

The Israeli Physician Assistant in a Tertiary Medical Center Emergency Department

Ilan Merdler MD MHA^{1*}, Aviram Hochstadt^{1*}, Amichai Sheffy MD², Sharon Ohayon MD MHA³, Itamar Loewenstein MD³ and Daniel Trotzky MD²

Departments of ¹Cardiology, ²Emergency Medicine, and ³Internal Medicine, Tel Aviv Sourasky Medical Center, Tel Aviv, affiliated with Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

ABSTRACT

Background: Emergency department (ED) overcrowding is associated with worse patient outcomes.

Objectives: To determine whether physician assistants (PAs), fairly recently integrated into the Israeli healthcare system, improve patient outcomes and ED timings.

Methods: We compared patients seen by physicians with patients seen by PAs and then by physicians between January and December 2018 using propensity matching. Patients were matched for age, gender, triage level, and decision to hospitalize. Primary endpoints included patient mortality, re-admittance, and leaving on own accord rates. Secondary endpoints were ED timing landmarks.

Results: Patients first seen by PAs were less likely to leave on their own accord (MD1 1.5%, PA 1.0%, $P = 0.015$), had lower rates of readmission within 48 hours (MD1 2.1%, PA 1.5%, $P = 0.028$), and were quicker to be seen, to have medications prescribed, and to undergo imaging without differences in timings until decisions were made or total length of stay. Patients seen by a physician with the assistance of a PA were attended to quicker (MD2 47.79 minutes, range 27.70–78.82 vs. MD + PA 30.59 minutes, range 15.77–54.85; $P < 0.001$) without statistically significant differences in primary outcomes. Mortality rates were similar for all comparisons.

Conclusions: Patients first seen by PAs had lower rates of re-admittance or leaving on their own accord and enjoyed shorter waiting times. Pending proper integration into healthcare teams, PAs can further improve outcomes in EDs and patient satisfaction.

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*The first and second authors contributed equally to this study

The average number of doctors in the Israeli population is 3.3 per 1000 persons [1], a ratio likely to increase in the future due to technological advancements in medical care and the ageing population [2]. Hence, in the future a severe physician shortage is expected with increased hospital crowding, which will be correlated with longer waiting times, reduced safety, and delayed care for patients [3,4]. This situation is especially true for emergency departments (ED), the front line of hospital care in Israel and perhaps where increasing patient numbers and low physician availability are most apparent.

Several other countries with similar struggles, namely the United States, Canada, Great Britain, and the Netherlands, have established a physician assistant (PA) practice to reinforce healthcare teams and relieve physicians of varying responsibilities, as defined by local regulations and institutional practices. In the United States, the introduction of PAs revolutionized health workforce policy [5] and there are currently over 100,000 licensed PAs [6].

In Israel, the practice of PAs has been approved by the Ministry of Health since 2013, requiring academic paramedic training and 1 year of practical experience in clinical rotations. Israeli PAs work under direct supervision of a physician with responsibilities ranging from focused history-taking, physical examination, and patient presentation to monitoring patients and assisting in urgent procedures. Unlike physicians or PAs in other countries, Israeli PAs are not certified to discharge or admit ED patients, prescribe medications, or perform surgical procedures [7-9].

Although PAs were introduced in the United States several decades ago, in most countries the integration of PAs into healthcare services is still rapidly developing. Most studies evaluating their contribution, including two controlled studies [10,11] have shown that incorporating PAs into the medical system is safe, does not impair patient care [12,13], potentially reduces physician workload [14], and patient waiting times. In addition, PAs are well accepted by patients and medical staff [15-17].

Research regarding PAs contribution in EDs is relatively scarce. Relatively few studies have been conducted, with mixed quality and significant limitations, and most include a non-interventional, non-controlled design. Furthermore, most studies have been conducted in the United States, where PAs are gen-

erally more experienced [18]. Hence, our study evaluated the effect of recently integrated PAs on ED outcomes and on ED timing benchmarks. We hypothesized that the incorporation of PAs into ED healthcare teams would improve ED productivity and shorten ED waiting times without impairing outcomes.

PATIENTS AND METHODS

STUDY POPULATION AND DEFINITIONS

Electronic medical records of all patients arriving to the Tel Aviv Medical Center adult ED from January 2018 to December 2018 were analyzed retrospectively. Patients under the age of 18 and over the age of 108 years were excluded. Ambulatory cases without defined diagnosis at discharge and cases in non-relevant ED branches (e.g., obstetrics-gynecology, ophthalmology) were excluded. All patients treated in the internal medicine or surgical wings of the adult ED between 8:00 and 16:00 (the PAs main working hours) were included. Data regarding the Canadian triage and acuity scale (CTAS) [19] and times until specific ED benchmarks (admission, discharge, earliest treatment directive) were collected from the electronic medical records. The study protocol was approved by the local institutional ethics committee according to the 1964 Declaration of Helsinki.

We conducted two separate comparisons. In the first we compared outcomes for patients first seen by a physician (MD1 group) with patients first seen solely by a PA (PA group). In the second comparison, outcomes for patients first seen by an MD (MD2 group) were compared with patients first seen by an MD with assistance in patient management from a PA (MD + PA group). We referred to mortality as in-ED mortality.

STATISTICAL ANALYSIS

Nominal variables were compared using a chi-square test and

are presented as n (%), continuous variables were compared using a welsh t-test except for variable representing time which were highly skewed and were compared using a Mann-Whitney U test. Continuous variables are presented as mean ± SD or median [IQR] as appropriate. As the three groups differed on their baseline characteristics, both comparisons were redone using propensity score nearest neighbor matching in a 2:1 ratio. Propensity scores were based on patient baseline characteristics. Results were considered significant when $P < 0.05$. All analyses were conducted using R version 3.6.1, R Foundation for Statistical Computing, Vienna, Austria.

To minimize the effect of significantly different patient numbers in the different study groups and potential confounders in this study, we used propensity-score matching (2:1). A propensity score was calculated with the aid of multivariable logistic regression analysis, which included the following variables: age, gender, triage level, decision to hospitalize (primary hospitalization in ED), and final decision to hospitalize (final hospitalization in other hospital departments).

RESULTS

During the study period, 250,081 patients were admitted to the Tel Aviv Sourasky Medical Center ED. After exclusion of patients according to the above criteria, 58,772 patients met inclusion criteria, with 34,704 patients (59.05%) admitted to the internal medicine wing in the ED. Propensity-matching by 2:1 ratio identified 7996 patients in the MD1 group and 3998 patients in the PA group in the first study arm and 3434 patients in the MD2 group matched with 1717 patients in the MD + PA group in the second study arm.

Baseline characteristics for unmatched groups are illustrated in **Table 1**: Differences at baseline are notable for higher male prevalence (MD1 51.6% vs. PA 49.9%, $P = 0.035$) and younger age

Table 1. Baseline characteristics for both study arms

Unmatched baseline characteristics							
First study arm (MD vs. PA)				Second study arm (MD vs. MD+PA)			
	MD only (n=52,778)	PA only (n=3998)	P value		MD only (n=53,010)	MD+PA (n=1737)	P value
Male (%)	27,240 (51.6)	1994 (49.9)	0.035	Male (%)	27,353 (51.6)	922 (53.1)	0.234
Internal (%)	31,229 (59.2)	2441 (61.1)	0.02	Internal (%)	31,297 (59.0)	966 (55.6)	0.005
Age (mean ± SD)	60.25 ± 21.84	62.93 ± 21.75	< 0.001	Age (mean ± SD)	60.24 ± 21.83	61.79 ± 21.96	0.004
Triage level 1 (%)	678 (1.3)	20 (0.5)	< 0.001	Triage level 1 (%)	681 (1.3)	31 (1.8)	0.089
Triage level 2 (%)	2367 (4.5)	190 (4.8)	0.455	Triage level 2 (%)	2371 (4.5)	104 (6.0)	0.003
Triage level 3 (%)	17,361 (32.9)	1446 (36.2)	< 0.001	Triage level 3 (%)	17,467 (33.0)	668 (38.5)	< 0.001
Triage level 4 (%)	30,996 (58.7)	2261 (56.6)	0.007	Triage level 4 (%)	31,107 (58.7)	902 (51.9)	< 0.001
Triage level 5 (%)	1376 (2.6)	81 (2.0)	0.029	Triage level 5 (%)	1384 (2.6)	32 (1.8)	0.056

ED = emergency department, MD = physician, PA = physician assistant

(MD1 60.25 ± 21.84 years vs. PA 62.93 ± 21.75 years, $P < 0.001$) in the MD1 group compared to the PA group. MD1 group patients were classified more often to triage levels 1, 4, and 5 and less to triage level 3. In the second study arm, MD patients tended to be younger (MD2 60.24 ± 21.83 years vs. MD + PA 61.79% ± 21.96 years, $P = 0.004$) without gender predominance. MD2 patients tended to be classified to triage levels 4 and 5 as opposed to the MD

+ PA group who tended to be classified to triage levels 3 and below.

Table 2 outlines propensity matched baseline characteristics, ED outcomes, and timing endpoints for the first study arm, comparing patients first seen by MDs vs. patients first seen by PAs. Baseline characteristics were well matched without significant differences in age (MD1 62.97 ± 21.24 years vs. PA 62.93 ± 21.75 years, $P = 0.927$), male gender (MD1 50.1% vs. PA

Table 2. Propensity matched characteristics and emergency department timing results comparing patients first seen by a physician vs. patients first seen by a physician assistant

Matched baseline characteristics (MD1 group)			
	MD only (n=7996)	PA only (n=3998)	P value
Male (%)	4003 (50.1)	1994 (49.9)	0.862
Internal ED (%)	4946 (61.9)	2441 (61.1)	0.407
Age (mean ± SD)	62.97 ± 21.24	62.93 ± 21.75	0.927
Triage level 1 (%)	44 (0.6)	20 (0.5)	0.825
Triage level 2 (%)	368 (4.6)	190 (4.8)	0.748
Triage level 3 (%)	2957 (37.0)	1446 (36.2)	0.395
Triage level 4 (%)	4472 (55.9)	2261 (56.6)	0.528
Triage level 5 (%)	155 (1.9)	81 (2.0)	0.798
First decision n (%)			
Admitted	2188 (27.4)	1115 (27.9)	0.558
Discharged	4556 (57.0)	2280 (57.0)	0.974
Left ED on their own	98 (1.2)	20 (0.5)	< 0.001
Died	10 (0.1)	3 (0.1)	0.624
Admitted	1144 (14.3)	580 (14.5)	0.79
Final decision, n (%)			
Admitted	2625 (32.8)	1305 (32.6)	0.853
Discharged	5245 (65.6)	2658 (66.5)	0.344
Left ED on their own	123 (1.5)	39 (1.0)	0.015
Died	11 (0.1)	3 (0.1)	0.508
Readmitted within 48 hours	168 (2.1)	60 (1.5)	0.028
Timing endpoints, median (25–75% interquartile range)			
Total length of stay	324.50 (198.00–508.25)	320.00 (199.00–507.00)	0.937
Time to first imaging	240.28 (150.04–358.81)	223.83 (135.33–349.61)	0.025
Time to first consultation	95.08 (52.49–185.15)	91.8 (51.94–176.00)	0.547
Time to first lab test	39.00 (25.00–59.00)	42.00 (28.00–62.00)	< 0.001
Time to first medication order	86.00 (46.00–162.00)	79.00 (42.00–156.00)	0.005
Time to first medical order	20.41 (10.42–52.63)	22.85 (11.20–56.87)	< 0.001
Time to first decision	186.00 (108.00–313.00)	180.50 (113.00–294.00)	0.228
Time to final decision	226.23 (135.54–381.04)	217.31 (138.06–354.99)	0.091
Time to be attend by MD	50.65 (29.53–84.20)	42.66 [27.40–65.41]	< 0.001

ED = emergency department, MD = physician, PA = physician assistant

49.9%, $P=0.862$), or different triage levels.

Regarding outcomes, patients in the MD group had higher rates of leaving on their own accord (MD1 1.5% vs. PA 1.0%, $P=0.015$) and being readmitted to the ED within 48 hours (MD1 2.1% vs. PA 1.5%, $P=0.028$) without significant differences in mortality rates.

Compared to patients seen by an MD, patients seen by PAs were attended to more quickly (MD1 50.65 minutes, range 29.53–84.20 vs. PA 42.66 minutes, range 27.40–65.41, $P<0.001$), waited shorter durations until medication orders were issued (MD1 86 minutes, range 46–162 vs. PA 79 minutes, range 42–156, $P=0.005$), until undergoing imaging (MD1 240.28 minutes, range 150.04–358.81 vs. PA 223.83 minutes, range 135.33–349.61, $P=0.025$), and showed tendency for a shorter wait until final decisions regarding continuation of care were made (MD1 226.23 minutes, range 135.54–381.04 vs. PA 217.31 minutes, range 138.06–354.99, $P=0.091$). Notably, there were no differences in times until consultation and total length of stay (LOS) in the ED.

Table 3 outlines propensity matched baseline characteristics, ED outcomes, and timing endpoints for the second study arm, comparing patients treated by a physician (MD2) and patients treated by a physician with the aid of a PA (MD + PA). There were no statistically significant differences in baseline characteristics, specifically with regard to age (MD2 61.21 ± 21.82 years vs. PA 61.81 ± 21.94 years, $P=0.358$), male gender (MD2 53.6% vs. PA 53.1%, $P=0.775$), or different triage levels. There were no differences in ED outcomes including leaving on own free will, mortality, or re-admittance rates.

Compared to patients seen by an MD, patients seen by an MD and assisted by a PA were again attended to more quickly (MD2 47.79 minutes, range 27.70–78.82 vs. MD + PA 30.59 minutes, range 15.77–54.85, $P<0.001$), but had longer LOS (MD2 338 minutes, range 204–534 vs. MD + PA 370 minutes, range 214–632, $P<0.001$) and did not have differences in durations until medications were ordered, until undergoing imaging or consultations were made and until decisions regarding care were made.

DISCUSSION

Israeli hospitals and EDs, like many around the world, are severely overcrowded and understaffed. The incorporation of PAs into the Israeli public hospital system has been a significant step toward reducing ED crowding, improving patient care, and reducing physician work burdens.

In our study, we found that patients first seen by PAs in the ED of our hospital were attended to quicker and had shorter waiting times until orders for medications were issued and until undergoing imaging. Despite the above results, total LOS for these patients and durations until decisions were made regarding extension of care were only mildly shorter and not in a statistically significant manner. Patients first seen by PAs had no difference in mortality rates yet had lower rates of leaving on their own accord and lower

rates of re-admittance to the ED within 48 hours of discharge.

Similar studies assessing PAs in EDs have been conducted, although not quite similar in their design and mainly performed in U.S. hospitals. Notable findings include reduced LOS in the ED [20,21] and higher patient satisfaction for patients treated by PAs for lower acuity cases, with only a minority of patients reported to be willing to wait longer to be seen by a physician [20]. This finding is partially consistent with our study, as total LOS in the ED was not shorter in either arm of the study, yet some waiting times were indeed shorter for patients first seen by PAs. Although we did not assess patient satisfaction directly, we conjecture that patients were more satisfied with the care they received from their lower rates of leaving before being discharged by a physician, as well as the shorter waiting times until receiving medications and undergoing imaging studies. Despite these advantages found in our study, patients can only be discharged by physicians in Israeli medical institutions. We assume that physicians may have been less inclined to promote discharge of these patients because they were under the care of another healthcare professional. This situation should be considered by physicians working alongside PAs in the future to materialize these advantages into quicker discharge. Promoting coordination between physicians and PAs should also be considered by hospital management and policy makers to perhaps establish quicker discharge alternatives for minor-severity cases.

Our study supports other studies concluding that treatment by PAs is safe and effective as an addition to medical teams (as opposed to direct substitution of physicians), achieving results non-inferior to solo-MD treatment in some treatment measurements, in the ED, in trauma [22], or in other specialized areas [10,11]. It is reasonable to assume that as ED PAs accumulate experience and expertise, they can further complement hyper-specialized physicians and provide a broader medical perspective to further improve waiting times and other safety measures [23].

Paradoxically, and contradicting our expectations, patients seen by a physician with the assistance of a PA had longer LOS in the ED compared to patients treated solely by a physician, despite being attended to quicker and without similar benefits of ED outcomes and reduced waiting times. One could assume that these were more complicated situations, requiring the attention of two healthcare professionals but that does not seem plausible since their stratification to different triage levels was similar to patients in the MD group. These results may also be explained by a lack of coordination between PAs and MDs, perhaps secondary to lack of communication and understanding of role and job definitions, particularly since PAs in Israel have only been licensed and incorporated into hospital healthcare teams fairly recently and into our institutional ED in the last couple of years.

Patient attitude toward not being attended by a physician remains an issue, particularly in higher acuity cases, although evidence suggests a correlation between waiting times and patient satisfaction [24]. Yet additional challenges remain for an optimal

Table 3. Propensity matched baseline characteristics and emergency department timing results comparing patients first seen by a physician with patients first seen by a physician and aided by a physician assistant.

Matched baseline characteristics (MD + PA group)			
	MD only (n=3434)	MD + PA (n=1717)	P value
Male (%)	1840 (53.6)	912 (53.1)	0.775
Internal ED (%)	1911 (55.6)	963 (56.1)	0.789
Age (mean ± SD)	61.21 ± 21.82	61.81 ± 21.93	0.358
Triage Level 1 (%)	60 (1.7)	31 (1.8)	0.97
Triage Level 2 (%)	196 (5.7)	102 (5.9)	0.784
Triage Level 3 (%)	1345 (39.2)	665 (38.7)	0.785
Triage Level 4 (%)	1776 (51.7)	888 (51.7)	< 0.999
Triage Level 5 (%)	57 (1.7)	31 (1.8)	0.79
First Decision, n (%)			
Admitted	1028 (29.9)	524 (30.5)	0.691
Discharged	1592 (46.4)	792 (46.1)	0.898
Left ED on their own	24 (0.7)	10 (0.6)	0.761
Died	6 (0.2)	0 (0.0)	0.194
Admitted in ED	784 (22.8)	391 (22.8)	0.991
Final decision, n (%)			
Admitted	2036 (59.3)	1018 (59.3)	< 0.999
Discharged	43 (1.3)	16 (0.9)	0.379
Left ED on their own	7 (0.2)	0 (0.0)	0.141
Readmitted within 48 hours	75 (2.2)	33 (1.9)	0.606
Timing endpoints, median (25–75% interquartile range)			
Total length of stay	338.00 (204.00–534.00)	370.00 (214.00–632.00)	< 0.001
Time to first imaging	230.43 (147.02–353.97)	224.07 (125.08–365.55)	0.322
Time to first consultation	98.73 (56.01–194.66)	100.71 (50.20–201.51)	0.933
Time to first lab test	37.00 (25.00–57.00)	40.00 (27.00–60.00)	< 0.001
Time to first medication order	78.00 (41.00–154.00)	75.50 (35.00–174.25)	0.502
Time to first medical order	21.03 (10.34–55.95)	28.96 (12.62–116.71)	< 0.001
Time to first decision	171.00 (96.25–294.00)	173.00 (91.00–292.00)	0.830
Time to final decision	237.35 (136.18–409.98)	232.54 (139.53–423.87)	0.421
Time to be attend by MD	47.79 (27.70–78.82)	30.59 (15.77–54.85)	< 0.001

ED = emergency department, MD = physician, PA = physician assistant

integration of PAs into the emergency healthcare system and maximizing their potential. Because PAs in Israel cannot prescribe medications or admit or discharge patients, their autonomy is somewhat unsubstantiated. For their work to be efficient, MDs need to trust and feel comfortable delegating tasks to PAs, and good MD–PA interactions may be crucial for proper collaboration. For optimized PA integration and better MD–PA coordination we recommend forming a designated PA program, which is directed by medical professionals, at every institution. PAs should

undergo proper orientation, including veteran PAs explaining their roles and offering strategies for proper collaboration. PA training should be a formal and gradual process, including shadowing experienced PAs or MDs for pre-specified periods and with regularly spaced performance feedbacks. Of utmost importance is to coordinate expectations for PAs, and maybe more importantly, MDs need to learn and understand the capabilities and capacities of PAs. PA professional development should be encouraged and may include a mentorship program and specific skill sessions

(e.g., ultrasound and radiology training, pain management) and attendance in regular department conferences and rounds, similarly to medical interns. In the future, when the PA system is properly implemented, adjudicated medication prescription (as in the United States) may further reduce physician burden. Finally, specifically for the ED, proper patient screening prior to PA assignment to specific patients may increase their efficiency.

PAs attend to patients and present them to physicians, thus reducing physician work burdens, saving valuable time in the ED. Less complex cases can be primarily managed by PAs, who can also perform tests or minor procedures and promote bureaucratic matters such as completing administrative paperwork and making telephone calls. PAs assuming a part of physician responsibilities affords the latter more time to care for urgent or sicker patients that are more complex and need more supervision. In addition, physicians can be more flexible to manage the entire ED optimally and dedicate more time for educating trainees or completing other tasks [25]. Finally, from a public healthcare point of view, the integration of PAs may add financial benefits, although that may be less applicable in Israel due to the unique local financial reimbursement arrangements.

LIMITATIONS

Our study has several limitations. First, PAs were added to healthcare teams and did not substitute physicians and hence, the main limitation of this study stems from its non-randomized design. Also, we conducted a retrospective, single center analysis. Propensity score matching exposes the study to inherent selection bias and we did not collect actual and valid data regarding patient satisfaction, rather we can only conjecture from the data that was collected. The use of median times rather than means is a necessity from the nature of time measurements.

CONCLUSIONS

Physicians specializing in emergency medicine are still the gold standard of care in the ED, yet currently in most hospitals in Israel, physicians specializing in other fields (e.g., Internal medicine, surgery) occupy most ED positions and are overwhelmed by patient burden. PAs specializing in emergency medicine provide valuable healthcare and offer a safe and trustworthy addition to emergency care teams, potentially improving waiting times, patient satisfaction, and outcomes. Whether results would further improve several years after integration of PAs into the ED healthcare systems and whether actual replacement of MDs by PAs can result in similar findings warrant future studies.

Correspondence

Dr. I. Merdler
 Dept. of Cardiology, Tel Aviv Sourasky Medical Center, Tel Aviv 64239, Israel
 Phone: (972-3) 697-3222
 Fax: (972-3) 697-4808
 email: ilanmerdler@gmail.com

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