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Pressure ulcers in veterans with spinal cord injury: A retrospective study

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Abstract — Pressure ulcers are a major complication of spinal cord injury (SCI) and have a significant effect on general health and quality of life. The objectives of this retrospective chart review were to determine prevalence, duration, and severity of pressure ulcers in veterans with SCI and to identify predictors of (1) outcome in terms of healing without surgery, not healing, or referral for surgery; (2) number of visits veterans made to the SCI outpatient clinic or received from home care services for pressure ulcer treatment; and (3) number of hospital admissions and days hospitalized for pressure ulcer treatment. From a sampling frame of 553 veterans on the Houston Veterans Affairs Medical Center SCI roster, 215 (39%) were reported to have visited the clinic or received home care for pressure ulcers (ICD-9 code 707.0 = decubitus, any site) during the 3 years studied (1997, 1998, and 1999). From this sample, 102 veterans met the inclusion criteria for further analyses, 56% of whom had paraplegia. The duration of ulcers varied greatly from 1 week to the entire 3-year timeframe. Overall, Stage IV pressure ulcers were the most prevalent as the worst ulcer documented. Number and severity of ulcers predicted outcome and healthcare utilization. This study illustrates the magnitude of the pressure ulcer problem among veterans with SCI living in the community. Reducing the prevalence of pressure ulcers among veterans with SCI will have a significant impact on the Department of Veterans Affairs' financial and social resources. Innovative approaches are needed to reduce pressure ulcer risk in veterans with SCI.

Key words: pressure ulcer, pressure ulcer prevalence, spinal cord injury, veteran.

Abbreviations: ANOVA = analyses of variance, ASIA = American Spinal Injury Association, DHCP = Decentralized Hospital Computer Program, SCI = spinal cord injury, VAMC = Veterans Affairs Medical Center.

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INTRODUCTION

Pressure ulcers are defined as lesions caused by unrelieved pressure, resulting in damage to the underlying tissue. They usually occur over bony prominences and are classified as stages by the degree of tissue damage observed [1]. The etiology of pressure ulcers is multidimensional. Pressure, shear, friction, moisture, and poor nutrition contribute directly to the physiological etiology of pressure ulcers. Other factors associated with the development of pressure ulcers include immobility and psychosocial factors, such as inadequate personal and financial resources and noncompliance with acknowledged preventive behaviors [2,3]. Pressure ulcers are a serious, life-long complication of spinal cord injury (SCI). Reliable prevalence data have been difficult to obtain because of methodological problems such as use of different pressure ulcer classification systems, multiple sources of data, and varying methods of obtaining data, including direct

observation versus retrospective chart review [4-6]. However, approximately one-third of persons with SCI residing in the community are reported to have pressure ulcers [7-8]. Yarkony and Heinemann reported prevalence rates of 8 percent at the first annual evaluation following rehabilitation within a Model System facility [9], 9 percent at the 2-year follow-up, and up to 32 percent at 20 years postdischarge. Carlson et al. reported a 29 percent prevalence rate during acute care, 3 percent during rehabilitation, and 17 percent during follow-up [10]. Despite these reports of pressure ulcer prevalence, no data are readily available on the duration of pressure ulcers, number of patient visits (clinic or home care) for pressure ulcer management, severity of the ulcers, or the outcomes of the ulcers in terms of healing, nonhealing, or the need for surgical intervention. Furthermore, although data are readily available on the cost of treating pressure ulcers in acute and long-term care, a dearth of information is available on the costs of treating pressure ulcers in persons with SCI [11-14]. Reports indicate that the average cost to heal complex full-thickness pressure ulcers is estimated to be \$70,000 [15].

This study determined the prevalence, duration, and severity of pressure ulcers in veterans with SCI and identified predictors of (1) visits made to the SCI clinic or home care visits veterans received for pressure ulcer treatment, (2) the number of hospital admissions for pressure ulcer treatment, and (3) the number of veterans with SCI with ulcers that healed, did not heal, or were referred for surgery. These data provide baseline information for assessing etiology, determining compliance with treatment interventions, and identifying factors associated with nonhealing or recurrence of pressure ulcers in veterans with SCI.

METHOD

Sample

Investigators obtained a computer-generated list of all patients on the Houston Veterans Affairs Medical Center (VAMC) Spinal Cord Registry during the 3 years studied. From this sampling frame of 553 veterans, investigators were able to identify 215 (39%) treated for a pressure ulcer (ICD-9 code 707.0 = decubitus, any site) during the 3-year period January 1, 1997, through December 31, 1999. Investigators accessed the veterans' electronic medical records sequentially for pertinent data for the 3 study years. Of the records reviewed, 102 met the study inclusion criteria (diagnosis of SCI; treated for a pressure ulcer, any stage, at the outpatient clinic or at home; and verifiable data on pressure ulcer stage, duration, and treatment of pressure ulcers). Patients whose files did not contain the relevant information (severity of ulcer, treatment, outcome of treatment, no pressure ulcers documented despite an associated ICD-9 code) were excluded from the final data set. More than half (113/215) of the charts were excluded primarily because of the extent of incomplete or missing pressure ulcer data in the medical record.

Procedures

A retrospective review of the electronic medical records was used to obtain data on veterans who had sought treatment for pressure ulcers in the SCI outpatient clinic or from the home care program of the Houston VAMC. The Decentralized Hospital Computer Program (DHCP), a database that allows access to the medical record of patients who receive treatment at the Houston VAMC, was the primary source of information obtained for this study. The investigators reviewed all notes for each patient for the 3 years studied. These included daily notes of nurses and therapists, physicians, and surgeons and the notes associated with medical

tests and X-rays. A pressure ulcer tracking form was developed on which the following information was recorded:

1. The anatomical location and severity of each ulcer at the initial visit for that ulcer.
2. The number of visits for each ulcer.
3. Treatment (topical dressings, debridement, referral for hospital admission or surgery).
4. Outcomes in terms of healing, nonhealing, or referral for surgery.
5. Number of hospitalizations for pressure ulcers.
6. Number of days hospitalized for pressure ulcers.

The investigators reviewed the records of all veterans who had an ICD-9 code of 707.0 (decubitus, any site). Of these records, 102 electronic charts met the criteria for review. The physicians whose patients' charts were reviewed gave written permission for the investigators to review their patients' medical records. The local Institutional Review Board for Human Subjects Research and the local Veterans Affairs Research and Development Committee approved the study.

Measures

Demographic and SCI-Specific Characteristics

Demographic information included the person's age, race, caregiver, marital status, and whether or not the person was diabetic. SCI descriptors included level of injury, completeness of the injury as determined by the American Spinal Injury Association (ASIA) Impairment Scale [16], etiology (motor vehicle crash, gunshot wound, fall, diving, or other), age at onset of SCI, and time since onset of the SCI.

Prevalence and Characteristics of Pressure Ulcers

Prevalence

Prevalence is a cross-sectional count of the number of cases (e.g., persons with SCI, pressure ulcers) that occur in a particular population within a specific period of time [17,18]. In this study, prevalence was based on the number of persons who visited the Department of Veterans Affairs (VA) SCI outpatient clinic or received home care for the treatment of a pressure ulcer in the years 1997, 1998, and/or 1999.

Severity

Severity was defined as the stage (I to IV) of a pressure ulcer at its initial assessment [1,17,19]. These stages are described in the **Figure**. If a person had multiple pressure ulcers, the most severe ulcer was the one that was tracked.

inchangeable erythema of intact skin, not to be confused with reactive hyperemia.

Stage II: Partial thickness superficial skin loss involving epidermis and/or dermis that usually presents as an abrasion, blister, or shallow crater.

Stage III: Full thickness skin loss with damage or necrosis of subcutaneous tissue that may extend down to, but not through, underlying fascia, presenting as a deep crater with or without undermining of adjacent tissue.

Stage IV: Full thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures (e.g., tendon or joint capsule), and may be present with undermining and sinus tracts.

Figure.

Stages of pressure ulcers.

Number of Ulcers

The total number of ulcers for each person who received treatment for pressure ulcers in the SCI outpatient clinic and/or from home-health personnel during the 3-year period was recorded.

Duration of Ulcers

Duration was defined as the length of time the veteran had a pressure ulcer during the 3 years of the study.

Location of Ulcer

The anatomical locations of pressure ulcers for this population were the sacrum, coccyx, right and left ischia, right and left trochanters, right and left leg, right and left medial and lateral malleoli, and right and left foot.

Outcome

Outcome was defined as the result of pressure ulcer treatment during that year. We determined outcome by reviewing the medical records from the time the ulcer first appeared in the first year of the study to either healing or the end of the study period. Outcomes were described as ulcer healed without surgery, did not heal and did not have surgery, or was surgically repaired. It is not known to what extent surgically repaired ulcers reopened after discharge.

Healthcare Utilization

Number of Visits

The number of SCI outpatient clinic visits and/or home-health visits for the treatment of pressure ulcers over the 3 years was calculated from information in the medical record. SCI clinic notes and home-health nurse's notes were used to verify the reason for the clinic or home visit. These notes were specific with regard to the problem being addressed in either the clinic or during the home visit.

Hospitalization

Whether or not the patient had been hospitalized for pressure ulcer treatment during the 3-year period was noted.

Number of Admissions

The number of hospital admissions for pressure ulcer treatment during the 3 years of the study was calculated. Physician or nurses' admission notes indicated the reason for the admission. Only those hospital admissions for pressure ulcer treatment were counted.

Days of Hospitalization

The number of days of hospitalization across all admissions for pressure ulcer treatment was recorded.

Analysis

We analyzed the data in two phases. Initially, we analyzed the data from only 1 year to determine if the study was feasible in terms of availability of information, as well as to determine what variables should be used and which would result in the greatest yield of information. As the study progressed, additional variables were identified and incorporated into the data set.

Descriptive statistics were obtained for all study variables for the entire sample and for a subset of patients admitted to the hospital for pressure ulcer treatment. Frequency tables were constructed for categorical variables (level and completeness of SCI, etiology, ethnicity, marital status, caretaker, ulcer severity, diabetes, and treatment outcome). Means, standard deviations, and ranges were calculated for all continuous variables (age, duration of SCI, number of ulcers, number of visits, number of hospital admissions, and days hospitalized). We performed analyses to identify relationships between demographic and SCI-related variables and selected outcome and use variables. Ranks of variables that were highly skewed (i.e., number of ulcers, visits, hospitalizations, and days hospitalized) were used in the analyses. A chi-square analysis was performed when both variables were categorical. For 2×2 tables, Fisher's exact test was used to determine significance. Analyses of variance (ANOVA) and t-tests were used when one variable was continuous and one variable was categorical. For ANOVA, posthoc analyses for multiple comparisons were performed. When both variables were continuous, a correlational analysis was performed. We collapsed categorical data into fewer categories as necessary to avoid very small cell sizes. For statistical significance, $p < 0.05$ was adopted in all analyses.

RESULTS

Characteristics of Study Population

We reviewed a total of 102 charts of veterans with SCI and pressure ulcers. All the patients whose charts were reviewed were male. More than half had paraplegia and over two-thirds had complete injuries (ASIA A). The most frequent cause of injury was a motor vehicle crash. More than half of the sample was Caucasian. Most were not married, and in almost half of the sample, the spouse or significant other was the primary caretaker. The majority of the samples were not

diabetic (**Table 1**). There were wide ranges of age, age at onset of SCI, and time since onset of SCI (**Table 2**).

Prevalence and Characteristics of Pressure Ulcers

Prevalence

Of the 553 veterans on the roster of the SCI outpatient clinic at the Houston VAMC, 215 (39%) were diagnosed with a pressure ulcer (ICD-9 code 707.0 = decubitus, any site) during the 3 years studied. Relevant data were obtained from 102 charts and were the basis for the results presented in this study.

Characteristics of Pressure Ulcers

The stage of the most severe pressure ulcer for each person was recorded. Stage IV pressure ulcers were the most prevalent (**Table 1**). Patients had an average of nearly four (median = 3) ulcers each (**Table 2**). Duration of pressure ulcers varied from 1 week to the entire 3 years studied. Pelvic ulcers (sacrum, coccyx, ischial tuberosities, and trochanters) accounted for almost two-thirds of the worst ulcers reported. Ulcers on the feet were the next most prevalent.

Outcome

The majority of the ulcers did not heal. Overall, the ulcers of 23 of the veterans healed, 54 did not heal, and 11 were surgically repaired. Outcome data on 14 veterans were unknown (**Table 1**). We found significant relationships between outcome and (1) stage of ulcer, (2) rank of number of ulcers, and (3) rank of number of clinic or home visits. Ulcers that were more severe were less likely to heal and more likely to be referred for surgery (Stage II: 60% healed, 40% did not heal, none referred for surgery; Stage III: 33.3 percent healed, 60 percent did not heal, 6.7 percent referred for surgery; Stage IV: 9.8 percent healed, 74.5 percent did not heal, 15.7 percent referred for surgery; chi-square = 15.1, $p < 0.004$). Patients whose study ulcer healed had fewer total number of ulcers than those whose ulcer did not heal (rank of number of ulcers: healed = 41.9, not healed = 61.4 [raw means = 2.5 versus 5.2 ulcers]; overall $F = 4.1$, $p < 0.02$; posthoc test of healed versus not healed, $p < 0.02$). Patients whose ulcer healed had fewer clinic or home visits than those whose ulcer did not heal (rank of number of visits: healed = 40.5, not healed = 64.0 [raw means = 3.3 versus 8.5 visits]; overall $F = 6.4$, $p < 0.003$; posthoc test of healed versus not healed, $p < 0.002$). Those referred for surgery did not differ from either of the other two groups (healed or not healed) for either number of ulcers or number of visits (rank of ulcers = 51.6 [raw mean = 3.7]; rank of visits = 55.0 [raw mean = 6.3]).

Table 1.
 Characteristics of sample: Frequencies and percentages of categorical variables for total samples (n = 102).

Variable	Number	Percent
SCI Level		
Tetraplegia	45	44
Paraplegia	57	56
ASIA Score		
A	70	69
B	15	15
C	9	9
D	7	7
Unknown	1	1
SCI Etiology		
MVC	48	47
GSW	22	22
Fall	9	9
Diving	3	3
Other	18	18
Ethnicity		
Caucasian	57	56
NonCaucasian	45	44
Marital Status		
Married	39	38
Not Married	63	62
Caretaker		
Spouse/Significant Other	48	47
Attendant	22	22
Lives Alone	23	22
Other	9	9
Stage of Worst Ulcer		
II	15	15
III	16	16
IV	57	56
Unstaged	14	14
Location of Worst Ulcer		
Sacrum/Coccyx	14	14
R/L Ischia	36	35
R/L Trochanters	14	14
R/L Feet/Ankle	26	26
Other	9	9
Unknown	3	3
Outcomes Over 3 Yr		
Healed	23	22
Not healed	54	53
Surgery	11	11
Unknown	14	14
Hospitalized		
Yes	57	56
No	45	44
Diabetes		
Yes	17	17

No	83	81
Unknown	2	2

SIA = American Spinal Injury Association (Standards for Neurological and Functional Classification of Spinal Cord Injury)

MVC = motor vehicle crash, GSW = gun shot wound, R/L = right/left

Healthcare Utilization

Number of Visits

The mean number of clinic or home visits made for pressure ulcer treatment was more than six visits per person (median = 4) (**Table 2**). Number of visits was significantly associated with the severity of the ulcer and the rank of the number of ulcers. Patients with Stage II ulcers had fewer visits than those with Stage IV ulcers (rank of number of visits: Stage II = 39.3, Stage III = 60.0, and Stage IV = 58.8 [raw means = 3.9 versus 6.3 versus 8.4 visits]; $F = 3.32, p < 0.05$). Patients who had more ulcers were likely to have more visits ($r = 0.70, p < 0.01$).

Table 2.

Means, standard deviations (SDs), and ranges of continuous study variables for total sample (n = 102).

Variable	Mean	SD	Range
Age (yr)	51	12.35	25-82
Age at Onset of SCI (yr)	34	13.34	13-69
Duration of SCI (yr)	18	11.29	1-54
Number of Ulcers	4	3.47	1-18
Number of Visits	6	7.63	1-59

Hospitalization

Of the 102 veterans included in the study, over half were admitted to the hospital for pressure ulcer treatment at least once during the 3 years of the study (**Table 3**). Five predictors of hospitalization were identified. These included (1) etiology (dichotomized as motor vehicle crashes versus all other etiologies), (2) ASIA impairment level (dichotomized as A and B versus C and D), (3) severity of study pressure ulcer (dichotomized as Stages II or III versus Stage IV), (4) location of ulcer (categorized as ischium and trochanter versus sacrum and coccyx versus foot and ankle), and (5) outcome (dichotomized as healed or not healed, omitting those referred for surgery). Persons injured in motor vehicle crashes were less likely than persons injured in other ways to be hospitalized for pressure ulcer treatment (45.8% versus 67.3%, chi-square = 4.7, $p < 0.03$). Persons with ASIA impairment levels of A or B were more likely to be hospitalized than those with levels of C or D (61.2% versus 31.3%, chi-square = 4.9, $p < 0.04$). Persons with Stage II or III ulcers were less likely to be hospitalized than persons with Stage IV ulcers (35.5% versus 71.9%, chi-square 11.0, $p < 0.001$). Persons whose study ulcer was on the ischium or trochanter were most likely to be hospitalized. Fifty patients had their worst ulcers in either the ischia or trochanters. Of these patients, 38 (76%) were hospitalized. Persons with ulcers on the sacrum or coccyx were next most likely to be hospitalized. Fourteen patients had their worst ulcers on the sacrum or coccyx. Of these patients, seven (50%) were hospitalized. Twenty-six

patients had their worst ulcers on their feet and/or ankles; of these, eight (31%) were hospitalized (chi-square = 15.0, $p < 0.001$). Patients whose ulcers healed without surgery during the 3 years of the study were less likely to be hospitalized for pressure ulcer treatment than those whose ulcer did not heal (30.4% versus 68.5%, chi-square = 9.6, $p < 0.003$).

Table 3.
Characteristics of patients admitted to hospital: Frequencies and percentages of categorical variables (n = 57).

Variable	Number	Percent
SCI Level		
Tetraplegia	23	40
Paraplegia	34	60
ASIA Score		
A	43	75
B	9	16
C	3	5
D	2	3
SCI Etiology		
MVC	22	39
GSW	15	26
Fall	8	14
Diving	2	3
Other	10	17
Ethnicity		
Caucasian	31	54
African American	23	40
Hispanic	3	5
Marital Status		
Married	19	33
Not Married	38	67
Caretaker		
Spouse	27	47
Attendant	16	28
None	14	25
Worst Ulcer		
II	3	5
III	8	14
IV	41	72
Unstaged	5	9
Location of Worst Ulcer		
Sacrum/Coccyx	7	12
R/L Ischia	27	47
R/L Trochanters	11	19
R/L Feet/Ankle	8	14
Other	4	7
Total Admissions		
1	26	46
2	14	25
3	11	19
4	2	3
5	3	5
6	1	2

Outcomes Over 3 Yr		
Healed	7	12
Not Healed	37	65
Surgery	10	18
Unknown	3	5

ASIA = American Spinal Injury Association (Standards for Neurological and Functional Classification of Spinal Cord Injury)

MVC = motor vehicle crash

GSW = gun shot wound

R/L = right/left

Number of Admissions

Number of admissions per patient averaged just over two admissions (median = 2) (**Table 4**). Almost 30 percent were admitted three or more times. These patients did not differ significantly from the total sample in demographic or SCI-specific factors. No predictors of number of admissions were identified. The characteristics of the hospitalized patients are displayed in **Tables 3 and 4**.

Table 4.

Means, standard deviations (SDs), and ranges of continuous study variables for patients admitted to hospital for pressure ulcer treatment (n = 57).

Variable	Mean	SD	Range
Age (yr)	53	11.73	28-78
Age at Onset of SCI (yr)	36	12.57	19-70
Duration of SCI (yr)	17	11.25	1-52
Number of Admissions	2	1.25	1-6
Days Hospitalized	150	142.87	2-786

Number of Days Hospitalized

The mean number of days hospitalized for pressure ulcer treatment was 150 days (median = 125) (**Table 4**). The only predictor of the rank of number of days hospitalized was the rank of number of hospitalizations ($r = 0.57, p < 0.001$).

DISCUSSION

The occurrence of pressure ulcers is among the most common long-term secondary medical complications in persons with SCI [19]. Methodological problems have limited the reliability of data describing the prevalence of pressure ulcers in this population. In this retrospective chart-review study, almost 39 percent of the veterans on the SCI roster at the one VAMC were treated for a pressure ulcer during a 3-year time frame. This figure is consistent with a number of earlier studies in which prevalence ranged from 17 to 33 percent in persons with SCI residing in the community [10,6]. Rish and colleagues conducted a 25-year morbidity and mortality study of veterans with SCI [20]. They found that the majority of morbidity problems and the most frequent cause of death were sepsis associated with genitourinary and pressure ulcer sequelae. Recurrence also is a major problem for veterans with SCI. Niazi and colleagues reported that in their sample of 176 veterans with SCI and a history of one or more pressure ulcers [21], 35 percent experienced a recurrence regardless of whether they had received surgical or nonsurgical treatment. Higher recurrence rates occurred in patients who smoked or who had diabetes or

cardiovascular disease. In a study of 48 veterans with SCI who had surgery to repair their pressure ulcers, postoperative complications were high (40%) and 79 percent experienced ulcer recurrence or new ulcer development [22]. Schryvers and colleagues conducted a retrospective chart review of patients with SCI who had had pressure ulcer surgery between 1976 and 1996 [23]. Recurrent admissions were reported for 54 percent of their sample. Recurrent severe ulcers were reported for 12 percent of the total sample. Factors that were associated with recurrence included unemployment, low level of education, drug or alcohol abuse, and poverty.

Almost three-fourths (69%) of the sample in the current study had complete SCI (ASIA A), indicating the absence of sensation and motor function below the neurological level, including the sacral segments S4 and S5 [16]. This finding is consistent with the literature that contends that increased immobilization (decreased motor function) and lack of sensory feedback are the leading causes of pressure ulcers [24,25].

The predictors of outcome (healed, not healed, or surgery) identified in this study are intuitive. Persons whose worst ulcer healed had less severe ulcers, fewer ulcers, and fewer clinic or home visits than those whose ulcer did not heal. However, persons referred for surgery were no different from individuals in the healed and not healed groups with respect to number of ulcers or number of visits.

Healthcare utilization for treatment of pressure ulcers among persons with SCI has not been well studied. In this study, patients received an average of over six clinic or home visits for pressure ulcer treatment in a 3-year period. Furthermore, more than half of the persons whose charts were reviewed were admitted to the hospital for pressure ulcer treatment at least once during the 3 years of the study and almost one-third had been admitted three or more times. The average number of days hospitalized was over 150 days. It has been estimated that 1 day of hospitalization on the SCI unit of a VAMC costs \$1,000 (personal communication with Administrative Officer on SCI Care Line). Therefore, the estimated average cost per patient for hospitalization for pressure ulcer treatment is \$150,000. This does not cover the costs associated with surgical intervention.

As with the predictors of outcome, several of the predictors of hospitalization for pressure ulcers were expected (ASIA A or B impairment level, severity of study pressure ulcer, and healed versus nonhealed during outpatient treatment). In addition, hospitalization occurred more frequently for ischial and trochanteric ulcers than for ulcers in other anatomical areas. However, one unforeseen finding was that etiology of SCI (motor vehicle crash versus all other causes) was associated with hospitalization for pressure ulcer treatment. Persons injured by motor vehicle crashes were less likely to be hospitalized; however, this group was younger at the time of the study and had had their SCI for a shorter duration than those injured in other ways. Another unexpected finding was that neither outcomes nor healthcare utilization was associated with whether or not the patient had diabetes. Future studies might explain these observations.

Inconsistent, inaccurate, and/or missing data in the medical records were the main limitations of this study. These factors reflect a lack of continuity in the documentation process that may have an effect on clinical care and follow-up. Appropriate documentation has been reported to have several major benefits to patients and healthcare providers. Among these are (1) tracking an

increase or decrease in the number of patient visits, (2) determining areas of high risk for skin breakdown for the individual and other similar veterans, (3) monitoring the effectiveness of treatment over time, and (4) performing cost analysis of treatment [4]. French and Ledwell-Sifner developed a flow sheet to help nurses to more thoroughly, objectively, and consistently assess a patient with pressure ulcers [26]. This approach was more successful in preventing and managing pressure ulcers than a standardized teaching protocol. To attempt to meet standards of quality of patient care, Cardi developed the "Clinical Competency Tool for Documentation of Pressure Ulcer Prevention and Management" [27].

The National Pressure Ulcer Advisory Panel (NPUAP) believes pressure ulcer incidence should be considered an indicator of quality care in healthcare institutions [4,28]. By tracking these indicators of care, clinicians and administrators will be documenting patient progress, healthcare utilization, and successful treatment approaches.

The cost-effectiveness of pressure ulcer prevention versus treatment has been studied in the acute and long-term-care patient populations. Aggressive and relatively low-cost preventive measures were found to reduce significantly pressure ulcer incidence in a long-term-care setting [29]. In a small study that included persons with paraplegia, implementation of the Agency for Health Care Policy and Research's (AHCPR's) clinical practice guideline on prevention of pressure ulcers in adults resulted in lower costs than current practice at the facility in which they were being treated [1,30]. Similar studies designed to assess the effect of pressure ulcer prevention programs in persons with SCI may reduce the incidence and recurrence of pressure ulcers, improve care, and reduce the staggering costs of treatment.

A potential indirect outcome of consistent documentation will be the development and evaluation of innovative and cost-effective outpatient and home-health programs that identify persons at highest risk for pressure ulcers and that prevent and/or reduce the frequency of pressure ulcer occurrence or recurrence in veterans with SCI.

CONCLUSIONS

This study illustrates the magnitude of the pressure ulcer problem among veterans with SCI living in the community. In this study, 39 percent of all patients on the SCI roster at the Houston VAMC were reported to have visited the clinic or received home care for pressure ulcers within a 3-year time frame. Although these data are consistent with prevalence rates reported in other literature, the lack of consistent and reliable data in some patient records reflects possible inaccuracies. A total of 625 visits were made to treat 400 pressure ulcers. At a cost of approximately \$250 per outpatient visit, this amounts to over \$156,000. The average number of hospitalization days for pressure ulcer treatment was 150 days, with an average cost of \$150,000 per patient hospitalized. In this study, 57 patients were hospitalized for pressure ulcer treatment, costing approximately \$8,550,000 over 3 years. This finding evidently shows that the costs of treating pressure ulcers in persons with SCI are astounding. Innovative approaches, especially for individuals with SCI living in the community, are needed to reduce a person's pressure ulcer risk. Consistent and more reliable documentation is one mechanism that may result in better treatment outcomes and quality of life for persons with SCI and pressure ulcers.

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