therapist effect in PT have not routinely quantified estimates of those effects. Rather, most studies have compared outcomes based on therapist experience^{8–11} and/or specialization (attaining specialty certification or fellowship),^{9,11,12} with neither attribute having consistently influenced patient outcomes.

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It is important to consider that a multitude of factors during the patient–therapist interaction may influence therapist variability. For instance, treatment type appears to play a role in the magnitude of therapist effects. A recent study¹³ quantified therapist effects estimates for the provision of outpatient physical therapy for neck or low back pain during two randomized clinical trials (RCTs).^{14,15} Across both studies, therapists accounted for approximately 3–7% of unique variability in patient disability outcome scores. However, therapist effects were less (approximately 0–3%) for patients receiving manual therapy compared to behavioral treatment strategies like brief psychological pain management. These findings may suggest that therapists treating with manual therapy have less outcome variability related to therapist effect. However, a caveat is that estimates were derived from RCTs, where treatment type and/or parameters may be standardized and may therefore restrict the capacity for therapists to modify individual treatments. Treatment in orthopedic manual physical therapy settings is intuitively more variable and often consists of multiple treatment types (e.g. manual therapy, exercise, therapeutic modalities, patient education). Although examining therapist effects in these settings prohibits an estimate by single treatment-type, findings would be more generalizable to treatment in real world settings.

Another potential drawback to RCTs is the homogeneity of participants, which may not represent the spectrum of patients with whom therapists typically interact in outpatient settings. For example, various patient factors like pain duration, pain level, or psychological distress, may be curbed by inclusion criteria in order to decrease heterogeneity. However, these factors may influence therapist effects. Two particular prognostic factors of interest are fear-avoidance and pain duration, both established predictors of pain intensity and disability for patients with musculoskeletal pain. Specifically, patients with high fear-avoidance^{16–21} or chronic pain^{22–27} respond less favorably to conservative treatment methods. One benefit of a cohort or ‘naturalistic’ study is the opportunity to examine patient factors and possibly expand our understanding of how these factors affect a therapist’s influence on treatment outcomes.

The purpose of this study was to examine therapist effects for patients with axial (neck or low back) pain treated in a typical outpatient orthopedic manual physical therapy facility. First, and consistent with previous reports in the physical therapy literature,¹³ we investigated therapist effects on patient outcomes following treatment. Since manual therapy was the primary treatment for patients, we anticipated that therapist effects may be low based on previous findings.¹³ However, we did not discount the

possibility that therapist effects might be higher than those observed in RCTs,¹³ since patients were managed via non-standardized interventions consistent with routine OP clinical practice. In addition to variability in therapist effect, we also sought to examine variability associated with therapist experience. We hypothesized that there would be a lack of influence related to therapist experience, which would be consistent with previous findings.^{8–11} An exploratory aim of this study was to consider the influence of patient factors, specifically fear-avoidance and pain duration, on therapist effects.

Methods

Overview

This was an observational study of consecutive patients seen at an outpatient physical therapy facility in Portland, OR between February 2009 and January 2011. Clinical data collected at intake included patient age, gender, pain duration, pain intensity, function, and fear-avoidance. Clinical data at discharge included patient pain intensity and function.

Patients

Patients were included if neck or low back pain served as their primary complaint. Patients were excluded if they were found to have no pain at the initial examination, had musculoskeletal pain in multiple sites of the body, or if the treating physical therapist considered their primary complaint to be non-musculoskeletal in nature. Data were collected during routine clinical patient care and de-identified prior to analysis. Therefore, patients did not provide informed consent and this study was deemed exempt by the University of Florida Institutional Review Board.

Measures

Patient demographics

Patients provided information pertaining to age, gender, and pain duration at their initial physical therapy visit. Pain duration was measured in the amount of symptom days from onset until beginning physical therapy.

Fear-avoidance beliefs

The fear-avoidance beliefs questionnaire (FABQ)²⁸ was completed during intake. While the FABQ contains a physical activity subscale (FABQ-PA) and a work subscale, only the FABQ-PA was included in this analysis. The FABQ-PA consists of five items pertaining to physical activity and harm to the region of pain. Items are rated on a seven-point Likert scale (range 0–6, ‘completely disagree’ to ‘completely agree’), and four of five items are included in scoring. Total score ranges from 0 to 24, with larger scores suggesting higher fear-avoidance related to physical activity. Although the FABQ-PA was originally intended for use in patients with low back pain, the

measurement can be modified so that fear-avoidance related to other anatomical regions of pain may be assessed. To do so, instances of the word, 'back', in either the instruction set or individual line items are replaced with the region of pain (e.g. neck). The modified FABQ-PA, as described, has demonstrated sufficient predictive validity in prior analyses.^{29–31} For this analysis, FABQ-PA was used as a continuous variable to examine therapist effects estimates.

Pain intensity

The visual analog scale (VAS) was selected to measure pain intensity based on a previous research that demonstrates its reliability and validity as a measure of musculoskeletal pain.³² A 10-cm line is anchored by the descriptors 'no pain' and 'worst pain imaginable'. Participants draw through the line to indicate their current pain intensity. A measurement is taken from the 'no pain' anchor to the patient mark, and reported numerically to one decimal point. The VAS was completed by all patients at intake and discharge. In this study, the VAS was analyzed either at discharge when accounting for intake VAS, or as a change score (difference in mean raw score from intake to discharge).

Function

The CareConnections functional outcomes index (CCFOI, formerly TAOS)³³ is a self-report questionnaire designed to measure a patient's perceived level of function. The CCFOI assesses a patient's ability to perform between two and three tasks specific to the region of pain (e.g. cervical, lumbar). Additionally, the CCFOI assesses the patient's ability to perform five general functional tasks (walking, work, personal care, sleeping, recreation/sports). Each task is ordinally rated from 0 (low level) to 5 (high level). A final score is derived by adding ratings for each task and dividing by the total possible score to arrive at a percentage (0–100%). The CCFOI has some support for its psychometric properties reported in the literature^{34,35} and is considered to be responsive based on prior analyses from this environment.^{30,31} For this analysis, the CCFOI was analyzed at discharge when accounting for intake scores.

Physical therapy practice

Therapists

Five physical therapists were included in this analysis (one male, four females), all of them worked at the same outpatient setting. The therapists were trained in varying degrees of orthopedic manual physical therapy, from newly enrolled ($n = 3$), one year into fellowship training ($n = 1$), and fellowship-trained ($n = 1$). Specialization was not examined based on the low number of specialized therapists employed at the facility at the time of study.

Patient treatment

Treatments were at the discretion of the physical therapist and treatment details were not monitored or measured. However, manual therapy was a prominent intervention that included thrust and non-thrust mobilization, soft tissue mobilization, and neurodynamic treatment. Other interventions included therapeutic exercise, physical modalities, and/or patient education. Therapists at this facility subscribe to a 'patient-centered' approach where patients are involved in establishing the treatment plan and goals. This allows for treatment specific to each patient's needs without the use of a standardized treatment. Management strategies for patients with high fear-avoidance or chronic pain were encouraged, however, not obligatory. A common treatment approach for these prognostic factors is to incorporate more active interventions (therapeutic exercise) versus passive interventions (manual therapy, modalities).

Data analyses

Data analyses were performed on patients who were discharged from physical therapy by the completion of the study and had complete intake and discharge data. Analyses were completed using IBM® SPSS® Statistics software, Version 20 (2011, IBM® Corp; Armonk, NY). Alpha level was set at 0.05 for all statistical tests. Distribution of variables was assessed via the Kolmogorov–Smirnov and Shapiro–Wilk tests and visual examination of histogram and Q–Q plots. Non-normal variables were normalized via probit (Blom) transformation.³⁶ Correlation amongst predictors was assessed to avoid collinearity effects in the regression models.³⁷ Intake characteristics for patients with incomplete data and excluded from the final analysis were compared to those with complete data and included in the final analysis using independent samples *t*-tests. Intake characteristics for patients with complete data were then examined by therapist using univariate ANOVA modeling.

Multilevel (hierarchical) linear modeling (HLM)^{3,5,13} was intended to examine therapist effects on patient outcomes (discharge pain intensity, discharge function) and the influence of therapist effects by patient prognostic factors (intake fear-avoidance, intake pain duration). Patients (level 1) were nested within therapists (level 2) and therapists were entered as a random effect based on previous analyses.⁵ An unconditional means model was constructed to assess convergence of the data and therapist differences (intercept-related variance) without patient- or therapist-level factors. Patient intake scores centered around the grand mean allowed for the assessment of therapist effects when treating patients with average pain or function at the beginning of therapy. These centered intake scores were included and allowed to vary with respect to therapist (random intercept and slope). Level

1 and 2 factors are then added incrementally (e.g. patient fear-avoidance, patient pain duration, therapist experience) and the model fit is assessed using Restricted Maximum Likelihood estimates. Percentage variability explained by patient or therapist level factors was examined using intra-class correlation, which is the proportion of between group variance to total explained variance.

If therapist differences were not significant, or if data failed to converge with the unconditional-means model, ANOVA modeling and ordinary least squares (OLS) regression (hierarchical) were performed to confirm lack of group level differences and influence, respectively. For OLS regression modeling, control was established for age, sex, pain duration, and intake pain or function in the first block; dummy-coded therapist factor and experience factor were entered in the second block; and finally centered therapist by patient prognostic factor interaction term (to reduce multi-collinearity) were entered in the third block.

Results

A total of 1080 patients with musculoskeletal pain were treated at the outpatient facility during the data collection period. Of these, 471 patients were designated as having neck or low back pain, from which 213 were excluded from the final analysis secondary to having incomplete intake and discharge assessments and/or not completing physical therapy prior to the date of final data collection. Therefore,

Table 1 Comparing intake characteristics for patients with complete vs. incomplete data

Measure	Included	Excluded	P
N	258	213	
% Female	62	72	0.016*
Age	46.4 (14.9)	44.8 (15.26)	0.253
Pain duration	303 (669)	382 (845)	0.271
Fear-avoidance	15.2 (5.5)	13.6 (6.1)	0.002*
Intake pain	5.1 (2.5)	4.6 (2.5)	0.017*
Intake function	69.4 (17.5)	63.3 (18.5)	0.000*

*= $P < 0.05$; age, pain duration, fear-avoidance, intake pain, and intake function reported in mean (SD); pain duration = number of symptom days prior to physical therapy; intake pain = visual analog scale (0–10 cm); intake function = CareConnections Functional Outcomes Index (0–100).

258 patients were included in the final analysis. Intake characteristics differed between patients with complete vs incomplete data (Table 1). For those with complete data, intake characteristics did not differ with respect to therapist (Table 2).

The linear model for discharge pain failed to converge, and ANOVA modeling and OLS regression confirmed a lack of therapist effects for this outcome ($P > 0.05$) (Fig. 1A). Variance explained with respect to therapist for discharge function was 3.5%, however, this was not significant ($P > 0.05$) (Fig. 1B). Experience was not found to influence either outcome ($P > 0.05$).

Due to issues of convergence, interactions between therapist and patient prognostic factors on patient outcomes were analyzed using OLS regression. The overall variance explained by the final model for discharge pain intensity was 13.5%. However, after accounting for intake pain intensity, interactions between therapist and either intake fear-avoidance or intake pain duration were not predictive ($P > 0.05$). Similarly, the overall variance explained by the final model for discharge function was 19.9%. However, after accounting for intake function, interactions between therapist and either intake fear-avoidance or intake pain duration were not predictive ($P > 0.05$). These findings suggest that intake fear-avoidance and intake pain duration did not influence therapist effects on outcomes for this cohort. Patient prognostic factors were entered as continuous variables, however, are presented as subgroups (high vs low fear-avoidance; acute, subacute, and chronic pain duration) to better illustrate lack of variability across therapists (Fig. 2).

Discussion

Therapist effects did not appear to influence patient outcomes of pain intensity or function in this particular clinical setting that routinely uses manual therapy. Moreover, established prognostic factors of fear-avoidance and pain duration were not found to influence therapist effects on patient outcomes. These findings contribute to the limited therapist effects research available in physical therapy by quantifying therapist effects estimates and using a cohort design in an outpatient orthopedic manual physical therapy

Table 2 Intake characteristics of patients with complete data, with respect to therapist

Therapist	1	2	3	4	5	P
N	101	44	46	31	36	
% Female	52	66	74	65	69	0.082
Age	47.8 (14.4)	45.5 (16.4)	45.5 (14.8)	46.7 (15.1)	44.5 (14.6)	0.051
Pain duration	296 (633)	216 (553)	425 (827)	180 (423)	386 (832)	0.628
Fear-avoidance	13.1 (6.3)	13.0 (6.3)	13.6 (6.1)	13.8 (4.7)	14.1 (5.6)	0.699
Intake pain	4.3 (2.5)	5.1 (2.5)	4.3 (2.5)	4.9 (2.4)	4.1 (2.4)	0.077
Intake function	70.3 (18.1)	66.0 (17.5)	71.1 (15.07)	69.2 (17.3)	69.1 (18.9)	0.817

No statistically significant differences were found between therapists; age, pain duration, fear-avoidance, intake pain, and intake function reported in mean (SD); pain duration = number of symptom days prior to physical therapy; intake pain = visual analog scale (0–10 cm); intake function = CareConnections Functional Outcomes Index (0–100).

Figure 1 Outcome change scores with respect to therapist. No statistically significant differences were found between therapists; (A) pain change with respect to therapist; pain change = difference between visual analog scale (VAS) at intake and discharge (0–10 cm); (B) function change with respect to therapist; function change = difference between CareConnections functional outcomes index (CCFOI) at intake and discharge (0–100).

setting. Further, the method for quantification is similar to established statistical models used in psychotherapy research^{3,5} and recent analysis of physical therapist effects in RCTs.¹³

We hypothesized that there would be low therapist effect estimates for this cohort since the therapists in this study routinely use manual therapy, which may make that effect less obvious than in a clinic where there is more variability in therapist approach. Specifically, therapist effects for manual therapy treatment subgroups in the Lewis *et al.*¹³ analyses ranged from <0.1% to 3.1% for disability outcome. At the same time, we considered the possibility that therapist effects estimates for our study may be higher than 3.1% since therapists were free to modify the treatment based on individual patient presentation. We propose that the relative uniformity of overall treatment philosophy and, specifically, manual therapy

interventions may be factors that limited the range of variability in therapist effect in this study. This would restrict variability in treatment selection and potentially limit variability in patient outcomes. This is the only conjecture since the exact treatment parameters (e.g. dosage, treatment type) used in this study were not measured. However, it is not uncommon for similar treatment styles to exist amongst therapists in the same manual therapy setting, which would be unintentionally similar to standardized treatments used in RCTs. Nevertheless, future therapist effects research should aim to collect detailed treatment records. This would allow investigators to discern whether or not treatment homogeneity plays a role in the assessment of outcomes variability based on the therapist effect. Further, manual therapy interventions are often grouped together without specification. It is possible that certain treatment interventions might actually lead to greater therapist variability and yet go unidentified as a result of the non-specific listing of those interventions.

Individual therapist factors measured in this study were limited to experience, and a lack of therapist variability in clinical outcomes based on this measure are consistent with previous studies.^{8–11} However, it is possible that more variability exists across intrinsic therapist attributes. Resnik and Jensen³⁸ reported important differential factors in a comprehensive theoretical model examining patient outcome with respect to therapist expertise. Clinical reasoning, treatment style, knowledge, and personal beliefs ('values' or 'virtues') differed between 'expert' and 'average' therapists. Recent work by Cook *et al.*³⁹ add to this argument in an examination of personal equipoise, or the absence of preference for competing treatment options.^{40,41} Lack of personal equipoise, or simply having a treatment preference, influenced outcomes for patients with low back pain receiving manual therapy. These findings were specific to an RCT, and as such, therapists were required to perform the randomly assigned intervention. How personal equipoise influences outcome when therapists are free to perform an intervention is unclear but merits future study in observational settings.

Recent psychotherapy studies have reported larger therapist effects when accounting for patient prognostic factors (e.g. psychological distress). Dinger *et al.*³ reported therapists effects of 3% of the total variance for psychological outcomes of patients treated in an inpatient psychotherapy clinic. However, when accounting for patients' pre-treatment psychological distress, therapist effects increased to 7% of the total variance. In addition, interactions have been reported between working alliance (patient's perceived bond with the therapist and shared perception of goals/tasks)⁴² and treatment outcome, after accounting for level of psychological

Figure 2 Change scores with respect to therapist based on patient prognostic factors. No statistically significant differences were found between therapists; pain change = discharge visual analog scale score (0–100 mm) – intake visual analog scale score (0–100 mm); function change = discharge CareConnections functional outcomes index (CCFOI) Score – intake CareConnections functional outcomes index (CCFOI) score; FA = fear-avoidance; low FA = <15 FABQ-PA; high FA = ≥15 FABQ-PA; acute pain = <14 days; subacute pain = 14–90 days; chronic pain = greater than 90 days.

distress.⁴³ Comparable interactions were not observed in this study, however, as previously mentioned, and may be a product of the type of treatment provided. The aforementioned psychotherapy studies utilized

psychosocial treatment, whereas the primary interventions in this study were physical (manual therapy, exercise, modalities). Although speculative, it is possible that patients with high fear-avoidance beliefs,

or chronic pain, have a lower response capacity for physical interventions compared to behavioral, and may, therefore, demonstrate greater variability when behavioral interventions are the principal treatment. It is also possible that patient prognostic factors moderate the influence of intrinsic therapist factors (e.g. personal equipoise, personal beliefs) on outcome. In other words, therapist treatment preference may have greater influence on chronic, as opposed to acute, pain. However, if clinical homogeneity (i.e. all therapists share the same treatment preference for chronic pain) extends to such factors, patient prognostic factors would not differentially influence therapist effects. Nevertheless, it is important that future therapist effects studies examine interactions between the patient, therapist, and treatment to elucidate the extent to which multiple factors influence outcome.

We are unable to make specific inferences about the clinical relevance of our findings. However, we believe that further investigation of the differential influence of patient factors on therapist effects may elucidate interactions impacting health service delivery. For example, therapists may get relatively poorer outcomes when managing patients who possess an influential prognostic factor that, if addressed through education and training, might improve patient care. If differential influence by a particular patient prognostic factor exists but is not examined, therapists ill-fitted to address that factor would continue to provide sub-optimal treatment. This particular study was limited to assessing patient fear-avoidance beliefs, however, pain catastrophizing^{44–51} and depression^{51–55} are two other psychological factors reported to be associated with pain and disability outcomes. A patient's level of physical impairment, region of injury, treatment expectation, and/or level of satisfaction could also influence therapist effects. Accounting for these patient prognostic factors may elucidate therapist variability as a means to improve patient care. This should not be confused with patient subgrouping used in treatment-based classification (TBC),^{56–60} which provides an empirically-supported treatment approach based on patient presentation and clinical response.

Limitations

Limitations of the current study should be considered with the results. Dinger *et al.*³ recently highlighted the use of cohort designs in therapist effects studies due to the potential limitations existing in RCTs, like small therapist sample size. Although the patient sample size was large in this study, the therapist sample size is small, which may limit overall therapist variability for our analyses. However, our cohort was intentionally limited to one setting so that we could examine therapist variability in outcomes for a 'typical' physical therapy setting. Further, therapist

effects have been found in other studies with comparable therapist sample sizes.¹³ Nevertheless, incorporating larger, more heterogeneous (e.g. multi-center, different treatment strategies) therapist groups may be beneficial from a health service perspective, as it allows for examination of therapist variation and effectiveness both within and across clinics.

We were unable to examine the influence of therapist specialization on outcomes due to the minimal number of specialized therapists in this particular facility at the time of the study. Previous studies have not substantiated the advantages of specialization, which are perceived to improve efficiency. The value of specialization may lie in treating patients with poor prognosis (high fear-avoidance, chronic pain), where specialized therapists may demonstrate improved outcomes and/or need fewer treatment visits. If so, then outcomes comparison based on specialization should be considered for these particular patient subgroups.

Finally, we cannot discount the potential for selection bias, as significant differences existed between those with complete and incomplete data. A key inclusion criterion was completion of physical therapy through discharge. It is possible that patients not completing physical therapy would introduce more variability in treatment due to a need for treatment modification. As such, examination of therapist variability through different time points prior to discharge may prove beneficial in future analyses. We note, however, that exclusion of a large sample based on lack of discharge data is not uncommon for clinical studies.^{19,61}

Conclusion

The presence of therapist effects, or variability in patients outcomes based on the treating therapist, was not found in our preliminary investigation of this cohort. Further, therapist effects did not vary based on patient fear-avoidance or pain duration, although, the lack of therapist variability in this particular setting limited further analysis of these factors. Future analysis of therapist effects should consider accounting for intrinsic therapist factors like personal beliefs and equipoise rather than experience based on years of practice. Additionally, patient prognostic factors should be further examined in studies utilizing more treatment options to examine the presence and magnitude of influence on therapist effects across different physical therapy settings.

Author Note

This study was exempt from University of Florida Institutional Review Board since all data were collected as part of routine clinical practice and de-identified before analysis.

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