Using Physician Assistant Program Admissions Criteria as Markers for

Success on the Physician Assistant National Certifying Examination

A Review of the Healthcare, Administrative, and Sociological Perspectives

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Abstract

Physician assistant programs serve as a "gatekeeper" to the PA profession, and as such, they are given the responsibility of educating competent PAs. Programs across the nation have a common goal in that they all strive to accept the most highly qualified students who will hopefully be successful in the program and on PANCE after graduation. Admissions committees often wonder which admissions variables correlate most with student success. This article discusses programs' responsibility to the PA profession to recruit, matriculate, and graduate highly competent individuals with the best chance of success in the program and on PANCE. Specifically, it reviews the literature surrounding the correlation between PANCE success and GRE scores; undergraduate and prerequisite GPA; prerequisite science course grades; graduate PA program point of entry including 3+2 BS/MS programs; and demographic factors including age, sex, and race/ethnicity. Additionally, this article discusses effects of graduate physician assistant program admission decisions from healthcare, administrative, and sociological perspectives. Programs have a responsibility to conduct their own research to find the admissions criteria that best suit their needs and correlate with success in the graduate PA program and on PANCE, and then make these criteria readily available to prospective students.

Keywords: physician assistant, admissions, PANCE, 3+2 BS/MS programs, prerequisites, point of entry, GRE.

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Introduction

Physician assistants (PAs) are trusted medical providers who work collaboratively with a

physician to care for patients. PAs perform history and physical examinations, order and

interpret diagnostic studies, diagnose illness, prescribe medications, and manage treatment plans.

PAs can also perform medical procedures and assist in surgery. They can work in any specialty

in medicine, and approximately half of all PAs work in a primary care setting (AAPA, 2020).

As the physician assistant profession nears its 53rd year; the need for PAs, and therefore

PA programs, is ever-growing. The Bureau of Labor Statistics estimates the projected growth of

PA employment to increase 31% from 2018-2028 (BLS, 2020). This growth is due to many

factors, including the need for more providers to care for underserved populations and the

elderly. Physician assistants are a well-established and well-respected part of healthcare teams

across the country (Howley, 2018).

After graduating from an accredited PA program, graduates must take the Physician

Assistant National Certifying Examination (PANCE), which is a computer-based, 300 question

multiple-choice examination testing basic medical and surgical knowledge (NCCPA, 2020).

Once a graduate successfully passes the PANCE, they can officially use the PA-C designation

and practice medicine. The Accreditation Review Commission on Education for the Physician

Assistant (ARC-PA) is the accrediting body that oversees PA education, and it requires all PA

programs to publish and make available to the public their PANCE pass rates for the most recent

5-year period (ARC-PA, 2019). Applicants are attracted to programs with high pass rates, so it

becomes an important feature for programs. ARC-PA also requires programs with a first-time

pass rate of 82% or lower to submit a report with a thorough analysis of the program and action

steps they will make to improve their PANCE pass rate (ARC-PA, 2019). For these reasons, PA

programs must recruit students who are most likely to succeed on the PANCE. Admissions

committees often wonder which admissions variables, including GPA, GRE scores, and patient

care hours, correlate most with student success.

      According to the PAEA Program Directory, 149 out of a total 291 programs across the

country require applicants to take the GRE for consideration for admission (PAEA, 2020). This

equates to 51.2% of all PA programs that require the GRE. There are currently 11 programs that

will accept either the GRE or MCAT as an admissions entrance exam (PAEA, 2020). The

remaining programs do not require any formal standardized testing prior to admission. For those

programs who do require GRE, minimum accepted score varies with some programs not having

a minimum score requirement at all.

      Most PA programs set minimum requirements for admissions criteria including overall

GPA, prerequisite GPA, and prerequisite course grades. The national averages for prerequisite

GPAs are overall GPA: 3.0 (on a 4.0 scale) and prerequisite GPA: 2.9 (on a 4.0 scale). Programs

are also required to report their reasons for requiring certain GPAs as part of admissions criteria.

72.5% of programs report their minimum required overall GPA and 75% report the minimum

required prerequisite GPA has been "shown to predict ability to complete the program". Other

reasons cited are "university or graduate school requirement", "narrow the applicant pool", and

"other reasons" (PAEA, 2020).

      Most PA programs require a minimum of C on prerequisite courses, specifically

Anatomy (67.3% of programs), Microbiology (69% of programs), and Physiology (65.3% of

programs) (PAEA, 2020). Programs went on to note that these three prerequisite courses are required because they are a "foundation for program course(s)," meaning those programs believe applicants must complete these courses prior to matriculation into the PA program so that the graduate PA courses can build upon them (PAEA, 2020).

Students can enter graduate physician assistant programs from various points. Some students will enter their undergraduate institution as part of a 3+2 BS/MS program, and others will complete their four years of undergraduate studies before applying to a PA program. Demographic factors including age, gender, and racial/ethnic backgrounds are included in each student's admissions portfolio, given the student chooses to provide that information. Programs should use this data to look for any correlation between admissions criteria or demographics and success on the PANCE.

Graduate PA program admission decisions affect the PA profession, the institution housing the PA program, and most importantly the students applying to the program. Programs, in a way, act as gatekeepers to the PA profession, so they must admit students who they believe have the best chance of success in the program, who will graduate and successfully pass PANCE, and ultimately become excellent PAs. Institutions that house PA programs, including colleges and universities, can benefit financially from the PA program, both at the undergraduate Pre-PA level and at the graduate level. In general, students are high achievers who do well academically and graduate on time. When students do experience academic difficulty, institutions should consider what assistance might be needed to support them. The pursuit of a graduate physician assistant degree is time-consuming, expensive, and academically challenging. These factors play a role for prospective students and families when considering this degree and career path. Failure to be accepted to or to successfully complete a PA program can have

significant financial implications on students and families. In addition, failure to achieve their academic and career goals can result in loss of confidence in oneself, loss of control over one's future, and a disruption in a student's social network. These can all have a significant impact on a student's mental health. When programs make admission decisions, not only do they need to review quantitative and qualitative data provided in the application; they must also consider the impact each decision has on the PA profession, the institution, and the students themselves.

Literature Review

In 1942 Dr. Eugene Stead, Jr. M.D. develops an expedited, 3-year, program to educate physicians at Emory University to provide military care during World War II. This program ultimately provided a model for the PA curriculum at Duke University in 1965. The first class at Duke's PA program consisted of four Navy medical corpsmen (PA History Society, 2021).

Physician assistant programs currently award a master's degree, and there are more than 250 PA programs in the country (AAPA, 2021). According to the Physician Assistant Education Association (PAEA) (2018), in the 2016-2017 admissions cycle 25,593 students submitted applications to PA school and 8,106 matriculated into a program. The equates to only 31.7% of applicants getting a seat in a program.

There has been much research regarding admission variables in PA programs, as well as other allied-health and medical programs. Some focus on admissions exams like the Graduate Record Examination, others focus on prerequisite courses and GPAs, and others with prerequisite healthcare hours obtained prior to matriculation. Several research studies focus on undergraduate, prerequisite courses and GPA and how they correlate with success in PA school. It is important to note that the studies described here were all performed by researchers at their own institution, on that particular population of students. Every program seeks to select the most

qualified candidates for their program, and that starts with using admissions criteria with the best predictive ability.

GRE

The Graduate Record Examination (GRE) is a computerized test utilized for graduate school admission. The exam is comprised of verbal reasoning, quantitative reasoning, critical thinking, and analytical writing skills (ETS, 2021). The areas that the GRE covers are deliberately broad skills that would be required for success in any graduate-level program, from business to art history. The GRE has been in existence since 1936, originally developed by the Cooperative Graduate Testing Program, a division of the Carnegie Foundation for the Advancement of Teaching (ETS, 2021). It was originally used to test knowledge of graduate students who were already enrolled in a liberal arts program. In 1948, the Educational Testing Service (ETS) began administering the GRE specifically as a graduate-school admissions exam. The exam is accepted at thousands of graduate schools, including many PA programs. According to the 2020 PAEA Program Report, 131 out of 227 (57.7%) of PA Programs require the GRE for admission. The median scores reported by programs were GRE-Verbal=153.4, GRE-Quantitative=152.8, and GRE-Analytical=4.1 (PAEA, 2020). According to Princeton Review, the median scores for 2017-2018 was GRE-Verbal=149.97, GRE-Quantitative=152.57, and GRE-Analytical=3.48. (Princeton Review, 2021). GRE scores are scored from 130-170 for both Verbal Reasoning and Quantitative Reasoning, and 0-6 for Analytical Writing (ETS, 2021).

The GRE has been utilized as a graduate school admissions exam due to its broad coverage of topics and the theory that GRE performance correlates with academic success in graduate school. There have been multiple studies on this theory, with many studies showing that GRE success, in combination with other factors including undergraduate GPA, correlates with

graduate school success. When GRE scores alone are assessed, the findings are less consistent.

When considering the GRE for all graduate programs, performance is less strongly correlated

with success on degree completion or board examination performance. (Hocking and

Piepenbrock, 2010). When the GRE is used for admission to healthcare-related fields, including

physician assistant, the usefulness of the exam is even less clear. The GRE does not test

specialized topics, including science, that are required for healthcare-related programs. There

have been various studies with mixed results regarding using the GRE as a measure of success in

healthcare-related programs as well as success on certifying board examinations after graduation.

Lolar et. al. (2020) researched the relationship between PA students' history-taking performance,

GRE scores, clinical year GPA, and Physician Assistant National Certifying Examination

(PANCE) scores. They utilized 147 PA students from Wayne State University for the study. The

researchers found no correlation between GRE scores and history-taking performance, but a

correlation was found between history-taking performance and PA school GPA as well as

PANCE performance (Lolar et. al., 2020).

     Luce (2011) found that students who had an overall low total composite score made up of

UG GPA, Science GPA, GRE-V, GRE-Q, and GRE-A had more academic difficulty than those

with a higher composite score. Yealy (2017) found that GRE-total may be predictive of PA

Program success but was not predictive of PANCE success. Utzman et. al. (2007) found that

lower GRE-V & GRE-Q contributed to the prediction of academic difficulty in physical therapy

students, while Thieman et. al. (2003) found that total GRE scores were not predictive of PT

student success in program or on boards. Danielson and Burzette (2020) found that GRE-V was

shown to predict success in veterinary school.

When attempting to utilize GRE as a predictor of PANCE success, there are even more mixed results. Higgins et. al. (2010) found that GRE-verbal and GRE-quant were both significant predictors of PANCE success. Pack (2019) found no significant correlation between overall GRE scores and PANCE success. Miranda (2006) conducted a study at Marietta College and found that neither GRE-V nor GRE-Q had any impact on future performance on PANCE scores. This shows that GRE may have usefulness in predicting which students will be successful in a PA program, but it cannot accurately predict success on PANCE. When used as part of admissions criteria, GRE more accurately predicts academic success when considered with other criteria, including undergraduate GPA.

Standardized testing, including the GRE, has been shown to be a barrier for students who identify as underrepresented minorities (URMs). Yuen & Honda (2019) found that requiring the GRE for admission to PA school results in lower matriculation of students who identify as underrepresented minorities (URMs). Wolf et. al. (2020) found that adding GRE as admissions criteria caused a significant barrier in the matriculation of URM students, particularly Black/African American students. Using GRE for admission to a PA program can then limit the amount of otherwise qualified applicants who identify as URMs, lessening diversity in each program and ultimately for the PA workforce in general.

These studies show the need for future research to determine whether there is a significant difference in graduate success depending on a student's GRE scores, whether the verbal or quantitative portion best predicts success, and whether there is a certain GRE score that best predicts graduate school success.

Undergraduate GPA

Several studies have attempted to determine if undergraduate GPA can predict success in graduate school. Admissions committees frequently utilize undergraduate GPA as part of the overall criteria for admission to graduate school. Danielson and Burzette (2020) found that undergraduate GPA correlated with graduate veterinary school GPA, as well as with Veterinary Educational Assessment (VEA) scores and North American Veterinary Licensing Examination (NAVLE) scores. This shows correlation with success not only in graduate school, but on professional board exams as well. Luce (2011) found that students who had an overall low total composite score made up of undergraduate GPA, science GPA, GRE-V, GRE-Q, and GRE-A had more academic difficulty than those with a higher score, showing that undergraduate GPA may play a role in predicting academic success. Thomas and Draugalis (2002) had similar results with graduate pharmacy students, finding that higher undergraduate GPA correlates with academic success, only when considered in combination with other variables. Dunleavy et. al. (2013) also had similar findings when studying the correlation between undergraduate GPA and graduate medical students' academic success. When studying the correlation between undergraduate GPA and success in a physician assistant program, Wolf et. al. (2020) found that having a lower undergraduate GPA correlates with higher levels of student attrition from a PA program.

There have also been studies researching the correlation between undergraduate GPA and PANCE success, with varying results. Several researchers have found a positive correlation between higher undergraduate GPA and PANCE success, including Higgins et. al. (2010), Honda et. al. (2018), Andreeff (2014), Miranda (2006), and Ennulat et. al. (2011). Other

researchers found there was no correlation between undergraduate GPA and PANCE success,

including Brown et. al. (2013) and Yealy (2017).

These studies show the need for future research to determine whether there is a

significant difference in graduate success depending on a student's overall undergraduate GPA,

and whether there is a certain GPA that best predicts graduate school success.

Prerequisite GPA

Prerequisite courses are the courses required by a graduate program for admission. In

healthcare-related programs, prerequisites are usually a combination of science and math

courses, and they vary among programs and majors. Prerequisite GPA is defined as the GPA

comprised of all prerequisite courses taken and is utilized in the graduate school admissions

process. Nuciforo et. al. (2014) found that science GPA was the best predictor of admissions to

physical therapy programs. When attempting to correlate prerequisite GPA with academic

success in a graduate program, there are also varying results. Huff and Fang (1999) found that

having a low science GPA correlates with academic difficulty in medical school. Wolf et. al.

(2020) found that a lower science GPA correlated with higher levels of student attrition from PA

program. These findings suggest prerequisite GPA, when used as an admissions criterion, may

help to gauge student success and risk of academic difficulty and/or attrition in graduate school.

There are also varying results when attempting to find a correlation between prerequisite GPA

and PANCE success. Brown et. al. (2013) and Yealy (2017) both found no significant prediction

between prerequisite GPA and PANCE success. Multiple other researchers and studies suggested

that prerequisite GPA is a positive predictor of PANCE success, including Butina et. al. (2017),

Pack (2019), Miranda (2006), and Ennulat (2011).

These studies show the need for future research to determine whether there is a significant difference in graduate success depending on a student's prerequisite GPA, and whether there is a certain GPA that best predicts graduate school success.

Undergraduate Science Course Grades

Compared with undergraduate and prerequisite GPA, there has been less research done on specific undergraduate science, prerequisite course grades as predictors of success in PA school and on PANCE. Higgins et. al. (2010) found that grades on prerequisite courses did not significantly correlate with PANCE success, while Butina et. al. (2017) found the direct opposite. Butina suggested that foundational coursework is the best predictor of PANCE success (Butina et. al., 2017). Andreeff (2014) took this a step further and looked at specific courses, including Chemistry I, Pathophysiology, and Biochemistry, to attempt to correlate those grades with PANCE success. She found that grades in Pathophysiology and Biochemistry had a significant correlation with PANCE success, while Chemistry I did not.

These studies show the need for future research to determine whether there is a significant difference in graduate success depending on a student's undergraduate science grades, and whether there are any specific prerequisite courses that best predict graduate school success.

Point of Entry

Graduate schools often offer multiple "tracks" or points of entry into the graduate phase of their program. A common point of entry is a 3+2 BS/MS option, in which students enter college as a Pre-PA student. Students follow a Pre-PA curriculum to finish all prerequisite classes and other undergraduate requirements in three years, instead of four. Then students would be eligible to matriculate into the graduate portion of the PA program for the remaining two years. A combined Pre-PA/PA program offers many benefits to students including less time

to graduation and lower overall costs. For students who do not choose to enter through an accelerated 3+2 program, they are then able to apply upon completion of their undergraduate education. These various points of entry lead to more diversity in the classroom, including varying ages and levels of experience; but with this, there is also more variety in the specific prerequisite coursework taken to gain entry into the program. Wolf et. al. (2020) studied the differences in academic performance between PA students who matriculated through an accelerated 3+2 BS/MS program vs. those who completed a traditional bachelor's degree prior to PA school. Researchers found that those who matriculated through the school's accelerated 3+2 BS/MS program had a higher attrition rate than those who matriculated through a traditional route. Those students who were dismissed due to academic difficulty had a significantly lower science GPA than other students, despite meeting admission standards (Wolf et. al., 2020). This can lead programs to investigate the undergraduate programs where their students completed prerequisite science courses to determine if courses had similar rigor or if any discrepancies can be identified. McCall et. al. (2007) attempted to determine whether NAPLEX performance could be predicted using preadmission predictors in Pharm.D. students. Researchers found that the degree obtained upon admission to Pharm.D. school, including BS, BA, or MS, did not significantly correlate with NAPLEX success (McCall et. al., 2007). These studies show the need for future research to determine whether there is a significant difference in graduate success depending on which point of entry a student takes to matriculate into a program.

Demographics

While demographics including age, gender, and racial/ethnic backgrounds are often included in research models; there is little reported on correlation with demographics and success in graduate school or on professional board exams. DiBaise et. al. (2015) attempted to determine

the characteristics and effectiveness of recruitment strategies for underrepresented minorities

(URM) and barriers for URM applicants to PA programs. Researchers found that programs who

actively recruit URM students have a higher matriculation rate of URM students, but the overall

number of programs who actively recruit is low (DiBaise et. al., 2015). Huff and Fang (1999)

researched which demographic populations are at highest risk of encountering academic

difficulty in medical school. They found being a woman, a member of URM class, or being older

all are significant predictors for experiencing academic difficulty (Huff and Fang, 1999).

Oakes et. al. (1999) found that age was a negative predictor of PANCE success, with

older students achieving lower scores than younger students. Miranda (2006) found that gender

had an impact on PANCE performance when studying students at Marietta College PA Program.

These studies show the need for future research to determine whether there is a significant

difference in graduate school success depending on a student's demographic profile.

Healthcare Perspective

To maintain a profession's reputation of excellence; programs must recruit, matriculate,

and graduate highly competent individuals with the best chance of success in the program and on

PANCE. Physician assistant programs, in a way, act as gatekeepers to the PA profession, and as

such, they are given the responsibility of educating competent PAs. As healthcare professionals

themselves, PA program faculty generally take this responsibility very seriously. The program's

name and reputation are on the line if it is not living up to that responsibility.

In the constantly evolving world of healthcare, physician assistants are expected to keep

current with technology, medical advances, healthcare delivery, reimbursement, laws and

regulations, and current pharmacology. New graduate physician assistants who have successfully

passed PANCE are generally considered to be competent in their field (Yturri et al., 1998). Due

to the primary care approach in most physician assistant programs, graduate PAs are eligible for employment in virtually any medical specialty. PAs can be hired by hospital systems, private practice offices, surgical centers, government organizations, schools, among many more. Those employers want to trust that graduates are competent to begin practice.

The Association of American Medical Colleges (AAMC) predicted there will be a shortage of up to 124,000 physicians by 2034 (AAMC, 2021). To supplement that shortage, there is a growing need for more physician assistant graduates to meet the increased demand of providers. The Bureau of Labor Statistics predicts employment of PAs to grow 31% between 2020 and 2030 (BLS, 2020). The American Academy of Physician Assistants (AAPA) has also been advocating for Optimal Team Practice (OTP) in recent years. One of the many goals of OTP is that PAs would be legally permitted to practice medicine without the relationship of a supervising physician (AAPA, 2021). State constituent chapters of the AAPA are currently advocating for change in PA/physician laws at the state level. Now in addition to meeting the need for growing numbers of PA graduates yearly, PA programs must now also prepare graduates for the possibility of more independent practice with Optimal Team Practice. This would require graduate PAs to learn additional skills and have a deeper knowledge of pathophysiology, diagnosis, and treatment plans of medical conditions; so that they could practice without the supervision or collaboration of a physician. Marincic & Ludwig (2011) found that supervising physicians perceive new graduate PAs to be "competent" and felt they "met expectations for their current practice." As new graduate PAs become comfortable in their practice, supervising physicians will inevitably trust them with more complex patient management and/or provide less supervision.

How can PA programs ensure that its graduates are competent? "Professional competence in medicine has been described as 'the mastery of a body of knowledge and the acquisition of a range of relevant skills' that are requisite to the ability to function in tasks considered essential within the profession" (Yturri et al., 1998). Marincic & Ludwig explain that supervising physicians perceive competence as "a reflection of the training that PAs receive and that passing the PANCE is evidence of competence" (Marincic & Ludwig, 2011). For these reasons, programs must graduate competent PAs who can pass PANCE and begin their careers.

How do schools assess and measure competence? ARC-PA standards of accreditation dictate specific criteria that each program must meet to maintain accreditation. Within these accreditation standards, there is significant attention given to curriculum, specifying certain items that each program must teach and assess competence. In 2018, a PAEA task force created the Core Competencies for New PA Graduates. These core competencies provide a framework of attributes that PA graduates must have achieved at the time of graduation to complete the program. The graduate would then be eligible to take the PANCE and ultimately begin work as a physician assistant. PAEA defines competency as "a specific skill, knowledge, or ability that is both observable and measurable" (PAEA, 2019). The PAEA Core Competency Domains include Patient-Centered Practice Knowledge, Society and Population Health, Health Literacy and Communication, Interprofessional Collaborative Practice and Leadership, Professional and Legal Aspects of Health Care, and Health Care Finances and Systems (PAEA, 2019). Within each domain lie several specific competencies, all of which are required to have been met at the time of graduation. PAEA designed the core competencies to answer the question, "What must new PA graduates know and be able to do on day one of clinical practice?" (PAEA, 2019).

The National Commission on the Certification of Physician Assistants (NCCPA) publishes the PANCE Content Blueprint, outlining the specific diseases and disorders, as well as types of knowledge and skills necessary for physician assistants to practice medicine. The topics listed on the NCCPA blueprint also align with those found on PANCE (NCCPA, 2019).

PA programs must combine competency requirements from ARC-PA, PAEA, and NCCPA when developing curriculum to ensure all topics are being taught and students can be deemed competent upon graduation. Programs must work backwards to determine which applicants would be most likely to be successful in the program and be best suited to be a successful PA. In addition to basic medical knowledge; students must be capable of critical thinking, understanding of business and legal aspects of medicine, teamwork, leadership, and time management. Some of these require non-cognitive attributes like maturity and professionalism that cannot be assessed using only quantitative measures, such as GPA, and require an interview to assess. To graduate competent PAs, programs must seek to admit those applicants who have the best chance to achieve competency.

The PA profession relies on programs to recruit, train, and graduate competent professionals. Since the profession relies on PANCE success as a measure of competence, PA programs select students through an admissions process that aims at identifying graduate students with the best chance of success in the program and on PANCE. However, the profession assumes that PA programs are holding up their end by maintaining standards, both during the admissions process and after matriculation, and ensuring students meet these difficult benchmarks.

Administrative Perspective

Combined 3+2 BS/MS programs are attractive to high school students as a "fast track" option to complete a competitive, desirable program such as physician assistant. Private institutions are always looking for ways to make their undergraduate population more stable, especially in the current highly competitive Northeast region. A fast-track program entices undergraduate enrollment and helps to stabilize a pipeline for desirable programs. Additionally, recruiting a student once as an incoming freshman brings students in for entire five years out of high school, instead of bringing in external students only for two years of graduate school. It is a more efficient way for schools to use their resources. Generally, these students are high achievers who are retained and graduate on time.

Desirable programs, such as PA, support other departments when students are brought in as freshmen, as they all take undergraduate courses in the core subjects and the sciences. A fast-track program boosts the enrollment of not only the graduate program in question, but all the undergraduate courses that students must take due to a robust general education requirement. The result of more stable credit hours for professors across disciplines is a real benefit. Students who enter through a 3+2 BS/MS program also utilize on-campus housing and dining services, which provides additional income to the institution. In comparison, students who attend only the two-year graduate program generally live in off-campus housing and do not purchase a meal plan.

Despite the level of academic achievement, some students do not matriculate to the graduate program. This may be because of poor academic performance or shifting interests. Regardless, the institution will still benefit because these students will likely complete their fourth year of undergrad to attain a bachelor's degree. If denial into the graduate program is due to poor academic performance, students could also retake courses then reapply, essentially then

spending six years on campus. Without a bachelor's degree in hand, undergraduate students are

ineligible to matriculate into a PA program at another institution, which makes it difficult for

students to leave the institution entirely if they still wish to pursue the PA profession. Students

may also choose to change their major within the institution, to another science or healthcare

field, or to another discipline entirely.

Should institutions offer guaranteed admission to the graduate phase when students enter

as a freshman? With a 100% guarantee of graduate admission for all undergraduate students,

institutions run the risk of higher rates of attrition at the graduate level. Taking into consideration

that some students admitted into the graduate phase may not be likely to succeed based on

admission requirements, this is a risky strategy. It will result in higher numbers of incoming

freshmen as students, but it may also result in higher attrition rates as well. While prospective

students and families like to see the guarantee of admission into the graduate program to protect

their investment, there is no direct link between high school performance and graduate

performance in a PA program that shows these students will be successful. Institutions that do

not offer a guaranteed admission to the graduate phase will need to be prepared to answer

prospective student and parent questions including, "What percentage of internal applicants are

admitted every year?" and "What happens to those who are not admitted?" Admissions

counselors and other school representatives should be prepared to be open and transparent about

these answers. Regardless of the answers to these questions, the lack of a guarantee may still

deter some students from matriculating into that institution, opting for another school that offers

a guaranteed seat in the graduate phase.

When considering the cost of attrition to an institution, Johnson (2012) found that

students who left at a later time (more than 36 months after enrollment) made up 9% of all

attrition but was responsible for 22% of expenditures. When students leave an institution early in their education (prior to 36 months after enrollment), the average cost was $12,000 per student, while costs rose to $34,000 when students left during their third year or later (Johnson, 2012). The revenue lost due to student attrition includes current and future tuition and fees, plus extras like room and board and on-campus purchases. In addition, when a student leaves an institution, the possibility of alumni donation funds leaves with them (Raisman, 2013).

At the institution level, students needing to repeat coursework put additional strain on faculty and advisors, as well as other student support services such as student health services and the counseling center. The more students who need to take a certain course requires the institution to run more sections of that course, and in turn, more faculty overload or adjunct payments. Students experiencing academic difficulty also tax faculty and advisor time, possibly rendering them less able to assist other students, prepare for classes, and complete research projects. This may also affect the institution's bottom line through the need to hire more faculty or advisors, or even through loss of grant money if faculty is unable to complete research.

Sociological Perspective

The cost of college to students and families is high, and 3+2 BS/MS programs offer a fast-track route to completion at a lower cost. Students can often complete the first year of their professional program at the undergraduate block tuition rate, maintaining undergraduate financial aid and scholarships. This first year of the professional program would count as their fourth year of college, traditionally. The average cost of attending a private graduate physician assistant program in 2020 was $91,639 (Pasquini, 2021). This figure includes tuition only for the 2-year graduate degree, and it would be in addition to a traditional 4-year undergraduate degree if students did not attend a 3+2 BS/MS program. Tuition varies among schools at both the

undergraduate and graduate levels, but regardless of which school a student attends, a 3+2

BS/MS program will cost less.

What happens if students complete the three years of undergraduate school and are not

accepted into the graduate phase? This is a cost consideration for students and families regardless

of what they choose as their next step. Students can complete their fourth year of undergrad in

the science department or change their majors, both of which come at an additional cost. If

students choose to complete their fourth year of undergrad and obtain a bachelor's degree, then

reapply to the PA program; if accepted, they would be entering as a graduate student, paying two

years of graduate tuition and losing undergraduate financial aid.

Failure to be accepted into the graduate phase on the first attempt can also result in loss

of confidence in oneself, loss of control over one's future, and a disruption in a student's social

network as other students in their entering class would have already matriculated with a different

cohort into the graduate phase of the program. These can all have a significant impact on a

student's mental health. Students may then need psychological support or additional support

from faculty and peers, as Lewis (2018) describes when studying the experiences of nursing

students who need to repeat coursework. Students may need to repeat coursework to obtain

higher grades. They may also need to repeat standardized testing, such as GRE. They may also

choose to complete a test preparation program to improve performance, such as the GRE test

prep course. Each of these remedial efforts presents a financial burden for students and families.

As physician assistant programs are generally cohort-based, if students are not accepted

on the first round, they need to wait an entire year for a new cohort to begin, delaying their

graduation by one full year. This not only results in higher tuition costs, but it also means they

will go one more year without working as a professional and earning the commiserate salary.

If students decide to change their major, that may require additional semesters for prerequisite courses in that specialty, which costs the student both time and money.

What if students were accepted to the graduate PA program and then experience academic difficulty with their graduate studies? Upon matriculation, students often feel that a major life goal has been met; and when they begin having trouble, that can be even more devastating than if it occurred during their undergraduate years. If students are unsuccessful in the graduate PA program and are dismissed due to not meeting academic standards, they are now left with at least three to four years of student loan debt and no degree or future plans. Like the effect that failure to be accepted into the graduate phase has on a student's mental health, dismissal from the graduate PA program can also result in loss of confidence in oneself, uncertainty and anxiety over one's future, sense of embarrassment, and feelings of failure; all of which have a significant impact on a student's mental health.

When viewing the issue from a population perspective, the public contributes to higher education of students through state and federally funded grants, work study, and loans. According to EducationData.org, $120 billion in federal student aid is paid out each year. 71% of college students seek financial aid, and students use that financial aid to pay for 92% of educational costs (Hanson, 2021). When students accept student aid throughout undergraduate, and even graduate, programs and then do not complete a degree; they do not offer the return on investment for taxpayers who contributed to that aid. Certainly, the taxpayers will not directly receive any reimbursement on their investment; but as a society, when a student successfully completes their degree, it allows two things to occur. Graduates can begin paying back their student aid if given as loans, and they will also be able to begin working in their profession, serving a role in society. Physician assistant graduates work in the healthcare field, which is a

commitment to serving the public's health needs. They enter the workforce as highly educated professionals who will contribute to society, both in their work and in their consumption of resources. Compared to those who graduate and begin working as a PA, students who do not complete a degree cannot offer the same contribution to society. When studying college dropouts and their employment and earnings, Giani, Attewell, & Walling (2020) found that, although college dropouts earn less money than those who complete a degree, they still earn more than those who completed no college at all. The researchers considered their incomplete time in college as a steppingstone to achieve a higher paying job. Ideally, students will matriculate into and successfully graduate from a PA program, allowing them to work as a PA and earn the commiserate salary, serving their role in society.

Analysis

The main focus of this research is to determine if admissions criteria including overall GPA, prerequisite GPA, overall course grades (Anatomy, Physiology, and Microbiology), and GRE scores can predict success in a PA program and on PANCE. There are several educational theories that describe how that learning process can build upon, and hopefully predict, future success in an academic setting. These include Experiential Learning Theory (ELT), Goal Orientation Theory, Tinto's Theory of Institutional Departure, and Walburg's Theory of Educational Productivity.

Experiential Learning Theory

Experiential Learning Theory (ELT) is grounded in the work of several 20th century scholars including John Dewey, Kurt Lewin, Jean Piaget, William James, and Carl Jung. David Kolb built upon this theory and, in 1984, he published his theory which includes four stages of

learning. These stages include concrete learning, reflective observation, abstract

conceptualization, and active experimentation (Institute for Experiential Learning, 2020).

He describes this theory as a continuous cycle of the four stages, in which a learner can

enter or exit in any stage (Van Wyk, 2017).

Concrete learning and reflective observation involve initially grasping a concept.

Abstract conceptualization and active experimentation involve taking that concept and

transforming the experience. Concrete learning is when a learner has a new experience or views

an old experience in a new way. Reflective observation is when the learner reflects personally,

using their own experience, to determine what this experience means to them. Abstract

conceptualization is when a learner forms new ideas or changes their existing ideas based on

both experience and reflection. Active experimentation is when a learner takes those new ideas

and applies them in a real-world setting (Institute for Experiential Learning, 2020).

All four of the learning stages in Experiential Learning Theory are commonly seen in

higher education, and especially in science and medical courses. Experience and continuous

building of knowledge is a foundation of medical education. This theory is applied to a

predictive model of PA program and PANCE success in the following way: GPA (including

undergraduate and prerequisite), science course grades, and GRE represent foundational

knowledge, which forms the starting point, or foundation, for future knowledge in the PA

program. Once students matriculate into a PA program, they build upon their foundational

knowledge through reflection, abstract conceptualization, and active experimentation through

their didactic courses, hands-on learning, and clinical rotation experiences. Once completed,

graduates will prepare for and take the PANCE. Upon passing the PANCE, they would then be

permitted to practice medicine. It is called "practicing medicine" for this exact reason. Working

in a medical field requires a commitment to lifelong learning, built on experience and

foundational knowledge. Evaluating admissions criteria as a marker of foundational knowledge

allows programs to choose applicants with the highest chance of future success.

Goal Orientation Theory

Goal Orientation Theory provides perspective on what motivates students to be

successful. This theory describes three goals that students may have when approaching a task:

Mastery, Performance-Approach, and Performance-Avoidance (Madjar, Bachner, and Kushnir;

2012). Students whose goal in class is Mastery wish to acquire new skills or knowledge, build

upon previously learned material, and generally enjoy the act of learning. The goal of

Performance-Approach is seen in students who seek positive evaluations, good grades, or public

recognition of their success. Students whose goal is Performance-Avoidance wish to avoid

negative evaluations, low grades, and fear being perceived as incompetent (Madjar, Bachner, and

Kushnir; 2012). Students who seek admission to a PA program are aware that while admissions

criteria vary among programs, high performance in undergraduate coursework and on

standardized tests is ideal. Many programs have specific prerequisite GPAs, both in general

undergraduate work and specifically in science courses. Some also require a minimum letter

grade for prerequisite science courses, and mandate students achieve a C or better for example.

Programs often require that students take a standardized test, such as the GRE or PA-CAT. As

students prepare to apply to PA programs, they do so with the knowledge of these requirements

in mind and use that knowledge in forming their big goals of matriculating into a PA program,

successfully completing the program, and becoming a practicing PA. Mastery oriented students

approach each task with the goal of completing understanding each topic in their undergraduate

work, knowing that they will need these building blocks to be successful in PA school

coursework as well as in their future career. These students tend to apply their goal of mastery to their courses in PA school as well, diving deeply into each disease process to ensure they fully understand the pathophysiology behind the disease as well as how to properly diagnose and treat them. Performance-Approach oriented students approach tasks with the goal of performing as well as possible, which may include getting an A in the course, scoring higher than their classmate on an exam, or making the Dean's List. These students may study extensively to achieve an A, or they may know that they can achieve an A in a course while putting in very little work. Performance-Avoidance oriented students wish to avoid negative outcomes, such as failing a test or course, being placed on academic probation, or receiving negative feedback from a professor. These students tend to focus on the minimum requirements to pass each test or course and aim to score higher than the minimum requirements, but not necessarily to perform their best. They also avoid participation for fear of negative feedback or public embarrassment if they are incorrect. If a program requires that students achieve a minimum of C on all prerequisite courses, Performance-Avoidance oriented students would aim for at least a C. Whereas, Performance-Approach oriented students would still aim for an A.

Depending on their approach, Performance-Approach and Performance-Avoidance students may or may not truly master the undergraduate coursework material, which if not well understood, could make building upon that knowledge difficult in PA school. For example, if a student who is taking an undergraduate microbiology course studied just enough and memorized the exact material would be on an exam, but never truly understood the structure and function of specific bacteria; later in PA school that student would struggle in pharmacology while learning why certain antibiotics may or may not work to treat those same bacteria. Whereas, mastery-

oriented students would grasp that same concept with less difficulty due to their deeper understanding of the foundational microbiology.

When considering student performance on requirements prior to matriculation in a Physician Assistant program as a predictor of graduate success on the PANCE, Goal Orientation Theory can provide both insights and challenges. If the admissions committee receives three applications and each student is motivated by one of the three distinct goals mentioned above, their course outcomes may be similar, but their motivation and efforts may be quite different. For example, all three students achieved a B in their undergraduate anatomy course. Student #1 is mastery oriented and studied long hours, working hard to ensure they fully understood each concept in detail. While Student #1 would have preferred to achieve an A in the course, they are satisfied knowing they understand the material. Student #2 is Performance-Approach oriented and strove to achieve an A in this course. Student #3 is Performance-Avoidance oriented and knew they needed to achieve a minimum of a C on this course. Students #2 and #3 either studied long hours to achieve their desired grades in the course, or perhaps understanding of the concepts came easy to these students so they didn't need to work as hard to achieve a B in the course. Student #2 is disappointed to achieve a B in this course as they would prefer to get an A as it would be the best possible outcome. Student #3 is thrilled to achieve a B in this course as they outperformed the minimum requirement of a C. These three students may look identical on the application, but their motivation for learning is very different and their likelihood of success in a PA program may also vary, despite their identical grades. This makes student selection for an admissions committee difficult, as the goal is to select the students who are most likely to be successful in the program, on PANCE, and in their careers as practicing PAs.

Tinto's Theory of Institutional Departure

Tinto's Theory of Institutional Departure (1975, 1993) has been tested extensively and is a well-established theory involving student attrition. He identified three sources as possible causes of student departure from college, including academic difficulties, student inability to meet their educational and occupational goals, and failure to become involved with the intellectual and social life of the institution (Tinto, 1975).

Using the Theory of Institutional Departure, Tinto attempted to predict college retention rates using both academic and social factors (Aljohani, 2016). This theory is applied to a prediction model of PA program and PANCE success in the following way: PA programs can use an applicant's history of academic success (or difficulty) as part of the original admissions process. For any students predicted to have academic difficulty during the program, or even fail the PANCE afterwards, early identification and student support can be instituted by the program faculty, with the ultimate goal of providing assistance to the student and improving retention.

Walburg's Theory of Educational Productivity

Walburg's Theory of Educational Productivity (1981) included nine factors that affected a student's ability to learn, and therefore be educationally productive (Neumann, Kauertz, & Fischer, 2012). The nine factors include ability or prior achievement, age, motivation, quantity of instruction, quality of instruction, home environment, school/classroom environment, peer group environment, and the mass media (Walberg et al., 1981). The first three variables listed are inherent traits to the student. Ability or prior achievement applies directly to a prediction model of PA program and PANCE success by assuming a student's past experiences will predict future ones. If a student performed well as an undergraduate by achieving high GPAs, course grades, and GRE scores; it can be assumed they will also perform well in graduate PA school. It can

further be applied for students with academic difficulties by creating an environment in graduate

PA school in which students can be most successful, including extensive quantity of instruction,

excellent quality of instruction, and supportive faculty and classmates. Faculty advising can also

be utilized to assist with time management, counseling students on reducing extracurricular

distractions, remedial instruction, and peer tutoring.

Ethical Implications

Institutions should make every effort to recruit only the most qualified candidates with

the highest chance of success, both for the sake of the program but more importantly for the

student's sake. Graduate PA programs are time-consuming, expensive, and stressful; so, it would

not be ethical to "take a chance" on a student with lower undergraduate grades and GPA. Though

it is always difficult when a student is denied admission to the graduate PA program, it is

seemingly more difficult when a student is admitted, spends time, money, and energy on their

classes, only to fail out of the program a few semesters later. At the point of dismissal, the

student likely feels emotionally and physically exhausted, may suffer from low self-esteem, and

has also spent time and money on courses that did not result in a degree.

PA program faculty and admissions committees, in a way, are seen as gatekeepers to the

PA profession; so it is their responsibility to matriculate, educate, and graduate the best and

brightest students, who go on to pass PANCE, and become competent PAs. Deciding whether to

admit or deny a student into a graduate PA program is not always easy. If the program uses

evidence-based admissions criteria in conjunction with the educational experience and clinical

judgment of the PA faculty, ideally they would be able to select those applicants with the best

chance of success. This is the ethical responsibility of the PA program to protect and maintain

the high standards and excellent reputation of the profession.

If students matriculated into a 3+2 BS/MS program and are struggling to maintain their undergraduate GPA and course grades, advisors have an ethical responsibility to assist students with an academic improvement plan. This may include the use of tutors or other academic support services offered by the institutions. Advisors shouldn't feel required to talk a student into or out of a particular plan; rather they should serve as a supportive role, discussing viable career options and the academic requirements of each.

Policy Recommendations

Institutions must be transparent about admissions criteria when recruiting high school students into 3+2 BS/MS programs, as well as when recruiting graduate students. Those criteria should be made public and readily accessible on the institution's website, as well as described during admissions events. Once programs decide on the admissions criteria that best suit their needs, it is imperative that this information is explained to admissions counselors, so that prospective students and their families are aware of the graduate program requirements.

Institutions must also describe alternate paths for students who may leave a Pre-PA or PA program voluntarily or due to academic difficulty. Advisors should make themselves aware of the academic support services offered by their institution so they can refer struggling students as needed. Advisors should also have discussions with students throughout their undergraduate years about their future graduate school and career plans. These discussions should include the student's academic and career goals, as well as secondary or alternate plans should their first choice not work out. Undergraduate science curriculum should make every effort to align the Pre-PA curriculum with other science or healthcare majors to allow students to switch majors if needed with minimal additional costs or time.

Programs need to conduct their own research and annual reviews of student outcomes to determine what admissions criteria best predict success on PANCE. Data should be analyzed by the program regularly as part of a continuous self-analysis and improvement plan. Programs need to use admissions data to identify potentially at-risk students at an early stage in their graduate education to provide additional mentoring and advisement to optimize their chance of success.

Summary Reflection

The physician assistant profession began in the 1960s, with the first class of PA students matriculating at Duke University in 1965 (PA History Society, 2021). There are currently over 250 PA programs in the United States, which collectively matriculated over 8,100 students in 2017 (AAPA, 2021). Considering there were over 25,000 applicants that year, that equates to a 31.7% acceptance rate (PAEA, 2018). One specific program in the Northeast receives an average of 900 applications every year and accepts 30 of those applicants. The high demand for entrance into a PA program allows programs to be selective in which students they choose, but how do admissions criteria correlate with success on PANCE after graduation?

Physician assistant programs across the nation have a common goal in that they all strive to accept the most highly qualified students who will hopefully be successful in the program and on PANCE after graduation. So how do programs know what makes a student highly qualified? Programs have unique admissions criteria, but some common themes include a minimum undergraduate GPA, possibly with the addition of a minimum science GPA, completion of the GRE exam or another form of standardized exam, patient care hours, letters of recommendation, and completion of certain prerequisite science courses. Some programs even require a minimum grade on those prerequisite science courses to ensure a level of competency is met in that topic.

When studying graduate school in general, the GRE, in conjunction with other factors including undergraduate GPA, does correlate with graduate success; but when researching healthcare-related programs, the usefulness of the exam is less clear. Standardized testing, including the GRE, has been shown to be a barrier for students who identify as underrepresented minorities. Programs that require standardized testing as part of admissions requirements may receive fewer applicants who identify as underrepresented minorities due to this barrier.

Numerous studies show that undergraduate GPA has been shown to correlate with graduate success in various healthcare-related programs. The link, however, between undergraduate GPA and PANCE success is less clear; with some studies showing a correlation between higher undergraduate GPA and higher rates of PANCE success, and other studies showing no correlation. Similar results have been shown with science GPA, with various results. Lower undergraduate and science GPAs have been shown to result in higher rates of student attrition.

Compared to GPA and GRE scores, here has been less research completed regarding performance on undergraduate science courses and its correlation to graduate success. Some studies have shown there is a correlation between higher performance on prerequisite courses and PANCE, and others have shown no link. Some researchers have taken it a step further and identified which individual courses correlate with success.

The point of entry into a graduate PA program may also help predict PANCE success. One study showed that students who were enrolled in a 3+2 BS/MS program had a higher attrition rate than those who matriculated through a traditional route. Those 3+2 BS/MS students who were dismissed due to academic difficulty had a significantly lower science GPA than other students, despite meeting admission standards (Wolf et. al., 2020).

Few studies have been completed that examine how a student's demographic profile correlates with PANCE success. Some studies have shown that being a woman, being older, and identifying as an underrepresented minority are significant predictors for experiencing academic difficulty; but nothing specifically examining a link between demographics and PANCE success was identified (Huff and Fang, 1999).

This review of the literature shows that more research is needed to identify if there are any correlations between GRE performance, undergraduate and prerequisite GPA, undergraduate science course grades, point of entry, and demographics with PANCE performance. Programs should strive to identify which criteria best predict PANCE success in their own students when determining their own admissions criteria. This may help to identify which applicants will be most successful. In addition, it may help to identify at-risk students in need of additional mentoring or support. When recruiting high school students to enter through a 3+2 BS/MS program, admissions counselors should be familiar with not only the undergraduate admissions requirements, but also the graduate PA program requirements. Institutions should also be transparent about the graduate PA admissions criteria on their website and during admissions events so that applicants have a full understanding of what is needed for admission. Institutions should consider the impact of students needing to repeat coursework if unsuccessful on the first attempt. Not only is there a financial impact on both the student and the institution; there may also be psychological ramifications including increased stress and anxiety, in addition to issues with self-esteem and feelings of inadequacy. Combined with increased time and money spent on the student's part, this may ultimately lead to student attrition. At the institution level, students needing to repeat coursework puts additional strain on faculty and advisors, as well as other student support services such as the counseling center. Early undergraduate advisement may help

students to not only become familiar with graduate program admissions requirements, but also with other potential options and majors at the institutions should the student be unsuccessful in meeting those requirements. Not only do programs seek to admit and graduate students with the best chances of success in the program and on PANCE; as educators, student wellness is always a priority, and they want to see students find success in whatever path they choose.

About the Author

Abigail Davis is a physician assistant-certified (PA-C) and the Marywood University Physician Assistant Program Director/Assistant Professor of Practice. She has practiced as a PA-C since 2006 in Emergency Medicine in Scranton, PA. Abigail began her career in academia in 2012 at Misericordia University, where she served as Director of Didactic Education. She returned to her alma mater, Marywood University, in 2014 to teach full-time in the PA Program, where she has served as a Clinical Coordinator, Academic Director, and now Program Director. Abigail earned both her BS in Health Science and MS in Physician Assistant Studies from Marywood University in 2004 and 2006 respectively and is now a doctoral candidate seeking her PhD in Strategic Leadership and Administration also from Marywood University. She lives in Dunmore, PA with her husband, Bobby, and their five children.

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