Original Research Article

INQUIRY: The Journal of Health Care Organization, Provision, and Financing
Volume 58: 1–9

DOI: 10.1177/00469580211060779
journals.sagepub.com/home/inq
SAGE

Laboratory and Pharmaceutical Data Associated With Hospital Readmission in Persons With Diabetic Foot Ulcers

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Abstract

Purpose: Diabetic foot ulcers (DFUs) are a leading cause of lower extremity amputations among persons with diabetes (PWD) and a common cause of hospitalizations. This study identified demographic characteristics, lab values, and comorbidities associated with 30-day and 90-day hospital readmission in persons with DFU.

Methods: A retrospective chart review at our institution examined 397 patients with type 2 diabetes admitted with DFU between January 2014 and December 2018. Variables were analyzed using descriptive statistics, t-tests, and logistic regressions.

Results: None of the studied demographic, laboratory (including Hemoglobin A1c) or comorbid diseases were associated with 30-day readmission in persons with DFU. Risk factors for 90-day readmission included discharge location to home with health care (OR: 2.62, 95% CI: 1.39, 4.95), anticoagulant use (OR: 2.36, 95% CI: 1.27, 4.39), and SQ insulin use (OR: 2.08, 95% CI: 1.20, 3.61).

Conclusions: None of the variables examined were associated with 30-day readmission; however, potential predictors for 90-day readmission included anticoagulation or insulin use and discharge home with healthcare services. Future studies should devise interventions to improve transition of care in patients with DFU to further assess the role of medications and home health care as a potential predictor of 90-day hospital readmission.

Keywords

diabetic foot ulcer, type 2 diabetes, readmissions, wound care, hemoglobin A1c

Highlights

What Do We Already Know About This Topic?

Diabetic foot ulcers lead to high healthcare expenditures as they are a leading cause of lower extremity amputations and hospital admissions.

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How Does Your Research Contribute to the Field?

This study sheds light on some of the potential variables associated with readmissions in those who are admitted with diabetic foot ulcers.

What Are Your Research's Implications Toward Theory, Practice, or Policy?

There needs to be further exploration as to why those with diabetic foot ulcers are more likely to have 90-day readmissions if they are discharged with a home care nurse or use medications such as oral anticoagulation or subcutaneous insulin.

Introduction

Diabetic foot ulcers (DFUs) are among the leading causes of hospital readmissions, with about 17%–23 of DFU patients readmitted unexpectedly at 30 days.[1] Approximately 30% of patients admitted for DFU are ultimately readmitted within 30 days.[2] Inpatient and follow-up DFU care is estimated to cost about $9–13 billion for Medicare and private insurance.[3,4] The cost of DFU care at one academic institution was $7.9 million over 4 years, with readmissions attributing to about $1.2 million to these expenditures.[5] Analyzing factors contributing to readmission in these persons is not only clinically beneficial but also potentially economically advantageous.

Several studies have investigated the causes of increasing readmission rates amongst DFU patients. Specific DFU-related complications (infection, pain, and hemorrhage) have been identified as the greatest risk factors for readmission.[6] Previous studies have found a positive correlation between HbA1c and readmissions in persons with diabetes, but none have explored this association in those with DFU.[7]

There have been inconsistent findings in regard to HbA1c and wound prognosis.[8,9] Vella et al.[8] found that baseline HbA1c did not predict DFU outcome but those with lower HbA1c had a shorter healing time. Christman et al.[10] noted that larger wounds in patients with HbA1c less than 8% healed better than smaller wounds in patients with an HbA1c over 8%. These results were not replicated by Fesseha et al. in which no significant association was found between baseline HbA1c and wound resolution in patients with DFU regardless of HbA1c.[9] Participants with HbA1c levels at or below 7%, whose values increased throughout the study, experienced paradoxically better long-term healing.[9]

This uncertainty about the relationship between HbA1c and wound healing needs further exploration, as does the relationship between HbA1c and readmission rates for those with DFU. In this retrospective chart review, we examined the relationship between HbA1c and readmissions in persons with type 2 diabetes (T2D) and DFU readmitted between January 2014 and December 2018. Medical, demographic, and pharmaceutical data were also assessed to determine indicators of 30-day and 90-day readmissions. Higher HbA1c (≥7%) was hypothesized to be positively associated with 30-day and 90-day readmission.

Methods

Research Design

An IRB-approved (Approval #19-0486) retrospective chart review was conducted examining patients with T2D and DFU admitted to our hospital between January 2014 and December 2018. Patients were identified using ICD-9 and ICD-10 codes: E11.621, 707.9, E11. 69, E11.628, E11. 610, E11.641, 707.1, E11.622, E11.618, and E08.65. Using the Sunrise® electronic health record, 5991 charts were initially reviewed. Demographic data was extracted, including age, gender, race, ethnicity, as well as data on admission date, length of stay (LOS), comorbidities, body mass index (BMI), HbA1c, c-reactive protein (CRP), ankle–brachial index (ABI), triglycerides, albumin, antibiotics, smoking history, home medications, and insurance. Smoking was categorized as past, current, or never. Insurance was categorized as Medicare, Medicaid, or private. Wound characteristics such as ulcer size, location, and type of amputation were collected from podiatry notes during the associated hospitalization periods.

Participants

Inclusion criteria included age ≥18, T2D, DFU, and admission between January 1st of 2014 and December 31st of 2018. Patients with non-diabetic foot ulcers or those who expired after initial admission were excluded.

Procedure

Among the 5991 charts initially reviewed, 953 charts represented patients with duplicate medical record numbers already included within the study; thus, they were omitted. Between January of 2014 and December of 2018, the initial admission of each patient was recorded. The admission following was recorded as a 30- or 90-day readmission contingent upon the interim period. These time periods were chosen as a) Medicare designates 30 days as the cutoff point for readmissions and b) other studies in the literature have evaluated both 30- and 90-day readmissions.[7,11,12] Among the 5991 charts, another 4388 charts were excluded as their admission diagnoses were unrelated to DFU. The remaining 650 patients were reviewed, where 253 patients were excluded. Two did not have a diagnosis of diabetes mellitus, 100 had non-diabetic foot ulcers, 12 expired during their initial visit, 10 had type 1 diabetes, and 1 had ketosis-prone type 2 diabetes. One hundred twenty one

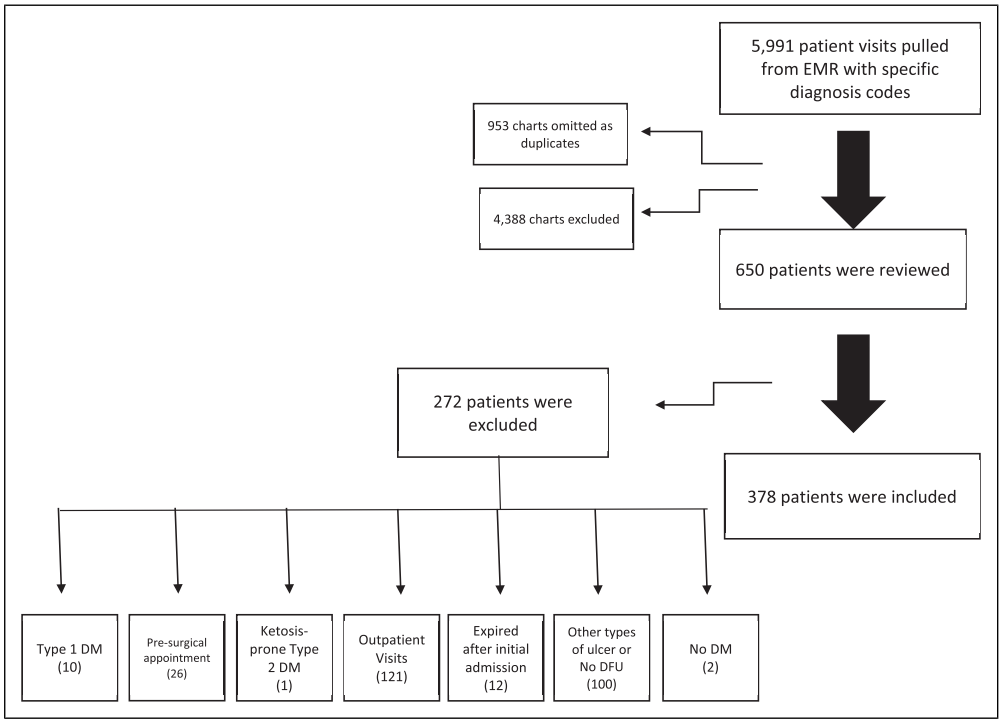

Figure 1. Flow chart for persons who met inclusion and exclusion criteria for the study.

charts represented outpatient visits, which were excluded. Seven charts were also omitted due to missing outlier data. Ultimately, 397 patients were included in this study (Figure 1) and readmissions were considered for all-causes.

Most subjects included were non-Hispanic white males averaging 65 years old, with a BMI>30 and HbA1c >7% (Table 1). The majority of participants never smoked cigarettes and had private insurance. Many participants also had comorbid hypertension and were using statins, antihypertensives, antibiotics, and subcutaneous insulin.

Data Collection

Study data was collected and managed using REDCap electronic data capture tools hosted at our institution. Predictors investigated (Table 2) included age (years); gender (female and male); race (white, black, and other); ethnicity (Hispanic/Latino and not Hispanic/Latino); discharge location (home, home with health care, rehab, and skilled nursing facility); insurance (private, Medicaid, and Medicare); right ABI (none and mild to severe); left ABI (none and mild to severe); ABI and ulcer on the same side (yes and no); ulcer size (<1 cm, >1 cm); ulcer location (toe, foot, and leg); and amputation (yes and no). Variables such as smoking status (never, past, and present); BMI (18.5–24.9, 25–29.9, and 30+); HbA1c (< 7%, >7%); HLD (yes and no); obstructive sleep apnea (OSA) (yes and no); HTN (yes and no); chronic kidney disease (CKD) (yes and no); neuropathy (yes and no); retinopathy (yes and no); history of cardiovascular risk factors (MI, CAD, stroke, and PVD) (yes and no); malignancy (yes and no); and PVR (yes and no) were also collected. Steroid use (yes and no); SGLT2 inhibitor use (yes and no); anticoagulant use (yes and no); statin use (yes and no); anti-hypertensive use (yes and no); antibiotic use (yes and no); oral hypoglycemic use (yes and no); and subcutaneous (SQ) insulin use (yes and no) were documented.

Data Analysis

Continuous variables were summarized using mean and standard deviation, and categorical variables were summarized using frequency and percent. Continuous variables were then compared across groups using the two-sample t-test or Mann–Whitney U test and categorical variables were compared across groups using the chi-square test or Fisher's exact test, as appropriate. Descriptive statistics were computed prior to excluding missing data.

Variables with extensive missing data were not considered for inclusion into a multivariable model (CRP, triglyceride, ABI and ulcer same side, ulcer size, amputation, and PVR). Before multivariable analysis, patients with missing or unknown values on all other variables of interest were excluded (n = 68) for a total of 310 patients. For multivariable analysis, a univariable screen was first carried out using logistic regression for all covariates to compute unadjusted odds ratios (ORs) for each of the outcomes. A significance level of .05 was used to determine factors eligible for inclusion in a preliminary multivariable logistic regression model. Variables of

Table 1. Association Between Characteristics and 30-Day Readmission and 90-Day Readmission.

	30-Day Readmission			90-Day Readmission		
	Yes, n (%)	No, n (%)	*P*-value	Yes, n (%)	No, n (%)	*P*-value
Demographics/lifestyle						
Age (N = 378), mean (SD)	65.85 (12.69)	66.08 (11.83)	.9082	65.67 (12.27)	66.19 (11.79)	.7067
Sex (N = 378)			.8740			.4622
Female	11 (10.19)	97 (89.81)		26 (24.07)	82 (75.93)	
Male	29 (10.74)	241 (89.26)		75 (27.78)	195 (72.22)	
Race (N = 372)			.1842			.0468
White	22 (10.33)	191 (89.67)		57 (26.76)	156 (73.24)	
Black	9 (10.84)	74 (89.16)		22 (26.51)	61 (73.49)	
Asian	6 (22.22)	21 (77.78)		13 (48.15)	14 (51.85)	
Other/multiracial	3 (6.12)	46 (93.88)		9 (18.37)	40 (81.63)	
Ethnicity (N = 371)			.7136			.8864
Hispanic/Latino	1 (4.76)	20 (95.24)		6 (28.57)	15 (71.43)	
Not Hispanic/Latino	39 (11.14)	311 (88.86)		95 (27.14)	255 (72.86)	
Smoking (N = 363)			.2227			.5236
Never	18 (8.26)	200 (91.74)		54 (24.77)	164 (75.23)	
Past	15 (14.42)	89 (85.58)		32 (30.77)	72 (69.23)	
Present	5 (12.20)	36 (87.80)		11 (26.83)	30 (73.17)	
BMI (N = 368)			.3528			.5384
18.5–24.9	6 (8.57)	64 (91.43)		15 (21.43)	55 (78.57)	
25–29.9	16 (14.04)	98 (85.96)		31 (27.19)	83 (72.81)	
30+	17 (9.24)	167 (90.76)		52 (28.26)	132 (71.74)	
Admission related						
Length of stay (days) (N = 378), mean (SD)	11.60 (17.07)	11.89 (19.86)	.4379	11.47 (12.72)	12.00 (21.54)	.5301
Discharge location (N = 366)			.6742			**.0288**
Home	9 (7.89)	105 (92.11)		21 (18.42)	93 (81.58)	
Home w/health care	20 (12.50)	140 (87.50)		54 (33.75)	106 (66.25)	
Rehab	7 (10.45)	60 (89.55)		15 (22.39)	52 (77.61)	
Hospice/SNF	3 (12.00)	22 (88.00)		8 (32.00)	17 (68.00)	
Insurance (N = 372)			.9258			.2025
Medicare	12 (11.21)	95 (88.79)		34 (31.78)	73 (68.22)	
Private	23 (10.90)	188 (89.10)		57 (27.01)	154 (72.99)	
Medicaid	5 (9.26)	49 (90.74)		10 (18.52)	44 (81.48)	
Clinical						
Right ABI (N = 128)			1.0000			.2580
Normal	9 (9.78)	83 (90.22)		6 (16.67)	30 (83.33)	
Mild–severe	3 (8.33)	33 (91.67)		24 (26.09)	68 (73.91)	

(continued)

Table 1. (continued)

	30-Day Readmission			90-Day Readmission		
	Yes, n (%)	No, n (%)	*P*-value	Yes, n (%)	No, n (%)	*P*-value
Left ABI (N = 119)			.7526			.3868
Normal	9 (10.47)	77 (89.53)		25 (29.07)	61 (70.93)	
Mild–severe	4 (12.12)	29 (87.88)		7 (21.21)	26 (78.79)	
ABI and ulcer same side (N = 135)			.5335			.1516
Yes	5 (12.20)	36 (87.80)		7 (17.07)	34 (82.93)	
No	8 (8.51)	86 (91.49)		27 (28.72)	67 (71.28)	
Ulcer size (N = 108)			.6875			.0476
≤1 cm	1 (5.88)	16 (94.12)		2 (11.76)	15 (88.24)	
>1 cm	12 (13.19)	79 (86.81)		33 (36.26)	58 (63.74)	
Ulcer location (N = 371)			.4716			.9471
Toe	14 (10.94)	114 (89.06)		33 (25.78)	95 (74.22)	
Foot	16 (8.60)	170 (91.40)		51 (27.42)	135 (72.58)	
Leg	8 (14.04)	49 (85.96)		15 (26.32)	42 (73.68)	
Amputation (N = 148)			.6826			1.0000
Yes	14 (10.53)	119 (89.47)		39 (29.32)	94 (70.68)	
No	2 (12.50)	14 (87.50)		4 (25.00)	12 (75.00)	
HLD (N = 378)			.3511			.1655
Yes	23 (12.04)	168 (87.96)		57 (29.84)	134 (70.16)	
No	17 (9.09)	170 (90.91)		44 (23.53)	143 (76.47)	
OSA (N = 378)			.2293			.1994
Yes	5 (16.67)	25 (83.33)		11 (36.67)	19 (63.33)	
No	35 (10.06)	313 (89.94)		90 (25.86)	258 (74.14)	
HTN (N = 377)			.0802			.1847
Yes	35 (12.15)	253 (87.85)		82 (28.47)	206 (71.53)	
No	5 (5.62)	84 (94.38)		19 (21.35)	70 (78.65)	
CKD (N = 377)			.8688			.0085
Yes	9 (11.11)	72 (88.89)		31 (38.27)	50 (61.73)	
No	31 (10.47)	265 (89.53)		70 (23.65)	226 (76.35)	
Neuropathy (N = 377)			.6252			.5241
Yes	8 (9.20)	79 (90.80)		21 (24.14)	66 (75.86)	
No	32 (11.03)	258 (88.97)		80 (27.59)	210 (72.41)	
Retinopathy (N = 377)			.2347			.3861
Yes	3 (18.75)	13 (81.25)		6 (37.50)	10 (62.50)	
No	37 (10.25)	324 (89.75)		95 (26.32)	266 (73.68)	
MI/CAD/stroke/PVD (N = 377)			.2447			.0127
Yes	23 (12.50)	161 (87.50)		60 (32.61)	124 (67.39)	
No	17 (8.81)	176 (91.19)		41 (21.24)	152 (78.76)	

(continued)

Table 1. (continued)

	30-Day Readmission			90-Day Readmission		
	Yes, n (%)	No, n (%)	*P*-value	Yes, n (%)	No, n (%)	*P*-value
Malignancy (N = 377)			.4110			.2150
Yes	6 (15.00)	34 (85.00)		14 (35.00)	26 (65.00)	
No	34 (10.09)	303 (89.91)		87 (25.82)	250 (74.18)	
PVR (N=157)			.9841			.6058
Normal	7 (10.77)	58 (89.23)		18 (27.69)	47 (72.31)	
Abnormal	10 (10.87)	82 (89.13)		29 (31.52)	63 (68.48)	
Labs						
A1c (N = 369)			.3929			.3236
≤7	10 (8.77)	104 (91.23)		27 (23.68)	87 (76.32)	
>7	30 (11.76)	225 (88.24)		73 (28.63)	182 (71.37)	
CRP (N = 210), mean (SD)	6.75 (6.27)	8.25 (13.16)	.7434	8.53 (9.15)	7.96 (13.72)	.2480
Triglycerides (N = 82), mean (SD)	125.90 (94.85)	131.94 (90.73)	.4941	128.10 (75.17)	132.28 (95.96)	.9458
Albumin (N = 368), mean (SD)	3.69 (.53)	3.72 (1.76)	.4397	3.63 (.51)	3.76 (1.93)	.5638
Drug use						
Steroid (N = 371)			.3700			.6497
Yes	5 (15.15)	28 (84.85)		10 (30.30)	23 (69.70)	
No	34 (10.06)	304 (89.94)		90 (26.63)	248 (73.37)	
SGLT2 inhibitor (N = 371)			1.0000			.2537
Yes	1 (6.25)	15 (93.75)		2 (12.50)	14 (87.50)	
No	38 (10.70)	317 (89.30)		98 (27.61)	257 (72.39)	
Anticoagulant (N = 371)			.0920			**.0087**
Yes	11 (16.18)	57 (83.82)		27 (39.71)	41 (60.29)	
No	28 (9.24)	275 (90.76)		73 (24.09)	230 (75.91)	
Statin use (N = 371)			.2608			.0569
Yes	29 (11.79)	217 (88.21)		74 (30.08)	172 (69.92)	
No	10 (8.00)	115 (92.00)		26 (20.80)	99 (79.20)	
Antihypertensive (N = 371)			.7094			.1905
Yes	31 (10.23)	272 (89.77)		86 (28.38)	217 (71.62)	
No	8 (11.76)	60 (88.24)		14 (20.59)	54 (79.41)	
Antibiotic (N = 375)			1.0000			.9726
Yes	37 (10.72)	308 (89.28)		93 (26.96)	252 (73.04)	
No	3 (10.00)	27 (90.00)		8 (26.67)	22 (73.33)	
Oral hypoglycemic (N = 372)			.5237			.1841
Yes	15 (9.55)	142 (90.45)		37 (23.57)	120 (76.43)	
No	25 (11.63)	190 (88.37)		64 (29.77)	151 (70.23)	
SQ insulin (N = 371)			.3222			**.0053**
Yes	26 (11.82)	194 (88.18)		71 (32.27)	149 (67.73)	
No	13 (8.61)	138 (91.39)		29 (19.21)	122 (80.79)	

Table 2. Association Between Predictors and 90-Day Readmission, Final Multivariable Model.

	OR (95% CI)
Discharge location	
Home with healthcare vs home	2.62 (1.39, 4.95)
Hospice/Skilled nursing facility vs home	1.65 (.54, 5.07)
Rehabilitation facility vs home	1.08 (.47, 2.47)
Anticoagulation use	
Yes vs no	2.36 (1.27, 4.39)
SQ insulin use	
Yes vs no	2.08 (1.20, 3.61)

theoretical clinical importance were also included in the preliminary multivariable model, including age, sex, race, ethnicity, and HbA1c level. Backward elimination was then applied to select variables into a final multivariable model. Correlation between covariates was assessed for the multivariable models, and goodness of fit was evaluated using the Hosmer–Lemeshow test. A ROC curve was fit to measure AUC.

All analyses were performed using SAS Studio version 3.8 (SAS Institute, Cary, NC), and results were considered statistically significant at the $P < .05$ level of significance.

Results

Among 378 final participants, 40 (10.58%) had 30-day readmissions and 101 (26.72%) had 90-day readmissions. No variables of interest were found to be significantly associated with 30-day readmission on bivariate analysis (Table 1). Race, discharge location, ulcer size, CKD, MI/CAD/stroke/PVD, anticoagulant use, and SQ insulin use were found to be significantly associated with 90-day readmission, unadjusted for other covariates (Table 1).

No variables of interest were found to be significant on univariable analysis for 30-day readmission, so a multivariable model was therefore not computed. For the outcome of 90-day readmission, the preliminary multivariable model included variables of theoretical clinical importance (age, sex, race, ethnicity, and HbA1c level) as well as variables that were found to be significant on univariable analysis (discharge location, anticoagulant use, statin use, and SQ insulin). After backward elimination was applied to select variables, the final multivariable model included discharge location, anticoagulant use, and SQ insulin use. Covariates in the final multivariable model were not found to be correlated. The Hosmer–Lemeshow test indicated the model sufficiently fit the data ($P = .9452$), and AUC was found to be .6727.

Risk factors for 90-day readmission included discharge location to home with health care (OR: 2.62, 95% CI: 1.39, 4.95), anticoagulant use (OR: 2.36, 95% CI: 1.27, 4.39), and SQ insulin use (OR: 2.08, 95% CI: 1.20, 3.61) (Table 2). Interestingly enough, glycemic control as measured by HbA1c greater or less than 7% was not associated with 30- or 90-day readmissions.

Discussion

Glycemic control as measured by HbA1c greater or less than 7% was not associated with 30- or 90-day readmissions, despite the fact that glycemic control is associated with wound healing. Christman et al. observed a .028 cm^2 decreased healing rate per day for each 1.0% increase in HbA1c.[16] Anticoagulation use, use of subcutaneous insulin, and discharge to home with healthcare services were statistically significant in their association with higher rates of 90-day readmission.

DFU and amputations have traditionally been associated with comorbid CKD, as both are manifestations of the microvascular sequelae of diabetes mellitus. In this study, we found an association between CKD and 90-day readmission on bivariate analysis (Table 1). However, after exclusions were made for the multivariable model, this relationship was no longer significant. Margolis et al. noted the more advanced the stage of CKD, the greater the association with both DFU and amputation regardless of the presence of PAD.[13] Amongst persons with diabetes, those with DFU have a greater rate of mortality compared to those without DFU due to their burden of CKD as well as cardiovascular disease,[14] in addition to their standing risk of hospital admissions secondary to CKD and cardiovascular comorbidities independently.

Medications such as anticoagulants and insulin formulations were commonly used among the participants and were all positively associated with readmission. Interestingly, previous research contradicts the results of the current study. Anticoagulant usage has been found to reduce ulcer size and in some cases heal wounds.[15] In this study, anticoagulation usage paradoxically increased the likelihood of readmission 2.36 (1.27, 4.39). This could be due to delayed healing secondary to prolonged bleeding, which is noted to independently extend hospitalizations.[16] Holscher et al. noted that the primary reason for unplanned 30-day readmission was deterioration and treatment of the wound (41%).[1] These studies suggest that increased wound healing time, potentially caused by anticoagulants, can increase rates of readmission. Our results correlate with this association but do not suggest causation. We found an association between MI/CAD/stroke/PVD and 90-day readmission on bivariate analysis (Table 1). However, after exclusions were made for multivariable model, this relationship was no longer significant.[17]

Insulin is historically noted to benefit not only diabetes but also wound management. Topical insulin application leads to numerous improvements in skin healing such as adherence of the epidermis to the dermis, decrease in formation of oxidative radicals, and an enhanced macrophage response.[18] A small study by Zhang et al. noted that those who received half of their insulin dose in their abdomen and the other near their DFU had a quicker healing time than those who received all

of the injection in their abdomen.[19] Such findings would suggest insulin usage would prevent readmission for DFU; however, our results demonstrated that SQ insulin users 2.08 (1.2, 3.61) were at a higher risk for 90-day readmission. Tight blood glucose control has been consistently documented to aid in rapid healing of diabetic foot ulcers and decrease the risk of amputation.[20,21] As a result, the Society for Vascular Surgery, the American Podiatric Medical Association, and the Society for Vascular Medicine recommend that persons with DFU have an HbA1c of 7% or less.[22] Our retrospective study utilized medication reconciliation data to determine current pharmaceutical prescriptions but did not account for medical adherence. As such, participants may have been prescribed insulin but may have been following an inconsistent regimen, leading to the inverse association observed. In addition, these risk factors may be seen due to the fact that these patients are sicker or have a worse disease course.

Our results demonstrated patients discharged to home with healthcare services were more likely to be readmitted. This has been previously reported in diseases such as congestive heart failure, but this is not well-studied in those with diabetes. Some of the reasons for increased readmissions for patients who receive home care includes higher frequency of provider visits and poor communication between the home care nurse and the provider.[23] Jafary et al. had one of the few studies on home wound care. They noted that by discharging patients with DFU home and setting them up with home care nursing in a Hospital-In-A-Home program, both saved money and led to faster wound healing when compared to those who were hospitalized.[24] Their study did not assess the rate of readmissions.

Limitations

This study had several limitations due to its retrospective nature. Multiple data points such as ulcer size, ulcer location, and ABI/PVR results were missing and thus could not be considered in the multivariable model. Variations in ulcer size may also be present as the manual measurement may have been somewhat subjective and rounded according to personal discernment. Interventions performed for patients with peripheral artery disease were not detailed. Additionally, medication recordings and coding errors were noted. Anticoagulation brand and/or generic names were not specified, which also would have helped to better delineate outcomes. This study may have also been subject to additional confounding variables not assessed, potentially influencing the results of the study. As a study conducted at a single center with predominantly white male obese participants, these results may not be generalizable. An increased presence of ethnic minorities could have altered comorbidity and insurance data, in correlation with racial disparities in BMI, CAD, HTN, etc. and insurance coverage, further increasing readmissions.[19] Moreover, the single-center design restricts the ability to determine causation while only providing association. Additionally, this work did not account for readmission at different institutions within and independent of our institution. A multi-center randomized prospective study using wound grading or classification would be optimal to greater identify demographic factors, comorbidities, and laboratory data associated with readmission in DFU patients and yield more generalizable results. It would also be of benefit to further stratify HbA1c values to see if there was a greater association between higher HbA1c (ie, over 10%) and readmission.[7]

Conclusions

Patients with DFU discharged home with health care were more likely to be readmitted after 90 days. Likewise, those using anticoagulation or SQ insulin were at higher risk for 90-day readmission. Interestingly, these effects were not seen in the 30-day period and no association was seen with hemoglobin A1c at either time period.

Understanding the underlying cause for readmissions in persons with DFU still needs to be further explored. Conducting focus groups or semi-structured interviews to obtain qualitative data in this area would be of benefit. The combination of both qualitative and prospective quantitative data can be used to design an intervention aimed at targeting identified obstacles to health maintenance and reducing the need for readmissions. It would also be of use to assess the home care nurses evaluations of such patients as their use was associated with higher readmission rates in patients with DFU.

As hospitals continue to develop programs to decrease readmissions, programs focused on those with diabetes need to be devised as persons with diabetes have greater rates of readmissions than those without; these readmissions can be for diabetic complications such as DFU or other comorbid conditions.[25] Identifying those higher risk patients and determining the factors which contribute to their readmissions will improve health outcomes and decrease healthcare expenditures.

Acknowledgments

We would like to thank our colleagues of both the inpatient diabetes team and wound care team for the care that they provide to those with diabetic foot ulcers.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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