PREDICTIVE EFFECTS OF PHYSICIAN ASSISTANT STUDENTS' PRE-ADMISSION DIRECT PATIENT CONTACT HOURS ON PERFORMANCE IN SUPERVISED CLINICAL PRACTICE EXPERIENCES

by

Gerald Robert Weniger

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Philosophy

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ABSTRACT

The demand for physician assistants (PAs) is predicted to rise because of the growing shortage of physicians. PA educational programs are tasked with producing graduates who are skilled within six domains of competency: 1) medical knowledge, 2) professionalism, 3) interpersonal and communication skills, 4) patient care, 5) practice-based learning and improvement, and 6) systems-based practice. The Physician Assistant National Certifying Exam only assesses two of the six competencies: medical knowledge and professionalism. Without much time in a curriculum to teach the 'softer skills' like communication and interpersonal skills, many PA programs require pre-admission patient contact experience in order to at least expose students to some of these competencies prior to matriculation. The purpose of this non-experimental, quantitative, regression study was to determine if the non-cognitive variable of pre-admission patient contact hours is predictive of subsequent PA student performance as defined by their score on preceptor evaluations for a supervised clinical practice experience (SCPE). The sample consisted of 140 participants who were graduates of a single PA program from 2015 to 2019. The instrumentation included pre-admission patient contact hours and scores on preceptor evaluations of PA students for SCPEs in Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery. This investigation used seven bivariate linear regression analyses to determine that the quantity of an incoming PA program applicant's pre-admission patient contact hours is not predictive of their subsequent performance on SCPEs. However, further investigation is warranted for the Women's Medicine setting.

Keywords: physician assistant, competency, performance, outcomes, pre-admission patient contact experience, non-cognitive admission variables

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List of Abbreviations

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

American Academy of Physician Assistants (AAPA)

Association of American Medical Colleges (AAMC)

Centralized Application Service for Physician Assistants (CASPA)

Competency-based Medical Education (CBME)

End of Rotation (EOR)

Grade point average (GPA)

Graduate Review Examinations (GRE)

Institutional Review Board (IRB)

More knowledgeable other (MKO)

Multiple Mini-Interviews (MMI)

National Commission on Certification of Physician Assistants (NCCPA)

Physician Assistant (PA)

Physician Assistant Education Association (PAEA)

Physician Assistant National Certifying Exam (PANCE)

Statistical Package for Social Sciences (SPSS)

Supervised clinical practice experience (SCPE)

Zone of proximal development (ZPD)

CHAPTER ONE: INTRODUCTION

Overview

The purpose of this research study was to determine if the non-cognitive variable of pre-admission patient contact hours is predictive of subsequent physician assistant (PA) student performance as defined by the percentage grade on their final preceptor evaluation for a supervised clinical practice experience. PAs are healthcare providers who are trained via graduate-level educational programs to practice medicine in collaboration with a physician. The use of prior patient care experience as a non-cognitive variable in PA program admission processes warrants further investigation. This introduction provides an overview of the historical, social, and theoretical background of the central premise for this research study. The problem statement will describe the intentions behind the study, and the purpose statement will make clear the manner in which the study will address the problem. The significance of the study will depict the role that the research has in addressing a gap in the current literature. Finally, the potential outcomes created by the study will be outlined within the research question.

Background

Historical Context

In the United States, the demand for physician assistants (PA) is predicted to increase because of the growing shortage of physicians (Association of American Medical Colleges [AAMC], 2019). PA educational programs are charged with producing graduates who are competent medical practitioners. The four major organizations within the PA profession have previously defined six domains of competency: 1) medical knowledge, 2) professionalism, 3) interpersonal and communication skills, 4) patient care, 5) practice-based learning and improvement, and 6) systems-based practice (American Academy of Physician Assistants

[AAPA], 2012). These six competencies are the same as the ones adopted for medical schools by the Accreditation Council for Graduate Medical Education (ACGME) in 1999. Adopting the same competencies as physicians makes sense, since PAs practice medicine in collaboration with physicians.

In order to obtain a state license to practice medicine, a PA must first acquire national certification by passing the Physician Assistant National Certifying Exam (PANCE). The PANCE is a five-hour assessment that includes 300 multiple-choice questions. The PANCE, however, only assesses two of the six competencies: medical knowledge and professionalism (National Commission on Certification of Physician Assistants [NCCPA], 2019b). Questions about medical knowledge make up the vast majority of the exam (95%), while approximately 5% of questions are on professional practice (NCCPA, 2019b).

The competencies of interpersonal and communication skills, patient care, practice-based learning and improvement, and systems-based practice are not directly addressed on the PANCE. Therefore, on the one hand, PA programs are wise to spend most of their time training students in medical knowledge so that they are well prepared for the PANCE. On the other hand, this practice creates a disconnect within the profession. By putting almost all of the emphasis on the domain of medical knowledge, the profession inherently lessens the importance of the other five domains of competence. It would be less than ideal to have a PA program graduate who successfully passes the PANCE but lacks patient care skills or interpersonal and communication skills. Because the PA profession has committed to all six domains of competency as foundational to a PA's practice of medicine, then the profession needs to determine how to better ensure that graduates are well-trained in all six domains (AAPA, 2012). Thankfully, a PA

student's competency in all six domains is evaluated during the clinical phase of the PA program.

Since physician assistants practice medicine alongside physicians, PAs are educated in the medical model (AAPA, 2020b). The medical model of education is to have all of the classroom or didactic coursework first, followed by the clinical coursework and experience (AAPA, 2020b). The didactic phase of a PA program has a median length of 13 months; the clinical phase of a PA program has a median length of 12 months (Colletti et al., 2016). The clinical phase consists of a series of supervised clinical practice experiences (SCPE) that are defined by accreditation standards that all students must successfully complete in order to graduate and to demonstrate competence to become a PA (Accreditation Review Commission on Education for the Physician Assistant [ARC-PA], 2020).

The Accreditation Review Commission on Education for the Physician Assistant (ARC-PA) defines a SCPE as "supervised student encounters with patients that include comprehensive patient assessment and involvement in patient care decision making and which result in a detailed plan for patient management" (ARC-PA, 2020, p. 25). The accreditation standards mandate that PA students have a SCPE in each of the following settings: Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery (ARC-PA, 2020). The length of an individual SCPE that is required can vary by PA program, but the mean length is approximately five weeks (Physician Assistant Education Association [PAEA], 2018).

Throughout a supervised clinical practice experience, a PA student is assigned to a clinical preceptor who can be a physician, physician assistant, or nurse practitioner. The PA student spends at least 40 hours per week directly with the preceptor performing medical and

surgical duties as appropriate. These may include taking patient histories, performing physical examinations, ordering/interpreting laboratory and imaging tests, writing prescriptions, formulating diagnoses, performing procedures, and much more (AAPA, 2019). PA students are evaluated by the clinical preceptor at the conclusion of the SCPE. Details and wording of evaluation forms can vary among PA programs, but in some way, all must evaluate the competency of the student (ARC-PA, 2020). Ratings among competency areas are converted to a percentage score in order to determine a final grade for the SCPE course. Since all six domains of competency (particularly interpersonal and communication skills, professionalism, and patient care) may not be adequately addressed during the didactic phase of a PA program's curriculum, the clinical phase is a critically important time. Yet ensuring enough adequate exposure to these competencies may also be difficult in all clinical settings.

A majority of PA programs require pre-admission healthcare experience – something that has been foundational since the start of the profession (PAEA, 2017). This clinical experience is typically reported as pre-admission patient contact hours on PA school applications. Critics of requiring pre-admission patient contact hours point out that most medical schools do not have such a requirement (Hooker et al., 2017). A common rebuttal to this is that physicians complete a residency after medical school where they are exposed to thousands of patient care hours before becoming independent practitioners. Therefore, since PAs are not required to complete a residency, requiring a specified type and number of pre-admission patient contact hours on the front end may be logical.

Additionally, although medical schools do not require a set number of patient contact hours for admission, many do give weight to them in their selection process (AAMC, 2021). Requiring pre-admission patient contact hours does not guarantee future competency of the

medical provider, but it at least ensures exposure to opportunities in a clinical setting that may affect future interpersonal and communication skills, professionalism, and patient care. And these domains of competency are critical to providing high-quality patient care (AAPA, 2012). Furthermore, PA programs need to not only produce highly trained, competent individuals, but also must do so in a short amount of time due to workforce shortages (Hooker et al., 2017). Current accreditation standards do not prescribe program length (ARC-PA, 2018). Programs that are too short may not prepare graduates effectively. But programs that are too long may unnecessarily contribute to student debt, may be a barrier to the economically disadvantaged, and may not be an efficient method of getting providers into practice (Hooker et al., 2017).

Requiring prior healthcare experience is a common and notable practice in PA education. According to a 2017 PAEA report, approximately 58% of programs require pre-admission healthcare experience of some kind and an additional 27% of programs recommend it. Only 14% of programs do not require any prior healthcare experience (PAEA, 2017). Of those 58% of programs that require healthcare experience, 78% require it to be direct patient contact (PAEA, 2017). The mean number reported is 733.82 hours per applicant (PAEA, 2017). This is equivalent to approximately 18 weeks of full-time work. It is unknown if the amount of prior patient care experience affects a PA students' subsequent performance in a clinical setting.

Prior patient care experience is considered a non-cognitive factor within the admissions process for PA programs. Other non-cognitive factors are personal statements/essays, reference letters, and in-person interviews (Ingrassia, 2016). All of these non-cognitive variables are assessed during the admissions process because they are thought to be representative of an applicant's non-cognitive attributes such as motivation, knowledge of the profession, maturity, and work ethic (Ingrassia, 2016). These non-cognitive characteristics are exceedingly difficult to

quantify and it remains unknown if they are predictive of future clinical success. While in-person interviews, applicant essays, and reference letters attempt to gauge these characteristics directly, requiring direct patient care experience is a more indirect method of at least ensuring exposure to professional behaviors, and interpersonal and communication skills in a clinical setting. Approximately half of PA programs nationwide require some amount of pre-admission direct patient contact experience and 100% of PA programs require students to complete supervised clinical practice experiences as part of their training (PAEA, 2017; ARC-PA, 2020).

Social Context

Opponents of PA programs requiring pre-admission patient contact hours claim that this admissions variable creates a barrier to admission that is burdensome to the socioeconomically disadvantaged applicant (Hooker et al., 2017). By doing away with this requirement, more applicants would be eligible for admission without having to spend time and money on gaining relevant clinical experience. On the other hand, if this pre-admission requirement is done away with, then the overall length of the PA program may need to increase. This is problematic for two reasons. First, this would alter a significant factor from what differentiates PA school from medical school: overall length of study. Secondly, it would make the PA program itself more expensive, thus definitively creating a barrier to admission for the socioeconomically disadvantaged (Hooker et al., 2017).

Assessment of non-cognitive admissions variables is not only more holistic, but may foster an environment that ultimately brings more diversity into the PA profession (Brenneman et al., 2018. Therefore, if PA programs do not wish to add length to their current curricula, requiring pre-admission patient contact hours prior to matriculation may allow PA educators to keep the overall duration of PA programs lower.

Theoretical Context

The fundamental concepts for understanding how physician assistant students acquire the necessary knowledge, skills, and attitudes to be competent medical providers can be found in a number of different models and learning theories. In the early 20th century, a Soviet psychologist, Les Vygotsky, first proposed his social development theory, which was quite different than Jean Piaget's cognitive development theory (Vygotsky, 1978). Piaget's theory focuses on self-initiated development that is needed before one can learn (Sincero, 2011). Vygotsky's theory claims that social interactions between a learner and a *more knowledgeable other* are crucial to knowledge development (Vygotsky, 1978). The more knowledgeable other can be a teacher, parent, coach, or, in the case of PA education, a clinical preceptor. In this example, the clinical preceptor guides the learner (PA student) through a zone of proximal development (ZPD). The ZPD is the area where the learner can only accomplish a task with the help of the clinical preceptor (Vygotsky, 1978). This kind of collaborative learning is rather common in clinical settings. PA students in this phase of their training are no longer in the classroom with traditional lecture-based teaching. Instead, they are in a preceptor model of medical education where they are assigned to a single clinician (typically a licensed physician or physician assistant) who facilitates the learning process in a medical office, hospital, emergency department, or surgery center. The preceptor serves as a role model, mentor, and guide as the PA student develops clinical problem-solving skills while seeing patients with real problems. If clinical experience is a necessary and fundamental component of PA education, then it seems reasonable that exposure and experience in a clinical setting prior to PA school would be valuable and may impact that future clinical learning. At the very least, prior clinical experience

provides students the opportunity to observe and understand the collaborative process that occurs in clinical education between a PA student and a more knowledgeable other.

Briefly, two additional theories can be effectively applied to clinical settings in which PA students are interacting with patients: the theory of multiple intelligences and the Peter principle. In the well-known book, *Frames of Mind: The Theory of Multiple Intelligences*, Gardner outlined the theory of multiple intelligences which detailed seven types of intelligences that do not function independently, but rather are co-dependent on each other (Gardner, 1983). Two of the intelligences, interpersonal intelligence and bodily-kinesthetic intelligence, can specifically be cultivated well in clinical settings (Gardner, 1983). Having exposure to clinical settings and hands-on learning opportunities via direct patient care experiences may help foster these two types of intelligence, thereby removing some of the burdens from PA programs to teach these skills as extensively.

The Peter principle was developed by Peter and Hull and first described in 1970 in their book of the same name (Peter & Hull, 1970). The theory defines four levels of competence: 1) unconscious incompetence, 2) conscious incompetence, 3) conscious competence, and 4) unconscious competence. A learner progresses through these levels, moving from not knowing how to complete a task and not even knowing that they do not know; to accomplishing a task quite easily, as if by second nature (Peter & Hull, 1970). Learners only get to the final stage via exposure, repetition, and practice (Peter & Hull, 1970). This is exactly the type of hands-on exposure that is provided for learners in clinical settings. Therefore, pre-admission exposure to these settings and experiences could benefit a student later on in their formal training.

Problem Statement

Passing the multiple-choice PANCE is required to be eligible for a medical license in all 50 states, but this exam only evaluates the domains of medical knowledge (95% of the exam) and professionalism (5% of the exam) (NCCPA, 2019a; NCCPA, 2019b). Therefore, a passing score may not actually be representative of a PA's competency in all six domains of the profession. There have only been two prior studies that have investigated the relationship between prior patient contact experience and subsequent PANCE scores. An investigation by Brown et al. (2013) found no correlation between the extent of prior healthcare experience and PANCE scores. Higgins et al. (2010) also showed no correlation between prior healthcare experience and PANCE scores. Additional studies have tried to correlate prior patient care experience with other cognitive variables. Honda et al. (2018) showed that prior clinical experience was not a predictor of PA program overall GPA. However, they did discover that a 10% increase in the quantity of hands-on patient care hours was associated with a greater than 14 point increase in PANCE scores (2018). When the data was adjusted for educationally disadvantaged background and age, there was a greater than 18 point increase in PANCE scores, which was statistically significant (Honda et al., 2018). Hegmann and Iverson (2016) evaluated five cohorts of PA students and found that the quantity of pre-admission patient contact hours had an inverse relationship with standardized patient examination scores during clinical year and with preceptor evaluations, but neither was statistically significant. In conclusion, pre-admission direct patient contact hours have been studied for their relationship with certain cognitive variables like PANCE scores, overall program GPA, and more. But the relationship between those hours and other PA program outcomes is less clear. The evidence for the usefulness of this non-cognitive variable within PA program admissions is not as comprehensive or clear as the

literature on cognitive factors (Brenneman et al., 2018). Therefore, the problem is that the literature has not fully addressed whether the amount of prior direct patient contact hours affects a PA student's subsequent performance in clinical settings such as in required supervised clinical practice experiences.

Purpose Statement

The purpose of this non-experimental, quantitative, regression study was to determine if the non-cognitive variable of pre-admission patient contact hours is predictive of subsequent PA student performance as defined by their score on final preceptor evaluations for a supervised clinical practice experience. For this study, the predictor variable was the number of a PA student's pre-admission patient contact hours. Patient contact hours could come from one experience or a combination of experiences and may have been paid work or voluntary. Medical scribing and shadowing of a clinician were not acceptable. Experiences that had a higher level of training, autonomy, and responsibility were more desirable. Examples include time as a paramedic, physical therapist, radiologic technologist, occupational therapist, registered nurse, dietician, athletic trainer, emergency medical technician, respiratory therapist, surgical assistant, or patient care technician. The experience(s) must have included live, human patients, with the applicant working directly with them in a medical setting. Veterinary or dental experiences were not acceptable. Therefore, direct patient contact hours are defined as paid or volunteer time spent by an applicant in a medical setting, directly touching, caring for, and interacting with a patient (Physician Assistant Program, 2020, para 12). The criterion variables for this study were the final percentage scores a student achieved on their specific supervised clinical practice experiences (SCPEs) in the following settings: Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery

(Physician Assistant Program, 2020, table 2). These are the seven SCPEs required by the program of study (and by a majority of PA programs) as determined by national accreditation Standards (Physician Assistant Program, 2020, table 2). For each SCPE, a clinical preceptor evaluates the PA student on various items including non-cognitive attributes like patient care, professionalism, and interpersonal and communication skills ([redacted] PA Program], 2020a). A total score is calculated to represent the student's performance in that SCPE ([redacted] PA Program, 2020a). The study population included graduates from a small, accredited, graduate-level physician assistant educational program at a large public university. The sample consisted of 140 participants who were all PA program graduates from 2015 to 2019.

Significance of the Study

This study has significance for the growing body of literature on PA student outcomes, PA student competency, and admissions factors in PA education. Approximately 58% of PA programs require some type of pre-admission patient contact experience and 27% more recommend it (PAEA, 2017). Despite this, there is a growing chorus of PA educators who have called for an end to the requirement due to a lack of impact the experience has on future PANCE scores (Hooker et al., 2017). But PANCE scores are only one outcome measure of a PA student's success. The PA profession community as a whole has long declared that competence in six different domains is what makes a quality PA – not simply their medical knowledge (AAPA, 2012). Other domains like patient care, professionalism, and interpersonal and communication skills are more closely related to non-cognitive characteristics of applicants such as behavior, collaboration, leadership, and maturity. Non-cognitive factors such as pre-admission direct patient contact hours are therefore reported during admissions as a means of

gauging an applicant's aptitude in these areas. These non-cognitive attributes are not only desirable, but are also exactly what PA employers believe are lacking in PAs according to a 2016 survey conducted by the Physician Assistant Education Association (PAEA, 2016). This study adds to the current literature on this topic. Specifically, if a predictive relationship can be found between the quantity of an applicant's pre-admission patient contact hours and their future performance in SPCEs as a PA student, then this could only further solidify the current practice of requiring such hours and perhaps diminish the call from some educators to end the requirement (Hooker et al., 2017). Furthermore, the relationship between pre-admission patient contact hours and PA student outcomes other than PANCE scores has a scarcity of evidence-based literature. The results of this study impact PA educators, future applicants to PA programs, and the medical community in general. More specifically, this study adds to the literature on PA student outcomes/competency, and admissions factors in PA education by assessing the relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on supervised clinical practice experiences in Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery.

Research Question

The research question for this study was:

RQ: Is the quantity of an incoming PA program applicant's pre-admission patient contact hours predictive of their subsequent performance on supervised clinical practice experiences in Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery?

Definitions

1. *Accreditation Review Commission on Education for the Physician Assistant (ARC-PA)* – "The Accreditation Review Commission on Education for the Physician Assistant (ARC-PA) is the accrediting agency that protects the interests of the public and PA profession by defining the standards for PA education and evaluating PA educational programs within the territorial United States to ensure their compliance with those standards" (Accreditation Review Commission on Education for the Physician Assistant [ARC-PA, 2020, para. 1]).
2. *American Academy of Physician Assistants (AAPA)* – "Founded in 1968, the American Academy of PAs is the national professional society for PAs. It represents a profession of more than 131,000 PAs across all medical and surgical specialties in all 50 states, the District of Columbia, U.S. territories, and the uniformed services" (AAPA, 2020a, para. 1).
3. *Centralized Application Service for Physician Assistants (CASPA)* – "The Centralized Application Service for Physician Assistants simplifies the process of applying to physician assistant programs. You start by selecting the programs you wish to apply to, then you submit one application that includes all necessary materials. Once received by CASPA, your application and materials go through a verification process before being transmitted to all of your selected programs." (Centralized Application Service for Physician Assistants [CASPA], 2020, para. 1).
4. *Cognitive admissions variables* – Data collected by PA programs from applicants during the admissions process, to include overall GPA, science GPA, and prerequisite course grades (Brenneman et al., 2018; Jones et al., 2014).

5. *More knowledgeable other (MKO)* – A concept proposed by psychologist Les Vygotsky, an MKO is anyone who has more knowledge about a specific subject matter than the learner. An MKO is typically a teacher, parent, tutor, or coach (Vygotsky, 1978).
6. *National Commission on Certification of Physician Assistants (NCCPA)* – "…the only certifying organization for physician assistants in the United States. Established as a not-for-profit organization in 1974, NCCPA is dedicated to assuring the public that certified PAs meet established standards of clinical knowledge and cognitive skills upon entry into practice and throughout their careers. All U.S. states, the District of Columbia and the U.S. territories have decided to rely on NCCPA certification as one of the criteria for licensure or regulation of PAs. As of Dec. 31, 2019, there were more than 139,000 certified PAs" (NCCPA, 2020a, para. 1).
7. *Non-cognitive admissions variables* – Data collected by PA programs from applicants during the admissions process, to include personal statement, in-person interview, and prior patient contact experience (Brenneman et al., 2018; Jones et al., 2014).
8. *Physician Assistant (PA)* - "medical professionals who diagnose illness, develop and manage treatment plans, prescribe medications, and often serve as a patient's principal healthcare provider" (AAPA, 2019, para. 1).
9. *Physician Assistant Education Association (PAEA)* – "…the only national organization representing physician assistant educational programs in the United States. Currently, all of the accredited programs in the country are members of the Association. PAEA provides services for faculty at its member programs, as well as to applicants, students, and other stakeholders" (Physician Assistant Education Association [PAEA], 2020, para. 1).

10. *Physician Assistant National Certifying Exam (PANCE)* – This is a 300-question, multiple-choice exam that "assesses basic medical and surgical knowledge" (NCCPA, 2019a, para. 3). "After passing PANCE, PAs are issued NCCPA certification and can use the PA-C designation until the certification expiration date" (NCCPA, 2019a, para. 4).
11. *Pre-admission patient contact experience* – Defined differently depending on the PA program. Some are broad and some more restrictive. For the institution/program of study, patient contact hours could come from one experience or a combination of experiences and may have been voluntary or paid work. Clinical shadowing and medical scribing were not acceptable. Experiences that had a higher level of training, responsibility, and autonomy were more desirable. Experience(s) must have been with live, human patients, and in a medical setting. Dental and veterinary experiences were not acceptable. Experience was measured in hours ([redacted] PA Program, 2020b, para 12).
12. *Supervised Clinical Practice Experience (SCPE)* – "Supervised student encounters with patients that include comprehensive patient assessment and involvement in patient care decision making and which result in a detailed plan for patient management" (Accreditation Review Commission on Education for the Physician Assistant, Inc. [ARC-PA], 2020, page 25).
13. *Zone of proximal development (ZPD)* - A concept proposed by psychologist Les Vygotsky, a ZPD is the area where guidance and direction need to be provided to the learner by a more knowledgeable other. Without said guidance, the task cannot be completed or knowledge cannot be attained (Vygotsky, 1978).

CHAPTER TWO: LITERATURE REVIEW

Overview

A thorough and systematic review of the literature was conducted to investigate the role of pre-admission variables for physician assistant (PA) programs and how they relate to PA program success. The chapter begins with a discussion of two relevant theoretical frameworks related to intelligence and competence which translate to knowledge and skill acquisition in medical education. The next section reviews the history of the PA profession and the projected workforce need for PAs. There is then a brief review of related literature on physician assistant professional competencies and the variability among typical PA program admissions practices. The final section reviews literature on demographics in PA admissions and evaluates the use of specific cognitive and non-cognitive attributes within admissions. A summary concludes the document.

Theoretical Framework

Social Development Theory

Social development theory is a set of concepts that was developed by a Soviet psychologist named Les Vygotsky in the early 20th century (Vygotsky, 1978). When speaking of social development theory, Vygotsky mostly referred to the psychological development of children; however, psychologists have since applied his theories to adult learning as well. Vygotsky's social development theory opposes Jean Piaget's cognitive development theory which claims that a person must undergo development before being able to learn (Sincero, 2011). Where Vygotsky and Piaget agreed is that people are generally curious and can be actively involved in their own learning and the discovery of new ideas (Mcleod, 2018). But whereas Piaget placed more emphasis on self-initiated development, Vygotsky focused on social

contributions to the process of development (Mcleod, 2018). In other words, Vygotsky's social development theory claimed that meaningful learning was fundamentally a social activity and occurs when an individual has social interaction with a skillful tutor (Vygotsky, 1978). A tutor is often a parent or teacher (Vygotsky, 1978). The learner seeks to understand the actions of the tutor (or the instructions provided by the tutor) so that they can then consider the information and organize their own behavior (Vygotsky, 1978). This social interaction was viewed by Vygotsky as a collaborative process that enhances cognitive development (Vygotsky, 1978). Some might call this a constructivist approach to knowledge acquisition, where people construct their knowledge, not only from direct personal experience, but also as they are shaped by social interaction and from the guidance and instruction of others (McLeod, 2019a).

Vygotsky's (1978) social development theory had two key principles: the "more knowledgeable other," and the "zone of proximal development." The more knowledgeable other (MKO) refers to a person who has a better or more thorough understanding of the subject matter than the learner. This may be more understanding in terms of the process, the task, or the concept at hand (Sincero, 2011). For all intents and purposes, the MKO is a parent, teacher, coach, tutor, or other mentor; but it may also be a peer who simply has more knowledge about a particular subject than the learner (Vygotsky, 1978). Closely related to the MKO is the concept of the zone of proximal development (ZPD). Imagine a body of knowledge that a person can learn on their own, and separately, a body of knowledge that a person simply cannot learn even with assistance. The zone of proximal development is the area between those two zones, i.e., the zone where the learner can accomplish a task or gain new knowledge, but only with help from an MKO (Vygotsky, 1978). The term "proximal" is used because it refers to the skills or knowledge that a person is extremely "close" to mastering (McLeod, 2019b). Vygotsky viewed

the ZPD as the area where guidance and instruction needed to be provided in thoughtful ways in order for the learner to develop higher cognitive functioning (1978). Specifically, Vygotsky (1978) defined the ZPD as "…the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (p. 86). To support a learner moving through the ZPD, teachers are encouraged to be present as an MKO and to provide scaffolding. Scaffolding refers to the specific activities that the educator (MKO) uses to guide the learner through the zone of proximal development.

It is important to note that although scaffolding and the ZPD have become almost synonymous, Vygotsky never actually used that term (McLeod, 2018). The term scaffolding was coined by Wood, Bruner, and Ross in a 1976 journal publication. Wood and his colleagues defined scaffolding as a method "that enables a child or novice to solve a task or achieve a goal that would be beyond his unassisted efforts" (Wood et al., 1976, p. 90). Throughout the twentieth and twenty-first centuries, the terms scaffolding, guided learning, and cooperative learning have all been used fairly synonymously (McLeod, 2018). They are integrally related to Vygotsky's original concept of the zone of proximal development because the focus is the teacher's role as mediating the learning activity by sharing knowledge via social interaction (Dixon-Krauss, 1996). At its core, Vygotsky's social development theory explains that learning occurs when a leaner has a more knowledgeable other who guides them through a zone of proximal development.

Vygotsky's social development theory applies to much more than just school learning. It can effectively be applied to areas such as economics, adult language learning, cultural activities, athletics, and even medical education. PA schools follow a preceptorship model of education

just like medical schools. Thus, PA students in the clinical phase of their training are assigned to work with a preceptor (typically either a licensed physician or PA). That preceptor acts as the student's more knowledgeable other as they provide scaffolding on a day-to-day basis via advice, assistance, and delegated autonomy. A clinical preceptor guides the PA student through the zone of proximal development.

This clinical phase of a PA program is a necessary and foundational element of PA education. It is logical to consider that experience in a clinical setting and exposure to real-life patients prior to PA school might impact a student's future clinical learning. Students with clinical experience prior to PA school may have an advantage later during the clinical phase of PA school because they already understand the preceptorship model of education. That is, they have already witnessed scaffolding and social development theory in action.

The Theory of Multiple Intelligences

Howard Gardner is an American developmental psychologist and was a professor of education and cognition at the Harvard graduate school (he recently retired in 2019) (Smith, 2008). Dr. Gardner studied under Jerome Bruner (an American psychologist known for his cognitive learning theory and spiral curriculum) and Erik Erikson (a German-American developmental psychologist known for his stage theory) (Smith, 2008). The 'theory of multiple intelligences' was developed by Gardner and detailed in his book, *Frames of Mind*, in 1983. Gardner defines intelligence as the ability to solve problems or the ability to make useful products among multiple cultures (1983). He developed criteria to use as benchmarks in order to determine whether something could be deemed intelligent or not. The intelligences that Gardner describes do not operate independently, but instead complement each other. He suggested that the intelligences could be used for both constructive and destructive purposes (Gardner, 1983).

Gardner (1983) identified seven types of intelligence: 1) bodily-kinesthetic intelligence is using mental abilities to control body movements to solve problems, 2) interpersonal intelligence is the ability to understand the motivations, intentions, and desires of others, 3) intrapersonal intelligence is the ability for one to understand their own motivations, feelings, and desires, 4) linguistic intelligence is the ability to use spoken and written language to express oneself, 5) mathematical intelligence is the ability to use logic and to solve math problems, 6) musical intelligence is the ability to perform and compose music and to recognize pitch, tone, and rhythm, and 7) spatial intelligence is the ability to use and recognize patterns within space.

According to Hooker et al. (2017), an increasing number of physician assistant educators are questioning the value of pre-admission patient contact hours in PA education. They cite studies that seem to show no predictive correlation of pre-admission patient contact hours with success on the 'physician assistant national certifying exam' (PANCE). These studies will be expounded upon below. There may be many other reasons, however, for desiring applicants to obtain experience with patients prior to PA program matriculation (Hooker et al., 2017). One such reason is to be certain that the applicant understands, and is comfortable with touching patients (Hooker et al., 2017). In other words, the practice of medicine involves touching humans, and this creates the potential for contacting all kinds of fluids, dealing with odors, and other aspects of a patient's body habitus. If one does not fully understand this concept prior to PA training, it may be too late to discover once a PA program has begun. At that point, dropping out of school would have caused great loss of time and finances. Therefore, perhaps pre-admission patient contact hours allow for future PA students to successfully explore the world around them via bodily-kinesthetic intelligence. It gives them the opportunity to be sure that a career involving human touch is for them. Later within a PA program, they can then learn the

skills of linguistic intelligence (interviewing patients), interpersonal intelligence (relating to patients), and mathematical intelligence (diagnosis of disease through problem solving) (Gardner, 1983).

The Peter Principle

According to Barron (1990), Laurence Peter was an educational theorist who was born in Vancouver, British Columbia. He first worked as a teacher, but later earned his Doctor of Education from Washington State University and became a professor at the University of Southern California. Dr. Peter developed the 'Peter principle' with co-author Raymond Hull. At first, they intended the principle to be humorous and tongue-in-cheek, but it proved to be accurate in multiple settings (Barron, 1990).

The Peter principle (theory) is technically not only a learning theory because it has broader applications, such as in management and business (Barron, 1990). But it certainly does apply to learning and in classroom settings. Peter and Hull (1970) described four levels of competence that students (and/or employees) can progress through. Their theory maintains that a student/employee will continue to get promoted up a hierarchical chain as they demonstrate competence for a specific role (Peter & Hull, 1970). Then at some point, the student/employee will fail in a new role because of incompetence – and this is because necessary job skills do not always translate from one role to another (Peter & Hull, 1970). The principle asserts that people get rewarded for the success they achieve in a current role, rather than being rewarded based on their abilities, intelligence, or personality needed for the new role (Peter & Hull, 1970).

The four levels of competence that Dr. Peter identified are defined as follows: 1) unconscious incompetence is not knowing how to complete a task, without knowing that you do not know; 2) conscious incompetence is when you still do not know how to complete the task but

now you at least realize that you do not know (i.e., you are at least aware of the gap in your knowledge base); 3) conscious competence is when you are now able to complete the task but it requires intense and focused concentration; and 4) unconscious competence is when you can accomplish the task easily – when it becomes like second nature (Peter & Hull, 1970). The final stage is achieved through repetition and practice and is akin to the concept of muscle memory in athletics (Peter & Hull, 1970).

These four levels of competence are a compelling framework for how students learn new skills. Students clearly begin the learning process in a state of 'unconscious incompetence' and then progress through the two middle stages until they ultimately reach 'unconscious competence' (Peter & Hull, 1970.) It is logical that all four stages are necessary steps to learning, and are facilitated by in-person, hands-on experiences, especially in disciplines like medicine. Perhaps healthcare experiences that provide pre-admission patient contact hours help to begin this progression through the stages of competence for PA students.

Summary of Theoretical Framework

To summarize, the theoretical framework is predominantly based upon Vygotsky's social development theory. This theory claims that the social interactions among a leaner and a more knowledgeable other are fundamental to the learning process (Vygotsky, 1978). It is a constructivist approach to building knowledge where the learner relies on direct personal observation that is shaped by guidance, coaching, and assistance through the zone of proximal development (Vygotsky, 1978). The more knowledgeable other may provide scaffolding (specific collaborative activities) for the learner in order to facilitate learning (Wood et al., 1976). Social development theory applies to the clinical settings used for learning in medical education and training of physician assistants. In this scenario, the learner is the PA student and

the more knowledgeable other is the clinical preceptor (licensed PA or physician). This collaborative relationship uses scaffolding to develop clinical problem-solving skills via real patient encounters. In addition, the theory of multiple intelligences is helpful as it identifies several types of intelligence that lend themselves to learning in clinical settings. And the Peter principle provides a framework to understand the level of competence that is necessary for PA students to attain.

Related Literature

Historical Considerations

The word "preceptor" is defined in the dictionary as "an instructor, teacher, or tutor" (Merriam-Webster, n.d.). Perhaps a better and more specific definition is found in a medical dictionary: "an expert or specialist, such as a physician, who gives practical experience and training to a student, especially of medicine or nursing" (preceptor, 2003). The truth is that precepting has played an essential role in medical education for as far back as ancient history. Medical training was accomplished via an apprenticeship (or preceptor) model in the 5th century BC in Greece (Langlois, 2003). There is evidence that physicians taught and mentored alongside students as they cared for their own patients (Langlois, 2003). Fast forward to the early 1900s and Sir William Osler was one of the first physicians to bring medical students out of the classrooms and to the bedside for clinical training. Dr. Osler was a Canadian physician who was not only one of the four founding professors of Johns Hopkins Hospital, but was also the first to create a residency program for physician specialty training (John Hopkins Medicine, 2020). Obviously, Dr. Osler was one who realized the importance of, and eagerly supported, clinical training in medicine (Langlois, 2003). Studies have shown that medical students learn more by doing than by watching alone. Specifically, Fernald et al. (2001) carried out a longitudinal (3-

year) study of medical students in a primary care preceptorship (2001). The investigators were able to identify student perspectives on clinical experience as substantial themes emerged from their analysis. A trusting relationship between student and preceptor, an active learning environment, and sufficient time in a clinical setting were all recognized as beneficial (Fernald et al., 2001). In the end, the authors recommended that clinical preceptors "strive for greater student autonomy as an important piece of the learning experience" (Fernald et al., 2001, p. 19).

Roles of a Clinical Preceptor

Clinical preceptors are required to fulfill several distinct roles and to deftly switch between these roles rapidly. As supervisors, clinical preceptors are directly responsible for the actions of their students. They must trust students to act appropriately and to elevate concerns when necessary. As mentors, clinical preceptors serve both as a role model and counselor to students. This is true for not only the practice of medicine, but for the professionalism and behavior aspects as well. As teachers, clinical preceptors work to guide, impart knowledge, and facilitate student learning. Lastly, as evaluators, clinical preceptors have the responsibility to gauge a student's understanding and to assess a student's competence among defined domains.

The PA Profession: Background

The PA profession was developed in the late 1960s in response to a decrease in the number of physicians practicing primary care in the United States (Carter & Strand, 2000). The PA profession was intended to fulfill the need for more medical providers who could enhance the services traditionally provided by physicians only (Hooker et al., 2017). This, in turn, could help ease the physician shortage, especially in primary care (Hooker et al., 2017). The AAPA (2019) defined PAs as "medical professionals who diagnose illness, develop and manage treatment plans, prescribe medications, and often serve as a patient's principal healthcare provider" (para.

1). “With thousands of hours of medical training, PAs are versatile and collaborative. PAs practice in every state and in every medical setting and specialty, improving healthcare access and quality” (AAPA, 2019, para. 1).

Current Need for PAs

The United States is expected to have a shortage of up to nearly 122,000 physicians by 2032 - this includes both primary care and specialty care (AAMC, 2019). The major factor that is driving demand for physicians is a growing and aging population (AAMC, 2019). Although the nation's population is estimated to grow by at least 10% by 2032, the population over age 65 is expected to increase by 48% (https://www.census.gov/). Sometimes the general public questions why more universities do not develop new medical schools to address this physician shortage. But the answer is not that easy because the bottleneck is at the residency level (AAMC, 2019). Upon completing medical school, physicians are expected to complete a residency before they can practice. In 2014, 5.6% of medical school graduates in the United States did not match into a residency - and this number is rising (LaPaglia et al., 2015). But the number of available residency spots is limited because residencies are funded by Medicare (AAMC, 2019). Therefore, the only way to increase the number of practicing physicians is to increase funding to Medicare. Dr. Matthew Mintz, an internist and a clinical associate professor at the George Washington School of Medicine notes that, "both sides of the aisle are talking about how to cut (or at least preserve) Medicare funding. Calls to increase Medicare spending to fund new residency slots is usually met with deaf ears..." (Kowarski, 2018, para. 19). In essence, it would take a literal act of Congress to ‘fix’ the physician shortage. For all of these reasons, the demand for PAs will continue to increase in the United States for the foreseeable future. In fact,

the US Bureau of Labor Statistics projected a 31% increase in the number of PAs needed from 2018-2028 (https://www.bls.gov/ooh/healthcare/physician-assistants.htm).

Competency-based Medical Education

Competency-based medical education (CBME) is a way of looking at medical education (including the training of PAs) with a focus on the "outcome (i.e., attained competence), rather than input (i.e., time in training, rotations completed, etc.)" (ten Cate, 2014). By focusing on outcomes, CBME asks the question, 'what can our students do?' rather than 'did our students compete the program?' (Ross et al., 2018). Competency-based medical education has become a strong topic of interest in the world of medical education. In 2017, ten Cate noted:

> Since the turn of the 21st century, competency-based medical education (CBME) has become a dominant approach to postgraduate medical education in many countries. CBME has a history dating back half a century and is rooted in general educational approaches such as outcome-based education and mastery learning. (p. 1)

Advocates of CBME believe that its strengths are its focus on outcomes, formative assessments, and skills other than knowledge (ten Cate, 2017). This CBME model is in contrast to traditional medical education that, "is based on a curriculum that is subject centered and time-based. Most evaluations are summative, with little opportunity for feedback. The teaching learning activities in the assessment methods focus more on knowledge than on attitude and skills" (Shah et al., 2016, p. S5). Indeed, some will argue that CBME is not just a strong topic of interest, but rather a fundamental and 'transformative change' in how clinicians are prepared for practice (Ross et al., 2018). The world of PA education is still in the very early stages of this transformative change of preparing PAs. But an important first step was developing competencies for the profession.

Six Competencies of the PA Profession

It would appear that the PA profession was wise to follow the medical profession in establishing six core competencies. In 2005, the four major PA organizations collaborated to define competencies for the PA profession "in response to similar efforts conducted within other healthcare professions and the growing demand for accountability and assessment and clinical practice" (AAPA, 2012, para. 1). This document titled, "Competencies for the Physician Assistant Profession," was originally written and adopted in 2005 and then revised in 2012 (AAPA). It provides a strong and stable foundation for the PA profession to organize around by delineating six competency areas for PAs: 1) medical knowledge, 2) interpersonal and communication skills, 3) patient care, 4) professionalism, 5) practice-based learning and improvement, and 6) systems-based practice (AAPA, 2012). These six competency domains are exactly the same as the ones that the Accreditation Council for Graduate Medical Education (ACGME) adopted in 1999 for medical schools (ACGME, 2012). This is fitting since PAs practice medicine in collaboration with physicians.

However, just because competencies were established, does not mean that the work was done. Transformative change may take time before it makes an impact on various aspects of educational programs. According to ten Cate (2017), many programs began implementing CBME concepts over a decade ago, but it was not until 2019 that the external accrediting body for PA programs, the Accreditation Review Commission for the Physician Assistant, or ARC-PA, released an updated version of their educational standards (ARC-PA, 2018). These new standards included a shift to CBME language and ideas that are to be implemented by all PA programs by October 2020 (ARC-PA, 2018). Changes to accreditation standards are what ultimately drive many PA programs to make significant modifications. With a shift to

competency-based language in accreditation standards, most PA programs are now forced to implement a complete overhaul of curricula, instructional approaches, and methods of assessment.

Physician Assistant National Certifying Exam (PANCE)

Despite six defined competencies for the PA profession, there still seems to be a disconnect between them and PA education in general. As the sole assessment necessary to obtain national certification, the physician assistant national certifying exam (PANCE) is the benchmark to be eligible for medical practice as a PA (AAPA, 2019). It is administered by the National Commission on Certification of Physician Assistants (NCCPA). One cannot secure a state license to practice medicine without first becoming nationally certified by passing the PANCE (AAPA, 2019). PA programs structure curricula around the PANCE blueprint, they pay large amounts of money for PANCE review courses, and they proudly market and advertise their PANCE pass-rate scores on school websites. Students also realize that the PANCE is the only gateway to the profession and therefore spend large sums of money on 'PANCE prep' books, 'PANCE prep' courses, and web-based banks of PANCE-type practice questions in order to prepare for this exam.

Questions on the PANCE are categorized into two dimensions: knowledge of diseases/disorders that PAs encounter, and knowledge of skills/tasks that PAs perform when treating patients (NCCPA, 2019a; NCCPA, 2019b). Therefore, the exam includes content on all body systems including cardiovascular, pulmonary, dermatologic, gastrointestinal, endocrine, musculoskeletal, hematologic, renal, neurologic, and much more (NCCPA, 2019a; NCCPA, 2019b). The exam also covers task categories such as diagnostic and laboratory studies, clinical intervention, history taking and performing physical exams, pharmaceutical therapeutics,

formulating diagnoses, managing patients, and professional practice (NCCPA, 2019a; NCCPA, 2019b).

The 'medical knowledge' component comprises 95% of the PANCE, and the 'professional practice' component makes up the other 5% of the exam (and was not included until 2019; NCCPA, 2019a; NCCPA, 2019b). This means that even though the first certification exam was administered by the NCCPA in 1973, it was not until 46 years later that the exam contained anything but medical knowledge (NCCPA, 2019a; NCCPA, 2019b). Furthermore, by not including the other four competencies of 'interpersonal and communication skills,' 'patient care,' 'practice-based learning and improvement,' and 'systems-based practice' on the PANCE, these four domains are never formally assessed by the NCCPA.

Some might argue that concepts of patient care and communication skills are included on the PANCE because they are embedded within questions. But answering a question that might mention those topics is not the same as actual patient care or communication skills. Still, others may argue that creating an exam that does assess all six domains would be too costly. It may even require a practical exam component, which could not only be costly but would be extremely burdensome to administer. Therefore, if the NCCPA cannot assess all six domains, then maybe PA programs have a responsibility to do so. It should not be acceptable for a PA program graduate to pass the PANCE but be lacking cultural awareness, lacking interpersonal and communication skills, or lacking awareness of systems-based practice in organizational, societal, and economic healthcare environments. If the PA profession is convinced that all six competencies are necessary and foundational to PA practice, then the profession must figure out how to better ensure that graduates are well-trained in all six of these competencies (AAPA,

2012). Including competency-based outcomes within the new ARC-PA standards was a huge first step (ARC-PA, 2018).

Supervised Clinical Practice Experiences

Physician assistant education is governed by external accreditation standards published by the Accreditation Review Commission on Education for the Physician Assistant (ARC-PA). The ARC-PA defines supervised clinical practice experiences (SCPE) as "supervised student encounters with patients that include comprehensive patient assessment and involvement in patient care decision making and which result in a detailed plan for patient management" (ARC-PA, 2020, p. 25). SCPEs are also commonly referred to as 'clinical rotations' by many faculty in PA education. The ARC-PA requires that SCPEs occur in the following disciplines: family medicine, internal medicine, general surgery, pediatrics, obstetrics/gynecology, and behavioral/mental health care (ARC-PA Standards of Accreditation, 2020). They also require that SCPEs occur in the following settings: outpatient, inpatient, the operating room, and the emergency department (ARC-PA Standards of Accreditation, 2020). The length of an individual SCPE is not defined by the ARC-PA, however. This allows individual PA programs the freedom to determine how long in the clinical setting is necessary for their students to meet their program defined learning outcomes. It would be nevertheless helpful to know what the length of a SCPE is for PA programs on average. Thankfully, every two years the Physician Assistant Education Association (PAEA) collects and publishes this data. National data from PA programs on the required minimum weeks of a clinical rotation (i.e., SCPE) is found in Table 1.

Table 1

PA Programs' Required Minimum Weeks for SCPEs

Supervised Clinical Practice Experience	Length (minimum # of weeks)
Family Medicine	6.5
Internal Medicine	5.7
Pediatrics	4.8
General Surgery	5.0
Emergency Medicine	4.8
Obstetrics/Gynecology (Women's Medicine)	4.6
Behavioral Medicine/Mental Health	4.5

Note. Data is based upon national means. Anywhere from 183-205 PA programs reported data, depending on the SCPE.

Abridged table from PAEA, 2017, p. 6.

As previously mentioned, the PANCE is the board certification exam for PAs that is taken after graduation from an accredited PA program. Of the six defined competencies for the profession, the exam only measures the domains of medical knowledge (95% of exam content) and professionalism (5% of exam content) (NCCPA, 2019a; NCCPA, 2019b). With that large of discrepancy in the amount of content, it is safe to say that the PANCE essentially only assess the domain of medical knowledge. Therefore, PA programs must use additional means to demonstrate that graduates are competent in the other five domains of competency. Many PA programs choose to utilize preceptor evaluations of students for this purpose (PAEA, 2018).

For the program of study, the seven required SCPEs directly align with the external accreditation requirements: family medicine, internal medicine, pediatrics, general surgery, emergency medicine, women's medicine, and behavioral medicine ([redacted] PA Program, 2020a). During each clinical rotation a PA student is assigned directly to a clinical preceptor who is a physician, physician assistant, or nurse practitioner ([redacted] PA Program, 2020a). At the conclusion of the SCPE, the clinical preceptor is responsible for completing a preceptor evaluation form on each individual PA student. Appendix A has examples of all seven preceptor evaluation forms for the program of study. The evaluation consists of approximately 20 items that mutually assess a students' knowledge, skills, and attitudes within the six domains of competency for the PA profession. The preceptor rates the student on each item using a scale of 0-3. This scale is defined as, 0 = "inadequate," 1 = "competence," 2 = "proficiency," and 3 = "mastery" ([redacted] PA Program, 2020a). All ratings are totaled in order to determine a final preceptor evaluation score, which is then converted to a total percent grade for the clinical rotation course ([redacted] PA Program, 2020a).

PA Program Length and Admission Standards

Due to healthcare workforce shortages, PA programs are under pressure to produce highly trained, competent individuals in a relatively short amount of time (Hooker et al., 2017). Although ARC-PA standards are what drive much of PA education, specific details of curriculum content and program length are not prescribed (ARC-PA, 2018). Yet it would be advantageous for PA programs to know an ideal program length. Programs that are too short may not have enough didactic or clinical time to prepare graduates adequately. Programs that are too long may unnecessarily increase student debt from tuition costs and not be the most efficient manner of getting practicing clinicians into the healthcare system. Furthermore, PA

programs are reluctant to increase the average length of their programs as then the profession would lose a key factor that differentiates it from medical school. According to the most recent report from the Physician Assistant Education Association, the average length of a PA program is approximately 27-months (PAEA, 2019). Historically, PA programs have been able to keep the length of educational programs down by requiring a certain number of prerequisite courses prior to admission (AAPA, 2019). Each PA program is different because there are currently no standardized admission requirements on a national level (PAEA, 2019). Generally speaking, however, a vast majority require the prerequisites courses of anatomy, physiology, and several additional foundational courses in biology, chemistry, physics, psychology and/or statistics (AAPA, 2019). National data on specific prerequisite course requirements from PA programs is found in Table 2.

Table 2

PA Program Prerequisites

Course	Percent
Human Physiology	91.71
Human Anatomy	90.67
Microbiology	81.87
General Chemistry	80.31
Statistics	68.39
General Biology	65.80
General Psychology	61.14
Organic Chemistry	53.37
Biochemistry	46.63
Medical Terminology	35.23
Basic Mathematics or Algebra	27.46
Genetics	25.91
Developmental Psychology	15.03
Abnormal Psychology	13.99
English Composition	11.92

Note. Programs chose multiple courses; therefore, percent column does not add up 100.

Abridged table from PAEA, 2017, p. 4.

Current & Historic Reasons for Pre-admission Contact Hours

According to a 2017 report from PAEA, approximately 58% of PA programs require some type of preadmission healthcare experience and an additional 27% recommend it. Only 14% do not require it at all (PAEA, 2017). This healthcare experience may come in many forms. Some programs specify a certain amount of clinician shadowing that must be completed, others accept any healthcare related experience, and still others may specify that the experiences must involve directly taking care of patients in a medical or related setting (PAEA, 2017). Of the 58% of programs that require healthcare experience, 78% require it to be direct patient contact (PAEA, 2017). Applicants often gain these hours by working or volunteering as a certified nursing assistant, emergency medical technician, medical assistant, or surgical technician, just to name a few (AAPA, 2019).

Among these PA programs that require pre-admission direct patient contact hours, the mean requirement is 733.82 hours per applicant (PAEA, 2017). This amounts to approximately 18-weeks of full-time work. Most PA educators would agree that historically, there are three main reasons for the pre-admission contact hours requirement (Hooker et al., 2017). First, since PA school is much shorter than medical school, already matriculating to a PA program having completed a certain amount of patient care experience seems logical and prudent (Hooker et al., 2017). Second, the original idea for the PA profession came from physicians in the 1960s and 1970s who decided to train people to be PAs who already had a wealth of experience (Hooker et al., 2017). Army medics and Navy corpsman returning from active duty were seen as the perfect candidates for this new undertaking in medicine only because they were already highly skilled and 'battle tested' (Hooker et al., 2017). In fact, "newly discharged corpsman often had extensive field medical experience. Some possessed advanced skills in acute injuries, laboratory

medicine, x-ray capability, suturing, fracture stabilization, and ventilation therapy" (Hooker et al., 2017, p. 18).

The final reason that most PA programs require pre-admission patient contact hours is that many PA educators believe that work experience and life experience gained in patient care settings may help an applicant to be more mature (Hooker et al., 2017). PA programs are widely known to be quite rigorous and time intensive as they are trying to train students in the art and science of practicing medicine in 27-months (on average). Students who are successful in doing this tend to be the ones who exhibit the qualities of perseverance and grit that often come with maturity (Hooker et al., 2017). The argument is that prior work experience and life experience equates to individuals that have likely encountered, and perhaps overcome, the many obstacles and challenges of everyday life (Hooker et al., 2017).

To investigate this idea, Jones, Simpkins, and Hocking (2014) reviewed the websites of 126 physician assistant and physical therapy programs to assess what non-cognitive variables were commonly mentioned as being desirable in applicants. They found that 'maturity' was the term most often cited on program websites (>70% of the time) as being desirable (Jones et al., 2014). Other attributes that were often cited as being most important were, 'motivation', 'interpersonal skill', 'communication skill', and 'commitment' (Jones et al., 2014). Another study surveyed 94 PA programs and asked them to rate non-cognitive attributes based on their perceived importance in the admissions process (McDaniel et al., 2013). 'Motivation for becoming a PA', 'maturity', and 'professional demeanor' were the three most highly rated qualities (McDaniel et al., 2013).

In conclusion, it is clear that PA programs desire applicants who exhibit maturity and strong interpersonal skills, but it remains unclear whether requiring pre-admission patient contact

hours may actually help to achieve this goal (Jones et al., 2014; McDaniel et al., 2013). Specifically, there is currently little evidence to show that pre-admission patient contact hours are linked to PA program outcomes (Hooker et al., 2017; Jones et al., 2014; McDaniel et al., 2013). Most of the research in this area has focused on pre-admission variables and their relationship to PANCE performance. But little has been done to assess relationships to other markers of PA program success.

Admissions Variables

Within PA education, many research studies have attempted to identify characteristics desired in candidates for admission (Jones et al., 2014). However, there is not a clear consensus on best practices when considering measurable and reliable data points that are valid (Jones et al., 2014). The research literature on admissions variables can be sub-divided into studies that assess three different categories: demographic factors, cognitive factors, and non-cognitive factors. Cognitive variables have to do with academics, such as overall undergraduate GPA, undergraduate science GPA, and standardized test scores, like on the graduate record examination (GRE) (Brenneman et al., 2018). All PA programs take into consideration the cognitive factors, but some rely on them more heavily than others. Non-cognitive variables include work ethic, maturity, interpersonal and communication skills, motivation, and knowledge of the profession (Ingrassia, 2016). These characteristics can be extremely difficult to quantify and therefore contribute to the intrinsic subjectivity of admissions decisions (Jones et al., 2014). They are typically assessed via reference letters, personal statement/essays, in-person interviews, and prior healthcare experience (Ingrassia, 2016). Despite being difficult to quantify, assessment of non-cognitive variables is tremendously important for determining an applicant's aptitudes within the domains of professionalism/behavior and interpersonal communication skills

(Brenneman et al., 2018). Furthermore, "studies in the medical discipline have shown that increasing the relative weight on non-cognitive attributes increases the percentage of underrepresented minority applicants admitted to medical schools" (Yuen & Honda, 2019, p. 1241).

Research has successfully been able to show strong predictive relationships between cognitive variables and later success within healthcare education programs (Brenneman et al., 2018). But the evidence for the utility of non-cognitive variables is mixed and lacking depth (Brenneman et al., 2018). For these reasons, Jones et al. (2014) declared, "given the range of positions and general lack of reliability and validity in studies of non-cognitive admissions attributes, we think that health professions admissions processes remain imperfect works in progress" (p. 1).

In the following sections, the three different categories of admissions variables: demographic factors, cognitive factors, and non-cognitive factors, will be further described.

Demographics in admissions.

Given that Title VII of federal law in the United States prohibits discrimination based on demographic factors, including race, gender, age, and religion, there is not much literature on this subject (Civil Rights Act, 1964). Asprey et al. (2004) showed that age and male gender are negative predictors of success on the PANCE. But others have found opposing results, specifically that neither gender nor age affected PANCE performance (Higgins et al., 2010).

Yuen and Honda (2019) investigated how PA applicants' demographics and undergraduate academics affected their likelihood of matriculation into a PA program. They initially found that the likelihood of matriculation was lower among older applicants, male applicants, and underrepresented minorities (Yuen & Honda, 2019). However, in models where

the authors adjusted for typical methods of academic achievement, the underrepresented minority effect was no longer significant and the gender effect was reversed. Older applicants remained less likely to matriculate even in the adjusted model (Yuen & Honda, 2019).

Cognitive factors in admissions.

A 2015 study of medical school admissions found small but significant correlations between overall undergraduate GPA and undergraduate science GPA with the measured outcome of medical board certification (Durning et al., 2015). This same study also found positive correlations among in-program variables and success with board certification. Specifically, internal medicine clerkship grade, clerkship year GPA, medical school GPA, and USMLE Step 1 exam scores, were also significantly correlated with board certification (Durning et al., 2015). They concluded that for medical students, the focus on cognitive variables in admissions is justified (Durning et al., 2015).

Other studies have investigated the relationship of cognitive variables and outcomes for PA programs specifically. Trenton, Patel-Junankar, Baginski, and Scott (2018) looked at 147 PA students over a three-year period using multilevel linear regression and found that undergraduate GPA was closely correlated with PA program GPA. They also showed that undergraduate GPA is strongly correlated with PANCE score; specifically, that an increase in GPA from 3.0 to 4.0 was associated with a >54-point increase in PANCE score. These findings are similar to Andreeff (2014) who also found that overall undergraduate GPA was predictive of higher PANCE scores; even when the covariates of gender and age were controlled for. Andreeff (2014) also showed that undergraduate grades in biochemistry and pathophysiology were predictive of higher PANCE scores, but grades in chemistry I were not. In conflict with these findings are the results of a 2013 study by Brown and colleagues. These authors found no

correlation between PANCE performance and overall undergraduate GPA, or prerequisite science GPA. However, they did show that PANCE scores were correlated with PA program overall GPA, PA program anatomy grade, and PA program pharmacology grade. There was also a moderate correlation between PANCE pass/fail rate and whether students had taken their prerequisite science courses at a 2-year or 4-year institution (Brown et al., 2013). Higgins et al. (2010) also found that grades on prerequisite courses did not predict PANCE performance among six PA programs.

End of rotation (EOR) exams are products created and published by the Physician Assistant Education Association (PAEA, 2019). They are available for PA programs to purchase and use as summative assessments of individual clinical rotations, and many programs do so (PAEA, 2019). There are seven different EOR exams available, one each for the most common areas of medicine: pediatrics, women's health, surgery, family medicine, internal medicine, psychiatry, and emergency medicine (PAEA, 2019). In 2015, two separate studies were able to demonstrate that EOR exam scores correlated well with PANCE scores. Hegmann, Roscoe, and Statler (2015) did so by incorporating individual EOR exam scores from three different PA programs. Massey et al. (2105) performed a similar study, except they used composite scores from the EOR exams rather than individual EOR scores. Both studies found strong correlations between EOR scores and PANCE scores (Hegmann et al., 2015; Massey et al., 2015). The latter study by Massey et al. (2015) also found a statistically significant difference in the number of students who achieved a PANCE score of ≥400 and the students who achieved a PANCE score <400. The first group had a mean EOR composite score of 74% and the second group had a 61% (Massey et al., 2015). This difference was also statistically significant (Massey et al., 2015).

Butina and colleagues (2017) used secondary analyses of data to assess whether admissions variables and grades in foundational (basic science) courses within a PA program would be predictive of PANCE success. Their goal was not only to assess the relationship between these variables, but in doing so, they intended to ascertain a students' risk of future poor PANCE performance at a time early enough for intervention and advising (Butina et al., 2017). They used path analysis, an extension of multiple regression, to provide a more robust analysis of the data points, and found that the summation of performance in the three basic science courses was a stronger predictor of PANCE success than in any one of the courses alone (Butina et al., 2017). In fact, performance in basic science courses within PA school is a much stronger predictor of PANCE performance than any admissions variables (Butina et al., 2017).

Lastly, a 2019 literature review by Moore et al. (2019), concluded that overall undergraduate GPA and simply completing a variety of undergraduate science prerequisite courses correlated with passing the PANCE.

Non-cognitive factors in admissions.

Brenneman et al. (2019) keenly observed that, "PA admissions processes have typically given more weight to cognitive attributes than non-cognitive ones, both because a high level of cognitive ability is needed for a career in medicine and because cognitive factors are easier to measure" (p. 25). Nevertheless, an increasing number of PA educators believe that a shift towards a more holistic admissions process that includes more of a focus on non-cognitive factors will help bring more diversity into the profession (Brenneman et al., 2018). It may also help to identify applicants who have the emotional intelligence and soft skills to be competent future PAs (Brenneman et al., 2018). Indeed, a survey of PA employers revealed that key non-

cognitive characteristics that they believed PAs lack are collaboration, leadership, professional maturity, and critical thinking (PAEA Stakeholder Summit Summary, 2016).

Personal statements.

Lopes, Badur, and Weis (2016) claimed that the personal statement is a "time-honored component of applications to college, professional education programs, and postgraduate education programs. Yet, there is no consistent evidence that the personal statement is considered an important part of any application process" (p. 1). Therefore, the authors surveyed PA programs about their attitudes towards, and uses of, an applicant's personal statement (Lopes et al., 2016). With a 75% response rate (n=122), the surveys showed that approximately 62% of respondents thought personal statements were 'useful' or 'very useful' (Lopes et al., 2016). And over three-fourths of respondents either 'sometimes' or 'always' utilized the personal statements to select applicants for interviews (Lopes et al., 2016). Less than one-third of respondents were 'very concerned' or 'extremely concerned' that personal statements were not truly written by the applicants (Lopes et al., 2016). This is the only known study that investigated the use of applicants' personal statements for PA program admissions. However, data from the 2017 PAEA Curriculum Report 1 supports these findings, as it shows that >97% of PA programs require a personal statement upon application to the program.

On-site interviews.

Clearly admissions committees also believe that on-site interviews are important to the admissions process because approximately 98.41% of PA programs require them (PAEA, 2017). Table 3 details the top six reasons why PA programs require on-site interviews.

Table 3

Reasons for Requirement of On-site Interviews

Reported Reason	Percent
Evaluate applicants' interpersonal and communication skills	98.41
Evaluate applicants' professionalism and behavior issues	95.24
Evaluate applicants' dedication to PA career	84.13
Assess whether applicants' goals align with the program's goals/mission	79.37
Help applicants in their decision to choose a program	78.84
Evaluate applicants' ability to work in teams	60.32
Other	3.7

Note. Programs chose multiple categories; therefore, the percent column does not add up 100.

Abridged table from PAEA, 2017, p. 10.

In looking at these reasons, it seems clear that non-cognitive variables are assessed during interviews. Yet the value of this practice is disputable because different interview formats are used. About 73% of PA programs utilize traditional, individual interviews and almost 50% utilize group interviews (PAEA, 2017, p. 11). Almost 34% of PA programs have moved towards the multiple mini-interview (MMI) format, whether as individuals or groups (PAEA, 2017, p. 11).

A meta-analysis of interview outcomes from a broad variety of healthcare related professions concluded that traditional interviews were a very weak predictor of academic performance (Goho & Blackman, 2006). The concern is that "the geniality and winsomeness of an individual was actually being ranked rather than specific cognitive and non-cognitive factors" (Ingrassia, 2016, p. 503). There is however, a strong body of evidence that the MMI format can be quite effective (Ingrassia, 2016). The strength of MMIs is that they utilize prescriptive scenarios in a highly structured format, making them less subjective and susceptible to rater bias

(Ingrassia, 2016). Notably, in physical therapy students, the multiple mini-interview format has been shown to be predictive of clinical, but not academic, performance (Hayes et al., 1999).

Pre-admission healthcare experience.

Researchers have investigated the relationship between pre-admission patient contact experience and other variables as well. A study by Brown et al. (2013) found no correlation between PANCE score and 'extent of prior healthcare experience' at a single institution. However, the authors did not define what 'extent of prior healthcare experience' meant. It is unclear whether shadowing, direct patient care, or all healthcare-related hours were included in this. Furthermore, it was not specified how 'extent of prior healthcare experience' was quantified (i.e., hours, months, years)? In agreement with these findings is a study by Higgins et al. (2010) where they showed no correlation between PANCE score and prior healthcare experience. This study did quantify the experience in 'years' and utilized a larger and more board sample representing six institutions (Higgins et al., 2010). However, the author's admitted that, "we did not collect the individual universities' definitions of what constitutes health care experience, which may contribute to this variable's lack of significance" (Higgins et al., 2010, p. 14).

Looking at a single PA program in New England, Honda and colleagues (2018) found that a 10% increase in the quantity of hands-on patient care hours was associated with a >14 point increase in PANCE scores; and when adjusted for age and educationally disadvantaged background, the point difference on PANCE scores increased by >18, which was statistically significant. Prior clinical experience was not a predictor of PA program GPA, however (Honda et al., 2018).

Pre-admission patient contact hours have been studied for their relationship to outcomes besides the PANCE. In 2016, Hegmann and Iverson assessed whether the quantity of pre-admission patient contact hours correlates with stronger clinical preceptor evaluations and with higher standardized patient examination scores during the clinical year. They looked at five cohorts of PA students over a 5-year period (Hegmann & Iverson, 2016). The quantity of pre-admission patient contact hours had an inverse relationship with preceptor evaluations and with standardized patient examination scores, but neither was statistically significant (Hegmann & Iverson, 2016). They concluded that an increased quantity of pre-admission patient contact hours is not correlated with improved clinical year preceptor evaluations nor with improved standardized patient exam scores (Hegmann & Iverson, 2016).

Summary

PA students in the clinical part of their training need to be allowed to interact with patients by observing and exploring clinical settings while also being guided and directed by a clinical preceptor. This type of facilitative learning fits with the model of Vygotsky's social development theory and is important for the development of problem-solving skills. Within this framework clinical preceptors act as a "more knowledgeable other" in order to guide students through a zone of proximal development. That is, the zone where students are very close to mastering a body of knowledge, but cannot without assistance from the MKO (Vygotsky, 1978). The exposure and experience of the clinical setting also may facilitate the development of bodily-kinesthetic intelligence so that PA students can eventually achieve a state of unconscious competence with common skills and tasks (Gardner, 1983).

The demand for PAs will continue to increase as the shortage of physicians in the United States continues (AAMC, 2019). PA programs are under increased pressure to produce qualified

graduates, and ultimately, competent medical practitioners (US Bureau of Labor & Statistics, 2019). During the clinical portion of training, PA students are evaluated on all six domains of competency by their clinical preceptors. These evaluations are important because the post-graduation board exam (PANCE) only assesses medical knowledge (95% of exam content) and professionalism (5% of exam content). It does not address the other four competencies that have been defined by the PA profession (NCCPA, 2019a; NCCPA, 2019b). These other competencies represent the more "soft skills" necessary to be a quality medical provider. PA programs are hesitant to add to the length of training in order to teach these soft skills. In addition, since PA programs are only 27-months long on average, programs may need to emphasize the need for selecting applicants who already possess desirable non-cognitive attributes rather than expecting students to learn them while in the program (Brenneman et al., 2018). And most non-cognitive variables are closely tied to personal values and may therefore not be easy to teach anyways (Brenneman et al., 2018). Therefore, PA programs require such things as personal statements, on-site interviews, and pre-admission contact hours in an effort to assess non-cognitive attributes of applicants (Jones et al., 2014).

The evidence for cognitive factors (overall GPA, science GPA, prerequisite grades, etc.) impacting PANCE scores and other PA program-related outcomes is mixed; with many studies showing a positive correlation, but others that do not (Andreeff, 2014; Brown et al., 2013; Butina et al., 2017; Durning et al., 2015; Hegmann et al., 2015; Higgins et al., 2010; Massey et al., 2015; Moore et al., 2019; Trenton et al., 2018). The evidence for non-cognitive factors (personal statement, pre-admission patient contact hours, etc.) impacting PA program outcomes is minimal (Brenneman et al., 2018; Brown et al., 2013; Goho and Blackman, 2006; Hayes et al., 1999; Hegmann & Iverson, 2016; Higgins et al., 2010; Honda et al., 2018; Ingrassia, 2016; and Lopes

et al., 2016). More research on how non-cognitive variables impact future PA program success needs to be done. Specifically, do pre-admission patient contact hours have a predictive relationship with in-program outcomes such as clinical course performance?

CHAPTER THREE: METHODS

Overview

Chapter Three outlines and explains the methodology that was employed to sufficiently address the research question. This study explored the predictive relationship between an incoming PA program applicant's quantity of pre-admission patient contact hours and their subsequent scores on final preceptor evaluations for supervised clinical practice experiences in Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery. This chapter includes the study design, research question, hypotheses, participants, setting, instrumentation, procedures, and data analysis.

Design

This study used a non-experimental, quantitative, regression research design with archival data. It included seven separate bivariate linear regression analyses. The aim was to determine if a predictive relationship exists between a PA program applicant's quantity of pre-admission patient contact hours and their subsequent performance (as measured by their score on final preceptor evaluations) for supervised clinical practice experiences in seven clinical specialty areas (Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery). The study was carried out with data from a small graduate physician assistant program at a large, public institution. The research design was appropriate for use in this study because of the quantitative variables utilized in the prediction of a relationship (Gall et al., 2007). Additionally, although there could be a causal relationship between these variables, in this case it is not possible to manipulate the predictor variable (quantity of pre-admission patient contact hours) because, by definition, the

hours were already completed prior to admission to the graduate program (Gall et al., 2007). It was also considered a non-experimental design because the nature of the research question does not allow for random assignment into groups (Gall et al., 2007). For the purpose of this research study, the PA program applicant's quantity of pre-admission patient contact hours was the predictor variable, and their score on final preceptor evaluations from supervised clinical practice experiences in each of seven different SCPEs (Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery) were the criterion variables. Therefore, seven separate bivariate linear regression analyses were used to model the relationships in this study (Gall et al., 2007).

Research Question

The research question for this study was:

RQ: Is the quantity of an incoming PA program applicant's pre-admission patient contact hours predictive of their subsequent performance on supervised clinical practice experiences in Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery?

Null Hypotheses

The null hypotheses for this study were:

$H_0$1: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Behavioral Medicine*.

$H_0$2: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Family Medicine*.

$H_0$3: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Internal Medicine*.

$H_0$4: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Emergency Medicine*.

$H_0$5: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Pediatric Medicine*.

$H_0$6: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Women's Medicine*.

$H_0$7: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *General Surgery*.

Participants and Setting

The participants for this quantitative regression research study were established via convenience sampling in order to fit with the purpose of the study and to allow for study feasibility. The population dataset included de-identified data that was mined from existing archival records of a public institution of higher education.

The study population included all graduates from a small graduate level physician assistant educational program at a large public university. The university is a single campus located in a mid-Atlantic city in the United States. As of July 1, 2018, the city and surrounding

county had an overall population of 135,277 (United States Census Bureau, 2020). Overall university enrollment is over 21,000, including undergraduate and graduate students (Office of Institutional Research, 2020). The university had full regional accreditation at the time participants were enrolled. The PA program also had full external accreditation at the time by the Accreditation Review Commission on Education for the Physician Assistant (ARC-PA). The most popular areas of study at this university include health sciences, nursing, psychology, biology, and marketing (Office of Institutional Research, 2020). The PA program at this institution is 28-months in length, or seven semesters, including full summer terms. The first 16-months (four semesters) are the didactic phase of the program. This mostly consists of on-campus coursework including traditional lectures, practical skills development in a human laboratory setting, group work, case studies, case presentations, and hands-on procedure workshops. The final 12-months (three semesters) are the clinical phase of the program. This consists of ten separate supervised clinical practice experiences (SCPEs) that are each four weeks in length. These SCPEs take place at medical offices, surgery centers, emergency departments, and hospitals throughout the United States. All PA students are required to complete two SCPEs each in Family Medicine and Internal Medicine; and one SCPE each in Behavioral Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery. Graduates from the PA program earn a Master's degree in Physician Assistant Studies.

The sample consisted of graduates from 2015 through 2019. Requirements of graduation included successful completion of all didactic courses, supervised clinical practice experiences, a capstone project, and a summative examination. Successful graduates must also have at least a 3.0 overall grade point average and no more than two "C" grades in courses. Upon earning a

third “C” in a course, the student is dismissed from the Graduate School. The sample size included 140 participants who were all PA program graduates. The data of all graduates from 2015 to 2019 were utilized, not simply a representative smaller sample as would be the case if the population were larger. The sample data represents five separate cohorts of PA graduate students between 2015-2019. The physician assistant studies program accepted approximately 28 graduate students per cohort over that period of time.

For this linear regression, the 140 participants exceeded the minimum number of 106 that is required for a medium effect size with statistical power of 0.70 at the 0.05 alpha level (Warner, 2013, p. 362). This minimum was calculated from $N > 104+k$, where k is the number of predictor variables. In this case, $k=1$, therefore, $N>104+1$, or $N>105$ (Warner, 2013, p. 362).

Participant Demographics

A convenience sample population of 140 physician assistant students participated in this study. One hundred thirteen (80.7%) of the participants were female and 27 (19.3%) were male. All participants were between the ages of 21 and 47 years at the time of matriculation into the physician assistant program. The average student age at time of matriculation was 26.1 years. The sample population ($N = 140$) consisted of the following racial demographics: 4 (2.9%) African American/Black, 0 (0%) American Indian/Native Islander, 9 (6.4%) Asian/Pacific Islander, and 127 (90.7%) White/Caucasian graduate students.

Instrumentation

The instrumentation used in this non-experimental, quantitative, regression study included pre-admission patient contact hours and scores (percentages) on final preceptor evaluations of graduate PA students for supervised clinical practice experiences in Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine,

Women's Medicine, and General Surgery. This score is a measure of student performance. De-identified data was used to maintain confidentiality.

Pre-admission Patient Contact Hours

For this study, the predictor variable was the total quantity of a PA program applicant's pre-admission patient contact hours. This is a quantity that is self-reported by applicants to physician assistant programs on their initial application through the Centralized Application Service for Physician Assistants (CASPA). It is a required component for admission to the PA program of study, and for approximately half of all PA programs nationwide (PAEA, 2017). Applicants are required to submit the title and location of the experience, a description and list of daily duties/responsibilities, their supervisor's name and contact information (for verification of hours), and a total number of hours completed (CASPA, 2020). All hours must be completed prior to matriculation into a PA program (Physician Assistant Program, 2020, para 12).

Approximately 58% of PA programs nationwide require a certain amount of healthcare experience, and an additional 27% recommend it (PAEA, 2017). Of the programs that require hours, many require minimums of at least 500, 1,000, or 2,000 hours, but some PA programs do not require any experience at all. Furthermore, the healthcare experience can come in several forms: shadowing, scribing, and direct patient care/contact. Of the 58% PA programs that require experience, 78% require it to be direct patient contact (PAEA, 2017). The program of study has always required a minimum of 1,000 hours of direct patient contact from its applicants; due by the time they matriculate (Physician Assistant Program, 2020, para 12). This archival data is considered reliable because it will be taken directly from the official admissions records of each student at their time of program application (a primary source maintained by the PA program). The dataset is also known to be adequate and is derived from admissions records that

are complete.

Pre-admission direct patient contact hours could come from either a single setting/experience or from a combination of experiences and may have been voluntary or paid (Physician Assistant Program, 2020, para 12). Shadowing of a clinician and medical scribing were not acceptable experiences and therefore, when reported, were not counted towards the total hours (Physician Assistant Program, 2020, para 12). Experiences that had a higher level of training, responsibility, and autonomy were more desirable. Examples include experience as a physical therapist, athletic trainer, patient care technician, occupational therapist, registered nurse, paramedic, dietician, surgical technician, emergency medical technician, or respiratory therapist (Physician Assistant Program, 2020, para 12). All experience(s) must have been with live, human patients in a medical setting; i.e., veterinary and dental experiences were not acceptable (Physician Assistant Program, 2020, para 12). These benchmarks are consistent with similar programs within PA education in the United States. Several prior studies of physician assistant students have utilized quantity of pre-admission patient contact hours as a variable, including Brown et al. (2013), Higgins et al. (2010), Honda et al. (2018), and Hegmann et al. (2016). Therefore, the actual quantity of self-reported and CASPA verified pre-admission patient contact hours were obtained from existing university records.

SCPE Evaluations

The criterion variables for this study were the scores (percentages) on final preceptor evaluations earned by a PA student in each of the supervised clinical practice experiences (SCPE) specialty areas. Students completed ten separate SCPEs in 4-week increments, however, they were required to complete two SCPEs each in Family Medicine (8 weeks) and Internal Medicine (8 weeks); while completing one SCPE each in Behavioral Medicine (four weeks),

Emergency Medicine (four weeks), Pediatric Medicine (four weeks), Women's Medicine (four weeks), and General Surgery (four weeks). Therefore, for the purpose of this study, the final percentage preceptor ratings for the two Family Medicine were averaged together, and the same was done for the two Internal Medicine SCPEs. The rest of the SCPE percent grades represent a single 4-week experience at that site. This yields a total of seven SCPE specialty areas that are required by the program of study and by all PA programs as dictated by accreditation standards (ARC-PA, 2020). These seven are Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery.

During a supervised clinical practice experience, a PA student was assigned directly to a clinical preceptor who is either a certified and licensed physician, physician assistant, or nurse practitioner. The Accreditation Review Commission on Education for the Physician Assistant defines SCPEs as "supervised student encounters with patients that include comprehensive patient assessment and involvement in patient care decision making and which result in a detailed plan for patient management" (ARC-PA, 2020, p. 25). The PA student spent at least 40 hours per week with the preceptor, doing most things the preceptor does on a daily basis including: evaluating patients, performing physical exams, ordering/interpreting laboratory and imaging studies, making diagnoses, performing procedures, writing prescriptions, counseling patients, and much more.

Performance assessment is distinct from aptitude tests, intelligence tests, and achievement tests (Gall et al., 2007). Aptitude tests intend to predict a person's future performance, intelligence tests offer an estimate of a person's general intellectual level, and achievement tests aim to measure a person's knowledge of specific facts (Gall et al., 2007). But a performance assessment (also known as an authentic assessment) is a method of evaluating

students by directly assessing their performance on "tasks that have intrinsic value" (Gall, Gall, & Borg, 2007, p. 215). Tasks utilized in performance assessment are devised to represent complex, comprehensive, real world tasks (Gall et al., 2007). In light of this, clinical preceptors are therefore charged with assessing a PA student's performance at the conclusion of a four- or eight-week supervised clinical practice experience. They accomplish this by completing a "preceptor evaluation form." Appendix A contains all seven preceptor evaluation forms for the program of study.

Each preceptor evaluation form contains approximately 20 items for which the preceptor rates the student. The items collectively gauge the students' performance within the six domains of competency for the PA profession: 1) medical knowledge, 2) professionalism, 3) interpersonal and communication skills, 4) patient care, 5) practice-based learning and improvement, and 6) systems-based practice (AAPA, 2012). Students are rated on a four-point scale of 0-3, with 0 = "inadequate," 1 = "competence," 2 = "proficiency," and 3 = "mastery". The ratings for each item are totaled in order to calculate a total preceptor evaluation score as a percentage grade. This percent grade represents a measure of the individual student's performance within the supervised clinical practice experience.

The dataset is known to be sufficient and is derived directly from students records that were complete. This archival data is considered reliable because it was taken directly from the official PA program records of each student, which is a primary source. No known prior research has compared quantity of pre-admission direct patient contact hours to PA students' subsequent performance in supervised clinical practice experiences. Therefore, the actual final percentage grades of graduate PA students for each of the seven SCPE specialty areas were

obtained from existing university records at the same institution where the pre-admission patient contact hours were obtained.

Procedures

This research study was conducted using the following procedures. The researcher obtained appropriate prior approval from the Institutional Review Boards (IRB) of both Liberty University and the parent university for the PA program of study (see Appendix B and C for respective IRB approvals). Approval was granted to access existing records in order to use students' quantity of pre-admission direct patient care hours and their final percentage scores earned on seven different supervised clinical practice experiences while in the PA program: Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery. In order to protect anonymity, the data was de-identified by a third-party administrative assistant prior to being given to the researcher. Only the data from students who were enrolled in the PA Program of study between 2015-2019 (5 separate cohorts of approximately 28 students each) were included as participants in this study. The academic records of all 141 students were assessed for the necessary data and stored in an electronic database. The demographic variables of age, sex, and race were recorded. The mean age of participants and percentages of each gender and race were calculated. The total quantity of pre-admission patient contact hours for each student was also calculated. The student scores on final preceptor evaluations for the supervised clinical practice experiences of Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery was recorded.

Data was collected and stored within a secure Excel file that was kept on a password protected computer in a locked office. Once collected and tallied within a Microsoft Excel

spreadsheet, all data was transferred to IBM© Statistical Package for Social Sciences (SPSS©) software for statistical analysis. All data was stored in a secure SPSS database on a password protected computer in the researcher's locked office. Prior to statistical testing, all participant data that was missing values was eliminated.

Data Analysis

Seven bivariate linear regressions were utilized to determine if the non-cognitive variable of pre-admission patient contact hours is predictive of subsequent PA student performance as defined by their score on final preceptor evaluations on their supervised clinical practice experiences (SCPEs). The seven different SCPEs are Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery.

Prior to statistical testing, data was assessed for missing values. The preceptor evaluation scores were missing for one student; therefore, this student was excluded from the final sample. This left a remaining sample size of 140 participants. This exceeds the required minimum (106) for a medium effect size with statistical power of 0.70 at the 0.05 alpha level (Warner, 2013, p. 362). This minimum was computed from $N > 104+k$, where k is the number of predictor variables. In this case, $k=1$, therefore, $N>104+1$, or $N>105$ (Warner, 2013, p. 362).

One scatter plot per null hypothesis (criterion variable) was created in order to assess for assumptions of normal distribution of data, linearity of data, and bivariate outliers (Gall et al., 2007). Therefore, seven scatterplots were examined. The assumption of bivariate outliers was assessed by looking for extreme bivariate outliers. Any extreme outliers were examined because they can negatively affect the regression analysis by reducing the fit of the regression equation (Gall, Gall, & Borg, 2007). The assumption of linearity was assessed by looking for a linear

relationship between the predictor and criterion variables. There needs to be a linear relationship between the two variables in order for the linear regression to be valid (Gall, Gall, & Borg, 2007). Lastly, the assumption of bivariate normal distribution was assessed by looking for the classic "cigar" shape (Gall, Gall, & Borg, 2007).

The assumption of linearity was tenable because the bivariate linear regression is robust to slight deviations when the sample size is large, as in this case. Similarly, regarding heteroscedasticity, the assumption is tenable since bivariate linear regression is robust to some violations of this assumption when the sample size is this large.

To investigate the research question, seven separate linear regressions were analyzed because the predictor variable and the criterion variables are continuous (Gall, Gall, & Borg, 2007). The R^2 value represents the linear regression, i.e., how much of the total variation in the criterion variables (SCPE scores) can be explained by the predictor variable (quantity of pre-admission direct patient contact hours) (Gall, Gall, & Borg, 2007). The significance level was used as the indictor of whether to reject, or fail to reject, the null hypotheses. It is often set at $p < 0.05$, because this is a typical level of significance used in educational research (Gall, Gall, & Borg, 2007). However, a Bonferroni correction was implemented in order to limit the risk of Type I error because of the multiple significance tests that are being performed (Warner, 2013, p. 98-99). The Bonferroni correction helped to generate a more conservative corrected alpha level for each test. It is calculated by dividing 0.10 by the number of different significance tests. Therefore, since we are running seven tests of significance, the corrected alpha will be 0.10/7, or 0.014 (Warner, 2013, p. 98-99).

CHAPTER FOUR: FINDINGS

Overview

The purpose of this non-experimental, quantitative, regression study was to determine if a predictive relationship exists between a PA program applicant's quantity of pre-admission patient contact hours and their subsequent performance with supervised clinical practice experiences in seven clinical specialty areas (Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery). The criterion variables were percentage scores on final preceptor evaluations in the seven aforementioned specialty areas. The predictor variable was the number of patient contact hours a student in the PA program had at the time of their application. Seven bivariate linear regressions were run to test the seven null hypotheses. This chapter includes the research question, null hypothesis, data screening, descriptive statistics, assumption testing, and the results of the bivariate linear regressions.

Research Question

The research question for this study was:

RQ: Is the quantity of an incoming PA program applicant's pre-admission patient contact hours predictive of their subsequent performance on supervised clinical practice experiences in Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery?

Null Hypotheses

The null hypotheses for this study were:

$H_0$1: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Behavioral Medicine*.

$H_0$2: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Family Medicine*.

$H_0$3: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Internal Medicine*.

$H_0$4: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Emergency Medicine*.

$H_0$5: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Pediatric Medicine*.

$H_0$6: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Women's Medicine*.

$H_0$7: There is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *General Surgery*.

Descriptive Statistics

The descriptive statistics for the participants in this study are displayed in Table 4. A convenience sample of 140 physician assistant students participated in this study. Data was available on 141 students, but one was excluded due to multiple missing preceptor evaluation values for that student. There were 113 (80.7%) female participants and 27 (19.3%) male participants. The mean age of a physician assistant student at the time of matriculation was 26.1 years. The age range was 21-47 years. The sample population ($N = 140$) consisted of the following racial demographics: 4 (2.9%) African American/Black, 0 (0%) American Indian/Native Islander, 9 (6.4%) Asian/Pacific Islander, and 127 (90.7%) White/Caucasian graduate students. The mean number of pre-admission patient care hours in this sample of 140 student's was 3,437 (range: 200-32,000). The mean final percentage grade for 140 students across all seven SCPEs was 91% (range: 61%-100%).

Table 4

Descriptive Statistics for Participant Demographics

Demographics	*N*	%
Sex		
Male	27	19.3
Female	113	80.7
Race		
African American/Black	4	2.9
American Indian/Native Alaskan	0	0
Asian/Pacific Islander	9	6.4
White/Caucasian	127	90.7

Note: $N = 140$

Results

Data Screening

Data screening was conducted on all variables. The researcher sorted, screened, and assessed the data on each variable to determine any errors, unusual scores/hours, inconsistencies, or irregularities. Data was available on 141 physician assistant students across five cohorts. One student was excluded from the sample due to missing preceptor evaluation scores. There were no other inconsistencies or obvious errors noted. This left a sample size of 140 participants.

Assumption Testing

A bivariate linear regression was used to test each null hypothesis. Bivariate linear regression requires that the assumptions of no bivariate outliers, linearity, and bivariate normal distribution are met (Gall et al., 2007). To test these assumptions, a scatterplot was created for each pair of variables. Bivariate linear regression is robust to slight deviations when the sample size is large and so the assumption of linearity was tenable in this case. Bivariate linear regression is also robust to some violations of heteroscedasticity in large sample sizes; therefore, this assumption is tenable as well (see Figures 1-7).

Figure 1

Scatterplot of Behavioral Medicine SCPE Scores vs. Pre-admission Patient Contact Hours

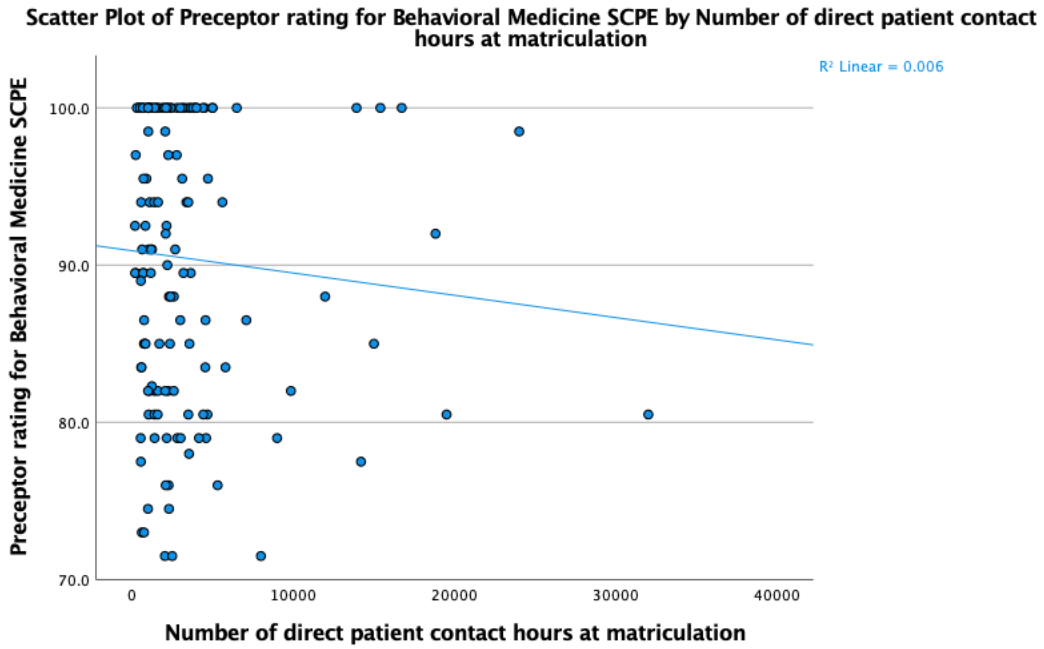


Figure 2

Scatterplot of Family Medicine SCPE Scores vs. Pre-admission Patient Contact Hours

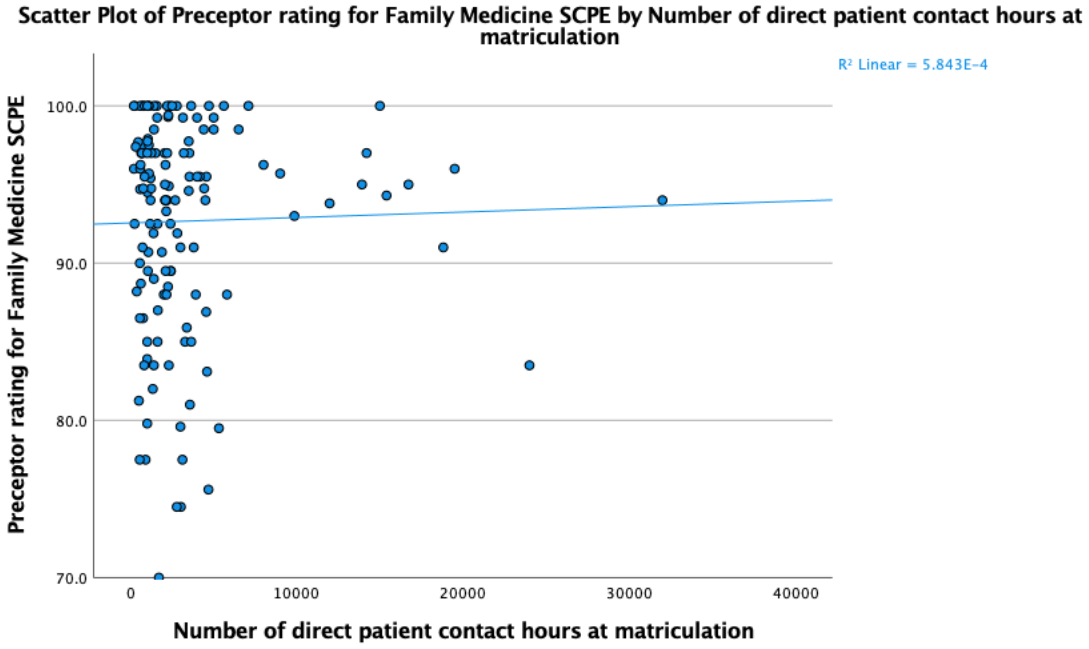


Figure 3

Scatterplot of Internal Medicine SCPE Scores vs. Pre-admission Patient Contact Hours

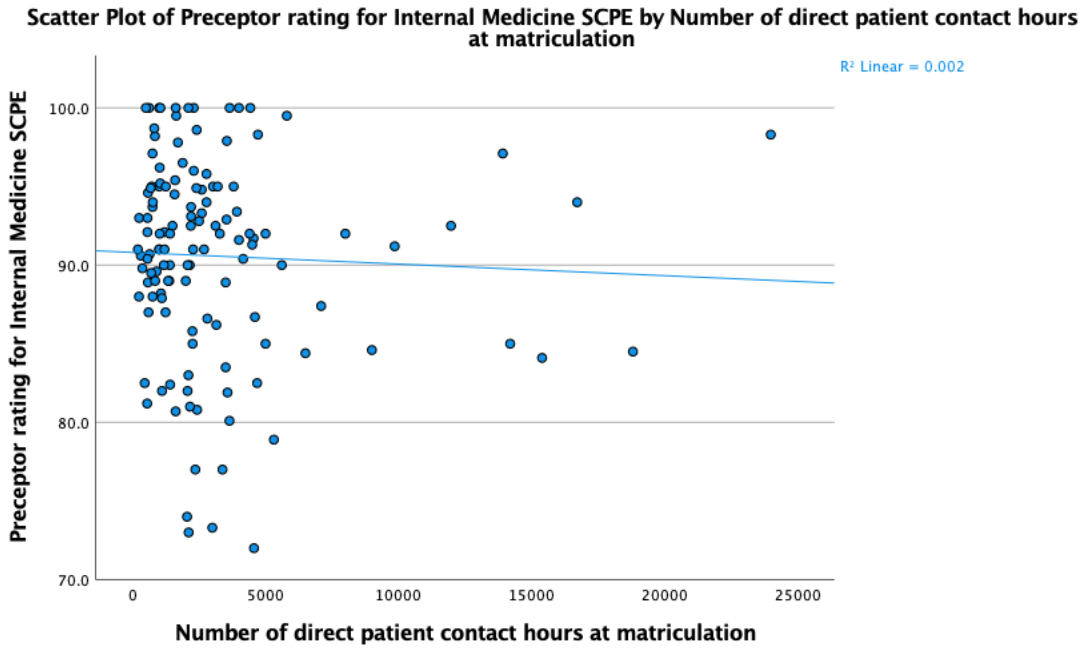


Figure 4

Scatterplot of Emergency Medicine SCPE Scores vs. Pre-admission Patient Contact Hours

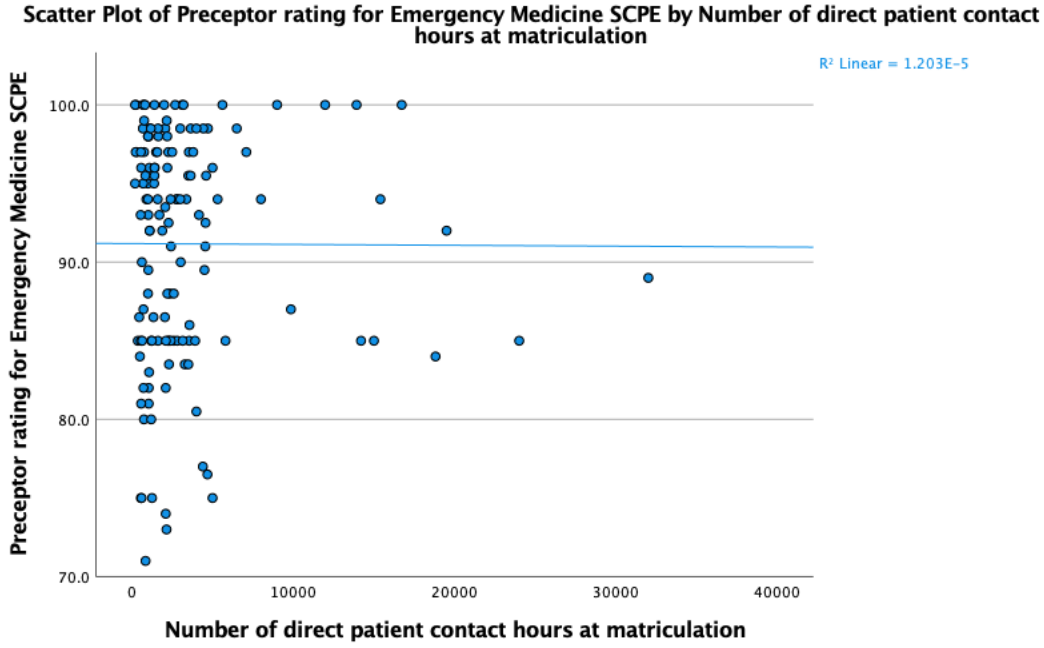


Figure 5

Scatterplot of Pediatric Medicine SCPE Scores vs. Pre-admission Patient Contact Hours

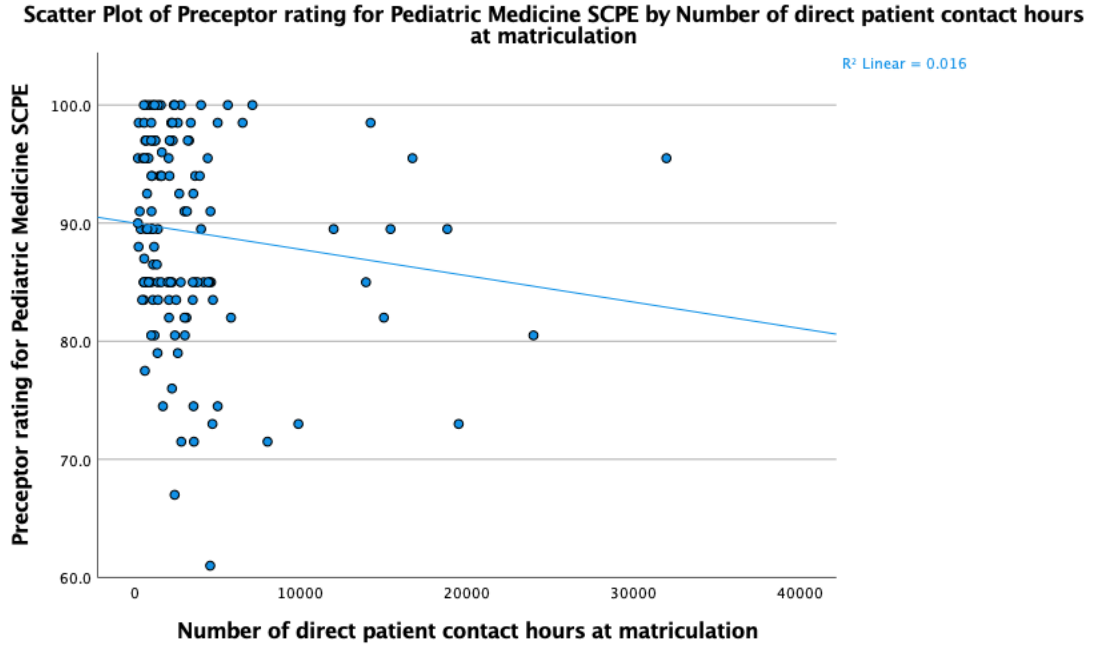


Figure 6

Scatterplot of Women's Medicine SCPE Scores vs. Pre-admission Patient Contact Hours

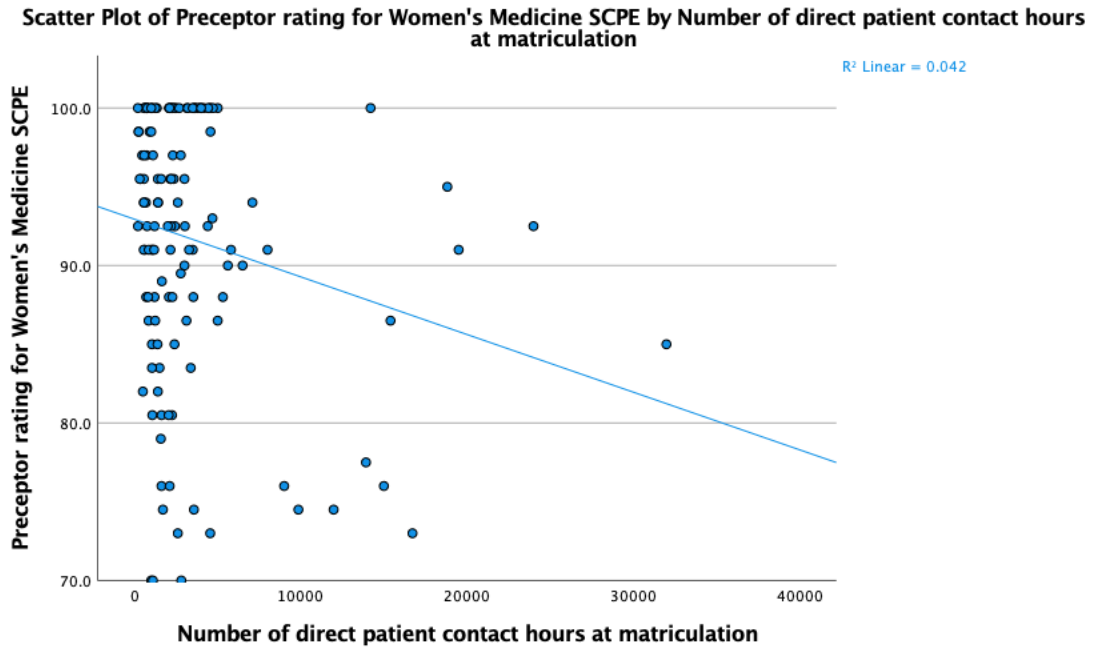
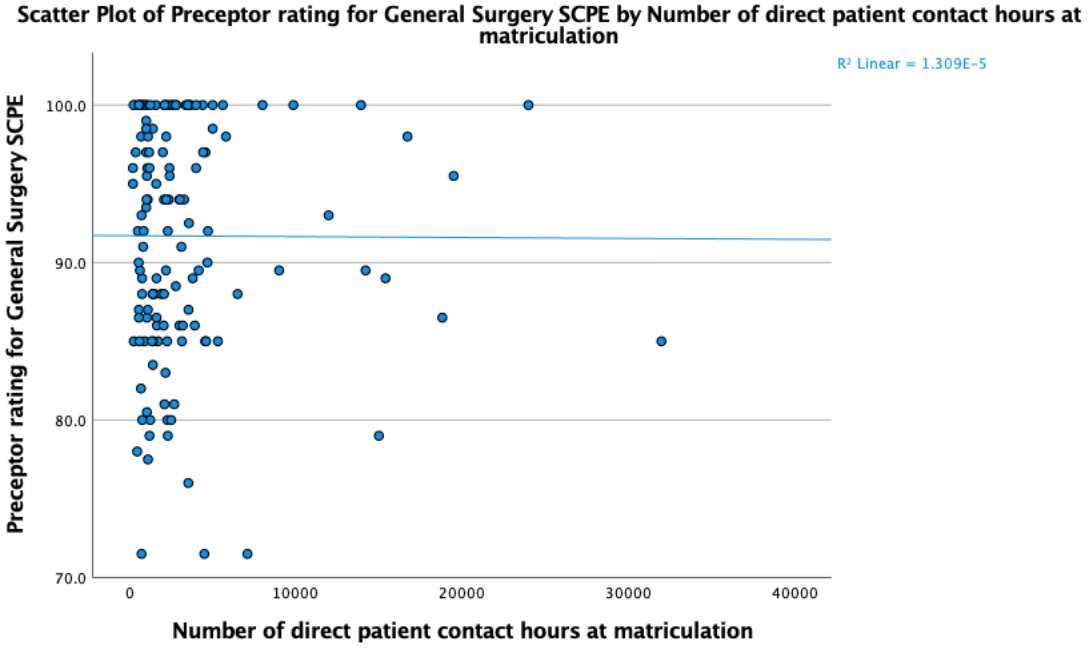


Figure 7

Scatterplot of General Surgery SCPE Scores vs. Pre-admission Patient Contact Hours



Null Hypothesis One

A bivariate linear regression was run to test null hypothesis one which states that there is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Behavioral Medicine*. The regression equation for predicting overall comprehension score is, $Y = 0.00X_{\text{pre-admission patient contact hours}} + 90.9$. The 95% confidence interval of this slope was .000 to .000. Table 5 provides a summary of the regression analysis for the variable predicting overall comprehensions scores. Accuracy in predicting Behavioral Medicine SCPE grade, $R = -.07$, is very weak and negative. A student's pre-admission patient contact hours accounted for 6% of the explained variability in Behavioral Medicine SCPE grades (see Table 5).

Table 5

Coefficients

Model	*B*	*SE B*	B
1 (Constant)	90.9	0.938	
Number of direct patient contact hours at admission	0.00	0.00	-0.075

Note. [a] Dependent Variable: Preceptor rating for Behavioral Medicine SCPE
[b] $R^2 = 0.006$ ($p<.001$)

The results of a one-way ANOVA revealed no statistically significant difference. Therefore, null hypothesis one failed to be rejected. Pre-admission patient contact hours (M = 3,436.98, SD = 4,702.84) did not significantly predict subsequent performance in Behavioral Medicine SCPEs (M = 90.43, SD = 8.94), $F(1, 138) = 0.773$, $p < .381$ (see Table 6).

Table 6

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	61.85	1	61.85	0.773	.381[b]
Residual	11043.46	138	80.03		
Total	11105.32	139			

Note [a.] Dependent Variable: Preceptor rating for Behavioral Medicine SCPE
[b.] $p<.001$

Null Hypothesis Two

A bivariate linear regression was run to test null hypothesis two which states that there is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Family Medicine*. The regression equation for predicting overall comprehension score is, $Y = 3.456e\text{-}5X_{\text{pre-admission patient contact hours}} + 92.56$. The 95% confidence interval of this slope was .000 to .000. Table 7 provides a summary of the regression analysis for the variable predicting overall comprehensions scores. Accuracy in predicting Family Medicine SCPE grade, $R = .02$, is very small. A student's pre-admission patient contact hours accounted for 1% of the explained variability in Family Medicine SCPE grades (see Table 7).

Table 7

Coefficients

Model	*B*	*SE B*	B
1 (Constant)	92.56	0.722	
Number of direct patient contact hours at admission	3.456e-5	0.00	0.024

Note. [a] Dependent Variable: Preceptor rating for Family Medicine SCPE
[b] $R^2 = 0.001$ ($p<.001$)

The results of a one-way ANOVA revealed no statistically significant difference. Therefore, null hypothesis two failed to be rejected. Pre-admission patient contact hours (*M* =

3,436.98, *SD* = 4,702.84) did not significantly predict subsequent performance in Family Medicine SCPEs (*M* = 92.68, *SD* = 6.79), $F(1, 135) = 0.079$, $p < .779$ (see Table 8).

Table 8

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	3.66	1	3.664	0.079	.779[b]
Residual	6266.362	135	46.417		
Total	6270.025	136			

Note [a.] Dependent Variable: Preceptor rating for Family Medicine SCPE
[b.] p<.001

Null Hypothesis Three

A bivariate linear regression was run to test null hypothesis two which states that there is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Internal Medicine*. The regression equation for predicting overall comprehension score is, $Y = -7.387e\text{-}5X_{\text{pre-admission patient contact hours}} + 90.81$. The 95% confidence interval of this slope was .000 to .000. Table 9 provides a summary of the regression analysis for the variable predicting overall comprehensions scores. Accuracy in predicting Internal Medicine SCPE grade, *R* = -.04, is very weak and negative. A student's pre-admission patient contact hours accounted for 2% of the explained variability in Internal Medicine SCPE grades (see Table 9).

Table 9

Coefficients

Model	*B*	*SE B*	B
1 (Constant)	90.81	0.741	
Number of direct patient contact hours at admission	-7.387e-5	0.00	-0.044

Note. [a] Dependent Variable: Preceptor rating for Internal Medicine SCPE
[b] $R^2 = 0.002$ ($p<.001$)

The results of a one-way ANOVA revealed no statistically significant difference. Therefore, null hypothesis three failed to be rejected. Pre-admission patient contact hours (M = 3,436.98, SD = 4,702.84) did not significantly predict subsequent performance in Internal Medicine SCPEs (M = 90.58, SD = 6.4), $F(1, 126) = 0.239$, $p < .626$ (see Table 10).

Table 10

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	9.85	1	9.846	0.239	.626[b]
Residual	5185.409	126	41.154		
Total	5195.255	127			

Note [a.] Dependent Variable: Preceptor rating for Internal Medicine SCPE
[b.] $p<.001$

Null Hypothesis Four

A bivariate linear regression was run to test null hypothesis two which states that there is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Emergency Medicine*. The regression equation for predicting overall comprehension score is, $Y = -5.403e\text{-}6X_{\text{pre-admission patient contact hours}} + 91.18$. The 95% confidence interval of this slope was .000 to .000. Table 11 provides a summary of the regression analysis for the variable predicting overall comprehensions scores. Accuracy in predicting Emergency Medicine SCPE grade, $R = -.003$, is very small and negative. A student's pre-admission patient contact hours accounted for 0% of the explained variability in Emergency Medicine SCPE grades (see Table 11).

Table 11

Coefficients

Model	*B*	*SE B*	B
1 (Constant)	91.18	0.771	
Number of direct patient contact hours at admission	-5.40e -6	0.00	-0.003

Note. [a] Dependent Variable: Preceptor rating for Emergency Medicine SCPE
[b] $R^2 = 0.000$ ($p<.001$)

The results of a one-way ANOVA revealed no statistically significant difference. Therefore, null hypothesis four failed to be rejected. Pre-admission patient contact hours (*M* =

3,436.98, *SD* = 4,702.84) did not significantly predict subsequent performance in Emergency Medicine SCPEs (*M* = 91.16, *SD* = 7.33), $F(1, 138) = 0.002$, $p < .968$ (see Table 12).

Table 12

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	0.090	1	.090	0.002	.968[b]
Residual	7461.544	138	54.069		
Total	7461.634	139			

Note [a.] Dependent Variable: Preceptor rating for Emergency Medicine SCPE
[b.] p<.001

Null Hypothesis Five

A bivariate linear regression was run to test null hypothesis two which states that there is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Pediatric Medicine*. The regression equation for predicting overall comprehension score is, $Y = -0.00X_{\text{pre-admission patient contact hours}} + 90$. The 95% confidence interval of this slope was -.001 to .000. Table 13 provides a summary of the regression analysis for the variable predicting overall comprehensions scores. Accuracy in predicting Pediatric Medicine SCPE grade, *R* = -.12, is small and negative. A student's pre-admission patient contact hours accounted for 16% of the explained variability in Pediatric Medicine SCPE grades (see Table 13).

Table 13

Coefficients

Model	*B*	*SE B*	B
1 (Constant)	90	0.879	
Number of direct patient contact hours at admission	-0.00	0.00	-0.126

Note. [a] Dependent Variable: Preceptor rating for Pediatric Medicine SCPE
[b] $R^2 = 0.016$ ($p<.001$)

The results of a one-way ANOVA revealed no statistically significant difference. Therefore, null hypothesis five failed to be rejected. Pre-admission patient contact hours (M = 3,436.98, SD = 4,702.84) did not significantly predict subsequent performance in Pediatric Medicine SCPEs (M = 89.25, SD = 8.35), $F(1, 134) = 2.175$, $p < .143$ (see Table 14).

Table 14

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	150.496	1	150.496	02.175	.143[b]
Residual	9272.003	134	69.194		
Total	9422.498	135			

Note [a.] Dependent Variable: Preceptor rating for Pediatric Medicine SCPE
[b.] $p<.001$

Null Hypothesis Six

A bivariate linear regression was run to test null hypothesis two which states that there is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *Women's Medicine*. The regression equation for predicting overall comprehension score is, $Y = 0.00X_{\text{pre-admission patient contact hours}} + 92.94$. The 95% confidence interval of this slope was -.001 to .000. Table 15 provides a summary of the regression analysis for the variable predicting overall comprehensions scores. Accuracy in predicting Women's Medicine SCPE grade, $R = -.20$, is small and negative. A student's pre-admission patient contact hours accounted for 42% of the explained variability in Women's Medicine SCPE grades (see Table 15).

Table 15

Coefficients

Model	*B*	*SE B*	B
1 (Constant)	92.94	0.886	
Number of direct patient contact hours at admission	0.00	0.00	-0.206

Note. [a] Dependent Variable: Preceptor rating for Women's Medicine SCPE
[b] $R^2 = 0.042$ ($p<.001$)

The results of a one-way ANOVA revealed no statistically significant difference. Therefore, null hypothesis six failed to be rejected. Pre-admission patient contact hours (M = 3,436.98, SD = 4,702.84) did not significantly predict subsequent performance in Women's

Medicine SCPEs (M = 91.66, SD = 8.46), $F(1, 134) = 5.919$, $p < .016$ (see Table 16). It is noted, however, that with a p value set at 0.014 due to the Bonferroni correction, the null was very nearly rejected. In fact, the null would have been rejected if the typical alpha level of 0.05 had been used.

Table 16

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	408.822	1	408.822	5.919	.016[b]
Residual	9254.530	134	69.064		
Total	9663.351	135			

Note [a.] Dependent Variable: Preceptor rating for Women's Medicine SCPE
[b.] p<.001

Null Hypothesis Seven

A bivariate linear regression was run to test null hypothesis two which states that there is no significant predictive relationship between the quantity of an incoming PA program applicant's pre-admission patient contact hours and their subsequent performance on a supervised clinical practice experience in *General Surgery*. The regression equation for predicting overall comprehension score is, $Y = -5.727e\text{-}6X_{\text{pre-admission patient contact hours}} + 91.705$. The 95% confidence interval of this slope was .000 to .000. Table 17 provides a summary of the regression analysis for the variable predicting overall comprehensions scores. Accuracy in predicting General Surgery SCPE grade, R = -.004, is very weak and negative. A student's pre-

admission patient contact hours accounted for 0% of the explained variability in General Surgery SCPE grades (see Table 17).

Table 17

Coefficients

Model	*B*	*SE B*	B
1 (Constant)	91.705	0.783	
Number of direct patient contact hours at admission	-5.727e-6	0.00	-0.004

Note. [a] Dependent Variable: Preceptor rating for General Surgery SCPE
[b] $R^2 = 0.000$ ($p<.001$)

The results of a one-way ANOVA revealed no statistically significant difference. Therefore, null hypothesis two failed to be rejected. Pre-admission patient contact hours (M = 3,436.98, SD = 4,702.84) did not significantly predict subsequent performance in General Surgery SCPEs (M = 91.69, SD = 7.44), $F(1, 138) = .002$, $p < .966$ (see Table 18).

Table 18

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	.101	1	.101	.002	.966[b]
Residual	7702.071	138	55.812		
Total	7702.171	139			

Note [a.] Dependent Variable: Preceptor rating for General Surgery SCPE
[b.] p<.001

CHAPTER FIVE: CONCLUSIONS

Overview

This chapter incorporates a discussion of the results including conclusions, implications of the results, limitations of the study, and recommendations for future research.

Discussion

The purpose of this non-experimental, quantitative, regression study was to determine if the non-cognitive variable of pre-admission patient contact hours is predictive of subsequent PA student performance as defined by their score on final preceptor evaluations for seven different supervised clinical practice experiences.

The research question was: is the quantity of an incoming PA program applicant's pre-admission patient contact hours predictive of their subsequent performance on supervised clinical practice experiences in Behavioral Medicine, Family Medicine, Internal Medicine, Emergency Medicine, Pediatric Medicine, Women's Medicine, and General Surgery? According to the current analysis, the answer to the research question is 'no'. Pre-admission patient contact hours did not significantly predict subsequent performance for any of the seven supervised clinical practice experiences because no statistically significant differences were found with any of the seven linear regressions. Notably, the null hypothesis pertaining to Women's Medicine (null hypothesis six) was very nearly rejected at $p < 0.016$. The alpha level was set at 0.014 due to the Bonferroni correction. However, if the usual p value of 0.05 had been used, null hypothesis six would have been rejected. The variation (R^2) for this variable was also the highest of any at 42% (others were 6%, 1%, 2%, 0%, 16%, and 0% respectively). Therefore, for null hypothesis six, one can place more confidence in the predictive value of the regression line. More specifically, this means that 42% of the variation in the outcome variable

(performance in the Women's Medicine SCPE) can be explained by variation in the predictor variable (number of pre-admission direct patient care hours).

In conclusion, for this small, individual PA program that is located within a large, public university, the number of pre-admission patient contact hours is not predictive of their subsequent performance on supervised clinical practice experiences in any of the seven settings. However, for the Women's Medicine SCPE, the null was very close to being rejected; therefore, this finding deserves to be investigated further. It is quite unusual that pre-admission patient contact experience may indeed impact a PA student's subsequent performance in a Women's Medicine setting, but not other settings. There is currently nothing in the literature that would explain this directly, but one can speculate that the competencies of patient care, interpersonal and communication skills, and professionalism are more important for success in a Women's Medicine setting, as well as more desired by the female patients in this setting. All of these soft skills are related to empathy, or what some call emotional intelligence. Empathy is a critical part of provider-patient relationships and has been correlated with improved patient satisfaction, improved clinical outcomes, and improved patient compliance (Casas et al., 2017). A 2017 study found that self-reported empathy in medical students was predictive of performance in Pediatric clinical settings, but not other settings, including Women's Medicine (Casas et al., 2017). In this case, women make up 58% of practicing physicians in the field of Women's Medicine, and 84% of trainees in that field (Temkin, 2020). In addition, 69.3% of practicing certified physician assistants are female, and 80.7% of the PA students in this specific study were female (NCCPA, 2020b, p. 132). Therefore, all patients in the Women's Medicine setting are female, and the majority of the preceptors and PA students are also female. A 2017 study found that female medical students were more likely than male medical students to be described by

their evaluators as “compassionate,” “caring,” and “empathetic” (Ross et al., 2017). Consequently, with more female evaluators in the setting of Women’s Medicine, more female students in this setting who are better at the soft skills of empathy, interpersonal communication, and professionalism, and more female patients who value these same skills, it is possible that prior clinical experience impacted a student’s performance in Women’s Medicine because these students received higher ratings from preceptors on the soft skill evaluation questions. Lastly, perhaps the preponderance of female patients in this setting were more vocal to preceptors about the student being proficient in these areas, and this in turn, affects the students’ evaluation favorably.

Prior research looking at *demographic variables* (age, race, gender) has successfully shown predictive relationships within admissions and/or program outcomes (Asprey et al., 2004; Higgins et al., 2010; Yuen & Honda, 2019). Prior studies assessing *cognitive variables* (overall undergraduate GPA, science undergraduate GPA, EOR exam scores) have also revealed predictive relationships within admissions and/or program outcomes (Durning et al., 2015; Trenton et al., 2018; Andreeff, 2014; Brown et al., 2013; Hegmann et al., 2015; Massey et al., 2015; Butina et al., 2017; Moore et al., 2019). Finally, prior research assessing *non-cognitive variables* like pre-admission patient contact hours has also been conducted, but typically only to look at relationships to outcomes such as PA program GPA, PANCE scores, and standardized patient exam scores (Brown et al., 2013; Higgins et al., 2010; Honda et al., 2018; Hegmann & Iverson, 2016). Therefore, evidence for the utility of non-cognitive variables in admissions has not been clear, and research is also lacking on markers of PA student success other than the PANCE (Brenneman et al., 2018). Specifically, no one to the researcher’s knowledge has assessed the relationship of a non-cognitive factor (like pre-admission patient contact hours) to

the outcome of PA student performance in supervised clinical practice experiences. As pointed out by Brenneman et al. (2019), "PA admissions processes have typically given more weight to cognitive attributes than non-cognitive ones, both because a high level of cognitive ability is needed for a career in medicine and because cognitive factors are easier to measure" (p. 25). Yet an increasing number of PA programs have shifted towards a more holistic admissions process that includes a greater focus on non-cognitive factors because they believe it could bring more diversity into the profession and may help to identify applicants who have the soft skills and emotional intelligence necessary to be successful PAs (Brenneman et al., 2018).

The 2017 PAEA Curriculum Report noted that approximately 58% of PA programs required some type of preadmission healthcare experience and an additional 27% at least recommended it. Only 14% of programs did not require it at all (PAEA, 2017). This healthcare experience manifests in various ways: clinician shadowing, healthcare-related experience, or experiences that directly involve patient care (PAEA, 2017). Of the 58% of PA programs that required healthcare experience, 78% of those required it to be direct patient care (PAEA, 2017). The mean requirement among those programs was 733.82 hours per applicant – this equates to approximately 18-weeks of full-time work (PAEA, 2017). Knowing whether or not this prior direct patient care experience affects a student's subsequent performance in clinical settings during PA school is valuable because historically, many PA educators cite three main reasons for having the direct patient care requirement as part of admissions: 1) PA school is shorter than medical school, therefore, already matriculating to a PA program having completed some patient care experience seems practical and reasonable, 2) the very first PAs ever were Army medics and Navy corpsman returning from active duty with a wealth of experience, and 3) PA educators simply believe that work/life experience gained inpatient care settings may help an applicant to

be more mature (Hooker et al., 2017). While all three of these reasons may be valid, the research of this study shows that for this small, individual PA program that is located within a large, public university, the number of pre-admission patient contact hours is not predictive of a PA students' subsequent performance on any of the seven supervised clinical practice experiences.

Jones, Simpkins, and Hocking (2014) reviewed the websites of 126 physician assistant and physical therapy programs to assess what non-cognitive variables were desirable in applicants and found that 'maturity' was the term most often cited (>70% of the time) (Jones et al., 2014). Other attributes that were often cited were 'motivation,' 'interpersonal skill,' 'communication skill,' and 'commitment' (Jones et al., 2014). McDaniel, Thrasher, and Hiatt (2013) found that 'motivation for becoming a PA,' 'maturity,' and 'professional demeanor' were the three most highly rated qualities among the faculty of 94 surveyed PA programs (McDaniel et al., 2013). Therefore, although it is clear that PA programs desire applicants who are mature and have strong interpersonal skills, it remains unclear whether requiring pre-admission patient contact hours may actually help to achieve that goal. The results of this study are in alignment with prior research that concludes there is little evidence that pre-admission patient contact hours are linked to PA program outcomes (Hooker et al., 2017; Jones et al., 2014; McDaniel et al., 2013). Further study is necessary to determine whether, with a larger sample size, there could be a predictive effect in the setting of Women's Medicine. Women's Medicine is a setting where it is possible that soft skills such as interpersonal communication, professionalism, and empathy are more desirable and necessary.

Implications

Theoretical Implications

Jean Piaget's cognitive development theory focuses on self-initiated development, while Les Vygotsky's social development theory places more emphasis on social contributions to the process of development and learning (Mcleod, 2018). Vygotsky claimed that meaningful learning occurs as a social activity, specifically when a learner has social interaction with a skillful tutor as a collaborative process (Vygotsky, 1978). In the case of modern PA education, a PA student in a clinical setting collaborates with a preceptor, their "more knowledgeable other." This clinical preceptor guides the PA student through their zone of proximal development via advice, encouragement, feedback, assistance, constructive criticism, and delegated autonomy. The clinical phase of a PA program is obviously a necessary and integral part of PA education.

Separately, but related, Howard Gardner's theory of multiple intelligences identified seven types of intelligence that he believed complement each other (Gardner, 1983). The clinical setting seems like the perfect environment for one to develop three of those intelligences in particular: bodily-kinesthetic intelligence (using cognitive abilities to solve problems and control body movements), linguistic intelligence (using written and spoken language to express oneself), and mathematical intelligence (using logic to solve math (and clinical) problems) (Gardner, 1983).

In conclusion, from a theoretical perspective, while it may seem logical that experience in a clinical environment prior to PA school would affect a student's future success in a clinical setting, the current study does not support this notion. This study's findings fit the narrative that pre-admission patient contact hours do not have much bearing on subsequent PA student success.

Specifically, the amount of pre-admission patient contact hours does not predict the subsequent performance of PA students within seven common supervised clinical practice experiences.

Practical Implications

By its very nature, the practice of medicine is extremely hands-on and entails interpersonal relationships. Therefore, requiring applicants to complete hands-on experience in a clinical setting prior to matriculation into a PA program seems quite reasonable at face value. Yet this practice has come under criticism. Opponents argue that medical schools do not require pre-admission patient contact hours, so why should PA programs? But there are many differences between medical school and PA school, not the least of which is that medical students must complete a residency that is much longer than the clinical phase of a PA student's education. Residency training can last anywhere from 3-7 years, depending on the specialty area, while the clinical phase of a PA program lasts, on average, just over a year (53.2 weeks; ACGME, 2012; PAEA, 2020).

Another criticism of requiring pre-admission patient care hours prior to PA school is that the requirement creates a "barrier" to admission. Opponents argue that more applicants would be eligible for PA school without this barrier. However, the PA profession is one that demands intelligence, decision-making ability (often under high-pressure), and professional responsibility. PAs, like physicians, often need to make life or death decisions. Consequently, PA programs, like other professional, clinical, programs have competitive admissions processes for good reason. Therefore, while a requirement to obtain a specified amount of pre-admission patient contact hours may most certainly represent an obstacle to admission, I do not believe it is an unreasonable one. In fact, one could argue that all components of an admissions process to a competitive program are technically "barriers" or "obstacles." By this line of thinking, using the

term “barrier” is simply putting a negative spin on words such as “requirement” or “prerequisite.” Pre-admission patient care hours should not be viewed as a barrier, but rather a logical and time-tested prerequisite to admission for competitive professional programs. I argue this despite the findings of my research. The current study showed that pre-admission patient contact hours do not predict future success on supervised clinical practice experiences. But that is not to say that these hours do not have value for the future PA student. This will be discussed more in “Recommendations for Future Research.”

Competency to practice as a physician assistant is defined by six specific pre-defined domains, yet the PANCE only assesses one of them (medical knowledge) extensively and a second one (professionalism) minimally (NCCPA, 2019a; NCCPA, 2019b). Additionally, PA programs do not want to add any length to their current curricula. Requiring pre-admission patient contact hours is one way of ensuring that applicants are at least exposed to concepts of professionalism and interpersonal communication in clinical settings; two key competencies. When applicants matriculate with this experience already completed, it may remove some of the burdens from PA programs to teach these softer skills as extensively. Again, while the current study showed that pre-admission patient contact hours do not predict future success on supervised clinical practice experiences, it does not mean that these hours may impact other important aspects of PA student preparation and future competency.

Limitations

This research study was limited to a single PA program in the southeastern United States. All students who matriculate into this program are required to have completed a minimum of 1,000 hours of direct patient contact. The mean number of hours in this sample was actually much higher at 3,437. However, individual PA programs in the United States have

different requirements for this admission's pre-requisite. In fact, some programs (14% of them) do not require any hours at all (PAEA, 2017). Therefore, although the students from 5-years of consecutive cohorts of a single institution were included in this study, it is difficult to generalize the findings from this one program to other PA programs nationwide.

The use of direct patient care hours as the predictor variable is a limitation of this study because of the variability in what is accepted for these hours. The PA program of study defines acceptable hours as anything that is within the realm of medicine and involves direct (touching) care of a patient. Based on this definition, a wide range of occupations are eligible, including emergency medical technician, certified nursing assistant, patient care technician, medical assistant, respiratory therapist, mental health worker, paramedic, dietitian, athletic trainer, and many more. The levels of responsibility, degree of autonomy, and opportunity of decision making vary widely among all of these occupations. Therefore, grouping this wide-ranging assortment of occupations into a single variable of direct patient care hours may not account for the variability present and inherent to each occupation.

The use of student performance on supervised clinical practice experiences as the outcome variables are also a limitation. Student performance was defined by percentage score, and that score was derived from how a student was rated by their clinical preceptor on approximately 20-items on a SCPE-specific evaluation form. Evaluations were completed at the conclusion of a four or eight week period. Students were rated on a four-point scale of 0-3, with 0 = "inadequate," 1 = "competence," 2 = "proficiency," and 3 = "mastery". Preceptors were mostly physicians, but included nurse practitioners, and physician assistants as well. Therefore, there is variability that could not be controlled for, in the use of different raters (preceptors), and in the subjectivity of those ratings. Of note, a performance assessment (also known as an

authentic assessment) is intended to represent comprehensive, complex, real world tasks, and is a method of assessing students by directly evaluating their performance on "tasks that have intrinsic value," such as those in a clinical setting (Gall, Gall, & Borg, 2007, p. 215). Therefore, the outcome variables do in fact meet the definition of a performance test (as being distinct from aptitude tests, intelligence tests, or achievement tests), yet the limitations of their use remains (Gall, Gall, & Borg, 2007).

Another limitation of this study is the method of data analysis. A regression analysis is a common choice to use in predictive studies; however, regressions only indicate whether or not a relationship exists between two variables. A regression analysis cannot reveal a causal relationship between variables (Gall, Gall, & Borg, 2007).

Recommendations for Future Research

This study focused on one, small PA program that is housed in a large, public university. It would be useful for the study to be replicated at multiple PA programs of varying sizes (especially larger ones), and for it to include private universities as well. A larger overall sample size may produce different results.

A closer look at the Women's Medicine supervised clinical practice experience is also warranted. It is possible that the competencies of professionalism, interpersonal and communication skills, and patient care (the soft skills that can be fine-tuned in clinical settings) are more essential for a student to succeed in a Women's Medicine environment. Further research should aim for a higher sample size of PA students and only focus on the relationship between prior patient care experience and subsequent performance in the Women's Medicine supervised clinical practice experience.

The current study assessed all types of direct patient care experience collectively for their predictive effects. Future research could take a single type of direct patient care experience (such as emergency medical technician or certified nursing assistant) and assess whether these individual occupations have any predictive effect on subsequent performance on supervised clinical practice experiences.

Lastly, future research could repeat this study in a similar way, but could reduce subjectivity of preceptor rating of performance by only including an individual preceptor per supervised clinical practice experience type, rather than the sum of all clinical preceptors.

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APPENDIX A

Preceptor Evaluation of Students
Behavioral Medicine

Student: _____
Preceptor: _____
Dates of Rotation: _____

Evaluation Instructions

Please evaluate the student within each **Program Competency**

Inadequate Students whose performance demonstrates significant deficiencies in any given are
Competence Students whose performance is expected for their current level of training with **direct supervision**, average student
Proficiency Students whose performance is expected for their current level of training with **indirect supervision**
Mastery Students whose performance is at the ability to **teach others**

N/A – Not Applicable Students did not perform or were not observed often enough to permit an accurate evaluation

Medical Knowledge

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to demonstrate an understanding of common psychiatric disorders					**N/A**
Development of a differential diagnosis					**N/A**
Pharmacologic knowledge of treatment options and use					**N/A**
Non-Pharmacological knowledge of treatment options					**N/A**
Ability to synthesize knowledge gained					**N/A**

Interpersonal & Communication Skills

	Inadequate	**Competence**	**Proficiency**	**Mastery**	

	Deficient	With direct supervision	With indirect supervision	Could teach others	
Oral communication (case presentations/discussions)					**N/A**
Ability to establish appropriate rapport with Patients/Families					**N/A**
Ability to establish appropriate rapport with medical staff					**N/A**
Ability to document pertinent information (H&P, Assessment and Plan)					**N/A**
Ability to work collaboratively in an interprofessional patient-centered team					**N/A**

Patient Care

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to perform a history and mental status examination					**N/A**
Ability to perform an appropriate physical examination					**N/A**
Ability to order and interpret diagnostic labs and imaging					**N/A**
Ability to develop a management plan					**N/A**
Ability to counsel patients on mental illness and resources					**N/A**
Ability to counsel patients in health promotion and disease prevention					**N/A**
Ability to recognize emergent problems					**N/A**
Ability to manage patients with acute problems					**N/A**
Ability to manage patients with chronic problems					**N/A**

Professionalism

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	

Demonstration of professional and ethical behavior at all times					**N/A**
Reliable and completes performance of all assigned duties					**N/A**
Ability to accept constructive criticism					**N/A**
Demonstration of compassion and respect for patients					**N/A**
Improvement during the rotation					**N/A**

Practice Based Learning & Improvement and Systems Based Practice

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Awareness of limitations					**N/A**
Ability to demonstrate use of clinical literature					**N/A**
Ability to balance cost and quality care					**N/A**
Awareness of health disparities					**N/A**

Clinical Skills unique to the rotation

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to perform a mental health assessment					**N/A**

Comments:

Program Suggestions for improvement:

Preceptor Signature: _____
Date: _____

Preceptor Evaluation of Students
Emergency Medicine

Student: _____
Preceptor: _____
Dates of Rotation: _____

Evaluation Instructions

Please evaluate the student within each **Program Competency**

Inadequate Students whose performance demonstrates significant deficiencies in any given area
Competence Students whose performance is expected for their current level of training with **direct supervision**, average student
Proficiency Students whose performance is expected for their current level of training with **indirect supervision**
Mastery Students whose performance is at the ability to **teach others**

N/A – Not Applicable Students did not perform or were not observed often enough to permit an accurate evaluation

Medical Knowledge

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to demonstrate an understanding of common problems/disorders encountered in emergency medicine *(see learning outcomes for details of problems/disorders)					**N/A**
Development of a differential diagnosis					**N/A**
Pharmacologic knowledge of treatment options and use					**N/A**
Non-Pharmacological knowledge of treatment options					**N/A**
Ability to synthesize knowledge gained					**N/A**

Interpersonal & Communication Skills

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Oral communication (case presentations/discussions)					**N/A**
Ability to establish appropriate rapport with Patients/Families					**N/A**
Ability to establish appropriate rapport with medical staff					**N/A**
Ability to document pertinent information (H&P, Assessment and Plan)					**N/A**
Ability to work collaboratively in an interprofessional patient-centered team					**N/A**

Patient Care

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to perform a history of present illness					**N/A**
Ability to perform an appropriate physical examination					**N/A**
Ability to order and interpret diagnostic labs and imaging					**N/A**
Ability to develop a management plan					**N/A**
Ability to counsel patients on their management plan					**N/A**
Ability to counsel patients in health promotion and disease prevention					**N/A**
Ability to recognize emergent problems					**N/A**
Ability to manage patients with acute problems					**N/A**
Ability to manage patients with chronic problems					**N/A**

Professionalism

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	

Demonstration of professional and ethical behavior at all times					**N/A**
Reliable and completes performance of all assigned duties					**N/A**
Ability to accept constructive criticism					**N/A**
Demonstration of compassion and respect for patients					**N/A**
Improvement during the rotation					**N/A**

Practice Based Learning & Improvement and Systems Based Practice

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Awareness of limitations					**N/A**
Ability to demonstrate use of clinical literature					**N/A**
Ability to balance cost and quality care					**N/A**
Awareness of health disparities					**N/A**

Clinical Skills unique to the rotation

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability with culture collection (throat, wound, blood, etc.)					**N/A**
Initiating IV therapy					**N/A**
Suturing minor lacerations					**N/A**
Wound cleansing and dressing					**N/A**
Blood sample collection					**N/A**
Basic EKG interpretation					**N/A**
Nasogastric intubation					**N/A**
Stool for occult blood					**N/A**
Joint/limb immobilization					**N/A**
Resuscitation					**N/A**
Incision and drainage					**N/A**
Joint aspiration					**N/A**
Technical Skills Overall (performance of procedures)					**N/A**

Comments:

Program Suggestions for improvement:

Preceptor Signature: _____
Date: _____

Preceptor Evaluation of Students
Family Medicine

Student: _____
Preceptor: _____
Dates of Rotation: _____

Evaluation Instructions

Please evaluate the student within each **Program Competency**

Inadequate Students whose performance demonstrates significant deficiencies in any given area
Competence Students whose performance is expected for their current level of training with **direct supervision**, average student
Proficiency Students whose performance is expected for their current level of training with **indirect supervision**
Mastery Students whose performance is at the ability to **teach others**

N/A – Not Applicable Students did not perform or were not observed often enough to permit an accurate evaluation

Medical Knowledge

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to demonstrate an understanding of common problems/disorders encountered in primary care *(see learning outcomes for details of problems/disorders)					**N/A**
Development of a differential diagnosis					**N/A**
Pharmacologic knowledge of treatment options and use					**N/A**
Non-Pharmacological knowledge of treatment options					**N/A**
Knowledge of normal development					**N/A**
Knowledge of appropriate immunizations					**N/A**

Ability to synthesize knowledge gained					**N/A**

Interpersonal & Communication Skills

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Oral communication (case presentations/discussions)					**N/A**
Ability to establish appropriate rapport with Patients/Families					**N/A**
Ability to establish appropriate rapport with medical staff					**N/A**
Ability to document pertinent information (H&P, Assessment and Plan)					**N/A**
Ability to work collaboratively in an interprofessional patient-centered team					**N/A**

Patient Care

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to perform a history of present illness					**N/A**
Ability to perform an appropriate physical examination					**N/A**
Ability to order and interpret diagnostic labs and imaging					**N/A**
Ability to develop a management plan					**N/A**
Ability to counsel patients on their management plan					**N/A**
Ability to counsel patients in health promotion and disease prevention					**N/A**
Ability to recognize emergent problems					**N/A**
Ability to manage patients with acute problems					**N/A**
Ability to manage patients with chronic problems					**N/A**

Professionalism

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Demonstration of professional and ethical behavior at all times					**N/A**
Reliable and completes performance of all assigned duties					**N/A**
Ability to accept constructive criticism					**N/A**
Demonstration of compassion and respect for patients					**N/A**
Improvement during the rotation					**N/A**

Practice Based Learning & Improvement and Systems Based Practice

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Awareness of limitations					**N/A**
Ability to demonstrate use of clinical literature					**N/A**
Ability to balance cost and quality care					**N/A**
Awareness of health disparities					**N/A**

Clinical Skills

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability with culture collection (throat, wound, blood, etc.)					**N/A**
Ability to perform a pelvic exam (with or without PAP smear)					**N/A**
Technical Skills Overall (performance of procedures)					**N/A**

Comments:

Program Suggestions for improvement:
Preceptor Signature: _____
Date: _____

Preceptor Evaluation of Students
General Surgery

Student: _____
Preceptor: _____
Dates of Rotation: _____

Evaluation Instructions

Please evaluate the student within each **Program Competency**

Inadequate Students whose performance demonstrates significant deficiencies in any given area
Competence Students whose performance is expected for their current level of training with **direct supervision**, average student
Proficiency Students whose performance is expected for their current level of training with **indirect supervision**
Mastery Students whose performance is at the ability to **teach others**

N/A – Not Applicable Students did not perform or were not observed often enough to permit an accurate evaluation

Medical Knowledge

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to demonstrate an understanding of common problems/disorders encountered in general surgery *(see learning outcomes for details of problems/disorders)					**N/A**
Development of a differential diagnosis					**N/A**
Pharmacologic knowledge of treatment options and use					**N/A**
Non-Pharmacological knowledge of treatment options					**N/A**
Ability to synthesize knowledge gained					**N/A**

Interpersonal & Communication Skills

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Oral communication (case presentations/discussions)					**N/A**
Ability to establish appropriate rapport with Patients/Families					**N/A**
Ability to establish appropriate rapport with medical staff					**N/A**
Ability to document pertinent information (H&P, Assessment and Plan)					**N/A**
Ability to work collaboratively in an interprofessional patient-centered team					**N/A**

Patient Care

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to perform a history of present illness					**N/A**
Ability to perform an appropriate physical examination					**N/A**
Ability to order and interpret diagnostic labs and imaging					**N/A**
Ability to develop a management plan					**N/A**
Ability to counsel patients on their management plan					**N/A**
Ability to counsel patients in health promotion and disease prevention					**N/A**
Ability to recognize emergent problems					**N/A**
Ability to manage patients with acute problems					**N/A**
Ability to manage patients with chronic problems					**N/A**

Professionalism

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	

Demonstration of professional and ethical behavior at all times					**N/A**
Reliable and completes performance of all assigned duties					**N/A**
Ability to accept constructive criticism					**N/A**
Demonstration of compassion and respect for patients					**N/A**
Improvement during the rotation					**N/A**

Practice Based Learning & Improvement and Systems Based Practice

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Awareness of limitations					**N/A**
Ability to demonstrate use of clinical literature					**N/A**
Ability to balance cost and quality care					**N/A**
Awareness of health disparities					**N/A**

Clinical Skills

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to assist in surgical procedures					**N/A**
Ability in suturing					**N/A**
Ability to employ aseptic technique					**N/A**
Technical Skills Overall (performance of procedures)					**N/A**

Comments:

Program Suggestions for improvement:

Preceptor Signature: _____
Date: _____

Preceptor Evaluation of Students
Internal Medicine

Student: _____
Preceptor: _____
Dates of Rotation: _____

Evaluation Instructions

Please evaluate the student within each **Medical Competency**

Inadequate Students whose performance demonstrates significant deficiencies in any given area
Competence Students whose performance is expected for their current level of training with **direct supervision**, average student
Proficiency Students whose performance is expected for their current level of training with **indirect supervision** (similar to a practicing PA)
Mastery Students whose performance is at the ability to **teach others**

N/A – Not Applicable Students did not perform or were not observed often enough to permit an accurate evaluation

Medical Knowledge

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to demonstrate an understanding of common problems/disorders encountered in internal medicine *(see learning outcomes for details of problems/disorders)					**N/A**
Development of a differential diagnosis					**N/A**
Pharmacologic knowledge of treatment options and use					**N/A**
Non-Pharmacological knowledge of treatment options					**N/A**
Ability to synthesize knowledge gained					**N/A**

Interpersonal & Communication Skills

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Oral communication (case presentations/discussions)					**N/A**
Ability to establish appropriate rapport with Patients/Families					**N/A**
Ability to establish appropriate rapport with medical staff					**N/A**
Ability to document pertinent information (H&P, Assessment and Plan)					**N/A**
Ability to work collaboratively in an interprofessional patient-centered team					**N/A**

Patient Care

	Inadequate	Competence	Proficiency	Mastery	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to perform a history of present illness					**N/A**
Ability to perform an appropriate physical examination					**N/A**
Ability to order and interpret diagnostic labs and imaging					**N/A**
Ability to develop a management plan					**N/A**
Ability to counsel patients on their management plan					**N/A**
Ability to counsel patients in health promotion and disease prevention					**N/A**
Ability to recognize emergent problems					**N/A**
Ability to manage patients with acute problems					**N/A**
Ability to manage patients with chronic problems					**N/A**

Professionalism

	Inadequate	Competence	Proficiency	Mastery	

	Deficient	With direct supervision	With indirect supervision	Could teach others	
Demonstration of professional and ethical behavior at all times					**N/A**
Reliable and completes performance of all assigned duties					**N/A**
Ability to accept constructive criticism					**N/A**
Demonstration of compassion and respect for patients					**N/A**
Improvement during the rotation					**N/A**

Practice Based Learning & Improvement and Systems Based Practice

	Inadequate Deficient	Competence With direct supervision	Proficiency With indirect supervision	Mastery Could teach others	
Awareness of limitations					**N/A**
Ability to demonstrate use of clinical literature					**N/A**
Ability to balance cost and quality care					**N/A**
Awareness of health disparities					**N/A**

Clinical Skills

	Inadequate Deficient	Competence With direct supervision	Proficiency With indirect supervision	Mastery Could teach others	
Ability with culture collection (throat, wound, blood, etc.)					**N/A**
Ability to interpret EKGs					**N/A**
Technical Skills Overall (performance of procedures)					**N/A**

Comments:

Program Suggestions for improvement:

Preceptor Signature: _____
Date: _____

Preceptor Evaluation of Students
Obstetrics and Gynecology

Student: _____
Preceptor: _____
Dates of Rotation: _____

Evaluation Instructions

Please evaluate the student within each **Program Competency**

Inadequate Students whose performance demonstrates significant deficiencies in any given area
Competence Students whose performance is expected for their current level of training with **direct supervision**, average student
Proficiency Students whose performance is expected for their current level of training with **indirect supervision**
Mastery Students whose performance is at the ability to **teach others**
N/A – Not Applicable Students did not perform or were not observed often enough to permit an accurate evaluation

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to demonstrate an understanding of common problems/disorders encountered in obstetrics and gynecology *(see learning outcomes for details of problems/disorders)					**N/A**
Development of a differential diagnosis					**N/A**
Pharmacologic knowledge of treatment options and use					**N/A**
Non-Pharmacological knowledge of treatment options					**N/A**
Knowledge of normal development					**N/A**
Ability to synthesize knowledge gained					**N/A**

Interpersonal & Communication Skills

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	

Oral communication (case presentations/discussions)					**N/A**
Ability to establish appropriate rapport with Patients/Families					**N/A**
Ability to establish appropriate rapport with medical staff					**N/A**
Ability to document pertinent information (H&P, Assessment and Plan)					**N/A**
Ability to work collaboratively in an interprofessional patient-centered team					**N/A**

Patient Care

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to perform a history of present illness					**N/A**
Ability to perform an appropriate physical examination					**N/A**
Ability to order and interpret diagnostic labs and imaging					**N/A**
Ability to develop a management plan					**N/A**
Ability to counsel patients on their management plan					**N/A**
Ability to counsel patients in health promotion and disease prevention					**N/A**
Ability to recognize emergent problems					**N/A**
Ability to manage patients with acute problems					**N/A**
Ability to manage patients with chronic problems					**N/A**

Professionalism

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Demonstration of professional and ethical behavior at all times					**N/A**
Reliable and completes performance of all assigned duties					**N/A**

Ability to accept constructive criticism					**N/A**
Demonstration of compassion and respect for patients					**N/A**
Improvement during the rotation					**N/A**

Practice Based Learning & Improvement and Systems Based Practice

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Awareness of limitations					**N/A**
Ability to demonstrate use of clinical literature					**N/A**
Ability to balance cost and quality care					**N/A**
Awareness of health disparities					**N/A**

Clinical Skills

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to assist in surgical procedures					**N/A**
Ability in suturing					**N/A**
Ability to employ aseptic technique					**N/A**
Ability to perform a pelvic exam (with or without PAP smear)					**N/A**
Ability to provide care and counseling in all stages of prenatal and postnatal care					**N/A**
Ability to choose and counsel patients on best contraceptive use					**N/A**
Technical Skills Overall (performance of procedures)					**N/A**

Comments:

Program Suggestions for improvement:

Preceptor Signature: _____
Date: _____

Preceptor Evaluation of Students
Pediatrics

Student: _____
Preceptor: _____
Dates of Rotation: _____

Evaluation Instructions

Please evaluate the student within each **Program Competency**

Inadequate Students whose performance demonstrates significant deficiencies in any given area
Competence Students whose performance is expected for their current level of training with **direct supervision**, average student
Proficiency Students whose performance is expected for their current level of training with **indirect supervision**
Mastery Students whose performance is at the ability to **teach others**

N/A – Not Applicable Students did not perform or were not observed often enough to permit an accurate evaluation

Medical Knowledge

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to demonstrate an understanding of common problems/disorders encountered in pediatric medicine *(see learning outcomes for details of problems/disorders)					**N/A**
Knowledge of well child checks					**N/A**
Understanding of normal growth and development					**N/A**
Understanding of normal nutrition					**N/A**
Development of a differential diagnosis					**N/A**
Pharmacologic knowledge of treatment options and use					**N/A**
Non-Pharmacological knowledge of treatment options					**N/A**

Knowledge of normal development					**N/A**
Knowledge of appropriate immunizations					**N/A**
Ability to synthesize knowledge gained					**N/A**

Interpersonal & Communication Skills

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Oral communication (case presentations/discussions)					**N/A**
Ability to establish appropriate rapport with Patients/Families					**N/A**
Ability to establish appropriate rapport with medical staff					**N/A**
Ability to document pertinent information (H&P, Assessment and Plan)					**N/A**
Ability to work collaboratively in an interprofessional patient-centered team					**N/A**

Patient Care

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability to perform a history of present illness					**N/A**
Ability to perform an appropriate physical examination					**N/A**
Ability to order and interpret diagnostic labs and imaging					**N/A**
Ability to develop a management plan					**N/A**
Ability to counsel patients on their management plan					**N/A**
Ability to counsel patients in health promotion and disease prevention					**N/A**
Ability to recognize emergent problems					**N/A**
Ability to manage patients with acute problems					**N/A**

Ability to manage patients with chronic problems					**N/A**

Professionalism

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Demonstration of professional and ethical behavior at all times					**N/A**
Reliable and completes performance of all assigned duties					**N/A**
Ability to accept constructive criticism					**N/A**
Demonstration of compassion and respect for patients					**N/A**
Improvement during the rotation					**N/A**

Practice Based Learning & Improvement and Systems Based Practice

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Awareness of limitations					**N/A**
Ability to demonstrate use of clinical literature					**N/A**
Ability to balance cost and quality care					**N/A**
Awareness of health disparities					**N/A**

Clinical Skills

	Inadequate	**Competence**	**Proficiency**	**Mastery**	
	Deficient	**With direct supervision**	**With indirect supervision**	**Could teach others**	
Ability with culture collection (throat, wound, blood, etc.)					**N/A**
Ability to interpret EKGs					**N/A**
Foreign body removal					**N/A**
Technical Skills Overall (performance of procedures)					**N/A**

Comments:

Program Suggestions for improvement:

Preceptor Signature: _____
Date: _____

APPENDIX B

[EXEMPT]
NOTICE OF EXEMPT APPROVAL

DATE: July 29, 2020
TO: [redacted]
FROM: [redacted], IRB Panel
PROTOCOL TITLE: Predictive effects of physician assistant students' pre-admission direct patient contact hours onperformance in subsequent supervised clinical practice experiences.

FUNDING SOURCE: **None**

PROTOCOL NUMBER: 20-1923

The request for an exempt determination for the above-referenced study has been approved. The study was determined to be research thatis exempt from Institutional Review Board (IRB) review under 45 CFR 46.104 Category . The project as described in the application may proceed without further oversight.
Exempting an activity from review does not absolve you from ensuring that the welfare of the subjects participating in the research is protected and that methods used and information provided to gain subject consent are appropriate to the activity. You are reminded thatany changes in your protocol that affects human subjects must be submitted to the IRB to determine if review and approval will be required *before* implementing new procedures.
Please direct any questions about the IRB's actions on this project to the IRB Chair:

Dr. [redacted]

[redacted]

[/EXEMPT] [EXPEDITED]

APPENDIX C

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

July 24, 2020

Gerald Weniger
Leldon Nichols

Re: IRB Application - IRB-FY20-21-37 Predictive Effects of Physician Assistant Students' Pre-admission Direct Patient Contact Hours on Performance in Supervised Clinical Practice Experiences

Dear Gerald Weniger, Leldon Nichols:

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects research. This means you may begin your research with the data safeguarding methods mentioned in your IRB application.

Decision: No Human Subjects Research

Explanation: Your study does not classify as human subjects research because:

(1) it will not involve the collection of identifiable, private information.

Please note that this decision only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued non-human subjects research status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this determination or need assistance in determining whether possible modifications to your protocol would change your application's status, please email us at irb@liberty.edu.

Sincerely,

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office