10-5-2024

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ABSTRACT

Introduction:

Physical therapy (PT) is recommended as a primary treatment for low back pain (LBP), a common and impactful musculoskeletal condition after limb loss. The purpose of this brief report is to report the duration and cost of PT care, and subsequent escalation of care events, for LBP in service members with and without limb loss.

Materials and Methods:

This was a retrospective cohort, descriptive study. Service members with and without limb loss (matched) who received PT for LBP at a military treatment facility from 2015 to 2017 were included. Duration of PT care, number of PT visits, and escalation of care events 1 year after PT were extracted from medical records. Escalation of care events was identified as epidural steroid injections, referrals to specialists (e.g., orthopedists, spine surgeons, and pain management), and LBP-related hospitalizations.

LBP-related PT encounters were queried; duration of care, number of visits, and cost of care were quantified. Escalation of care events, including opioid prescription, epidural steroid injections, specialty referrals, and hospitalizations, were identified up to 1 year after PT care.

Results:

The average course of PT care for LBP was 12.9 more visits, 48.7 days longer, and $764.50 more expensive in service members with limb loss ($n = 16$) vs. those without limb loss ($n = 48$). Higher rates of opioid prescriptions and specialty referrals were observed in service members with limb loss.

Conclusions:

This study suggests that service members with limb loss and LBP received higher quantities and longer durations of PT than those without limb loss, yielding a nearly 4 times higher cost of PT.

INTRODUCTION

Caring for young service members with limb loss throughout their lifespan requires tremendous resources from the Military Health System (MHS)—i.e., an estimated lifetime cost exceeding $1.5 million for each service member with limb loss.[1,2] Secondary conditions, like low back pain (LBP),[3–6] can adversely affect long-term outcomes after limb loss,[5,7–9] which is particularly concerning for service members who are generally young at the time of limb loss. Among persons with limb loss, annual prevalence rates for LBP can reach 90%,[3,4] and nearly half of persons with limb loss have reported LBP as "more bothersome" than either residual or phantom limb pain.[10] Moreover, LBP is the condition most contributing to a reduced quality of life among veterans who had sustained traumatic limb loss more than 20 years prior.[7] Physical therapy is recommended by clinical practice guidelines (CPGs) as the primary strategy for LBP.[11–15] Despite recommendations for PT to address LBP, pharmacological interventions, surgery, and injections are still utilized.

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doi:https://doi.org/10.1093/milmed/usae455

Opioids can provide interim relief of LBP and improve sleep; however, short-term side effects include nausea, dizziness, vomiting, constipation, and dry mouth.[16–18] However, the long-term side effects of opioids, such as risk for overdose, abuse, and addiction, cannot be ignored. Additionally, veterans with LBP whose treatment starts with a prescription of opioids (compared to PT) are more likely to have subsequent spinal surgery and become chronic opioid users.[19] Surgical procedures such as radiofrequency ablation, laminectomy, and spinal decompression surgeries can provide short-term pain relief, while long-term effects are unknown.[20,21] The utilization of PT early in the treatment of LBP can decrease the probability of opioid prescription,[22] risk for long-term opioid use,[23] and reduce the probability of imaging services, emergency department visits, and cost of medical care.[22]

The MHS recommends nonopioid medications and nonpharmacological treatments as the primary interventions for service members with acute LBP.[24] Service members who receive nonpharmacological treatments for LBP tend to have lower odds of duty limitations, hospitalization, and opioid prescription, whereas those who were prescribed opioids had negative outcomes.[25] Some patients with LBP receive interventions with little to no relief, leading to suboptimal outcomes and inefficient use of MHS resources.[26]

One-year post-injury, service members with limb loss utilize PT at a higher rate than civilian counterparts (111–129 vs. 34 visits 1-year post-injury),[27] which could lead to more expensive care. It is plausible that service members with limb loss and LBP receive PT interventions with little to no pain relief resulting in long-term health care utilization, leading to suboptimal outcomes and inefficient use of MHS resources.[26] This may result in many patients with LBP requiring continued long-term symptom management. Receiving PT early for LBP reduces the probability of imaging services, emergency department visits, and cost of care.[22] The purpose of this study was to report the duration and cost of PT care and associated escalation of care events (i.e., opioid prescription, spinal injection, referral to specialist, and hospitalization) for LBP in service members with and without lower limb loss.

MATERIALS AND METHODS

A retrospective cohort, descriptive study was conducted on service members who received PT for LBP at the Naval Medical Center San Diego or Walter Reed National Military Medical Center from January 1, 2015 to January 1, 2018. Service members with lower limb loss were identified through the Extremity Trauma and Amputation Center of Excellence Registry and the Military Data Repository and were matched at a 1 to 3 ratio to a representative cohort of service members without lower limb loss based on age, gender, body mass index, and care location.

LBP diagnoses were identified through the International Classification of Disease, 10th Revision (ICD-10) codes. The date of the first PT evaluation was defined as the index date. From the index visit, a 12-month period before the index visit and a 12-month follow-up period were queried. PT encounters related to LBP were identified using the Medical Expense and Performance Reporting System (MEPRS) and Current Procedural Technology (CPT) codes. MEPRS codes identified the care provider (e.g., PT, primary care, and orthopedics), and CPT codes identified PT evaluations and interventions. Duration of care was defined as the number of days between the index and final PT visit. The final PT visit was determined if no follow-up visits were identified for at least 45 days. The total number of PT visits was then quantified between the index and final PT visits. Cost of PT care was calculated using payment rates for all CPT codes used based on the maximum allowable charge rates for Medicare data or TRICARE claims published in the Civilian Health and Medical Program of Uniformed Services system.[28]

Opioid prescription was queried using the Pharmacy Data Transaction Service (PDTS) and identified by the American Hospital Formulary System therapeutic class codes 280808 and 280812. One-year escalation of care events was identified as epidural steroid injections, referrals to specialists (e.g., orthopedists, spine surgeons, and pain management), and LBP-related hospitalizations. The medical resource utilization data was identified and categorized using MEPRS codes, CPT codes, and Healthcare Common Procedure Coding System, along with LBP ICD-10 codes.

Descriptive characteristics, including means, SDs, median, and interquartile range, were calculated for patient demographics and medical management domains. Wilcoxon tests were used to assess differences in number of PT visits, duration of PT care, cost of PT care, opioid prescriptions, spinal injections, spinal surgery, referral to specialists, and LBP-related hospitalizations between service members seen for LBP with and without limb loss. All tests were two-sided ($\alpha = 0.05$). No modeling was conducted due to the very small sample sizes.

RESULTS

The two groups, service members with unilateral lower limb loss and LBP wand service members with LBP but without limb loss, did not significantly differ in age, sex, height, weight, or body mass index (**Table 1**; $P > .05$). At the index visit, service members with lower limb loss were 5.5 ± 3.3 years from traumatic injury. Most service members had below-knee (50%) or above-knee (44%) limb loss, and 6% had concurrent lower and upper extremity involvement. The average course of PT care for patients with LBP and limb loss was 12.9 more visits, 48.7 days longer, and $764.50 more expensive than patients with LBP but without limb loss (**Table 2**).

During the 12 months before the index visit, higher rates of opioid prescriptions (63% vs. 42%) and specialty referrals (44% vs. 29%) were observed in service members with vs. without limb loss (Figure 1). The percentage of service members with opioid prescriptions during the 12-month period

Table 1. Participant Demographics by Group

	Participants without limb loss ($N = 48$)	**Participants with limb loss ($N = 16$)**
Age (years)	32.8 ± 5.3	32.8 ± 5.5
Sex (male, %)	100%	100%
Stature (cm)	176.8 ± 7.9	174.2 ± 4.8
Body mass (kg)	84.0 ± 8.5	80.5 ± 5.6
Body mass index (kg/m^2)	26.8 ± 1.8	26.4 ± 2.7

Means and SDs are provided for each variable.

Table 2. Physical Therapy Care for Low Back Pain by Group

	Control (participants without limb loss) ($N = 48$)	**Participants with limb loss ($N = 16$)**
Number of physical therapy visits		
Mean ± SD	6.5 ± 2.1	19.4 ± 3.6
Median (IQR)	4.0 (2.0–8.5)	7.5 (1.5–30.0)
Duration of physical therapy care (days)		
Mean ± SD	70.4 ± 12.5	119.1 ± 21
Median (IQR)	44.5 (25.5–87.5)	93.0 (40.0–179.5)
Cost of physical therapy care ($)		
Mean ± SD	262.4 ± 351.6	1026.9 ± 1353.5
Median (IQR)	157.0 (71.9–298.7)	449.1 (122.9–1455.8)

IQR = interquartile range.

after PT care remained the same for those with limb loss, whereas a slight increase (+6%) was observed in service members without limb loss (Figure 1). During the 12-month follow-up period, the percentage of service members with specialty care referrals for LBP was lower in both groups (−7%; Figure 1). A small percentage of service members in either group received spinal injections before PT care, but after PT care, these percentages increased slightly (+6–7%; Figure 1). Before receiving PT, a small percentage of service members had LBP-related hospitalizations; after receiving PT, this increased slightly (+4%) for service members with lower limb loss yet remained the same for service members without limb loss (Figure 1).

DISCUSSION

The findings of the study suggest that service members with lower limb loss and LBP receive higher quantities and longer durations of PT care than their counterparts without limb loss. However, it is unclear if LBP improved as a result of PT, since symptom intensity and frequency were not assessed in this study. Differences in PT utilization translated to a nearly 4 times higher cost of PT care for LBP in those with lower limb loss. The total cost of LBP-related care can be 60% lower when LBP care is provided in adherence with CPGs.[29] In a recent study of service members with LBP, the likelihood of incurring 1-year escalation-of-care events, such as receiving an opioid prescription or spinal injections, was 50-220% higher for those who received intervention not supported by the CPG recommendation such as mechanical traction, but lower by 50% for patients who received CPG-supported interventions such as manual therapy.[30] It is unclear whether service members in the current study received CPG-recommended PT care or not. Further exploration of PT care in service members with lower limb loss and LBP is needed to determine the efficacy and efficiency of CPG recommendations for this cohort.

Despite the lack of CPG recommendations for the use of opioids for LBP management,[11,13,14,31–33] a high percentage of service members with and without lower limb loss received an opioid prescription before and after PT care, similar to previous reports.[34] Although service members may have received an opioid prescription if their LBP was not resolved with PT, it is plausible that they may have also received opioids for other concomitant medical problems. Given that opioid prescription data within the DHA Pharmacy Data Transaction Service are not linked with a specific diagnosis code, identification of the exact purpose for the opioid prescription is unattainable. Nevertheless, early utilization of PT for LBP can reduce the probability of opioid prescription,[22] risk for long-term opioid use,[23] and escalation of care events.[22] Receiving PT care early for LBP should be considered as an option to reduce the cost of care. Additionally, the use of passive PT interventions can increase the patient's likelihood of subsequent opioid prescription and other specialty cares for LBP, while the use of manual therapy can reduce opioid use.[35,36] Future work should focus on evaluating the timing of PT care and type of PT interventions utilized in service members with limb loss and LBP. Since this was a retrospective study that queried patient medical records, the researchers are unable to make a definitive conclusion on the purpose of the opioid prescription.

Several limitations should be considered when interpreting the findings of the current study. The retrospective analysis evaluated PT billing practices, which are generally not standardized and may not reflect the extent of procedures performed. Anecdotal reports from physical therapists at the two queried facilities indicated that providers frequently did not attach an LBP-related ICD-10 code to the visit when evaluating and treating a patient with lower limb loss for LBP, since concomitant problems (e.g., mobility and balance issues) were common and thus perhaps LBP was deemed as lower priority than the amputation. As such, there are likely more service members with lower limb loss who may have received substandard PT care for their LBP but were not identified for the current analysis. Additionally, it has been observed that although service members without limb loss receive a focused plan of care for their LBP when they receive PT care, those with limb loss receive LBP treatments on an as-needed basis as a part of their ongoing limb loss care, which may contribute to more visits and a longer course of care. The retrospective nature of this report limited the ability to consider acuity and complexity of LBP symptoms, as well as

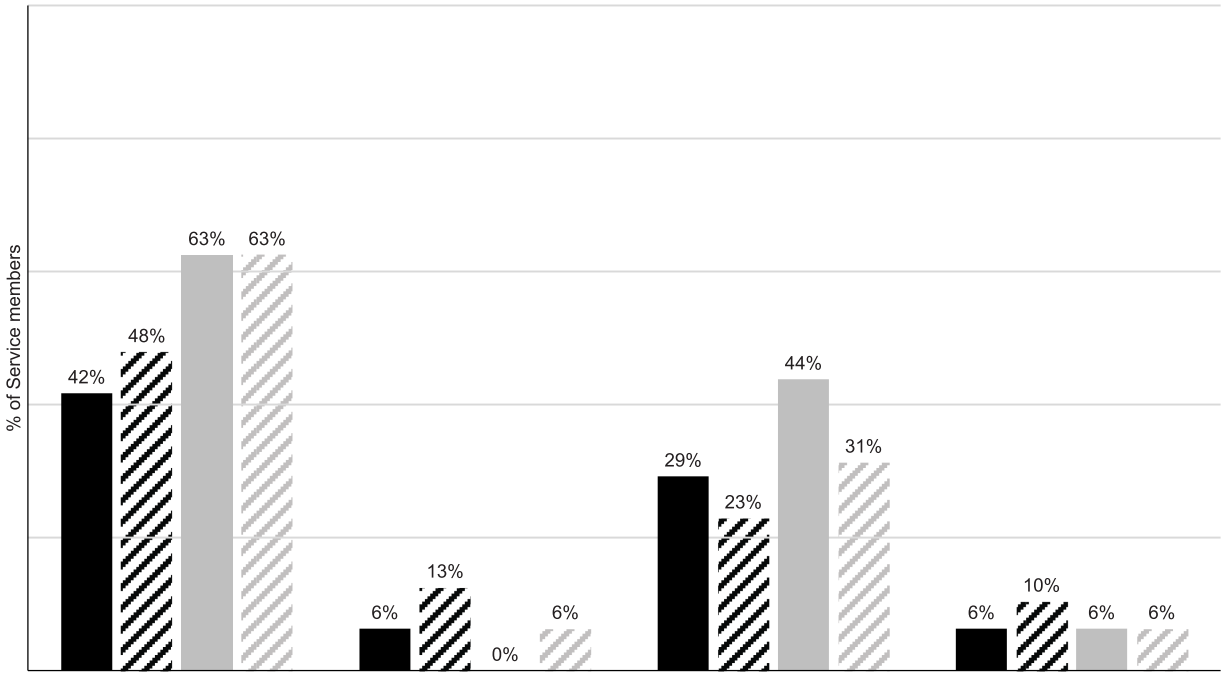

Figure 1. Escalation of care events before and after receiving physical therapy care for low back pain (LBP). Solid black = service members without limb loss, 1-year before index physical therapy visit for LBP. Solid gray = service members with limb loss, 1-year before index physical therapy visit for LBP. Striped black = service members without limb loss, 1-year after index PT visit for LBP. Striped gray = service members with limb loss 1-year after index PT visit for LBP.

psychosocial factors that may influence reported escalation of care events. Future work should analyze the cost-effectiveness of PT interventions for service members with LBP.

The findings of this preliminary retrospective study suggest that service members with limb loss and LBP receive higher quantities and longer durations of PT care than those without limb loss, resulting in nearly a 4 times higher cost of PT care. Additionally, service members with limb loss and LBP also use higher rates of opioid prescriptions and specialty referrals after receiving PT care. However, the current study is underpowered; therefore, future research with larger sample sizes and longitudinal analyses is recommended to identify more effective strategies for the management of LBP after limb loss, thereby improving short- and long-term function and quality of life in this unique patient population.

ACKNOWLEDGMENTS

This manuscript is a product of the NIH-DOD-VA Pain Management Collaboratory. For more information about the Collaboratory, visit https://painmanagementcollaboratory.org/.

FUNDING

The U.S. Army Medical Research Acquisition Activity, 820 Chandler Street, Fort Detrick, MD 21702-5014 is the awarding and administering acquisition office. This work was supported by the Assistant Secretary of Defense for Health Affairs endorsed by the DoD through the National Institutes of Health–DoD–Department of Veterans Affairs Pain Management Collaboratory Pragmatic Clinical Trials Demonstration Projects under award no. W81XWH-18-2-0007. For more information about the Collaboratory, visit https://painmanagementcollaboratory.org/. This research was also supported by the National Center for Complementary and Integrative Health of the National Institutes of Health under award no. U24AT009769.

CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY

The datasets generated and/or analyzed during the current study are not publicly available due to government policies but are available from the corresponding author upon reasonable request.

INSTITUTIONAL REVIEW BOARD (HUMAN SUBJECTS)

This study was approved by the Naval Medical Center San Diego Institutional Review Board (NMCSD.2018.0034). The authors certify that they have no affiliations with or financial involvement in any organization or entity with a direct financial interest in the subject matter or materials discussed in the article.

INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE (IACUC)

Not applicable.

INSTITUTIONAL CLEARANCE

Institutional clearance approved.

INDIVIDUAL AUTHOR CONTRIBUTION STATEMENT

S.F., B.M.G., C.L.D., B.D.H., and C.P. designed this research. Data were gathered and analyzed by J.K. and C.P. B.M.G. drafted the original manuscript. All authors reviewed and edited the manuscript, as well as approved the final version of the manuscript.

CLINICAL TRIAL REGISTRATION

Identifier: NCT04494490.

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Military Medicine, 00, 0/0:1, 2024, doi:https://doi.org/10.1093/milmed/usae455, Brief Report