

Factors Associated With Surgeon Referral for Physical Therapy in Patients With Traumatic Lower-Extremity Injury: Results of a National Survey of Orthopedic Trauma Surgeons

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Background. Variation in referral rates for physical therapy exists at both the individual physician and practice levels.

Objective. The purpose of this study was to explore the influence of physician and practice characteristics on referral for physical therapy in patients with traumatic lower-extremity injury.

Design. A cross-sectional survey was conducted.

Methods. In 2007, a Web-based survey questionnaire was distributed to 474 surgeon members of the Orthopaedic Trauma Association. The questionnaire measured physician and practice characteristics, outcome expectations, and attitude toward physical therapy. Referral for physical therapy was based on case vignettes.

Results. The response rate was 58%. Surgeons reported that 57.6% of their patients would have a positive outcome from physical therapy and 24.2% would have a negative outcome. The highest physical therapy expectations were for the appropriate use of assistive devices (80.7%) and improved strength (force-generating capacity) (76.4%). The lowest outcome expectations were for improvements in pain (35.9%), coping with the emotional aspects of disability (44.1%), and improvements in workplace limitations (51.4%). Physicians reported that 32.6% of their patients referred for physical therapy would have no improvement beyond what would occur with a surgeon-directed home exercise program. Multivariate analyses showed positive physician outcome expectations to have the largest effect on referral for physical therapy (odds ratio=2.7, $P<.001$).

Conclusions. The results suggest that orthopedic trauma surgeons refer patients for physical therapy based mostly on expectations for physical and motor outcomes, but may not be considering pain relief, return to work, and psychosocial aspects of recovery. Furthermore, low referral rates may be attributed to a preference for surgeon-directed home-based rehabilitation. Future research should consider the efficacy of physical therapy for pain, psychosocial and occupational outcomes, and exploring the differences between supervised physical therapy and physician-directed home exercise programs.

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Variation in referral rates for physical therapy exists at both the individual physician and practice levels.¹⁻⁶ Patient characteristics explain less than 25% of the observed variation.^{1,5,7-9} Research conducted to date has not fully elucidated the specific factors associated with variation in physical therapy referral. Evidence, however, suggests that physician characteristics, such as knowledge of therapeutic services and attitude toward physical therapy, may explain the residual variability in referral rates.^{3,5,9-13} Researchers also have suggested that outcome expectations or the belief in the efficacy of physical therapy intervention may be an important contributor to the referral decision.^{6,14} Campbell and colleagues¹⁵⁻¹⁷ examined outcome expectations in a series of studies looking at referral of children with cerebral palsy for physical therapy, but their results did not support an association between utilization of services and beliefs regarding the value of physical therapy. Prior studies on clinical decision making have shown that physicians do not always make referrals consistent with their efficacy beliefs, especially if they are risk averse.^{18,19} Physicians may avoid referral if they believe an efficacious physical therapy program may involve negative outcomes or potentially harmful consequences.

Physician outcome expectations have not been systematically studied in relation to the management of traumatic orthopedic injuries. Be-

cause little evidence exists for the effectiveness of physical therapy for this patient population,²⁰ physician beliefs in the value of physical therapy may yet explain variability in referral rates. The purpose of this study was to explore the influence of physician and practice characteristics on referral for physical therapy in patients with traumatic lower-extremity injury. This patient population was of particular interest because the physical disability resulting from these injuries often is significant and physical therapy has the potential to favorably affect the recovery process.^{21,22} Our primary hypothesis was that positive physician outcome expectations would be associated with an increased likelihood of referral for physical therapy, after controlling for physician attitude and practice characteristics. In addition, we hypothesized that negative outcome expectations would be associated with a decreased likelihood of referral. Regional differences in referral rates also were explored because the literature suggests that geographic location may account for differences in physician practice styles and health care delivery.^{5,23,24} The study's findings have important implications not only for the management of patients with traumatic lower-extremity injury, but also for explaining the variation in physician referral rates for physical therapy.

Method Study Design

A Web-based cross-sectional survey was distributed to orthopedic trauma surgeons from March to June of 2007. The sampling frame was a 777-person membership list maintained by the Orthopaedic Trauma Association (OTA). Participants were excluded if they were working outside the United States (15%), if they were research (2%) or health care profession (2%) members of OTA, if they were in residency (6%) or fel-

lowship (9%) training, or if e-mail addresses were unavailable (5%). Exclusion criteria yielded a final population of 474 orthopedic trauma surgeons.

Questionnaire Development and Content

Case vignettes measured physical therapy referral as either "yes" or "no." Surgeons were asked after each case "if they would refer this patient to any of the following providers." These health care providers included a physical medicine and rehabilitation physician, an occupational therapist, a physical therapist, and a chiropractor. Surgeons also were provided with a no-referral category.

Vignettes were constructed using an empirical model by Heverly et al²⁵ in order to achieve sufficient referral variation. Each vignette was based on an actual patient with a femur, tibia, or ankle fracture treated by lower-extremity reconstruction that was abstracted from the Lower Extremity Assessment Project (LEAP) database.^{26,27} LEAP was a multicenter, prospective cohort study of 601 patients with severe lower-extremity trauma resulting in reconstruction or amputation. Sixteen case scenarios were reviewed and edited by 3 expert trauma surgeons. Eight vignettes were selected for the questionnaire based on the expectation of variability in physician referral for physical therapy. These vignettes included the following injuries: type IIIB tibia shaft fracture, type IIIA proximal tibia fracture, type IIIB tibia transverse fracture, type IIIB bicondylar plateau fracture of the tibia, type IIIA distal tibia extra-articular fracture, type IIIA metaphyseal distal articular tibia fracture, type IIIA talus fracture, and nondisplaced talar neck fracture.

Three scales were included in the survey to measure physician out-

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come expectations (positive and negative) and attitude toward physical therapy. The positive outcome expectations scale included 21 items that covered 4 broad categories of outcomes: (1) *physical and motor* (appropriate use of assistive devices, independent gait, decreased edema, prevention of contractures, increased endurance, and improved strength [force-generating capacity], range of motion (ROM), muscle tone [velocity-dependent resistance to stretch], and balance); (2) *pain* (ability to manage pain, decreased acute pain, and prevention of chronic pain); (3) *occupational* (transition into part-time work, increased productivity and number of hours able to work, ability to meet physical demands of work, and return to full-time work); and (4) *social and emotional* (increased satisfaction with overall care, decreased self-perceived disability, and ability to manage physical and social/emotional aspects of disability). Six of the items on assistive devices, muscle tone, endurance, contractures, and coping with the physical and social aspects of injury were derived from previous work by Campbell et al.¹⁷ The remaining items were selected based on a literature review on outcomes after traumatic injury and interviews with practicing trauma surgeons.

The items for the negative outcome expectations scale were developed from open-ended interviews with trauma surgeons and consisted of the following 6 items: prolonged recovery, increased pain, increased medication use, inappropriate medical information, no improvement beyond what would occur with a home program, and no improvement beyond what would naturally occur. For both outcome expectations scales, surgeons were asked, "In what percentage of your patients with lower-extremity trauma will supervised physical therapy lead to the following outcomes?" Respondents were

given choices on a 6-point scale ranging from 0% (outcome would never occur) to 100% (outcome would always occur).

The attitude scale consisted of 6 items: (1) physical therapists are useful to physicians in my specialty, (2) physical therapists are helpful as consultants in my practice, (3) physical therapists are competent to make decisions concerning patient care, (4) physical therapists play an important role in health care, (5) physical therapists are qualified to evaluate and treat as direct-access providers, and (6) physical therapists are capable of autonomous practice. Four of the items relating to the usefulness, competence, and importance of physical therapists were based on a General Favorability scale developed by Ritchey et al.² Two of the items on physical therapists' capability for autonomous practice were derived from open-ended interviews with trauma surgeons. Surgeons were asked to rate their general attitude toward physical therapy by agreeing or disagreeing with each item on the scale. Six response categories were provided, which ranged from "strongly disagree" to "strongly agree." The last section of the questionnaire included demographic and practice questions predicated on prior surveys and a review of the health services research literature.^{2,18,28-30}

Questions gathered information on physician age, sex, board certification, fellowship training, years in practice, and practice type and trauma case workload. Additional questions were asked to examine financial interest in therapy practice, type and frequency of contact with physical therapists, and frequently requested treatment modalities. Surgeons also were asked what percentage of their physical therapy prescriptions were specific (frequency, duration, and treatment modalities), general (frequency and duration)

and open (evaluate and treat). Scales and demographic questions were reviewed and edited by 3 practicing trauma surgeons and one researcher with expertise in survey research.

Procedure

The survey with 8 case vignettes was pilot tested by 12 trauma surgeons and a random sample of 20 eligible OTA members. Five vignettes (Appendix) focusing on tibia or talus fractures were selected for inclusion in the final questionnaire. These vignettes were selected based on the variability in physician response (50%-60% of physicians making a physical therapy referral).

A pre-notice e-mail describing the purpose of the survey was sent to eligible OTA members, followed a few days later by a cover letter stating the goals and participants' rights. Each cover letter contained a link to the Web-based survey. Follow-up e-mail reminders were sent to all nonresponders 7, 14, 24, and 45 days after initial contact. To protect the anonymity of each respondent, survey questionnaires were tracked by a Web-based system using randomly allocated numbers.

Data Analysis

Data analysis and interpretation of results were performed using Stata statistical software, version 9.0.* Descriptive techniques were used to determine the distribution of referral to health care providers for each vignette. The outcome of referral or no referral to a physical therapist then was abstracted for surgeons after each case vignette. Overall positive and negative physician outcome expectations scores were obtained by separately summing the ratings of 0% to 100% on the likelihood of 21 positive outcomes and 6 ratings of 1 to 6 for each item in the attitude scale.

* Stata Corp, 4905 Lakeway Dr, College Station, TX 77845.

The internal consistency, construct validity, and factor structure of the 3 scales were explored with coefficient alpha (α), scree plots, and principal components and factor analysis with varimax rotation.³¹

Bivariate and multivariate analyses included 1 positive outcome expectations scale and 2 negative outcome expectations and attitude scales derived from scree plots, principal components estimation, and factor analysis. Chi-square tests initially were used to investigate the association between the physical therapy referral/no-referral decision and physician sex, board certification, trauma fellowship, region of practice, practice location, type of practice, monthly trauma cases, frequency of communication and referral relationship with physical therapists, and financial interest in a physical therapist practice. Student *t* tests were used to investigate physician years in practice, positive outcome expectations scale, negative outcome expectations scales, and attitude scales. Bivariate mixed model logistic regression analyses then were conducted, which included a random intercept to account for the clustering of responses by physician.

Covariates that were significant at $P < .25$ in bivariate analysis or considered relevant to the referral decision were entered into multivariate mixed-model forward and backward logistic regression models. The .25 level was used as a screening criterion to allow for the possibility that a collection of variables, each of which may be weakly associated with the outcome, may become important predictors when placed in a model together.³² Physician and practice factors were entered as a group, and likelihood ratio tests were conducted to remove the least-significant covariates. Models also were compared using goodness-of-fit tests, and multicollinearity was ex-

plored post-regression with the variance inflation factor. Interactions between age and years in practice, practice location and type of practice, and years in practice and monthly trauma cases were explored. Variables that were significant at $P < .15$ or with known clinical importance (communication with physical therapists) were retained. The stability of the final model was tested by adding back in each excluded variable one at a time. The level of significance was set at $P < .05$.

Missing data for physician years in practice (1.1%), type of practice (2.2%), monthly trauma cases (3.3%), frequency of communication with physical therapists (1.8%), and financial interest in a physical therapist practice (1.8%) were handled using regression models that imputed the missing values as a function of the other covariates. Specifically, years in practice was imputed using a linear regression model that controlled for physician age, board certification, and attitude toward physical therapy, and trauma case workload was imputed based on practice location, trauma fellowship, and physician attitude. Missing values for type of practice were imputed as a function of practice location, trauma case volume, and financial ownership in a physical therapist practice. Missing values for frequency of communication were imputed as a function of physician years in practice, attitude toward physical therapy, and practice location.

Results

Response Rate and Respondent Characteristics

The response rate for eligible trauma surgeons was 58% ($n=274$). Demographic and professional characteristics and missing data are presented in Table 1. Overall, missing data were less than 4%. Responses were relatively well distributed across the 4

geographic regions: 33.2% from the south, 24.9% from the west, 21.5% from the midwest, and 20.4% from the northeast. Eighty-eight percent of the surgeons were board certified, 65% had completed a fellowship in trauma, and the physicians had been in practice an average of 15 years ($SD=9.0$). Thirty-eight percent of the surgeons were seeing 40 or more trauma cases per month, and, on average, 71% of these cases were lower-extremity injuries.

Seventy-three percent of the surgeons reported using specific prescriptions (frequency, duration, and treatment modalities) for referral for physical therapy, and 42.7% had a consistent referral relationship with a physical therapist practice. Only 12.4% reported having a financial interest in a physical therapist practice.

The most frequently requested or expected physical therapy services for patients with traumatic lower-extremity injury were ROM exercises (95.1%), gait training (92.8%), joint mobilization (82.3%), and assistive device training (76.2%) (Tab. 2). The least-requested services were biofeedback (6.4%), electrical nerve stimulation (14%), and ultrasound diathermy (22.6%).

Referral Rates

The distribution of referral for each vignette is displayed in Table 3. The average physician referral rate for physical therapy based on the 5 case vignettes was 69.2%. Fewer than 1% of surgeons referred patients to an occupational therapist, and 2.8% of surgeons referred patients to a physical medicine and rehabilitation specialist. No statistical differences were found in vignette physical therapy referral rates across geographic regions.

Positive Outcome Expectations of Physical Therapy

On average, surgeons reported that 57.6% (SD=17%) of their patients with traumatic lower-extremity injury would have a positive outcome from physical therapy. The highest physical therapy expectations were for the appropriate use of assistive devices (80.7%) and improved strength (76.4%) and ROM (75.7%) (Tab. 4). The lowest outcome expectation of physical therapy was the prevention of chronic pain (34.4%). Overall, physicians reported that 35.9% of their patients would have improvements in pain (acute and chronic), 44.1% would have a greater ability to cope with the emotional aspects of disability, and 51.4% would have a reduction in workplace limitations through supervised physical therapy.

Negative Outcome Expectations of Physical Therapy

On average, surgeons reported that 24.2% (SD=13%) of their patients with traumatic lower-extremity injury would have a negative outcome from physical therapy. Surgeons believed that 32.6% of their patients referred for physical therapy would have no improvement beyond what would occur with a surgeon-directed home exercise program and that 27.2% of their patients referred for physical therapy would have no improvement beyond what would naturally occur (Tab. 4). Surgeons also reported that inappropriate medical information would be transmitted to 27.5% of their patients by physical therapists. Relatively few surgeons reported that patients would experience prolonged recovery (12%) following supervised physical therapy.

Attitude Toward Physical Therapy

The overall average of the summed attitude scores was 3.5 (SD=0.85) out of a maximum possible score of 6. Table 5 presents the average score

Table 1.

Distribution of Respondents by Demographics, Training, and Practice Characteristics (n=274)

Characteristic	Value
Mean age, y (SD)	47.5 (9.0)
Missing: 4	
Sex, n (%)	
Female	17 (6.2)
Male	257 (93.8)
Board certified, n (%)	
No	32 (11.7)
Yes	242 (88.3)
Trauma fellowship, n (%)	
No	93 (33.9)
Yes	178 (65.0)
Missing	3 (1.1)
Mean years in practice (SD)	15.0 (9.0)
Missing: 3	
Region of practice, n (%)	
South	91 (33.2)
West	68 (25.0)
Midwest	59 (21.5)
Northeast	56 (20.4)
Practice location, n (%)	
Inner city	157 (57.3)
Suburb	84 (30.7)
Rural	28 (10.2)
Missing	5 (1.8)
Type of practice, n (%)	
Academic setting	124 (45.3)
Group	79 (28.8)
Hospital-based	54 (19.7)
Solo	11 (4.0)
Missing	6 (2.2)
Monthly trauma cases, n (%)	
0–10	37 (13.5)
11–20	61 (22.3)
21–40	86 (31.4)
41+	81 (29.5)
Missing	9 (3.3)
Mean % of monthly trauma cases that are lower extremity (SD)	71.0 (17.8)
Missing: 9	

(continued)

Table 1.
Continued

Characteristic	Value
Type of physical therapy prescription, n (%)	
Specific (frequency, duration, treatment modalities)	201 (73.4)
General (frequency and duration)	39 (14.2)
Open (evaluate and treat)	24 (8.8)
Missing	10 (3.6)
Communicate with physical therapists, n (%)	
Never	19 (6.9)
Monthly	86 (31.4)
Weekly	127 (46.4)
Daily	37 (13.5)
Missing	5 (1.8)
Type of communication, n (%) ^a	
Notes (including prescription)	235 (85.8)
Telephone	153 (55.8)
Conversation in clinic	86 (31.4)
Rounds	74 (27.0)
E-mail	61 (22.3)
Meeting	20 (7.3)
Missing	5 (1.8)
Consistent referral to specific therapist, n (%)	
No	149 (54.4)
Yes	117 (42.7)
Missing	8 (2.9)
Financial interest in physical therapist practice, n (%)	
No	232 (84.7)
Yes	34 (12.4)
Missing	8 (2.9)
Mean positive outcome expectations score (SD)	57.6 (17)
Mean negative outcome expectations score (SD)	24.2 (13)
Mean attitude score (SD)	3.5 (0.85)

^a Percentages total more than 100% because some respondents reported more than one type of communication.

for each item in the physician attitude scale. Physicians agreed that physical therapists are useful to their practice (average score=5.2) and play an important role in health care (average score=4.8), but they were somewhat unsure of physical therapists' ability to provide help as a consultant (average score=3.7) and make decisions about patient care (average score=3.2). Most physi-

cians disagreed with the statements that physical therapists are qualified to act as direct-access providers (average score=2.0) and are capable of autonomous practice (average score=2.1).

Scree Plot, Principal Components and Factor Analysis

Principal components analysis and a screen plot demonstrated one factor

within the positive outcome expectations scale with an eigenvalue of 11.6. This factor explained more than 55% of the variance in the items. Factor loadings for all items were greater than 0.60. One positive outcome expectations score was calculated for each surgeon by summing all of the 21 positive outcome expectations items. This score was used in the bivariate and multivariate analyses and retained in the final multivariate model. Coefficient α for the one factor positive outcome expectations scale was .96.

For the negative outcome expectations scale, principal components analysis and a scree plot demonstrated 2 factors with eigenvalues of 2.8 and 1.4, respectively. Factor 1 explained 47% of the variance in the items, and factor 2 explained 23% of the variance in the items. Factor loadings indicated that factor 1 consisted of 3 items (ie, no improvement beyond what would naturally occur, no improvement beyond what would occur with a home program, and provide inappropriate medical information) and that factor 2 consisted of 3 items (ie, increased pain, increased medication use, and prolonged recovery). Factor loadings for all items were greater than 0.40. Two negative outcome expectations scores were obtained for each surgeon by summing the 3 items corresponding to factor 1 and the 3 items corresponding to factor 2. The alpha coefficient for the factor 1 scale of no improvement and inappropriate information was .77 and the alpha coefficient for the factor 2 scale of increased pain and medication use and prolonged recovery was .74. Both of the negative outcome expectations scores were used in the bivariate and multivariate analyses, but only the factor 1 (no improvement and inappropriate information) scale was retained in the final multivariate model.

Table 2.

Description of Requested Physical Therapy Services for Patients With Traumatic Lower-Extremity Injury (n=265)

Treatment Modality	n (%) ^a
Range-of-motion exercise	252 (95.1)
Gait training	246 (92.8)
Joint mobilization	218 (82.3)
Crutch or cane training	202 (76.2)
Therapeutic exercise (including strength training)	177 (66.8)
Balance training	175 (66.0)
Soft tissue mobilization	150 (56.6)
Proprioceptive neuromuscular reeducation	101 (38.1)
Ultrasound diathermy	60 (22.6)
Electrical nerve stimulation	37 (14.0)
Biofeedback	17 (6.4)

^a Percentages total more than 100% because respondents reported more than one type of treatment modality.

Principal components analysis and a scree plot demonstrated 2 factors within the attitude scale with eigenvalues of 2.9 and 1.3, respectively. Factor 1 explained 48% of the variance in the items, and factor 2 explained 22% of the variance in the items. Factor loadings indicated that factor 1 consisted of 3 items (ie, physical therapists are useful to physicians in my specialty, physical therapists play an important role in health care, and physical therapists are helpful as consultants in my practice) and that factor 2 consisted of 3 items (ie, physical therapists are qualified to evaluate and treat as direct-access providers, physical therapists are capable of autonomous practice, and physical therapists are

competent to make decisions concerning patient care). Factor loadings for all items were greater than 0.50. Two attitude scores were obtained for each surgeon by summing the 3 items corresponding to factor 1 and the 3 items corresponding to factor 2. The alpha coefficient for the factor 1 scale of general attitude was .81, and the alpha coefficient for the factor 2 scale of attitude toward autonomous practice was .74. Both of the attitude scores were used in the bivariate and multivariate analyses, but only the factor 1 (general attitude) scale was retained in the final model.

Factors Associated With Physical Therapy Referral

The final multivariate model included the following variables: positive outcome expectations scale, no improvement and inappropriate information scale, general attitude scale, years in practice, type of practice, monthly trauma cases, frequency of communication with physical therapists, and financial interest in a physical therapist practice. Results from this multivariate model are presented in Table 6. Positive outcome expectations had the largest effect on surgeon referral for physical therapy. Specifically, a 20% increase in positive outcome expectations was associated with a 2.7 increase in the likelihood of referral for physical therapy ($P<.001$). Negative outcome expectations in relation to no improvement and providing inappropriate medical information displayed a statistically significant negative effect on referral (odds ratio=0.66, $P=.01$). Surgeon attitude toward physical therapy was not statistically associated with referral (general attitude: odds ratio=0.83, $P=.12$).

Physician years in practice and spending greater than 70% of their time in a solo practice were negatively associated with referral for physical therapy ($P<.05$). Monthly trauma volume of 40 or more cases exhibited a statistically significant positive association with physical therapy referral (odds ratio=1.7,

Table 3.

Distribution of Orthopedic Surgeon Referral to Health Care Providers by Case Vignette (n=274)

Vignette	Physical Therapist n (%)	Occupational Therapist n (%)	PM&R ^a Physician n (%)	Chiropractor n (%)	No Referral n (%)
1	151 (55.1)	3 (1.1)	8 (2.9)	0 (0.0)	112 (40.9)
2	207 (75.5)	3 (1.1)	9 (3.3)	0 (0.0)	55 (20.1)
3	190 (69.3)	0 (0)	8 (2.9)	0 (0.0)	76 (27.7)
4	190 (69.3)	1 (0.4)	3 (1.1)	0 (0.0)	80 (29.2)
5	211 (77.0)	2 (0.7)	11 (4.0)	0 (0.0)	50 (18.3)

^a PM&R=physical medicine and rehabilitation.

Table 4. Physicians' Outcome Expectations of Supervised Physical Therapy for the Treatment of Patients With Traumatic Lower-Extremity Injury (n=274)

Expected Outcome	Average % of Patients With Outcome ^a
Positive: physical and motor	
Appropriate use of assistive devices	80.7
Improved strength	76.4
Improved range of motion	75.7
Improved muscle tone	72.4
Independent gait	72.3
Increased endurance for physical activity	72.2
Improved balance and coordination	72.0
Prevention of contractures	61.0
Decreased edema	49.3
Positive: pain	
Ability to manage pain	36.8
Decreased acute pain	36.5
Prevention of chronic pain	34.4
Positive: occupational	
Transition into part-time work	51.7
Increased productivity at work	47.5
Increased number of hours able to work	49.6
Ability to meet physical demands of work	55.4
Return to full-time work	53.0
Positive: social and emotional	
Increased satisfaction with overall care	66.7
Ability to manage physical aspects of disability	58.3
Decreased self-perceived disability	46.3
Ability to cope with social or emotional aspects	41.9
Negative	
No improvement beyond what would occur with home exercise program	32.6
Inappropriate medical information	27.5
No improvement beyond what would naturally occur	27.2
Increased pain	23.6
Increased medication use	22.0
Prolonged recovery	12.0

^a Scores range from 0% to 100%, with a score of 0% indicating outcome would never occur and a score of 100% indicating outcome would occur in 100% of patients.

$P=.02$), whereas financial interest in a physical therapist practice showed only a moderate effect (odds ratio=1.7, $P=.09$).

Discussion

Positive physician outcome expectations exhibited a significant effect on

referral of patients with traumatic lower-extremity injury for physical therapy, but only one of the negative outcome expectations scales significantly decreased the likelihood of referral. These findings suggest that surgeon referral rates can be in-

creased with a better understanding of the positive effects of physical therapy. In addition, health care providers wanting to influence the practice of physical therapy referral may want to focus on educating surgeons about the information provided to patients during physical therapy treatment and on evidence supporting the efficacy of supervised physical therapy compared with standard care and independent home exercise programs.

Surgeons appear to be referring patients for physical therapy based on the expectation of improvement in physical and motor outcomes. This conclusion is further supported by the distribution of frequently requested physical therapy services; greater than 60% of surgeons reported requesting treatment modalities consistent with ROM, gait, assistive device, strength, and balance outcomes. The findings, however, indicate that surgeons may not be considering physical therapy for pain relief, improvement in psychosocial aspects of recovery, and return to work. Future research might consider the effect of physical therapy on these outcomes, especially because high levels of chronic pain and psychological distress and poor return to work rates have been found among patients with traumatic lower-extremity injury.³³⁻³⁵ Furthermore, understanding how surgeons are currently addressing pain and psychosocial and occupational concerns has the potential to improve patient management throughout the recovery process.

For negative outcome expectations, the findings provide insight into surgeons' ambivalence toward physical therapy referral and provide direction for clinical research. Some surgeons may not be referring patients for physical therapy based on beliefs that patients will have increased pain and medication use and a pro-

longed recovery. However, referral of patients with traumatic lower-extremity injury for physical therapy appears to be particularly affected by surgeons' concerns over the provision of inappropriate medical information to patients. Qualitative findings suggest that this concern is specifically directed toward information on bone and soft tissue healing, surgical procedures, postsurgical contraindications and precautions, and recovery time. Furthermore, based on the finding that 20% of responding surgeons believe that more than 60% of their patients would have no improvement with physical therapy beyond what would occur with a home exercise program, surgeons may have a preference for physician-directed rehabilitation over supervised physical therapy. Researchers looking at the efficacy of physical therapy for patients with traumatic injuries might consider comparing supervised rehabilitation with both usual medical care and the most commonly used physician-directed home exercise programs.

Our study also showed significant associations between referral frequency and monthly trauma case volume, solo practice, and physician years in practice. The positive association with trauma case volume confirms the results of a study conducted by Kerssens and Groenewegen³ showing that physicians who frequently referred patients to physical therapists had busier practices. The negative association with solo practice supports the results from studies examining physician referral to specialists.^{28,36} However, in contrast to our findings, studies on physician referral to specialists have demonstrated a positive association between years in practice and referral.^{29,36,37} The negative relationship found in the current study could be attributed to a difference in training based on year of medical school graduation or possibly to more-

Table 5. Average Score for Physicians' Attitudes Toward Physical Therapists (n=274)

Item	Average Score ^a
Physical therapists are useful to physicians in my specialty	5.2
Physical therapists play an important role in health care	4.8
Physical therapists are helpful as consultants in my practice	3.7
Physical therapists are competent to make decisions concerning patient care	3.2
Physical therapists are qualified to evaluate and treat as a direct-access provider	2.0
Physical therapists are capable of autonomous practice	2.1

^a Scores range from 1 to 6, with a score of 1 indicating strong disagreement with statement and a score of 6 indicating strong agreement with statement.

experienced surgeons feeling more comfortable overseeing a home-based exercise program.

We did not find an association between referral and physician sex or practice location (rural versus urban), which is inconsistent with prior research on referral to specialists. Studies have shown that female

physicians and physicians practicing in larger communities have higher referral rates.^{29,38,39} Researchers suggest that specialist supply and differences in local medical culture may explain the influence of practice type on referral. In addition, an influence of geographic location on referral for physical therapy was not supported by our findings, and financial

Table 6. Multivariate Random-Effects Logistic Regression Model of Orthopedic Surgeon Referral for Physical Therapy (n=274)^a

Variable	OR (95% CI)	P
Positive physician outcome expectations scale ^b	2.7 (1.9–3.7)	<.001
Negative physician outcome expectations scale: no improvement/inappropriate medical information ^b	0.66 (0.50–0.88)	.01
Physician attitude scale: general attitude ^c	0.83 (0.66–1.1)	.12
Physician years in practice	0.97 (0.95–0.99)	.01
Group practice (reference)		
Academic practice	1.0 (0.62–1.7)	.98
Hospital practice	1.2 (0.65–2.3)	.66
Solo practice	0.16 (0.06–0.46)	<.01
No financial interest in physical therapist practice (reference)		
Financial interest in physical therapist practice	1.7 (0.87–3.1)	.09
<40 trauma cases per month (reference)		
≥40 trauma cases per month	1.7 (1.1–2.7)	.02
Daily communication with physical therapists (reference)		
Weekly communication with physical therapists	0.87 (0.45–1.7)	.69
Monthly communication with physical therapists	0.88 (0.44–1.9)	.73
No communication with physical therapists	0.51 (0.19–1.3)	.17

^a OR=odds ratio, CI=confidence interval.

^b Scores range from 0% to 100%, with a score of 0% indicating outcome would never occur and a score of 100% indicating outcome would occur in 100% of patients.

^c Scores range from 1 to 6, with a score of 1 indicating strong disagreement with statement and a score of 6 indicating strong agreement with statement.

interest in a physical therapist practice had only a moderate effect on referral. To our knowledge, this is the first study to systematically examine the relationship between financial interest in a physical therapist practice and referral. Because only 12% of the responding surgeons reported a financial interest in a physical therapist practice, additional work is needed to further explore this association.

We also did not find increased communication, a close physician-therapist relationship, or a positive attitude to be associated with patterns of physical therapy referral. These findings have important implications because the referral literature suggests that improving communication between physicians and physical therapists and physician attitude toward physical therapy may positively affect physical therapy referral rates.^{3,7,11-13} Although the results of our study do not support this hypothesis, it is important to recognize that these findings are in the context of treatment of patients with high-energy lower-extremity trauma. In the context of conditions more commonly treated by physical therapists, such as back pain or arthritis, the results may vary. Further study into the effects of communication and cooperation on the appropriateness of physical therapy referral is warranted.

An interesting finding is the relatively low referral rate to occupational therapists and physical medicine and rehabilitation physicians compared with physical therapists. Less than 1% of the responding surgeons, on average, referred patients to occupational therapists, and less than 3% of the surgeons referred patients to physical medicine and rehabilitation physicians, whereas 69% of the surgeons referred patients to physical therapists. This distribution may be related to sur-

geons focusing more on lower-extremity ROM, strength, and gait after traumatic injury than on activities of daily living, which are under the purview of occupational therapists. The low referral rate to physical medicine and rehabilitation physicians is more difficult to explain and slightly surprising. An explanation may be that this specialty is less well understood among orthopedic trauma surgeons or possibly that surgeons rely on primary care physicians to recognize the need for this type of referral after patients are discharged from the hospital. Researchers might want to consider examining the use of physical medicine and rehabilitation physicians prior to hospital discharge and throughout the recovery period and, if underutilized for patients with traumatic lower-extremity injury, explore the possible contribution these physicians might have to long-term outcomes.

Study Limitations

Several limitations in our study warrant consideration. The main limitation stems from the survey design, which presented physicians with case vignettes. Patient scenarios are different from actual clinical encounters in several ways: they contain only a small portion of the information usually available to physicians, information is presented simultaneously instead of sequentially as in the medical setting, and they are unable to capture the physician-patient interaction. In addition, listing physical therapy as a referral option may have led physicians to indicate a referral decision they otherwise might not have made in the clinical environment. Even though vignettes are affordable and a valuable tool for representing the behavior of a group of physicians,⁴⁰⁻⁴² we acknowledge there is some degree of uncertainty about the validity of our referral outcome.

Another limitation is our survey's convenience sample of orthopedic surgeons. Thus, our findings may not be generalizable to all orthopedic surgeons responsible for treating patients with traumatic lower-extremity injury. The sample, however, is likely representative of the surgeons who are treating the majority of the high-energy lower-extremity trauma—the condition described in the vignettes. Furthermore, even though our response rate of 58% was high relative to that of other physician surveys,⁴³⁻⁴⁵ no information was available on nonrespondent demographics. As a result, we are unable to accurately assess the systematic differences between respondents and nonrespondents and appropriately acknowledge the potential bias of our findings.

Conclusions

We recommend that efforts to influence the physical therapy referral process for patients with traumatic lower-extremity injury focus on surgeons' beliefs about the positive outcomes of physical therapy. The results suggest that orthopedic trauma surgeons refer patients for physical therapy based mostly on expectations for improvement in physical and motor outcomes and that surgeons may not be considering physical therapy for pain relief, psychosocial aspects of recovery, and return to work. Furthermore, low referral rates may be attributed to a preference for surgeon-directed home-based rehabilitation and to the belief that physical therapists are providing inappropriate medical information to patients. Future research should consider the efficacy of physical therapy for pain and for psychosocial and occupational outcomes and should explore the differences between supervised physical therapy and the most commonly utilized physician-directed home exercise programs.

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Appendix.

Case Vignettes

Case A: Jim

Jim, age 28 years, sustained a type IIIB tibia shaft fracture as a result of a motorcycle accident 8 weeks ago.

- ~ The tibia fracture was treated with a locked nail.
- ~ The soft-tissue defect was covered with a rectus muscle free flap.

The flap is well healed without drainage, and there is no evidence of infection. Residual edema is mild.

- ~ Bilateral hip and knee range of motion is normal.
- ~ Involved ankle dorsiflexion and plantar flexion and subtalar motion are mildly limited.
- ~ The patient is currently weight bearing as tolerated. He is using axillary crutches for ambulation and is independent with transfers and gait.

You have instructed him to increase his weight bearing to 22.68 kg (50 lb). There is a possibility that the patient will need further surgery for a bone graft.

Case B: Ralph

Ralph, age 33 years, sustained a type IIIB bicondylar plateau fracture of the tibia as a result of a motorcycle accident 12 weeks ago. Extensive degloving was present.

- ~ The tibia fracture was stabilized with dual plating.
- ~ The soft-tissue defect was covered with a medial gastrocnemius muscle flap.

Residual edema is mild, and there is no wound drainage. Current radiographs show early healing.

- ~ Patient is partially weight bearing and uses axillary crutches for ambulation.
- ~ He is completely independent with transfers and moderately independent with gait.
- ~ Involved knee flexion range of motion is 95 degrees.
- ~ Involved ankle dorsiflexion is 10 degrees, and plantar flexion is 30 degrees.

Case C: Paul

Paul, age 31 years, sustained a nondisplaced talar neck fracture as a result of a motorcycle crash 12 weeks ago. The right calcaneus, cuboid, and cuneiform were fractured.

- ~ The foot fractures were all treated with open reduction internal fixation after initial treatment with an external fixation.

Physical examination reveals no wound drainage, normal fracture alignment, and moderate edema.

(Continued)

Appendix.

Continued

- ~ Patient is non-weight bearing.
- ~ He requires axillary crutches for ambulation, but is completely independent with all transfers and gait.
- ~ Bilateral hip and knee range of motion is within normal limits.
- ~ Involved ankle dorsiflexion is 5 degrees, plantar flexion is 20 degrees, and there is less than 50% of subtalar motion.

Case D: Peter

Peter, age 28 years, sustained an open type IIIA pilon fracture, with a wound greater than 5 cm, and considerable muscle injury as a result of a motorcycle accident 12 weeks ago.

- ~ The tibia fracture was stabilized with a plate.
- ~ The wound was treated with a delayed primary closure.
- ~ Patient was treated on an outpatient basis for a wound infection several weeks ago.

A clinical examination reveals mild edema and no wound drainage. You do not anticipate any additional surgery at this time.

- ~ The patient is fully weight bearing and ambulates independently with axillary crutches.
- ~ Involved knee flexion is 100 degrees.
- ~ Involved ankle dorsiflexion is 5 degrees, and plantar flexion is 20 degrees.

Case E: Robert

Robert, age 33 years, sustained a type IIIA talus fracture as a result of a motor vehicle accident 12 weeks ago. The talar body and talonavicular joint were displaced. The fracture was treated with an internal fixation.

Anteroposterior and lateral weight-bearing radiographs of the foot reveal good fracture alignment and progressive bone healing. There is no evidence of wound drainage, and the soft tissue coverage is stable.

- ~ The patient is non-weight bearing and uses a walker for ambulation.
- ~ He is independent with transfers and moderately independent with ambulation.
- ~ Involved knee flexion is 0 to 90 degrees.
- ~ Involved ankle dorsiflexion is 0 degrees, and plantar flexion is 40 degrees.