



Predictors of Physical Therapy Academic and NPTE Licensure Performance

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Abstract

Purpose: Screening potential candidates for their ability to successfully negotiate the rigorous academic challenges of Doctor of Physical Therapy (DPT) programs in the United States is a critical part of the admissions process. Among the most commonly investigated criteria are pre-admission parameters such as undergraduate overall cumulative grade point averages (GPA), combined science-math GPAs, as well as verbal and quantitative graduate requirement entrance scores (vGRE and qGRE). To expand upon this line of inquiry, the current study explored the relationship between pre- and post-admission criteria and the performance scores on the national physical therapy licensure exam (NPTE). Since recent changes (2013) were instituted in the way questions were both formulated as well as graded, validity of using such pre-admission parameters needed to be re-examined.

Method: Associations between individual preadmission parameters and final NPTE scores were compared using the academic records of two separate cohorts of DPT students from Touro College School of Health Sciences assessed over a period of three years (2014–2016). The method of admissions screening and the academic programming for each campus are identical. Descriptive, normative data for the two campuses for pre- and post-admissions variables, and pooled, aggregated data were used for correlation analysis to compare their relationships with students' performance on the NPTE licensure exams.

Results: Our findings support the use of vGRE and qGRE scores as particular predictors for success on NPTE exam scores. Early performance in post-admission GPAs corroborate the suggestion that early assessment of post-admission, graduate DPT academic performance can strongly predict a physical therapy student's later performance on the NPTE licensure exam.

Conclusions: These findings strongly support the use of early remediation protocols for already enrolled DPT students struggling within the academic program. Pre-admission screening using standardized test scores, such as the graduate requirement entrance exams (GREs) are also recommended.

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1. Introduction

The goal of identifying critical parameters serving as predictors towards a student's ability to succeed in the academic environment for medical and allied health programs has been well reported in the literature.¹

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Assessment of individual student records also serves the important purpose of aiding physical therapy admissions committees in the difficult task of choosing from an assortment of viable candidates to fill the finite number of spots available for incoming classes.² Factors such as pre-admission grade point averages (GPA), calculated cumulatively or segregated to consider only combined science-math averages have been suggested to be predictive in successfully passing licensure exams upon graduation from physical therapy programs.³ Standardized test scores, single or multiple personal interviews,⁴ and written essays have also been typically used by admission committees to assess an individual's suitability for acceptance.

These factors work in combination to generate a comprehensive outlook of an individual student's potential, often expressed in the form of a singular admissions ranking score.² Consideration of personality test scores has also been postulated to be a necessary factor for review since clinical skillsets are dependent upon the ability to successfully integrate inter-personal psychosocial relationships with patients as well as the various healthcare stakeholders.¹ The use of pre-admission qualitative factors has not been well supported in the literature, however, with respect to their ability to predict students' ability to succeed on the important and early benchmark of passing the licensure board exam. This licensure exam for physical therapists within the United States, also known as the National Physical Therapy Exam (NPTE), and graduation rates have historically been considered the benchmark indicators for success upon which to compare the predictability of each of these individual pre-admission criteria.^{5,6}

Despite the well-reported guidelines delineating the optimum admissions process^{2,3,6-9} individual physical therapy programs periodically must self-evaluate the efficacy of their own programs to screen potential candidates. Variability in individual parameters can vary greatly in predicting the success of different institutions' student body.^{8,9} Such curriculum evaluation has become more critical given the relatively recent changes instituted within the structure and weighting of didactic knowledge tested in the NPTE physical therapy licensure board exams.

As of January 2013, the Federation of State Boards of Physical Therapy (FSBPT) instituted a significant change in the content outlines used to derive examination questions. Refocusing and questioning of some areas such as those regarding research and evidence based practice, for example, were partially integrated into questions related to body systems or content areas,

and other areas (including those of Metabolic and Endocrine systems) were eliminated entirely. Change in how scale scores were calculated was also implemented to allow for more accurate and better differentiated student performance.¹⁰ These revisions to the NPTE licensure exam format have necessitated the need to confirm the validity of these earlier findings.

The current investigation was done to explore the relationships between individual student pre-admission criteria (e.g. pre-admission grade point averages, standardized scores, etc.), post-admission DPT academic performance, and success in passing the NPTE. In addition, the pre- and post- admission academic profiles of "poor performers" on first attempt NPTE board exam testing were compared to those who were successful in passing the NPTE on their first examination attempt. Identification of any differences in the academic performance patterns between these two cohorts may be useful during the admissions process. Of particular interest, would be the ability to identify those individual admissions criteria which are more sensitive towards identifying subsequent student performance on the NPTE following graduation.

2. Material and methods

Retrospective review of academic records obtained from the Registrar's Office for the students who were matriculated in the Doctoral of Physical Therapy Program (DPT) for both the Bay Shore and New York City (NYC) campuses of Touro College School of Health Sciences. To ensure compliance with Touro's Institutional Review Board (HSIRB), approval was obtained prior to the start of this inquiry. Since the Touro College of Physical Therapy program exists over two geographically separate campuses with identical curricula but is accredited as one, the data from each campus was taken for each of the graduating student populations. Sample populations were considered separately as well as in combined, aggregated form.

Participants: The academic records for the Classes of 2014, 2015, and 2016 were collected and coded according to campus attended. The total number of records available were for 190 individuals (47.6% females, 52.4% males) who successfully enrolled into the program. Out of these, nine students did not complete the program for various reasons not necessarily related to academic performance (i.e. financial constraints, personal or medical difficulties requiring leaving the program). Although inclusion into our statistical analysis was limited by the degree of data available for these individuals, whatever data was

Table 1Average \pm standard deviations of Bay Shore versus NYC pre- and post- admission academic performance.

Campus		Admission overall GPA	Converted VGRE	Converted qGRE	Comb science math GPA	First yr. DPT GPA	2nd and 3rd yr. DPT GPA	1st try NPTE
Bay Shore	Mean	3.31	152.02*	150.71*	3.08*	3.37	3.66	662.69
	N	93	92	92	92	95	93	81
	SD	.267	4.08	4.87	.31	.365	.19	53.93
NYC	Mean	3.35	153.42	152.64	3.20	3.32	3.56	663.07
	N	94	94	94	94	94	94	76
	SD	.34	4.64	5.62	.44	.59	.57	40.31
Total	Mean	3.33	152.73	151.68	3.14	3.35	3.61	662.87
	N	187	186	186	186	189	187	157
	SD	.31	4.41	5.34	.39	.49	.43	47.67

*Significant differences noted between campuses ($p < .05$). N represents total population sample number. SD represents standard deviation.

available was included within our analysis since they had met the successful criteria for admission into this DPT program.

2.1. Methods

The academic study variables under review were undergraduate pre-admission overall grade point average (GPA), combined science-math GPA, standardized grades for the graduate record exams for verbal (vGRE) and quantitative (qGRE), post-admission first year GPA for doctor of physical therapy (DPT) programs, and second and third year combined DPT GPA. Descriptive statistics (e.g. frequency data, means \pm standard deviations) were provided and broken down according to which of the two campuses (Bay Shore or NYC) the DPT students were attending as well as in combined pooled data. First time- pass/fail scores of the NPTE data was obtained through the Federation of State Boards of Physical Therapists (FSBPT). Of the sample population, 28 students did not provide consent to release their scores, thus this data was not available for those correlations related to the NPTE.

2.1.1. Academic profile of the poor performer on the first-time NPTE

To identify if the participants who failed their first attempt of the NPTE had a different academic profile from those who had successfully passed within the same time interval, a culled analysis assessing the performance of these students were compared to the larger student population using the statistical method outlined below. The academic profiles for participants ($n = 12$) who were confirmed to have not successfully passed the NPTE on their first attempt (i.e. “poor performers”) were analyzed separately as a smaller cohort. This culled sample data

was separated to identify if any individual pre-admission and post-admission parameters were unique from the larger sample population.

3. Statistical analysis

Descriptive statistics providing averages and standard deviations for individual continuous variables were calculated by individual campuses and in combined format. Since the method of scoring for the verbal and quantitative GREs changed for the graduating class of 2016 (scoring on a scale of 130 to 170 points instead of the previously used scale ranging from 200 to 800 points), those scores for the graduating classes of 2014 and 2015 were converted according to the official GRE Concordance tables to be on the same scale as that of class of 2016. Independent t-tests (two-tailed, 95% probability) were used to compare pre-admission values from each campus; equal variances assumed if Levene's test supported homogeneity of variances (or unequal variances assumed if it was not) and other parametric criteria were met.

Parametric data analysis using bivariate Pearson product correlation coefficient was conducted to identify the extent of linear correlation between individual factors (expressed as Pearson's r). Linear regression analysis was performed for variables which yielded significant relationships ($p < .05$) during bivariate correlation analysis with relationships of score to grade point/credit hour identified. R^2 values are indicated in figures to demonstrate the degree of variability in individual factors and how they contributed to the dependent variable, the NPTE board scores. All statistical analysis was done using computer software (Excel 2013 and SPSS v. 24).

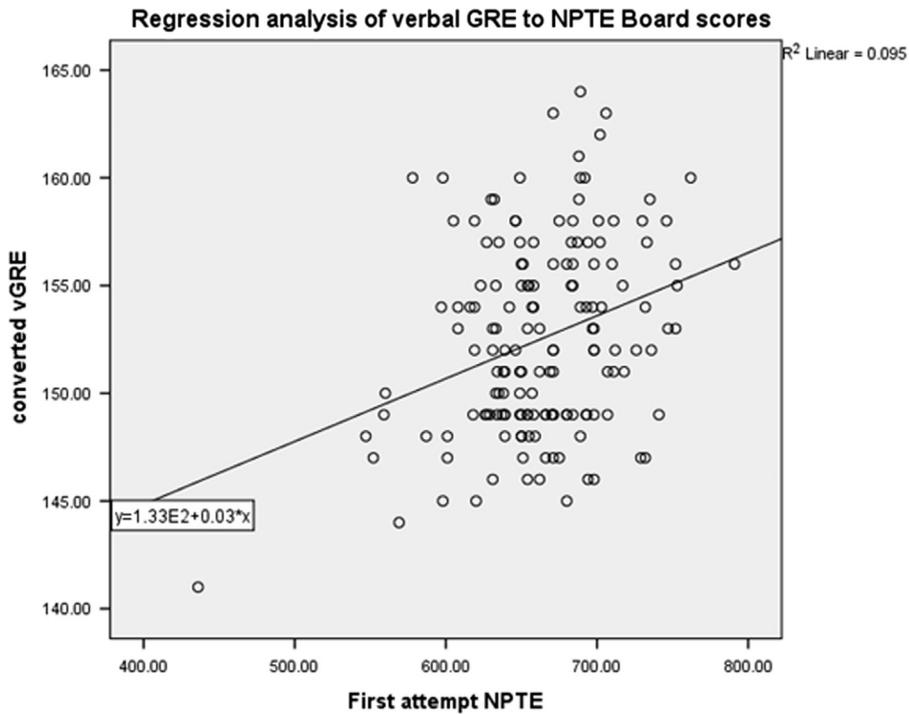


Fig. 1. Pre-admission verbal GRE scores (using converted scale 130 to 170) can contribute to 9.5% of the variability seen for first attempt NPTE board scores. Pearson product correlation coefficient $r = .31$. Regression analysis yielded $R^2 = .095$.

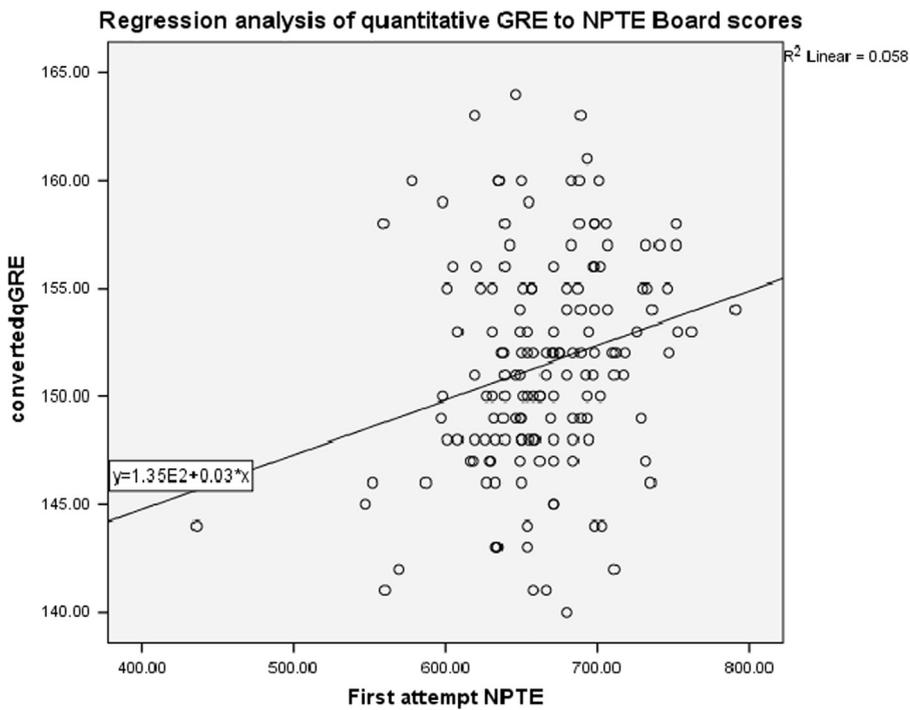


Fig. 2. Quantitative GRE (qGRE) scores were moderately and significantly correlated to first attempt NPTE scores (Pearson product correlation, $r = .31$, $p < .05$). Regression analysis yielded $R^2 = .058$.

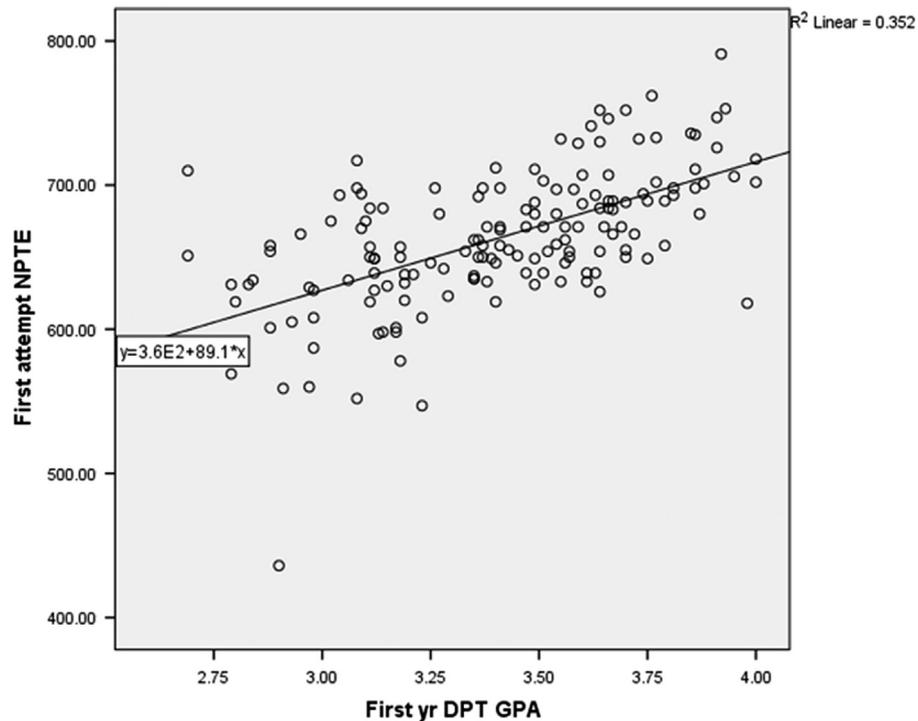


Fig. 3. Comparison of the first year DPT GPA grades were noted to be moderately and significantly correlated to first attempt NPTE scores (Pearson's product correlation, $r(157) = .60$, $R^2 = .352$, $p < .001$).

For secondary analysis, successfully graduating DPT students were sequestered into two cohorts; a small cohort of participants who had not passed the licensure exams on first attempt and a larger cohort of students who passed the licensure exams on first attempt. Single sample hypothesis testing was done to identify if this smaller group was significantly different from the larger group (up to $n = \sim 145$ available) for the pre-admission and post-admission academic parameters collected.

4. Results

4.1. Data compiled from Bay Shore and NYC campuses for pre-admission variables were: overall pre-admission GPA, verbal GRE (vGRE), quantitative GRE (qGRE), combined science and math GPA (Table 1). There were no significant differences between the overall pre-admission GPA between Bay Shore and NYC campuses. There were differences for converted vGRE ($p = .03$), converted qGRE ($p = .01$, independent t-test equal variances not assumed, two tailed), and combined science-math GPA ($p = .03$). These differences while statistically significant, were deemed not impactful since groups for each parameter differed

by .2 to .3 of a standard deviation and were well within the minimum criteria limits for admission. For these reasons, correlational analysis using aggregated data was chosen in order to reflect a more accurate outcome due to larger sample size.

4.2. Post-admission data from the Bay Shore and NYC campuses were also compared. There were no significant differences between the overall first year DPT GPA, second and third year DPT GPA and first try NPTE scores. Only first attempts were included in the analysis as the subsequent attempts comprised a very small n sample.

4.3. Correlation and regression analysis between first attempt NPTE and individual pre-admission factors indicated that pre-admission scores of standardized tests but not grade point averages (GPA) were significantly related to the NPTE outcome scores. (Figs. 1 and 2)

4.3.1 There was no significant correlation between the overall admission GPA and the first attempt NPTE scores. Pearson correlation r values when relating overall admission GPA to first attempt NPTE scores was $r(157) = .07$. There was also no significant correlation between the combined

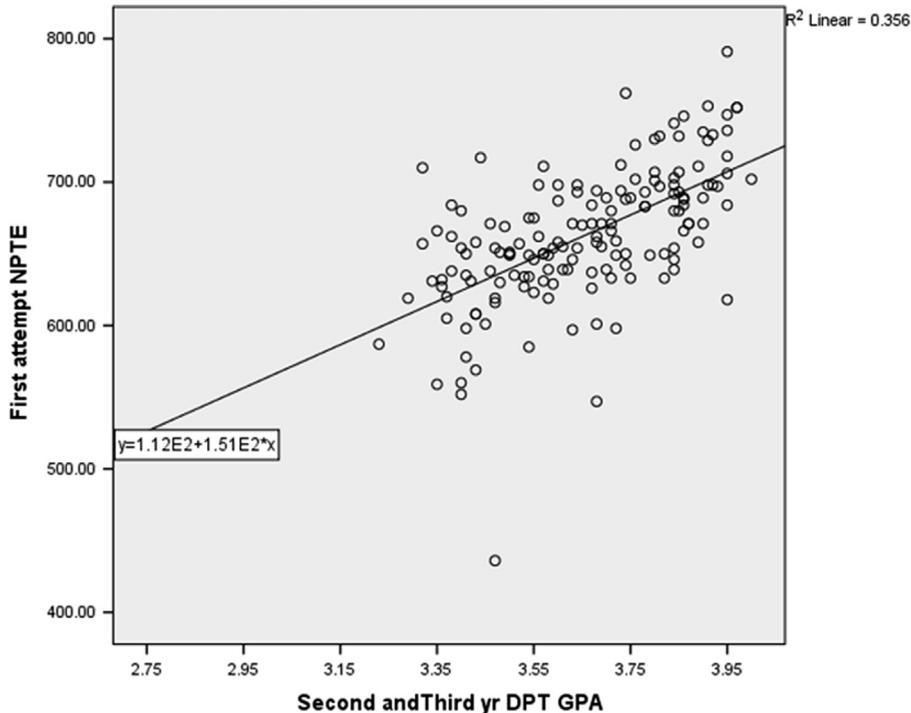


Fig. 4. Comparison of the second and third year DPT GPA grades were noted to be moderately and significantly correlated to first attempt NPTE scores (Pearson's product correlation, $r(157) = .60$, $R^2 = .356$, $p < .001$).

science-math GPA to that of the first attempt NPTE scores. When relating combined science-math GPA to NPTE, analysis yielded a Pearson correlation, $r(156) = .01$.

4.3.2 There was a significant correlation between the converted vGRE scores and the first attempt NPTE scores ($r(156) = .31$, $p < .001$), as well as between the converted qGRE scores and the first attempt NPTE scores ($r(157) = .24$, $p < .05$).

4.3.3 For converted vGRE scores, simple linear regression analysis yielded $F(1,154) = (16.25, p \leq .001)$, with an R^2 of .095. For converted qGRE scores, simple linear regression analysis yielded $F(1, 15) = (9.43, p < .05)$, with an R^2 of .058. For each regression analysis, the probability-probability plot (p-p plots) of regression standardized residual were found to be linear, suggesting that datasets followed a normal distribution.

4.4. Correlation and regression analysis between the post-admission GPA and first attempt NPTE indicated there was a strong relationship between the

academic performance of students and that of their later success on the licensure exam (Figs. 3 and 4).

4.4.1 First year GPA in the DPT program strongly correlated to the students' performance on the NPTE scores as indicated by the Pearson's correlation coefficient, $r(157) = .60$, $p < .001$.

4.4.2 Second/third year combined GPA in the DPT program was also strongly correlated to the students' performance on the NPTE scores with the Pearson's correlation coefficient $r(157) = .60$, $p < .001$.

4.4.3 Regression analysis indicated that both the first year DPT GPA and the second/third year combined DPT GPAs were strong predictors of NPTE score performance (first attempt). For the first year DPT GPA, $F(1, 154) = (83.55, p < .001)$ with an $R^2 = .352$ thus suggesting that 35.2% of the variability in the NPTE scores could be attributed to first year DPT GPA. NPTE scores were higher by 89.10 points for each grade point/credit hour (i.e. the unit of measure for grade point averages) of the first year DPT GPA. For the second year DPT GPA, $F(1,155) = (85.85, p < .001)$ with an $R^2 = .356$. NPTE scores increased by

Table 2
Average (\pm standard deviation) of pre-admission and post-admission scores for students separated by binomial (pass/fail) performance on NPTE licensure exams.

	Overall Pre-admission GPA	Combined Pre-admission science-math GPA	vGRE (adjusted)	qGRE (adjusted)	First year DPT GPA	Second and Third year DPT GPA	First attempt NPTE
Students who passed NPTE	3.31 \pm .30 (n = 145)	3.11 \pm .38 (n = 145)	152.8 \pm 4.3 (n = 145)	151.6 \pm 4.8 (n = 145)	3.44 \pm .31 (n = 144)	3.67 \pm .18 (n = 145)	671.7 \pm 37.8 (n = 145)
Students who failed 1st time NPTE	3.33 \pm .37 (n = 12)	3.11 \pm .45 (n = 11)	149.6 \pm 6.1 (n = 11)	149.1 \pm 6.9 (n = 11)	3.02 \pm .15 (n = 12)	3.47 \pm .14 (n = 12)	563.8 \pm 44.2 (n = 12)

* $p < .001$, one sample t-test (2 tailed); $t(11) = -9.443$.

** $p < .05$, one sample t-test (2 tailed); $t(11) = -4.780$.

150.8 points for each grade point/credit hour of the combined second and third year DPT GPA.

Fig. 3. Regression analysis of first year DPT GRE and NPTE licensure exam scores

4.5. The academic performance of the DPT students when considering the first year DPT GPA and the combined second to third year DPT GPA did not demonstrate a strong relationship to the individual pre-admission factors. There was, however, a strong relationship between the DPT GPAs obtained during the two different time points in the DPT curriculum.

4.5.1 No significant correlation was noted when first year DPT GPA was compared to: overall admission GPA, with a poor correlation coefficient; $r(186) = .07$; combined science-math GPA; $r(18) = .03$, converted verbal GREs $r(190) = .09$; and converted quantitative GRE scores $r(190) = .14$.

4.5.2 The second and third year DPT combined grade demonstrated a poor correlation when compared to pre-admission overall GPA, adjusted vGRE, adjusted qGRE, and combined science-math GPA scores (r was equal to .058, .024, .05, and -.02, respectively).

4.5.3 A very strong and statistically significant correlation (Pearson $r = .90$, $p < .001$) was noted when comparing first year DPT GPA to that of the combined second and third year DPT GPA, suggesting that early positive academic performance is a strong predictor of academic performance during the duration of the DPT program; subsequent regression analysis yielded $F(1, 184) = (801.44, p < .001)$ with an R^2 of .81.

4.6. No significant differences were noted for pre-admission factors between individuals who were unsuccessful in their first attempt to pass the NPTE compared to those who passed. In contrast, the post-admission factors of first year and second/third DPT GPA grades were significantly lower ($p < .05$) in those individuals who failed the NPTE compared to those who passed. (Table 2)

5. Discussion

Although one may argue that successful training of an entry level physical therapist is best reflected by proficient demonstration of their clinical skillsets, the first benchmark for US trained physical therapy

students to enter the physical therapy profession is designated by the passing of the NPTE licensure exam. Successful passing of this exam will result in the issuance of a US license by the Federation of State Boards of Physical Therapy to work as a physical therapy practitioner in the jurisdiction of choice. Additionally, while some measures of student clinical proficiency, such as the Physical Therapist Manual for the Assessment of Clinical Skills (PT MACS), have been suggested to have small but significant correlations to performance on the NPTE¹¹, this has not always been demonstrated for all clinical performance instruments.¹² Thus the scores for the NPTE themselves, are generally viewed as one of the more optimum “end” outcome measure in the assessment of students enrolled in physical therapy programs.^{5,7,11,14}

There are also a broad range of pre-admission and post-admission measurements available to choose from when considering the effectiveness of any academic program in achieving its mission end goal to produce proficient entry level clinicians. Prior to a student's admission into a physical therapy program, several quantitative and qualitative factors are commonly cited to be used in assessment of a student's suitability for enrollment.^{7,9,13,14} While it is unclear why some factors may provide evidence of serving as more “predictive benchmarks” in a student's academic success compared to others, underlying influences such as program variations or sample sizes of analyses are likely to introduce covariance in individual assessments. The latter particularly can influence correlational analyses, since this type of analysis is exquisitely sensitive to sample sizes and degree of variability.¹⁵

Identifying the nature of relationships between such early factors (i.e. pre-admission data) to different endpoint outcome measures (i.e. post-admission measures) provides important insight into the overall associations between these components. For example, in a meta-analysis study by Kuncel and Hezlett (2007), the use of standardized tests was strongly supported as an overall positive predictor of graduate student success when related to a broad spectrum of outcomes including first year-grade point average, graduate GPA, research productivity, research citation counts, and licensing examination performance.¹²

Amongst the many pre-admission criteria available, our study (in keeping with earlier reports) indicates the verbal and quantitative GREs are the best predictors of the NPTE scores specifically. Conceivably this may be related in part, to an individual's capabilities to take standardized tests in general, as has been previously suggested.¹¹ Thus, despite the 2013 changes in the NPTE testing infrastructure, the validity of

using these standardized GRE test scores is still supported.

A strong association between early post-admission GPA in the DPT program and NPTE performance suggests that academic performance may provide an important tool for identifying individuals in need of early remediation in the DPT program. Dockter⁶ previously reported first year DPT GPA as a significant predictor towards success on the NPTE. The current findings also support the continued trend that the relative academic success of DPT students remaining in the program will have a similarly predictively successful trend on the NPTE scores.

Although the use of remediation to provide extra-curricular academic support to enrolled physical therapy students who are struggling academically has been suggested previously,¹⁶ no current published guidelines exist to trigger such remediation plans. In other healthcare professions, individual triggers for remediation procedures may be triggered by performance on key competency exams,¹⁷ self- or external referrals,¹⁸ or low overall graduate GPA.¹⁹

The current findings suggest that overall DPT GPA scores correlate with performance on the NPTE. Within the current dataset, it is suggested that those individuals with a first year GPA of 3.25 or above in the DPT program, are likely to pass the NPTE (with cutoff scores 600 or above). This correlation is further supported by assessment of the academic scores of unsuccessful students to more successful performers, which suggested that post-admission performance is indeed a significant consideration in identifying later success in licensure exam performance.

One of the findings in the current study was the small but significant differences in the pre-admission criteria between the two campuses. Although these differences were relatively small, it remains possible that these differences may have contributed to some of the variability found within the correlation analyses performed. This student population, considered in an aggregated population, were formulated using identical admissions screening processes and attended identical program curricula in the Touro DPT program; thus were considered in combined format.

Future studies on this line of inquiry to include additional parameters for admission as it relates to the clinical proficiency of successfully graduating DPT students may prove helpful. The usage of uncorrelated metrics may result in acceptance of candidates who do not score highly on combined quantitative measures alone, but choice of qualitative parameters must be considered carefully. For example, Clinical Performance Instrument (CPI), is

commonly used by physical therapy programs to assess a student's clinical skillset. However, the validity of this instrument has been refuted, since it requires clinical instructor and student to assess the student's clinical proficiency using a visual analog scale.²⁰ In addition, correlation between CPI instrument assessments and the NPTE has been reported to be poor.¹² Expanded assessments to review students' readiness must be explored further to yield more reliable outcomes.

6. Conclusions

The evaluation of the recent graduating classes' (2014–2016) performances supported the predictive ability of certain pre- and post-admission factors to identify physical therapy students who will later perform well on the NPTE. The key parameters prior to admission to the physical therapy program were the verbal and quantitative GRE scores. After enrollment, there was also strong evidence to suggest that academic achievers with overall GPAs of 3.25 or greater tended to be successful in passing their licensure exams on their first attempt. First year academic performance in the physical therapy program particularly, could be used as a helpful benchmark to identify students who may encounter difficulties in passing the NPTE. Early remediation plans for these at risk students may greatly improve individual DPT academic performance as well as yield improved overall pass rates for DPT programs.

Declarations of interest

None.

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