Advancing the practice of trauma: utilizing advanced practice providers to improve patient outcomes through a collaborative team approach

Alaina M Lasinski ![ORCID],[1] Allysen Shaughnessy ![ORCID],[1] Benjamin Reynolds,[2] Raquel Forsythe,[2] Annika B Kay,[3] Brian K Yorkgitis ![ORCID],[4] Brandy N Younge,[5] Ashley B Christmas,[6] Jeffrey A Claridge ![ORCID] [7]

[1]Department of Surgery, MetroHealth Medical Center, Cleveland, Ohio, USA
[2]Department of Surgery, University of Pittsburgh Medical Center Health System, Pittsburgh, Pennsylvania, USA
[3]Department of Surgery, Intermountain Healthcare, Salt Lake City, Utah, USA
[4]Department of Surgery, University of Florida College of Medicine-Jacksonville, Jacksonville, Florida, USA
[5]Department of Surgery, OhioHealth, Columbus, Ohio, USA
[6]Department of Surgery, Atrium Health, Charlotte, North Carolina, USA
[7]Department of General Surgery, The Cleveland Clinic, Cleveland, Ohio, USA

Correspondence to
Dr Alaina M Lasinski; alasinski@metrohealth.org

SUMMARY
Advanced practice providers (APPs) have become essential to trauma teams in the United States during the last few decades. The optimal utilization of APPs is not yet known and is likely highly variable secondary to many factors. We discuss three aspects of the multidisciplinary approach to caring for trauma patients. First, a review of the literature demonstrates that APPs in trauma improve quality of care, patient throughput, and decrease cost. We then report on models of APP utilization by comparing five trauma centers across the country, concluding that utilization remains highly variable due to several system and provider factors. The final portion of this review highlights current billing and coding practices in integrated teams considering recent changes to Centers for Medicare and Medicaid rules in 2024.

INTRODUCTION

Advanced practice providers (APPs) are integral members of the trauma team. Their role is critical to patients, other providers, and at the hospital system level. APP utilization in trauma is variable across centers, and their optimal utilization is not known and is likely individualized. This article serves as a review of three components related to APP utilization. They include: (1) a review of the history of utilization and clinical outcomes of APPs in trauma; (2) a discussion of APP utilization models at five level I trauma centers; and (3) a summary of current billing and coding practices affecting trauma teams using APPs. This information was presented in part at an educational session at the 36th Eastern Association for the Surgery of Trauma Annual Scientific Assembly. We have broken the session into two separate articles, with this being about APP utilization and the other article discussing APP postgraduate training and APP trauma fellowships in the United States.[1]

Although the term advanced practice provider is all-encompassing and includes physician assistants (PAs), nurse practitioners (NPs), certified registered nurse anesthetists, and certified nurse midwives, the term APP within this review refers to a PA and/or NP. Of note, different certifications exist for NPs including, but not limited to, family nurse practitioner (FNP), adult-gerontology acute care nurse practitioner (AGACNP), and pediatric nurse practitioner-acute care (PNP-AC). States may regulate NP education, licensing, and job descriptions based on the most recent Advanced Practice Registered Nurse Consensus Model updates. As the nursing field continues to evolve, certificate options may also change.[2] When applying the information in this review, it is important to consider the NP's specific licensure at the state and hospital system level.

Further, it is important to recognize that NPs may be limited to providing care for patients of certain ages and acuity. Age and acuity restrictions are determined by an NP's certifying organization, not by the state or institution.[3] For example, FNPs and adult-gerontology primary care NPs (AGPCNPs) are both licensed to care for patients in non-hospital settings where patients are stable but may be acutely or chronically ill. They differ, however, in the populations they can see; FNPs may see infants to older adults, whereas AGPCNPs may see early adolescents (defined as >10 years old) to older adults. In the acute care setting (hospital or non-hospital), where AGACNPs are licensed to work, the AGACNPs may see patients from late adolescence to older adults, without an exact age defined.[4] Finally, PNPs are licensed to care for patients in any setting from infancy to age 21 years.[5] Contrarily, PAs are not restricted to caring for patients of certain ages and are trained as generalists. Historically, they were most often hired into primary care though recent trends demonstrate a new shift into specialty practice.[6] It is most likely that the APPs on trauma teams are either PAs or AGACNPs though recognition of the NP's certification and experience is important to consider in the discussion of utilization.

SECTION 1: THE HISTORY OF APP UTILIZATION AND THEIR INFLUENCE ON TRAUMA SURGERY OUTCOMES
Background
Trauma surgery is a subspecialty field historically practiced in academic centers by resident teams supervised by attending trauma surgeons.[7 8] The service requires around-the-clock provider availability and is a place where the work volume stresses staff resources.[7 9] In 2003 and again in 2011, resident work hours were restricted by the Accreditation Council for Graduate Medical Education, limiting all residents to 80 hours of work per week and first-year residents to 16 hours of call.[10] This

resulted in workforce challenges, and APPs were found to be a cost-effective and consistent solution to the deficits.[7 9 10] In 2010, the US congress passed the Affordable Care Act, leading to large insurance coverage gains with a more insured population and increased insurance reimbursement for trauma centers.[11 12] The latter caused an influx of regional medical centers seeking verification and designation as trauma centers by the American College of Surgeons (ACS).[13]

The last decade has seen an increase in APP scope of practice and autonomy.[14 15] The most current survey data for both NPs and PAs demonstrate an influx of these providers in the hospital setting, with about 30% of APPs now practicing primarily in a hospital or inpatient setting.[9 12 15 16] For PAs specifically, the largest practice area is now surgical subspecialties,[16] and APPs are being hired into trauma services to assist in meeting consistent and expanding needs for provider staffing.[10 12] As APPs continue to enter trauma surgery practice, it is imperative to demonstrate their impact on clinical and system outcomes in this specific surgical subspecialty. Studies in emergency medicine and critical care fields have cited APPs as the ideal provider for care coordination. When implemented with a team, improvements in outcomes have been demonstrated. These include decreasing patient length of stay (LOS), decreasing time to consultations/treatment, decreasing overall mortality, providing cost savings, and increasing patient satisfaction.[10 14 17] However, few studies exist to show that the same improvements are occurring in trauma surgery despite APPs having a greater presence in the field. This section of the article reviews those published studies in trauma.[8 17–21]

Methods

A comprehensive literature search was completed using PubMed, Ovid MEDLINE, Clinical Key, the *Journal of Trauma and Acute Care Surgery*, and Google Scholar. Additionally, the references of systematic reviews were screened for relevant articles. The literature search was originally limited to the last 5 years. However, due to the paucity of quality and primary studies on this subject, the search was expanded to include articles within the last 10 years. Only peer-reviewed articles that discussed APPs in a trauma surgery setting were considered.

Results

A total of 21 studies were found using the discussed methods. Just six studies met the inclusion criteria, directly examining APP outcomes in trauma surgery within the last decade. All were single-center retrospective reviews at level I trauma centers. Each study compared the time before APPs were hired into a trauma surgery service with the time after hire or compared the time before and after the expansion of APP duties. Most studies separated APP and resident duties, whereas others integrated APPs into their resident teams (table 1).[8 17–21]

Table 2 highlights the significant results from these different studies. Of note, four studies demonstrated significant reductions in LOS.[8 17–20] Intensive care unit (ICU) and stepdown unit (SDU) LOS were evaluated in five of the six studies, with all findings showing statistical significance.[8 18–21] All studies, except Woodfall *et al*, who observed no change, saw an overall decrease in ICU or SDU LOS.[8 18–21] The study by Sise *et al* observed an increase in hospital LOS of 1.3 hours despite showing a decrease in ICU LOS. The authors explained that this was likely a reflection of growth in geriatric trauma during the 4-year interval study, along with a gradual shift in care after opening an APP-run trauma care unit (TCU). Under this model, patients were moved

quickly out of the ICU into the TCU, where case managers and social workers could begin their care but could not change the overall time spent in the hospital.[21]

Three of the five APP outcome studies reviewed cost, and although statistical significance was not reached, all three studies did find that the overall cost of care was decreased with APP patient care. The decrease in cost was stated to be due to reductions in ICU and SDU LOS and hospital LOS (HLOS).[17 19 21] Notably, Sise *et al* saw a decrease in cost despite an increase in HLOS, explaining that reducing ICU LOS contributed greatly to decreasing cost regardless of overall HLOS.[21]

All studies measured clinical outcomes but overlapped only in mortality and deep vein thrombosis rates. One study reported fewer discharges to skilled nursing facilities, increased discharges to home, and faster time to the operating room with APPs on service.[17] Reduced time to the operating room in this study (by 11 hours) is multifactorial and likely explained by the fact that the pre-intervention cohort was managed by hospitalists as compared with trauma NPs managing the post-intervention cohort. Additionally, the authors attribute this difference to using the Goldman Cardiac Risk Index and collaboration with cardiology on a patient-to-patient basis. Two studies showed an increase in discharges before noon with the implementation of APPs.[8 17] Among clinical outcomes, one study found a decrease in urinary tract infections (UTIs),[20] and another study showed a decrease in at least one hospital complication.[21]

Discussion

The limited studies available to date in the role of trauma APPs demonstrate that APPs positively impact patient throughput by reducing ICU and SDU LOS and HLOS.[8 17 19–21] APPs place rehabilitation consultations more quickly, more frequently discharge patients before noon, more consistently discharge patients to their home, and reduce hospital 30-day readmission rates.[8 17 19–21] A shown benefit of reduced LOS is a decrease in the cost of care.[17 19 21] Cost of care data in one study reported savings of $9000 per patient, resulting in savings of $27.9 million in hospital charges in 1 year.[19] The overall findings in this review suggest substantial cost savings with the implementation of APPs in trauma surgery care teams.

The principal factor to consider in trauma care is patient clinical outcomes data. In the appraised studies, clinical outcomes were either improved or unchanged with the increased utilization of APPs.[8 17–22] The most impactful outcomes were a reduced or unchanged mortality rate, reduced rates of pneumonia, UTIs, and major arrhythmias, and a reduced number of overall clinical complications.[8 18 20 21] These clinical outcome findings together demonstrate that APPs strengthen the workforce by overall maintaining or improving the quality of patient care in trauma surgery and that APP patient care in trauma is both safe and effective.

There were a few notable limitations to this review. All studies summarized were retrospective single-center data reviews, limiting the quality of evidence and increasing the possibility of bias. Although staffing models before the implementation of APPs were discussed in all studies, there were no comments made on the adequacy of staffing for the service needs. Outcomes measured in the studies were dissimilar, with only a consistent overlap in LOS data. Only two studies described the scope of APP practice in detail, and APP competency was only described in one study; therefore, results may not be generalizable due to differences in the scope of practice

Table 1 Summary of clinical outcomes with APP utilization at level I trauma centers

Reference	Study type	Study objective/design	Outcomes
Hardway et al[17]	Retrospective data review; single center	Analysis of change in outcomes after implementation of TNPs to manage low-acuity trauma patients. Comparison was also made with hospitalist physicians who were previously caring for non-surgical admitted patients* (1 yr and 10 mos).	▶ HLOS ▶ In-hospital mortality ▶ Discharge order before noon ▶ Missed injury rate ▶ 30-day readmission rate ▶ Time to operating room from admission ▶ Rate of non-surgical admission ▶ Cost

Holliday et al[8]	Retrospective data review; single center	Outcomes comparison before NPs implemented in trauma (12 mos), during implementation with limited role of discharging patients only (12 mos), and after NP role expanded to include admissions, ICU rounds, trauma floor rounds, and post-acute clinic visits (12 mos).	▶ HLOS
			▶ ICU LOS
			▶ Time from admission to rehabilitation consult placement
			▶ Discharge order placed before noon
			▶ 30-day readmission rate
			▶ Missed injury rate
			▶ Unplanned ICU admission rate
			▶ Inpatient complication rates:
			  – Pneumonia
			  – DVT

Woodfall et al[18]	Retrospective data review; single center	Outcomes compared before (2012), during (2013), and after (2014) APP roles were restructured to include: (1) standardizing ICU transfer process, (2) APPs made primary care providers on trauma ward, (3) standardizing the discharge process, (4) calling all patients within 24–48 hours of discharge, (5) organizing an APP lead trauma clinic for outpatient follow-up.	▶ ICU readmission rate ▶ Unplanned hospital readmission rate ▶ HLOS ▶ ICU LOS ▶ Mortality
Collins et al[19]	Retrospective data review; single center	Comparison of outcomes 2 years before NPs implemented in trauma SDU, and 1 year after NPs implemented.	▶ SDU LOS ▶ HLOS ▶ Cost to patient of inpatient stay ▶ Physician and nursing satisfaction

Gillard et al[20]	Retrospective data review; single center	Outcomes comparison between:
		Year 1: time when MLPs on trauma team had limited role—rounding on trauma floor and ICU patients, and staffing clinic M–F during day (1 yr).
		Year 2: time when APP role expanded by adding—taking calls, admitting, and transferring patients, and performing procedures daily, 7 days/week (1 yr).
			▶ ED dwell times for trauma alerts, trauma transfers, and trauma consults
			▶ Daily admission quantity
			▶ Daily discharge quantity
			▶ Rate of patient complication occurrences
			  – DVT
			  – Major arrhythmia
			  – Urinary tract infection
			▶ Hospital mortality
			▶ HLOS
			▶ ICU LOS

Sise et al[21]	Retrospective data review; single center	Outcomes comparison in trauma division between four different time periods, each 1 yr in length. Year A—trauma surgeon and resident team. Year B—addition of NPs 5 days/week. Year C—implementation of trauma medical-surgical and trauma SDU on a single floor. Year D—addition of CNS and increase in NPs to 7 day/week.	▶ HLOS ▶ ICU LOS ▶ ICU readmission ▶ Mortality ▶ Patients with at least one complication ▶ Cost

*Non-surgical admitted patients—traumatically injured patients admitted to non-surgical service without surgical evaluation.
APP, advanced practice provider; CNS, clinical nurse specialist; DVT, deep vein thrombosis; ED, emergency department; HLOS, hospital LOS; ICU, intensive care unit; LOS, length of stay; M–F, Monday–Friday; MLPs, midlevel practitioners; NPs, nurse practitioners; SDU, stepdown unit; TNPs, trauma nurse practitioners.

and knowledge base between trauma APPs at different level I trauma centers.

Conclusion

The studies reviewed reveal the value of APPs in managing patient care within trauma surgery and demonstrate improved quality of care, efficient patient throughput, and decreased cost. With increased resident shortages, APPs can serve as a beneficial addition to trauma teams. Further research is needed on APP training in fellowships or residency models, the best utilization of APPs, APP competency standardization, and prospective studies on APP collaboration with resident-run teams in trauma surgery. In the next section, we describe different APP utilization models at five level I trauma centers across the country.

SECTION 2: FIVE DIVERSE TRAUMA CENTERS AND THEIR APP UTILIZATION MODELS

Basic statistics about five different US trauma programs, including trauma volumes and trauma team complement, are listed in table 3. Four centers are ACS-verified level I trauma centers, with two centers having pediatric verification and one center covering level III trauma center satellites. Yearly trauma activations range from 3900 to over 11 000. Yearly admissions to the trauma service range from 1900 to 6000. Average daily trauma census ranges from 20 to 90. The number of attendings covering the trauma service ranges from 7 to 19. The number of APPs covering the trauma service ranges from 9 to 25. The trauma team complements vary between programs, but most are comprised of a combination of attendings, trainees, and APPs.

Table 2 Summary of trauma APP study results by outcome

Study	Hospital LOS	ICU/SDU LOS	Hospital 30-day readmission	ICU readmission	Discharge order before noon	Clinical outcomes	Cost
Hardway et al[17]	↓*		↔		↑*	Mortality ↔	↓
Holliday et al[8]	↓*	↓*	↓	↔	↑*	Pneumonia ↓ DVT ↓	
Woodfall et al[18]	↔	↔	↓	↓*		Mortality ↔	
Collins et al[19]	↓	↓*					↓
Gillard et al[20]	↓	↓*				Mortality ↓ DVT ↓ UTI ↓* Major arrhythmia ↓	
Sise et al[21]	↑*	↓*		↓		Mortality ↔ At least one complication ↓*	↓

↓: decreased; ↔: no difference; ↑: increased.
*Statistically significant.
APP, advanced practice provider; DVT, deep vein thrombosis; ICU, intensive care unit; LOS, length of stay; SDU, stepdown unit; UTI, urinary tract infection.

APP utilization, hiring, and educational support across programs have some similarities but many key differences (table 4). In most centers, APPs cover the ICU, SDUs, and the trauma floor. They also see activations and serve as first assistants in the operating room. In most centers, the APPs work in an integrated fashion with the residents; in only one center do they work separately from residents, collaborating directly and only with an attending physician. At most centers, APPs are not capped in the number of patients they see; in one center, they are capped at 8 patients but can flex to 16 patients. There is a variation in practice across centers regarding procedures APPs perform. In four of five centers, APPs work an average of 40 hours per week, including nights. Regarding hiring to these trauma teams, 0% to 21% of APPs are fellowship or residency trained, and 25% to 64% of APPs are new graduates upon hiring. Attrition rate for APPs ranges from 0% to 27%.

Education for and administrative responsibilities of trauma APPs are inconsistent across centers. Three programs (Intermountain Medical Center, OhioHealth, and MetroHealth) currently offer an APP fellowship; one program (University of Pittsburgh Medical Center) lost funding for their fellowship program 6 years ago. Two programs (University of Florida Jacksonville and OhioHealth) have competency standards for their trauma APPs. Continuing medical education support for APPs ranges from $1000 to $2500 yearly. In four of five programs, APPs are given administrative time. The APPs are expected to do research in one program, but APPs are participating in quality

Table 3 Trauma program demographics

Program	Location	Adult trauma center level	Pediatric trauma center level	Average daily trauma census	Average yearly activations	Average yearly admissions to trauma service	Attending coverage	APP coverage	Trauma team complement
UPMC	Pittsburgh, Pennsylvania	Level 1 (PTSF)	N/A	35–80	5200	4200	13 surgeons	9.2 trauma—5 PA, 4 NP 5 CCM—3 PA, 2 NP	Attending, SCC fellow, surgery chief, 1–3 surgery interns, 3 EM residents, APPs
Intermountain Medical Center	Murray, Utah	Level 1 (ACS)	N/A	20–40	3900	1900	7 surgeons	12—8 PA, 4 NP	Attending, APPs, EM/peds residents, APP fellow
University of Florida–Jacksonville	Jacksonville, Florida	Level 1 (ACS and state)	Level 2 (ACS)	35	4462	2800	10 surgeons 2 CC-anesthesia	9—1 PA, 8 NP	Attending; surgery PGY4, PGY2; 3 interns; 1–2 APPs
OhioHealth Grant Medical Center	Columbus, Ohio	Level 1 (ACS)	N/A	90	4300	6000	15 surgeons	25—6 PA, 19 NP	Trauma bay: attending, resident, APP SDU: attending, APP ICU: attending and resident±APP Floor: attending, APP
MetroHealth Medical Center	Cleveland, Ohio	Main: level 1 (ACS) Satellites: level 3 (ACS)	Main: level 2 (ACS) Satellites: N/A	Main: 40	Main: 5830 Satellites: 5734	Total: 2000	19 surgeons	10 full-time—7 PA, 3 NP 5 PRN—3 PA, 2 NP	Main: 2 attendings, 1 APP, 1–2 surgery chiefs, 1–2 intermediate residents, 1–3 interns Level 3: 1 attending, 1 APP

ACS, American College of Surgeons; APP, advanced practice provider; CC, critical care; CCM, Critical Care Medicine; EM, emergency medicine; ICU, intensive care unit; N/A, not applicable; NP, nurse practitioner; PA, physician assistant; PGY, post-grad year; PRN, as needed; PTSF, Pennsylvania Trauma Systems Foundation; SCC, surgical critical care; SDU, stepdown unit; UPMC, University of Pittsburgh Medical Center.

Table 4 APP utilization across trauma programs

Program	# of years APPs on team	Services covered by APPs	Procedures performed by APPs	APP/resident workflow	Patient caps for APPs	APP schedules	Fellowship/ residency-trained APP	New graduate hires	Attrition rate	CME support/yr
UPMC	18	ICU, SDU, trauma/EGS floor, activations, 1st assist (EGS/trauma), EGS consults, trauma clinic	Laceration repair: sometimes A-line placement: rarely CVC placement: rarely CVC removal: sometimes CT placement: sometimes CT removal: often Pigtail placement: sometimes Pigtail removal: often	Integrated	No cap	40 hrs/week including nights for CCM APPs	21%	42%	10%	$1000
Intermountain Medical Center	23	ICU, floor, activations, 1st assist (trauma), clinic	Laceration repair: often A-line placement: rarely CVC placement: often CVC removal: often CT placement: often CT removal: often Pigtail placement: often Pigtail removal: often	Integrated	No cap	40 hrs/week including nights	17%	25%	0%	$2500
UF Jacksonville	15	ICU, SDU, floor, activations	Laceration repair: often A-line placement: often CVC placement: sometimes CVC removal: rarely CT placement: rarely CT removal: often Pigtail placement: rarely Pigtail removal: often	Integrated	No cap	12 12-hour shifts/ month	0%	50%	3 in 7 years	$1500
OhioHealth Grant Medical Center	20	ICU as needed, SDU, floor, observation unit, 1st assist (trauma), activations, clinic	Laceration repair: often A-line placement: often CVC placement: often CVC removal: rarely CT placement: often CT removal: often Pigtail placement: often Pigtail removal: often	Integrated and separate	No cap	40 hrs/week including nights	28%	64%	6.3%	$2500
MetroHealth Medical Center	5	Main: floor, activations Level 3: floor, activations, 1st assist, clinic (all trauma and EGS)	Laceration repair: often A-line placement: rarely CVC placement: sometimes CVC removal: often CT placement: sometimes CT removal: often Pigtail placement: often Pigtail removal: often	Separate	8, flex to 12–16	40 hrs/week including nights	0%	40%	27%	$1000

a-line, arterial line; APPs, advanced practice providers; CCM, critical care medicine; CME, continuing medical education; CT, chest tube (large-bore); CVC, central venous catheter; EGS, emergency general surgery; ICU, intensive care unit; SDU, stepdown unit; UF, University of Florida; UPMC, University of Pittsburgh Medical Center.

improvement projects or research projects volitionally in four programs.

This description elucidates the wide variety of practice patterns, education, and clinical advancement of APPs in trauma teams. The variation in utilization is likely secondary to several trauma service factors including quantity and severity of trauma activations; resident and physician staffing models for the trauma service including critical care, emergency general surgery, and elective surgery responsibilities; patient census; and operative case load. APP factors such as years of experience, completion of a postgraduate training program, procedural competency, and licensing are also factors to be considered. As discussed prior, there may be limitations for certain NPs regarding providing care to pediatric patients that affect their utilization on the team. The experience and procedural competence of APPs may be supplemented with additional postgraduate training in trauma, which we discuss in a separate article.[1] Creating an APP fellowship in trauma may have future promise for individual trauma centers. Although not included in this review, it is likely that the utilization of APPs at level II trauma centers also differs from their utilization at level I and III trauma centers. Thankfully, based on the APP skillset, their utilization is fluid and can adapt to the trauma team's dynamic needs. The trauma community will benefit from future studies examining optimal utilization of the APP. Further, expanding APP education specific to trauma and relevant technical skills while ensuring procedural competence may further benefit the efficiency of trauma centers and improve patient care. Critical to hospital systems and trauma centers that use team-based models with physician and APPs as billing providers, a discussion of billing and coding is required.

SECTION 3: UP-TO-DATE APP BILLING AND CODING BEST PRACTICE IN TRAUMA

Billing for APPs can be complicated. Medicare and most Medicaid and commercial payor products allow APPs to provide and bill for services normally furnished by a physician at all levels of evaluation and management (E&M), including diagnostic testing. Medicare codifies its reimbursement rates under federal law. For the APP workforce, the rate of reimbursement has remained at 85% of what a physician would be paid for the same service. Although some commercial payors and Medicaid products will reimburse an APP's service at the same rate as a physician fee, most reimburse at a discounted rate, typically following Medicare's 85% rule.[23]

All providers use documentation to support the level of E&M that is ultimately billed to the payor. With the advent of the electronic health record (EHR), the amount of documentation a provider must write has been widely cited as burdensome and, in some studies, a driver of burnout.[24] In response, the Center for Medicare and Medicaid Services (CMS) changed its rule around documentation requirements for reimbursement in 2019, which was designed to help decrease this burden. Now, providers can 'review and verify' documentation made by other members of the healthcare team, including students, without having to rewrite the same items in the EHR. This matters greatly for APPs, who may spend a disproportionate amount of time documenting in the EHR compared with other team members.[25]

The APP's role in supporting the provisions of the Emergency Medical Treatment and Labor Act (EMTALA) has been confusing. Under EMTALA, the hospital must provide an on-call list of physicians on staff who are available to provide treatment to stabilize individuals with emergency medical conditions. Medicare has clarified the APP's role in EMTALA, saying the

'…on-call physician has the option of sending a representative, i.e., directing a licensed (APP) as his or her representative to appear at the hospital and provide further assessment or stabilizing treatment…' If an on-call physician does use an APP for that role, they are still ultimately responsible for the service under EMTALA and must appear personally if/when asked by the treating physician.[26 27]

One of the biggest changes to Medicare billing has been the recent split/shared visit rule change announced in the 2022 Physician Fee Schedule (FS).[28] CMS defines a split/shared visit as a medically necessary encounter with a patient where the physician and a qualified APP each personally perform a substantive portion of an E&M visit face-to-face with the same patient on the same date of service. Prior to 2022, a substantive portion of an E&M visit would involve all or some portion of the history, examination, or medical decision-making (MDM) key components of an E&M service. The new rule changed this and will move the split/shared visit from its traditional documentation of an E&M-based decision-making method of attribution to a time-based attribution method. With the new rule, the provider who spent more than half of the total time in the care of the patients, that is, the 'substantive portion' of the visit, will be the billing provider.

The rule change went into partial effect on January 1, 2022, whereby CMS would allow billing providers to document the 'substantive portion' using at least one key component (history, physical examination, or MDM) in its entirety or being the provider who spent more than half of the total time in the care of the patient. The 2022 year was meant to aid in the transition to an entirely time-based methodology, which was to begin in 2023. However, CMS received significant feedback from healthcare systems and physician organizations asking to delay the implementation of the rule for 2023, and so in November 2022, it was announced that time-based billing would be delayed until January 2024.[29] Notably, in November 2023, CMS updated the split/shared billing rules for 2024, stating that the 'substantive portion' of a split or shared visit includes more than half of the total time spent by the physician or APP or a substantive part of the MDM.[30]

Medicare defines specific medical activities that qualify to determine the time spent during a split/shared encounter. These include[31]:

▶ Preparing to see patient (ie, EHR results review)
▶ Obtaining and/or reviewing a separately obtained history
▶ Performing an appropriate physical examination and/or evaluation
▶ Ordering medication, tests, and procedures
▶ Counseling and educating the patient, their family, or their caregiver
▶ Coordinating care when it has not been reported or billed separately
▶ Referring and communicating with other healthcare professionals when not reported or billed separately
▶ Documenting clinical information in the EHR
▶ Independently interpreting results when not separately billed or reported and communicating the results to the patient, their family, or their caregiver.

Activities which do not qualify for time spent include[31]:

▶ Performance of other services that are reported separately (ie, procedures)
▶ Travel
▶ Teaching that is general and not limited to discussion that is required for the management of a specific patient

Implementing the new split/shared rule in 2024 will carry some potential impacts. If work relative value units (wRVUs) are inappropriately awarded to the physician when that individual has not done the substantive portion of the visit, there are potential Stark law implications. If the APP is the billing provider and did the substantive portion of the visit, then those wRVUs will be awarded to him/her. There are potential revenue impacts related to APP direct billing. As discussed previously, APPs only receive 85% of the physician's fee, which potentially leaves 15% unrealized. However, because APPs are compensated less than physicians, even with 85% reimbursement, they may be able to offset their cost to an employer faster than their physician colleagues in the same field.

Lastly, because split/shared visits were previously not appended with a modifier when submitted for reimbursement, they were not easily subject to an external audit. Now, all split/shared visits must have an 'FS' modifier to identify them. This will make auditing easier to ensure that the substantive portion of the visit was performed by the appropriate billing provider. Therefore, it is incumbent for all parties to document appropriately, ensuring compliance with the new split/shared rule changes in 2024. To do this, there are five key steps:

1. The APP and physician must recognize when they are performing a split/shared visit and meet all the CMS requirements for co-employment in the same group, including treating the patient on the same calendar day.
2. The billing provider must perform a face-to-face encounter with the patient and identify the providers contributing to the split/shared service in the EHR.
3. The billing provider must document to meet the split/shared requirement. Either one of the key components described above (2022–2023) or more than half of the total time spent by the APP and physician or the substantive portion of the MDM (2022–2023, and solely the method 2024 and beyond) would meet this requirement.
4. If the physician is the billing provider, then it is important to highlight his/her role as having done the substantive portion.
   a. If using the MDM method, a statement could be used like the one below:

   'I certify that I have performed the substantive portion of service in its entirety through MDM for this patient's care. Please link my documentation with John Doe, PA-C's documentation, who also provided care for this patient on this date.'

   b. If using the time method, both the APP and the physician should memorialize the time spent:
   ▶ Physician: 'I certify that I have performed the substantive portion of service in its entirety, having spent 35 minutes on this patient's care. Please link my documentation with John Doe, PA-C's documentation, who also provided care for this patient on this date.'
   ▶ APP: 'I have spent 30 minutes on this patient's care. Please link my documentation with Jane Doe, MD's documentation who also provided care for this patient on this date.'
5. Lastly, when the bill is submitted, it must be appended with the 'FS' modifier.

Staying informed on APP billing in trauma surgery is vital to ensure appropriate compliance with the latest Medicare billing rule changes. As these changes come into effect, the utilization of APPs in trauma should also be closely evaluated and re-evaluated to maximize best practices and reimbursement.

To complicate the matter, many hospitals track wRVU generation of APPs and physicians, and clinical productivity may be tied to financial bonuses. Especially related to the new CMS rules regarding split/shared billing, it is important to define what the substantive portion of an encounter entails to avoid conflict and ensure collaboration between APPs and physicians when assigning wRVUs. It may not be unusual for an APP to spend more time on an encounter than a physician, especially when he/she is doing most of the documentation; however, one can certainly argue that the decision to operate on a patient is reserved for the surgeon and constitutes significant MDM that would count as the substantive portion of the visit. Regarding MDM, however, 'substantive' remains poorly defined by regulatory bodies, and until it is further clarified, each hospital, or trauma group, should create criteria to define it to minimize confusion about wRVU assignment.

At the first author's institution, MDM is considered the substantive portion of the visit for emergency department, outpatient, inpatient, and observation care services, whereas time is considered the substantive portion of a critical care encounter. MDM consists of three elements including number and complexity of problems addressed at the encounter, amount and/or complexity of data to be reviewed and analyzed, and risk of complication and/or morbidity or mortality of patient management; E&M level of service is based on meeting two of the three MDM elements.[32] If the amount and/or complexity of data to be reviewed and analyzed is used, the hospital requires additional documentation for moderate or high MDM levels of service by the billing provider. These requirements include documentation of independent interpretation of tests performed by another physician/APP and/or discussion of management or test interpretation with an external physician/APP. Although this is just one hospital's system for defining the substantive portion of the visit, more work is needed to understand optimal billing structures in team-based models where multiple billing providers are involved in patient care, especially in hospital groups where productivity and pay are linked to billing practices.

CONCLUSION
The addition of APPs to trauma teams during the last few decades has had significant clinical implications for trauma patient care and throughput. Currently, APP utilization across trauma teams is diversified and tailored to each team's specific needs. There is not one formula for ideal trauma APP utilization. Rather, a nuanced consideration of factors such as number of trauma activations, patient census, attending and resident surgeon staffing models, and other clinical and administrative responsibilities of staff must be made before deploying APPs within the trauma system. These factors, in addition to APP postgraduate education, experience, licensing, and procedural competence, should be considered when centers are designing their system for trauma patient care. Although not yet studied or reported on, we speculate the reach of APPs on trauma teams goes beyond clinical benefit and likely extends into the research and administrative realms as well, where there are APPs going beyond their normal clinical duties to advance care of the trauma patient.

X Alaina M Lasinski @AMLasinski, Brian K Yorkgitis @DrBYork, Ashley B Christmas @blackcloudmd and Jeffrey A Claridge @claridgejeffrey

Patient consent for publication Not applicable.

Ethics approval As this is not human subjects research, no IRB approval was required.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iDs
Alaina M Lasinski http://orcid.org/0000-0001-5316-4234
Allysen Shaughnessy http://orcid.org/0000-0002-5341-3517
Brian K Yorkgitis http://orcid.org/0000-0001-8947-3370
Jeffrey A Claridge http://orcid.org/0000-0002-3526-2241

REFERENCES

1 Lasinski AM, Shaughnessy A, Claridge JA. Trauma advanced practice provider education: the current state of trauma advanced practice provider postgraduate education in the United States. *Trauma Surg Acute Care Open* 2024:e001423.
2 Smith-Kimble C. FNP vs. ACNP + Core Differences 2022, Available: https://nursejournal.org/resources/fnp-vs-acnp [Accessed 16 Jan 2024].
3 APRN Licensure and Practice in Ohio. State of Ohio.Ohio board of nursing. Available: APRN+Licensure+and+Practice+in+Ohio.pdf [Accessed 6 Feb 2024].
4 Peacock A, Blakely K, Maes C, Henson A, DiGiulio M, Henderson MJ. Adult-Gerontology nurse practitioners: A discussion of scope and expertise. *The Journal for Nurse Practitioners* 2022;18:1037–45.
5 Heuer A, Hatton A. NAPNAP Position Statement on Age Parameters for Pediatric Nurse Practitioner Practice2018, Available: https://www.jpedhc.org/article/S0891-5245(18)30580-7/pdf
6 Link. Twenty-third annual report on physician assistant educational programs in the United States, 2006-2007. 2008. Available: -content/uploads/imported-files/23rd-Annual-Report-on-Physician-Assistant-Educational-Programs-in-the-United-States-2006–2007.pdf [Accessed 6 Feb 2024].
7 Johal J, Dodd A. Physician Extenders on surgical services: a systematic review. *Can J Surg* 2017;60:172–8.
8 Holliday A, Samanta D, Budinger J, Hardway J, Bethea A. An outcome analysis of nurse practitioners in acute care trauma services. *J Trauma Nurs* 2017;24:365–70.
9 Kleinpell RM, Grabenkort WR, Kapu AN, Constantine R, Sicoutris C. Nurse practitioners and physician assistants in acute and critical care: A concise review of the literature and data 2008-2018. *Crit Care Med* 2019;47:1442–9.
10 Eaton BC, Vesselinov R, Ahmeti M, Stansbury JJ, Regner J, Sadler C, Nevarez S, Lissauer M, Stout L, Harmon L, *et al*. Surgical faculty perception of service-based advanced practice provider impact: A Southwestern surgical Congress multicenter survey. *Am Surg* 2021;87:971–8.
11 Zerhouni YA, Scott JW, Ta C, Hsu PC-H, Crandall M, Gale SC, Schoenfeld AJ, Bottiggi AJ, Cornwell EE 3rd, Eastman A, *et al*. Impact of the affordable care act on trauma and emergency general surgery: an Eastern Association for the surgery of trauma systematic review and meta-analysis. *J Trauma Acute Care Surg* 2019;87:491–501.
12 Hooker RS, Cawley JF. Physician assistants/Associates at 6 decades. *Am J Manag Care* 2021;27:498–504.
13 Truong EI, Ho VP, Tseng ES, Ngana C, Curtis J, Curfman ET, Claridge JA. Is more better? do statewide increases in trauma centers reduce injury-related mortality *J Trauma Acute Care Surg* 2021;91:171–7.
14 Woo BFY, Lee JXY, Tam WWS. The impact of the advanced practice nursing role on quality of care, clinical outcomes, patient satisfaction, and cost in the emergency and critical care settings: a systematic review. *Hum Resour Health* 2017;15:63.
15 Rabinowitz E. Physician Assistants Add Value, Enhance Revenue: Medical Economics; 2016, Available: https://www.medicaleconomics.com/view/physician-assistants-add-value-enhance-revenue
16 Statistical Profile of Certified Physician Assistants: National Commission on Certification of Physician Assistants 2021, Available: https://www.nccpa.net/wp-content/uploads/2022/12/2021-Statistical-Profile-of-Recently-Certified-PAs-11.15.22.pdf
17 Hardway J, Samanta D, Evans KJ, Bethea A. Rate of Nonsurgical admissions at a level 1 trauma center: impact of a trauma nurse practitioner model. *J Trauma Nurs* 2020;27:163–9.
18 Woodfall MC, Browder TD, Alfaro JM, Claudius MA, Chan GK, Robinson DG, Spain DA. Trauma advanced practice provider programme development in an academic setting to optimize care coordination. *Trauma Surg Acute Care Open* 2017;2:e000068.
19 Collins N, Miller R, Kapu A, Martin R, Morton M, Forrester M, Atkinson S, Evans B, Wilkinson L. Outcomes of adding acute care nurse practitioners to a level I trauma service with the goal of decreased length of stay and improved physician and nursing satisfaction. *J Trauma Acute Care Surg* 2014;76:353–7.
20 Gillard JN, Szoke A, Hoff WS, Wainwright GA, Stehly CD, Toedter LJ. Utilization of pas and NPS at a level I trauma center: effects on outcomes. *JAAPA* 2011;24:34,
21 Sise CB, Sise MJ, Kelley DM, Walker SB, Calvo RY, Shackford SR, Lome BR, Sack DI, Osler TM. Resource commitment to improve outcomes and increase value at a level I trauma center. *J Trauma* 2011;70:560–8.
22 Morris DS, Reilly P, Rohrbach J, Telford G, Kim P, Sims CA. The influence of unit-based nurse practitioners on hospital outcomes and readmission rates for patients with trauma. *J Trauma Acute Care Surg* 2012;73:474–8.
23 Medicare Benefit Policy Manual. Center for Medicare and Medicaid Services; 2022.
24 Robertson SL, Robinson MD, Reid A. Electronic health record effects on work-life balance and burnout within the I(3) population collaborative. *J Grad Med Educ* 2017;9:479–84.
25 Medicare Program. CY 2020 revisions to payment policies under the physician fee schedule and other changes to part B payment policies; Medicare shared savings program requirements; Medicaid promoting Interoperability program requirements for eligible professionals; establishment of an ambulance data collection system; updates to the quality payment program; Medicare enrollment of opioid treatment programs and enhancements to provider enrollment regulations concerning improper prescribing and patient harm; and amendments to physician self-referral law advisory opinion regulations final rule; and coding and payment for evaluation and management, observation and provision of self-administered Esketamine interim final rule the Federal register: The Daily Journal of the United States Government. 2019;84(221);
26 National Archives and Records Administration. Code of Federal Regulations, General Provisions, Necessary Stabilizing Treatment for Emergency Medical Conditions. Title 422019;
27 Center for Clinical Standards and Quality/Quality SOG. State Operations Manual Department of Health & Human Services. Centers for Medicare & Medicaid Services; 2019.
28 Calendar Year (CY) 2022 Medicare Physician Fee Schedule Final Rule: CMS.gov; 2021, Available: https://www.cms.gov/newsroom/fact-sheets/calendar-year-cy-2022-medicare-physician-fee-schedule-final-rule
29 Medicare and Medicaid Programs. CY 2023 Payment Policies under the Physician Fee Schedule and Other Changes to Part B Payment Policies; Medicare Shared Savings Program Requirements; Medicare and Medicaid Provider Enrollment Policies, Including for Skilled Nursing Facilities; Conditions of Payment for Suppliers of Durable Medical Equipment, Prosthetics. Orthotics, and Supplies (DMEPOS); and Implementing Requirements for Manufacturers of Certain Single-dose Container or Single-use Package Drugs to Provide Refunds with Respect to Discarded Amounts; 2023.
30 Centers for Medicare and Medicaid Services. Calendar year (CY) 2024 Medicare physician fee schedule final rule. CMS.gov: Centers for Medicare & Medicaid Services; 2023.
31 Medicare Program. CY 2022 Payment Policies Under the Physician Fee Schedule and Other Changes to Part B Payment Policies; Medicare Shared Savings Program Requirements; Provider Enrollment Regulation Updates; and Provider and Supplier Prepayment and Post-Payment Medical Review Requirements. The Federal Register: The Daily Journal of the United States Government. 2019;65154;
32 American Medical Association. CPT evaluation and management (E/M) code and guideline changes. AMA-Assn.org; 2022. Available: ama-assn.org