2024

Advanced Practice Providers in Emergency Medicine

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ADVANCED PRACTICE PROVIDERS IN EMERGENCY MEDICINE

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Bachelor of Science in Health Sciences, University of North Dakota, 2020

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A Scholarly Project

Submitted to the Graduate Faculty of the University of North Dakota in partial fulfillment of the requirements for the degree of Master of Physician Assistant Studies Grand Forks, North Dakota

May 2024

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Acknowledgements

I would like to thank Mindy Staveteig, PA-C for her guidance throughout the process of writing this paper. I would also like to thank the University of North Dakota library resources for their assistance in refining my search criteria and discovering appropriate literature. I would also like to thank the whole University of North Dakota Physician Assistant program for the education and guidance that they provided over the course of this program. Lastly, I would like to thank my classmates, family, and friends for their support throughout my efforts to graduate with my masters in Physician Assistant studies.

Abstract

The emergency department is at the core of healthcare in western medicine. It is commonly the first site of patient contact prior to admission or surgical intervention. Management of admission and discharge from the ED is integral to efficient flow of hospital operation. The critical operation of the ED has long acted as a barrier for the application of advanced practice providers (nurse practitioners and physician assistants) from being heavily utilized in this setting. As healthcare costs, physician shortages, and the acceptance of APPs has increased over time, EDs have increased their utilization of APPs. However, there remains concerns regarding the utilization of APPs in the ED. The purpose of this literature review was to evaluate the performance of APPs, specifically PAs, in the setting of the ED. Relevant recent peer reviewed studies were collected and analyzed for relevancy to the topic. This systemic review finds that utilization of PAs in the ED is a cost-effective decision that results in no significant change to patient outcomes or efficiency metrics when compared to physicians.

Keywords: physician assistant, physician associate, emergency department, emergency medicine, emergency service, hospital, cost, effectiveness, cost effectiveness, patient outcome, patient satisfaction, history, and role.

Introduction

Physician assistants (PAs) are board certified medical clinicians that practice in many countries and in varying fields of medicine. While PAs are considered by many to be an integral part of modern medical care, especially in the United States healthcare system, there remains a level of skepticism around the field. PAs practice under the state board of medicine, however, their level of autonomy varies from state to state. Due to the profession being a relatively new one, many in the general public are uneducated on the care that PAs can provide. While PAs work in many areas of medicine, this review will mainly focus on their utilization in the emergency department. Emergency medicine is the second largest field for PA utilization behind primary care (NCCPA, 2022). The purpose of this review is to analyze peer reviewed published data to gain a comprehensive understanding of the history of PAs, their role in the emergency department, the cost effectiveness of their utilization, and the patient outcomes resulting from their care.

Methods

This comprehensive literature review was conducted by searching PubMed, CINAHL, and Embase. A total of 100 articles were identified. This review includes articles published between 2009 and 2023. Key words used to conduct the search were: physician assistant, physician associate, emergency department, emergency medicine, emergency service, hospital, cost, effectiveness, cost effectiveness, patient outcome, patient satisfaction, history, and role. The databases were searched using an advanced search builder using AND or OR for each research question that was proposed. The available literature was narrowed by analysing available abstracts to determine if each article related specifically to the four proposed research questions. After eliminating unrelated articles, 9 articles were deemed appropriate for this paper.

Literature Review

Historical use of Advanced Practice Providers, APP's

The PA profession has developed into an essential medical field, but it is rarely discussed just how this relatively new medical professional field became what it is today. Hooker et al. (2021) set out to give some insight into the history of the PA profession and how its humble beginnings resulted in PAs being found within the majority of hospitals in the U.S. The career spawned from military veterans with medical experience coming back to civilian life with aspirations in utilizing the medical experience which war provided. Much like today, in the 1960s there were a lack of primary care providers. In an effort to help fill this need, the PA profession was born. Some of the original goals of the profession were to assist medical doctors by seeing patients in the primary care setting. This original goal, while still core to the profession, has been expanded to provide care to patients in 65 distinct areas of medicine (Hooker et al., 2021).

PAs are licensed to practice in all 50 states; however, their level of autonomy is highly dependent on the state in which they practice. Many states do not allow PAs to practice without the oversight of a physician. Medical organizations can also limit the autonomy of PAs by simply not allowing the level of autonomy legally allowed by the state in question. For example, the state in which a PA is practicing might allow PAs to prescribe scheduled medication, but the hospital within that state might have a policy stating that PAs can not prescribe scheduled medication without a physician sign off. All practicing PAs are required to receive a 4 year undergraduate degree, graduate from an accredited PA program, and pass a national standardized board certification exam.

As of 2021, there were 277 accredited PA programs within the United States. The overwhelming majority of these programs are at the masters level and range from 24-36 months in length (Hooker et al., 2021). There are 8 accredited PA doctoral programs according to the

Academy of Doctoral PAs (ADPA, 2023). Programs consist of didactic and clinical phases where students learn both in the classroom and in the clinical setting. About 66% of matriculating students are female with the average age at graduation being 29 years of age. As of 2021, there were 125,000 practicing PAs in the U.S. and the bureau of labor statistics projects there to be support for 169,000 practicing PAs by 2030. PAs are trained as medical generalists. This results in a unique ability for career changes from one specialty to another unrelated specialty. It is reported that more than half of PAs change their specialty at least once over their career. This flexibility acts as a strong draw for those that may want to work in a labor intensive fast paced specialty during their younger years and a more calm flexible specialty as they get older. Moreover, this flexibility results in high career satisfaction and career retention. It is expected that the demand for physician services will continue to exceed supply for the foreseeable future. PAs will help fill the gaps that will be inevitably created. This gap does not just exist in the U.S. and as a result 18 countries now utilize PAs (Hooker et al., 2021).

Physician assistants are relativity new medical professionals. While there are many in the general public that are not sure what exactly a PA does, the profession is becoming well known by other medical professionals. How is it that an entire medical profession went from being an idea to a career that is vital to the U.S. healthcare system? Cawley et al. (2012) set out to explain the beginnings of the PA profession. It is generally known that the PA profession was started with military medics arriving home from the Vietnam war getting trained to help fill the primary care gap that existed in the U.S. This is a great oversimplification of the origins of the PA. Cawley et al. (2012) points out that there was a great increase in the U.S. population throughout the 1940's and 50's. It was at this same time that the medical field was moving from a physician being a generalist to a specialist. With great medical advances and increased medical knowledge, it was

no longer feasible for a physician to be the primary care provider, OB doctor, surgeon, anesthesiologist, infectious disease doctor, etc. Physicians began to specialize in one area of medicine and only perform duties within that area of medicine. Between 1940 and 1949 the number of specialists nearly doubled, whereas the number of generalists dropped by ten thousand. While the American Medical Association (AMA) initially denied that this evolution in medicine would be an issue, it was clear by 1960 that there was a severe lack of generalist physicians available (Cawley et al. 2012).

In an effort to aid in this gap within medicine, Dr. Eugene Stead the chairman of medicine at Duke University, wished to develop a new program to train medical providers to assist physicians with patient care. He wanted these medical providers to be trained in a shorter amount of time than physicians and as generalists in medicine. He first attempted to use nurses to train into this new role; however, the National League of Nursing refused to accredit his endeavor on three separate occasions (Cawley et al. 2012). Through various influences, Stead then realized that military corpsmen could be ideal for this new role. Corpsmen often had extensive medical experience through their time in war and were arriving home to the states in great numbers. As the first PA program began at Duke, the MEDEX, a combination of medicine and extension, began at the University of Washington. The Duke PA program was inaugurated in 1965. The curriculum was based on medical school curriculum, but the time of the program was cut from 4 years to 2 years. The MEDEX began in 1968, and was very similar to the Duke PA program, except it had a specific goal to extend medical care to rural and underserved areas and matriculants were required to have extensive medical experience. In 1971 an amendment to the Washington Medical Practice Act was passed allowing MEDEX graduates to practice medicine under the supervision of a licensed medical physician. This program had success and by 1974 additional programs were

developed in Los Angeles, Alabama, North Dakota, Colorado, Pennsylvania, Utah, South Carolina, and Dartmouth (Cawley et al. 2012).

At this time the American Medical Association (AMA) held considerable influence over medical legislation and both physician and public opinions on all things medicine. The AMA, and other national physician led organizations, were quite accepting of the new PA profession. By 1971, the AMA was heavily involved in accrediting PA programs.

The authors of this paper conclude that the stars had to align for the PA profession to develop and expand the way that it did. There had to be an obvious gap in medicine, an interest in a new profession, well positioned individuals willing to take part in this new career, influential leadership to develop programs, and broad acceptance from physicians for this idea to take off. They also warn that with the PA profession now becoming ever more specialized and a growing primary care need, the healthcare system is poised to repeat history yet again (Cawley et al. 2012).

Role of APP's in the ED

The emergency department is vital to a hospital's reputation, efficiency, and success. In recent decades emergency departments throughout the United States have increased utilization of advanced practice providers, such as physician assistants (PAs) and nurse practitioners (NPs). Carpenter et al. (2022) surveyed 125 academic emergency department chairs and their respected residency program directors in an effort to further understand the current role that advanced practice providers (APP's) play in American academic emergency departments. Methodology of the survey centered around questions involving various aspects of APPs from hiring practices to their perceived impact on education of other medical professionals being trained in their respected ED's. The survey was designed in two parts. The first part was sent to members of the Association of Academic Chairs of Emergency Medicine (AACEM). AACEM-member chairs were then asked

to provide contact information for their residency program director. Residency program directors were then sent the second part of the survey and asked to complete and return the data. Ninety one of 125 AACEM-member chairs responded to the initial survey, and 75 of them provided contact information for the residency program directors of their respected institutions. A total of 59 residency program directors responded. The data within this paper was compiled from these 59 complete sets of surveys and further analyzed using Microsoft excel. It was found that 98% of responding departments utilized APP's in their ED's. 86% reported APP's working in fast track settings, 80% reported APP's work in the main ED, and 54% reported APP's work in the waiting room. APP's were found to evaluate low acuity patients more often than high acuity patients, 38% vs 97% (Carpenter et al. 2022). These results highlight the classical role of APP's well as they are intended to assist in patient care by decreasing the patient load of physicians and allowing physicians to provide care for patients that need a higher level of care. 44% of reporting chairs reported a gradual increase in individual APP's scope as they gain experience and additional training. This speaks to the ability that APP's can further assist in patient care as they become increasingly experienced in a given field as their careers may progress. Program directors were asked what impact APP's had on medical student and resident training in their facilities. They found that 24% reported the presence of APP's negatively impacted medical student training and 30% stated felt it negatively impacted resident training (Carpenter et al. 2022).

The authors do not assess why some faculty feel this way and why others do not. This may be personal perception with or without any examples or data to support their statements or personal bias in the reported answers to survey questions. Seventy five percent of responding program directors felt it was important for residents to gain experience working with APP's. Two thirds of

chairs reported that APP's contribute positively to the quality of patient care (Carpenter et al. 2022).

While this study provides some insight into how APP's are utilized in an academic ED setting and how member chairs and program directors feel they may fit into those settings, it is not able to extrapolate its findings to non-academic EDs. This study does not address the potential variability between academic and non-academic EDs and the potential variation in their utilization of APP's. Moreover, surveying program directors and member chairs may miss vital information that APP's and physicians working on the floor may be able to provide. The authors are unable to ensure a lack of bias from respondence as the surveys were anonymous and mostly completed by physicians. The authors rarely separated PA's from NP's. While both professions are considered APP's and have similar roles in many situations, they have vastly different training and are governed by separate state boards and laws. This makes it difficult to separate the roles of NP's from PA's and how the surveyed felt about the two professions. Carpenter and his colleagues concluded that APP's play a vital role in the academic ED's that were surveyed (Carpenter et al. 2022).

It is well known that the emergency departments are staffed by various skilled medical professionals, including NPs and PAs. Although NPs and PAs are utilized widely within the ED setting, their scope of practice is not well standardized. In an effort to understand current staffing models and guide future ED training for these professions, Philips et al. (2018) surveyed members of the American College of Emergency Physicians Council (ACEP). A survey was designed using qualitative methods. This nine question initial survey was given to ACEP council meeting and a second 26 question survey was given after the annual two-day council meeting was complete. Of the 364 councilors 331 completed the first survey and 208 of 371 completed the second survey.

163 respondents reported utilizing APPs in their respected EDs; 72.4% utilized both NPs and PAs, 17.2% reported using only PAs, and 10.4% reported using only NPs. Thirty percent of respondent EDs stated that their departments have APPs see emergency severity index (ESI) level 1 patients and 90% reported APPs seeing ESI levels 3-5. ESI scoring goes from 1, the most critical patient, to 5, a less urgent patient who should receive care within 30 minutes time. The survey reports varied with the level of supervision required for ESI patients from some EDs requiring physician involvement with every patient to others that do not require any physician involvement. The survey also provided information on the number of resources that APPs use. It was reported that APPs with less experience use slightly more resources than those with greater experience. It was also reported that NPs use a greater number of resources than PAs at all experience levels (Philips et al. 2018). For the purpose of this survey, resources included labs, imaging, and consultations. A separate section of the survey was allotted for council members that have worked with both PAs and NPs in the ED setting. Interestingly, data from this section reports that 41% of the 95 respondents felt that an emergency medicine fellowship should be necessary for NP new graduates. The corresponding question for PA new graduates reported 36.8% felt the same (Philips et al. 2018).

Philips et al. (2018) discussed the variation between EDs and how they utilize APPs. They state that this variation is likely due to location, if the ED rural or urban, as well as state laws and corporate policy. In about half of states, NPs are allowed to practice independent of physician oversite, however, the same can not be said for PAs. Most states require PAs to practice under the supervision of physicians. It is also stated that an increased utilization of APPs in the ED is partially explained by the general lack of ED physicians and hospitals attempting to lower costs by utilizing APPs in place of physicians. The paper does express an explanation of why PAs are more

commonly utilized in the ED despite their general lack of autonomy. The authors feel that this hiring discrepancy can be explained by the data collected by the study. Since PAs use less resources and are generally considered less in need of additional training, PAs are, therefore, seen as a superior provider compared to NPs in the ED setting. The authors also provide possible explanations for why this discrepancy between the two professions is seen. Firstly, it could be that NPs and PAs provide care to a slightly different patient population. This could explain some of the differences seen by the data. Secondly, and more likely according to the authors, the variation is likely due to NPs and PAs seeking different levels of autonomy (Philips et al. 2018). If NPs generally prefer to work without any physician assistance, it is possible they could use more resources and appear to be less capable. If PAs work closely with physicians and ask for assistance when needed, they might use less resources and appear more competent in their scope of practice. Since the surveys within this study did not expand on these possible explanations, it can not be said if these are concrete reasons for the discrepancies stated. Limitations of this study are found in the subjective nature of its construction. A survey does not provide objective data on the skills, effectiveness, or variation between NPs and PAs. Although the sample population consisted of a varied group of physicians from across the U.S., the data collected can not be extrapolated to all EDs within the U.S. (Philips et al. 2018).

Cost effectiveness of ED's utilizing APP's

One of the major factors to consider when discussing the role of a PA is the cost effectiveness of the care provided. Both the cost to the hospital system and the cost that patients might absorb are major points of focus. Due to the closed nature of hospital system finances, data was not able to be obtained regarding the cost of employment of a PA within a hospital setting. However, patient cost has been extensively reviewed in regards to many different hospital units

that a PA might work. Brink et al. (2021) published a review comparing the cost effectiveness of PAs compared to physicians. Public databases were searched for relevant articles without limiting publication dates. Articles used have publication dates ranging from 1977 to 2021. Articles were excluded if they discussed NPs and PAs synonymously, PAs were still in training, or data originated from a teaching institution. Prospective articles were screened for quality with the *Risk of Bias in Non-Randomised Studies-of Interventions* (ROBIN-I) tool. A total of 42 articles were used after excluding articles based on bias, relevance, and availability of the full report. These 42 articles were based on 39 separate studies. Ten of these studies occurred in ED/acute care settings, 8 studies were in veteran affairs settings, and the remainder was within various hospital settings. Thirty-five of these studies scored a low risk for bias, however, 3 studies scored a serious risk, and one study scored a critical risk of bias. Twenty-nine studies measured the cost of care. Seventeen studies reported a decrease in cost of care with the utilization of a PA, whether that utilization be independent patient care or co-care with a PA and physician team. One study found that the cost of care with a PA was slightly more than that of a physician alone. Two of the studies showed that there was about a 4 hour increase in length of stay with the utilization of a PA compared to an MD, however, the cost of care was still lower than when compared to physician care alone. Three studies analyzed if PAs would negate their lower cost of employment by ordering more diagnostic tests or otherwise using more hospital resources when caring for patients. The result of these studies showed that PAs do not use greater hospital resources, but rather use less resources than their physician counterparts (Brink et al. 2021). Five studies analyzed the use of a PA in assisting with a physician's patient load. These studies showed a decrease in patient wait times and in time spent per patient. These 5 studies did not include any analysis on the cost effectiveness of the PA employment that they were analyzing (Brink et al. 2021).

None of the studies used the gold standard of research such as randomized controlled trials or double blind placebo trials as they are not applicable to the topics at hand. This being said, the majority of studies were well executed and contained valuable information that can be applied to various areas of medicine. Many of these studies contained information that was not discussed in this section as it did not apply to the cost effectiveness of PA employment. The authors of this review did not discuss in detail the areas that PA employment decreased healthcare cost. Without complete transparency from hospital systems it is unlikely that researchers would be able to analyze exactly how PA utilization results in decreased patient care costs. Hospital costs that both PAs and physicians contribute to include but are not limited to, employment cost, prescription costs, length of stay, time spent with patients, consults, diagnostic tests ordered, referrals made, and materials used. As discussed in other sections of this paper, it has been shown that PAs do not vary from physicians in many of these categories other than compensation. It is likely that the utilization of PAs decreases patient, and therefore hospital costs mostly due to their decreased cost of employment (Brink et al. 2021).

This study was thorough as it assessed PAs in 5 different countries and involved various specialty areas over many decades of data. The study did not, to any meaningful extent, address multiple factors that could affect the cost of PA employment on patients or hospitals. These factors may include but are not limited to previous experience of a PA hired, length of onboarding or training, and organizational change that may be required to utilize PAs. Another issue that was not addressed in a meaningful way was the variation in PA scope of practice. The question of "does a PA with a greater scope of practice affect the cost effectiveness of that PA when compared to one with a lesser scope within the same clinical field?" This is a major question that could guide the future of the career field. It is logical that if a PA with greater scope of practice is more cost

efficient, then states and hospital systems would utilize PAs to their greatest potential. The opposite is also true. If a PA with a greater scope is less cost effective, then expanding the scope of practice for the profession is less likely to be implemented into clinical practice. Another limitation, for the purpose of this paper, Brink et al. (2021) did not separate data regarding specialty. This makes it difficult to determine differences in cost effectiveness between specialties. However, the paper does conclude that PAs are a cost-effective addition to all departments discussed, this includes the ED (Brink et al. 2021).

As the ED physician disparity continues to increase, many EDs are opting to utilize PAs and NPs to provide patient care to counteract the steadily increasing operation costs that have been seen within the ED. Limited research has been done analyzing the efficiency of APPs within the ED. Mafi et al. (2022) analyzed data from the National Hospital Ambulatory Medical Care Survey (NHAMCS) to compare various aspects of patient care in the ED setting between APPs alone, APPs in combination with physicians, and physicians alone. A cross sectional analysis of NHAMCS data on patients 18 years or older from January 1st, 2009 to December 31st, 2017 was used. In total this data represented 177,657 ED visits. The authors used primary outcome metrics to compare groups. These metrics included diagnostic tests used, medications given or prescribed, and length of time per visit. In an effort to control for provider selection bias, the authors used an inverse probability propensity score which utilized patient data including age, sex, nurse rated acuity triage score, primary diagnosis category, chronic comorbidities, insurance type, U.S. region, and year. Weighted multivariable logistic and linear regression models were then used to compare NPs/PAs to physicians. Significance threshold of $p<0.01$ was used for all data. The authors split the patient interactions into three groups; patients were seen by a NP/PA alone, patients were seen by a combination of physician and NP/PA, and patients were only seen by a physician. 12,410

patients were in the NP/PA only group, 21,560 were in the combination group, and 143,687 were in the physician only group. The mean ages of each group's patients were 41 (NP/PA only), 45 (NP or PA), and 47 (physician only) respectively. There was also an increasing prevalence of comorbidities as well with 1.5% (NP/PA only), 3.5% (NP or PA), and 4.1% (physician only) of patients presenting with a chronic comorbid condition for each group. The mean triage acuity scores were 3.03 (NP/PA only), 2.85 (NP or PA), and 2.67 (physician only). These results are what was expected as physicians tend to care for patients presenting with more complex/urgent issues than those patients being seen by a NP/PA. It was found that the NP/PA alone interactions used less medication, diagnostic tests, hospitalizations, procedures, and CT/MRI studies than the physician alone group (Mafi et al. 2022). This was in contrast to the NP/PA physician combined group which used more of the above stated resources than the physician alone group. These results still hold true when controlling for acuity scores and comorbid conditions. Nearly half, 49.7% of all patients seen by a NP/PA involved a consult by a physician with both lower and higher triage scores. The authors concluded that, broadly speaking, NP/PAs were more efficient with less complex patients than physicians and less efficient with more complex patients (Mafi et al. 2022).

The authors also admit to many limitations to their study. Firstly, they were not able to eliminate selection bias as patients are not randomly assigned to a provider. This means that patient selection data within a given ED compared to between separate EDs. Secondly, it can not be determined when physicians first saw a patient and then passed on care to a NP/PA from interactions where a patient first saw a NP/PA and then a physician consult was made. Thirdly, they were not able to determine the validity of the data used, as it was from the NHAMCS and there was no way to know how often data was misclassified. Lastly, the authors did not have access

to down-stream patient outcomes. This limits the ability to determine the true quality of patient care provided (Mafi et al. 2022).

Patient outcomes when seen in the ED by an APP

McKinley et al. (2023) analyzed 5,585 low acuity pediatric patients to determine the clinical significance in length of stay (LOS) for patients treated by PA's compared to those treated by pediatricians. While by no means an absolute measure of efficiency of a medical provider, length of stay is a metric that can be used to determine the efficiency of patient care, along with many other considerations. Length of stay may be particularly important in the ED due to time generally being of more value to providers as well as the ED commonly being the first place patient care is initiated within the hospital. Longer length of stay can lead to dissatisfied patients that may be more hesitant to seek medical care in the future. This study took place within a single large academic pediatric ED and involved patients with a emergency severity index (ESI) triage level of 4 or 5. This study took place within the fast track portion of the ED where low acuity patients present. The fast track ED is staffed with pediatricians, PA's and NP's. The PAs that work in this unit were required to have a minimum of one year pediatric experience prior to hiring. Patients were seen in order of arrival by the next available clinician. Data was collected via electronic medical records from a pool of almost 2.5 years of patient encounters. The data selected had to be from a shift where the ED was staffed with a PA and pediatrician. Data where the patient was admitted to the hospital or left without treatment was withdrawn from analysis. LOS was defined as the time between patient check in and patient discharge. Any LOS above the 99th percentile was excluded. A paired t-test was used to compare the statistical significance in LOS between pediatricians and PAs. A total of 276 shifts were analyzed involving 15 different PAs and 22 different pediatricians providing care for 5,585 patients, 5,460 were included in analysis. PAs

cared for 2,597 patients whereas pediatricians cared for 2,863 patients. It was found that the average PA spent about 10 minutes longer with patients (160.1 minutes) than pediatricians (150 minutes). This was determined to be statistically significant, but not clinically significant by the authors of the study (McKinley et al. 2023). Interestingly, PAs used antibiotics in 12.9% of patient encounters compared to 16.3% of pediatrician led encounters. The 7-day return rate of patients for both groups was 4.4%. Some possible reasons for the different average length of stay between the two groups may have been a difference in average experience, difference in level of history taken, or variation in the chief complaint of the patients chosen by their respected provider. It is also of note that 75.5% of PA led cases were ESI level 4 whereas 74.1% of pediatrician cases were ESI level 4 (McKinley et al. 2023).

Limitations of this paper include the difficulty to extrapolate this data out of the context in which it was derived. It may not be relevant to non-academic ED settings in which not all cases are low acuity children. It is also unclear why the authors chose length of stay to include patient waiting time rather than just including face to face patient-clinician time. When discussing the efficiency of a clinician it seems important to only include the time the clinician has with the patient. A clinician can not control the time a patient spends in the waiting room or how many patients arrive at a given time. This study also did not discuss cost-effectiveness of a ED employing a PA compared to a pediatrician. While many other factors such as number of rooms to see patients and nursing staff working with a clinician may factor into cost a department must bear; the cost of employing a PA is less than that of a pediatrician. The authors mentioned how patient selection is not tightly regulated. For this reason, it is possible that PAs or pediatricians may select patients based on chief complaint, level of acuity, age, language, or other factors which may play a role in explaining the LOS difference between the two groups. While this paper has its limitations, it helps

to provide insight into the effectiveness that PA's have in regard to patient outcomes and cost effectiveness within the ED setting (McKinley et al., 2023).

The ED is largely considered the bottle neck of the hospital. There is a large concern that patients may have to wait extended periods of time before they are seen by a clinician. This results in many patients leaving the ED before they are seen. The concern when a patient leaves the ED without being seen is that their medical complaint is not properly treated and may result in a more serious medical situation down the line. Ducharme et al. (2009) compared the wait times of patients, before and after the addition of NPs/PAs, in 6 Ontario EDs. The authors stated that between 2003 and 2004 in Ontario EDs 3.1% of patients left the ED without being seen. The authors analyzed health records data pertaining to patient care and flow to determine the impact that the addition of APPs had to patient wait times. Data was collected from two separate time intervals, Nov 13th 2006 – Dec 3rd 2006 (before the addition of APPs) and June 11th 2007 - June 29th 2007 (after the addition of APPs). Logistic regression analysis using SPSS was done on the collected data. This resulted in 9,585 visits that were within the first time period and 10,007 visits that were during the second time period. PAs were on duty during 1,076 patient interactions and NPs were on duty for 1,744 patient interactions. Results of the data showed that a patient was 1.6 times more likely to be seen within the benchmark time when that patient was seen by a PA. That number increased to 2.1 times more likely when being seen by a NP. When a patient was not seen by either a NP or PA, but a NP or PA was working at the time, the odds of a patient being assessed within the benchmark time increased to 1.9 times more likely when a PA was on duty and 1.5 times more likely when a NP was on duty (Ducharme et al. 2009). When a PA was involved with patient care the overall patient length (LOS) of stay decreased by 30.3% (262.4 min to 182.9 min). When an NP was involved in patient care the overall LOS decreased by 48.8% (356.3 min to 131.1

min). When there was a PA on duty but not directly involved in patient care, the average LOS decreased from 304.2 min to 277.2 min and from 257.7 min to 233.8 min when an NP was on duty. Without controlling for patient acuity, the odds that a patient left without being seen also decreased. A patient was 24.6% less likely to leave without being seen when a PA was on duty and 17.6% less likely with a NP on duty. When controlling for patient acuity, the data became more significant with patients being 44% less likely to leave without being seen when a PA was on duty and 29% less likely with a NP on duty (Ducharme et al. 2009).

The authors conclude that the addition of APPs within the ED improves flow and decreases patient wait times and LOS. They extrapolate by assuming that this would also increase patient satisfaction and decrease possible complications of patients that would have left without being seen if it was not for the addition of APPs to the ED (Ducharme et al. 2009). They also make comments regarding the possible impacts the addition of APPs to the ED might have on other units of the hospital. One example of this impact could be additional providers in the ED ordering diagnostic tests, this could potentially overwhelm the lab and radiology staff. They state that further studies will have to be done in order to make that determination. The authors also admit that their study does not answer if patient care is affected with the addition of APPs to the ED. They state that this was out of the scope of their paper and will need to be analyzed in the future. This article is also limited in its ability to extrapolate the results to other institutions. The data was from 6 medium sized hospitals within one area of Canada. It is unknown if their conclusions would hold true in hospitals of other sizes located in other countries. While relatively limited in nature, Ducharme et al. (2009) provides compelling data on the improved flow that EDs can achieve with the addition of a single APP per shift (Ducharme et al 2009).

It is well established that there is a lack of healthcare availability within rural communities of the U.S. Rural communities have higher mortality rates of cancer, heart disease, stroke, injury, mental illness, and chronic respiratory disease when compared to urban communities. This is likely due to a combination of various factors. Two likely major factors include decreased access to healthcare and lack of clinician access. Many physicians may not wish to live in rural areas due to the lack of desirable activities or opportunities. This is were PAs have been known to provide care when other clinicians may not. With about 8 rural hospitals in the U.S. closing each year, the access to healthcare for those living in rural America is becoming less and less. It is becoming more common for rural emergency departments to be staffed with PAs, often one clinician working at a given time. This brings to question if a solo PA is capable of providing the same level of care as a physician. Moore (2021) studied his local critical access hospitals ED in hopes of gaining insight into the quality of care PAs were providing. He notes how each year 10 million patients are managed in the ED by PAs alone. This fact is important when posing the question if that care is the same quality as it would be if provided by a physician. This becomes even more significant when considering that rural ED PAs commonly manage serious medical interventions such as heart attacks, strokes, labor, and trauma. They are also more likely than their urban counterparts to perform complex medical interventions such as chest tube insertion, ETT insertion, point of care ultrasound, and central venous access line placement (Moore 2021).

Moore (2021) conducted a retrospective observational study on a critical access hospital in rural Arizona. The location of this ED was in a small town of 7,000 residents, however, there was a heavy tourism industry that consists of 3 million visitors annually. The study took place from April 1st, 2016, to December 8th, 2018, and consisted of patient care provided by 12 PAs and 9 physicians, 4 of which were board certified in emergency medicine. Patient satisfaction metrics

were conducted by survey and by InMoment, Inc. statistical analysis was done using t-tests, person correlation coefficient, and Wilcoxon sign tests as appropriate with a p value of < 0.05 (Moore 2021).

The study consisted of 25,883 patient interactions with 15,205 were patients managed by a PA and 10,678 were patient managed by physicians. The average age of a patient managed by a physician was 36.4 years old compared to 34.4 years old for a patient managed by a PA. The mean length of stay (LOS) of patients seen by a PA was 126 minutes and the average for physicians was 120 minutes. The mean time from when a patient checked into the ED to when they were seen was 16.2 minutes for the PA group and 11.4 minutes for the physician group. PAs averaged seeing 1.2 patients per hour and physicians averaged seeing 0.9 patients per hour (Moore 2021). All the above metrics are measures of a clinician's efficiency. The following metrics are measures of a clinician's effectiveness in treating patients. The 72-hour return rate for patients in the PA group was 5.9% and 5.3% for the physician group. The percentage of patients admitted for the PA group was 4.6% and 5.1% for the physician group. Both groups had a transfer rate of 4.7% and a mortality rate of 0.1%. The emergency service index (ESI) was used to determine each patient's need for urgent medical attention. The average ESI for the PA group was 3.3 and 3.2 for the physician group. Patients were surveyed on their satisfaction of the care they received and ranked the care on a 1-10 scale. The average patient satisfaction for the PA group was 9.3 and 9.0 for the physician group (Moore 2021).

With the stated data, Moore (2021) stated that he was unable to find a statistically significant difference in the effectiveness nor the efficiency between PAs and physicians working in the ED. He concludes that PAs patient outcomes and efficiency is similar to that of a physician when working in a rural ED. He does list some limitations to his findings. Firstly, the PAs within

this study averaged 15 years of clinical experience. He does not state if that experience was all after becoming a PA or if that figure included clinical experience prior to becoming a PA. Secondly, he states that 4 of the 9 physicians in the study were board certified ED physicians, the other 5 were certified in other specialties. He states that "physician specialization did not affect the metrics analyzed in this study compared with PAs" Moore (2021). It is not clear what is meant by this statement. Thirdly, this study was a pilot study done with data from one single ED. It is not clear if this data would be similar across rural EDs nationally (Moore 2021).

Discussion

As the U.S. population ages there will be a greater demand for medical care and therefore a greater need for medical providers. Since many of the physicians of the baby boomer generation are or will be retiring in the near future, there is an increasing need for medical providers. The physician assistant field was developed, in part, to help fill the need for medical providers that developed in the 20th century. There is a debate regarding the utilization of PA's to help fill the need for providers. This paper discussed many of the major areas of contention, including cost effectiveness, the role of a PA, and quality of care provided to patients. While there is limited data independently researching PA's in these areas, the available data points towards the conclusion that PAs are a safe and cost effective way to provide care to patients in many fields.

Since PA's are trained as generalists, they are trained with the ability to adapt to roles in various medical professions. Emergency departments are one of the busiest departments within a hospital and are commonly referred to as the bottleneck of the hospital. It was discussed that many hospitals utilize PA's within fast track systems in the ED. PA's manage lower acuity patients with less likelihood of being admitted in order to free up time for physicians to manage more complex patients (Carpenter et al. 2021) (McKinley et al. 2023). Little data has been published regarding

ED utilization of PA's managing high acuity patients. Research in this area needs to be conducted to determine the quality of care and patient outcomes for PA's caring for high acuity patients within the ED. Multiple papers within this review compared length of stay (LOS) between either PA's and physicians or APPs and physicians. It was generally found that patients being cared for mainly by a PA or APP had a slightly increased LOS (McKinley et al. 2023), however when PAs were involved in patient care that was mainly provided by a physician, LOS significantly decreased (Ducharme et al. 2009). While both Ducharme and McKinley wrote compelling papers that accurately assessed the LOS of patients in their given setting, Ducharme et al. (2009) analyzed patients of all acuity levels in 6 different hospitals both before and after the addition of APPs to the ED. This gives a broader understanding of the impact that APPs have on LOS within the ED setting. While LOS can not directly determine patient outcome, quality of care, or patient satisfaction, it does play a role in all those areas. The efficiency of an ED is important when determining various metrics. From the available data, it seems to determine that the utilization of PAs in the ED increases the efficiency of the department as a whole.

Due to the lack of hospital system data on ED spending, it was very difficult to quantify the cost effectiveness of PA utilization within the ED. It is well known that PAs have lower salaries than physicians, however, many states require physician oversite of PAs. There was no data available analyzing the cost effectiveness of employing a PA that required physician oversite compared to the cost of employing a physician alone. The available research on the cost effectiveness of PA utilization in the ED centered around LOS and resource utilization. As stated earlier, patient LOS is comparable between physicians and PAs. It was also determined that resource utilization is comparable or even less for PA's when compared to physicians (Mafi et al. 2022) (Brink et al. 2021). Both studies were incredibly strong for different reasons. Brink et al.

(2021) was a review that compiled data from many studies to further analyze the cost effectiveness of PAs in various hospital settings. Mafi et al. (2022) conducted a cross sectional analysis of 177,657 ED visits over an 8-year period in order to get a better understanding of the cost effectiveness of PA utilization in the ED. Both studies concluded that PA efficiency is comparable to that of a physician. However, neither study analyzed the correlation of efficiency and years of experience. It is unknown based on this data if a PA with little experience is comparable to a physician of little experience for example. It is only able to be concluded that broadly speaking PAs and physicians are comparable in their cost effectiveness when providing patient care. If a PA spends about the same amount of time with a patient and orders the same amount of diagnostic tests or medication when compared to a physician, it can be assumed that salary for that provider would be the other major healthcare cost involved in that patient interaction. Since PA's are paid less than physicians, it would appear their utilization is very cost effective within the ED. No paper was reviewed that discussed insurance compensation when care is provided by a PA versus a physician. If insurance compensation did vary based on who was providing care to that patient, then cost effectiveness might change. However, no such determination was made by this review.

While the data is limited and further research needs to be done to fully understand the benefits or downfalls for PA utilization in the ED, it appears that PAs are a safe and cost-effective way to provide high quality care to patients in the ED. PA's could help fill roles for providers that will be needed as healthcare costs and needs increase in the coming decades. While the PA profession was originally intended to assist in the need for primary care providers, mainly in rural areas, the field has grown to assist physicians and patients in all areas of medicine (Hooker et al. 2021). Despite Hooker et al. (2021) stating that the PA field is getting further from its original goals to assist physicians in the primary care setting of underserved communities, Carpenter et al.

(2021) and Philips et al. (2018) showed the lasting adaptability of the field. Carpenter and Philips showed how there is no standardized way to utilize a PA, rather each department can make its own decision regarding how best to utilize PAs. Since there are no standardized federal laws regarding autonomy or prescription rights, each employer of PAs may utilize them in varying ways or to varying degrees. The goal of PAs remains to assist in the care of patients, just as it always has been.

Conclusion

It can be concluded from the evidence in this review that Physician Assistants are safe, effective, and economical clinicians in the emergency department setting. The PA field has grown from its original goal to provide care to underserved areas, specifically in the area of primary care. With this expansion to other fields, emergency medicine has become one of the main areas that PAs are utilized. The evidence shows that ED PAs use a similar amount of resources compared to their physician counterparts with similar patient LOS and return rates (McKinley et al., 2023) (Ducharme et al 2009) (Moore 2021) (Brink et al. 2021) (Mafi et al. 2022). With healthcare costs increasing and the U.S. population aging, it is likely that the utilization of PAs in the ED will continue to increase in the coming decades.

There are many concerns that remain in the realm of PA utilization. Firstly, there is no standardized level of autonomy for PAs. This could be for many possible reasons. In general, states that have a greater need for medical providers legislate greater autonomy for PAs. As provider needs increase, it is likely that states that currently grant lower levels of autonomy to PAs will legislate greater levels of autonomy in the future. This does not solve the variation in autonomy from state to state. While federal legislation on PA autonomy might simplify this problem, it does not guarantee a solution as every state does have varying needs for medical providers. Secondly,

there is a disconnect between the general public's understanding of what a PA is compared to the medical community's understanding of the PA field. Public awareness and education is crucial to the ensuring the public's trust in the profession. Thirdly, there remains limited quality research on PA utilization in the ED. Much of the research focuses on fast-track settings as they are a major way that PAs are utilized in the ED. However, more research needs to be conducted on high acuity patients being cared for by PAs to gain a greater understanding on the safety of PA utilization for this patient population. Another gap in current research is the cost to a hospital that requires a greater level of physician oversite compared to one that does not. This is an important metric to gaining a more comprehensive understanding of the true cost-effectivness of PA utilization. As the field continues to grow, more research will be conducted to answer these important questions.

Application to Clinical Practice:

This review can be used by hospital administrators, law makers, physicians, and PAs to help gain insight into PA utilization in the ED specifically. EDs commonly struggle with provider burnout, long patient wait times, and over utilization of resources; adding PAs to a ED that does not utilize them may help with some of these concerns. Increased PA utilization will help with rising healthcare costs, increased healthcare need, and the expanding provider shortage that is likely to become a growing concern in the coming decades.

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