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An Examination of the Relationship Between Physician Assistant Program Characteristics and Performance on the Physician Assistant National Certifying Examination

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AN EXAMINATION OF THE RELATIONSHIP BETWEEN PHYSICAN ASSISTANT
PROGRAM CHARACTERISTICS AND PERFORMANCE ON THE PHYSICIAN
ASSISTANT NATIONAL CERTIFYING EXAMINATION

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ABSTRACT

One of the most highly regarded indicators of a physician assistant (PA) training

program's quality is the record of success of its graduates in passing the Physician Assistant

National Certifying Examination (PANCE). Similar to other professional examinations such as

the bar examination and the certified public accountant examination, the PANCE can provoke a

great deal of anxiety for both new graduates and program administrators. Successful completion

of the PANCE is a prerequisite for licensure in all 50 states and represents a final hurdle for

students seeking to begin their new healthcare career.

To promote transparency and to protect consumers, the Accreditation Review

Commission on Education for the Physician Assistant (ARC-PA) requires that all PA programs

publicly display their program's PANCE pass rate data for the past 5 years. The Physician

Assistant Education Association (PAEA) requires that PA programs complete annual reports

related to curriculum, administration, and personnel, making a wide variety of statistical data

available for public review. Information presented includes admissions requirements, program

duration, faculty-student ratios, the proportion of faculty having a doctoral degree, and the length

of time a program has been in operation. Unfortunately, there have been relatively few studies

that have attempted to determine whether any of these factors predict successful outcomes for

PA programs.

To date, most studies that have examined predictors of success on the PANCE are either

very dated, are limited to single institutions, or have explored only individual program

characteristics such as student GPA or admissions criteria. There has not been a recent large-

scale, systematic study which has attempted to determine whether any relationships can be drawn

between readily available public data and PANCE performance. This study examined data from

all PA programs with 5 or more years of PANCE data to determine whether a relationship exists

between required clinical experience, student to faculty ratios, duration of the program

curriculum, faculty credentials, and 5-year PANCE average pass rates.

ACKNOWLEDGMENTS

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CHAPTER 1–INTRODUCTION

Background

It is rare that an individual is presented with the opportunity to develop an entirely new profession, but that was precisely the challenge that Eugene Stead, MD, faced in the mid-1960s. Stead was serving as the chairman of the Department of Medicine at Duke University, and he was acutely aware that there were large swathes of medically underserved rural areas spread throughout North Carolina. Many physicians and policymakers around the nation had been arriving at a similar conclusion: Clearly, there must be a way for a world power like the United States to provide better access to healthcare for its citizens.

Stead began with an effort to found what would have likely become the nurse practitioner profession. He found a willing partner for his vision in Thelma Ingles, RN. Ingles was a registered nurse, a recognized nursing education leader, and a consultant for the Rockefeller Foundation. Over the course of her career, she cultivated an interest in developing an advanced medical role for nurses. In 1958, she attempted to develop a master's degree program to provide nurses with advanced skills, but the program was denied accreditation by the National League of Nursing (Physician Assistant History Society, n.d.). She remained undaunted in her belief that nurses with advanced training were a natural fit for the health care provider void that Stead sought to fill. Having nurses as students was an attractive possibility for Stead since they already had received substantial experience in a patient care environment. Stead and Ingles collaborated to create a prototype program to provide advanced medical training for nurses at Duke. Both Stead and Ingles were pleased with the outcome of the training process, but again the National League of Nursing refused accreditation on the grounds that delegating medical tasks to a

nursing professional was inappropriate. The effort was therefore abandoned (Hooker et al., 2017).

Like many visionaries, Stead persisted and explored other options. He had been involved in medical education at Emory University during World War II and recalled the streamlined education that was needed to supply physicians for the war effort. Out of necessity, the standard 4-year medical curriculum was compressed to produce a physician workforce sufficient to meet both domestic and military needs (Piemme et al., 2013). In addition, the physician shortage saw medical students successfully assigned to duties that graduate physicians had traditionally performed. Stead noted that while typical medical students lacked the level of patient care experience that nurses would usually have, they nevertheless quickly developed into competent clinicians with appropriate, intensive training. Stead consequently decided that substantial previous nursing experience might not be necessary to produce a competent primary care clinician. He examined the abbreviated medical curriculum he previously developed and enrolled four former Navy corpsmen into his program at Duke University in 1965. Two years later, the first class of three physician assistants (PAs) graduated in October 1967 (Hooker et al., 2017).

Five decades later, the United States still struggles with the question of how to provide basic medical services to its residents. Medicine has become increasingly complex, both in terms of technology and the bureaucracy that has grown around it to support it. And the PA profession has followed suit, blossoming from one program with three graduates to over 235 programs and almost 123,000 PAs currently certified for practice (NCCPA, 2019).

PA Educational Programs

The history of oversight for PA education is fairly complex. As the new profession began

to grow, it became clear that some measures would be required to ensure the quality of

developing programs and to protect the public by ensuring that entry-level clinicians were

competent to practice. Beginning in 1971, the American Medical Association (AMA) developed

the document "Essentials of an Accredited Program for the Assistant to the Primary Care

Physician" (Piemme et al., 2013). Over the ensuing decades, oversight passed among several

AMA committees before finally being passed to an independent agency, the Commission on

Accreditation of Allied Health Education Programs (CAAHEP), in 1994. In 1995 the

Accreditation Review Commission on Education for the Physician Assistant (ARC-PA) was

incorporated, and it assumed sole oversight for the accreditation of PA educational programs in

2000. (ARC-PA History, n.d.)

The ARC-PA publishes and regularly updates Accreditation Standards for Physician

Assistant Education (the "Standards") currently in their fourth edition. The Standards address all

aspects of program operation, including administration, budgeting, the admissions process, the

curriculum, and student clinical experiences. Compliance with the Standards is monitored

through required annual reports and a self-study and site visit process, which occurs

approximately every 10 years. Non-compliance with the Standards usually results in a program

receiving citations that must be addressed. Significant citations result in a program being placed

on probation; failure to take prompt, satisfactory corrective action may lead to loss of

accreditation.

Compliance with the Standards remains a source of anxiety for PA program

administrators. Paradoxically, one of the large challenges in meeting the Standards is that many

of the requirements are relatively non-prescriptive. The ARC-PA recognizes that from its origination, the PA profession was designed to train healthcare providers for underserved areas. The ARC-PA has therefore been reluctant to create barriers that might prohibit a program from opening in a resource-challenged area. As an example, while other healthcare education accreditation agencies may require that a clinician-in-training work with 100 pediatric patients, the ARC-PA instead requires that PAs in training see "sufficient" patients to meet "program defined" goals (ARC-PA, 2010). While at a superficial glance this latitude may appear to be a blessing, it presents a significant challenge to a program administrator. The program must not only meet goals, but it must also establish those goals, justify why those particular goals were selected, and then establish and justify benchmarks indicative of success. In essence, the ARC-PA does not tell a program what to do—it asks a program several complex questions: what it is doing, why it is doing what it is doing, and how does the program know it is achieving what it thinks it is achieving?

Traditional medical school training models generally supply two years of didactic training in the basic sciences, followed by two years of clinical training through various medical settings, such as internal medicine, surgery, pediatrics, women's health, emergency medicine, and psychiatry. Modeled as it is after medical education, the experience of PA students is somewhat similar to that of medical students. There is typically a didactic experience ranging from 12 to 18 months that consists of training in the basic sciences. This is followed by an additional 12 to 18 months in the clinical setting rotating through the same specialties that medical students rotate through (PAEA, 2018). To a casual observer, there may be few dramatic differences noted between the initial training of physicians and PAs.

Going deeper than this casual observation reveals a fairly significant difference from medical education. While the required prerequisite courses and the curricula of most medical schools remain fairly similar, there is tremendous variability in PA education. PA programs are remarkably diverse and exist in all manner of institutions, sponsored by community colleges and Ivy League institutions alike. The duration of the training program can vary by as much as a year. Even the credentials awarded for the completion of a PA program have ranged from a completion certificate to a master's degree, although the master's degree will soon become the required credential that must be awarded by all PA programs that wish to maintain accreditation (ARC-PA, 2010).

One common element of all PA education programs is that they culminate in a need to successfully pass a board examination to eventually become licensed. Accreditors, faculty, administrators, students, and applicants view the success of a program's graduates in passing this examination as an important marker of program quality.

The Physician Assistant National Certifying Examination (PANCE)

The licensure and practice of PAs is regulated on a state-by-state basis and is usually controlled by the same entity that regulates physician licensure, typically a medical board or board of medical examiners. While physician licensure and practice are typically fairly uniform from state to state, there exist significant variations in PA scope of practice. Some states limit the numbers of PAs that can work with a physician, and others have varied requirements for writing prescriptions. Residency and fellowship programs exist for graduates of PA programs, but completion of such programs is not currently required for practice. Similar to many other healthcare professions, one significant step a PA must complete to help determine readiness for

entry-level practice is the passage of a board examination. In the case of PAs, the required

examination is the Physician Assistant National Certifying Examination (PANCE), which is

administered by the National Commission on Certification of Physician Assistants (NCCPA).

The nature of the PANCE has evolved somewhat over the history of its administration. In

its early years, it was administered over the course of two days and consisted of both

standardized multiple-choice questions and simulated patient encounters. In the 1990s, as the

accreditation process for PA programs became more rigorous, it was felt that the programs could

serve as sufficient judges of clinical skills, and the patient simulations were discontinued. At

present, the examination is administered via computer and consists of approximately 300

multiple choice questions oriented toward primary care medicine. Only graduates of an ARC-PA

accredited program are eligible to take the PANCE. All U.S. jurisdictions require passage of the

PANCE for a candidate to be eligible for licensure as a PA. Graduates may attempt the

examination up to six times and must successfully complete it within 6 years of graduation.

While individual test takers are obviously very invested in their success on the PANCE,

PA programs also have a great deal of concern about results. The ARC-PA requires that all

programs publicize on their website the success rates for their last 5 years of graduates in passing

the PANCE. Any program that graduates a cohort with a pass rate below 85% is required to

submit a report to the ARC-PA analyzing a likely cause for the low pass rate and outlining steps

that will be taken to improve the pass rate (ARC-PA, 2010).

For good or for ill, the PANCE passage rate of a program has come to be viewed as a

critical marker of program quality, and the passage rate is one of the first items that prospective

applicants evaluate in investigating programs. Programs may choose to publicize other

statistics—such as the success of graduates in finding job placements—but the PANCE passage

rate remains the primary ARC-PA required component, and programs exert a great deal of effort to maximize this statistic.

PA Program Growth

The addition of a PA program to an academic institution's inventory generally represents an attractive revenue source. For the last decade, the increasing demand for health providers has caused many mainstream publications to declare the PA profession to be a highly desirable career option ("U.S. News," 2019). In times of economic uncertainly, a career in a health profession may provide a measure of security that may be lacking in other disciplines such as business or law (Kiviat, 2008). A PA program also will not usually require the same level of expense and sophistication that would be needed to launch a medical school. The most complex element (and often a rate-limiting factor in terms of program size) tends to be the ability to develop a relationship with sufficient healthcare systems to ensure clinical placements for students as required by accreditation standards.

The ARC-PA (2019) predicts continued rapid expansion of PA training programs. Figure 1 illustrates program growth over the past 30 years. At the time this study was conducted, there are 243 programs in various stages of the accreditation process. Based on applications from institutions to open new programs, the ARC-PA is projecting that there will be 301 programs in operation as of April 2024.

Figure 1

Number of Accredited PA Programs. ARC-PA (2019a).

Accredited Programs 9/1991 - 3/2019
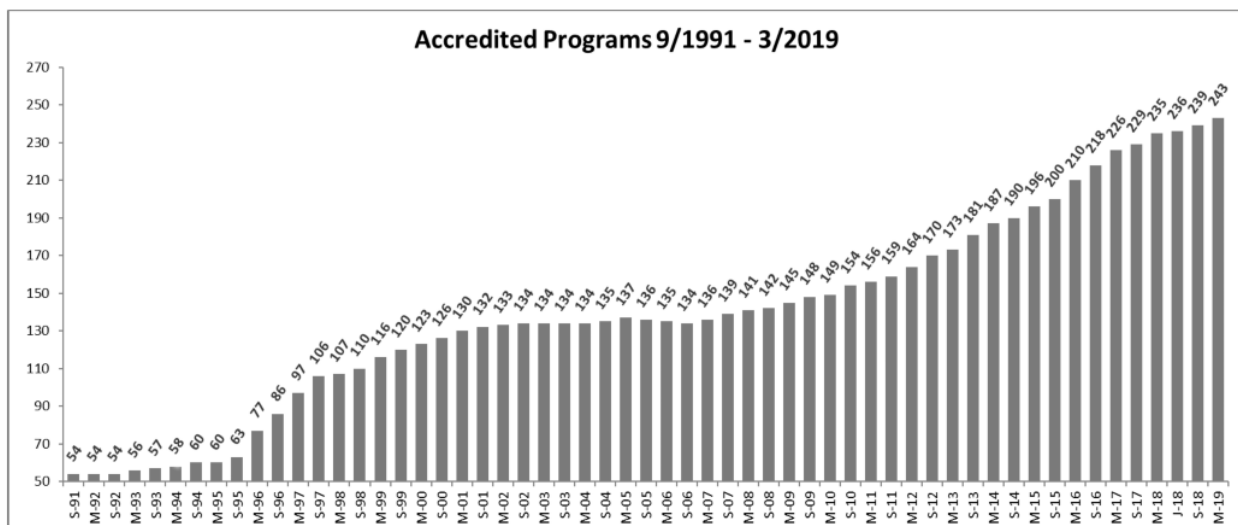
Note. From *Number of Accredited PA Programs*, by ARC-PA, 2019 (http://www.arc-pa.org/ accreditation/ resources/program-data/). Copyright 2019 by ARC-PA. Reprinted with permission.

The Controversy Over Student Demographic Changes

As initially conceived by Stead, the PA profession was intended to serve as a second career for people who already possessed relatively significant experience with some type of hands-on patient care. The earliest PA students were typically former military medics and corpsmen who had seen combat experience in Korea or Vietnam. This being the case, the earliest PA students were overwhelmingly male, had significant hands-on patient care experience, and were somewhat older than the student population entering medical school who typically enter directly following their undergraduate education in their early 20s.

The PA profession has grown and matured over the past 50 years, leading to some demographic changes. One change is that the average age of students is growing younger. PAEA data indicate that the average age of entering students was approximately 30 years old in 1997. Follow up surveys indicate that this dropped to 26 years old in 2015. (PAEA, 1998, 2015).

Like their medical school peers, many students are now entering PA school immediately after

their undergraduate education.

Another significant change is the amount of healthcare experience that applicants bring to

the table. The earliest data available from PAEA indicate that matriculated students averaged

around 5600 hours of healthcare experience in the 1983–1984 academic year (Figure 2).

Figure 2
Total Health Care Experience Hours Gained by PA Program Matriculants, 1984–2011. PAEA.
(2012).
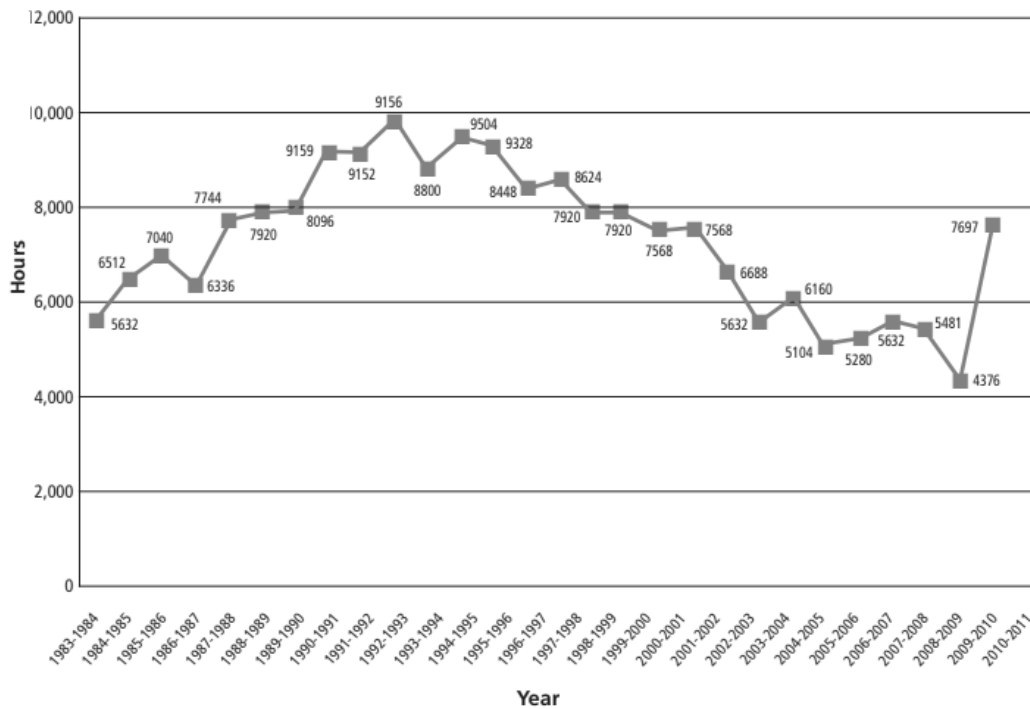
Note. From *Total Healthcare Experience Hours Gained by PA Program Matriculants, 1984-*
2011, by PAEA, 2012 (https://paeaonline.org/wp-content/uploads/2016/10/29th-Annual-
Report.pdf). Copyright 2012 by PAEA. Licensed under CC BY-NC-SA 4.0.

Experience peaked over 9000 hours in the early 1990s before beginning a slow decline to

approximately 4400 hours in the 2008–2009 academic year. After a rebound to approximately

7700 hours in the 2009–2010 academic year, experience again began to fall, most recently

leveling below 3,000 hours (Table 1).

Table 1
Average Matriculant Healthcare Experience, 2012–2017

Academic Year	Average Matriculant Healthcare Experience
2016–2017	2891 hours
2015–2016	2875 hours
2014–2015	3138 hours
2013–2014	3100 hours
2012–2013	3000 hours

Note. Data from PAEA By the Numbers: Program Report 33; By the Numbers: Program Report 32; By the Numbers: Program Report 31; By the Numbers: Program Report 30, 29th Annual Report. Retrieved from: https://paeaonline.org/research/program-report/

Some PAs have found the changing demographics of the PA student population alarming

and believe that the admission of younger, less experienced students damages the profession,

leading to some sharp exchanges at professional conferences and in online fora:

Figure 3

Posted November 15, 2018   Report post

> On 10/31/2018 at 10:31 AM, Notfall said:
>
> I think a lot of people forget that the **traditional** path still remains high school, bachelors in biology, PA program. Too many people are recommending nursing school, resp tech, all these positions that require huge commitments. As they are valuable, I think the most straight forward path to take is ER tech. There's no prior experience required and regardless of the school they will award you greatly for the experience.

I think you misspelled "shortcut": *Traditional* is that PAs are mid-career medical professionals. *Current* is that they are inexperienced <25 year olds with awesome GPAs and minimal healthcare experience.

On 11/15/2018 at 2:05 PM, rev ronin said:

I think you misspelled "shortcut": *Traditional* is that PAs are mid-career medical professionals. *Current* is that they are inexperienced <25 year olds with awesome GPAs and minimal healthcare experience.

Exactly. Could not agree more. The traditional applicant is a person with prior significant medical experience.

In answer to the question posed by the OP, the top performers in my class of 80 were medics, resp therapists, and RNs/LPNs, In fact, based solely on GPA at graduation, #s 1-3 were paramedics and 4-10 were nurses and resp therapists. There was a DIRECT correlation in my class between intensity/duration of prior experience and GPA. Our top student was a 10 year paramedic(not me) and our worst student was a 21 year old emt(it was a BS program at the time).

Note. Postings from *PhysicianAssistantForum.com*, 2018 (https://www.physicianassistantforum. com/topic/48781-aoa-warning-on-pa-independence/page/3/ ?tab=comments#comment-422392).

Such PAs believe that there is a strong correlation between prior healthcare experience and success in PA school. They feel that since the profession was initially conceived as a second career for other types of healthcare providers, accepting students with less experience moves the profession away from its roots. As indicated in the online forum postings, they are concerned that PA programs are beginning to value academic performance over healthcare experience in setting admissions criteria.

PA education currently finds itself divided over healthcare experience. All programs view hands-on healthcare experience as a positive and, all other things being equal, look favorably upon applicants with increased experience. While many long-established programs still require substantial (2,000 hours) experience, an increasing number of programs require much less, and some programs require none at all. Unfortunately, programs are currently making decisions related to an appropriate amount of required healthcare experience in the absence of data to support their decisions.

Statement of Problem

As illustrated, PA training programs demonstrate a remarkable degree of variability in their prerequisite requirements, curriculum, and other program characteristics. Explosive growth within the profession is leading to the founding of many new PA training programs. Institutions are making decisions related to the nature of these programs with little solid data to guide their decision-making process.

As an example, when a program is in development, how does one best determine the duration of the curriculum? All things being equal, one might expect a longer program to have improved outcomes since students will usually have additional clinical experience and contact time with the material. Recent research suggests that this may not be the case. Furthermore, as Colletti, Salisbury, Hertelendy, and Tseng (2016) noted, there are personal and societal costs associated with attending a longer program. Tuition is generally higher, and there is a delay in getting needed clinicians into the workforce.

An institution developing a program might believe that attracting faculty who possess more advanced academic credentials should be able to provide higher quality education. Such an assumption fails to consider the possibility that faculty with advanced credentials may be more driven toward research activities while faculty with a less impressive pedigree might be able to devote more time to the close, careful instruction of their students, thereby improving outcomes.

Perhaps most contentious is the debate related to the necessity of healthcare experience. It seems intuitive that additional healthcare experience would be valuable. It is not often acknowledged that highly experienced candidates may have developed deeply ingrained bad habits and may possess a dangerous level of overconfidence in their abilities.

There is a large—but manageable—data set available related to PA education. The lack of any current and meaningful comprehensive analysis presents a very real obstacle to institutions as they seek to develop programs or improve outcomes in currently existing programs. Now that the PA profession is over 50 years old and fairly robust data collection has been ongoing for two decades, sufficient data should exist to begin answering some of these questions.

Research Questions

What is the relationship between the following program characteristics and program 5-year average pass rates on the Physician Assistant National Certifying Examination (PANCE)?

1. Required healthcare experience

2. Duration of the program in months

3. Student to full-time faculty ratio in the program

4. Proportion of full-time faculty possessing a doctoral degree

Significance

As noted, the number of PA educational programs is growing rapidly, but as institutions are developing these programs, they are doing so largely in the absence of data to suggest characteristics that might be predictive of success. Many of the decisions come with a considerable cost, either to the institution or to a potential student.

Healthcare Experience

Exposure to the healthcare environment is extremely valuable to a student considering a career in the healthcare field. It can help to ensure that a student fully understands the

commitment required in terms of time and effort and that a potential clinician is fully aware of the complications and frustrations inherent in working in healthcare. Healthcare experience is also commonly viewed as evidence that a student has begun to develop the interpersonal skills necessary to thrive in a healthcare setting.

A significant downside to a healthcare experience requirement is that it may also act as a barrier to entry to a PA program. In recent years, the profession has begun to express concerns about diversity within the profession, and the upcoming fifth edition of the ARC-PA standards demand that programs document efforts to recruit a more diverse student body (ARC-PA, 2019). Effectively doing so suggests a need to decrease barriers to admission. In many cases, working to gain healthcare experience necessarily competes for the time needed to perform well academically.

It is essential that programs determine the real value (if any) of healthcare experience for program outcomes. If healthcare experience has a significant effect on PANCE scores, programs that require higher levels of experience would be expected to perform better on the PANCE.

Duration of the Curriculum

There are both personal and institutional costs associated with the length of a program. From a student's perspective, more semesters of school means more tuition dollars spent. From an institutional perspective, a longer curriculum leads to an increased need for instructors, teaching space, and clinical placements, all of which come at a cost. Unless a positive correlation can be shown between a PA program's duration and its outcomes, increasing the length of a PA program will be associated with decreased cost-effectiveness.

Given the wide variation in the duration of PA programs, it would be valuable to know whether the length of a program is correlated with positive outcomes. This study intends to help fill this gap in the literature.

Student to Full-time Faculty Ratio

It can be challenging to recruit PAs to make the switch from clinical practice to a career in PA education. Experienced PAs generally command a six-figure salary in clinical practice; the Bureau of Labor Statistics (2018) cited a mean annual wage for PAs of $108,610. To attract faculty, educational institutions must try to approach this salary. The ARC-PA requires that certified PAs be on the faculty of each program, but it does not require a specific student-to-faculty ratio. Applicants view small class sizes and higher student to full-time faculty ratios as markers of quality, and common ranking systems also use these as factors in determining institutional quality (U.S. News and World Report, 2019).

An increased number of full-time faculty comes at an obviously increasing cost to an institution, a cost that is eventually passed to students through tuition expenses. It would be valuable to determine whether the student to full-time faculty ratio has a demonstrable impact on student outcomes.

Proportion of Faculty Possessing a Doctoral Degree

Another factor sometimes used in determining the quality of an educational institution is measuring the proportion of faculty who have earned a doctoral degree (U.S. News and World Report, 2019). Faculty with a higher level of educational attainment have more experience in an educational environment and are potentially more skilled at delivering a curriculum. Advertisements for PA faculty in recent years have increasingly expressed a desire for doctoral-trained candidates, but only 1.7% of PAs possess a doctoral degree (NCCPA, 2017).

Two issues face programs that insist on hiring only doctorally-prepared faculty. First, as noted above, doing so can severely limit the applicant pool. Requiring a doctoral degree may exclude candidates with extensive and valuable clinical experience. It may also hamper a program's efforts to recruit more diverse faculty. Second, doctorally-trained faculty can presumably pursue a higher rank and command a greater salary, putting an increased financial burden on the program.

Limitations

There are several limitations to this study. First, while it will be the broadest study to date, it does not represent a global survey of PA educational programs. The study was limited to programs that had 5 years of PANCE data available, effectively excluding programs that have been established within the last 7 years. The study anticipated a sample size of approximately 180 programs.

Several other studies have attempted to identify the characteristics that can predict success on the PANCE. The ability to successfully do so has proven elusive. In part, this may be due to the overall heterogeneity and complexity of PA education. For example, even though two programs may have the same length, they may be in urban and rural settings and have radically different curricula. As a study intended to be broad rather than deep, this study did not explore this level of complexity.

It should be recognized that PA students usually enter PA programs from much more heterogenous backgrounds than medical students come from. A typical medical student enters medical school directly from their undergraduate institution. While this has become more common in PA education, there are still a substantial number of enrollees who enter the PA

profession after having practiced as another healthcare provider. The very heterogeneous backgrounds presented by PA students will influence PANCE performance and may complicate an analysis.

Finally, there is a very real concern that standardized examinations may not provide an accurate measure of competence of programs or of individual graduates (Pophal, 1999). A standardized examination represents a very artificial experience compared to the competencies required to function in a clinical environment. Such an examination may measure little more than a candidate's ability to successfully complete a standardized examination and may speak little to the complex technical and interpersonal skills needed to function in a healthcare environment. Perhaps our greatest error is placing too much emphasis on the PANCE as a marker of quality.

Delimitations

As noted, this study was limited to programs for which there is an available 5-year PANCE score report. Developing a new program is challenging, and it takes some time to examine a cohort's performance and adjust to improve a curriculum. Limiting the study to programs with at least 5 years of graduating cohorts helps to ensure that a program has had time to implement the desired curriculum.

The study also excluded several programs where students are only admitted as first-year students undergraduate and then complete their undergraduate and graduate degrees in sequence. Such programs do not admit applicants to the graduate, professional phase of the program and therefore lack data related to application requirements.

Definition of Terms

Accreditation Review Commission on Education for the Physician Assistant (ARC-PA): The organization responsible for accrediting PA educational programs in the United States.

Doctoral Degree: –While a number of PA faculty have earned a traditional doctoral degree such as a Ph.D. or an Ed.D., there are also a wide variety of clinical doctoral degrees that faculty have earned, including Doctor of Health Science (DHSC), Doctor of Medical Science (DMS and DMSc), and Doctor of Medical Humanities (DMH). There are also a number of Doctors of Medicine (MD) and Osteopathy (DO) serving as faculty in PA programs. For the purposes of this study, all represent education beyond that required to practice as a PA, and all were considered doctoral degrees. The American Academy of Physician Assistants regards the master's degree as the appropriate terminal degree for PAs.

National Commission on Certification for the Physician Assistant (NCCPA): The body that certifies PAs. A certified PA is permitted to use the designation "PA-C" following their name in a professional setting. The NCCPA develops and administers the PANCE and establishes and enforces requirements for continuing education and ongoing certification.

Physician Assistant (PA): An individual who has completed a PA training program and is licensed to practice medicine in collaboration with a physician. A PA's responsibilities may vary from state to state, but they are usually authorized to approach patients to take histories, perform physical examinations, order and interpret diagnostic studies, prescribe treatments, and assist in surgeries.

Physician Assistant Clinical Knowledge Rating and Assessment Tool (PACKRAT): A standardized, computer-based formative examination produced by the PA Education

Association. The PACKRAT was first released in 1996 and is widely administered across PA programs as a formative assessment tool to track student progress.

Physician Assistant Education Association (PAEA): The professional organization representing PA educators and educational programs. The PAEA conducts research related to PA education and establishes best practices. All accredited PA programs are members of the PAEA. This organization was formerly known as the Association of Physician Assistant Programs.

Physician Assistant National Certifying Examination (PANCE): The standardized examination administered by the NCCPA that all PA program graduates must pass to become eligible for licensure. To be eligible for the examination, candidates must graduate from an ARC-PA accredited program.

PANCE Score: Students are presented with a numerical score related to their PANCE performance. Scores fall between 200 and 800, with a minimum passing score around 360. The NCCPA does not release information related to how the percentage of questions answered correctly is reflected by this scaled score.

Summary

This study provides data useful to institutions as the PA profession continues to grow. Studies have previously attempted to identify characteristics associated with success on the PANCE, but such studies have been limited in size and scope and many were conducted years ago when the number of programs in operation was much smaller. Over the past three decades, almost 200 new programs have determined prerequisite requirements and developed curricula without any solid evidence of factors that might contribute to improved outcomes. As noted, there are a large number of PA programs currently in development. What are the essential

characteristics to look for in applicants? How can these programs best structure their curriculum? How do they make an argument to their administration regarding the optimum number of students and faculty for the program? A great deal of data is available from the PA Education Association and other sources, but it has not been systematically examined and linked to outcomes in recent years.

This study is the broadest study conducted to date. There have been similar, earlier studies, but they were conducted at a time when there were many fewer PA programs. Most recent studies have examined single aspects of single programs and lack generalizability to other PA programs.

CHAPTER 2–REVIEW OF RELATED LITERATURE

Essentially all significant literature related to PA education is contained within *The Journal of Physician Assistant Education* (JPAE)—formerly *Perspective on PA Education*— the official publication of the PA Education Association (PAEA). To date, studies that have examined predictors of success on the PANCE have been fairly limited in one respect or another. In general, there have been two broad classes of studies.

The most common class of study seeks to identify characteristics of students that are predictive of success on the PANCE. Studies have examined a wide variety of variables, including undergraduate GPA, program GPA, GRE scores, and scores on a variety of standardized and program-specific examination. These studies look through the lens of the program to characterize students at risk of poor performance on the PANCE. The implication is that these students will not be selected for admission to a PA program, or, if admitted, early intervention can occur to increase the possibility of successful remediation. The majority of recent studies are of this type and, in many cases, the inclusion of factors unique to a program— such as GPA or test scores—limits generalizability.

The second class of study seeks to identify characteristics of programs that are likely to lead to success on the PANCE. There are two primary limitations to the data provided by these studies. First, many were conducted a long time ago. The second limitation follows from the first: A long time ago, there were far fewer PA programs, so the sample size was smaller. The literature review examined both classes of studies.

There are several studies that have attempted to be comprehensive, but they were conducted years ago when the number of PA programs was dramatically smaller. More recent studies have tended to have been conducted by faculty focusing on unique aspects of their own

program—such as performance in a course or their students' GPAs—as predictors of PANCE scores. Due to the variability between programs, findings from these studies would likely lack generalizability.

Healthcare Experience

The relative importance of healthcare experience remains an intense topic of debate in PA education. Unfortunately, it also represents a gaping hole in the literature. As noted by Hooker, Cawley, and Asprey (2010),

> Although most [PA] programs emphasize prior health-related experience as a requirement for admission, the literature demonstrating the utility of this requirement is almost nonexistent. There is no indication that students need prior healthcare experience in order to succeed in PA school and practice.

In the 10 years following the above statement, only a single study has tried to address the importance of healthcare experience.

Hegmann and Iverson (2016) conducted a single institution multiyear retrospective cohort study that sought to determine whether there was a relationship between healthcare experience and two independent variables: preceptor evaluation of student performance while on clinical rotations and performance on a practical examination. The authors concluded that their "5-year single institution sample did not support the hypothesis that previous direct healthcare experience is associated with improved outcomes in PA students, as measured by either clinical year preceptor evaluations or by standardized patient examinations" (Hegmann and Iverson, 2016). The scatterplot graphs included with their study indicated that the poorest performing individuals on both measures were actually students with the most experience.

Park, DaSilva, Barnes, Susarla, and Howell (2010) sought to identify a relationship between previous dental assistant experience and dental student performance at Harvard Dental School. Like the Hagemann and Iverson study, this study was limited by cohort size—159 students—and the fact that it examined a single institution. The authors performed a bivariate analysis to determine whether a relations ship existed between dental assisting experience and performance in each of the preclinical and clinical courses. No significant relations were identified, leading authors to conclude that the predictive value of assisting experience was negligible. In their discussion, the authors noted that their study was further limited by failing to consider the length of earlier experience. Students self-reported the data and were not asked to quantify the duration of their experience.

Program Duration

Determining an appropriate length for a PA training program is understandably daunting. The corpus of knowledge and necessary procedural skills that must be taught have grown dramatically since the PA profession was conceived in the 1960s. As an example, it is becoming routine for modern students to be exposed to the use of ultrasonography, a technology that did not exist in the early years of the profession. It seems natural to assume that a longer program must necessarily be better, but it is important to consider that there are negative effects associated with longer programs, including the increased cost to individual students and a delay in the ability to deliver clinicians to the underserved areas where they are most needed (Colletti et al., 2016). It is only practical to extend a PA curriculum so long; beyond a certain limit, the length will become comparable to medical school. The PA profession was designed to produce practitioners efficiently. There is a threat that if the duration of PA school approaches that of

medical school, there simply will not be a need for the profession; students may as well just attend medical school.

A PubMed search conducted using search terms "physician assistant" and "program length" found only a single article by Colletti et al. (2016). Truncating "program length" to "length" produced 59 articles, but only the original article identified was relevant to this study. An additional search for "program length" and "PANCE" failed to identify additional articles. A similar search conducted through the website of the *Journal of Physician Assistant Education* found two additional studies that examined the effect of program length on PANCE outcomes.

One of the earliest studies to examine program characteristics predictive of PANCE success was conducted by McDowell, Clemens, and Frosch (1999). The study examined 38 programs at a time when there were approximately 125 programs in existence. Programs were aggregated into three groups: those less than 24 months in length, those equal to 24 months in length, and those greater than 24 months in length. A one-way ANOVA was conducted and failed to identify a relationship between program length and PANCE performance. The authors concluded that program length did not have a significant impact on PANCE pass rates.

The next study to examine the relationship between program length and PANCE performance was conducted by Asprey and Dehn (2004). The authors were primarily interested in comparing masters-level programs with non-master's degree programs, but the length of the program was included as the master's degree programs tended to be approximately 3 months longer than non-master's programs. The study examined cohorts graduating in 1990, 1995, and 2000; no statistically significant effect of program length was identified, leading the authors to conclude that program length did not affect PANCE pass rates.

In 2016, Colletti et al. conducted a study focusing exclusively on the relationship between PA program length and PANCE outcomes. The study noted the relative dearth of previous studies examining the issue. The study examined the largest cohort of PA programs to date, with 108 programs included. The study looked for correlations between PANCE performance and total program length, length of didactic coursework, and length of clinical coursework. Again, no statistically significant relationship was found. The authors concluded, "The implications of this student suggest that shorter PA programs prepare students to pass the PANCE and enter the workforce as effectively as longer programs." (Colletti et al., 2016).

Student to Full-time Faculty Ratio

It seems intuitive that a lower student to full-time faculty ratio might be linked to improved outcomes. A PubMed search using the terms "PANCE" and "ratio" discovered a single study (Bushardt et al., 2012) that seemed to indicate that this may, in fact, be the case. The study used publicly available databases to obtain information related to the number of students, number of faculty, faculty credentials, degree conferred by the program, and PANCE performance. The study obtained data from 152 PA programs, which represented a fairly comprehensive sample at the time of data collection in 2010. Linear regression determined that the student-faculty ratio was a significant predictor of PANCE performance. The authors concluded that improving the student-faculty ratio may have a positive effect on a program's PANCE pass rate.

Proportion of Faculty Possessing an Earned Doctoral Degree

There is an apparent assumption in PA education—and perhaps all of higher education— that faculty with doctoral degrees are superior to those who lack doctoral degrees. As evidence of

this, Van Rhee and Davanzo (2010) proposed creating a ranking system for PA programs that examined faculty credentials as a criterion. A popular method that applicants currently use in assessing PA program quality is reviewing the *U.S. News and World Report* "Best Health Schools" rankings that are produced every three years. Data are collected by presenting PA program directors with a list of all currently accredited programs in the nation. Program directors are asked to provide an assessment of the quality of each program on a 1–5 scale. Given the unscientific nature of this ranking system, Van Rhee and Davanzo developed a new ranking system, one vital component of which was the number of doctorally-trained faculty in the program.

A PubMed using the terms "PANCE" and "credentials" returned 13 results; only two of these (Bushardt et al., 2012; Colletti et al., 2006) were relevant to the topic of advanced degrees among PA faculty. A search for the terms "PANCE" and "doctoral" returned only the Bushardt et al. and Van Rhee and Davanzo studies. Searches for "terminal" and "degree" did not yield any additional results.

The Bushardt et al. (2012) study remains the only study to have examined the relationship between faculty credentials and PANCE performance. The authors examined the degree conferred, number of faculty, number of students, faculty credentials, and PANCE performance reports. Linear regression was performed to determine whether any of these independent variables had an impact on PANCE performance. Only two factors were determined to have a significant effect. First, the degree conferred. Master's degree programs had a significantly higher PANCE pass rate. Second, as noted above, a lower student to full-time faculty ratio also improved performance. Faculty credentials were not found to have a significant effect, leading the authors to conclude:

These results, if replicated, suggest that if a program is seeking to increase its student

performance on the PANCE, it may be more helpful to focus resources on improving

student-to-faculty ratio, regardless of whether the faculty are doctoral level. (Bushardt et

al., 2012)

Other Program Characteristics

Comments from applicants during the admissions process indicate that applicants

associate a longer program operating history with an improved outcome on the PANCE. There

appears to be an underlying assumption that a more established program has had time to conduct

ongoing assessment and work out any curricular shortcomings. There have unfortunately been

few organized efforts to adequately test this assumption.

A PubMed search conducted using the terms "PANCE" and "accreditation" revealed only

one relevant study, the Van Rhee and Davanzo study cited above. Substituting the search term

"length" revealed only two relevant articles, the Van Rhee and Davanzo study and the Colletti et

al. study cited above. Neither of these articles were relevant to the topic of length of program

accreditation. Substituting the term "duration" in the search returned no results.

As noted above, McDowell, Clemens, and Frosch (1999) conducted an early study that

examined a variety of characteristics related to predicting PANCE performance. At the time this

study was conducted, the PANCE examination consisted of several components, one of which

was an assessment of a candidate's skills through simulated patient encounters. The study

discovered a significant relationship between the length of time since initial accreditation and

performance on this hands-on aspect of the PANCE. There was no relationship between time

elapsed since initial accreditation and performance on the didactic portion of the PANCE. The skills-based portion of the PANCE is no longer administered.

Remaining studies have examined a wide variety of other program characteristics in an attempt to predict PANCE performance. Many of these studies have tended to examine characteristics at the level of individual programs such as admissions statistics (Andreef, 2014; Butina, et al., 2017; Honda et al., 2018) or GPA while in the PA program (Ennulat et al., 2011; Honda et al., 2018). While many of these studies are well-designed, given the wide variability between programs described above, there are difficulties with generalizability. Asprey, Dehn, and Kreiter (2004) found significant associations between PANCE performance and the test subjects' age and gender. They concluded that younger candidates and female candidates demonstrated significantly better performance.

The single greatest characteristic predictive of improved PANCE performance across several studies is attending a PA program that awards a master's degree. McDowell, Clemens, and Frosch (1999) found a statistically significant difference in pass rates between bachelor's (87.3%) and master's (93.7%) program pass rates. This study was conducted at a time when there was wide variability in the credentials offered by PA programs. In addition to programs in 4-year institutions, there were still a number of PA programs in community colleges that awarded certification upon program completion. Bushardt et al. (2012) reexamined the issue a decade later. By the time of this study, a mandate had been issued by ARC-PA that all PA programs must issue a master's degree by 2020 to remain accredited. The study again noted a significant difference between master's and non-master's programs. It was determined that 85% of master's level programs could achieve a benchmark 90% pass rate, while only 15% of non-master's programs could achieve this level of success.

The final readily generalizable characteristic some studies have examined is student performance on standardized examinations offered by the PAEA. The "Physician Assistant Clinical Knowledge Rating and Assessment Tool" ("PACKRAT") is a computer-administered, 200 question multiple-choice examination designed to closely mimic the PANCE. It is administered as a formative examination to allow students to determine areas of strength and weakness as they prepare for the PANCE. The examination also provides valuable data to the PA program as it allows for a comparison of students with the national cohort. Since the examination is intended to serve as a self-assessment tool, there is wide variability in when programs choose to administer the PACKRAT. Some programs choose to administer it to their students multiple times, such as at the conclusion of both the didactic and clinical portions of the curriculum.

The PAEA also produces end-of-rotation examinations that programs can purchase and administer to students during the clinical phase of the program. These examinations are specialty-specific and are attractive to programs because they also provide an opportunity for programs to measure their performance against the performance of the national cohort. Like the PACKRAT, these examinations are designed to mimic the PANCE, and they consist of multiple-choice questions delivered via computer. These examinations focus on the specific content of the rotation (i.e., obstetrics and gynecology), and unlike the PACKRAT, these are usually high stakes summative examinations.

Massey coordinated several studies seeking to identify the ability of these assessments to predict PANCE performance based on other examinations. (Massey et al., 2011; Massey et al., 2013; Massey et al., 2015). The studies conducted a sophisticated analysis involving multiple regression on a variety of exams, both those administered by PAEA and proprietary program examinations. While the inclusion of proprietary examinations hampers the generalizability of

the results, the studies did conclude that the PAEA PACKRAT and end of rotation examinations were predictive of success on the PANCE.

Hegmann, Roscoe, and Statler (2012) discovered similar findings with their regression analysis, determining that end of rotation examination scores account for 65% of the variability in PANCE scores. This study is severely limited, however, because it only included data from three programs.

Other Healthcare Professions

Much like the PA profession, entry into practice as a physical therapist (PT) is predicated upon the successful passage of a board examination, the National Physical Therapy Exam (NPTE). A PubMed search conducted using the terms "NPTE" and "success" revealed five articles, two of which paralleled some of the considerations in this study. Covington, McCallum, Engelhard, Landry, and Cook (2016) examined the relationship between program resources and success on the NPTE. They determined that programs with 100% pass rates had significantly more full-time faculty per student (that is, a lower student to full-time faculty ratio). The study also noted that programs with a 100% pass rate also spent significantly more on both personnel and programmatic budgets.

Much like this study examined faculty credentials and their effect on PANCE pass rates, the same authors in the previous study also examined the effect of scholarly research productivity on examination pass rates for physical therapists (Cook, Landry, Covington, McCallum, & Engelhard, 2015). The PT profession recently established the Doctor of Physical Therapy as the degree for entry-level physical therapists, rendering a study of doctoral-level faculty in PT education irrelevant. The researchers hypothesized that research productivity would

promote a "scholarly-rich" environment, which would enhance learning success by students and lead to higher NPTE pass rates. The initial analysis appeared to indicate that an increased number of scholarly works, grants, and grant proposals were significantly higher in programs with 100% board pass rates. When further analysis was conducted to control for other factors such as the number of faculty and the Carnegie classification of the institution, no significant associations were identified. The authors concluded that no relationship exists between faculty scholarship and PT student board performance.

In parallel with the PA profession, researchers have also examined the ability of standardized tests to predict outcomes on the PT board examination. Similar to the PACKRAT in the PA profession, the PT profession also has a formative assessment, the Practice Exam and Assessment Tool (PEAT). A study released by the Federation of State Boards of Physical Therapy indicated that 99.3% of candidates who achieve a passing score on the PEAT exam would pass the NPTE (Mueller, Wang & Zhang, 2014). The authors concluded that success on the PEAT examinations was highly predictive of success on the physical therapy board examination.

Occupational Therapy (OT) is another profession that must pass an examination, the National Board for Certification in Occupational Therapy (NBCOT) exam, to become eligible for licensure. A PubMed search for "NBCOT" revealed only a single peer-reviewed article related to predicting success on this board examination (Avi-Itzhak, 2015). Similar to the PA and PT professions, OT students have the opportunity to take a practice formative examination to assess their readiness for the board examination. The study examined the ability of the practice examination to predict performance on the board examination. Both examinations test knowledge across four broad domains of knowledge required for OT practice. The study was

limited by a small study population; the author explored the predictive ability of the exam on only 65 students in a single program.

Using the board examination as the independent variable, the author categorized scores as either "pass" or "no pass" and performed a logistic regression. Consistent with studies in other professions, the results indicated that the practice examination had a modest predictive ability for two of the four domains on the board examination. The author also determined that practice examination could more accurately predict subjects likely to pass than subjects likely to fail. The author concluded that the difference in predictive ability among domains might be due to when the involved curriculum was delivered to students and recommended further study.

Summary

The literature reveals several efforts to identify factors associated with success on the PANCE, some related to student characteristics and some related to program characteristics. Unfortunately, some of these efforts have become quite dated, approaching two decades old. Due to the relatively small number of programs in existence at the time, these studies tend to be hampered by small data sets. Many recent studies have also been hampered by small data sets as researchers tend to use samples of convenience—typically their own programs—as a sole source of data. The value of these studies is frequently further degraded by the inclusion of proprietary program data as an independent variable. Including such data prevents the findings from being generalizable to other programs. Finally, some authors, such as Bushardt et al. (2012), have noted that while their initial results are promising, further data and repeated studies are required to confirm their findings.

This study addresses several of these flaws. First, it avoided the use of data aside from that which is readily available. Conducting the study in this fashion helped to ensure that the study is reproducible, and that the results are generalizable. Second, many aspects of predicting success on the PANCE have only been studied once. Further data points are necessary to confirm or refute findings suggested by previous studies. Finally, the current study helps to bring knowledge up to date. The rapid growth of the PA profession has led to a very different environment than existed when many of the previous studies were conducted.

CHAPTER 3–METHODOLOGY

This quantitative study examined the relationship between four independent variables—required healthcare experience, program duration, student to full-time faculty ratio, and proportion of faculty possessing a terminal degree—and the program's 5-year pass rate on the Physician Assistant National Certifying Examination (PANCE). While there have been some studies that have examined these relationships with small cohorts, to date, there has been no study that has explored these relationships in depth.

Subjects

The subjects of this study consisted of all accredited PA training programs in the United States with five or more years of available data related to program PANCE pass rates. The 5-year pass rate was selected as the dependent variable for several reasons. First, it is a factor used by the Accreditation Review Commission on Education for the Physician Assistant (ARC-PA) to assess program quality. The ARC-PA requires that the 5-year pass rate be posted on all program websites, making it readily and publicly available. The ARC-PA monitors pass rates carefully and requires programs to explain low pass rates and describe a plan for improvement. Selecting a 5-year pass rate also helped to level out the data and diminish the effect of a program experiencing a single outlier year of poor performance. Finally, the ARC-PA requires that programs undertake a program of continuous program assessment and improvement. A program that has five years of graduate data has had time to overcome some of the glitches and growing pains that accompany the development of a new program.

There are currently 238 accredited programs (ARC-PA, n.d.). Approximately 39 programs have been founded within the last 7 years and did not have five years of PANCE pass rates available for inspection. With a predicted sample size of approximately 175 programs, this study represents the most comprehensive study to date.

Variables

The study explored the relationship of four independent variables to a PA program's 5-year PANCE average pass rate:

1. Required healthcare experience

   Different programs have dramatically different requirements related to prerequisite healthcare experience requirements, ranging from no required experience to over two thousand hours.

2. Duration of the PA program curriculum in months

   PA programs also have dramatically different curricular lengths, ranging from 22 to 40 months.

3. Student to full-time faculty ratio

   The ARC-PA does not establish a required student-to-faculty ratio for PA programs. It requires that a minimum of three faculty members be certified as physician assistants and that programs have sufficient faculty to meet the program's needs.

4. Proportion of faculty possessing a doctoral degree

The ARC-PA also does not require any specific credentials for physician assistant faculty, simply that they have sufficient experience and knowledge to function effectively.

Sources of Data

In attempting to identify program characteristics that predict PANCE performance, several previous studies have examined data unique to an individual PA program, which limits the ability to reproduce the findings or generalize the results to the larger population. For example, admission to medical school generally requires a fairly stable set of prerequisite coursework in chemistry, biology, organic chemistry, and physics. In contrast, each PA program is given remarkable latitude to determine prerequisite courses that may include some, none, or all the aforementioned classes. Eliminating some of the program-specific data used in the previous studies mentioned will allow for easy reproducibility of this study as the number of PA programs continues to grow. This study used data that were readily available online. The ARC-PA requires that data related to admissions requirements and PANCE pass rates be posted on each program's website, allowing for ease of data collection. Other data related to faculty size, faculty credentials, and student body size and length were obtained from other public sources, including organizational websites for the Physician Assistant Education Association (PAEA) and the Accreditation Review Commission on Education for the Physician Assistant (ARC-PA).

PA National Certifying Examination (PANCE) Pass Rates: To become eligible for licensure, a graduate of a physician assistant program is required to pass the PANCE. The PANCE is a 300-

question standardized examination administered on a computer in a securely proctored environment. The examination is administered by the National Commission on Certification for the Physician Assistant (NCCPA). The test is scored on a scale from 200 to 800. The NCCPA has established 362 as the lowest passing score. Every PA program is required to post on its website the pass rates for the past five cohorts of graduating students. Programs with fewer than five graduating cohorts—that is, developing programs—were excluded from this study.

Healthcare Experience: ARC-PA requires programs to fully disclose all admissions requirements on the program website. If the program's healthcare experience requirement is unclear, the program was contacted via telephone or email to ensure that accurate data were obtained.

Program Duration: The length of each program is reported in months and can be readily obtained from the PAEA website. Individual program websites were used to confirm these data.

Student to Full-time Faculty Ratios: The PAEA website displays information related to the number of faculty in each program and the number of students in each entering cohort. This information was checked for accuracy against information available on each program's website and was used to determine the student to full-time faculty ratios.

Proportion of Faculty Possessing a Doctoral Degree: The PAEA website maintains a list of faculty members associated with each program, along with their academic credentials.

Information on the PAEA website was confirmed by the information available on each

program's website.

Procedure

      A roster of all PA programs in the United States was obtained from the ARC-PA website.

Each program's website was examined to determine whether it presented 5-year PANCE average

pass rate data as required by accreditation standards. Programs that have not been in existence

long enough to present a 5-year PANCE average pass rate report were excluded from the study.

When it was determined that a program was suitable for inclusion, the program's website was

inspected to determine prerequisite healthcare experience requirements, the duration of the

curriculum, the number of students enrolled, the number of faculty, and faculty educational

credentials. Data were compiled into an Excel spreadsheet. To help ensure the accuracy of the

data, data obtained from PA program websites was cross-checked against program data

displayed on the PAEA website.

      Based upon current data available from NCCPA, program PANCE pass rates have ranged

from 89% to 97% over the past five years, yielding a 93% 5-year national PANCE average pass

rate. These data include over 40,000 test administrations, and it should be normally distributed

(NCCPA, 2019). According to PAEA, the average duration of PA program curricula is 26.3

months, with program lengths roughly normally distributed. PAEA also reports a national

average student to full-time faculty ratio of 15.3:1 (PAEA, 2018)

Method of Analysis

      Like several previous studies outlined in the review of the literature, the proposed study is a retrospective, quantitative study. The independent variables for the study included the amount of required prerequisite healthcare experience (in hours), the duration of a PA program's curriculum (in months), its student to full-time faculty ratio, and the proportion of faculty possessing a doctoral degree. The dependent variable for the study was the program's 5-year PANCE average pass rate. Data collected for these variables were imported into IBM SPSS for Windows for analysis.

      Initial analysis consisted of descriptive statistics to help develop an initial impression of the data set. High values, low values, the range, the mean, and the standard deviation were calculated for each of the independent variables. A scatterplot was constructed comparing each of the independent variables with the dependent variable to identify any patterns that may be present.

      There are a variety of methods for assessing the strength of a relationship between two data sets. The primary consideration for selecting an analytic method is determined by the nature of the data being analyzed. In this case, it is expected that the data collected for both the dependent and independent variables should be continuous, and normally distributed. It should, therefore, be possible to analyze the data using parametric tests. Calculating a correlation coefficient—a Pearson r—helps to describe the relationship between pairs of variables in quantitative data (Witte & Witte, 2004). In a correlational study, a coefficient of .66 or greater is regarded as a particularly good value that allows for good predictions (Cresswell, 2011). Correlation coefficients were calculated for the following independent variables, and each program's 5-year PANCE average pass rate:

Healthcare experience: As indicated above, there is a wide variation among programs on the importance they place on previous healthcare experience. While it is nearly universal that programs place some value on previous healthcare experience, some programs require several thousand hours while other programs require none. If there is a relationship between healthcare experience and success on the PANCE, it was expected that there would be a positive correlation and programs requiring larger amounts of experience should demonstrate a higher 5-year PANCE average pass rate.

Program duration: A reasonable assumption is that a longer curriculum would lead to increased contact time with the curriculum and improved outcomes. To date, only small studies have been conducted (McDowell et al., 1999; Colletti et al., 2006), and they have failed to identify a significant relationship between program length and outcomes. If a longer program duration has a significant effect on 5-year PANCE average pass rates, a positive correlation should be detected upon analysis.

Student to full-time faculty ratio: Having participated in hundreds of student interviews, it is apparent that typical applicants hypothesize that high student to full-time faculty ratios improve an educational program and lead to improved outcomes. Correlation analysis was performed to test whether programs with a higher faculty-student ratio enjoy higher 5-year average pass rates on the PANCE.

Proportion of faculty possessing a doctoral degree: The PA program ranking system proposed by Van Rhee and Davanzo (2010) indicates that at least some faculty and program administrators

theorize that doctoral degrees for faculty are associated with improved outcomes. It these beliefs are true, correlation analysis should indicate a significant, positive correlation coefficient between programs with higher proportions of doctorally-trained faculty members and program 5-year PANCE average pass rates.

Identifying the presence of a strong correlation indicates that variables are related but should not be taken to mean that a change in one variable is directly responsible for the change in another variable (Geher & Hall, 2014). When a significant correlation is identified between two variables, it becomes possible to use one variable to make predictions about the other variable. In the case of this study, a correlation analysis explored how closely related the independent variables are to the PANCE score.

After completing a correlation analysis, multiple regression analysis was used to further define the cumulative relationship between the independent and dependent variables. In regression analysis, a straight line is inscribed on the graph of the scatterplot of independent and dependent variables. The line is constructed such that it minimizes the squared distance from each of the points to the line. Regression analysis, therefore, affords a researcher the opportunity to determine the strength and direction of the relationship between the two variables. When this relationship has been sufficiently characterized, it becomes possible to use the equation of the line to make predictions related to likely outcomes for the dependent variable when provided with data for the independent variable (Creswell, 2011).

CHAPTER 4–RESEARCH FINDINGS

Introduction

This study sought to describe the relationship between a PA program's 5-year PANCE average pass rate and four independent variables: the program's required healthcare experience (in hours), the duration of the program's curriculum (in months), the program's student to full-time faculty ratio, and the proportion of faculty possessing a doctoral degree. Inspection of the website of the Accreditation Review Commission on Education for the Physician Assistant identified 244 physician assistant programs with an accreditation status assigned. All 244 programs were entered into a Microsoft Excel spreadsheet, and initial accreditation dates were examined. Programs with fewer than five cohorts of graduates taking the PANCE were identified, and the data were sorted to exclude these programs. Doing so left 155 programs eligible for inclusion in the study.

Data related to required healthcare experience, curricular duration, student to full-time faculty ratios and proportion of faculty with a doctoral degree was obtained from individual program websites and the website of the Physician Assistant Education Association (PAEA). The data were then imported into IBM SPSS Statistics 25 for analysis.

Question 1: What is the relationship Between PA Program 5-Year PANCE Average Pass Rates and Amount of Required Healthcare Experience?

Descriptive Statistics

Conventional wisdom among many practicing PAs holds that an increased amount of healthcare experience should improve a student's performance and lead to a more competent PA. The results demonstrated that required healthcare experience varied widely among programs. The maximum amount of healthcare experience required was 2500 hours. Examination of the dataset identified 61 programs that did not have any requirement for healthcare experience, but many of these programs' websites noted that prior healthcare experience would be considered a desirable factor during their admissions process. The mean number of required hours across all programs was 405.42 hours (Table 2):

Table 2

Descriptive Statistics: Healthcare Experience

	N	Minimum	Maximum	Mean	Std. Deviation
Required Experience Hours	155	0	2500	405.42	520.266
Valid N (listwise)	155				

Correlation Analysis

A scatterplot of 5-year PANCE average pass rate versus required experience hours was generated. An inspection of the scatterplot failed to yield a readily identifiable relationship between the variables. Of the two programs with the lowest 5-year PANCE average pass rate, one required no experience, but the other required a minimum of 1,000 hours, well above the

mean. Programs with a 100% 5-year PANCE average pass rate ranged from a program requiring

no experience to a program requiring the highest amount of experience (Figure 4):

Figure 4

Simple Scatter of 5 Year PANCE Avg by Required Experience (hours)

A correlation analysis was performed using IBM SPSS Statistics Version 25 (Table 3).

As expected, based upon an inspection of the scatterplot, there was no significant correlation

identified. The correlation coefficient between 5-year PANCE average pass rates and required

healthcare experience was very low, at 0.005 suggesting there is no evidence of a correlation

between these two variables. The significance was calculated to be 0.953, indicating a non-

statistically significant relationship between required healthcare experience and 5-year PANCE

average pass rates.

Table 3

Correlation Between 5-Year PANCE Average Pass Rates and Required Healthcare Experience Hours

		5-year PANCE Average	Required Experience Hours
5 Year PANCE Average	Pearson Correlation	1	.005
	Sig. (2-tailed)		.953
	N	155	155
Required Experience Hours	Pearson Correlation	.005	1
	Sig. (2-tailed)	.953	
	N	155	155

Research Question 1 Summary

Research question 1 sought to identify the nature of the relationship between required healthcare experience hours and program 5-year PANCE Average pass rates. Based on the findings described above, there is no evidence of a statistically significant relationship between these two variables. Programs with more extensive requirements for healthcare experience do not appear to be outperforming programs with lower healthcare experience requirements on 5-year PANCE average pass rates.

Question 2. What is the relationship between PA program 5-Year PANCE Average Pass Rates and Duration of the Program in Months?

Descriptive Statistics

Research question 2 sought to characterize the relationship between the duration of PA program curricula and 5-year PANCE average pass rates. There is an underlying assumption that a longer program duration allows for more contact time with the material, which should improve PANCE performance. The duration of curricula among PA programs was found to vary considerably, from a minimum of 21 months to a maximum of 40 months. The mean duration of PA educational programs was found to be just over 27 months (Table 4):

Table 4
Descriptive Statistics: Program Duration

	N	Minimum	Maximum	Mean	Std. Deviation
Duration (months)	155	21	40	27.03	2.761
Valid N (listwise)	155				

Correlation Analysis

SPSS was used to construct a scatterplot of program duration compared with average 5-year PANCE pass rates. Inspection of the scatterplot (Figure 5) failed to demonstrate a pattern suggesting a strong relationship between these two variables. A program with the lowest 5-year PANCE average pass rate had a curricular duration near the average of 27 months. The program with the longest curriculum (40 months) was outperformed on 5-year PANCE average pass rates by many programs with significantly shorter curricula.

Figure 5

Simple Scatter of 5 Year PANCE Average by Duration (months)
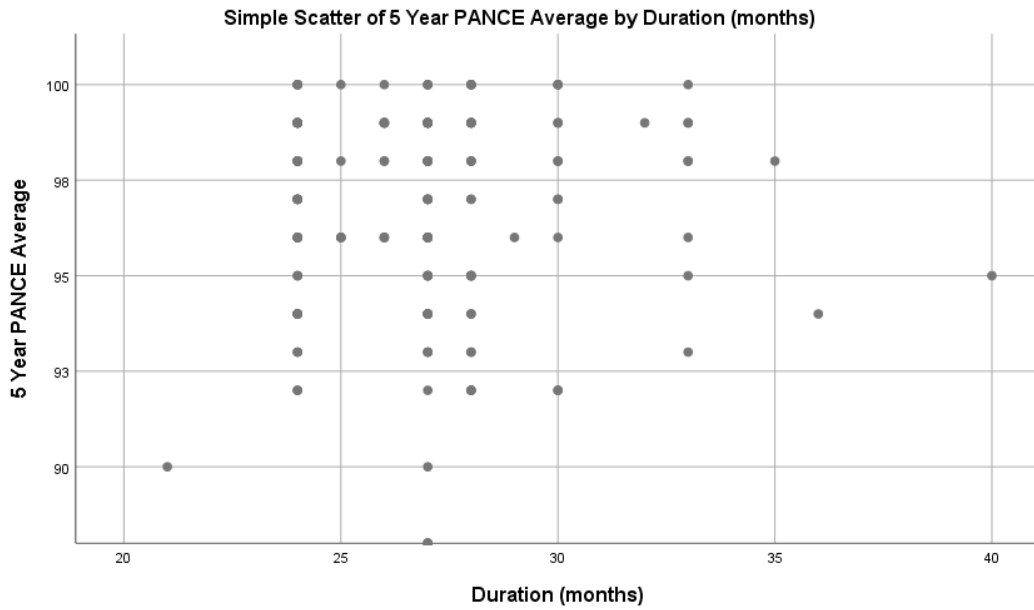
A correlation analysis was performed using IBM SPSS Statistics Version 25 (Table 5).

As expected, based upon inspection of the scatterplot, no significant correlation was identified.

The correlation coefficient between 5-year PANCE average pass rates and program duration was

low, at 0.028 suggesting that these two variables are not well correlated. The significance was

calculated to be 0.729, indicating a non-statistically significant relationship between program

duration and 5-year PANCE average pass rates.

Table 5

Correlation Between PANCE 5-year Average Pass Rate and Program Duration

		5-year PANCE Average	Duration (months)
5-year PANCE Average	Pearson Correlation	1	.028
	Sig. (2-tailed)		.729
	N	155	155
Duration (months)	Pearson Correlation	.028	1
	Sig. (2-tailed)	.729	
	N	155	155

Research Question 2 Summary

It may seem intuitive that a longer program would afford more contact time with curricular material and lead to improved outcomes. However, based upon the findings above, there does not appear to be evidence of a statistically significant relationship between the duration of PA training programs and 5-year PANCE average pass rates. Based on the results of this study, there is no evidence to suggest that programs with a longer duration are outperforming shorter programs in terms of 5-year PANCE average pass rates.

3. What is the relationship between PA program 5-Year PANCE Average Pass Rates and Student to Full-time Faculty Ratios?

Descriptive Statistics

Due to the wide variation in the duration of PA program curricula, identifying a valid means for assessing a student to full-time faculty ratio is challenging. Most PA programs are structured in a fashion where the first year of the program is primarily didactic in nature, and the remainder of the program is clinical in nature. During these clinical experiences, the students spend most of their time away from the program at clinical sites and have limited interaction with a program's full-time faculty. This investigation calculated a student to full-time faculty ratio by dividing the number of students in each entering cohort by the number of full-time faculty in the program.

Descriptive statistics related to the student to full-time faculty ratio can be found in Table10. In summary, programs ranged from a low of 2.13 first-year students per full-time faculty member to a high of 10.42 first-year students per faculty member for the entering cohort. The mean number of students per faculty member was approximately 5.11:

Table 6

Descriptive Statistics: Student to Full-time Faculty Ratio

	N	Minimum	Maximum	Mean	Std. Deviation
Student to Full-time Faculty Ratio	155	2.13	10.42	5.1064	1.49009
Valid N (listwise)	155				

Correlation Analysis

A scatterplot comparing 5-year PANCE average pass rate and student to full-time faculty ratio was created (Figure 6). The examination of the scatterplot failed to suggest a readily identifiable relationship between these variables. It was noted that a program with the lowest student to full-time faculty ratio (just over 2) achieved a 5-year PANCE average pass rate equal to that of the program with the highest student to full-time faculty ratio (over 10). Programs with the lowest 5-year PANCE average pass rates ranged from just over two to just under six students per full-time faculty member:

Figure 6

Simple Scatter of 5 Year PANCE Average by Student to Fulltime Faculty Ratio
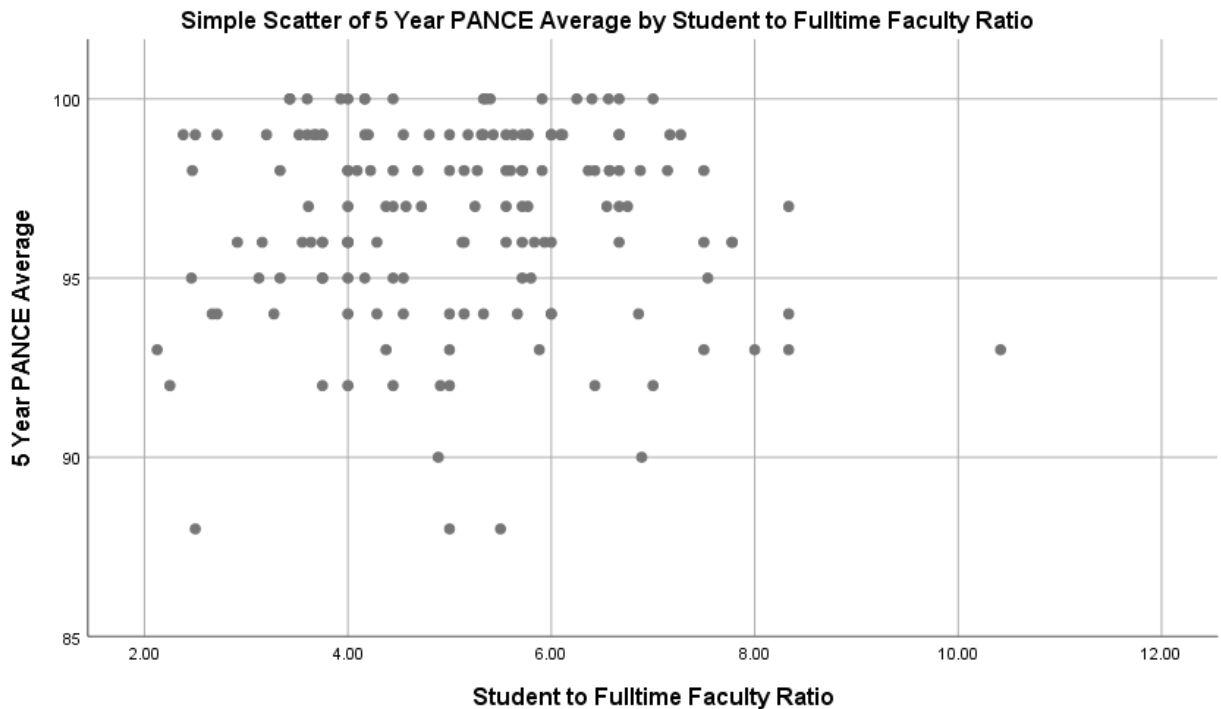
A correlation analysis was performed using IBM SPSS Statistics Version 25 (Table 7). As suspected based upon inspection of the scatterplot, there was no significant correlation identified. The correlation coefficient between 5-year PANCE average pass rates and student to full-time faculty ratio was very low, at -0.004. The significance was calculated to be 0.961, indicating a non-statistically significant relationship between student to full-time faculty ratio and 5-year PANCE average pass rates.

Table 7

Correlation Between 5-Year PANCE Average Pass Rate and Student to Full-time Faculty Ratio

		5-year PANCE Average	Student to Full-time Faculty Ratio
5-year PANCE Average	Pearson Correlation	1	-.004
	Sig. (2-tailed)		.961
	N	155	155
Student to Full-time Faculty Ratio	Pearson Correlation	-.004	1
	Sig. (2-tailed)	.961	
	N	155	155

Summary

In spite of a previous study having determined a significant, positive relationship between student-faculty ratio and improved PANCE performance (Bushardt et al., 2012), the findings above do not provide evidence of a statistically significant relationship between these variables. Based on the results of this investigation, there is no evidence that programs with a lower student to full-time faculty ratio do not appear to outperform programs with lower full-time to student-faculty ratio in terms of 5-year PANCE average pass rates.

4. What is the Relationship Between the 5-year PANCE Average Pass Rate and the

Proportion of Faculty Possessing a Doctoral Degree?

Descriptive Statistics

Research question four explores the impact of having more faculty with doctoral degrees

on PANCE outcomes. As with other independent variables, programs varied widely, from a low

of 6% of faculty possessing a doctoral degree to a program with 100% of faculty possessing a

doctoral degree. There were no programs that completely lacked doctorally-trained faculty

members. The mean proportion of program faculty possessing a doctoral degree across programs

is 31.4% (Table 8).

Table 8
Descriptive Statistics: Proportion of Doctoral Faculty

	N	Minimum	Maximum	Mean	Std. Deviation
Proportion of Doctoral Faculty	155	.06250	1.00000	.3143120	.16225652
Valid N (listwise)	155				

Correlation Analysis

A scatterplot of 5-year PANCE average pass rates and the proportion of faculty

possessing a doctoral degree was created using IBM SPSS. As was the case with the other

independent variables, no readily identifiable pattern was evident. Programs with a 100% 5-year

PANCE average pass rate demonstrated proportions of faculty with doctoral degrees ranging

from under 10% to approximately 55%. Programs with the lowest 5-year PANCE average pass

rates fell in the midrange, having from just under 40% to just over 60% of faculty holding a

doctoral degree (Figure 7):

Figure 7

Simple Scatter of 5 Year PANCE Average by Proportion of Doctoral Faculty
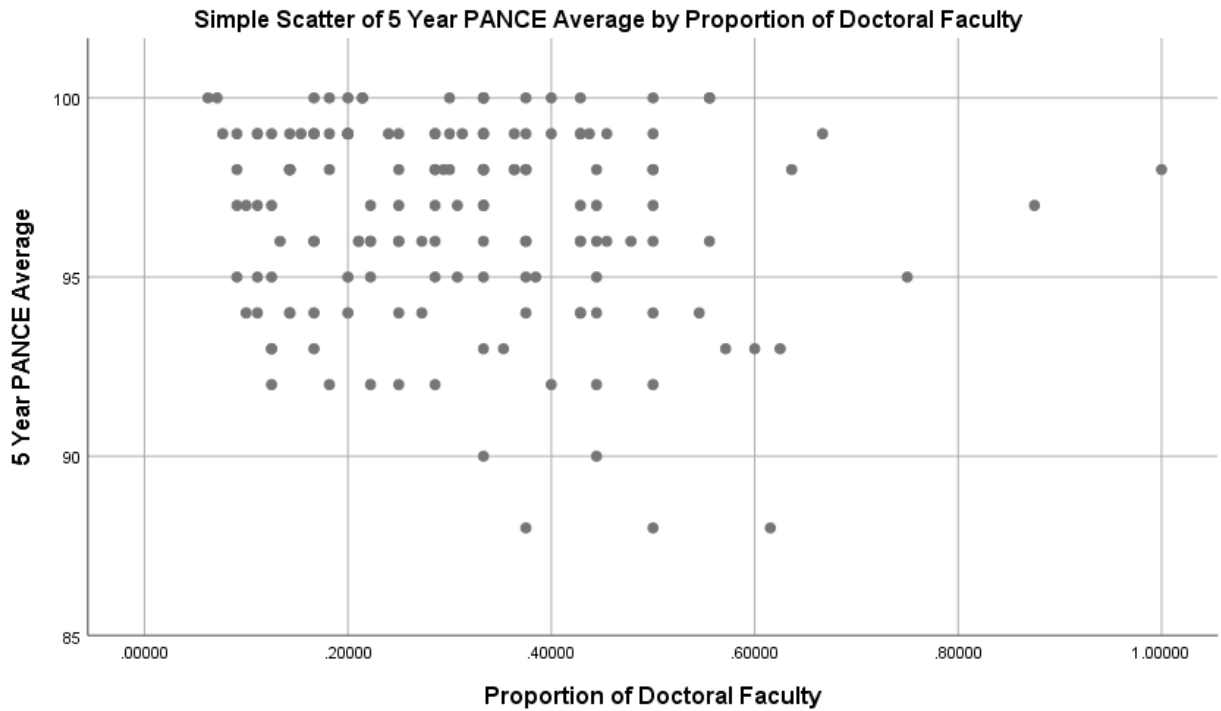
A correlation analysis was performed using IBM SPSS Statistics Version 25 (Table 9). As suspected based upon inspection of the scatterplot, there was no significant correlation identified. The correlation coefficient between 5-year PANCE average pass rates, and the proportion of faculty possessing a doctoral degree was low, at -0.119. The significance was calculated to be 0.139, indicating a non-statistically significant relationship between proportion of faculty possessing a doctoral degree and 5-year PANCE average pass rates.

Table 9

Correlation Between 5-year PANCE Average Pass Rate and Proportion of Faculty with a Doctoral Degree

		5-year PANCE Average	Proportion of Doctoral Faculty
5-year PANCE Average	Pearson Correlation	1	-.119
	Sig. (2-tailed)		.139
	N	155	155
Proportion of Doctoral Faculty	Pearson Correlation	-.119	1
	Sig. (2-tailed)	.139	
	N	155	155

Summary

While having a higher proportion of faculty members holding a doctoral degree may be held by some as an indicator of institutional quality, these data failed to demonstrate a statistically significant relationship between the number of doctorally-prepared faculty members in PA programs and 5-year PANCE average pass rates. Several very high-performing programs with 100% 5-year PANCE average pass rates were found to have low proportions of faculty members with doctoral degrees. Based on the results of this study, there is no evidence that programs with a higher proportion of doctorally-prepared faculty members are outperforming programs with a lower proportion of doctorally-prepared faculty members.

Multiple Regression

Multiple regression analysis was performed in SPSS using all four independent variables: the amount of required healthcare experience, duration of the program, student to full-time faculty ratio, and proportion of doctorally-trained faculty members. The descriptive statistics for each of these variables were provided above and are summarized in Table 10.

Table 10

Multiple Regression: Descriptive Statistics

	Mean	Std. Deviation	N
5-year PANCE Average	96.61	2.727	155
Required Experience Hours	405.42	520.266	155
Duration (months)	27.03	2.761	155
Student Faculty Ratio	5.1064	1.49009	155
Proportion of Doctoral Faculty	.3143120	.16225652	155

The multiple regression model was performed including all four of the dependent variables using the "enter" method in SPSS. The variables included are indicated in Table 11.

Table 11

Multiple Regression: Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Proportion of Doctoral Faculty, Student Faculty Ratio, Duration (months), Required Experience Hours[b]		. Enter

a. Dependent Variable: 5-year PANCE Average
b. All requested variables entered.

A correlation matrix was constructed in SPSS to explore the relationships between all the

variables included in the study (Table 12).

Table 12

Multiple Regression: Correlations

		5-year PANCE Average	Required Experience Hours	Duration (months)	Student-to-faculty Ratio	Proportion of Doctoral Faculty
5-year PANCE Average	Pearson Correlation	1	.005	.028	-.004	-.119
	Sig. (2-tailed)		.953	.729	.961	.139
	N	155	155	155	155	155
Required Experience Hours	Pearson Correlation	.005	1	-.182*	-.210**	-.015
	Sig. (2-tailed)	.953		.024	.009	.851
	N	155	155	155	155	155
Duration (months)	Pearson Correlation	.028	-.182*	1	-.163*	-.092
	Sig. (2-tailed)	.729	.024		.043	.257
	N	155	155	155	155	155
Student to Full-time Faculty Ratio	Pearson Correlation	-.004	-.210**	-.163*	1	.002
	Sig. (2-tailed)	.961	.009	.043		.982
	N	155	155	155	155	155
Proportion of Doctoral Faculty	Pearson Correlation	-.119	-.015	-.092	.002	1
	Sig. (2-tailed)	.139	.851	.257	.982	
	N	155	155	155	155	155

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

As noted previously, no statistically significant correlation between the independent variable (5-

year PANCE average pass rate) and the independent variables was identified at a $p = 0.05$ level.

Several correlations were noted between some of the independent variables. Cohen (1988)

provided general recommendations regarding the characterization of the strength of a correlation based on the magnitude of a Pearson's r, proposing that a Pearson's r from 0.1 to 0.3 be characterized as a "small correlation."

There was a statistically significant ($p = .024$), small, negative correlation ($r = -.182$) between "Required Experience Hours" and "Duration." This negative correlation indicates that programs requiring more experience hours may tend to be shorter in duration. There was another statistically significant ($p = .009$) small, negative correlation ($r = -.210$) between "Required Experience Hours" and "Student to Full-time Faculty Ratio." This negative correlation indicates that programs requiring more healthcare experience may tend to have lower student to full-time faculty ratios. A final statistically significant ($p = .043$), small, negative correlation ($r = -.163$) correlation was noted between "Duration" and "Student to Full-time Faculty Ratio." This negative correlation indicates that programs requiring more prerequisite healthcare experience may tend to have lower student to full-time faculty ratios.

A model summary was constructed to determine the coefficient of variation for the regression model (Table 13).

Table 13
Multiple Regression: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.121[a]	.015	-.012	2.743	2.119

a. Predictors: (Constant), Proportion of Doctoral Faculty, Student to Full-time Faculty Ratio, Duration (months), Required Experience Hours
b. Dependent Variable: 5-year PANCE Average

The small R square (.015) and adjusted R Square (-.012) indicate that the model has a negligible ability to explain variability in 5-year PANCE average pass rates.

An ANOVA table was constructed to assess the statistical significance of the overall

model (Table 14).

Table 14.
Multiple Regression: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.721	4	4.180	.556	.695[b]
	Residual	1128.273	150	7.522		
	Total	1144.994	154			

a. Dependent Variable: 5-year PANCE Average
b. Predictors: (Constant), Proportion of Doctoral Faculty, Student to Full-time
Faculty Ratio, Duration (months), Required Experience Hours

The *p*-value was calculated at .695, indicating that required experience hours, duration, student

to full-time faculty ratios and proportion of doctoral faculty are not statistically significant

predictors of the 5-years PANCE average pass rate.

Finally, SPSS was used to construct a coefficient table for the model (Table 15). Based

on the noted values, it was expected that the model's variables would not be statistically

significant in predicting variability in 5-year PANCE average pass rates. The coefficient table

indicated that this was, in fact, the case.

Table 15.

Multiple Regression: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	96.711	2.688		35.986	.000	91.401	102.022
	Required Experience Hours	.000034	.000	.006	.076	.939	-.001	.001
	Duration (months)	.018	.084	.019	.220	.826	-.147	.184
	Student to Full-time Faculty Ratio	.001	.155	.001	.007	.994	-.305	.308
	Proportion of Doctoral Faculty	-1.977	1.369	-.118	-1.444	.151	-4.682	.728

a. Dependent Variable: 5-year PANCE Average

The first coefficient examined, required experience hours, was found to have a small (.34) non-statistically significant ($p = .939$) impact on the 5-year PANCE average pass rate. If statistical significance had been achieved, this finding would suggest that each additional 1000 hours of clinical experience would increase the 5-year PANCE average pass rate by 0.34. The second and third variables demonstrated an even smaller effect. For program duration, each 1-month increase in the duration of a program was associated with a minuscule (.018) statistically non-significant ($p = .826$) increase in the 5-year PANCE average pass rate. Increasing the faculty to student ratio was associated with a negligible (.001) non-statistically significant ($p = .994$) increase in the 5-year PANCE average pass rates.

The variably which came closest to achieving statistical significance ($p = .151$) was the proportion of faculty possessing a doctoral degree. Interestingly, it was also the only variable to display an inverse relationship with the 5-year PANCE average pass rate. Had statistical

significance been achieved, this finding would suggest that having a higher proportion of faculty with doctoral degrees is associated with lower 5-year PANCE average pass rates.

In summary, multiple regression of the four independent variables—required healthcare experience, program duration, faculty-to-student ratio, and proportion of faculty possessing a doctoral degree—did not explain the variability in 5-year PANCE average pass rates in a statistically significant fashion. At best, a very small effect was noted. The implications of this finding are discussed in the next section.

CHAPTER 5–CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

Introduction

Physician assistant education has entered a period of explosive growth. As new programs develop, the institutions that sponsor them are allowed tremendous latitude in determining how to structure their program to afford the best student and program outcomes. Accreditation standards provide each program the opportunity to establish its own priorities related to required prerequisites for students, curricular length, and number and faculty qualification. In some respects, the PA profession is still very much in its infancy, and PA programs are making policy decisions related to these priorities in the absence of solid empirical data to support their decisions.

As described in the review of the literature, previous researchers have attempted to identify factors associated with improved PANCE outcomes at both the student and program level. In most cases, these studies have failed to identify statistically significant predictors of program PANCE performance. This study sought to build upon this foundation by characterizing the relationship between program 5-year PANCE average pass rates and four PA program characteristics commonly thought to be significantly associated with PA program outcomes: required prerequisite healthcare experience, program duration, student to full-time ratio and proportion of faculty possessing a doctoral degree. The identification of factors that reliably impact program performance on the PANCE could be used to inform policy decisions at the program level.

Like previous studies, none of the independent variables examined in this study were found to explain variability in 5-year PANCE average pass rates in a statistically significant fashion. In all four cases, the Pearson correlations were found to be very small and not

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statistically significant. The remainder of this paper will summarize the findings of this study,

describe the general limitations of this study that impacted analysis, and discuss implications for

future research that PA policymakers should consider.

Summary and Interpretation of Results

Required Healthcare Experience

It was anticipated that increased prerequisite healthcare experience requirements might be

positively correlated with program PANCE performance. A Pearson correlation of program

required healthcare experience hours and 5-year PANCE average pass rates indicated a

minuscule, positive, non-statistically significant relationship ($r = .005$, $p = .953$) between the

variables. It is, therefore, not possible to reject the null hypothesis that there is no correlation

between these variables. Based on the results of this study, there is not a statistically significant

difference in 5-year PANCE average pass rates between programs with longer or shorter

healthcare experience requirements.

Many PAs have very strong feelings related to the prerequisite healthcare experience.

They argue that the early PA programs all required substantial healthcare experience before

entering PA school and that the profession was founded with the understanding that this level of

experience was essential to producing a competent clinician. However, the evidence does not

support this theory. The literature review identified one article addressing healthcare experience

and PA student performance. In 2016, Hegmann and Iverson examined the relationship between

healthcare experience and program performance markers, such as preceptor evaluations. The

study focused on the performance of individual students in a single program. Their study failed

to identify a significant relationship between healthcare experience and preceptor evaluations of performance on clinical rotations.

Healthcare experience is presumed to contribute to the development of several important characteristics of healthcare providers, such as solid communication and interpersonal skills. Most preceptor evaluations of student performance ask preceptors to evaluate these interpersonal skills, along with assessing a student's knowledge base. If prior healthcare experience contributes meaningfully to success in PA school and in one's career, one would expect policies requiring increased experience to demonstrate a positive effect on the overall program PANCE pass rate.

PA Program Duration

Malcolm Gladwell's 2011 book *Outliers* helped to propel him to fame and popularized the notion that 10,000 hours of practice leads to expertise. It seems fairly intuitive that increasing contact time with the material should lead to improved knowledge, competence, and program performance on the PANCE. Perhaps counterintuitively, the findings of this study do not appear to support this conclusion.

It was anticipated that PA program duration might be positively correlated with PANCE outcomes, although several previous studies (McDowell et al., 1999; Asprey et al., 2004; Colletti et al., 2016) failed to identify a significant relationship between these variables. A Pearson correlation of PA program duration and 5-year PANCE average pass rates indicated a minuscule, positive, non-statistically relationship ($r = .028$, $p = .729$) between the variables. Therefore, the null hypothesis cannot be rejected. Based on the results of this study, there is not a statistically

significant difference in 5-year PANCE average pass rates between programs that are longer or shorter in duration.

A simple investigation of program length is complicated by the fact that there are a wide variety of curricular models used in PA education. Some programs follow a fairly "traditional" medical school format, with semester-long courses covering topics such as anatomy, physiology, pharmacology, and physical examination. A recent trend among healthcare education programs often finds them developing a "systems-based" curriculum where students are immersed in material related to a single organ system. Students are instructed in all aspects of the material as related to an organ system—such as the cardiovascular system—over the course of several weeks before moving on to the next system. Another curricular variation used by many PA programs is a "case-based" or "problem-based" curriculum where students are presented with a case instead of a traditional lecture and must do a great deal of investigating on their own to progress through the material.

It is likely that a complex interaction of both the length and the nature of the curriculum are synergistically at work in contributing to program 5-year PANCE average pass rates. Comparing the length of program curricula is a fairly straightforward operation. However, controlling for different curricular models would be challenging. Information related to each program's particular curricular model is not readily available, and there is no standard definition of what constitutes a "problem-based" or "case-based" curriculum. It would be ideal for a program to develop an experimental model where different student cohorts were exposed to different curricular structures to compare their effect on cumulative PANCE pass rates. Accreditation standards, however, require that all students receive equivalent education while in a PA program. This requirement may complicate the ability of a program to investigate the

impact of delivering different curricular models to a control group and an experimental group to ascertain the most effective way to deliver the material.

Student to Full-time Faculty Ratio

It was anticipated that student to full-time faculty ratios might be negatively correlated with program PANCE performance. In other words, it was believed that programs with fewer students per faculty member would outperform students with more students per faculty member. A Pearson correlation of student to full-time faculty ratio and 5-year PANCE average pass rates did identify a negative correlation, but it was an extremely small and non-statistically significant relationship ($r = -.004$, $p = .961$). It is, thus, not possible to reject the null hypothesis that there is no correlation between these variables. Based on the results of this study, there is not a statistically significant difference in 5-year PANCE average pass rates between programs with the differing student to full-time faculty ratios.

Only a single previous study examined student-to-faculty ratios and PANCE performance (Bushardt et al., 2012). Those investigators determined that a lower student-to-faculty ratio led to improved outcomes on the PANCE. This study did not replicate the findings of the Bushardt study, but there were some differences between the two studies. Like the Bushardt study, this study examined only levels of full-time faculty within a program. In calculating a student to full-time faculty ratio, this study only used the number of students in a program's entering cohort. Since the first year of a PA program is primarily didactic, it is typically these first-year students who would have the most intense contact with these full-time faculty.

Faculty Doctoral Degrees

It was uncertain whether a relationship would be identified between 5-year PANCE average pass rates and the proportion of faculty possessing a doctoral degree. Doctoral training is a prerequisite for teaching in many fields and is sometimes used as a marker of institutional quality. Like the previous single study (Bushardt et al. 2012) that examined this research question, this study was unable to identify a significant relationship between 5-year PANCE average pass rates and the proportion of faculty possessing a doctoral degree. A Pearson correlation identified a very weak, negative, non-statistically significant relationship ($r = -.119$, $p = .139$).

It is worth considering that many of the doctoral degrees held by PA faculty are not necessarily accompanied by the development of formal teaching skills, as seen in many traditional doctoral programs. Students pursuing a doctoral degree in a field such as chemistry or history frequently serve as teaching assistants or graduate assistants and are directly involved in the education of undergraduate students. Such students may assist in grading coursework, lecture during recitation sessions, and direct laboratory exercises. Many of the doctoral degrees held by faculty working in PA programs are not accompanied by activities that would be expected to develop teaching skills. Even when the content area is directly related to medicine (such as a Doctor of Medicine degree), the individual holding that degree might effectively have no meaningful classroom teaching experience. Competence acquiring knowledge need not automatically indicate competence in transmitting knowledge. In many fields, a doctoral degree is oriented toward developing a student with competence in research and the generation of new knowledge, and not necessarily skill in lecturing.

Multiple Regression

Correlation analysis indicated that all four independent variables had a very small, non-statistically significant relationship with 5-year PANCE average pass rates. A multiple regression was run to examine the cumulative effect of the independent variables' ability to explain variation in the 5-year PANCE average pass rate. Analysis of the model summary (Table 13) and the ANOVA table (Table 14) indicated that the regression model was not statistically significant and only explained 1.5% of the variability in the 5-year PANCE average pass rate.

Future Research Considerations

Limitations of the Current Study

There were limitations with the data set, some that were anticipated in advance and some that were not apparent until the data were collected and the analysis began. One limitation concerned the nature of the data being compared in the independent and dependent variables. The data for the dependent variable (the 5-year PANCE average pass rate) represents an average for data collected over the course of a 5-year period from 2014–2018. This information was readily available from PA program websites as required by the ARC-PA. Serial observations over time should generally afford the best insight into the true nature of a program's PANCE performance. Due to the relatively small student cohort sizes of PA programs, even a single student having an off day while taking the PANCE—perhaps failing the PANCE because they were ill—could potentially decrease a program's PANCE pass rate several percentile points for the year. Using data averaged over the course of five years affords the advantage of smoothing the data and blunting the potential impact of a single atypical year.

The data collected for the independent variables are a snapshot taken during the 2018–2019 academic year. The lack of a readily available, annual historical data set related to some of the independent variables does not allow for similar smoothing of the independent variables over the course of 5 years. If 2018 happened to be an unusual year for a program, the data considered for the associated independent variable in the study would be affected.

It is also worth considering that these independent variables are not all at equal risk of being subject to wide variation over a short period of time. The variable least likely to have changed during the study period is the duration of the program. While PA programs are free to adjust their curricular length as deemed appropriate to improve student outcomes, programs generally would not choose to make such a change lightly or frequently. Curricular changes of this nature are typically accompanied by a fairly substantial institutional process and also requires presenting the proposed change to the ARC-PA for approval. Since the ARC-PA maintains records of all approvals of curricular changes, it might be possible with further study to control for programs that had undergone significant changes in program length between 2014 and 2018.

It is also fairly unlikely that a program's prerequisite healthcare experience would have significantly changed during the course of the years that PANCE data were accumulated. The amount of healthcare experience required by a PA program is generally tied to the philosophy of the program and sits on one side or the other of a large divide. One side looks to the historical roots of the PA profession as a second career for people with substantial healthcare experience. The other side sees a profession that is becoming younger without apparent ill effect.

The other two independent variables—faculty to full-time student ratio and proportion of faculty holding a doctoral degree—are much more potentially subject to considerable change

over the course of the five years that the PANCE pass rate data were accumulating. During this time period, the number of accredited programs jumped from 187 to 239 (ARC-PA, 2019b). Competition increased for a limited pool of PA educators, who found themselves in a position of being able to work almost any place they desired to work. Data collected by the Physician Assistant Education Association (PAEA) suggest annual faculty attrition rates as high as 9% (PAEA, 2009). Extrapolated over the course of five years of PANCE administrations, faculty turnover in a program might, therefore, possibly approach 45%. Longitudinal data related to year-to-year staffing levels at PA programs and faculty mobility does not exist in a centralized collection. It is possible that both student to full-time faculty ratios and the credentials of faculty at any given program could vary widely over the course of 5 years, and it would be difficult to obtain these data unless it could be provided directly from programs.

One unanticipated limitation of the study concerns the data related to 5-year PANCE average pass rates. For the study period of 2014–2018, the mean 5-year pass rate was 96.61, and the standard deviation was 2.727, meaning that the vast majority of scores ranged from 91.16 to 100. It was not anticipated that these scores would be so tightly clustered. It can be challenging to explain variability where little variability exists. Earlier studies have been able to achieve statistically significant results, but it is possible that more variability existed in past years when these studies were conducted.

Future Research

There are several ways that the analysis in this study might be improved in future research. First, this study examined program-required healthcare experience hours with the underlying assumption that programs that require more experience hours place a relatively higher value on experience and will, therefore, tend to admit students who have accumulated more hours of experience. This belief may not necessarily be the case, and it is possible that the hours required by a program are not a reliable surrogate for the actual number of hours that matriculating students have actually completed. The application process for PA school has come to resemble the application process for medical schools. Applicants tend not to target a single program and its unique admission requirements. Instead, applicants anticipate applying to several programs and attempt to accumulate as many hours as practical to expand the pool of programs where they can be considered for admission. It would be an improvement to study the actual experience hours for students enrolled in programs to develop program averages and then determine whether those averages can be correlated with program PANCE pass rates. There data are not currently readily available, but it could be obtained either directly from programs or by making small adjustments to annual survey instruments administered to PA programs by the Physician Assistant Education Association (PAEA).

A second limitation in this study related to healthcare experience is that the data examined did not allow for differentiation between different types of healthcare experience. Some programs only consider healthcare experience valid if it consists of direct, hands-on patient care. Many of these programs require applicants to have gained their experience through a paid position as some type of certified healthcare provider, such as a paramedic. The healthcare experience requirement for other programs is much less stringent; in some cases, programs are

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even willing to accept shadowing or volunteering as healthcare experience. It is likely that if healthcare experience does significantly impact performance on the PANCE, it may be necessary to differentiate between different types of experiences to make an effect apparent. It might be worthwhile to attempt to determine whether there is a significant performance difference between programs that require direct, hand-on experience and programs willing to accept less intense experiences. Again, data this granular does not currently exist in a readily available dataset; it needs to be collected directly from a sampling of PA programs.

It may well be the case that a program's healthcare experience requirements really have no significant impact on PANCE performance. Experience can undoubtedly help to develop many characteristics, including time management, interpersonal skills, and the ability to work under stressful conditions. All of these factors can contribute to the creation of more competent students and healthcare providers, but none of these factors necessarily correlate with improving the knowledge base needed to perform well on a computer-based standardized examination like the PANCE.

With respect to curricular length, this study evaluated only the total length of the physician assistant curriculum and did not attempt to differentiate between the didactic and clinical phases. A program cited in this study as being 27 months in length might, therefore, have a didactic phase ranging from 12 to 16 months in length. Further study is desirable to determine the relative importance of these different aspects of the PA curriculum. Since the PANCE primarily tests didactic knowledge, there is a possibility that a longer didactic phase confers and advantage. As noted above, it would also be desirable to control for different curricular models, which might indicate that length is more significant to some models than others (i.e., problem-based learning).

Student to full-time faculty ratios could change significantly over the course of five years. It might be possible to obtain sufficient data from PA programs to study student-to-faculty ratios in a prospective fashion and control for changes in faculty size. Instead of purely looking at numbers of faculty, a better study would also find a way to consider faculty qualifications and experience. Perhaps the number of faculty at a PA program would be found to be less significant than the number of years of teaching experience faculty have amassed. Again, these data do not currently exist in a readily accessible fashion, but it might be possible to extract it from data collected in annual surveys conducted by the PAEA.

One possible marker of faculty quality examined in this study was the doctoral degree. A limitation in this study was a failure to make distinctions between the types of doctoral degrees held by faculty members in PA programs. Fields of study varied widely among PA faculty holding doctoral degrees. Each PA program is required to have at least one licensed and board-certified physician serving as a medical director for the program, accounting for one doctoral degree. Many of the doctoral degrees in PA programs were in fields directly related to the material taught in a PA program, such as medical science, allopathic medicine, and osteopathic medicine. Other degrees were perhaps less directly applicable, such as degrees in ministry and educational administration. A number of faculty are simply designated as having a Ph.D., with no indication of the field of study involved. While the holders of some of these non-medically related degrees may have gained skills valuable for the operation of a PA program, they have not necessarily increased their knowledge base related to medical topics or their ability to convey medical knowledge to students. It would be desirable for a future study to control for different fields represented among degree holders.

Finally, this study was broad rather than deep. There are a small number of programs that regularly outperform the vast majority of programs in their PANCE pass rates. It may be worthwhile to examine these programs in detail. A deep-dive, case-based study may be able to tease out exactly how these programs achieve their remarkable level of success. In a field as complex as healthcare education, there are still a great number of other variables to examine.

Implications for PA Stakeholders

Almost daily, Americans are confronted with evidence that our healthcare system is in crisis. The often acrimonious debate concerning the Affordable Healthcare Act has revealed a broken system that struggles to deliver even basic care to many of our citizens. It seems fairly intuitive that a lack of regular primary care can eventually lead to complex, expensive, and even debilitating problems. PAs are particularly well-positioned to help address the United States' healthcare crisis. Stated succinctly, the PA profession was designed to go to places no one wants to go to care for people no one wants to care for. The subject matter on the PANCE focuses mainly on ensuring that graduates have a sufficient knowledge base to competently practice the primary care medicine our nation needs.

Providing effective care for a diverse population requires an equally diverse population of healthcare providers. Coplan and Fleming (2019) note that the PA profession has had difficulty in responding to a call for a diversified workforce. They noted that disparities in educational opportunity beginning as early as primary school can hamper the ability of students to get on a track that will lead to admission to a PA program. The 5th edition of the ARC-PA's *Standards of Accreditation for Physician Assistant Education* goes into force in September of 2020, with added requirements that programs take action to recruit faculty and students with diverse

backgrounds (ARC-PA, 2019c). One means of accomplishing this is by minimizing barriers to entry to PA education. The independent variables in this study may serve as significant entry barriers, and PA programs would be wise to consider ways to attenuate this effect.

Stakeholders should reconsider the importance of healthcare experience as an admission requirement. With this only being the second study evaluating the impact of prior healthcare experience on PA education, further evaluation is needed to explore the relationship between programmatic healthcare experience requirements and PANCE performance. Characterizing this relationship—or a lack thereof—has significant policy implications. If it can be determined that healthcare experience is not as essential to success as widely thought, PA programs must be willing to rethink policies related to healthcare experience requirements. Obtaining healthcare experience comes at a cost. Programmatic healthcare experience requirements may serve as a significant barrier to entry for many applicants to PA training programs. The level of experience demanded by some programs requires that applicants obtain the equivalent of a year of full-time employment, thereby deferring entry to the PA profession by at least a year. It is undeniably wise for students to gain some experience in a healthcare setting to ensure they are making a well-informed career decision before they begin PA school. But there is currently no solid evidence to suggest that healthcare experience is as essential as some PAs believe. Hegmann and Iverson (2016) were unable to identify the effect of healthcare experience at the level of individual students, and this study was unable to identify an effect at the program level. Programs with very high experience requirements might unwittingly be excluding diverse candidates with other characteristics even more important for success. Decreasing healthcare experience requirements may make it possible for PA programs to greatly expand their applicant pool without adverse effects on their PANCE pass rates.

Stakeholders must also reconsider the often held belief that longer is better for PA educational programs. Based upon the findings of this and several previous studies (McDowell et al., 1999; Asprey et al., 2004; Colletti et al., 2016), there is also no evidence to indicate that longer programs have significantly higher 5-year PANCE average pass rates than shorter programs. If further investigation continues to demonstrate the absence of a significant relationship, there are significant policy implications for PA programs. As Coplan and Flemin (2019) noted, tuition costs can serve as a significant entry barrier for many applicants, disproportionately affecting underrepresented minority students. Shorter programs tend to have lower tuition costs and also position students to begin earning a salary more quickly than students attending a longer program. Shorter programs confer a societal benefit in that they bring sorely needed clinicians into the patient care environment more quickly. As programs consider their curricular structure, the length of the program may be less significant than has traditionally been believed.

Given the inability of multiple studies to discern a significant relationship between program length and PANCE performance, it would be wise for programs to examine their curricular length and identify means for advancing students through the curriculum more quickly. There is already a significant push in medical education to move toward a competency-based curriculum. Powell and Carraccio (2018) noted that having classes proceed through school on a cohort model is often inefficient as students master material and skills at very different rates. ARC-PA accreditation standards are already well-equipped to work with competency-based education since there are no requirements related to the length of activities or specific numbers of patients that must be seen or procedures that must be performed. PA programs would

be well-advised to follow the lead of medical schools in considering the feasibility of moving toward shorter, competency-based curricula.

Stakeholders should consider how faculty composition might affect program performance. In addition to barriers to student entry, the PA educational system can be impacted by barriers preventing PAs from becoming faculty members. The rapid expansion of PA programs across the nation has caused a relative shortage in the number of qualified, full-time faculty available to teach at PA programs. The ARC-PA (2010) refers to these full-time, PA-certified faculty members within a program as "principal faculty" and requires that a program be staffed with a minimum of three principal faculty members. Programs naturally take pride in being able to report many principal faculty, and these faculty are essential as they interact with and advise students daily.

Part-time or contingent faculty are frequently viewed in a negative light in higher education. In many settings, they are viewed as victims being taken advantage of by a system that seeks to exploit their labor while refusing to provide adequate employment benefits. In PA education, the situation is somewhat different. Adjunct faculty are often full-time healthcare providers (often earning significantly more than full-time faculty) who teach as secondary employment. The use of these adjunct faculty has the potential to considerably extend the depth and breadth of the program's curriculum, delivering content well outside of the expertise of the program's principal faculty. These part-time positions also introduce clinically-practicing PAs to the culture of higher education and frequently serve as an entry point for new faculty into PA education.

This study was unable to identify a statistically significant relationship between student to full-time faculty ratios and the 5-year PANCE average pass rate, a relationship which was

determined to be significant in previous research. Further studies will be needed to resolve this conflict and determine the strength of this relationship. In the meanwhile, instead of being concerned about pure numbers of full-time faculty, programs are well advised to cultivate a faculty composed of both full-time and part-time members with diverse backgrounds and areas of expertise.

Stakeholders must consider the implications of demanding (or even just preferring) that faculty have earned a doctoral degree. As discussed above, doctoral degrees are often regarded as a marker of institutional quality. Institutions with a high percentage of faculty who have earned doctoral degrees proudly advertise that fact. Having earned a doctoral degree is a requirement for employment, promotion, and tenure at many institutions. Unfortunately, requiring a doctoral degree also serves as a significant barrier to hiring diverse faculty in PA programs, and Coplan and Fleming (2019) proposed that this ultimately leads to difficulty recruiting a diver student body.

Nationwide, the pool of available PAs who have earned a doctoral degree is small. The most recent data available suggests that approximately 1.8% of certified PAs have earned a doctoral degree (NCCPA, 2019). Some of these doctorally-trained PAs have earned their degree to enhance their clinical practice or their ability to work in medical administration and are not considering a career in academia.

One recent study indicated that approximately one-third of advertisements for PA faculty positions note that a doctoral degree is either preferred or required (Kayingo et al., 2017). Stakeholders should realize that requirements such as these may be closing the door on tremendously talented faculty members. There is a current generation of PAs that graduated with bachelor's degrees and are now approaching the end of their clinical career. These women and

men have amassed forty years of experience working on a daily basis in clinical settings. Programs must carefully weigh the importance of the practical wisdom gained by these clinicians before rejecting them outright on the basis of an academic qualification that ultimately might not be that important.

Conclusion

The rapid expansion of PA educational programs has been largely taking place in the absence of any data related to program characteristics that may be associated with improved outcomes for students. One universally appreciated outcome for PA programs is performance on the Physician Assistant National Certifying Examination (PANCE). While an argument could be made that a standardized examination is not the best predictor for which students will perform well in clinical practice, the PANCE remains the sole standardized evaluation allowing for comparison across all PA programs. Both potential applicants and the ARC-PA assign great importance to a program's PANCE pass rate. However, this faith may be misplaced if we cannot discover factors that predict or are predicted by high programmatic PANCE pass rates.

There have been relatively few studies to examine predictors of PANCE performance, and most of these studies were limited by their age or cohort size. This study sought to determine the relationship between program outcomes as measured by their 5-year PANCE average pass rate and four independent variables: required healthcare experience, duration of the PA program's curriculum, the student to full-time faculty ratio, and the proportion of faculty who earned a doctoral degree. The study enrolled all PA programs with 5 or more years of PANCE data available. Ultimately, the study failed to identify a significant relationship between any of these dependent variables and 5-year average PANCE pass rates. As is the case in analyses of

this type, a failure to reject the null hypothesis does not necessarily mean the null hypothesis is true. There may, in fact, be a relationship between these variables that can be discerned with further study.

One encouraging—and perhaps frustrating—implication of this finding is that it appears that almost any combination of factors can make a program perform well on the PANCE. The ARC-PA has repeatedly advanced relatively non-prescriptive accreditation standards with the explanation that they wish to give programs a great deal of latitude in structuring their programs. With the national 5-year PANCE average pass rate hovering around 95%, it appears that programs are doing well in meeting expectations related to the knowledge base. A complex interplay of PA program characteristics creates a unique milieu for each program, and each program will need to undertake an extensive study to determine the unique internal characteristics that promote improved performance.

Finally, some uncomfortable questions remain. What, for example, is the real significance of the PANCE, and has it been assigned too much importance in PA education? As high-stakes standardized testing has become pervasive across all levels of education, there has been increasing concern about instructors "teaching to the test" instead of developing students with sorely needed critical thinking skills. The PANCE remains the solitary metric that is readily available to discern differences in outcomes between PA programs. As such, everyone involved in PA education, from applicants to accreditors, has assigned it an almost magical status. It assesses a single component—knowledge base—of a complex set of competencies required to produce a skilled clinician.

Studies like this one have been conducted to attempt to identify factors associated with success on the PANCE. To date, there has been no attempt to determine what, if anything,

success on the PANCE predicts. Future studies may discover that higher PANCE scores are

associated with improved patient outcomes or more cost-effective patient care. But for the time

being, success on the PANCE may be indicative of little more than skill in completing a

standardized examination.

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November 20, 2019

Chris Hanifin

Re: 2020-030

Dear Mr. Hanifin,

The IRB is in receipt of the application for your study entitled "An Examination of the Relationship Between Physician Assistant Program Characteristics and Performance on the Physician Assistant National Certifying Examination." After reviewing the inclusive content, the proposed study was deemed to be "Not Human Subjects Research" by the Research Ethics Committee of the Seton Hall University Institutional Review Board and is therefore beyond the purview of the Institutional Review Board. Therefore, you are under no obligation to submit any further correspondence to the Seton Hall University Institutional Review Board regarding this effort, unless of course there are any modifications made to the design or intent of your study that may otherwise change the designation to human subject's research. If you plan to create any future correspondence with the Institutional Review Board about this study, please reference the ID# listed above.

Sincerely,

Mara Podvey

Mara C. Podvey, PhD, OTR
Associate Professor
Co-Chair, Institutional Review Board

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