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A Study on the Relationship Between GRE Scores of Doctor of Physical Therapy Students and First Time Pass Scores on the National Physical Therapy Examination Scores: A Retrospective Study

Givan Hinds

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J.N. Andrews Honors Program
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HONS 497
Honors Thesis

A Study on the Relationship between GRE Scores of Doctor of Physical Therapy Students and
First Time Pass Scores on the National Physical Therapy Examination Scores: A Retrospective
Study

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In Partial Fulfillment of the Course HONS 497 Senior Honors Thesis

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ABSTRACT

Background: This study explored relationships between Graduate Record Examination (GRE) and National Physical Therapy Examination (NPTE) scores.

Methodology: This is a retrospective correlational design utilizing a purposive sample ($n = 102$) of Doctor of Physical Therapy (DPT) students from three consecutive cohorts. Correlations were examined between GRE Verbal (GREV), GRE Quantitative (GREQ), and GRE Total (GRET) scores with the NPTE first time pass rate utilizing a Spearman rho correlation coefficient. Discriminant analysis was used to calculate the cut-off score that would correlate with a minimum passing score of 600 on the NPTE.

Results: The results showed a weak, but significant correlation between GREV and NPTE scores ($r = .454, p < .001$), GREQ and NPTE scores ($r = .420, p < .001$) and GRET and NPTE scores ($r = .484, p < .001$). Discriminant analysis revealed cut-off scores at pass rates of 80%, 90%, and 100% for GREV (320, 420, 540), GREQ (350, 510, 610), and GRET (680, 950, 1000), respectively.

Conclusion: The cut-off score results from this study reflect minimal (80%), acceptable (90%), and exceptional (100%) first time pass scores deemed acceptable according to the Commission on Accreditation of Physical Therapy Education (CAPTE) and the program goals for this institution. Future research with a larger and more diverse sample is needed with emphasis on the predictive ability of GRE and first time pass scores on the NPTE.

INTRODUCTION

The purpose of this study was to explore the relationship between scores on the Graduate Records Examination (GRE) and first time pass scores on the National Physical Therapy Examination (NPTE), the licensure examination taken by Physical Therapists after graduation from an accredited physical therapy school in the USA. Numerous studies have looked at correlations and predictive abilities between preadmission variables and success in graduate programs. Such preadmission variables include GPA (calculated by the Physical Therapy Centralized Application Service (PTCAS), DPT program calculated science GPA and DPT program prerequisite GPA, GRE Verbal, Quantitative, Total, and Written scores (Perry et al., 2013). Other studies have looked at different variables that may indicate success as a Physical Therapist. Luedtke-Hoffman (2012) examined at a clinical assessment tool called the Physical Therapist Manual for the Assessment of Clinical Skills (PT MACS), GPA, and clinical instructor perceptions of the student and relationship to the NPTE. The results showed a significant moderate relationship between GPA and NPTE ($r = .512, p < .01$) and a weak but significant correlation between PT MACS sections and corresponding scores on the NPTE ($r = .246, p < .01$), PT MACS final clinical rotation, PT MACS first clinical rotation, ($r = .413, p < .01$), and PT MACS Visual Analog Scale (VAS) ratings of first time entry-level performance on the NPTE ($r = .116, p < .01$). Such studies support the claim that there are significant correlations between GPA and clinical performance preadmission variables and the NPTE. A retrospective study by Song et al (2007) ($n = 67,565$) asserted that the sorting of students into graduate school may be based on their cognitive skill as assessed by GRE scores. They concluded that students with higher average verbal scores are more likely to attend graduate school than students with higher quantitative scores. They reported positive, significant returns for Master's degrees (7.3%) and

Doctoral degrees (12.8%) per year. Another study outlined the average GRE scores for admission into the top 20 educational doctoral programs in the United States (mean 542.8 for GREV and 617.7 for GREQ) (Walker, 2008). The purpose of this study is to examine a small cohort of physical therapy students with respect to pre-admission GRE scores and the first time pass rate on the NPTE to provide a baseline understanding of the role of GRE in program and licensure success for students and admissions committees. The research questions are as follows:

Primary Research Question:

1. Is there a significant correlation between GRE scores (GRET, GREV, and GREQ) and first time passing NPTE scores for this sample?

Secondary Research Question:

2. What are the minimum GRE passing scores (discriminant scores of GRET, GREV, and GREQ) that correlate with the minimum (first time) NPTE passing score?

BACKGROUND

A study by Perry et al (2013) on one DPT Program, looked at several preadmission factors that correlated with success in the first year of the DPT program, including DPT program calculated science GPA (DPT sGPA), DPT program prerequisite GPA (DPT pGPA), PTCAS undergraduate science GPA (CAS sGPA), PTCAS total undergraduate GPA (CAS tGPA) and GRE quantitative (GREQ), GRE verbal (GREV), GRE total (GRET) and GRE written (GREW) scores at $p < .01$. They found significant correlation for all variables and GPA-f: ($r = .422$, $p < .01$ for DPT sGPA; $r = .381$, $p < .01$ for DPT pGPA; $r = .266$, $p < .05$ for PTCAS tGPA; $r = .356$, $p < .01$ for PTCAS sGPA; $r = .432$, $p < .01$ for GREV; $r = .453$, $p < .01$ for GREQ; $r = .528$, $p <$

.01 for GRET; $r = .295$, $p < .01$ for GREW). This study measured success by final cumulative GPA (GPAf) at the end of the first year in DPT school. Independent variables for the study included GPA calculated from the Physical Therapy Centralized Application Service (PTCAS) (they looked at 2 of 22 types of GPAs calculated by PTCAS) and the DPT calculated GPA. The PTCAS calculates a standardized set of GPAs including the science GPA (Anatomy and Physiology in Biology, Biology, Chemistry, and Physics) as well as overall cumulative GPA including graduate, undergraduate, and professional courses (PTCAS, 2013) while the DPT program at the university studied considers GPA for specific prerequisite coursework only in the life/physical sciences and general courses. Perry et al (2013) also investigated the variables of total GRE scores (GRET) and individual quantitative and verbal GRE scores (GREV and GREQ), and reported GRE scores correlated with the first year GPA of DPT students in their program. Perry et al (2013) found small, but significant, correlations between preadmission variables, including GRE scores, and GPA-f, their measure of success ($r = .432$ (GREV), $r = .453$ (GREQ), $r = .528$ (GRET), all at $p < .01$). Building on the study by Perry et al (2013), our study utilized Spearman rho correlations to determine a positive correlation between GRE scores (GRET, GREV and GREQ) and first time passing NPTE scores.

A study by Luedtke-Hoffman et al (2012) looked at the relationships between a clinical assessment instrument (PT MACS) and the NPTE. This clinical test is not a preadmission examination like the GRE, and is not used on the national level. However, the study asserted that “theoretically, performance by student physical therapists in the clinical setting may be related to the knowledge assessed by the physical therapist licensure examination [NPTE].” Yet this study ($n = 985$) found that “small but significant relationships were found between 2 PT MACS sections and corresponding sections on the NPTE. The study concluded that “an assessment tool

that tests cognitive, psychomotor, and affective domains of PT education cannot predict performance on a predominantly cognitive test such as the NPTE.” Previous studies by Perry et al, (2013) and Kuncel et al (2010) reported the validity of the GRE as a preadmission examination and have found weak but significant positive correlations between such pre-admission factors (whether GPA, or GRE) and success on the NPTE, while studies such as the one by Luedtke-Hoffman (2012) show that clinical assessment tests are not as useful to determine success on the NPTE.

One limitation of this correlation study between GRE and NPTE could be that it is difficult to envision a relationship between a graduate entry level examination for interdisciplinary graduate school applicants and a “competency specific” (APTA, 2013) clinical board examination as the NPTE. A research report by Hocking et al (2010) asserted the weakness of the predictability of GRE scores *on their own* in their study on the predictive ability of the GRE and its usage across Physician’s Assistant (PA) programs. According to this report, the GRE’s predictability on success in health profession programs was strong when paired with other preadmission factors. They reported that of the 127 Master’s programs for PAs, only 70 (55%) require the GRE for admission. Of these 70 programs, only 15 require a minimum score to be considered for admission, and 38 do not have a minimum cut off score, but require certain score to be competitive. The study concludes that 60% of PA programs using the GRE are not doing so up to ETS guidelines, and this information is important for PA admissions decisions. The study by Hocking et al (2010) did not look specifically at a licensure exam such as the NPTE. The GRE, as asserted by Kuncel et al (2010) (r ranges from .22 to .27 for master’s and doctoral students, $p < .10$) is a valid preadmission test for this analysis, because it is the final exam one must take before being admitted into the DPT program, and it is of vital importance to

the academic future of the individual taking it. Both critical and abstract thinking are vitally important to success in a doctoral program such as the DPT and on its licensure examination, the NPTE (Kuncel et al., 2010). The Educational Testing Service (ETS), the service responsible for creating the GRE states on their website that the “Verbal Reasoning section measures (one’s) ability to analyze and draw conclusions from discourse, understand multiple levels of meaning, select important points and understand the meanings of sentences and entire texts”, skills that are non-negotiable for any of the DPT classes (“Test Content, The Verbal Reasoning,” 2013). Knowledge of quantitative reasoning is also necessary for interpreting the physiology, underlying physics and chemistry principles related to physical therapy evaluation and intervention, as well as interpretation of statistics related to research journal articles that will be used for learning purposes in DPT classes. The GRE Quantitative Reasoning section “measures (one’s) ability to interpret and analyze quantitative information and use mathematical skills such as...statistics to solve problems” (“Test Content, The Quantitative Reasoning,” 2013).

Several scientific research studies have looked at correlations and relationships between incoming undergraduate Science GPA and successful completion of the DPT program (Perry et al, 2013). Luedtke-Hoffman (2012) looked at performance during physical therapist clinical education (using the program’s evaluation tools and mechanisms) and the NPTE. Watson-Glaser Critical Thinking Appraisal (WGCTA) scores (WGCTA form A: $r = .541$, $p < .001$; WGCTA form B: $r = .533$, $p < .001$) or clinical performance instrument (CPI) scores ($r = .322$, $p < .001$) as predictors of success on the NPTE were studied by Elliot et al (2012). Matovu et al (2011) determined GREV to be a statistically significant predictor of academic success in the first year of the DPT program ($r = .422$, $p < .007$). Other studies have looked more specifically at correlations between GPA and academic success before entering into a Physical Therapy

Assistant (PTA) program and passing the PTA-NPTE boards at the end of the DPT program (Shaab et al, 2013). The purpose of this study is to collect data for three cohorts of DPT students in a Midwestern DPT school and analyze relationships between GRE total, quantitative, and qualitative scores with first time pass rate on NPTE.

GRE and NPTE Validity

The validity of the GRE in predicting performance on master's and doctoral level students was tested by Kuncel et al (2010). This study empirically synthesized approximately 100 other studies to investigate if the GRE predicts the performance of both masters and doctoral students. With a sample size of 10,000 students, this study found that GRE scores not only predict first year GPA (GPAf) ($r = .27$ GREV, $r = .22$ GREQ for Master's students and $r = .22$ GREV, $r = .24$ GREQ for Doctoral students, $p < .10$), but also graduate GPA and faculty ratings (overall evaluations of performance, ratings of professionalism, research accomplishment, and dissertation/research quality). The study by Kuncel et al (2010) utilized a meta-analysis that discusses the relationship between standardized tests such as the GRE and success in higher-level degrees such as the master's level and the doctoral level, arguing that doctoral work is of a higher complexity level than a master's degree. The doctoral student not only contributes original work to the body of knowledge, and is an expert in their field, but has a less structured (by teachers and classes) and more autonomous approach to the material they are studying than master's students. Yet this study asserted "research indicates that standardized test scores predict learning and performance in situations that require the processing information or acquisition of new knowledge..." (Kuncel et al, 2010). Doctoral work, being at a higher-complexity level and requiring this type of information processing and acquisition of new knowledge, exhibit the type of performance that standardized test scores attempt to predict. This study draws the conclusion

that students with better performance on standardized tests will profit more from a low-structure, high-complexity program at the doctoral level. Based on this study by Kuncel et al (2010), it can be inferred that standardized test performance (presented in GRE scores) can be a valid indicator of success in doctoral programs. The study reported that GREV and GREQ were weak, but valid predictors of first year graduate GPA in both master's and doctoral programs. This study's hypothesis shared the same hypothetical sentiments of this study. The GRE and doctoral programs (such as the DPT) require acquisition of new knowledge, processing of information and decision making, as well as efficient verbal and quantitative skills. For this study "academic success" is defined as completion of the DPT program, as well as passing the physical therapy licensure exam, the NPTE. This study will investigate positive correlations between a valid testing tool (GREV, GREV and GREQ) scores and NPTE scores, and then undergo a discriminant analysis to determine the minimum score required that correlates with a passing score on the NPTE.

A study by Bridgeman et al (2004) (n = 15,948) tested several factors that may influence GRE scores. The study looked at participants' response speed to verbal and quantitative questions on the GRE. They found that if the test time was increased by 1.5 times, up to 7 points were gained on both GREV and GREQ. The study also looked at factors of gender, ability, and timing and their influence on GRE scores. According the General Linear Model (GLM) to a gender, ability, and timing model of testing, an ANOVA test determined ability and gender to be statistically significant for GREV ($p < .05$) ($F(1, 7,638) = 1.67$; $p < .05$), while GREQ determined that timing was not significant, nor was the interaction between timing and ability ($F(1, 6,993) = 23.42$; $p < .001$).

Mupinga et al (2005) conducted a qualitative study that considered face validity of the GRE in terms of international students' perception of it in a limited qualitative study of seven students. They surveyed seven students from Louisiana State University who were in programs requiring a combined (verbal and quantitative) GRE score of not less than 1000 (on the 200-800 scale). Interviews were appropriate for getting data that would be useful for sensitive information in the participants' own words, though the lack of standardization in such methods was noted. The students were asked "What problems did you have with the GRE?" The study suggested that most US institutions require the GRE for entrance into graduate school, and some even employ "cut-offs" for consideration for admission into the program. They found, based on the responses from the formal and informal interviews, that the international students felt the GRE Verbal section was biased against international students and did not measure cognitive capacity to perform well in graduate school. Stricker (2004) looked from a different perspective at the ease with which non-English speakers take the GRE: through the TOEFL. They found TOEFL scores were moderately or highly correlated with the computer-based GRE General Test scores ($r > .10$, $p < .05$, GREV had r values ranging from .33 to .61). This may indicate some disconnect between the international student's perceptions of importance of GRE for graduate school placement and the relationship to primary English language competence. This study attempts to define the relationship between two standardized tests that measure the outcome of a cohort of doctoral level physical therapy students, with relationship to pre-admission GRE scores.

A study by (Young, 2008) focused on quantitative measures such as GRE and GPA as predictors of admissions decisions to get into graduate and doctoral programs. Young found that the verbal section of the GRE ($r = .94$, $p > .05$) and graduate GPA of the candidates ($r = .42$, $p >$

.05) correlate significantly with the first discriminant function, and that undergraduate GPA ($r = .80$) and graduate GPA account for a substantial amount of variance.

Hollman et al (2008) studied the reliability for assessing performance on the behavioral interview (a preadmission factor) to predict first-time performance on the NPTE. The study ($n = 89$) found that performance on GREV (ROC curve area = .734) and the behavioral interview (ROC curve area = .685) were statistically significant predictors of NPTE performance. The positive likelihood ratio was 6.0 for GREV predicting NPTE performance and 2.75 for the behavioral interview predicting likelihood performance.

Physical Therapy students complete intense study in a rigorous curriculum meant to prepare the student academically for a Physical Therapy career. Still, simply completing the DPT coursework does not directly translate into becoming a Physical Therapist. One last prerequisite that DPT students must overcome before becoming a licensed Physical Therapist is the National Physical Therapy Examination (NPTE). In terms of the validity of the NPTE, limited research has been published. However, the Federation of State Boards of Physical Therapy reported the internal validity of the NPTE via their own practice analysis (FSBPT, 2013). Every five years, the FSBPT ensures that more test questions are addressing skill areas of great importance. The NPTE examination has 250 questions that measure the knowledge and abilities required of entry-level PT students, and these questions are written by Licensed Physical Therapists in the United States of America who have been trained in test writing by the Federation on Physical Therapy Education Item Writer's Workshop and have expertise in the specific section of the exam to which they are appointed. The FSBT has also reported the internal consistency reliability estimates of the NPTE to be greater than .80 for the NPTE-PT test forms (FSBT, 2009). They

report that based on the NPTE-PT coefficients being higher than .90, these test forms are “precise measures of entry-level knowledge in the field of physical therapy” (FSBT, 2009).

Procedures

a) Research Design

After Andrews University IRB approval, the primary investigator obtained anonymous data from the admissions director regarding DPT students that graduated from the classes of 2010, 2011, and 2012. All data was kept confidential with numbers assigned to student data by the Admissions Director to create anonymous data for analysis prior to the primary investigator receiving the data sheet. The primary analyses (SPSS, Spearman rho correlation, and discriminant analysis) was regarding passing both the GRE and the NPTE. The data was analyzed for variable (GRET, GREV, and GREQ scores) relationships with the first time NPTE scores by utilizing a Spearman rho correlation. A discriminant analysis was performed that determined the minimum score on GRE that correlates with a passing NPTE score of 600 or above. A discriminant analysis involves the listing of all the GRE scores (three separate lists for GRET, GREV, and GREQ) next to the corresponding NPTE scores. The analysis leveled off the marking point at the GRE scores that accumulated near to the passing score of 600 on the NPTE. These scores are the minimum scores needed on the GRE (GRET, GREV and GREQ) to pass the NPTE.

b) Sample

This retrospective study used a purposive sample of GRE (GRET, GREV, GREQ) and NPTE scores from 102 students from a small Midwestern university from the graduating DPT classes of 2010, 2011 and 2012 between the ages of 18 and 50 years old.

Inclusion Criteria

Students who were above the age of 18, and graduated from the DPT program, were chosen for inclusion in the study. Students who were not on academic probation previous to entry and then graduation, and did not take an extra year to complete the program were included in our sample.

Exclusion Criteria

There were few exclusion criteria for the graduating DPT classes of 2010, 2011, and 2012. Students who were not between the ages of 18 and 50, as well as students who did not complete the DPT program were not included.

Measurement/Instrumentation

The anonymous data was collected and compiled onto an Excel spreadsheet, and analysis of the data involved importing this spreadsheet into SPSS 21.0 software. Correlations were computed utilizing a Spearman rho for the variables (GRE scores) and (NPTE scores) variables. The level of significance (alpha) was set at $p < .05$. All scores were calculated from the previous scoring system based upon a perfect score of 800. The passing score for the NPTE remained at 600.

Description of Measurement Technique

The variables were assigned to the SPSS data spreadsheet: GRE Verbal scores became GREV, GRE Quantitative scores became GREQ, GRE Total scores became GRET, and their variable type was “Numeric” and “Scale” data. Graduation Year and Graduation Status were

noted and coded as Nominal data. The scores were then put in an Excel spreadsheet, along with the NPTE Raw scores.

The sample as a whole was analyzed to satisfy the first research question. Spearman rho correlations were run utilizing SPSS 21.0 between the variables and Means and Standard deviations were reported. Each GRE score (GREV, GREQ, and GRET) was correlated with NPTE first time pass scores with $p < .001$.

Detailed Study Procedures

After approval from the Institutional Review Board on December 3, 2013, data was collected and coded by a physical therapy department staff member. The variables collected were GRE scores and NPTE scores of the 102 students sampled; GREV = GRE Verbal score, GREQ = GRE Quantitative score, GRET = GRE Total Score, NPTE the first time. Discriminant analysis for correlation of passing scores on NPTE was determined. All data was de-identified prior to data collection.

Descriptive statistics (means, standard deviations and frequencies) were analyzed to describe mean GRE and NPTE scores. SPSS testing was used to analyze the data and Spearman rho correlations were used to analyze the correlation between GRE and NPTE scores.

RESULTS

Weak but significant correlations were found between GREV ($r=.454$, $p < .001$), GREQ ($r=.420$, $p < .001$), and GRET ($r=.484$, $p < .001$) scores and NPTE raw scores respectively using Spearman rho correlations.

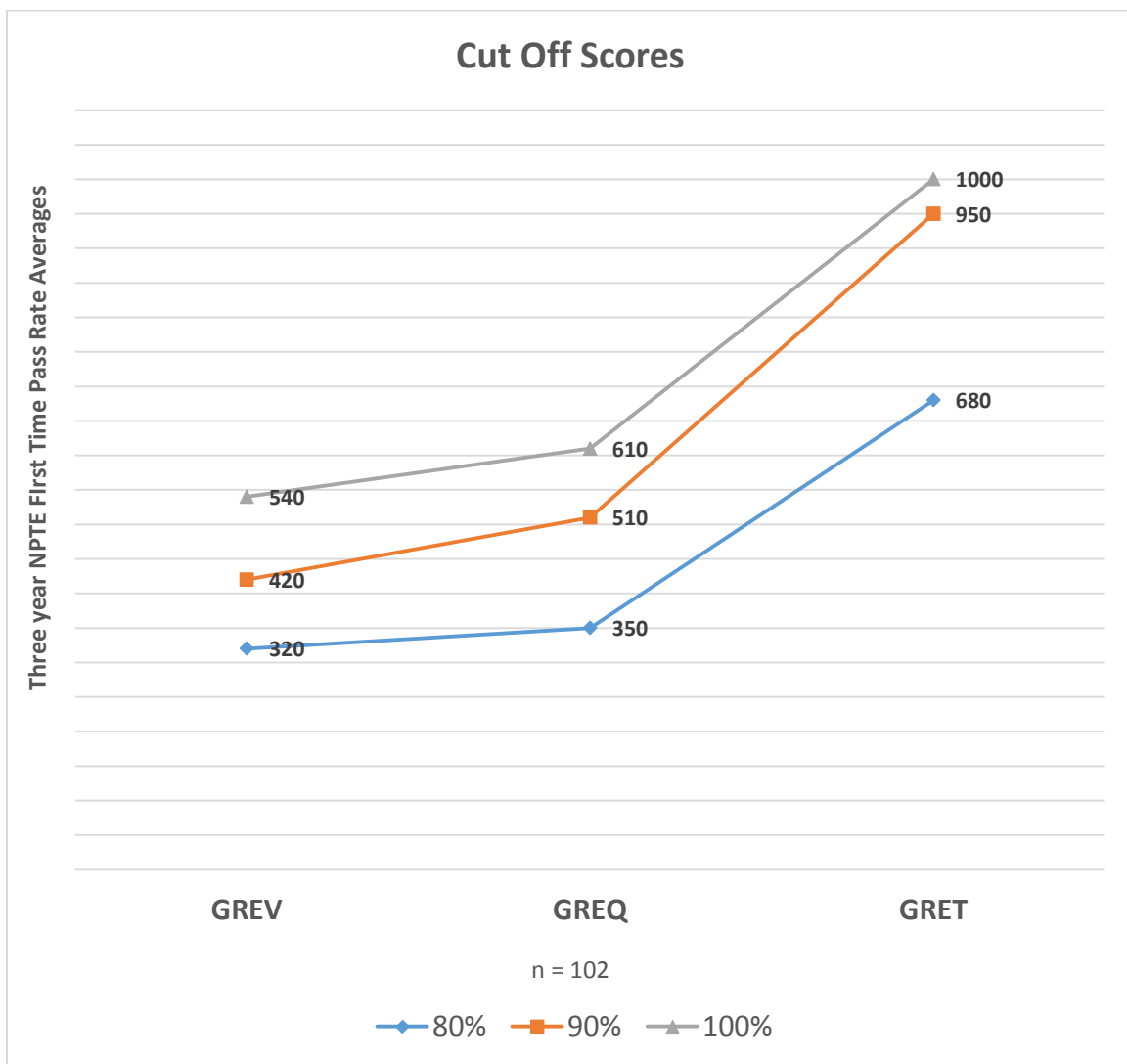
Table 1. GRE and NPTE Correlation

	GREV	GREQ	GRET
r values (n = 102)	0.454	0.420	0.484

RESULTS

Discriminant analysis (sorting data from largest to smallest) utilizing an Excel spreadsheet revealed cut-off scores within the 80%, 90%, and 100% NPTE pass rates were 320, 420, and 540 (GREV), 350, 510, and 610 (GREQ), and 680, 950, and 1000 (GRET) respectively. The average NPTE pass rate for the cohort (3 classes) was 83.33% ($n = 102$).

Figure 1. Cut Off Scores for NPTE First-Time Pass Rates



DISCUSSION

This study found weak but significant correlations between GREV ($r=.454$, $p < .001$), GREQ ($r=.420$, $p < .001$), and GRET ($r=.484$, $p < .001$) scores and NPTE raw scores respectively after using a Spearman rho correlation. Discriminant analysis was used to find cut off scores at 80%, 90%, and 100% first time NPTE pass rates of the sample of 102 students. The cut off scores were 320, 420, and 540 (GREV), 350, 510, and 610 (GREQ), and 680, 950, and 1000 (GRET). The average NPTE first time pass rate for the cohort was 83.33% ($n = 102$).

An undergraduate honors thesis by Kelsey Taylor of East Tennessee State University (2012), also looked at correlations between GRE and GPA scores with success (NPTE exam) pass rates. Taylor's sample size ($n = 67$) was significantly smaller than that of this study, and it looked at DPT classes of 2007, 2008, and 2009. Taylor found that graduate grade point average (GGPA) has a much more significant correlation ($r = 0.535$) with the NPTE scores than GRE scores had with NPTE scores ($r = .2143$). Another study by Davenport et al (2011) reported weak correlations between GRE and NPTE scores ($r = .214$) with a sample of 67 students from three consecutive DPT classes (Davenport et al, 2011). Both of these studies offer valuable statistical results for their respective admissions committees, however these specific results cannot make conclusions on a national scale.

Similarly to the Perry et al (2013) study, this study looked at a pre-admission factor that contributes to determining the acceptance of a student into the DPT program. Perry et al found small but significant correlations between the GRE preadmission variables ($r = .432$ (GREV), $r = .453$ (GREQ), $r = .528$ (GRET) and NPTE scores. However, this study along with Taylor's study supports the fact that GPA and NPTE scores have a more significant correlation. Students must pay attention to their overall grade point average, and not simply a test score for success on an

exam such as the NPTE. Luedtke-Hoffman et al (2012) looked at PT clinical education and NPTE scores. They reported poor, but significant correlations between PT MACS (a clinical assessment instrument) and NPTE scores ($r \geq .23$, $p < .01$). This study found a significant relationship between GRE and NPTE first time pass rates that need to be considered for admissions and future research studies with a larger cohort.

Limitations

This study's smaller scope in terms of sample size and diversity of various locations is a limitation of this study. This study can only speak on the trends and correlations between the GRE and NPTE scores of a 3-class cohort.

Clinical/Educational Application

The findings of this study may be utilized by admissions coordinators and faculty to determine relationships between GRE scores and NPTE first time pass rates to consider as part of admissions process for DPT Students.

Demographics

The basic demographics of the three cohorts were left out of the study because of confidentiality restraints. However in further research, demographics such as age, gender, and ethnicity, along with a larger sample size and more DPT programs, could offer interesting insight into the differences between demographic groups and into the GRE and NPTE first time pass scores.

Future Research Suggestions

A larger sample size and utilization of cluster sampling of several universities for future studies may contribute to an understanding of the predictive relationship of the GRE with the NPTE first time pass rate. The university studied aligns itself with CAPTE minimum requirements (CAPTE has a minimum of 80%), but does not yet have a goal above the minimum for first time NPTE rates. Future research may involve the discovery of such a baseline. Future research should focus on the covariates such as GPA, GPA Science, PTCAS GPA, and other predictive factors in conjunction with GRE to establish a prediction model for admissions for DPT student success.

CONCLUSION

This study found a significant, but weak correlation between GREV ($r = .454$), GREQ ($r = .420$), GRET ($r = .484$) scores and NPTE scores. Furthermore cut off scores for the cohort studied were reported as 320, 420, 540 (GREV), 350, 510, 610 (GREQ), and 680, 950, and 1000 (GRET) within 80%, 90% and 100% NPTE first time pass rate. Further research is needed to establish the predictive relationship of the GRE with the NPTE first time pass rate.

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