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Effects of prosthetic limb prescription on 3-year mortality among Veterans with lower-limb amputation

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Abstract—Our objective was to determine the relationship between receipt of a prescription for a prosthetic limb and 3 yr mortality postsurgery among Veterans with lower-limb amputation (LLA). We conducted a retrospective observational study that included 4,578 Veterans hospitalized for LLA and discharged in fiscal years 2003 and 2004. The outcome was time to all-cause mortality from the amputation surgical date up to the 3 yr anniversary of the surgical date. Of the Veterans with LLA, 1,300 (28.4%) received a prescription for a prosthetic limb within 1 yr after the surgical amputation. About 46% (n = 2,086) died within 3 yr of the surgical anniversary. Among those who received a prescription for a prosthetic limb, only 25.2% died within 3 yr of the surgical anniversary. After adjustment, Veterans who received a prescription for a prosthetic limb were less likely to die after the surgery than Veterans without a prescription, with a hazard ratio of 0.68 (95% confidence interval: 0.60–0.77). Findings demonstrated that Veterans with LLA who received a prescription for a prosthetic limb within 1 yr after the surgical amputation were less likely to die within 3 yr of the surgical amputation after controlling for patient-, treatment-, and facility-level characteristics.

Key words: amputation, lower-limb amputation, methods, mortality, outcomes, prosthesis, prosthetic limb, retrospective studies, time-dependent covariate, Veterans.

INTRODUCTION

Lower-limb amputation (LLA) is a life-altering event, affecting the patient's quality of life and health as well as their functional, economic, and psychosocial status [1]. It has been shown that there is a decrease in social

Abbreviations: BIRLS = Beneficiary Identification Records Locator Subsystem, CI = confidence interval, CMS = Centers for Medicare and Medicaid Services, CNS = central nervous system, DME = Durable Medical Equipment, FY = fiscal year, HR = hazard ratio, ICD-9-CM = International Classification of Diseases-Ninth Revision-Clinical Modification, ICU = intensive care unit, ID = identification, LLA = lower-limb amputation, NF/SG VHS = North Florida/South Georgia Veterans Health System, NPPD = National Prosthetics Patient Database, PTF = Patient Treatment File, VA = Department of Veterans Affairs, VAMC = VA medical center, VHA = Veterans Health Administration.

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participation, employment, and overall general functioning within the community following an amputation [2]. Comorbid conditions such as depression may set in, making it difficult for people to return to their normal activities postamputation [3]. In addition, families may be affected because they may view the amputation as a burden, forcing unwanted changes in their own lives such as modifying their work schedules or adjusting their living environment if the patient cannot return home safely without the changes [4]. Conversely, family members may become very overprotective and assist the person with the amputation such that the person may not achieve optimal functional recovery.

Rehabilitation can assist the person with an amputation to regain as much function as possible. One important component of rehabilitation is the prescription and receipt of a prosthetic limb for those who are able to use one [5]. A prosthetic limb could help improve mobility, potentially leading to better quality of life. Improved mobility can allow the prosthesis wearer to be more independent in performing activities of daily living, potentially requiring less assistance from another person. Patients who have had rehabilitation for prosthetic training have been shown to have higher levels of physical and cognitive functioning [6]. Even gains in low levels of physical independence achieved through rehabilitation showed improved 1 yr survival postsurgery among Veterans with LLA [7].

We previously demonstrated that younger Veterans, those with transtibial compared with transfemoral LLAs, and those initially evaluated with higher physical and cognitive abilities were more likely to receive a prescription for a prosthetic limb. Factors negatively influencing receipt of a prosthetic limb included admission to the hospital from extended care compared with home, numerous amputation etiologies, comorbidities, and undergoing certain procedures while hospitalized [8]. We also showed that older age, higher amputation level, more comorbidities, evidence of inpatient procedures for pulmonary and renal problems, central nervous system (CNS) procedures, treatment on an intensive care unit (ICU) or medical bed section (i.e., cardiology, pulmonary) compared with a surgical bed section (i.e., neurosurgery, thoracic surgery), and regional differences were associated with 1 yr mortality postsurgery among Veterans with LLA [9–10].

One study conducted at a nonuniversity teaching center found that the hazards of death for prosthetic users among patients who had LLA was 80 percent less than for nonprosthetic wearers after adjusting for age, diagnosis, prefunctional status, and presence of coronary artery disease [11]. However, we do not know the relationship between the receipt of a prescription for a prosthetic limb and mortality postsurgery among Veterans with LLA. We hypothesized that after controlling for various patient-, treatment-, and facility-level characteristics, receiving a prescription for a prosthetic limb would reduce the hazards of death.

METHODS

This study was approved by the institutional review boards at the University of Pennsylvania, Philadelphia, Pennsylvania; the Samuel S. Stratton Department of Veterans Affairs (VA) Medical Center (VAMC), Albany, New York; and the North Florida/South Georgia Veterans Health System (NF/SG VHS), Gainesville, Florida, as well as by the VA Research and Development Committees in Albany and Gainesville.

Data Description

Data used for this study were obtained from eight Veterans Health Administration (VHA) administrative databases: Patient Treatment File (PTF) inpatient databases (main, bed section, surgical, and procedure), two Outpatient Care Files, VA Beneficiary Identification Records Locator Subsystem (BIRLS) Death File, and National Prosthetics Patient Database (NPPD). These databases were described and applied in previous articles [8–9] and have been shown to be accurate and reliable [12–20].

In order to acquire additional information on those Veterans who obtained a prescription for a prosthetic limb in the private sector after being discharged from the VAMC where the surgical amputation occurred, the Durable Medical Equipment (DME) file from the Chronic Condition Data Warehouse of the Centers for Medicare and Medicaid Services (CMS) was used to extract receipt of a prescription for a prosthetic limb. DME is a noninstitutional claims database, which includes International Classification of Diseases-Ninth Revision-Clinical Modification (ICD-9-CM) diagnosis codes, Healthcare Common Procedure Coding System codes, and dates of service submitted by DME suppliers and providers [21].

Study Cohort Selection

There were 4,697 Veterans admitted for LLA from 125 VAMCs with acute discharge dates between October 1, 2002, and September 30, 2004 (fiscal years [FYs] 2003 and 2004). Cases were limited to transtibial, transfemoral, and hip disarticulation (surgical ICD-9-CM procedure codes: 84.10, 84.13–84.19, and 84.91) [22]. Our exposure timeframe was limited to 1 yr postsurgery because typically patients only receive a prescription for a prosthetic limb within this timeframe (see "Exposure Measure" section). Prescriptions received after the 1 yr postsurgery anniversary may be related to another amputation or may affect longer-term survival; thus, 116 subjects were removed because their prescriptions were obtained outside of the 1 yr postsurgery criteria. One subject was removed for missing living location before hospitalization, and two subjects were excluded for unspecified amputation level. Thus, 4,578 subjects remained in the study for analyses.

Exposure Measure

Receipt of a prescription for a prosthetic limb was the time-varying independent exposure, which was measured from the amputation surgical date to 1 yr anniversary date and obtained from the NPPD and DME files.

Outcome

The outcome was time to all-cause mortality measured from the amputation surgical date up to 3 yr. The BIRLS database was used to identify the date of death [23].

Covariates Description

Patient-Level Characteristics

The sociodemographics included age, categorized as ≤65, 66 to 80, and ≥81 yr; sex; marital status (married vs unmarried); living location before hospitalization (extended care vs non-VA hospital or home); and patient residential setting (rural vs urban). Amputation level was categorized as either transtibial or transfemoral amputation. Hip disarticulations were combined with transfemoral amputation because of low prevalence (n = 33) and to create one "above knee" category as in our previous studies [7–10,24–35]. The new category is referred to as "transfemoral/hip disarticulation."

The contributing amputation etiologies, previously categorized by our group [9], were identified using ICD-9-CM diagnosis codes from PTF main and bed section files from admission up to the surgical date and from the outpatient care files from 3 mo before hospitalization admission date.

The Elixhauser comorbidity index was our primary measure of comorbidities, identified through ICD-9-CM codes from the outpatient care files 3 mo before hospitalization and from the inpatient main and bed section files up to the surgical date [36]. Diabetes mellitus and peripheral vascular disease were categorized as amputation etiologies rather than comorbidities.

Three additional clinical covariates were controlled for because the literature showed that they may contribute to the receipt of a prescription for a prosthetic limb [8,37–47]. These clinical covariates included dementia, stroke, and vision impairment based on ICD-9-CM codes (**Table 1**).

Table 1.
International Classification of Diseases-Ninth Revision-Clinical Modification (ICD-9-CM) codes for dementia, stroke, and visual impairment.

Condition	ICD-9-CM Codes
Dementia	2900, 2901, 29010, 29011, 29012, 29013, 2902, 29020, 29021, 2903, 2904, 29040, 29041, 29042, 29043, 2908, 2909, 2941, 29410, 29411, 2948, 2942, 29420, 29421, 2949, 3310, 3311, 33111, 33119, 3312, 33182, 797.
Stroke	430, 431, 432, 4320, 4321, 4329, 433, 43300, 43301, 43310, 43311, 43330, 43331 43380, 43381, 43390, 43391, 434, 43400, 43401, 43410, 43411, 43490, 43491, 436, 438, 4380, 4381, 43810, 43811, 43812, 43819, 4382, 43821, 43822, 43830, 43831, 43832, 43840, 43841, 43842, 4385, 43850, 43851, 43852, 43853, 4386, 4387, 4388, 43882, 43883, 43884, 43885, 43889, 4389.
Visual Impairment	36041, 36042, 36841, 36845, 36846, 36847, 369, 3690, 36900, 36901, 36902, 36903, 36904, 36905, 36906, 36907, 36908, 3691, 36910, 36911, 36912, 36913, 36914, 36915, 36916, 36917, 36918, 3692, 36920, 36921, 36922, 36923, 36924, 36925, 3693, 3694, 37775, 9509.

Treatment-Level Characteristics

Hospital events and diagnostic tests were captured from the Inpatient Procedure File from the hospital admission up to the surgical date, which included data regarding active pulmonary pathology, acute CNS, ongoing active cardiac pathology, ongoing wound problems, serious nutritional compromise, severe renal disease, and substance abuse and/or mental health issues [8]. Admission on a medical or surgical ICU anytime between the hospital admission to the surgical date and the length of stay from admission to surgery were included to approximate patient complexity.

Facility-Level Characteristics

Hospital geographic setting (rural vs urban), VAMC geographic regions (Southeast vs Northeast, Midwest, South Central, or Mountain Pacific), and hospital size estimated by total number of beds (8–126 vs 127–244, 245–362, or 363–480) were included.

Other

A year variable was added to control for any differences that may have occurred in clinical practice over the two years. Year 1 (FY 2003) included Veterans discharged from October 1, 2002, to September 30, 2003, and year 2 (FY 2004) included Veterans discharged from October 1, 2003, to September 30, 2004.

Statistical Analyses

Baseline patient-, treatment-, and facility-level characteristics were compared between Veterans who received and did not receive a prescription of prosthetic limb and between those who died and did not die within 3 yr of the surgery to provide a frequency distribution of the variables. Frequency and proportions were presented for the categorical variables, and mean ± standard deviation were presented for the continuous variables. Chi-square tests and Student *t*-tests were used to evaluate the differences between the exposure and outcome of interest to describe the cohort.

A Cox regression model was used to estimate the hazard ratios (HRs) and 95 percent confidence intervals (CIs). Patient-, treatment-, and facility-level characteristics and year were the dependent variables. The receipt of a prescription for a prosthetic limb was added to the model as a time-dependent covariate. For Veterans who died within the 3 yr period after the surgery, the time to event variable was defined as the time between the PTF surgery date and date of death. For Veterans who did not die within the 3 yr period, time to event was defined as the time between the PTF surgery date and end of study. Variables included in the final model were selected based on clinical relevance and were only used to control for potential confounding. We used identification (ID) statement in PROC PHREG in SAS version 9.2 (SAS Institute Inc; Cary, North Carolina), and VAMC is specified as the ID variable so the correlation among Veterans from the same VAMC was accounted for. We applied criteria established by Belsley et al. [48] and used an approach illustrated by Mason [49] to test collinearity between the variables. A condition index larger than 20 is a clear indication of harmful collinearity. All statistical significance was defined by $p < 0.05$, two-sided.

RESULTS

Among the total sample of 4,578 Veterans, 1,300 (28.4%) with LLA received a prescription for a prosthetic limb within 1 yr after the surgical amputation. Of the total sample, 2,086 (45.6%) died within 3 yr of the surgical anniversary. Among those who received a prescription for a prosthetic limb, only 25.2 percent died within 3 yr of the surgical anniversary. The overall average age of this cohort was 66.9 ± 11.2 yr, and 99.1 percent were male.

Table 2 shows the unadjusted patient characteristics comparing patients who received and did not receive a prescription for a prosthetic limb within 1 yr of the surgical amputation. **Table 3** shows the unadjusted associations of patient characteristics between patients who did and did not die within 3 yr of the surgery. Both tables provide a frequency distribution of the variables and only display variables that were significant in the Cox regression model.

There were no concerns regarding collinearity among the variables in the final model since the largest condition index was 1.91. After adjusting for patient-, treatment-, and facility-level variables and year, Veterans who received a prescription for a prosthetic limb were less likely to die after the surgery than Veterans without a prescription (HR = 0.68, 95% CI = 0.60–0.77). **Table 4** presents the HRs of other patient- and treatment-level variables significant in the Cox regression model and are only in the model for adjustment purposes.

Table 2.
Distribution of characteristics by receipt of prescription for prosthetic limb.

Variable	Total	Received Prescription	Did Not Receive Prescription	*p*-Value
Patient-Level				
Age, yr (mean ± SD)	66.9 ± 11.2	63.6 ± 10.5	68.3 ± 11.2	<0.001
Amputation Level (%)				
Transtibial	2,762 (60.3)	1,045 (37.8)	1,717 (62.2)	<0.001
Transfemoral/Hip Disarticulation	1,816 (39.7)	255 (14.0)	1,561 (86.0)	
Etiologies (%)				
Systemic Sepsis (yes)	516 (11.3)	104 (20.2)	412 (79.8)	<0.001
Systemic Sepsis (no)	4,062 (88.7)	1,196 (29.4)	2,866 (70.6)	
Comorbidities (%)				
Arrhythmias (yes)	803 (17.5)	177 (22.0)	626 (78.0)	<0.001
Arrhythmias (no)	3,775 (82.5)	1,123 (29.7)	2,652 (70.3)	
Chronic Pulmonary Disease (yes)	923 (20.2)	226 (24.5)	697 (75.5)	0.003
Chronic Pulmonary Disease (no)	3,655 (79.8)	1,074 (29.4)	2,581 (70.6)	
Congestive Heart Failure (yes)	1,094 (23.9)	242 (22.1)	852 (77.9)	<0.001
Congestive Heart Failure (no)	3,484 (76.1)	1,058 (30.4)	2,426 (69.6)	
Dementia (yes)	340 (7.4)	29 (8.5)	311 (91.5)	<0.001
Dementia (no)	4,238 (92.6)	1,271 (30.0)	2,967 (70.0)	
Fluid and Electrolyte Disorders (yes)	1,020 (22.3)	230 (22.5)	790 (77.5)	<0.001
Fluid and Electrolyte Disorders (no)	3,558 (77.7)	1,070 (30.1)	2,488 (69.9)	
Liver Disease (yes)	164 (3.6)	56 (34.1)	108 (65.9)	0.09
Liver Disease (no)	4,414 (96.4)	1,244 (28.2)	3,170 (71.8)	
Metastatic Cancer (yes)	61 (1.3)	11 (18.0)	50 (82.0)	0.07
Metastatic Cancer (no)	4,517 (98.7)	1,289 (28.5)	3,228 (71.5)	
Pulmonary Circulation Disease (yes)	39 (0.9)	10 (25.6)	29 (74.4)	0.70
Pulmonary Circulation Disease (no)	4,539 (99.1)	1,290 (28.4)	3,249 (71.6)	
Renal Failure (yes)	863 (18.9)	229 (26.5)	634 (73.5)	0.18
Renal Failure (no)	3,715 (81.1)	1,071 (28.8)	2,644 (71.2)	
Stroke (yes)	373 (8.1)	67 (18.0)	306 (82.0)	<0.001
Stroke (no)	4,205 (91.9)	1,233 (29.3)	2,972 (70.7)	
Treatment-Level				
Acute Procedure Before Surgery (%)				
Severe Renal Disease (yes)	218 (4.8)	42 (19.3)	176 (80.7)	0.002
Severe Renal Disease (no)	4,360 (95.2)	1,258 (28.9)	3,102 (71.1)	
ICU Admission (yes)	1,256 (27.4)	277 (22.1)	979 (77.9)	<0.001
ICU Admission (no)	3,322 (72.6)	1,023 (30.8)	2,299 (69.2)	
Other				
Year 1 (%)	2,319 (50.7)	657 (28.3)	1,662 (71.7)	0.92
Year 2 (%)	2,259 (49.3)	643 (28.5)	1,616 (71.5)	

Note: This table shows frequency distribution of each variable by receipt of prescription for prosthetic limb. Following variables were removed from table since they were not significant in final model: sex, marital status, living location before hospitalization, patient residential setting, device infection, diabetes type I, diabetes type II, local significant infection, problems with peripheral circulation, skin breakdown, trauma, alcohol abuse, chronic blood loss anemia, coagulopathy, depression, drug abuse, other neurological disorders, paralysis, psychoses, visual impairment, weight loss, active pulmonary pathology, acute central nervous system, ongoing active cardiac pathology, serious nutritional compromise, length of stay from admission to surgery, hospital geographic setting, geographic region, and number of beds.
ICU = intensive care unit, SD = standard deviation.

Table 3.
Distribution of characteristics comparing those who died with those who remained alive for 3 yr postsurgery.

Variable	Total	Died (*n* = 2,086)	Alive (*n* = 2,492)	*p*-Value
Receipt of Prescription for Prosthetic Limb (%)	1,300 (28.4)	328 (25.2)	972 (74.8)	<0.001
No Receipt of Prescription for Prosthetic Limb (%)	3,278 (71.6)	1,758 (53.6)	1,520 (46.4)	
Patient-Level				
Age, yr (mean ± SD)	66.9 ± 11.2	69.7 ± 10.8	64.6 ± 11.0	<0.001
Amputation Level (%)				
Transtibial	2,762 (60.3)	1,097 (39.7)	1,665 (60.3)	<0.001
Transfemoral/Hip Disarticulation	1,816 (39.7)	989 (54.5)	827 (45.5)	
Contributing Etiologies (%)				
Systemic Sepsis (yes)	516 (11.3)	299 (57.9)	217 (42.1)	<0.001
Systemic Sepsis (no)	4,062 (88.7)	1,787 (44.0)	2,275 (56.0)	
Comorbidities (%)				
Arrhythmias (yes)	803 (17.5)	467 (58.2)	336 (41.8)	<0.001
Arrhythmias (no)	3,775 (82.5)	1,619 (42.9)	2,156 (57.1)	
Chronic Pulmonary Disease (yes)	223 (4.9)	125 (56.1)	98 (43.9)	<0.001
Chronic Pulmonary Disease (no)	3,655 (79.8)	1,576 (43.1)	2,079 (56.9)	
Congestive Heart Failure (yes)	223 (4.9)	125 (56.1)	98 (43.9)	0.001
Congestive Heart Failure (no)	4,355 (95.1)	1,961 (45.0)	2,394 (55.0)	
Dementia (yes)	340 (7.4)	227 (66.8)	113 (33.2)	<0.001
Dementia (no)	4,238 (92.6)	1,859 (43.9)	2,379 (56.1)	
Fluid and Electrolyte Disorders (yes)	1,020 (22.3)	578 (56.7)	442 (43.3)	<0.001
Fluid and Electrolyte Disorders (no)	4,471 (97.7)	2,053 (45.9)	2,418 (54.1)	
Liver Disease (yes)	164 (3.6)	80 (48.8)	84 (51.2)	0.40
Liver Disease (no)	4,414 (96.4)	2,006 (45.4)	2,408 (54.6)	
Metastatic Cancer (yes)	61 (1.3)	50 (82.0)	11 (18.0)	<0.001
Metastatic Cancer (no)	4,517 (98.7)	2,036 (45.1)	2,481 (54.9)	
Pulmonary Circulation Disease (yes)	39 (0.9)	26 (66.7)	13 (33.3)	0.008
Pulmonary Circulation Disease (no)	4,539 (99.1)	2,060 (45.4)	2,479 (54.6)	
Renal Failure (yes)	863 (18.9)	530 (61.4)	333 (38.6)	<0.001
Renal Failure (no)	3,715 (81.1)	1,556 (41.9)	2,159 (58.1)	
Stroke (yes)	373 (8.1)	215 (57.6)	158 (42.4)	<0.001
Stroke (no)	4,205 (91.9)	1,871 (44.5)	2,334 (55.5)	
Treatment-Level				
Acute Procedure Before Surgery (%)				
Severe Renal Disease (yes)	218 (4.8)	153 (70.2)	65 (29.8)	<0.001
Severe Renal Disease (no)	4,360 (95.2)	1,933 (44.3)	2,427 (55.7)	
ICU Admission (yes)	1,256 (27.4)	688 (54.8)	568 (45.2)	<0.001
ICU Admission (no)	3,322 (72.6)	1,398 (42.1)	1,924 (57.9)	
Other				
Year 1 (%)	2,319 (50.7)	1,095 (47.2)	1,224 (52.8)	0.02
Year 2 (%)	2,259 (49.3)	991 (43.9)	1,268 (56.1)	

Note: This table shows frequency distribution of each variable by 3-year mortality postsurgery. Following variables were removed from table since they were not significant in final model: sex, marital status, living location before hospitalization, patient residential setting, device infection, diabetes type I, diabetes type II, local significant infection, problems with peripheral circulation, skin breakdown, trauma, alcohol abuse, chronic blood loss anemia, coagulopathy, depression, drug abuse, other neurological disorders, paralysis, psychoses, visual impairment, weight loss, active pulmonary pathology, acute central nervous system, ongoing active cardiac pathology, serious nutritional compromise, length of stay from admission to surgery, hospital geographic setting, geographic region, and number of beds.
ICU = intensive care unit, SD = standard deviation.

Table 4.
Clinically based hypothesis-driven final model results.

Variable	Hazard Ratio	95% CI	*p*-Value
Receipt of Prescription for Prosthetic Limb	0.68	0.60–0.77	<0.001
Patient-Level			
Age (yr)	1.03	1.02–1.03	<0.001
Amputation Level (Ref: Transfemoral/Hip Disarticulation)	1.33	1.21–1.46	<0.001
Contributing Etiologies (Ref: No)			
Systemic Sepsis	1.50	1.32–1.71	<0.001
Comorbidities (Ref: No)			
Arrhythmias	1.13	1.01–1.26	0.03
Chronic Pulmonary Disease	1.23	1.11–1.36	0.001
Congestive Heart Failure	1.33	1.20–1.47	<0.001
Dementia	1.32	1.14–1.54	0.003
Fluid and Electrolyte Disorders	1.21	1.10–1.34	0.002
Liver Disease	1.57	1.24–1.98	0.002
Metastatic Cancer	2.86	2.15–3.82	<0.001
Pulmonary Circulation Disease	1.54	1.04–2.29	0.03
Renal Failure	1.57	1.39–1.76	<0.001
Stroke	1.31	1.13–1.51	0.004
Vascular Disease	1.34	1.12–1.60	0.001
Treatment-Level			
Acute Procedure Before Surgery			
Severe Renal Disease	1.67	1.38–2.01	<0.001
ICU Admission	1.19	1.08–1.31	0.004
Other			
Year (Ref: Year 2)	1.20	1.09–1.31	0.001

Note: Following variables were included in final model but removed from table because they were insignificant: sex, marital status, living location before hospitalization, patient residential setting, device infection, diabetes type I, diabetes type II, local significant infection, problems with peripheral circulation, skin breakdown, trauma, alcohol abuse, chronic blood loss anemia, coagulopathy, depression, drug abuse, other neurological disorders, paralysis, psychoses, visual impairment, weight loss, active pulmonary pathology, acute central nervous system, ongoing active cardiac pathology, serious nutritional compromise, length of stay from admission to surgery, hospital geographic setting, geographic region, and number of beds.
CI = confidence interval, ICU = intensive care unit, Ref = reference.

DISCUSSION

Findings supported our hypothesis that Veterans with LLA who received a prescription for a prosthetic limb within 1 yr after the surgical amputation were less likely to die within 3 yr of the surgical amputation after controlling for patient-, treatment-, and facility-level characteristics and year. Moreover, our time-varying variable of receipt for prescription for a prosthetic limb demonstrated that the time to receipt of the prescription for a prosthetic limb was associated with lower hazards of mortality. More specifically, the earlier the prescription for a prosthetic limb was received, the lower the hazards of mortality were. This makes clinical sense because patients who do not have any postsurgery or late complications may be more likely to be fitted early with a prosthesis [50]. Those with wound infections or slow healing surgical sites, severe cardiovascular disease, local or systemic infections, or other complicating factors such as nonhealing wounds on their sound limb may see significant delays in the prosthetic fitting process. These patients may be more medically compromised in general than those who tolerate the surgery and postsurgery recovery without any complications and, thus, have a higher mortality rate in general. The early prosthetic prescription may simply be a marker for good health, and healthier people generally live longer.

However, it is critical that patients who would benefit from a prescription for a prosthetic limb obtain one as soon as they are medically stable. Postdischarge plans to assure patients return to see a prosthetic team should be a priority because intensive rehabilitation follow-up after hospital discharge could increase the prevalence of prosthetic limb users. Tracking patients via an amputation

clinic or other rehabilitation clinic until they are ready for a prosthetic prescription might make a difference in timing of the prescription for those delayed by complicating factors and ultimately may result in greater survival.

Early fitting for a prosthesis may also provide a psychological boost to patients' motivation, thus further promoting their overall health status [51]. The perception that they are "ready" for a prosthesis and the therapy needed to be a successful prosthetic limb user can bolster a patient's confidence and sense of well-being. There needs to be emphasis on the role of social and psychological factors when evaluating and tailoring interventions to enable the optimal use of the prosthetic limb so that patients experience positive outcomes, such as increased social participation and community reintegration and higher quality of life and reduced burden on the family and community [41].

Considering psychosocial factors along with physical when prescribing prosthetic limbs and targeting rehabilitation to the specific needs of the prosthetic wearer rather than focusing solely on improving function will be beneficial to the prosthetic wearer [50]. The way persons with amputation create meaning out of their experience influences their attitude toward use and acceptance of the prosthetic limb. Users have to believe that their lives are worth living and need to be able to integrate the new device into their lives [52]. When other factors are considered, quality of life will be improved and prolong survival in general. More often than not, the psychological well-being of the individual is more important than the fact that the individual had an amputation [53].

Provision of a prosthetic limb is typically considered for community-level ambulation, but this may be an unreachable goal for many patients with LLA [4]. Safe transfers and short-distance household ambulation may be the highest functional goal achieved by many, and for others, provision of a prosthetic limb for aesthetics may be the only goal but it should not be discounted.

Prosthetic fitting rates have ranged from 50 to 90 percent among patients with transtibial or transfemoral amputations [54], while rates of actual prosthetic use have ranged from 49 to 95 percent [44,55–56]. This raises a question regarding the appropriateness and effectiveness of the prosthetic intervention. Patients who receive a prosthesis may not be using the device to its full potential [57] or appropriate rehabilitation goals may not have been clearly developed in collaboration with the patient. One study showed that Veterans who had LLA who were in possession of a prosthetic limb primarily used a wheelchair for mobility [57]. Another study demonstrated that 16 percent of nonusers never wore their prosthetic limb and 33 percent had thrown their prosthesis out during the first year [58]. Nonusers may reject a prosthetic limb because of poor fit [58] or possibly because they were not adequately trained and do not feel safe using it. It will be important to address the use and nonuse of prosthetic limbs in the future, especially because of the increasing costs of prosthetic limbs and the increasing prevalence of LLA.

There were several limitations in this study. Findings may not generalize to the entire population since this was a study that included Veterans. Moreover, the majority of Veterans are male, so it is unknown whether findings can be generalized to females. Race was not included because of the large amount of missing information in the VHA administrative databases. Also, although functional outcomes of those with hip disarticulations differ from those with transfemoral amputations, we combined the two types of amputation levels because of low prevalence among those with hip disarticulation. Furthermore, it may be that more prosthetic prescriptions are written for healthier patients or that people who are most seriously ill or disabled and likely to die are much less likely to be written a prescription. Although we have attempted to control for patient characteristics, it is difficult to fully adjust for confounding by indication in clinical research, especially using retrospective data. There may be other factors influencing the receipt of a prosthetic prescription that are also related to mortality that we were not able to identify, obtain, or differentiate in the data. Consequently, the association between receipt of a prosthetic limb and lower mortality should not be interpreted as causal. While we cannot make strict causal inferences, it is noteworthy that the statistical significance of the receipt of a prescription for a prosthetic limb remains even after accounting for many potential confounding clinical conditions.

CONCLUSIONS

Even after controlling for other factors known to be associated with mortality, such as age, amputation level, and numerous comorbidities [7,9–10,22,59–65], early receipt of a prescription for a prosthetic limb was a strong factor associated with lower mortality. Given that some patients may not be suitable, combined with the small

cost of a prosthesis, leads to a dilemma worth exploring because of the mortality benefit demonstrated in this study among those who received a prescription for a prosthetic limb. Clinicians need to address the users' specific psychological, social, and physical needs when prescribing prosthetic limbs. Follow-up physical examinations should also resolve issues surrounding fit and delivery systems. Patient-centered care, including patient's choice, opinion, and acceptance of prosthesis, can lead to higher prosthetic use and longer survival.

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