



Depressive symptoms in patients with wounds: A cross-sectional study

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Depression slows wound healing in patients with chronic wounds. The prevalence of depressive symptoms differs in the literature and the current understandings of factors related to depression in patients with wounds have been limited. To investigate the prevalence of depressive symptoms and the associated factors in patients with wounds, we performed this retrospective study in which depressive symptoms were evaluated with the Patient Health Questionnaire 9-item (PHQ-9). Valid PHQ-9 scores were collected from 222 patients (112 males and 110 females; age: 64.1 ± 15.8) out of 260 consecutive patients evaluated at an outpatient physical therapy wound clinic during 2012–2015. The proportion of patients with minimal to severe depressive symptoms was 81.5% [80.8% in patients with venous leg ulcers (VLUs) and 82.0% in non-VLUs]; 22.1% patients with wounds had scored positive for depression (moderate to severe depressive symptoms). Specific proportions of positive depression screening were 26.6% in patients with VLUs and 18.8% in non-VLU patients, and 14.1 and 40.0% in patients with wounds <90 and ≥ 90 days as of initial examination, respectively. PHQ-9 scores were significantly decreased from 5.85 ± 6.01 at initial examination to 3.42 ± 4.35 at last visit ($p < 0.001$). The odds of a positive depression screening was 3.20 (95% CI = [1.49, 6.87]) in patients with wounds ≥ 90 days (vs. <90 days) and 2.53 (95% CI = [1.26, 5.08]) in patients with pain related to the wounds (vs. without pain), after patients' age, gender, and race were controlled for. No difference was found in proportions of positive depression screening between VLUs and other wound diagnoses. Depressive symptoms were common in patients with wounds, especially in patients with wounds ≥ 90 days and with pain related to the wounds at initial examination. Therefore, clinicians should take into consideration patients' mental status upon management of wounds.

INTRODUCTION

Depressive symptoms including feeling sad, blue, unhappy, miserable, or down in the dumps are common and may be a normal reaction to life stress, bereavement, or the grief process. When these feelings and emotions become chronic and interfere with activities of daily living, social, and familial responsibilities, these depressive symptoms then can be diagnosed as major depressive disorder, also known as depression.¹ Clinical depression is characterized by depressed mood, anhedonia (loss of interest), guilt, sleep disturbance, fatigue or energy loss, concentration problems, appetite and weight changes, psychomotor retardation or agitation, and suicidal ideations.² Causes of depression include a combination of genetic, biological, environmental, and psychological factors.²

Depression is a common, costly mental health disorder which can result in multiple relapses during its disease course. Reeves et al.³ reported that 6.8% of American adults had moderate to severe depression during a two week study period and the rate of reported lifetime diagnosis of depression was 16.1% in 2008.³ In Europe, Wittchen et al.⁴ estimated that 6.9% adults (14–65 years old) had

depression in 2010. Depression is currently the third leading contributor to global burden of disease, the second leading cause of disability worldwide and a major contributor to the burden of suicide and ischemic heart disease.^{5,6} The total economic burden of depression was estimated at 118 billion Euro in Europe in 2004 and \$210.5 billion US dollars in the United States in 2010 and both numbers are expected to grow.^{7,8}

The negative impacts of depression extend beyond its socioeconomic costs in the society. It also slows wound healing in chronic wounds which are defined as wounds that fail to progress or respond to treatment over the normal expected healing time frame.⁹ During the past decades, depression has been found to be related to prolonged infection, delayed wound healing and increased wound reoccurrence in patients with chronic wounds.^{10–13} Pathophysiological analyses indicate that depression increases the production of systemic proinflammatory cytokines while decreasing beneficial cytokines that are important for wound healing.^{14,15} Depression also decreases growth hormone level at wound site and suppresses neutrophil function.¹⁶

The negative influences of depression on wound healing seem clear; however, studies exploring the prevalence of depression in chronic wounds have been limited to a few small sample size surveys.^{17–20} Using the Hospital Anxiety and Depression Scale (HADS), Jones et al.¹⁷ reported that 27% of the 190 patients with venous leg ulcers (VLUs) scored as depressed while 26% scored as anxious; Souza Nogueira et al.¹⁸ identified anxiety in 30% and depression in 40% of the 30 patients with VLUs. Using the Beck Depression Inventory, Salome et al.²⁰ reported 26.66% patients had moderate to severe depression in a study of 60 patients with VLUs. Using the Quick Inventory of Depressive Symptomatology-Self Report (QIDS-SR16), Wachholz et al.¹⁹ found severe depressive symptoms in 22% and mild depressive symptoms in 34.1% of 41 patients with chronic leg ulcers.

Additionally, the prevalence rates of depression in pressure ulcer, diabetic foot ulcers (DFU) and others remain unclear in the literature. Although influences of depression on wound healing are evident, the mechanisms of depression in patients with wounds remain understudied. Pain and odor have been found to be related to depression in patients with chronic venous wounds,^{17,21,22} but more factors that may be associated with the development of depression in patients with wounds should be explored as well.

In the present study, we aimed to (1) investigate the prevalence of depressive symptoms in patients with wounds at an outpatient physical therapy clinic, and (2) explore the relationship between depression and patients' demographic and wound history characteristics.

METHODS

Subjects

This was a cross-sectional study performed at the Daemen College Physical Therapy Wound Care Clinic which is a subsidiary of the Daemen College Physical Therapy Department. Established in 2012 as a result of a grant secured from a private philanthropic organization, this clinic has been operating as a research outpatient physical therapy clinic that specializes in wound care and serves the Western New York community by offering treatment free of charge to patients for a 2-year period. Staffing at the clinic included a clinic manager who is also a licensed physical therapist, a certified wound care specialist with about 10 years' experiences in physical therapy wound care, a new physical therapy graduate, and a physical therapy aide. Patients treated at the clinic had a wide range of socioeconomic status. Although treatment was free of charge, patients all had medical insurances to different extents.

The study protocol was approved by the Daemen College Institutional Review Board prior to data extraction.

Depression assessment

The Patient Health Questionnaire (PHQ), an alternative screening tool for clinicians to the Primary Care Evaluation of Mental Disorders (PRIME-MD), offers clinicians a concise, self-administered screening and diagnostic tool for depression.^{23–25} The PHQ 9-item (PHQ-9) is a 9-question, less specific version of the PHQ; it includes eight questions for symptom assessment and one question for the

assessment of functional impairment. The answers to each question is scored on a scale of 0 to 3, hence with a total score of 0 to 27.²³ A highly cited study by Kroenke et al.²⁴ reported that PHQ-9 is a reliable and valid measure of depression severity on top of providing help for the diagnosis of depressive disorders. Löwe et al.²⁵ also found PHQ-9 can effectively measure changes of depression symptoms in patients.

As part of medical documentation, the clinic collected patients' psychological profiles through PHQ-9 together with patients' demographic and wound history information since the opening of the clinic on September 10, 2012. As per the clinic policy, patients were required to fill in the PHQ-9 both at the initial examination and at discharge. In our study, all patients with wound(s) and a valid PHQ-9 score at initial examination were eligible for study inclusion. Scoring and interpretation of the total score of the PHQ-9 follows the guidelines developed by the inventor Pfizer Inc.²³ The total score is calculated by adding up separate scores of all checked boxes on the PHQ-9. Severity of depressive symptoms was reported as follows: none (score 0), minimal (score 1–4), mild (score 5–9), moderate (score 10–14), moderately severe (score 15–19), and severe (score 20–27). A score of ≥ 10 has been found to have high sensitivity (88%) and specificity (88%) for detecting depression.²⁴ The use of the PHQ-9 with a cut-off point of ≥ 10 was also recommended for depression screening by a recent meta-analysis.²⁶ Thus, a score of ≥ 10 representing moderate to severe depressive symptoms was considered as a positive screening of depression in our study.

Statistical analyses

Patient demographic and wound history characteristics were summarized in the descriptive statistics, including age, gender, race, education level, living status, marital status, body mass index (BMI), wound duration as of initial examination, pain related to the wound(s) at initial examination, PHQ-9 score, number of co-morbidities, wound status at last visit, number of wounds, treatment duration, the total number of visits, and wound etiology.

Proportions of the patients with depressive symptoms at initial examination were calculated and described according to the severity. Based on the PHQ-9 score, the patients were divided into two groups: patients with positive (PHQ-9 score ≥ 10) and negative (PHQ-9 score < 10) depression screening. The Fisher's exact tests were used to compare categorical and dichotomized data, and the Mann-Whitney *U* tests were used to compare the total number of visits and treatment duration between two groups. The *t*-test was used to compare age, and the Wilcoxon signed-rank test was used to compare the PHQ-9 score before and after treatment. Additionally, the Fisher's exact tests were also used to explore the differences in positive depression screening between patients with VLU and other wound diagnoses. Binary logistic regression was used to examine the associations between patient characteristics and positive depression screening after controlling for patients' age, gender and race. All the analyses were conducted using SPSS 17.0 software for Windows (SPSS Inc., Chicago, IL).

Table 1. Descriptive statistics of demographic and wound history characteristics of the patients ($n = 222$)

Characteristic	Mean \pm SD or % (N)
Age (years)	64.1 \pm 15.8
Gender	
Female	49.6 (110)
Male	50.5 (112)
Race	
Caucasians	90.1 (200)
African Americans	8.1 (18)
Others	1.8 (4)
Education level	
<4-year college degree	70.3 (156)
\geq 4-year college degree	29.7 (66)
Living status	
Alone	26.6 (59)
With others	73.4 (163)
Marital status	
Other than married	55.4 (123)
Currently married	44.6 (99)
BMI (%)	
<30 kg/m ²	46.4 (103)
\geq 30 kg/m ²	53.6 (119)
Wound duration*	
<90 days	40.1 (89)
\geq 90 days	59.9 (113)
Pain related to wound(s)	
No	49.1 (109)
Yes	50.9 (113)
PHQ-9 score (%)	
\geq 10	22.1 (49)
<10	77.9 (173)
Numbers of comorbidities (%)	
\leq 2	37.4 (83)
>2	62.6 (139)
Wound status at last visit (%)	
Remaining open	50.0 (111)
100% closure	50.0 (111)
Number of wounds (%)	
1	55.0 (122)
\geq 2	45.1 (100)
Treatment duration (days)	119.0 \pm 251.7
Total number of visits (times)	26.7 \pm 33.5
Wound type (%)	
Venous leg ulcers (VLU)	42.3 (94)
Non-VLU	57.7 (128)

*Upon initial examination.

RESULTS

Patient demographics and depressive symptoms

From September 10, 2012 to February 20, 2015, clinicians at the clinic had evaluated 260 patient episodes. PHQ-9 information was missing in 37 episodes at initial examination, and one episode with the PHQ-9 information was not related to wound treatment (the patient had no wound). Exclusion of these episodes resulted in 222 episodes in 195 patients: 172 patients had only one episode; 20 patients (15 with VLUs, 4 with DFUs, and 1 with pilonidal cysts) had two episodes; 2 patients (both with VLUs) had three episodes, and 1 patient had four episodes of traumatic leg wounds treated at the clinic. In total, 23 patients had at least one wound relapse and 3 out of these 23 patients had positive depression screening (1 had once, 2 had twice) at initial exams. Nevertheless, as wound relapse was not the focus of our study and did not affect our analyses or greatly alter our results, 222 patient episodes included were referred to as 222 patients in the remaining text for the conciseness of the report.

The 222 patients (112 males and 110 females) consisted of 200 Caucasians, 18 African Americans, 2 American Indians, and 2 Hispanic Americans, with an average age of 64.1 years (± 15.8). The majority of the patients (70.3%) had an education level lower than a 4-year college degree. There was a large variation across all patients in both treatment duration (119 ± 252 days) and numbers of visits (27 ± 34 times). The average PHQ-9 score was 5.85 (± 6.01) at initial examination, and according to our definition, 22.1% of the patients had a PHQ-9 score ≥ 10 . Detailed characteristics of the sample were summarized in Table 1.

The percentages and numbers of the patients with different depression severities were presented in Table 2. The proportion of patients with minimal to severe depressive symptoms was 81.5% (80.8% in patients with VLUs and 82.0% in non-VLU patients). According to the cut-off point set in this study (PHQ-9 score ≥ 10), 22.1% of the patients had a positive depression screening (26.6% in VLU and 18.8% in non-VLU patients).

In addition, the PHQ-9 scores were available in 113 patients at last visit (3.42 ± 4.35), where wounds were completely closed in 78.8% (89) patients. A significant decrease in the PHQ-9 scores was observed at last visit ($p < 0.001$), compared to the initial examination. Twenty-four patients had a PHQ-9 score ≥ 10 at initial examination, with 20 of them having wound completely closed upon last visit, and with all experiencing a decrease in the PHQ-9 scores but two whose scores stayed the same as initial examination. Four of the remaining 89 patients (113 - 24) experienced an increase in the PHQ-9 score and changed their depression screening from negative at initial examination to positive at last visit, with three of them having wound remain open upon last visit.

Odds of a positive depression screening

The odds of a positive depression screening in patients with wound duration ≥ 90 days (vs. < 90 days) upon initial examination was 2.84 [1.36, 5.91] (Table 3). The odds of a positive depression screening in patients with pain (vs.

Table 2. Depression severity in all, venous leg ulcer (VLU), and non-VLU patients

Depression severity (PHQ-9 score)	% (N)		
	VLU (n = 94)	Non-VLU (n = 128)	Total (n = 222)
None (0)	19.2 (18)	18.0 (23)	18.5 (41)
Minimal (1–4)	33.0 (31)	38.3 (42)	36.0 (80)
Mild (5–9)	21.3 (20)	25.0 (32)	23.4 (52)
Moderate (10–14)	9.6 (9)	10.9 (14)	10.4 (23)
Moderately severe (15–19)	10.6 (10)	3.9 (5)	6.8 (15)
Severe (20–27)	6.4 (6)	3.9 (5)	5.0 (11)

no pain) related to the wound at initial examination was 2.14 [1.11, 4.14]. The PHQ-9 scores at initial examination reported by the patients having a positive depression screening were on average higher than the scores reported by

those having a negative depression screening (15.4 vs. 3.1). No differences in the odds of having a positive depression screening were found between each pair of other characteristics (e.g., between the patients with one wound and ≥ 2

Table 3. Comparison between patients with positive and negative depression screening

Characteristic	Negative Screening (n = 173)	Positive Screening (n = 49)	Odds ratio [95% CI] [†] or p-value
Gender (Female/male)	85/88	25/24	0.93 [0.49, 1.75]
Wound duration [‡] (<90/ ≥ 90 days)	78/95	11/38	2.84 [1.36, 5.91]**
Number of wounds (1/ ≥ 2)	99/74	23/26	1.51 [0.80, 2.86]
Wound status at last visit (Open/closed)	85/88	26/23	0.85 [0.45, 1.61]
Numbers of comorbidities (≤ 2 / > 2)	67/106	16/33	1.30 [0.67, 2.55]
Marital status (Others/married)	100/73	23/26	1.55 [0.82, 2.93]
Education level (<4 year/ ≥ 4 year college)	122/51	34/15	1.06 [0.53, 2.10]
BMI (<30/ ≥ 30 kg/m ²)	83/90	20/29	1.34, [0.70, 2.54]
Living status (Alone/others)	50/123	9/40	1.81 [0.82, 4.00]
Pain related to wound(s) [‡] (No/yes)	92/81	17/32	2.14 [1.11, 4.14]*
Venous leg ulcers (Yes/no)	69/104	25/24	0.64 [0.34, 1.21]
Age (year)	64.35 \pm 16.38	63.08 \pm 13.61	0.225
Treatment duration (day)	122.06 \pm 277.56	108.35 \pm 124.46	0.929
Number of visits	26.21 \pm 32.95	28.63 \pm 35.84	0.852
PHQ-9Eval [¶]	3.14 \pm 2.85	15.41 \pm 4.20	<0.001

[†]CI, confidential interval.

[‡]Upon initial examination.

[¶]PHQ-9Eval, Patient Health Questionnaire 9-item score at initial examination.

Bold numbers indicate statistical significance (* $p < 0.05$, ** $p < 0.01$).

Table 4. Associations between patient characteristics and positive depression screening ($n = 222$)

Characteristic	Odds ratio [95% confidential interval]			
	Unadjusted [†]		Adjusted	
Education level (0- <4 year, 1- ≥4 year college)	1.06	[0.53, 2.10]		
Living status (0- alone, 1- with others)	1.81	[0.82, 4.00]	–	–
Marital status (0- others, 1- married)	1.55	[0.82, 2.93]	–	–
Body mass index (0- <30, 1- ≥30 kg/m ²)	1.34	[0.70, 2.54]	–	–
Wound duration (0- <90, 1- ≥90 days)	2.84	[1.36, 5.91]**	3.20	[1.49, 6.87]**
Pain at initial examination (0- no, 1- yes)	2.14	[1.11, 4.14]*	2.53	[1.26, 5.08]**
Number of comorbidities (0- ≤2, 1- >2)	1.30	[0.67, 2.55]	–	–
Wound status (0- open, 1- closed)	0.85	[0.45, 1.61]	–	–
Number of wounds (0- 1, 1- ≥2)	1.51	[0.80, 2.86]	–	–
VLU [‡] (0- no, 1- yes)	1.57	[0.83, 2.97]	–	–
Treatment duration (day)	1.00	[0.998, 1.001]	–	–
Number of visits	1.00	[0.99, 1.01]	–	–

[†]Unadjusted models: each variable was entered into a separate model (with age, gender, and race controlled), instead of being mutually controlled in one model.

[‡]VLU: venous leg ulcer.

Bold numbers indicate statistical significance (* $p < 0.05$, ** $p < 0.01$).

wounds). In the other way of explanation, no differences in other characteristics were found between the patients with positive and negative depression screening.

Associations between patient characteristics and positive depression screening

According to the results from logistic regression models (Table 4), the patients with wound duration ≥90 days as of initial examination and with pain related to the wound at initial examination were more likely to report a positive depression screening, after controlling for age, gender, and race. When both factors were mutually controlled in one model, the associations became even stronger for both the patients with wound duration ≥90 days as of initial examination (3.20, 95% CI = [1.49, 6.87]), and those with pain

related to the wound at initial examination (2.53, 95% CI = [1.26, 5.08]) (Table 4).

Depression among different types of wounds (Table 5)

The proportions of positive depression screening among the patients with VLUs, traumatic and surgical wounds (TSW), DFU, pressure ulcer, arterial wounds, and others were 26.6, 22.4, 17.9, 25.0, 5.9, and 8.7%, respectively. Compared to the patients with VLUs, no significant differences were found in the odds of having positive depression screening for the patients with any other wound diagnosis ($p > 0.05$ for all).

DISCUSSION

Based on the PHQ-9 score, 22.1% patients with wounds had positive depression screening. Specific proportions of positive depression screening were 26.6% in VLU patients and 18.8% in non-VLU patients as per wound diagnosis, and were 14.1% and 40.0% in patients with wounds lasting <90 and ≥90 days as of their initial examination. This is similar to the findings by Jones et al.,¹⁷ where the positive depression screening was found in 27% patients with VLUs. Patients with wound duration of ≥90 days were 2.84 times more likely as patients with wound duration of <90 days to have a positive depression screening, which may be the cause for the differences in the prevalence rate of positive depression screening between the present study and the study by Souza Nogueira et al.¹⁸ (40% of 30 patients with VLUs as assessed with HADS). Nonetheless, different sample sizes, the use of different questionnaires for depression screening, and different compositions of wound diagnoses may also contribute to the varying finding.

Table 5. Comparison of odds of having depression among patients with different types of wounds ($n = 222$)

Wound types	N	# of positive screening (%)	Odds ratio
			[95% confidence interval]
Venous leg ulcer	94	25 (26.6)	ref
TSW [†]	58	13 (22.4)	0.80 [0.37, 1.72]
Diabetic foot ulcer	28	5 (17.9)	0.60 [0.21, 1.75]
Pressure ulcer	16	4 (25.0)	0.69 [0.21, 2.26]
Arterial wound	17	1 (5.9)	0.17 [0.02, 1.37]
Others	9	1 (8.7)	0.35 [0.04, 2.90]
Total	222	49 (22.1)	

[†]TSW, traumatic and surgical wounds.

In our study, the positive depression screening represented moderate to severe depressive symptoms. The proportion of moderate to severe symptoms in VLU patients (26.6%) is more or less consistent with that in patients with chronic leg ulcers (26.66%) reported by Salome et al.,²⁰ and falls between the prevalence rates of severe (22.0%) and mild depressive symptoms (34.1%), reported by Wachholz et al. (no prevalence rate of moderate depressive symptoms was reported in their study).¹⁹ Salome et al.²⁰ used the Beck Depression Inventory as a depression screening tool rather than the PHQ-9, which may be partially responsible for a different prevalence rate from our findings: mild to severe depressive symptoms (91.7%) vs. minimal to severe depressive symptoms (81.5%). The high prevalence of depressive symptoms in patients with wounds may be due to the existence of co-morbidities in patients with wounds.²⁷ In the present study, 139/222 (62.6%) patients had more than 2 co-morbidities and 59.46% patients had minimal to mild depressive symptoms with a PHQ-9 score 1-9.

The present study adds further evidence that depressive symptoms are common in patients with wounds, especially with longer duration and pain at initial examination. The prevalence rate of positive depression screening (22.1%) in our cohort was more than three times higher than the rate of depression diagnosed in the ordinary population (6.8–6.9%).^{3,4} Given the negative effects of depression on wound healing and patients' quality of life,^{10–16} clinicians in the wound care field should pay extra attention to patients' emotional status. When necessary, professional consultation with or even referral to clinicians of the psychiatric specialty is needed. This is especially true when looking at the PHQ-9 score at last visit in our cohort: the score has remained constant for 2 (out of 24 patients with positive depression screening), and even increased beyond the threshold of positive depression screening for four patients. This indicates that despite somewhat success at the population level, treatment of wounds may not be sufficient for the depressive symptoms on a small number of patients. As a relatively simple screening tool for depression, PHQ-9 may pick up patients who would benefit from additional treatments. The results of the study add indirect support to the importance of wound care from a team-based approach with possible psychiatric clinician involvement.

Pain is another significant factor associated with positive depression screening in this study. Gender, education level, BMI, and number of wounds and comorbidities were not found associated with the positive depression screening. These findings are consistent with the existing reports.^{17,21,22} Therefore, management of depressive symptoms in patients with wounds may begin with treatment of pain, which is of great importance as pain also limits function and decreases the quality of life besides its associations with depression. The odds of having positive depression screening for patients with pain and longer wound duration in logistic regression models both increased when the two factors (pain and wound duration) were mutually controlled in one model. This might indicate a positive interaction between pain and wound duration, but more research is warranted.

Interestingly, wound status (open vs. closed), treatment duration, and number of visits at last visit do not vary in patient with positive and negative depression screening at

initial examination in this study. This finding seems to differ from the previous knowledge that depression is more likely to slow down wound healing.^{10,11,13–16} Upon a close analysis, the end point of wound healing differs between ours and the previous studies. In our study, wound status at the last visit upon data extraction was used, while the relationships between wound healing and patients' mental status were usually prospectively evaluated in previous studies.^{10,11,13–16} Thus, depression may slow wound healing, but wound healing results (remaining open vs. closed), treatment duration, and number of visits may not be able to retrodict patients' mental status at initial examination. One reason may be that treatment of wounds at the clinic may have influenced patients' mental status and modify the relationships between depression and wound healing, which is also supported by the observation that treatment at the clinic significantly lowered patient's PHQ-9 scores. Specifically, among the 113 patients with PHQ-9 scores at last visit, PHQ-9 scores decreased in all but 2 (stayed the same as initial examination) of the 24 patients with positive depression screening. Given this interesting finding, we would like to believe that wounds may contribute to the development of depression. This belief is consistent with the finding that delayed wound healing is associated with more severe depressive symptoms.²⁸

In the present study, the proportions of positive depression screening in other types of wounds were also reported and compared with that of VLUs. No difference was found in positive depression screening between patients with VLUs and other wound diagnoses, but this could be due to a relatively small sample size in some wound diagnoses. In addition, previous studies reported that the odor related to wounds appeared to be associated with depression.^{17,21,22} Due to the retrospective character of this study, we did not capture relevant information. Nevertheless, based on our clinic experiences, we believe that odor remains an important contributor to the development of depression in patients with wounds.

The feasibility of clinical operation of such an outpatient physical therapy wound care clinic was reported in a different study;²⁹ the usage of PHQ-9 per se seems an reasonable incorporation of outpatient physical therapy wound care. Reporting positive PHQ-9 screening in a context of collaborative care incorporating both medical and mental health specialists provides optimal disease management.³⁰ However, in the absence of collaborative care settings, the correct protocol for managing patients with positive screens remains unclear and thus warrants further investigation and discussion.³¹

LIMITATIONS

First, the study was conducted at a single wound care center which provided free wound care to patients, so our findings may not be generalizable to other settings with different geographic and patient socioeconomic characteristics. Second, some patients may be under treatments for depression, but our data did not capture this information. Third, the positive screening of depression in the present study was solely based on a PHQ-9 score ≥ 10 , which is different from the current clinical diagnosis of depression; thus, the patient population identified in this study might not precisely represent patients with actual clinical depression. Last, because the majority of the patients included

were Caucasians and other races only accounted for a small portion of the sample population, no detailed analyses across racial groups were performed.

CONCLUSION

Depressive symptoms are common in patients with wounds. Based on the PHQ-9 scores, 22.1% of the patients with wounds in the present clinic had positive depression screening. Two patient characteristics including wound duration ≥ 90 days and with pain at initial examination were associated with the positive depression screening. We suggest that clinicians should take patients' mental status into consideration upon management of wounds. Our data indicated that chronic wounds may contribute to the development of depression; however, further investigation to shed light on the relationship between depression and patients' wound healing process is needed.

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