

Diagnosis of Lower-Extremity Deep Vein Thrombosis in Outpatients With Musculoskeletal Disorders: A National Survey Study of Physical Therapists

Background and Purpose. Prompt identification of outpatients who may have proximal lower-extremity deep vein thrombosis (PDVT) is important, in part, because of the risk of pulmonary embolism. The purposes of our study were to determine the degree of accuracy of physical therapists' estimates of the probability of PDVT in hypothetical patient vignettes and to determine whether physical therapists would contact the referring physician about the hypothetical patients' condition as recommended in published evidence. **Subjects and Methods.** A survey instrument consisting of 6 vignettes was sent to a nationally representative random sample of 1,500 physical therapists. The clinical decision rule developed by Wells and colleagues served as the gold standard for PDVT probability. **Results.** A total of 969 (65% response rate) physical therapists completed the survey. We found no evidence of nonresponse bias. For the 2 high-probability vignettes, 87% and 64% of the physical therapists underestimated the probability of PDVT. For the 2 high-probability cases, 32% and 27% of the physical therapists reported that they would not have contacted the referring physician. For the 2 moderate-probability cases, 15% and 30% of the physical therapists would not have contacted the referring physician. Therapist experience, certification status, place of practice, and region of the country did not explain the findings. **Discussion and Conclusion.** The care of outpatients who are at risk for PDVT could potentially be improved by use of the clinical decision rule developed by Wells and colleagues, although more study is warranted. [Riddle DL, Hillner BE, Wells PS, et al. Diagnosis of lower-extremity deep vein thrombosis in outpatients with musculoskeletal disorders: a national survey study of physical therapists. *Phys Ther.* 2004;84:717-728.]

Key Words: *Diagnosis, Venous thrombosis.*

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Venous thromboembolism (VTE) is one of the more common complications seen in patients with cancer or following surgery, trauma, or prolonged immobilization.¹

Venous thromboembolism refers to all forms of thrombosis in the venous circulation and manifests in 2 ways: deep vein thrombosis (DVT) and pulmonary embolism (PE). The 3 most common sequelae of VTE are recurrent nonfatal VTE, postthrombotic syndrome, and fatal PE.² When DVT occurs in the lower extremity, the DVT is classified as proximal or distal. Proximal DVTs (PDVTs) are those that are located at or proximal to the trifurcation of the popliteal vein. Distal DVTs (or calf DVTs) are always distal to the trifurcation of the popliteal vein. Proximal deep vein thrombosis is considered to be the more dangerous form of lower-extremity DVT because the thrombi are larger than those associated with calf DVT and are more likely to lead to PE.^{3,4} Calf vein thrombi are usually considered to be of little consequence unless the thrombi migrate proximally.^{3,4}

Patients who have had major orthopedic surgery or trauma of the lower extremities are among those at highest risk for VTE.⁵ For example, PDVT is reported to occur in 66% of patients with isolated lower-extremity fractures who were seen in a trauma unit.⁶ Deep vein thrombosis also can occur in patients following discharge from the hospital and in nonhospitalized patients. Warwick and colleagues⁷ reported that 64% of VTE complications among 1,162 patients following hip arthroplasty occurred following discharge from the hospital.

Because of decreasing lengths of hospitalization for patients following surgery, some authors^{1,8} have suggested that when these patients are seen in outpatient settings, their risk for PDVT is elevated relative to when hospital stays were longer. We suspect, therefore, that physical therapists in outpatient settings may now be more likely to see patients with undiagnosed PDVT as compared with when hospital stays were longer.

Physical therapists in outpatient settings routinely screen patients with musculoskeletal problems for potentially serious disorders such as PDVT.⁹ The clinical diagnosis of PDVT, however, has traditionally been thought to be fraught with error, and physicians have relied heavily on radiologic or laboratory diagnostic tests.¹⁰ The Homans sign, for example, is one of the more commonly used clinical tests for detecting PDVT, but the test has essentially no diagnostic value.^{11,12} Many researchers¹³⁻¹⁷ have developed methods for more accurately identifying outpatients who may have PDVT. One of the more common approaches to improving diagnosis is by use of a clinical decision rule (CDR). Clinical decision rules quantify the individual contributions that components of the medical history and physical examination make to a diagnosis.¹⁸

In a series of studies,¹⁵⁻¹⁷ Wells and colleagues found that patients could be categorized into low-, moderate-, and high-risk groups based on their CDR scores (Tab. 1). The CDR consists of 9 medical history and physical examination findings that, in our opinion, are simple to obtain. Patients with scores of 0 or less had a 3% (95% confidence interval [CI] = 1.7%–5.9%) proba-

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Dr Riddle, Dr Hillner, Dr Wells, Dr Johnson, and Dr Zuelzer provided concept/idea/research design and fund procurement. All authors provided writing. Dr Riddle provided data collection and project management, and Dr Riddle, Dr Johnson, and Ms Hoffman provided data analysis.

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Table 1.
Clinical Decision Rule Developed by Wells and Colleagues¹⁶

Clinical Finding	Score ^a
Active cancer (within 6 months of diagnosis or palliative care)	1
Paralysis, paresis, or recent plaster immobilization of lower extremity	1
Recently bedridden >3 days or major surgery within 4 weeks of application of clinical decision rule	1
Localized tenderness along distribution of the deep venous system ^b	1
Entire lower-extremity swelling	1
Calf swelling by >3 cm compared with asymptomatic lower extremity ^c	1
Pitting edema (greater in the symptomatic lower extremity)	1
Collateral superficial veins (nonvaricose)	1
Alternative diagnosis as likely or greater than that of deep vein thrombosis ^d	-2

^a Score interpretation: ≤ 0 =probability of proximal lower-extremity deep vein thrombosis (PDVT) of 3% (95% confidence interval [CI]=1.7%–5.9%), 1 or 2=probability of PDVT of 17% (95% CI=12%–23%), ≥ 3 =probability of PDVT of 75% (95% CI=63%–84%).

^b Tenderness along the deep venous system is assessed by firm palpation in the center of the posterior calf, the popliteal space, and along the area of the femoral vein in the anterior thigh and groin.

^c Measured 10 cm below tibial tuberosity.

^d Most common alternative diagnoses are cellulitis, calf strain, and postoperative swelling.

bility of PDVT, scores of 1 or 2 indicated a 17% (95% CI=12%–23%) chance of PDVT, and those who scored 3 or higher had a probability of PDVT of 75% (95% CI=63%–84%). The findings were confirmed by other researchers.^{19–21}

The CDR developed by Wells and colleagues^{15–17} has appeared frequently in the general medical literature,^{5,10,19} but, to our knowledge, has not been discussed in the physical therapy literature. The primary purpose of our study was to determine the degree of accuracy of physical therapists' estimates of the probability of PDVT in a series of patient vignettes. Based on pilot data, we hypothesized that the majority of physical therapists' estimates of the probability of PDVT in patient vignettes would differ from those predicted by the CDR of Wells and colleagues.^{15–17} We also examined the extent of intratester reliability for judgments of low, moderate, and high probability.

We determined whether physical therapists indicated they would contact the referring physician about the hypothetical patients' condition. Extensive literature suggests that, because of the risk of life-threatening PE, any patient suspected of having PDVT should have formal diagnostic testing.^{1,10,22}

Our final purpose was to determine whether physical therapist characteristics of years of clinical experience, type of practice setting, board certification status, and geographic region affected the judgments of PDVT probability or referral to the patient's physician. Specialty certification has been shown to influence outcome in other medical specialties.^{23–25} Geographic region also has been shown to contribute to practice variation for other disorders^{26,27} and may affect judgments about PDVT made by physical therapists.

Materials and Methods

We purchased the dataset of all physical therapist members of the Orthopaedic Section of the American Physical Therapy Association (APTA).^{*} Members of the Orthopaedic Section were the focus of this study because patients with musculoskeletal disorders are among the most at-risk for developing PDVT.^{4,5} There were complete data on 8,358 physical therapists in the dataset as of July 31, 2002. The age, number of years of clinical experience, place of practice, and board certification status of all therapists were examined to determine if these variables influenced the results.

Subjects

Of the 8,358 eligible physical therapists, 1,189 therapists were listed as being board certified in orthopedic physical therapy and 7,169 were not board certified. Because we were interested in comparing results of physical therapists who were and were not board certified, we accounted for board certification status in our stratified sampling procedure. We randomly sampled 750 physical therapists who were not board certified (10% of the population) and 750 physical therapists who were board certified (63% of the population). Figure 1 gives a description of how the samples were chosen.

A postcard was sent to the randomly selected physical therapists 2 weeks prior to mailing of the survey questionnaire. The purpose of the postcard was to alert the therapists that the survey instrument was forthcoming. Survey questionnaires were then mailed along with a cover letter from the president of APTA's Orthopaedic Section encouraging participation. A stamped, self-addressed return envelope was included in the packet. A second postcard was sent 2 weeks following the mailing of the first survey questionnaire reminding therapists to complete the survey. A second survey questionnaire and a stamped, self-addressed envelope were sent to non-respondents 1 month after the initial survey questionnaire was mailed. This method has been shown to enhance the number of completed survey instruments beyond that expected by sending one survey instrument

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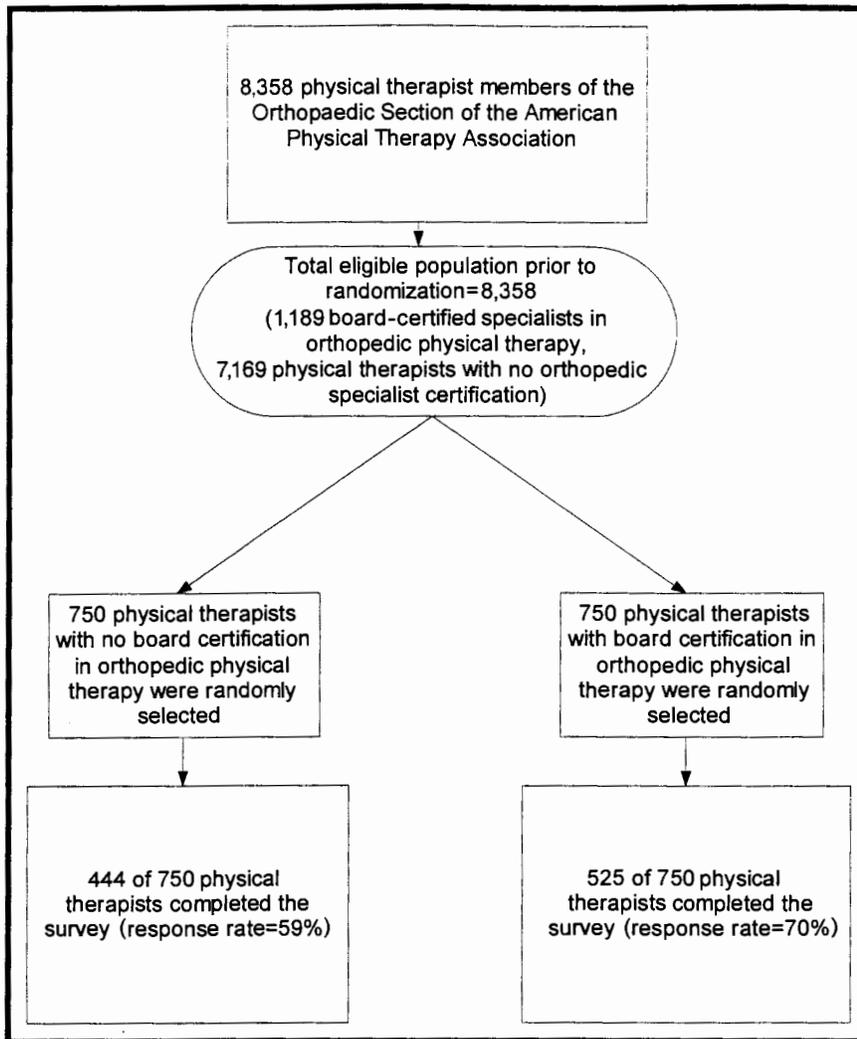


Figure 1.
Flow of physical therapists through the study.

without reminders.^{28,29} A total of 969 physical therapists (65%) completed the survey. Table 2 summarizes the characteristics of physical therapists admitted during the study.

Survey Structure and Content

The survey was designed to determine the accuracy of physical therapists' estimates of the probability of lower-extremity PDVT in hypothetical outpatients with a variety of musculoskeletal disorders. We designed the vignettes to reflect each of the 3 probability categories used in the CDR developed by Wells and colleagues.¹⁵⁻¹⁷ Two vignettes were written for each of the low-, moderate-, and high-probability categories, for a total of 6 vignettes. We wanted 2 vignettes for each category to examine the extent of agreement among physical therapists for each probability level. The vignettes and the "correct answers" for each vignette are shown in the Appendix.

Our research team wrote the vignettes, initially without the input of one of the coauthors (PSW), who was one of the developers of the CDR. We did not include that coauthor in the vignette writing because we wanted to determine if the probability estimates made by the research team agreed with those of that individual, whose ratings we considered to be the standard for the vignettes. We designed the vignettes to reflect orthopedic clinical practice and the types of outpatients who are generally considered to be at risk for PDVT. For example, 5 of the 6 vignettes described outpatients who had recently had orthopedic surgery.⁵ After the vignettes were written and probability estimates were made based on consensus of the other research team members, they were sent to the coauthor who was a developer of the CDR (PSW) for an independent estimate of PDVT probability. Probability estimates agreed in all cases.

We then conducted a pilot survey study, in part, to determine if therapists and orthopedic surgeons found the vignettes to be credible descriptions of the types of patients seen in orthopedic practices. We sent the pilot survey questionnaire to 12 physical therapists with 5 or more years of clinical experience. Only experienced therapists were chosen because we wanted the therapists to use their clinical experience as a basis

for judging credibility of the vignettes. The therapists were clinical instructors for the Department of Physical Therapy, Virginia Commonwealth University, and working in outpatient orthopedic clinics in the Richmond, Va, area. Ten of 12 therapists completed the pilot survey.

After reading each vignette, the physical therapist was asked to answer 2 questions. The first question asked the therapist to estimate the probability that the patient had symptomatic PDVT of the lower extremity. The 3 probability options were "low," "moderate," and "high" and were operationally defined for the therapists in accordance with the work of Wells et al.¹⁶ In our survey, we defined low, moderate, and high probability for the participants in the following way: *low probability* indicated that the therapist suspected that the probability of PDVT was 5% or less, *moderate probability* indicated that the probability of PDVT was greater than 5% but less than 25%, and *high probability* was a 25% or greater likelihood

Table 2.
Characteristics of the Populations and Samples

Therapist Characteristic	Board Certified					
	Yes			No		
	Population	Sample Surveyed		Population	Sample Surveyed	
		Replied	Did Not Reply		Replied	Did Not Reply
No. of therapists	1,189	525	225	7,169	444	306
Years of clinical experience (median)	14	15	14	10	10	9
Place of practice (%)						
Outpatient facility or private practice	94.4	94.9	93.8	86.3	86.5	86.0
Hospital based	5.6	5.1	6.2	13.7	13.5	14.1
Region (%)						
Northeast	23.8	25.5	24.0	21.7	20.1	21.9
South	25.7	25.1	25.8	28.3	27.7	27.8
Midwest	20.2	21.0	17.3	24.4	25.9	26.1
West	30.3	28.4	32.9	25.5	26.4	24.2

of PDVT. The second question asked was, "Would you contact the referring physician today about this patient's condition?"

We also sent the pilot survey questionnaire (with the question about physician referral deleted) to 8 orthopedic surgeons who were faculty members of the Department of Orthopaedic Surgery, Virginia Commonwealth University. We sought input from orthopedists because the vignettes addressed surgical procedures and we wanted this information to reflect actual practice. Six of the orthopedists completed the pilot survey. After completing the pilot survey, the orthopedists and the physical therapists were asked whether they found the vignettes to be credible descriptions of the types of patients seen in their practices. All clinicians indicated that they found the vignettes to be credible.

We concluded, based on our pilot work, that our vignettes had probability estimates that agreed with those of the developer of the CDR and were credible (clinicians reported that the vignettes were indicative of patients seen in their practices). The survey questionnaires were then sent to the randomly selected sample of therapists. The questions asked in the survey were identical to those asked in the pilot study. Therapists participating in the pilot study were not enrolled in the main study.

Data Analysis

Survey responses were reported as percentages and displayed in bar graphs. These data included sample proportions of physical therapists who answered "low probability," "moderate probability," and "high probability" to each of the vignettes. Sample proportions of

therapists who would and would not contact the referring physician that day also were calculated.

Because we had 2 vignettes for each probability category, we examined the intratester reliability of therapists' probability judgments. Instead of using a conventional approach to examining reliability with repeated judgments of the same subject (or, in this case, the same vignette), we determined the extent to which therapists agreed on their probability estimates of each pair of vignettes we assigned to the same category of probability. For the probability estimates of low, moderate, and high probability, intratester reliability was analyzed by calculating the percentage of agreement for the 2 vignettes in each category.

Multiple logistic regression was used to determine the effect of the following variables on each question asked in the survey: place of practice (hospital-based practice or outpatient-based practice), board certification status (yes or no), number of years of clinical experience (above or below median of 11 years), and region of the country (US census regions West, Midwest, Northeast, and South). The first analysis determined if any of the therapist characteristic variables influenced the responses to the question that asked therapists to estimate the probability of DVT for each of the 6 scenarios. A therapist's answer was considered "correct" if it matched the probability level as determined by the CDR for the given vignette. The second analysis determined if any of the therapist characteristic variables influenced the decision about whether to contact the referring physician. The "correct" decision regarding physician notification was "yes" for all scenarios. For both sets of analyses, we also tested all 2-way and 3-way interactions.

The significance level for the regression analyses was set at $P \leq .05$. We did not adjust for the experiment-wise error rate because we considered these regression analyses to be exploratory in nature. Because we calculated 2 logistic regression models (one for each question asked in the survey) for each of the 6 vignettes, we considered a variable as important only if it was significant in a majority (≥ 4) of vignettes. Variables that were found to be significant in less than a majority of vignettes were, in our opinion, not important.

Because we oversampled the physical therapists who were board certified, we adjusted our analysis using sampling weights in order to reflect the numbers of board-certified physical therapists in the population. The sampling weights include factors that correct for reductions in sample size due to survey nonresponse. Our sample size was a fairly large proportion of the population size—10% and 63% for non-board-certified and board-certified physical therapists, respectively. We therefore adjusted sample variance estimates using finite population corrections (subjects were sampled without replacement, which is designed to reduce sampling error).³⁰

To evaluate potential nonresponse bias, we first calculated the mean age, proportion of board-certified physical therapists, proportion of physical therapists within each practice type, and proportion of physical therapists within each region of the country for the full population. We then calculated 95% confidence intervals based on the responding sample. If a population mean or proportion did not fall within the corresponding 95% confidence interval, the sample was deemed biased on that characteristic.

Descriptive analysis for this article was generated using SAS software, Version 8 of the SAS System for Windows.[†] Logistic regression analysis was generated using SUDAAN,[‡] a statistical software program designed to analyze data from complex multistage sample surveys and cluster-correlated data. Graphics were generated using Microsoft Excel 2002.[§]

Results

Intratester reliability was examined by comparing the probability estimates made for each of the 3 probability categories. For the 2 low-probability cases, 24% of the physical therapists agreed that both cases were low probability. For the moderate-probability cases, 16% of therapists agreed that both cases were moderate proba-

bility. For the 2 high-probability cases, agreement occurred for 6% of the therapists.

For the 2 low-probability vignettes, physical therapists overestimated the probability of PDVT 71% of the time in one vignette and 10% of the time in the other vignette. For the 2 moderate-probability vignettes, physical therapists underestimated probability 21% of the time for one vignette and 26% of the time for the other vignette. Therapists overestimated probability for the 2 moderate-probability vignettes 28% and 37% of the time. For the 2 high-probability vignettes, therapists underestimated PDVT probability 87% and 64% of the time (Fig. 2). Figure 2 also summarizes population estimates for each of the probability categories. For example, for vignette H1, 35% of the population, or approximately 2,900 therapists, would rate the probability of PDVT in this high-probability vignette as low, whereas approximately 1,100 therapists in the population would rate the probability as high.

For the low-probability vignettes, 25% and 90% of the physical therapists reported that they would not contact the referring physician about the patient's condition. For the moderate-probability vignettes, 15% and 30% of the therapists indicated that they would not contact the referring physician. For the high-probability vignettes, 32% and 27% of the therapists indicated that they would not contact the referring physician (Fig. 3). Population estimates for the proportion of therapists who would and would not contact the referring physician regarding the patient's condition also are provided in Figure 3. For example, the percentage of therapists who indicated that they would not contact the referring physician regarding the condition of the patient described in vignette H2 equates to approximately 2,200 therapists in the population who would not contact the referring physician given the information in the vignette. Approximately 6,000 of the estimated 8,400 therapists in the population would refer the patient described in vignette H2 to a physician.

None of the potential confounding variables were found to consistently affect the responses of the physical therapists. Of the 12 logistic regression models (6 for each question), only 3 were found to be significant. For example, in one vignette, region of the country had an effect on the response to the question relating to physician referral (Wald F, $P = .0071$). Region of the country was not found to influence responses to the questions for any other vignette. Board certification status did not affect any of the responses in the study.

For all analyses, we tested both 2-way and 3-way interactions, but we did not find them to be significant. Years of clinical experience was examined as a continuous vari-

[†] SAS Institute Inc, PO Box 8000, Cary, NC 27511.

[‡] Research Triangle Institute, 3040 Cornwallis Rd, Research Triangle Park, NC 27709-2194.

[§] Microsoft Corp, One Microsoft Way, Redmond, WA 98052-6399.

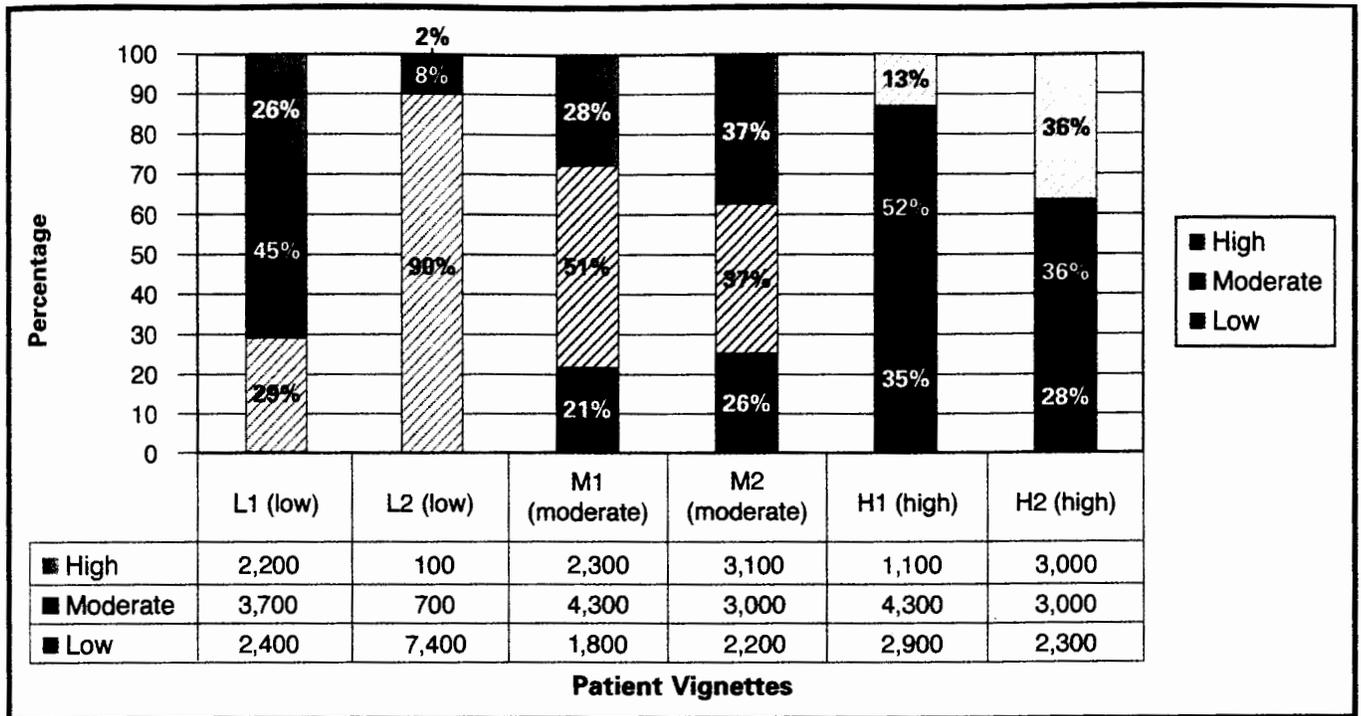


Figure 2. Probability estimates for the 6 vignettes along with population estimates for each of the probability levels. The "correct" answer for each vignette is indicated with diagonal lines in the bars. The numbers in the table represent population estimates of the numbers of Orthopaedic Section members of the American Physical Therapy Association who would rate such vignette as having high, moderate, or low probability. The percentages in the graphs and population numbers in the table have a standard error ranging from 0.5% to 3%. The numbers in the table have been rounded to the nearest hundred to reflect error in the point estimate.

able or as a dichotomous variable (greater than the median or less than or equal to the median) in all analyses, with no differences in results. We therefore presented the results for clinical experience using the simpler dichotomous variable.

To examine nonresponse bias, we compared characteristics of physical therapists who completed the survey (n=969) with those of the population of physical therapist members of APTA's Orthopaedic Section (n=8,358). We examined the following variables: median years of clinical experience, board certification status, types of practice settings, and regions of the country. For all variables, the population mean or proportion fell within the corresponding 95% confidence interval of the sample.

Discussion

Our hypothesis regarding the accuracy of physical therapist estimates of PDVT probability was supported. In 4 of 6 vignettes, a majority of therapists either overestimated or underestimated PDVT probability. Perhaps more troubling is the proportion of therapists (15%–90% depending on the vignette) who reported that they would not have contacted the referring physician about the patient's condition. The concern of potentially missing a patient with PDVT is greatest for the high-

probability vignettes. A majority of these patients will likely be found to have a DVT or PE at some point during the 3 months following the initial estimate of PDVT probability.^{16,19} Our data suggest that over 2,000 therapists in the population (approximately 25%) would likely not contact the referring physician when seeing a patient with a high probability of PDVT.

Because the potential consequences of missing a PDVT (eg, PE) are great, the literature supports conducting formal diagnostic testing even when the risk of PDVT is determined to be low.^{1,10} Given the considerable mortality and morbidity associated with PDVT, we contend that physical therapists should contact the referring physician whenever PDVT is suspected. The CDR can be used to aid in the identification of people who are at risk for PDVT and for estimating the likelihood of PDVT.

If our vignettes reflect the types of patients seen by physical therapists and the survey data reflect the clinical decisions physical therapists make, our data suggest that physical therapists may not be contacting the referring physician about a patient's PDVT risk as frequently as they should. This finding may be partially explained by therapists' inability to consistently estimate a patient's risk for PDVT.

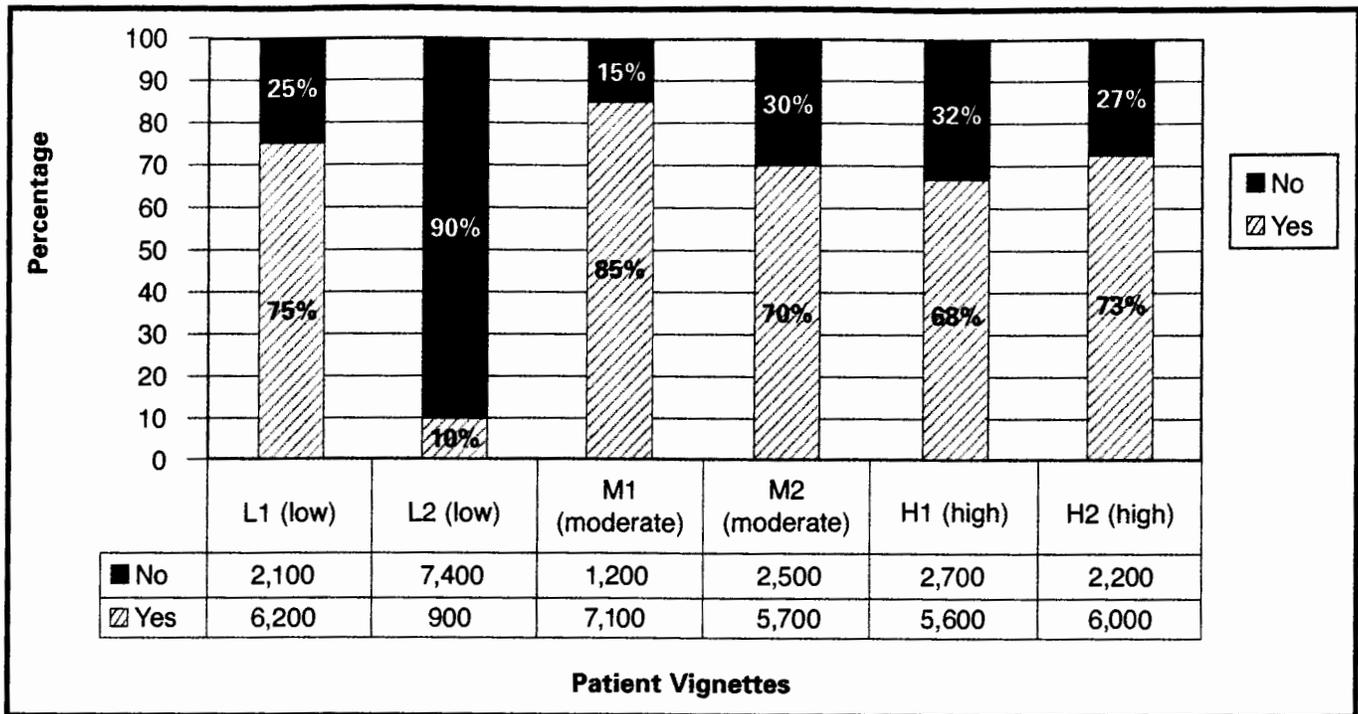


Figure 3.

Proportion of therapists who would contact the patient's physician regarding the potential for proximal lower-extremity deep vein thrombosis. The "correct" answer for each vignette is indicated with diagonal lines in the bars. The numbers in the table represent population estimates of the numbers of Orthopaedic Section members of the American Physical Therapy Association who would and would not contact the patient's physician. The percentages in the graphs and population numbers in the table have a standard error ranging from 1% to 3%. The numbers in the table have been rounded to the nearest hundred to reflect error in the point estimate.

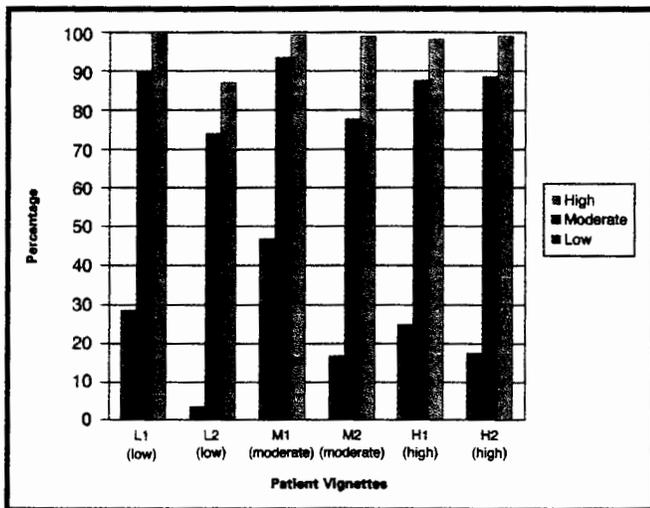


Figure 4.

Proportion of therapists indicating that they would contact the referring physician stratified by estimates of proximal lower-extremity deep vein thrombosis probability for each vignette.

To illustrate how discrepancies in probability estimates may influence patient care, we examined the impact of the physical therapists' responses to question 1 (DVT probability estimate) on their responses to question 2

("Would you contact the referring physician?"). Figure 4 illustrates the patterns of responses for those therapists who indicated that they would contact the referring physician stratified by the responses to question 1 (low, moderate, or high probability). For one high-probability vignette (vignette H2), 18% of the therapists indicated that they would contact the referring physician when they estimated the probability of developing PDVT to be low. This finding contrasts with 89% and 99% of the therapists who would contact the referring physician when estimates of probability were moderate or high, respectively. These data suggest that for patients with a high probability of developing PDVT, physical therapists who underestimate PDVT probability are more likely not to contact the referring physician as compared with therapists who do not underestimate probability. Underestimates of PDVT probability appear to be the more serious errors because they may lead the therapist to falsely conclude that physician referral is not needed. Use of the CDR developed by Wells and colleagues¹⁵⁻¹⁷ appears to have potential to improve the accuracy of physical therapists' judgments of PDVT probability and physical therapists' decisions regarding the need for physician referral.

Ideally, when a physical therapist uses the CDR to estimate probability for a patient with, for example, a low probability of developing PDVT, the next time the examiner rates a patient who truly has a low probability, the examiner also scores that person as having a low probability. Our intratester reliability analysis indicated that physical therapists appear to be highly inconsistent in their probability estimates. Our approach to examining reliability was unconventional, however, in that we judged the degree of reliability by comparing 2 different vignettes rather than having the same vignette judged twice by the same examiner. Given that the vignettes were worded differently, some of the error may have been attributable to differences in interpretation rather than to true differences in therapist judgments.

Evidence exists to suggest that with training, reliability of probability estimates made by nurses and physicians achieves an acceptable level ($\kappa = .75$).¹⁶ Research is needed to assess the reliability of physical therapists' probability estimates using the CDR on patients rather than with vignettes and to determine if training in use of the CDR affects reliability.

We found no evidence to indicate that physical therapists' characteristics of years of clinical experience, board certification status, practice setting, or region of the country influenced the results. Clinical judgments related to DVT diagnosis appear not to be influenced by these variables. Because of the random sampling procedure used in our study, the estimates obtained appear to be generalizable to the population of physical therapist members of APTA's Orthopaedic Section.

We found evidence for a valid CDR in the general medical literature regarding DVT diagnosis,^{15,19} and we determined the extent to which physical therapists' judgments agreed with this evidence. Some studies^{31,32} have demonstrated that a gap exists between research evidence and the practice of medicine, but we are not aware of data showing the extent of knowledge transfer to physical therapist practice. Knowledge transfer is especially difficult when attempting to take evidence from one specialty area and applying it to another area of practice.³³ Therefore, we suspected that there would be a disparity between the evidence and current practice. We believe our results describe the magnitude of this disparity.

Clinical Application of the CDR to Outpatients With Musculoskeletal Disorders

The CDR of Wells and colleagues¹⁵⁻¹⁷ was designed for use when there is any suspicion, based on medical history, signs, or symptoms, that the patient may have

PDVT. Suspicion, in our experience, usually arises when a patient's signs or symptoms are inconsistent with or out of proportion to the disorder for which the patient is being managed. The CDR has not been validated as a general screening tool on all patients independent of their signs or symptoms, and therefore we do not recommend indiscriminate use of the CDR.

In our experience, diagnosing PDVT is especially difficult in outpatients following lower-extremity surgery or trauma. These patients may have clinical findings (eg, lower-extremity swelling or calf tenderness) that would increase the CDR score, but these findings also may be considered part of the routine recovery following surgery or trauma and therefore unrelated to DVT. When working with patients who have a lower-extremity injury or surgery, physical therapists first need to determine whether use of the CDR is appropriate. If the clinician cannot confidently rule out the possibility of PDVT based on medical history and examination data, then we recommend that the CDR be used to further refine the patient's degree of risk for PDVT. We believe that physical therapists should be conservative and use the CDR whenever any question exists about the presence of PDVT.

In vignette L1, for example, the patient had calf swelling of greater than 3 cm and calf tenderness, which counted for 2 points on the CDR. Calf swelling and tenderness, however, also may be considered by the physical therapist to be attributable to chronic knee problems and not to a DVT. We believe the therapist has 2 options in this scenario. If, after collecting history and examination data, the therapist cannot confidently rule out DVT, we recommend that the CDR be used. The patient would score 2 points on the CDR (1 point each for the calf swelling and tenderness). In addition, the therapist would likely consider an alternative explanation (alternative diagnosis of a chronic knee injury) for the lower-extremity swelling and tenderness, which reduces the patient's score by 2 points. In this case, the CDR would indicate a score of 0 and a probability of DVT of approximately 3%. The second option is to consider the swelling and tenderness to be entirely attributable to the knee injury and not even consider PDVT as a possibility. For this second option, the therapist would not use the CDR. If the therapist has any suspicion that the signs or symptoms are out of proportion to usual clinical findings, then there is a risk of PDVT. We then recommend using the CDR so that the potential risk of PDVT is not ignored.

Limitations

It is unclear to what extent patient vignettes actually reflect clinical practice. It is possible that the decisions

made by physical therapists while completing the questions for the vignettes vary from those actually made during clinical practice. Recent evidence exists to support the use of case simulations for examining some clinician behaviors.^{34,35} Peabody and colleagues³⁵ determined whether case simulations were a legitimate method for measuring the process of care compared with actual clinical practice. The authors compared the data collected by a large group of physicians on a series of patients with data collected while the physicians completed case simulations that were identical to the characteristics of one of the patients seen in the clinic. Data from vignettes with diagnoses as varied as low back pain, diabetes, and coronary artery disease were found to be valid predictors of actual clinical performance for decisions related to clinical examination and diagnostic testing as well as intervention.³⁵ Use of vignettes appears to be appropriate for investigating the process of care provided by physicians in clinical practice. It is unclear whether the same is true for physical therapists. We also have no data that allow us to generalize our findings to patients with disorders unrelated to the musculoskeletal system or to physical therapists who are not APTA Orthopaedic Section members. Future research should address the generalizability of our results.

Conclusion

Some therapists may not be referring patients to a physician for additional workup when a patient's risk for developing PDVT warrants referral. Our data suggest that one potential reason for not recommending physician referral for DVT workup is error in estimating the probability of PDVT. Because of the potentially serious consequences of missing PDVTs, future research should focus on improving physical therapists' ability to screen for PDVT. Use of the CDR developed by Wells and colleagues¹⁵⁻¹⁷ may aid in improving physical therapists' accuracy of probability estimates of PDVT and subsequent referral decisions. More research is needed to determine the impact of use of the CDR developed by Wells and colleagues on outpatient care provided by physical therapists.

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