State Regulation and the Delivery of Physical Therapy Services

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Objective. The study purpose was to examine the relationship between state regulations of physical therapists (PT) and three dependent variables: physical therapist assistant (PTA) utilization more than 50 percent of the time during the treatment episode (high PTA utilization), number of visits, and patient self-reported functional health status (FHS) at discharge. We evaluated regulations governing licensure of PTAs, PT/PTA ratio, frequency of PT re-evaluation, and PTA supervision.

Data Source. The analytic sample included 63,900 patients from 38 states drawn from 395 clinics who participated in the Focus on Therapeutic Outcomes Inc. (Knoxville, TN) database in 2000 and 2001.

Study Design. Using a Bayesian modeling approach with the Markov Chain Monte Carlo estimation method, we fitted separate multilevel multivariate regression models predicting high PTA utilization, number of visits, and discharge FHS.

Data Collection Methods. Patients completed FHS surveys at intake and discharge. Clinicians recorded the number of visits and percentage of time a patient spent with each provider.

Principal Findings. After controlling for patient, therapist, and clinic characteristics, the presence of state regulations regarding PTA supervision was not associated with the likelihood of high PTA utilization. High PTA utilization and regulations requiring full-time onsite supervision were associated with more visits, whereas regulation of PT/PTA ratio was associated with fewer visits. Supervisory regulations were associated with better discharge FHS. High PTA utilization and use of therapy aides were associated with more visits per episode and lower discharge FHS.

Conclusions. The use of care extenders in place of PTs is likely to result in less efficient and lower quality care in outpatient rehabilitation.

Key Words. Physical therapy, rehabilitation, health services research, quality, outcomes measure

There is a growing trend in health care to supplement or substitute cheaper support personnel for more highly skilled providers (Buchan and Dal Poz 2002). Use of support personnel can relieve more highly skilled and costly professionals from routine tasks (Bashi and Domholdt 1993), thus extending

the amount of care delivered by providers (Loomis et al. 1997). As an example, licensed practical nurses and certified nurse aides are replacing registered nurses in some clinical situations. Similar staffing trends have occurred in physical therapy where physical therapist assistants (PTAs) and therapy aides are used in place of licensed physical therapists (PTs) (Gwyer 1995; Burcham 1998).

Proliferation of these staffing models has been driven by managed care organizations, the introduction of prospective payment systems, and low reimbursement rates (Burcham 1998), as well as workforce shortages in allied health (Bashi and Domholdt 1993; Hack and Konrad 1995; Jacoby 1995; Jones et al. 1996). To meet cost and workforce demands, some recommend PTs abandon their primary role of treating patients and instead become "managers" who evaluate patients and delegate treatment to support personnel (Aron 1997; Burcham 1998). Use of support personnel in outpatient therapy settings can double the number of patient visits a therapist can manage per day, thus increasing clinical productivity (Burcham 1998).

While some advocate use of support personnel to increase productivity without loss of quality (Saunders 1997), others warn that an overreliance on support personnel can negatively affect outcomes and compromise quality (Carr-Hill et al. 1995; Aron 1997). The concerns are that support personnel are being over utilized, performing skilled activities without adequate training, and not being adequately supervised (Feitelberg 1970; Holmes 1970; Watts 1971; Bashi and Domholdt 1993; Aron 1997). Improper utilization of support personnel may create hidden costs as well because of inefficiency (Orne et al. 1998).

In an effort to properly train and use support personnel in physical therapy, the American Physical Therapy Association (APTA) has differentiated training and function of PTs, PTAs, and therapy aides (Bashi and Domholdt 1993) and promulgated guidelines on delegation of responsibilities. Because these guidelines are voluntary for APTA members, the guidelines may not be followed consistently or may not be followed by non-APTA member therapists. Studies have shown that PTs view the PTA role as

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generally consistent with published guidelines (Robinson et al. 1994), but PTAs view their roles less consistently and sometimes violate recommended standards (Robinson, DePalma, and McCall 1995).

To date there has been no research describing the impact of using support personnel in physical therapy (Gwyer 1995). Despite efforts to promote reasonable uniformity in physical therapy regulatory standards and practices (Federation of State Boards of Physical Therapy 2002), there are wide variations in the governance of practice. PTs are licensed health professionals in all 50 states, and PTAs are licensed or regulated in 43 states (Maxwell, Boccuti, and Tong 2002). The majority of states have promulgated regulations delineating supervisory requirements for physical therapy support personnel, but the terminology and definitions of supervision vary (Maxwell, Boccuti, and Tong 2002). For example, Medicare requirements for PTA supervision for providers in private practice settings are more stringent than state regulations, requiring in-room, personal supervision of the PTA (American Physical Therapy Association 2004).

State regulation of PT and PTA behaviors has the potential to influence quality of care and utilization of health care personnel. To our knowledge, no prior research has explored the relationship between state regulation, personnel utilization, and patient outcomes in the field of physical therapy. Thus, the purpose of this study was to quantify the relationship between state regulation of physical therapy services, care delegation to the PTA, utilization of physical therapy services, and patient outcomes.

METHODS

Data Source

Data for this study come from the Focus on Therapeutic Outcomes Inc. (FOTO) (Knoxville, TN) database. To our knowledge, FOTO, a proprietary medical rehabilitation data management company, is the largest rehabilitation outcomes database available for researchers in the United States (Dobrzykowski and Nance 1997). Whereas regulatory requirements mandate the collection of clinical outcomes data in skilled nursing facilities through the minimum data set (Zimmerman 2003; Mor 2004), in-home care agencies through the use of the Outcome and Assessment Information Set (Health Care Financing Administration 1999), and in inpatient rehabilitation through the use of case-mix groups (Stineman 2002), there are presently no similar requirements for outpatient rehabilitation settings, limiting the availability of data for this population.

In 2000 and 2001, 395 outpatient rehabilitation clinics from 38 states participated in FOTO. Most patients were treated in hospital clinics (57 percent), private physical therapy clinics (10 percent), or corporate-owned clinics (10 percent), and were referred to therapy by orthopedic surgeons (44 percent), general practitioners (34 percent), occupational medicine physicians (6 percent), or neurologists (4 percent). The mean number of patients in the FOTO database was 355 (standard deviation = 537) per clinic.

The FOTO database contains a wide range of administrative data associated with outpatient services, patients' demographic information, and measures of functional health status (FHS) (see below for measure description). Data describing characteristics of the providers and participating facilities are also included. FOTO provides a standard set of data and reports patient outcomes to participating providers benchmarked to the FOTO national aggregate. The FOTO measure of FHS has been included on the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) list of accepted performance measurement systems for their ORYX[®] initiative (Joint Commission on the Accreditation of Healthcare Organizations 1998), and is recognized as a measure of clinical quality by the Agency for Healthcare Research and Quality (2005).

Mode of Data Collection

When a clinic registers with FOTO, the staff provide information about the clinic and are trained in the data collection process. Patients complete FHS surveys before their initial evaluation and following discharge from rehabilitation. Patient demographic data are collected at intake. Clinicians enter the patient's number of visits and treatment dates at discharge, and report the percentage of time spent with each type of provider during treatment. Data from patients and staff are entered on paper surveys, submitted to FOTO, and checked manually for completeness. Complete data are then computerized with additional checks to ensure that data are accurate and within appropriate ranges for each variable. Data identified as incomplete or inappropriate are returned to the clinic for correction. Corrected data undergo the same data quality screening upon resubmission.

Sample

Patients were selected from a larger data set of patients who received physical therapy in outpatient rehabilitation facilities participating in the FOTO outcomes system in 2000 or 2001 ($N = 106,054$). We included only patients who

were treated by PTs alone, or whose therapists delegated their care to PTAs or therapy aides. We excluded less than 10 percent of patients ($N = 9,150$) from the original data set who were treated by PTs and occupational therapists, occupational therapy assistants, athletic trainers, or exercise physiologists, because our primary interest was to study the utilization of PTAs. We believed including patients who were treated by both PTs and other professionals would detract from the analysis, because they have separate, but sometimes overlapping scopes of practice during the same treatment episode.

Finally, we included only patients who had complete intake and discharge data, resulting in a final sample of 63,900 (or 66 percent of total) patients (Table 1). Because patient baseline characteristics affect outcomes (Resnik and Hart 2003), we assessed differences between patients completing only intake and patients completing both intake and discharge surveys to examine potential selection bias. Patients with completed intake and discharge surveys were older (mean age 49.2 versus 45.5 years, $p < .001$), had higher initial FHS measures (mean 55.2 versus 53.6, $p < .001$) (see below for measure description). They were less likely to have acute onset of problems (22.4 versus 23.6 percent, $p < .001$) and impairments of the low back (28.4 versus 30.8 percent, $p < .001$), but more likely to have impairments of the shoulder (18.9 versus 16.6 percent, $p < .001$), knee (16.8 versus 16.3 percent, $p < .05$), or arm (4.2 versus 3.9 percent, $p < .05$) and a history of two or more surgeries (28.9 versus 25.5 percent, $p < .001$). Patients with completed intake and discharge forms were more likely to be Medicare recipients (17.3 versus 11.5 percent, $p < .001$), and unemployed, retired, or students (31.6 versus 26.8 percent, $p < .001$), and less likely to be Medicaid recipients (2.2 versus 4.5 percent, $p < .001$) or employed full-time (39.6 versus 43.8 percent, $p < .001$). They were also treated with more visits (10.4 versus 6.6, $p < .001$) over a longer duration of time (38.1 versus 26.3 days, $p < .001$).

Dependent Variables

Three dependent variables were analyzed: high PTA utilization, number of visits per treatment episode, and patient FHS at discharge. We created a dichotomous variable to represent high PTA utilization, defined as a patient seen by a PTA 50 percent or more of the treatment time, and low utilization if less than 50 percent of the treatment time. This variable was created by combining data from the patient discharge survey where the clinician was asked to estimate the percentage of time that each type of provider (including PT, PTA, and therapy aide) spent in that specific patient's episode of care. We believed

Table 1: Description of All Variables in the Multilevel Multivariate Models

<i>Variable</i>	<i>Percentage or Mean (SD)</i>
Dependent variables (<i>N</i> = 63,900)	
High utilization of PTA	7.7
Total number of visits (range 1–95)	10.2 (7.3)
FHS at discharge (range 0–100)	70.4 (19.4)
State regulations (<i>N</i> = 38)	
Any licensure or regulation of PTA	86.8
Any regulation of PT evaluation frequency	44.7
Any regulation of PT/PTA ratio	71.1
Regulations on PTA supervision level	
Full-time onsite supervision	7.9
Periodic in-room supervision	18.4
Periodic onsite supervision	26.3
Not specified	2.6
Telecommunication (reference)	44.7
Facility characteristics (<i>N</i> = 395)	
Full-time equivalent PTA/PT ratio	0.3 (0.5)
Setting	
Payer owned	2.0
Private practice	16.8
Corporate owned	16.2
Physician's office or other	5.0
Hospital outpatient (reference)	60.0
Patient characteristics (<i>N</i> = 63,900)	
Time with therapy aide (%)	
0 (reference)	77.4
1–25	17.1
26–100	5.5
Male	39.2
Age	49.3 (15.9)
FHS at intake (range 0–100)	55.2 (19.1)
Impairment type	
Shoulder	18.6
Knee	16.0
Arm	4.3
Neck	14.4
Hip	13.4
Other	4.3
Low back (reference)	29.0
Acuity	
Acute (reference)	22.5
Subacute	29.5
Chronic	48.0
Any surgery	28.1
Exercise history	61.4

Continued

Table 1: *Continued*

<i>Variable</i>	<i>Percentage or Mean (SD)</i>
Patient characteristics (cont.)	
Payer type	
Medicaid	2.2
Medicare Part B	17.5
Worker's compensation	16.0
HMO or preferred provider	47.3
Litigation, self-pay, or other	6.6
Indemnity insurance (reference)	10.4
Employment status at intake	
Working modified duty	10.7
Employed but not working	13.8
Receiving disability benefits	2.0
Unemployed, retired, or student	31.8
Full-time employment (reference)	41.7
Interaction: Medicare $\times$ private practice	1.1

PTA, physical therapist assistant; FHS, functional health status; PT, physical therapists.

that there would be quality of care differences for episodes of care that were predominantly managed by a PTA compared with a PT. We dichotomized this variable because of its skewed distribution: less than 2 percent of patients were treated by the PTA for more than 75 percent of the treatment time, and 8 percent were treated by the PTA 50 percent of the time or more.

The second dependent variable, number of visits per treatment episode, was a continuous variable recorded by the clinician at the time of discharge. We believed that fewer visits per treatment episode were a marker of greater efficiency of care. The third dependent variable was patient's self-reported FHS measured at discharge, defined as the patient's perception of their ability to perform functional tasks described in the FHS items. The FHS measure was calculated using a 24-item patient self-report questionnaire (Hart 2001, 2003; Resnik and Hart 2003). The 24 FHS questions originated from the SF-36 health survey (Ware and Sherbourne 1992; Ware, Kosinski, and Keller 1996) and from clinical input (Hart 2000). Calculation of the FHS measure has been described elsewhere (Hart 2001, 2003; Resnik and Hart 2003). Higher FHS measures represent higher levels of functioning. Previous research shows the FHS has good test-retest reliability ($ICC[2,1] = 0.92$) (Hart 2003), construct validity (i.e., FHS measures were able to differentiate patients with chronic versus nonchronic symptoms by change in FHS over the course of therapy) (Hart 2003), and responsiveness (i.e., effect size = 0.83 and standardized response mean = 0.87 for assessing change in FHS over the course of therapy)

(Resnik and Hart 2003), all assessed for patients receiving outpatient rehabilitation.

Explanatory Variables

The primary explanatory variables are four types of state regulations of PTs and PTAs: licensure of PTAs, regulation regarding PT/PTA ratio, requirement for reevaluation by PTs, and type of supervisory requirement. The basis of our categorization of state regulation was the analysis in an Urban Institute report submitted to the Centers for Medicare and Medicaid Services (Maxwell, Boccuti, and Tong 2002). We used state summary data indicating whether licensure (or regulation) of PTAs was required or not. Owing to the small number of states with wide variation in requirements, we collapsed other types of regulatory statutes to create summary variables indicating whether minimum PT/PTA staffing ratios were mandated or not, and whether any regulation requiring PT reevaluation was present or not. We used five categories to describe the type of supervision of the PTA: no supervision specified, full time onsite supervision, periodic in-room supervision, periodic onsite supervision, telecommunication supervision at all times (Maxwell, Boccuti, and Tong 2002), with the last category (telecommunication) serving as the reference group.

We examined the ratio of full-time equivalent PTAs to PTs in the clinic because we were interested in the effect of staff mix within each facility. Clinic facility type was included with the expectation that delegation patterns might differ by clinic setting. Clinics were classified using information provided in the FOTO clinician registration survey. The categories include hospital outpatient clinics (reference group), clinics owned by payers, PTs (private practice), corporate entities, and physicians or other owners.

In addition to the amount of time spent with the PTA as measured by high PTA utilization, we also examined the amount of time patients spent with therapy aides. The amount of time the patient spent with a therapy aide was classified as 0 percent (reference category), 1–25 percent, or more than 25 percent treatment time.

Variables for Risk Adjustment

Risk adjustment considers factors other than the health care intervention or processes of care that help explain variation in patient outcomes (Iezzoni 1994). Consistent with previous studies that have demonstrated the effects of patient characteristics on rehabilitation outcomes (Jette and Jette 1996a, b;

Resnik and Hart 2003), we controlled for the following potentially confounding variables: gender, age, intake FHS measure, impairment type, symptom onset, surgical history, exercise history, payer type, and employment status at intake. Patient age is a continuous variable reported in years, centered at the mean (49 years). Intake FHS intake measure is a continuous variable reported in scale points with a range of 0–100, centered at the mean (55 FHS units). Type of impairment was classified as anatomical part treated, i.e., neck, shoulder, arm (elbow, wrist, or hand), lumbar spine (reference group), hip, knee, and other. Symptom onset represents the number of days from condition onset until the beginning of therapy intervention, classified as acute (less than 21 days; reference group), subacute (22–90 days), and chronic (over 90 days). Surgical history is a dummy variable indicating any prior surgeries reported for the primary condition. Exercise history is a measurement of the patient's self-reported exercise experience before the episode of physical therapy, defined as a dummy variable for one or more times per week versus seldom/never. Payer type is the primary source of payment for the patient's physical therapy, including Medicaid, Medicare Part B, worker's compensation, health maintenance (HMO) or preferred provider organization, litigation, patient self-pay or other sources, and indemnity insurance (reference category). Employment status at intake is classified as working modified duty, employed but not working, previously employed and receiving disability benefits, unemployed including those who are retired or students, and full-time employment (reference category).

Analytical Approach

Using the *MLwiN* software (Version 2.0) (Rasbash et al. 2004), we fitted a multilevel multivariate regression model to examine the effect of state regulations on each of the three dependent variables, controlling for various patient and facility characteristics as specified above. Multilevel models are most appropriate for this analysis given the hierarchically structured data, where patients are nested within therapists, therapists within practice/clinic, and practices/clinics within state.

Failure to account for clustering will generally cause standard errors of regression coefficients to be underestimated (Goldstein 1995). Given our primary interest in the fixed effects of the covariates, we fitted a four-level variance components model for each of the three dependent variables. In other words, the only random coefficients in each model are state-, practice-, and therapist-level intercepts plus an error term at the patient level, which control

for the inherent nested structure of the data, allowing patients managed by the same therapist to be similar, therapists in the same practice/clinic to be similar, and practices/clinics in the same state to be similar. The estimated variance components allow us to assess the proportion of total variance accounted for at each level. In addition, we took advantage of the Bayesian modeling approach using the Markov Chain Monte Carlo estimation method, which produces unbiased estimates of parameter estimates.

Finally, in each model we evaluated statistical interactions to determine whether the outcome was different for patients receiving Medicare benefits treated in private practices, compared with all other patient-setting combinations. We hypothesized that this would be the case, because Medicare has more stringent supervisory requirements for “personal supervision” that apply only to PTs in private practice (American Physical Therapy Association 2004). Some believe that these regulations discourage the use of PTAs in private practices by making their supervision too burdensome or logistically impossible without compromising patient privacy.

RESULTS

PTA Utilization

The majority of physical therapy care was delivered by PTs with no reported assistance from PTAs. PTAs were involved in the care of patients only 35 percent of the time. High PTA utilization was relatively uncommon, with only 7.7 percent of the patients seen by PTAs more than 50 percent of the time (Table 1).

Multilevel logistic regression model results predicting high PTA utilization are presented in Table 2, with the effects of covariates expressed as odds ratios. There was no relationship between PTA licensure in the state, regulation of PT/PTA ratio, PT evaluation frequency, regulations of PTA supervision, and high PTA utilization. Factors that lower the odds of high PTA utilization include greater percentage of time spent with the therapy aide, payer type being HMO or preferred provider, and setting being payer owned. Factors associated with an increased likelihood of high PTA utilization include any employment status other than fulltime, and a higher ratio of PTA to PTs on staff. Medicare patients who were seen in private practice were 48 percent less likely to have had high PTA utilization. Variations in the outcome at the practice level accounted for the largest proportion of the total variance—56 percent (i.e., dividing the practice level variance, 3.525, by the total variance

Table 2: Bayesian Estimated Four-Level Logistic Regression Model Results Predicting High PTA Utilization ($N = 53,665$ patients)

<i>Variable</i>	<i>Odds Ratio</i>	<i>95% CI</i>	
State regulations			
Any licensure or regulation of PTA	0.615	0.332	1.138
Any regulation of PT evaluation frequency	0.853	0.400	1.82
Any regulation of PT/PTA ratio	0.527	0.237	1.172
Regulations on PTA supervision level			
Full-time onsite supervision	0.717	0.155	3.328
Periodic in-room supervision	0.607	0.281	1.31
Periodic onsite supervision	0.486	0.190	1.246
Not specified	3.284	0.161	67.05
Patient characteristics			
Time with therapy aide (%)			
1–25	0.616**	0.505	0.753
26–100	0.511**	0.333	0.784
Male	0.996	0.920	1.078
Age	1.004*	1.001	1.007
FHS at intake	0.939**	0.919	0.959
Payer type			
Medicaid	1.169	0.885	1.545
Medicare Part B	1.099	0.926	1.305
Worker's compensation	1.038	0.895	1.205
HMO or preferred provider	0.870*	0.759	0.998
Litigation, self-pay, or other	1.119	0.935	1.339
Employment status at intake			
Working modified duty	1.184*	1.037	1.352
Employed but not working	1.185**	1.048	1.34
Receiving disability benefits	1.623**	1.269	2.076
Unemployed, retired, or student	1.268**	1.133	1.419
Interaction: Medicare $\times$ private practice	0.516*	0.284	0.937
Facility characteristics			
Full-time equivalent PTA/PT ratio	3.142**	2.093	4.719
Setting			
Payer owned	0.178 ⁺	0.024	1.301
Private practice	0.648	0.256	1.644
Corporate owned	0.876	0.366	2.093
Physician's office or other	0.813	0.216	3.064
<i>Intercept (not shown)</i>			
Variance components (SE)			
State		0.110 (0.143)	
Practice		3.525 (0.563)	
Therapist		1.628 (0.163)	
Patient		1.000 (0.000)	

Statistical significance:

⁺ $p < .10$;* $p < .05$;** $p < .01$.

PTA, physical therapist assistant; FHS, functional health status; PT, physical therapists.

summed over all four levels, i.e., 6.263)—followed by the therapist level (26 percent) and patient level (16 percent). The variance at the state level was not statistically significant.

Utilization Patterns: Number of Visits

Treatment with a therapy aide for 1–25 percent time and greater than 25 percent compared with 0 percent, and high utilization of the PTA were associated with 1.8, 2.6, and 2.0 more visits, respectively. State requirements for full-time onsite supervision of the PTA were associated with 3.1 more visits, during the treatment episode, whereas state regulation of PT/PTA ratio was associated with 1.1 fewer visits during the treatment episode (Table 3). Other factors associated with increased number of visits per treatment episode include older age, impairments of regions other than low back (shoulder associated with three more visits per episode), subacute or chronic onset, having had surgery, less than full-time employment status, receiving worker's compensation, and being treated in private practice (compared with hospital outpatient setting). Factors associated with fewer visits per treatment episode include higher FHS intake measure and payer types being Medicaid, Medicare, HMO, or preferred provider. Variations in the fixed effects at the patient level accounted for most of the total variance (90 percent) in the number of visits, and the therapist, practice, and state levels altogether accounted for only 10 percent of the total variance.

Outcomes of Care: Discharge FHS

Unspecified state regulation of PTA supervision levels was associated with an FHS discharge measures that was approximately 5 points lower (Table 4). There was no effect of regulation regarding physical therapy evaluation, regulation of PT/PTA ratio, or PTA licensure on patient discharge FHS. Greater than 50 percent time spent with the PTA was predictive of lower discharge scores as was time spent with a therapy aide. Factors related to better discharge measures were higher intake FHS measure, younger age, impairment of the hip, shoulder, and knee, acute onset, having had surgery for primary condition, and history of regular exercise. Other factors associated with lower discharge measures include reimbursement through Medicaid, Medicare, worker's compensation, and litigation, self-pay or other insurance, being employed but not working, receiving disability benefits, and being unemployed, retired, or student. Although there was no main effect for setting of practice, patients on Medicare seen in a private practice had on average a 1.3 point

Table 3: Bayesian Estimated Four-Level Model Results Predicting Total Number of Visits ($N = 53,665$ patients)

<i>Variable</i>	β	<i>95% CI</i>	
State regulations			
Any licensure or regulation of PTA	-0.138	-1.283	1.008
Any regulation of PT evaluation frequency	-0.173	-1.074	0.728
Any regulation of PT/PTA ratio	-1.098*	-2.092	-0.104
Regulations on PTA supervision level			
Full-time onsite supervision	3.105**	1.304	4.906
Periodic in-room supervision	0.372	-0.780	1.523
Periodic onsite supervision	0.775	-0.403	1.954
Not specified	-0.213	-3.006	2.580
Patient characteristics			
High utilization of PTA	1.950**	1.716	2.184
Time with therapy aide (%)			
1-25	1.796**	1.586	2.006
26-100	2.583**	2.240	2.926
Male	0.038	-0.073	0.149
Age	0.014**	0.009	0.018
FHS at intake	-0.487**	-0.519	-0.456
Impairment type			
Arm	1.213**	0.918	1.508
Neck	0.843**	0.665	1.020
Hip	0.738**	0.554	0.922
Shoulder	3.076**	2.908	3.244
Knee	1.034**	0.852	1.216
Other	0.477**	0.199	0.755
Onset			
Subacute	0.932**	0.777	1.087
Chronic	1.074**	0.927	1.221
Any surgery	3.073**	2.937	3.209
Exercise history	0.353**	0.240	0.465
Payer type			
Medicaid	-1.564**	-1.990	-1.138
Medicare Part B	-0.539**	-0.799	-0.278
Worker's compensation	0.651**	0.412	0.890
HMO or preferred provider	-0.485**	-0.691	-0.279
Litigation, self-pay, or other	0.092	-0.200	0.383
Employment status at intake			
Working modified duty	0.196*	0.002	0.389
Employed but not working	2.100**	1.917	2.283
Receiving disability benefits	1.343**	0.940	1.746
Unemployed, retired, or student	0.251**	0.093	0.408
Interaction Medicare $\times$ private practice	0.185	-0.385	0.755
Facility characteristics			
Full-time equivalent PTA/PT ratio	0.214	-0.152	0.579

Continued

Table 3: *Continued*

<i>Variable</i>	β	<i>95% CI</i>	
Setting			
Payer owned	0.855	− 0.720	2.430
Private practice	1.677**	0.968	2.386
Corporate owned	0.264	− 0.393	0.920
Physician's office or other	0.550	− 0.344	1.444
Intercept	6.708**	5.424	7.992
Variance components (SE)			
State		0.915 (0.454)	
Practice		1.574 (0.291)	
Therapist		1.983 (0.166)	
Patient		39.775 (0.244)	

Statistical significance:

* $p < .05$;

** $p < .01$.

Omitted categories for multicategory variables: "Telecommunication" for regulations on PTA supervision level; "0%" for time with therapy aide; "Low back" for impairment type; "Acute" for onset; "Indemnity insurance" for payer type; "Full-time employment" for employment status at intake; and "Hospital outpatient" for clinic setting.

PTA, physical therapist assistant; FHS, functional health status; PT, physical therapists.

increase in FHS discharge measure ($p < .05$). Moreover, the total number of visits was associated with improved FHS at discharge ($p < .10$), although the magnitude of the effect was small. Similar to the model of visits per treatment episode, variance at the patient level made up the bulk of total variance—over 93 percent, with the remaining 7 percent accounted for at the upper three levels combined.

Discussion

Our study is the first to examine the relationship between state regulatory statutes, care delivery patterns, efficiency, and outcomes of care in physical therapy. Our analysis shows that state regulation of PTA supervision as well as provider skill mix were associated with number of visits per episode of care, and patient outcomes, but no type of state regulation of PT behavior or PTA supervision was related to high utilization of the PTA. In contrast, our analysis shows that Medicare regulations for continuous in-room supervision of PTAs in private practice are associated with a decreased likelihood of high PTA utilization, i.e., patients being treated by PTAs more than 50 percent of their

Table 4: Bayesian Estimated Four-Level Model Results Predicting FHS at Discharge ($N = 55,760$ Patients)

<i>Variable</i>	β	<i>95% CI</i>	
State regulations			
Any licensure or regulation of PTA	-0.725	-2.381	0.931
Any regulation of PT evaluation frequency	0.671	-0.605	1.946
Any regulation of PT/PTA ratio	-0.466	-1.858	0.927
Regulations on PTA supervision level			
Full-time onsite supervision	-0.450	-2.765	1.865
Periodic in-room supervision	-0.509	-1.967	0.950
Periodic onsite supervision	-0.114	-1.771	1.543
Not specified	-5.028*	-8.944	-1.112
Patient characteristics			
High utilization of PTA	-1.052**	-1.568	-0.536
Total number of visits	0.017 ⁺	-0.002	0.035
Time with therapy aide (%)			
1-25	-0.516*	-0.975	-0.056
26-100	-0.808*	-1.559	-0.057
Male	-0.029	-0.278	0.219
Age	-0.109**	-0.119	-0.098
FHS at intake	5.622**	5.550	5.694
Impairment type			
Arm	0.370	-0.283	1.023
Neck	-0.091	-0.484	0.303
Hip	1.006**	0.590	1.422
Shoulder	1.654**	1.275	2.033
Knee	1.779**	1.368	2.190
Other	-0.796*	-1.419	-0.172
Onset			
Subacute	-3.415**	-3.761	-3.069
Chronic	-6.332**	-6.661	-6.003
Any surgery	0.660**	0.349	0.972
Exercise history	1.575**	1.323	1.827
Payer type			
Medicaid	-6.018**	-6.984	-5.052
Medicare Part B	-1.057**	-1.647	-0.467
Worker's compensation	-5.013**	-5.551	-4.475
HMO or preferred provider	-0.251	-0.716	0.214
Litigation, self-pay, or other	-2.433**	-3.084	-1.782
Employment status at intake			
Working modified duty	-0.360	-0.798	0.079
Employed but not working	-1.299**	-1.720	-0.878
Receiving disability benefits	-7.519**	-8.416	-6.622
Unemployed, retired, or student	-1.926**	-2.281	-1.571
Interaction: Medicare $\times$ private practice	1.297*	0.010	2.584

Continued

Table 4: *Continued*

<i>Variable</i>	β	<i>95% CI</i>	
Facility characteristics			
Setting			
Payer owned	− 0.764	− 3.406	1.878
Private practice	− 0.597	− 1.888	0.694
Corporate owned	0.663	− 0.618	1.944
Physician’s office or other	1.030	− 0.810	2.870
Intercept	76.050**	74.194	77.906
Variance components (SE)			
State		0.694 (0.753)	
Practice		6.348 (1.088)	
Therapist		7.572 (0.701)	
Patient		209.362 (1.276)	

Statistical significance:

⁺ $p < .10$;

^{*} $p < .05$;

^{**} $p < .01$. Omitted categories for multicategory variables: "Telecommunication" for regulations on PTA supervision level; "0%" for time with therapy aide; "Low back" for impairment type; "Acute for onset; "Indemnity insurance" for payer type; "Full-time employment" for employment status at intake; and "Hospital outpatient" for clinic setting.

PTA, physical therapist assistant; FHS, functional health status; PT, physical therapists.

treatment time. These findings appear logical from a service delivery perspective as most types of supervisory regulation allow therapists to be responsible for multiple support personnel, yet require little by way of a scheduling or structured time commitment, whereas in-room supervision of PTAs in private practice as required by Medicare requires greater scheduling coordination and use of staff time.

Presence of state regulation of PT/PTA supervisory relationships was associated with the number of visits per treatment episode. In particular, regulations requiring full-time onsite supervision were associated with decreased efficiency (i.e., more visits), suggesting that this requirement may alter the pattern of care delivery. However, state regulations regarding PT/PTA ratio were associated with greater efficiency (i.e., fewer visits). A possible mechanism for this is greater involvement in daily decision making by PTs who supervise fewer assistants. Our analysis also shows that staff skill mix in physical therapy delivery affected the number of visits per treatment episode. High PTA utilization was a less efficient pattern of care delivery, as was more time spent with a therapy aide.

State regulations also appeared to influence care quality as measured by risk-adjusted discharge FHS. We found that absence of regulations specifying the type of supervision of the PTA was associated with lower discharge FHS scores, suggesting that enhanced PT involvement leads to better quality of care. This is supported by the finding that high PTA utilization and use of therapy aides were independently associated with lower discharge FHS. Patients seen primarily by PTAs and therapy aides in states with unspecified supervisory requirements had functional health outcomes that were on average 6.9 points lower than those seen primarily by PTs in states with specified supervisory regulations. These findings have implications for the educational preparation of PTs and PTAs and suggest the need for greater emphasis on PT supervisory skills and methods to work with PTAs as a team. While it is clear that patient characteristics account for most of the variance in number of visits (and thus costs) and functional health outcome, these factors, unlike state regulations and health service delivery patterns, are not amenable to change and are beyond the control of state regulatory bodies or providers.

Our analysis has a number of limitations. The study's cross-sectional design limits our ability to make causal inferences regarding the relationship of state regulation, skill mix, efficiency, and outcomes. In our analysis, we are unable to assess how the adoption of regulation has affected practice patterns. Regulation of health professionals is often promulgated in response to a concern in the health care environment. As such, states with stringent regulations may have had complaints regarding quality and safety that led to the adoption of such regulations.

Another limitation is that we did not account for local PT/PTA workforce supply, although we examined the PT/PTA ratio within each clinic. Obtaining accurate state-level workforce estimates of PTs and PTAs is a challenge. Data available from APTA include only members and are not representative of all providers. Data from the Federation of State Boards of Physical Therapy (FSBPT) tend to overestimate the workforce (Gwyer 1995; Chevan and Chevan 1998) as people are likely to be licensed in several states. Data from the U.S. Census are biased because PTAs are not easily distinguishable from PTs or therapy aides (Chevan and Chevan 1998). Data from the 1999 survey of State Occupation Employment and Wage Estimates do not include PT or PTA workforce estimates from all states (U.S. Department of Labor 1999).

Although the FOTO data include information on percent of time a clinician spends with a patient, such information was recorded by clinicians at patient discharge, subject to potential recall errors. We cannot quantify the

reliability of these data, or determine whether the recall favored any clinician group, such as those in states with stringent supervisory requirements. This potential misclassification could have biased the results. However, as the data were in gross categorical levels and FOTO data are not used for regulatory surveillance, we believe the potential for bias related to the percent of provider time was minimal.

Our study excluded 34 percent of patients in the FOTO database who had incomplete discharge data. We observed differences between patients with complete data and those lost to follow-up (as detailed in the sample description section). These differences make sense because older patients who might be retired or unemployed and on Medicare who present with subacute or chronic conditions tend to follow-through to complete an episode of care. On the other hand, younger, working patients with acute conditions may begin physical therapy but leave precipitously without completing a full plan of care because of failure to improve or worsening, or because their symptoms resolved and their physician discharged them from therapy, or they simply may not have kept a scheduled appointment. We believe our sample represents the typical patient who completes their outpatient rehabilitation.

There are limits to the generalizability of our conclusions to a broader population, as we do not know if our sample is representative of physical therapy practices in the U.S.

Our sample included only patients of PTs who participated in the FOTO database. No effort was made to contact clinicians who do not participate in this database. Because FOTO is an independent data management company with practices choosing to participate for a variety of reasons, there are threats to external validity. Furthermore, we omitted patients who were treated by other professionals during the episode of care. Thus, our findings cannot be generalized to patients who were treated in clinics not participating with FOTO or were treated by multiple health care professionals during their physical therapy episode of care.

CONCLUSIONS

We found that state regulations of physical therapy practice were not associated with patterns of care delegation to PTAs, but were associated with number of visits in the physical therapy treatment episode and patient outcomes in outpatient physical therapy practices. State regulation of PTA supervision was associated with better patient outcomes. Regulations regarding

physical therapy reevaluation, PT/PTA ratio, or PTA licensure did not affect outcomes.

High utilization of PTAs, and use of therapy aides were each independently associated with more visits per treatment episode, and lower functional health. Thus our findings suggest that use of care extenders such as PTAs and therapy aides in place of PTs is associated with more costly and lower quality care delivery in outpatient rehabilitation. These findings have implications for patients, providers, payers, and educators. Because regulation that specifies PTA supervision appears to improve patient outcomes, we believe that such regulation adopted at the state or institutional level could potentially lead to improved outcomes of care.

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