NCPD 2.0 ANCC Contact Hours

Postinjury Care and Complications Among U.S. Military Women With Combat-Related Major Limb Traumatic Amputation

Judy L. Dye, PhD, APRN, ANP-BC ■ Amber L. Dougherty, MPH ■ Kaeley B. Shannon, MPH ■ Susan L. Eskridge, PhD ■ Michael R. Galarneau, MS, EMT

BACKGROUND: U.S. servicewomen may be at greater risk of injury in future conflicts as they integrate into combat occupations. More than 1,000 servicewomen were wounded during military conflicts in Iraq and Afghanistan. Some women sustained traumatic amputations, and research on their postinjury health is needed.

OBJECTIVE: To describe acute care, complications, and health care utilization among servicewomen with combat-related amputations, comparing them with injured men.

METHODS: In this retrospective matched-pairs study, women were identified from the Expeditionary Medical Encounter Database between 2003 and 2012 and matched with men on amputation injuries, injury severity, and age. Differences were assessed with nonparametric tests for paired data.

RESULTS: Of 20 women identified for analysis, 13 received tourniquets, three were administered procoagulants, and six had massive transfusions. Women averaged 3.4 (*SD* = 1.6) postinjury complications, and the most frequent were heterotopic ossification (*n* = 17), posthemorrhagic anemias (*n* = 13), and bacterial wound infections (*n* = 10). Acute care and complications were similar among men. Women averaged more acute care days (*M* = 49.8, *SD* = 30.6) than men (*M* = 46.1, *SD* = 27.4) but fewer intensive care unit days (women: *M* = 2.6, SD = 4.0; men: *M* = 4.4, *SD* = 8.3). No statistical differences were observed.

CONCLUSION: Postinjury care among servicewomen with combat-related amputations was comparable with servicemen, and complications were common. This information can aid providers and nursing staff in the management of these injuries.

KEY WORDS: Amputations, Complications, Health care utilization, Military, Women

Cite as: Dye, J.L., Dougherty, A.L., Shannon, K.B., Eskridge, S.L., & Galarneau, M.R. (2022). Postinjury care and complications among U.S. military women with combat-related major limb traumatic amputation. *Journal of Trauma Nursing, 29*(2), 57-64. https://doi.org/10.1097/JTN.0000000000000636

The proportion of women serving in the U.S. military is increasing. Currently, women account for approximately 15% of Active Duty and 19% of Selected Reserve forces (U.S. Department of Defense, Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy, 2018), and more than 280,000 deployed in support of the conflicts in Iraq and Afghanistan (U.S. Department of Defense, 2013). Although women were previously restricted from ground combat positions and units, many suffered combat-related injuries due to blurred battle lines (e.g., guerilla warfare) (Dye et al., 2016; Karmark, 2016).

Dates: Submitted October 01, 2021; Revised December 21, 2021; Accepted December 21, 2021.

Author Affiliations: Medical Modeling, Simulation, and Mission Support Department, Naval Health Research Center, San Diego, California (Drs Dye and Eskridge, Mss Dougherty and Shannon, and Mr Galarneau); Leidos, Inc., San Diego, California (Drs Dye and Eskridge and Ms Dougherty); and Axiom, San Diego, California (Ms Shannon).

This work was presented as "Postinjury Care and Complications Among U.S. Military Women with Combat-Related Major Limb Traumatic Amputation" at the TriService Nursing Research Symposium, San Diego, CA, in May 2019.

Judy L. Dye had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

 Report No. 20-43 was supported by the Extremity Trauma and Amputation Center of Excellence under Work Unit No. N1333. The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. government. The study protocol was approved by the Naval Health Research Center Institutional Review Board in compliance with all applicable federal regulations governing the protection of human subjects. Research data were derived from an approved Naval Health Research Center, Institutional Review Board Protocol No. NHRC.2003.0025.

The authors declare no conflicts of interest.

Correspondence: Judy L. Dye, PhD, Medical Modeling, Simulation, and Mission Support Department, Naval Health Research Center, 140 Sylvester Rd, San Diego, CA 92016 (judy.l.dye4.ctr@mail.mil).

KEY POINTS

- Complications among women with combat-related amputations were common but not statistically different from those in men.
- The most common complications after amputations in women were heterotopic ossification, anemia, and bacterial wound infections.
- Women recovering from amputations had more acute care bed days but fewer ICU bed days than men.
- Future studies are warranted to inform military and civilian health care providers on the specific needs of women with combat-related injuries.

Furthermore, in 2013, the Direct Ground Combat Definition and Assignment Rule was rescinded, and all combat positions were subsequently opened to women (Karmark, 2016; U.S. Department of Defense, 2013). Because of these policy and enemy tactics changes, servicewomen may be at a greater risk of combat injury and death than in previous wars as they transition to expanded military roles (Armed Forces Health Surveillance Center, 2012; Dye et al., 2016).

At the time of this study, more than 1,000 women were wounded in action, and 168 died while serving in Iraq and Afghanistan (Defense Casualty Analysis System, n.d.). The majority of those wounded were injured by blasts (Dye et al., 2016). These injuries are often complicated by polytrauma, which presents unique challenges in emergency care (Centers for Disease Control and Prevention, 2013). Research on women with combat-related amputations is sparse, likely because of the small number of women with these injuries. A *Medical Surveillance Monthly Report* (Armed Forces Health Surveillance Center, 2012) counted only 24 servicewomen with deployment-related major limb amputation. Nevertheless, because of the growing number of servicewomen in combat occupations, it may be expected that the number of women with traumatic amputations will increase in future conflicts (Katon & Reiber, 2013).

Studies among women service members and veterans with deployment-related amputations have examined long-term outcomes (Katon & Reiber, 2013; Riviera et al., 2015), but a research gap remains in understanding their immediate outcomes and health care needs. Furthermore, research on sex differences in postamputation acute care and complications is primarily limited to civilians, and findings among civilians with traumatic amputations may not generalize to a military cohort (Edwards et al., 2016). A recent study on upper extremity amputations in civilians found that, although male sex predicted mortality, men and women did not differ in the occurrence of acute major and minor systemic and local complications (Fisher et al., 2018). Another study among civilians found that women with amputations did not differ from men in terms of comorbidities and length of hospital stay but were less likely to be fitted with a prosthetic lower limb than men at discharge (Singh et al., 2008). Previous research has also found that, in general, women civilians and veterans use more health care services than their male counterparts (Bertakis & Azari, 2010; Frayne et al., 2007; Friberg et al., 2016), but little is known about sex differences in postamputation health care utilization. Research on the immediate care and outcomes of servicewomen with combat-related amputations is necessary to obtain clinical knowledge to tailor individualized care and address the specific needs of this group (Randolph et al., 2016).

OBJECTIVE

The objectives of this study were to describe postinjury acute care, complications, and health care utilization among servicewomen with combat-related major limb traumatic amputations and to assess sex differences in these factors using matched-pairs analysis with a group of similarly injured servicemen.

METHODS

Study Sample and Data Sources

This was a retrospective matched-pairs study. The study sample was obtained from the Expeditionary Medical Encounter Database (EMED), maintained by the Naval Health Research Center in San Diego, CA (Galarneau et al., 2007). Data contained in the EMED are extracted from U.S. service members' medical records completed by military providers at treatment facilities in combat theater, close to the point of injury. Injuries are characterized using the Abbreviated Injury Scale (Gennarelli & Wodzin, 2005) and *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes (Commission on Professional Hospital Activities, 1997). Patient records in the EMED are combined with inpatient and outpatient medical information and tactical, operational, personnel, and deployment-related data obtained from other U.S. Department of Defense databases. Combining information from these sources makes a robust clinical picture of each patient available to clinicians and researchers. The study was approved by the institutional review board at the Naval Health Research Center.

The EMED was queried for servicewomen using the Abbreviated Injury Scale traumatic amputation codes for the upper extremities (711000.3, 711001.4, 711002.4, 711012.5, 711003.3, and 711004.2) and lower extremities (811000.3, 811001.4, 811010.5, 811002.4, 811012.5, 811003.3, and 811004.2). Twenty U.S. servicewomen who survived amputations that occurred within 24 hr of a combat-related injury event

during Operation Enduring Freedom or Operation Iraqi Freedom were identified for analysis. Injury dates ranged from 2003 to 2012. To compare acute care, complications, and health care utilization by sex, servicemen in the EMED were matched to women in a 1:1 ratio on Abbreviated Injury Scale amputation codes, age (±1 year), and Injury Severity Score (ISS; ±1 point) (Baker et al., 1974). In the case of a complex injury profile, such as a patient who suffered traumatic amputation in addition to open liver laceration or burns, additional injuries were matched as closely as possible to maintain similar injury profiles between the matched pairs.

Measures

Demographic and Injury-Specific Characteristics

Individual demographics and injury-specific characteristics were obtained from the EMED and included age, service branch (Army, Marine Corps, or Navy), occupation (administration and functional support, infantry, service and supply handlers, or other), military operation (Operation Enduring Freedom or Operation Iraqi Freedom), ISS, injury mechanism, and vehicle mount status (mounted or dismounted). The number of deployments and the number of days deployed were collected from the Defense Enrollment Eligibility Reporting System.

Acute Care

Postinjury acute care information was obtained from medical records review and included tourniquet use between the point of injury and the initial treatment facility in combat theater, procoagulant agent (i.e., tranexamic acid or factor VIIa) administration, and massive transfusion at a treatment facility in combat theater. These variables were categorized as "yes" or "no/unknown."

Complications

Medical complications that occurred within 30 days after injury were identified via *ICD-9-CM* codes from the Military Health System Data Repository and grouped into cerebrovascular, pulmonary, hematological, genitourinary, gastrointestinal, musculoskeletal, and integumentary complications. Heterotopic ossification, specifically, was confirmed by radiology reports and documented if occurring within 1 year after injury in both groups. Patient medical records were reviewed by registered nurses to confirm these complications, and any additional complications identified in the medical records review were added to the patient's clinical profile and included in the analysis. Complications were categorized as "yes" or "no/unknown."

Health Care Utilization

Health care utilization variables included hospitalizations, intensive care unit (ICU) bed days, acute care bed days, and outpatient physical therapy visits. Data for hospitalizations, ICU bed days, and acute care bed days were collected from the Standard Inpatient Data Record in the Military Health System Data Repository during the first year postinjury. Outpatient physical therapy visits were assessed using the Standard Ambulatory Data Record and Comprehensive Ambulatory and Professional Encounter Record in the Military Health System Data Repository. These visits were identified by a Medical Expense Performance Reporting System code for physical therapy clinic services used during the first year postinjury.

Statistical Analysis

Absolute numbers and percentages were calculated for categorical variables. Distributions of amputations by anatomical location were not calculated to maintain patient confidentiality. Means, standard deviations, medians, and ranges were calculated for continuous variables. Categorical variables were compared across the matched pairs using the McNemar test or McNemar–Bowker test, and continuous variables were assessed with the Wilcoxon signed-rank test. An α level of .05 was used to determine statistical significance. All analyses were completed using SAS Version 9.4 (SAS Institute, Cary, NC).

RESULTS

The study sample included 40 service members (20 women and 20 men) matched on ISS (M = 16.0, SD = 6.3), age (M = 26.0, SD = 5.4), and major limb traumatic amputations that occurred in the immediate 24-hr postinjury period. All amputations were caused by a combat blast-related event. There were 46 amputations, 23 in each sex, as three members in each group suffered bilateral amputations. Thirty-eight of 46 amputations (85%) were to the lower extremities.

The study sample's demographic and injury-specific characteristics are shown by sex in Table 1. All of the injured women served in the Army and were in primarily administrative (n = 6) or service and supply positions (n = 7), whereas men were distributed in the Army (n = 12), Marine Corps (n = 7), and Navy (n = 1), and most served in infantry positions (n = 12). Most women were injured in Operation Iraqi Freedom (n = 15), whereas men were more evenly distributed between Operation Enduring Freedom (n = 9) and Operation Iraqi Freedom (n = 11). The average number of days deployed was lower in women (M = 307.2, SD = 181.5) than in men (M = 380.1, SD = 217.1). Nearly half of all women and men were dismounted at the time of injury. There were no statistically significant differences between the sexes on any demographic or injury-specific variables ($ps > .05$).

Table 1. Demographic and Injury Characteristics by Sex

Characteristic	Women ($n = 20$)		Men ($n = 20$)		p[a]
	n (%) or M (SD)	Median (Range)	n (%) or M (SD)	Median (Range)	
Age, years[b]	26.1 (5.1)	25.0 (18–36)	26.0 (5.8)	25.0 (18–42)	–
Service branch[c]					–
Army	20 (100)		12 (60)		
Marine Corps	0		7 (35)		
Navy	0		1 (5)		
Occupation					.13
Administration/functional support	6 (30)		0		
Infantry	0		12 (60)		
Service/supply handlers	7 (35)		2 (10)		
Other	7 (35)		6 (35)		
Operation Iraqi Freedom[d]	15 (75)		11 (55)		.29
Deployments	1.5 (0.6)	1.0 (1–3)	2.1 (1.3)	2.0 (1–7)	.19
Days deployed	307.2 (181.5)	284.0 (70–734)	380.1 (217.1)	360.5 (51–761)	.33
Injury Severity Score[b]	15.7 (5.9)	16.5 (4–33)	16.3 (6.8)	17.0 (4–38)	–
Dismount injury	9 (45)		9 (45)		1.00

[a] p values for paired differences were calculated using the McNemar–Bowker test (occupation), the McNemar test (military operation [Operation Iraqi Freedom], dismount injury), and the Wilcoxon signed-rank test (deployments, days deployed.

[b] Variables used for matching.

[c] p value could not be calculated because there were less than two nonmissing levels.

[d] Military operation during which amputation occurred.

Acute Care

For acute care provided in combat theater, fewer women than men had tourniquets ($n = 13$ vs. $n = 16$), procoagulant agents ($n = 3$ vs. $n = 5$), and massive transfusion ($n = 6$ vs. $n = 8$), but differences were not statistically significant in paired analyses (ps $> .05$).

Complications

Overall, the average number of postamputation complications was 3.4 for women ($SD = 1.6$) and 3.3 for men ($SD = 1.9$). As shown in Table 2, the most common complications among women were heterotopic ossification ($n = 17$), posthemorrhagic anemias ($n = 13$), and bacterial wound infections ($n = 10$). These were also the most frequent complications among men. There were no sex differences in complications in paired analyses (ps $> .05$).

Health Care Utilization

As shown in Table 3, in the first year postinjury, women had a slightly higher mean number of acute care bed days ($M = 49.8$, $SD = 30.6$) than men ($M = 46.1$, $SD = 27.4$) but fewer ICU bed days (women: $M = 2.6$, $SD = 4.0$; men: $M = 4.4$, $SD = 8.3$). Both groups averaged approximately three hospitalizations during the study period. Within 1 year after injury, women ($M = 170.2$, $SD = 121.3$) averaged a higher number of outpatient physical therapy visits than men ($M = 138.0$, $SD = 71.7$). Overall, differences in health care utilization variables by sex were not statistically significant in paired analyses (ps $> .05$).

DISCUSSION

This study is one of the first to examine acute care, complications, and health care utilization of servicewomen with combat-related major limb traumatic amputations and to compare these characteristics with servicemen. The primary findings of this study were that postamputation complications among servicewomen were common but comparable with men in matched-pairs analysis. In addition, servicewomen and servicemen did not statistically differ in postamputation acute care or health care utilization measures.

Clinical records completed in combat theater provided information on some acute care and resuscitation measures, such as tourniquet use and procoagulant agent administration. The distribution of these initial treatment measures is similar to findings from a study by Godfrey et al. (2017) on mostly male service members with deployment-related traumatic amputations in the Joint Theater Trauma Registry. Although men and

Table 2. Postamputation Complications by Sex

Complication	*ICD-9-CM* Code	Women ($n = 20$), *n* (%)	Men ($n = 20$), *n* (%)	*p*[a]
Cerebrovascular				
Stroke[b]	430, 434	1 (5)	0	–
Deep vein thrombosis	453.40, 451.83	2 (10)	1 (5)	1.00
Pulmonary				
Pneumonia	486, 482	2 (10)	1 (5)	1.00
Pleural effusion/atelectasis	511.9, 518.0	4 (20)	4 (20)	1.00
Pulmonary embolus	415.1	1 (5)	1 (5)	1.00
Hematological				
Anemias (posthemorrhagic)	285.1	13 (65)	16 (80)	.45
Bacteremia	790.7, 038, 995.92	3 (15)	1 (5)	.63
Coagulopathy	286	4 (20)	2 (10)	.69
Genitourinary				
Acute renal failure	584, 586, 958.5	1 (5)	3 (15)	.50
Urinary tract infection[b]	599.0	2 (10)	0	–
Gastrointestinal				
Ileus[b]	560.1	0	2 (10)	–
Musculoskeletal				
Rhabdomyolysis[b]	728.88	0	3 (15)	–
Compartment syndrome	958.9	5 (25)	1 (5)	.13
Nonunion of fracture[b]	733.8	1 (5)	0	–
Heterotopic ossification	728.13	17 (85)	16 (80)	1.00
Integumentary				
Bacterial wound infection	041.9, 998.5, 958.3	10 (50)	10 (50)	1.00
Fungal wound infection[b]	998.5, 958.3	0	1 (5)	–
Nonhealing wound[b]	998.83, 997.69	0	1 (5)	–
Pressure ulcer	707.00	1 (5)	1 (5)	1.00
Acinetobacter (+swab)	041.85	2 (10)	2 (10)	1.00

Note. ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification.

[a]*p* values for paired differences were calculated using the McNemar test.

[b]*p* values could not be calculated because there were less than two nonmissing levels.

Table 3. Health Care Utilization by Sex

	Women ($n = 20$)		Men ($n = 20$)		
Variable	*M* (SD)	Median (Range)	*M* (SD)	Median (Range)	*p*[a]
Hospitalizations	3.1 (1.2)	3.0 (2–7)	3.5 (1.8)	3.0 (2–8)	.19
ICU bed days	2.6 (4.0)	1.0 (0–13)	4.4 (8.3)	0.5 (0–25)	.46
Acute care bed days	49.8 (30.6)	40.5 (11–110)	46.1 (27.4)	38.0 (11–110)	.70
Physical therapy visits	170.2 (121.3)	145.5 (0–433)	138.0 (71.7)	128.5 (6–284)	.17

Note. ICU = intensive care unit.

[a]*p* values for paired differences were calculated using the Wilcoxon signed-rank test.

women did not differ on these variables in the present study, there are other treatments not included in the analyses (e.g., types of blood products), and studies on differences regarding additional acute care and resuscitation measures may be warranted.

With the exception of one study that found no differences in heterotopic ossification between military women and men (Potter et al., 2007), the present study was novel in comparing complications after combat-related amputations by sex. No additional research on sex differences in military service members with combat-related amputation was available for comparison at the time of this study, and comparable literature among civilians with traumatic amputation is limited. Our findings are consistent with those of one study in civilians that found no differences between women and men in postamputation complications following upper extremity amputation (Fisher et al., 2018).

The greatest number of complications among women occurred in the form of heterotopic ossification at the amputation site. Previous research has shown that heterotopic ossification is more common among military populations than in civilians (Matsumoto et al., 2014). Clinician review of radiology reports confirmed that 85% of women in the present study developed heterotopic ossification within 1 year postinjury, which is higher than two previous military studies (Melcer et al., 2011; Potter et al., 2007). Melcer et al. (2011) identified heterotopic ossification in 60% of servicemen with combat-related amputation using radiology reports, which corroborated an earlier study by Potter et al. (2007) that found it in 63% of service members with amputations using medical records and radiographs. Both studies used a follow-up period of at least 12 months. The higher proportion of heterotopic ossification in the present analysis may be due to the relatively small sample size of women with combat-related major limb traumatic amputations.

Studies on civilians have reported postamputation wound infections and sepsis among the highest postamputation complications (Belmont et al., 2011; Low et al., 2017). This is highlighted by a previous study utilizing National Surgical Quality Improvement Program data that found wound infection rates of approximately 9% in patients undergoing below-the-knee amputations (Belmont et al., 2011). Bacterial wound infections were much more common in the present study, occurring among 50% of women. These dissimilar findings are not surprising considering that traumatic amputations occurring in combat may be more prone to infection because of the contaminated nature of wounds from the battlefield. Notably, wound infection rates in the present study compared closely with a recent study by Stewart et al. (2019), which investigated factors that may predict infections in extremity wounds incurred in combat. In their study, which comprised servicemen with combat-related traumatic amputations, Stewart et al. found that 47% had a wound infection during their initial hospitalization period.

Comprehensive rehabilitative care is essential for servicewomen and servicemen to optimize outcomes following traumatic limb amputation (Rivera & Pasquina, 2016), ideally using an interdisciplinary approach to individualize care (Parnell & Urton, 2021). Previous research in civilians and veterans demonstrates higher utilization of medical care, especially in women compared with men (Bertakis & Azari, 2010; Frayne et al., 2007; Friberg et al., 2016). In the present study, there were no differences between servicewomen and servicemen in bed days in the first year postinjury. Overall, women averaged nearly three more physical therapy visits per month than men, but the matched-pairs analysis difference was not statistically significant. It is important to note that military service members have full access to comprehensive rehabilitation after injury (Rivera & Pasquina, 2016). The relative equal use of postamputation outpatient physical therapy services in the present study may be due to fewer barriers to care in military than civilian health care systems. Future studies are warranted to investigate sex differences in the type of health care delivered, as well as outcomes occurring after 1 year, including postamputation pain, physical functioning and activity levels, prosthetic use, and dissimilarities in issues that may arise for women and men when returning to the civilian workforce.

The results of this study demonstrate that postamputation complications among servicewomen were common, particularly heterotopic ossification, posthemorrhagic anemias, and bacterial wound infections. For any member with severe traumatic injuries, continued quality care and health promotion are essential for long-term management. Within women veteran groups, health disparities such as smoking and mental health disorders have also been noted (Lehavot et al., 2012). These are added concerns when promoting healthy behaviors in a population with severe trauma and will need lifetime treatment as they enter veteran and civilian health care systems. Patient outcomes can be optimized by engaging service members who sustained amputations in self-care to meet physical and psychosocial needs early in the rehabilitative process (Schreiber, 2017).

LIMITATIONS

There are limitations that warrant mention. First, the total number of servicewomen with combat-related amputations from Operation Enduring Freedom and Operation Iraqi Freedom is low, which yielded a small sample size. We used a matched-pairs

design to mitigate the effects of this limitation. Second, the use of *ICD-9-CM* codes to identify postamputation complications may not elucidate important clinical subgroups (Al-Rawajfah et al., 2015). Finally, documentation in a combat environment may be incomplete due to the high operational tempo and need to provide immediate, lifesaving care. As such, some data points from the point of injury and military facilities in combat theater may be underreported, but we expect this would be nondifferential between the groups.

CONCLUSIONS

In this study, postamputation care and complications among servicewomen were comparable with those in servicemen. The findings highlight that servicewomen with combat-related amputations frequently experienced postinjury complications. This information will be useful in managing these injuries in military health care settings and civilian facilities in the continuum of care. Although it is encouraging to identify little or no differences between the sexes in postamputation care and complications, it is important to continue to examine the specific health care needs of injured military women as future conflicts will see greater numbers serving in combat occupations.

Acknowledgments

This work was supported by the Extremity Trauma and Amputation Center of Excellence under Work Unit No. N1333. The authors thank Patricia Saucedo and Melanie Adams for their assistance with injury coding, medical records review, and quality assurance.

Orcid iDs

Judy L. Dye https//orcid.org/0000-0001-6754-8001
Amber L. Dougherty https//orcid.org/0000-0002-1395-1142
Susan L. Eskridge https//orcid.org/0000-0002-1817-8355
Michael R. Galarneau https//orcid.org/0000-0002-7567-3395

REFERENCES

Al-Rawajfah, O. M., Aloush, S., & Hewitt, J. B. (2015). Use of electronic health-related datasets in nursing and health-related research. *Western Journal of Nursing Research*, *37*(7), 952–983. https://doi.org//10.1177/0193945914558426

Armed Forces Health Surveillance Center. (2012). Surveillance snapshot: Traumatic amputations among female service members, active and reserve components, U.S. Armed Forces, 2000–2011. *Medical Surveillance Monthly Report*, *19*(7), 23.

Baker, S. P., O'Neil, B., Haddon, W., & Long, W. B. (1974). The Injury Severity Score: A method for describing patients with multiple injuries and evaluating emergency care. *The Journal of Trauma*, *14*(3), 187–196.

Belmont, P. J. Jr., Davey, S., Orr, J. D., Ochoa, L. M., Bader, J. O., & Schoenfeld, A. J. (2011). Risk factors for 30-day postoperative complications and mortality after below-knee amputation: A study of 2,911 patients from the National Surgical Quality Improvement Program. *Journal of the American College of Surgeons*, *213*(3), 370–378. https://doi.org//10.1016/j.jamcollsurg.2011.05.019

Bertakis, K. D., & Azari, R. (2010). Patient gender differences in the prediction of medical expenditures. *Journal of Women's Health (Larchmont)*, *19*(10), 1925–1932. https://doi.org/10.1089/jwh.2009.1448

Centers for Disease Control and Prevention. (2013, March 13). *Explosions and blast injuries: A primer for clinicians*. Retrieved August 14, 2019, from https://stacks.cdc.gov/view/cdc/28987

Commission on Professional Hospital Activities. (1997). *International Classification of Diseases, 9th Revision, Clinical Modification*. Edwards Brothers.

Defense Casualty Analysis System. (n.d.). *Conflict casualties*. Retrieved from May 22, 2018, https://dcas.dmdc.osd.mil/dcas/pages/casualties.xhtml

Dye, J. L., Eskridge, S. L., Tepe, V., Clouser, M. C., & Galarneau, M. R. (2016). Characterization and comparison of combat-related injuries in women during OIF and OEF. *Military Medicine*, *181*(1, Suppl.), 92–98. https://doi.org/10.7205/MILMED-D-15-00237

Edwards, D. S., Guthrie, H. C., Yousaf, S., Cranley, M., Rogers, B. A., & Clasper, J. C. (2016). Trauma-related amputations in war and at a civilian major trauma center—comparison of care, outcome, and the challenges ahead. *Injury*, *47*, 1806–1810. https://doi.org/10.1016/j.injury.2016.05.029

Fisher, T. F., Kusnezov, N. A., Bader, J. A., & Blair, J. A. (2018). Predictors of acute complications following traumatic upper extremity amputation. *JSOA Journal of Surgical Orthopaedic Advances*, *27*(2), 113–118.

Frayne, S. M., Yu, W., Yano, E. M., Ananth, L., Samina, I., Thrailkill, A., & Phibbs, C. S. (2007). Gender and use of care: Planning for tomorrow's Veterans Health Administration. *Journal of Women's Health (Larchmont)*, *16*(8), 1188–1199. https://doi.org/10.1089/jwh.2006.0205

Friberg, I. O., Krantz, G., Määttä, S., & Järbrink, K. (2016). Sex differences in health care consumption in Sweden: A register-based cross-sectional study. *Scandinavian Journal of Public Health*, *44*, 264–273. https://doi.org/10.1177/1403494815618843

Galarneau, M. R., Hancock, W. C., Konoske, P., Melcer, T., Vickers, R. R., Walker, G. J., & Zouris, J. M. (2006). The Navy-Marine Corps Combat Trauma Registry. *Military Medicine*, *171*(8), 691–697. https://doi.org/10.7205/milmed.171.8.691

Gennarelli, T., & Wodzin, E. (2005). *The Abbreviated Injury Scale—2005*. Association for the Advancement of Automotive Medicine.

Godfrey, B. W., Martin, A., Chestovich, P. J., Lee, G. H., Inalls, N. K., & Saldanha, V. (2017). Patients with multiple traumatic amputations: An analysis of Operation Enduring Freedom Joint Theater Trauma Registry data. *Injury*, *48*, 75–79. https://doi.org/10.1016/j.injury.2016.08.008

Karmark, K. N. (2016, December 13). *Women in combat: Issues for Congress*. Retrieved April 20, 2018, from https://fas.org/sgp/crs/natsec/R42075.pdf

Katon, J. G., & Reiber, G. E. (2013). Major traumatic limb loss among women veterans and servicemembers. *Journal of Rehabilitation Research & Development JRDD*, *50*(2), 173–182. https://doi.org/10.1682/jrrd.2012.01.0007

Lehavot, K., Hoerster, K. D., Nelson, K. M., Jakupcak, M., & Simpson, T. L. (2012). Health indicators for military, veteran, and civilian women. *American Journal of Preventive Medicine*, *42*(5), 473–480. https://doi.org/10.1016/j.amepre.2012.01.006

Low, E. E., Inkellis, E., & Morshed, S. (2017). Complications and revision amputation following trauma-related lower limb loss. *Injury*, *48*, 364–370. https://doi.org/10.1016/j.injury.2016.11.019

Matsumoto, M. E., Mohammed, K., Jayabalan, P., Ziebarth, J., & Munin, M. C. (2014). Heterotopic ossification in civilians with

lower limb amputations *Archives of Physical Medicine and Rehabilitation*, *95*, 1710–1713. https://doi.org/10.1016/j.apmr.2014.03.010

Melcer, T., Belnap, B., Walker, G. J., Konoske, P., & Galarneau, M. (2011). Heterotopic ossification in combat amputees from Afghanistan and Iraq wars: Five case histories and results from a small series of patients. *Journal of Rehabilitation Research & Development JRDD*, *48*(1), 1–12. https://doi.org/10.1682/jrrd.2010.03.0033

Parnell, B., & Urton, M. (2021). Rehabilitation nursing challenges for patients with lower limb amputation. *Rehabilitation Nursing*, *46*(3), 179–184. https://doi.org/10.1097/rnj.0000000000000289

Potter, B. K., Burns, T. C., Lacap, A. P., Granville, R. R., & Gajewski, D. A. (2007). Heterotopic ossification following traumatic and combat-related amputations: Prevalence, risk factors, and preliminary results of excision. *The Journal of Bone & Joint Surgery. American Volume*, *89*(3), 476–486. https://doi.org/10.2106/JBJS.F.00412

Randolph, B. J., Nelson, L. M., & Highsmith, M. J. (2016). A review of unique considerations for female veterans with amputations. *Military Medicine*, *181*, 66–68. https://doi.org/10.7205/MILMED-D-16-00262

Riviera, J. C., Krueger, C. A., & Johnson, A. E. (2015). Female combat amputees have higher rates of posttraumatic stress disorder disability. US Army Medical Department Journal, Apr-Jun, 74-79.

Rivera, J. C., & Pasquina, P. F. (2016). Comprehensive rehabilitation following combat extremity trauma: Evolution and its impact on outcomes. *JOT Journal of Orthopaedic Trauma*, *30*(Suppl. 3), S31–S33. https://doi.org/10.1097/BOT.0000000000000672

Schreiber, M. L. (2017). Lower limb amputation: Postoperative nursing care and considerations. *MedSurg Nursing*, *26*(4), 274–277.

Singh, R., Hunter, J., Philip, A., & Tyson, S. (2008). Gender differences in amputation outcome. *Disability and Rehabilitation*, *30*(2), 122–125. https://doi.org/10.1080/09638280701254095

Stewart, L., Shaikh, F., Bradley, W., Lu, D., Blyth, D. M., Petfield, J. L., Whitman, T. J., Krauss, M., Greenberg, L., & Tribble, D. R. (2019). Combat-related extremity wounds: Injury factors predicting early onset infections. *Military Medicine*, *184*(Suppl. 1), 83–91. https://doi.org/10.1093/milmed/usy336

U.S. Department of Defense. (2013, January 23). *Defense Department rescinds direct combat exclusion rule; Services to expand integration of women in previous restricted occupations and units.* Retrieved April 24, 2018, from http://archive.defense.gov/releases/release.aspx?releaseid=15784

U.S. Department of Defense, Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy. (2018). *2018 demographics reports: Profile of the military community.* Retrieved July 16, 2020, from https://download.militaryonesource.mil/12038/MOS/Reports/2018-demographics-report.pdf

Lippincott® NursingCenter®

NCPD Nursing Continuing Professional Development

TEST INSTRUCTIONS

- Read the article. The test for this nursing continuing professional development (NCPD) activity is to be taken online at **www.NursingCenter.com/CE/JTN**. Tests can no longer be mailed or faxed.
- You'll need to create an account (it's free!) and log in to access My Planner before taking online tests. Your planner will keep track of all your Lippincott Professional Development online NCPD activities for you.
- There's only one correct answer for each question. A passing score for this test is 7 correct answers. If you pass, you can print your certificate of earned contact hours and access the answer key. If you fail, you have the option of taking the test again at no additional cost.
- For questions, contact Lippincott Professional Development: 1-800-787-8985.
- Registration deadline is December 6, 2024.

PROVIDER ACCREDITATION

Lippincott Professional Development will award 2.0 contact hours for this nursing continuing professional development activity.

Lippincott Professional Development is accredited as a provider of nursing continuing professional development by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 2.0 contact hours. Lippincott Professional Development is also an approved provider of continuing nursing education by the District of Columbia, Georgia, and Florida, CE Broker #50-1223. Your certificate is valid in all states.

Payment: The registration fee for this test is FREE for STN members and $21.95 for nonmembers.

STN members can take JTN CE for free using the discount code available in the members-only section of the STN website. Use the discount code when payment is requested during the check-out process.

DOI: 10.1097/JTN.0000000000000644