CE 1.0 ANCC Contact Hours

Addition of Advanced Practice Registered Nurses to the Trauma Team: An Integrative Systematic Review of Literature

Callie C. Crawford, BSN, RN, TCRN

ABSTRACT

The total cost of inpatient care from a traumatic mechanism of injury in the United States between 2001 and 2011 was $240.7 billion. Medical resident work hour reductions mandated in 2011 left a shortage of available in-hospital providers to care for trauma patients. This created gaps in continuity of care, which can lead to costly increased lengths of stay (LOS) and increased medical errors. Adding advanced practice nurses (APNs) specializing in acute or trauma care to the trauma team may help fill this shortage in trauma care providers. The purpose of this integrative systematic review of the literature was to determine whether adding APNs to the admitting trauma team would decrease LOS. A systematic review of primary research in CINAHL and PubMed databases was performed using the following terms: nurse practitioner, advanced practice nurse, trauma team, and length of stay. Included studies examined the effects of adding APNs to trauma teams, were written in English, and were published in 2007–2017. Six studies were included in the final sample, and all were completed at Level I trauma centers in the United States except one from Canada. Combined sample size was 25,083 admitted trauma patients. All 6 studies reported a decrease in LOS ranging from 0.8 to 2.54 days when APNs were added to the trauma team. More research is needed to identify the best utilization of an APN on a trauma team. It is recommended that all trauma centers add APNs to the trauma team to not only decrease admitted trauma patients' LOS but also provide continuity of care, decreasing costs, and minimizing errors.

Key Words

Advanced practice nurse, Length of stay, Outcomes, Systematic review, Trauma team

The total cost of inpatient care from a traumatic mechanism of injury in the United States between 2001 and 2011 was $240.7 billion (DiMaggio et al., 2016). Trauma care is the second leading health care expenditure in the United States and requires major policy considerations related to the care of admitted trauma patients (Newgard & Lowe, 2016). Costs of caring for the injured patient will undoubtedly increase over the next decade (Fakhry, Couillard, Liddy, Adams, & Norcross, 2010). According to the National Trauma Data Bank (NTDB), there were almost 800,000 hospital admissions for patients with a traumatic mechanism of injury (American College of Surgeons [ACS], 2015) in 2015, with an average length of stay (LOS) of 5.1–7.5 days nationwide (DiMaggio et al., 2016). Expensive hospital-based health care is often required by admitted trauma patients; therefore, the longer they remain admitted, the higher the expense (Hemmila et al., 2008). Medical resident work hour reductions instituted by the Accreditation Council for Graduate Medical Education (ACGME) in 2011 left a shortage of available in-hospital providers to care for trauma patients, which may contribute to the increase in LOS for this population of patients. Limited work hours for residents created gaps in continuity of care that could lead to an increased LOS and increased errors due to discontinuity (Peets & Ayas, 2012).

Length of stay for admitted trauma patients can be longer than necessary if advanced medical treatment is not provided immediately or when there is poor collaboration and communication between the multidisciplinary teams caring for the patient (Reeves, Pelone, Harrison, Goldman, & Zwarenstein, 2017). Adding advanced practice nurses (APNs) specializing in acute or trauma care to the trauma team may help fill this shortage in trauma care providers and increase communication between multidisciplinary teams, resulting in continued optimal outcomes for trauma patients and reduced LOS and health care costs.

An advanced practice registered nurse (APRN or APN) is an advanced degreed nurse. Advanced practice registered nurses with a specialty in acute care or trauma care are known as acute care nurse practitioners (ACNPs) or may be referred to as trauma unit-based nurse practitioners

Author Affiliation: JPS Health Network, Grand Prairie, Texas.

The author declares no conflicts of interest.

Correspondence: Callie C. Crawford, BSN, RN, TCRN, 428 Commonwealth Dr, Saginaw, TX 76179 (ccrawford16@att.net).

DOI: 10.1097/JTN.0000000000000439

Copyright © 2019 Society of Trauma Nurses. Unauthorized reproduction of this article is prohibited.

(TUBNPs) or trauma mid-level practitioners (TMLPs). These advanced providers work in a multitude of settings ranging from outpatient clinics to inpatient settings. Inpatient settings include floor units varying from medical–surgical floors to intensive care units (ICUs). Other than providing assessments, treatment plan creations, diagnosing, and prescribing medication, these providers often also hold competencies for interventions such as chest tube insertions, central line placements, airway insertions, and more, depending on the hospital's credentialing and required competencies.

There are no existing practice guidelines regarding the makeup of a trauma team. Each trauma center decides the members who make up their trauma team including whether or not APNs are added. Trauma teams minimally comprise a trauma attending surgeon and trauma surgical residents. Other members who could be on the trauma team include trauma coordinators (registered nurse in the emergency department [ED]), trauma nurse clinicians (registered nurse in a trauma services department), family nurse practitioners for clinic care, ACNPs, and TUBNPs. When the ACGME mandated that medical residents are limited to an 80-hr workweek along with limited night call hours in July 2011 (ACGME, 2010), this significantly impacted all Level I trauma centers because having a surgical residency program is a requirement to be a verified ACS Level I trauma center.

There are several research studies focused on comparing LOS and patient outcomes when care is provided by trauma teams including an APN with those that are physician-led, without an APN. A study completed in 2014 noted trauma patients who received care provided only by a resident and/or an attending surgeon were more likely to have a missed injury than those who received care by a nurse practitioner (Resler, Hackworth, Mayo, & Rouse, 2014). The authors concluded that ACNPs performed more consistent tertiary assessments than physicians. Missed injuries can cause an unexpected patient readmission, which would require at the minimum another ED visit and evaluation. Another study in 2016 identified ICU patients had a lower mortality rate and LOS for patients cared for by ACNPs than by resident-run (RR) teams (Landsperger et al., 2016). A study in 2007 stated that trauma APNs could effectively replace some functions that the senior trauma house staff fulfilled after identifying that the trauma APNs had the same outcomes as their traditional RR team (Haan et al., 2007). Given the number of studies focused on this question and the need to work toward decreasing escalating health care costs in this area, a systematic review of this work will provide trauma centers with the ability to alter or compose their trauma teams based on compiled evidence in order to ensure optimal patient outcomes while focusing on patient throughput and decreasing health care costs.

The purpose of this integrative systematic review of literature was to determine whether adding APNs to the admitting trauma team will decrease the LOS for admitted trauma patients. Limited resident work hours coupled with increasing patient volumes seen in trauma centers throughout the United States mean longer length of time between provider rounding and lack of communication between the multidisciplinary services. Missed communication often leads to unnecessary financial burdens and longer LOSs (Lang et al., 2014). Does the admitted trauma patient have a shorter LOS when being cared for by a trauma team including an APN versus a trauma team without an APN?

METHODS

Search Strategy

A systematic review of CINAHL complete and PubMed was performed. Articles were searched using the following terms: nurse practitioner, acute care nurse practitioner, advanced practice nurse, trauma, trauma team, and length of stay. Inclusion criteria for studies included (1) primary research focused on the effects of adding nurse practitioners to trauma teams; (2) written in English; and (3) published between 2007 and 2017. Exclusion criteria included studies focused on nurse practitioners who solely work in the ED and not as part of the trauma team.

Analysis

An adapted Quality Appraisal Review Checklist and Assessment Criteria tool was used for screening studies (Kmet, Lee, & Cook, 2004). This scoring system assesses the quality of research covering a wide range of study designs. Studies must have received at least 3.5 out of 5 points to be included in the review. Data extracted for analysis from each study were as follows: authors, publication date, purpose of the study, sample and sampling method, design and limitations, methods and tools used, findings/results, and conclusions. All data extracted can be seen in the evidence table (Table 1).

RESULTS

Characteristics of the Studies

The systematic search yielded 38 articles after 13 duplicates were removed. Of these articles, 26 did not meet the inclusion criteria because they did not focus on APNs on a trauma team. Twelve articles met the inclusion criteria based on the title and were further investigated. Two articles focusing on role expansion were excluded. Ten articles were reviewed in their entirety. The full article reviews found three articles not addressing adding APNs to the trauma team and the outcomes on LOS, and one did not meet the quality rating needed for inclusion. Six studies were included in the review and are synthesized and further described in detail in Table 1.

Copyright © 2019 Society of Trauma Nurses. Unauthorized reproduction of this article is prohibited.

TABLE 1 Research Studies Addressing Addition of Nurse Practitioners to the Trauma Team

Author/Pub Date	Purpose/Design	Sample/Setting	Methods/Intervention/Tools	Results	Conclusions/Use	Limitations/QA Rating
Collins et al. (2014)	To decrease LOS and improve throughput by adding experienced ACNPs to the trauma step-down area Mixed method (quantitative + qualitative) descriptive, retrospective	8,284 admitted injured patients over 3 years Vanderbilt University Medical Center (VUMC)	ACNPs added to the trauma step-down unit to coordinate patient care and attend trauma multidisciplinary team rounds and discharge huddle; compared data from 2 years before implementation with year postimplementation for: discharge data collected for LOS data from institution medical software (Medipac), case-mix index extracted from billing data	Average LOS decreased 0.55 days (p = .0239) in the first 6 months; total annual LOS decrease of 0.8 days; 6-month financial decrease of $8,878,000 in hospital charges	Adding ACNPs to the trauma team on the step-down unit decreased the average LOS, resulted in an estimated reduction of $27.8 million in hospital charges	Did not evaluate direct hospital costs and reimbursements (including additional ACNPs for future need) QA: 4.0
Gillard et al. (2011)	Analyze the impact of TMLPs on patient care and resource utilization Quantitative, descriptive, retrospective	2,801 admitted injured patients over a 26-month period (ICU and general care unit) St. Luke's Hospital, Bethlehem, PA	MLPs added to the trauma team to provide care in the ICU, general care unit, outpatient practice, perform simple surgical procedures, and trauma resuscitation; evaluated care pre- and post-MLP implementation	ED dwell time for full team activation decreased by 53 min; ICU and overall hospital LOS decreased by 0.8 days (p = .019) and 0.25 days (p = .092); total reductions by 392.2 hospital days post-TMLP implementation based on 1,585 admissions	TMLPs services resulted in a significant reduction in ICU LOS and overall hospital LOS was decreased; quality of care was maintained, and resources used more efficiently	New nursing practices and guidelines QA: 4.5
Morris et al. (2012)	Identify differences between care provided by a TUBNP and RR service Quantitative, descriptive, retrospective	3,859 admitted injured patients discharged alive during a 44-month period; excluding ICU direct discharges and deaths Hospital of the University of Pennsylvania	Scheduled multidisciplinary rounds held on TUBNP units; care provided by TUBNPs compared with RR service; queried trauma registry for a 44-month period; were cross-referenced with an administrative database	LOS was 0.5 days shorter than the RR service (p = .17); over the study period, this resulted in a decrease of 1,300 patient-days	Care provided by TUBNPs is clinically equivalent; results in decreased LOS	Retrospective database study with possible selection bias; bed availability dictates patient admission unit from the ED QA: 4.75

(continues)

Copyright © 2019 Society of Trauma Nurses. Unauthorized reproduction of this article is prohibited.

TABLE 1 Research Studies Addressing Addition of Nurse Practitioners to the Trauma Team (*Continued*)

Author/Pub Date	Purpose/Design	Sample/Setting	Methods/Intervention/Tools	Results	Conclusions/Use	Limitations/QA Rating
Sherwood et al. (2009)	Recognize that APCs can safely provide trauma care Quantitative, descriptive, retrospective	All 967 admitted injured patients in 2006 compared with similar information in the NTDB LDS Hospital	APCs assumed almost all resident duties 24/7; led trauma resuscitations, completed advanced skills, and maintained the outpatient clinic; NTDB data pulled from directly comparable categories	Decrease LOS for all ISS categories; lower combined mortality rate by ISS category ($p = .0001$)	APC-led trauma care provides outcomes similar to and better than those reported to the NTDB by predominately physician- or RR-led trauma teams	The NTDB contains data with a variety in care delivery models; NTDB composition of trauma centers is unknown QA: 3.5
Sise et al. (2011)	Identify the impact of adding APNs to the newly created dedicated TCU on the quality and cost of care Quantitative, descriptive, retrospective	9,172 admitted injured patients over 4 years; aged 15 years or older Scripps Mercy Hospital	Implemented a medical–surgical unit and a step-down TCU, increased NP coverage from 5 to 7 days per week; review of trauma registry data for age, gender, MOI, ISS, trauma ISS, GCS scores, LOS in the ICU, total hospital LOS for survivors, complications of care and mortality; data from hospital finance records obtained for the total cost of trauma patient care (direct cost calculated including salaries, supplies, fees, utilities, etc.); linked quality to costs (morbidity [no complications] and mortality)	Total hospital LOS decreased by a maximum of 61.7 hr for patients with an ISS ≥15 ($p < .001$); ICU LOS decreased by a maximum of 35.8 hr for patients with an ISS ≥15 ($p < .001$); 14.9% of patients with at least one complication down from 20.8% ($p < .001$); no significant decreases for mortality; median cost of a survivor with ISS ≥15 decreased 30.4% ($p < .001$)	Integrating NPs showed quality of care improved; LOS decreased in the ICU; reduction in complications; cost of care decreased	Reliance on available data and selection bias; trauma registry collection; financial records system evolution; organizational behaviors; cost calculations may not be generalizable QA: 4.5

Note. ACNP = acute care nurse practitioner; APC = advances practice clinician; APN = advanced practice nurse; ED = emergency department; GCS = Glasgow Coma Scale; ICU = intensive care unit; ISS = injury severity score; LOS = length of stay; MLP = mid-level practitioner; MOI = mechanism of injury; NP = nurse practitioner; NTDB = National Trauma Data Bank; RR = resident-run; TCU = trauma care unit; TMLP = trauma mid-level provider; TUBNP = trauma unit-based nurse practitioner.

Copyright © 2019 Society of Trauma Nurses. Unauthorized reproduction of this article is prohibited.

The sample consisted of five quantitative, descriptive, retrospective studies (Collins et al., 2014; Gillard et al., 2011; Morris et al., 2012; Sherwood et al., 2009; Sise et al., 2011). All articles were from trauma centers in the United States except for the systematic review, which was from Canada. Their purposes ranged from improving throughput in the hospital and overall LOS (Collins et al., 2014; Gillard et al., 2011; Sise et al., 2011) to evaluating the quality of care provided by APNs versus RR teams (Morris et al., 2012; Sherwood et al., 2009). All of the studies were conducted in Level I trauma centers (Collins et al., 2014; Gillard et al., 2011; Morris et al., 2012; Sherwood et al., 2009; Sise et al., 2011). Sample sizes ranged from 967 to 9,172 admitted trauma patients, with a total sample size across all studies of 25,083 admitted trauma patients.

Methods varied from adding APNs to the trauma team specifically to a trauma step-down care unit (Collins et al., 2014; Morris et al., 2012; Sise et al., 2011), all inpatient areas (Gillard et al., 2011), and one article had an APN assuming almost all of the resident roles 24/7 including ED trauma resuscitations and advanced skills (Sherwood et al., 2009). Two studies reviewed the financial impact of adding APNs to the admitting trauma team to decrease LOS and hospital costs (Collins et al., 2014; Sise et al., 2011).

Synthesis of Findings Across Studies

Findings across the studies strongly support the addition of APNs to the trauma team to aid in the reduction of admitted trauma patients' LOS. All six studies reported a decrease in LOS, with 40% reporting a reduction of 0.8 days (Collins et al., 2014; Gillard et al., 2011), 25% reporting a decrease of 0.5 days (Morris et al., 2012), and a maximum reported decrease of 2.54 days (Sise et al., 2011) when APNs were present on the trauma team. Forty percent of the studies reported a total summation of reduced hospital days over their study period of more than 390 patient-days (Gillard et al., 2011; Morris et al., 2012). Although all the studies discussed the impact and reduction of LOS, they did not all address complications and mortality of admitted trauma patients cared for by APNs on the trauma team. One of the main limitations of the studies included reliance on trauma registry data collection and the possible selection bias (Morris et al., 2012; Sherwood et al., 2009; Sise et al., 2011). This limitation did not influence the results because the admitted trauma patients' LOS did not require any interpretation of information; it was taken directly from date of admission and date of discharge.

DISCUSSION

Advanced practice nurses in hospital settings are becoming more common for varying reasons. One of these reasons is in response to the ACGME resident duty hour restrictions as evident in the studies. The purpose of this integrative systematic review of literature was to determine whether adding APNs to the admitting trauma team would decrease the LOS for admitted trauma patients. The results are collectively in favor of the addition of APNs to the trauma team to decrease the admitted trauma patient's LOS. Significant reductions in overall hospital LOS and ICU LOS were identified after the addition of APNs to the trauma team.

Decreased LOS correlates to decreased hospital charges. Collins et al. (2014) reported a very significant financial decrease of $8,878,000 in hospital charges during the first 6 months of adding APNs and an estimated reduction of $27.8 million in hospital charges during the 3-year period. Morris et al. (2012) reported a decrease of more than 1,300 hospital patient-days during their study time frame. One hundred percent of the studies on this sample showed that quality of care was maintained and outcomes were clinically equivalent to an RR trauma team. Adding APNs can provide continuity of care and help close the gap caused by resident duty hour restrictions. The admitted trauma patient does have a decrease in LOS when being cared for by a trauma team including an APN versus a trauma team without an APN.

A consistent decrease in LOS was found across studies. This finding is similar to that of Johal and Dodd (2017), who agreed and found that adding APNs to the trauma team not only reduced admitted trauma patient's LOS but also increased patient satisfaction rates, morbidity and mortality remained stable, and an overall improvement in quality and continuity of care was reported. In support of our findings, the study conducted by Lafferty (2011) found adding an APN in the academic setting provided continuity of care as residents often rotate every month or two and attending surgeons can rotate every week or more. These studies reinforce the findings of the research studies included in this sample.

This review is not without limitations. All of the studies were retrospective studies. No randomized controlled trials or quasi-experimental studies were located during the searches. The literature is lacking the inclusion of expenses to hire and train an APN and patient complications such as deep vein thrombosis, pneumonia, urinary tract infections, or other complications as defined by the NTDB.

Nursing Implications

Based on the findings in this integrative systematic review of literature, all trauma centers, especially Level I centers, should add APNs to the trauma team to not only decrease admitted trauma patients LOS but also provide continuity of care. More high-quality research is needed to assess the economic impact and effect on patient outcomes (including mortality, complications, and morbidity) when

Copyright © 2019 Society of Trauma Nurses. Unauthorized reproduction of this article is prohibited.

APNs are added to the trauma team. Functions of the APNs on the trauma team varied across all studies, with the main theme of utilization being in a specific treatment unit. Finally, this review affirms a need for intervention research to identify the best utilization of an APN on a trauma team. Hospital executive team members should consider adding APNs to the trauma team to aid in facilitating communication, decreasing LOS, reducing hospital charges, increasing quality patient outcomes, and increasing patient satisfaction.

REFERENCES

Accreditation Council for Graduate Medical Education (ACGME). (2010). *Common program requirements*. Retrieved from https://www.acgme.org/Portals/0/PDFs/Common_Program_Requirements_07012011%5B2%5D.pdf

American College of Surgeons. (2015). *NTDB annual report 2015*. Retrieved from https://www.facs.org/~/media/files/quality%20programs/trauma/ntdb/ntdb%20annual%20report%202015.ashx

Collins, N., Miller, R., Kapu, A., Martin, R., Morton, M., Forrester, M., ... Wilkinson, L. (2014). 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. *The Journal of Trauma and Acute Care Surgery, 76*, 353–357. doi:10.1097/TA.0000000000000097

DiMaggio, C., Ayoung-Chee, P., Shinseki, M., Wilson, C., Marshall, G., Lee, D. C., & Frangos, S. (2016). Traumatic injury in the United States: In-patient epidemiology 2000–2011. *Injury, 47*, 1393–1403. doi:10.1016/j.injury.2016.04.002

Fakhry, S. M., Couillard, D., Liddy, C. T., Adams, D., & Norcross, E. (2010). Trauma center finances and length of stay: Identifying a profitability inflection point. *Journal of the American College of Surgeons, 210*, 817–821. doi:10.1016/j.jamcollsurg.2010.01.030

Gillard, J. N., Szoke, A., Hoff, W. S., Wainwright, G. A., Stehly, C. D., & Toedter, L. J. (2011). Utilization of PAs and NPs at a level I trauma center: Effects on outcomes. *Journal of the American Academy of Physician Assistants, 24*(7), 34–43.

Haan, J. M., Dutton, R. P., Willis, M., Leone, S., Kramer, M. E., & Scalea, T. M. (2007). Discharge rounds in the 80-hour workweek: Importance of the trauma nurse practitioner. *Journal of Trauma, 63*(2), 339–343.

Hemmila, M. R., Jakubus, J. L., Maggio, P. M., Wahl, W. L., Dimick, J. B., Campbell, D. A., Jr., & Taheri, P. A. (2008). Real money: Complications and hospital costs in trauma patients. *Surgery, 144*(2), 307–316. doi:10.1016/j.surg.2008.05.003

Johal, J., & Dodd, A. (2017). Physician extenders on surgical services: A systematic review. *Canadian Journal of Surgery, 60*, 172–178. doi:10.1503/cjs.001516

Kmet, L. M., Lee, R. C., & Cook, L. S. (2004). *Standard quality assessment criteria for evaluating primary research papers from a variety of fields*. Retrieved from Alberta Heritage Foundation for Medical Research website: http://www.ihe.ca/documents/HTA-FR13.pdf

Lafferty, B. (2011). Trauma nurse practitioners. *Journal of Trauma Nursing, 18*, 115–120. doi:10.1097/JTN.0b013e31821f647f

Landsperger, J. S., Semier, M. W., Li, W., Byrne, D. W., Wheeler, A. P., & Wang, L. (2016). Outcomes of nurse practitioner-delivered critical care: A prospective cohort study. *Chest Journal, 149*(5), 1146–1154. doi:10.1016/j.chest.2015.12.015

Lang, J., Dallow, N., Lang, A., Tetsworth, K., Harvey, K., Pollard, C., & Bellamy, N. (2014). Inclusion of "minor" trauma cases provides a better estimate of the total burden of injury: Queensland Trauma Registry provides a unique perspective. *Injury, 45*(8), 1236–1241. doi:10.1016/j.injury.2014.03.023

Morris, D. S., Reilly, P., Rohrbach, J., Telford, G., Kim, P., & Sims, C. A. (2012). The influence of unit-based nurse practitioners on hospital outcomes and readmission rates for patients with trauma. *The Journal of Trauma and Acute Care Surgery, 73*, 474–478. doi:10.1097/TA.0b013e31825882bb

Newgard, C. D., & Lowe, R. A. (2016). Cost savings in trauma systems: The devil's in the details. *Annals of Emergency Medicine, 67*(1), 68–70. doi:10.1016/j.annemergmed.2015.06.025

Peets, A., & Ayas, N. T. (2012). Restricting resident work hours: The good, the bad, and the ugly. *Critical Care Medicine, 40*(3), 960–966.

Reeves, S., Pelone, F., Harrison, R., Goldman, J., & Zwarenstein, M. (2017). Interprofessional collaboration to improve professional practice and healthcare outcomes. *Cochrane Database of Systematic Reviews, 6*, CD000072. doi:10.1002/14651858.CD000072.pub3

Resler, J., Hackworth, J., Mayo, E., & Rouse, T. M. (2014). Detection of missed injuries in a pediatric trauma center with the addition of acute care pediatric nurse practitioners. *Journal of Trauma Nursing, 21*, 272–275. doi:10.1097/JTN.0000000000000080

Sherwood, K. L., Price, R. R., White, T. W., Stevens, M. H., & Van Boerum, D. H. (2009). A role in trauma care for advanced practice clinicians. *Journal of the American Academy of Physician Assistants, 22*(6), 33–41.

Sise, C. B., Sise, M. J., Kelley, D. M., Walker, S. B., Calvo, R. Y., Shackford, S. R., ... Osler, T. M. (2011). Resource commitment to improve outcomes and increase value at a Level I trauma center. *The Journal of Trauma, 70*(3), 560–568. doi:10.1097/TA.0b013e31820c7b79

For more than 310 additional continuing education articles related to advanced practice nursing topics, go to NursingCenter.com/CE.

Copyright © 2019 Society of Trauma Nurses. Unauthorized reproduction of this article is prohibited.