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Clinical and Economic Burden of Peristomal Skin Complications in Patients With Recent Ostomies

Charu Taneja ♦ Debra Netsch ♦ Bonnie Sue Rolstad ♦ Gary Inglese ♦ Lois Lamerato ♦ Gerry Oster

ABSTRACT

PURPOSE: The purpose of this study was to estimate the risk and economic burden of peristomal skin complications (PSCs) in a large integrated healthcare system in the Midwestern United States.

DESIGN: Retrospective cohort study.

SUBJECTS AND SETTING: The sample comprised 128 patients; 40% (n = 51) underwent colostomy, 50% (n = 64) underwent ileostomy, and 10% (n = 13) underwent urostomy. Their average age was 60.6 ± 15.6 years at the time of ostomy surgery.

METHODS: Using administrative data, we retrospectively identified all patients who underwent colostomy, ileostomy, or urostomy between January 1, 2008, and November 30, 2012. Trained medical abstractors then reviewed the clinical records of these persons to identify those with evidence of PSC within 90 days of ostomy surgery. We then examined levels of healthcare utilization and costs over a 120-day period, beginning with date of surgery, for patients with and without PSC, respectively. Our analyses were principally descriptive in nature.

RESULTS: The study cohort comprised 128 patients who underwent ostomy surgery (colostomy, n = 51 [40%]; ileostomy, n = 64 [50%]; urostomy, n = 13 [10%]). Approximately one-third (36.7%) had evidence of a PSC in the 90-day period following surgery (urinary diversion, 7.7%; colostomy, 35.3%; ileostomy, 43.8%). The average time from surgery to PSC was 23.7 ± 20.5 days (mean ± SD). Patients with PSC had index admissions that averaged 21.5 days versus 13.9 days for those without these complications. Corresponding rates of hospital readmission within the 120-day period following surgery were 47% versus 33%, respectively. Total healthcare costs over 120 days were almost \$80,000 higher for patients with PSCs.

CONCLUSIONS: Approximately one-third of ostomy patients over a 5-year study period had evidence of PSCs within 90 days of surgery. Costs of care were substantially higher for patients with these complications.

KEY WORDS: Colostomy, Complications, Cost analysis, Ileostomy, Ostomy, Peristomal skin, Stoma, Urostomy.

INTRODUCTION

Approximately 100,000 persons living in the United States undergo surgical creation of an ostomy each year.¹ Ostomy patients frequently experience problems due to peristomal skin

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damage.² Jemec and Nybaek³ reported that 39% of consultations at 4 nurse-led ostomy clinics in Denmark in 2007 were attributable to peristomal skin complications (PSCs).

The etiology of PSCs is complex and multifactorial and includes chemical injury (eg, peristomal moisture-associated skin damage, urine, or fecal irritant), trauma and mechanical destruction of tissue (eg, adhesive stripping injury), infection, contact dermatitis, and disease-related issues (eg, pyoderma gangrenosum).^{2,4} They often can be avoided, and/or their severity is limited, with adequate patient training and active engagement in the care of peristomal skin, along with emphasis on the importance of seeking professional care on a timely basis when problems arise. Several studies have reported that many patients with PSCs are unaware that this problem is not normal.⁵

Estimates of the incidence of PSCs range from 10% to 72%.⁶ Reasons for the wide range of estimates include relatively small and/or heterogeneous study populations, differences in the types of ostomies studied (eg, fecal vs urinary, end vs loop), differences in types of complications considered and how cases were defined, and differences in assessment periods. While PSCs may occur at any time, the incidence is highest in the first 5 years following surgery.⁷ Peristomal skin complications also have been reported to occur more frequently in ileostomy patients than in urostomy and colostomy patients.^{8,9}

Relatively little also is known about the economic burden of PSCs. We searched the literature and found only one study that has reported estimates of the economic costs of PSCs.

Martins and colleagues⁵ reported that the cost of an “average” PSC treatment episode (assumed to last 7 weeks) ranged from £106.29 (approximately US \$133) in those deemed mild and caused by mechanical trauma to £618.69 (approximately US \$776) for those deemed severe and disease-related. The costs of severe PSCs were 2- to 4-fold higher than those of mild cases. While we are aware of other studies that have examined healthcare utilization and costs among persons with a new ostomy,¹⁰⁻¹² none of these studies reported results stratified according to whether patients had evidence of PSCs in the postoperative period. Our descriptive study was designed to address this gap in the literature.

METHODS

We undertook a retrospective cohort study in a large integrated health system to estimate the incidence of PSCs over a 90-day period following ostomy surgery. We also evaluated levels of healthcare utilization and costs among patients with and without evidence of PSCs. Analyses of study data were principally descriptive in nature.

Data were obtained from information systems of Henry Ford Health System (HFHS), which provides medical care services to approximately 800,000 residents of Detroit, Michigan, and surrounding areas. Approximately one-third of all persons seen at HFHS facilities in any given year are members of Health Alliance Plan (HAP), a not-for-profit health maintenance organization that is wholly owned by HFHS. The health system uses a system-wide comprehensive multidimensional electronic medical record (EMR) that organizes and stores information on patient demographics, ambulatory care visits, clinical laboratory and radiology results, and inpatient admissions, as well as a range of other clinical parameters. HFHS also maintains administrative data stores, with information on all healthcare encounters with HFHS providers and facilities, including ambulatory care visits (outpatient clinic, emergency department), hospital admissions, and billing records generated within inpatient and outpatient settings. In addition, claims for healthcare services provided at non-HFHS sites and outpatient prescription claims are available for all HAP enrollees who designated HFHS as their care provider. All records can be linked through unique health record numbers. We limited our sample to persons enrolled in HAP because patients who are not members of HAP may have received care from non-HFHS providers, which is not captured in either available medical records or administrative data stores.

Information in the EMR is stored electronically and was not text-searchable and therefore was extracted manually to hard copy case report forms that we developed for use in this study. To ensure compliance with HIPAA, no patient-identifying information was extracted from HFHS data stores. Each study subject was assigned a unique identifier, which was then used to link information from different HFHS databases. The study was reviewed and approved by the HFHS institutional review board.

The sample comprised all persons, aged 18 years or older, who underwent colostomy, ileostomy, or urostomy between January 1, 2008, and November 30, 2012 (“study period”), and were members of HAP. Persons not continuously enrolled in HAP during the 120-day period following surgery (or who otherwise were lacking complete data) were excluded.

We examined the baseline characteristics of study subjects, including their age as of date of surgery, gender, and race (ie,

African American, white, other). We also noted year of surgery, type of surgery (colostomy, ileostomy, urostomy), whether the procedure was described as permanent or temporary, and total days in hospital during the index admission.

Study Procedures

Trained medical record technicians scanned the EMR for each study subject to determine if there was any evidence of a PSC within 90 days of surgery. Ascertainment of PSCs was based on notation of any of a number of predefined key words and terms (eg, “dermatitis,” “excoriated,” “maceration”). All such information was independently reviewed by 2 certified wound ostomy nurses (CWON); study subjects were designated as having experienced a PSC only if both nurses agreed.

Levels of healthcare utilization were then tallied for each study subject over a 120-day period following surgery, including all hospitalizations, outpatient visits, and stays in long-term care facilities, based on information in HFHS administrative data stores. We also tallied costs of inpatient care, outpatient care, long-term care, and outpatient pharmacy over a similar period of time, based on recorded billed charges (information on costs is not reported). A 120-day period of observation was employed to ensure that a minimum of 30 days of follow-up post-PSC would be available for each patient who developed such a complication. Because attribution of specific services to particular disease conditions is often difficult, utilization and costs were tallied on an all-cause basis.

Data Analysis

Age, gender, race, year of surgery, type of ostomy (colostomy vs ileostomy, or urostomy permanent vs temporary), and days in hospital for the index admission were examined using descriptive statistics. We examined the incidence of PSCs on an overall basis, as well as by type of ostomy, using cumulative incidence techniques that account for death as a competing risk.¹³ The percentage of patients dying within 90 days of ostomy surgery also was examined.

For patients with and without evidence of PSCs, respectively, we examined the percentages of patients receiving various types of services, as well as the number of times these services were rendered (if relevant), which we summarized using means, standard deviations, medians, and interquartile ranges. Costs of healthcare services also were tallied for patients with and without PSCs on an overall basis and by type of service. Total cumulative costs of care were analyzed using the Kaplan-Meier sample average (KMSA) estimator.^{14,15} With this method, the period of follow-up is divided into time segments of equal length, and the mean cost of all uncensored patients during each time interval is multiplied by the Kaplan-Meier estimate of the proportion of patients surviving to the beginning of the interval. These products are then summed across all intervals to yield a KMSA estimator of costs. In analyses of both healthcare utilization and costs, patients with evidence of closure of stoma during the 120-day period of follow-up were censored as of the date of the hospitalization in which this procedure was performed, since these patients no longer were at risk of developing PSCs.

All analyses were conducted using SAS proprietary software (release 9.1; SAS Institute Inc, Cary, North Carolina). Statistical testing for differences between patients with and without PSCs was not undertaken due to the small sample size and low statistical power.

RESULTS

Between January 1, 2008, and November 30, 2012, we identified 168 persons who were members of HAP and underwent surgical procedures involving ostomies. One hundred twenty-eight patients met all study entry criteria, including 51 (40% of all study subjects) who underwent colostomy, 64 (50%) who underwent ileostomy, and 13 (10%) who underwent urostomy. The average age of subjects was 60.6 ± 15.6 years (mean \pm SD) years when they underwent ostomy surgery (Table 1). Men comprised 61% of all colostomy patients, and 69% of urostomy patients were women; there were equal numbers of male and female ileostomy patients.

Approximately one-third of patients (35.2%) had ostomies that were described as temporary, while 27.3% had procedures that were described as permanent; we could not determine status for 37.5% of study subjects due to insufficient information in the medical record. Twelve patients (9.4% of study subjects) died within 90 days of index surgery, including 6 with colostomy (11.8%), 4 with ileostomy (6.3%), and 2 with urostomy (15.4%) (Table 1). The mean inpatient days for the index admission was 10.2 ± 5.1 days for urostomy, 14.5 ± 10.5 days for colostomy, and 19.8 ± 17.7 days for ileostomy.

Forty-seven patients (36.7%) had evidence of a PSC within 90 days of surgery, including 28 with ileostomy (43.8%), 18 with colostomy (35.3%), and 1 with urostomy (7.7%) (Figure 1). Among patients with PSCs, the average time from ostomy surgery to first notation of a PSC was 23.7 ± 20.5 days: colostomy, 23.2 ± 20.8 days; ileostomy, 24.2 ± 21.1 days; and urostomy, 22.0 ± 0.0 days.

The mean age was similar for patients with and without PSC (60 years vs 61 years, respectively). More men than women developed PSCs (57% vs 49% among patients without PSCs). Among the 47 patients with evidence of PSCs, 26 developed PSC during the index admission. The mean length of stay for the index admission was 21.5 days for patients with evidence of PSCs versus 13.9 days for all other patients (Table 2).

Information on healthcare utilization over the 120-day period following ostomy surgery is presented in Table 2 for patients with and without evidence of PSCs, respectively; similar information on costs is provided in Table 3. Patients with PSCs were more likely to be rehospitalized following their index admission (47% vs 33%, respectively), and among all patients readmitted to hospital, stays were longer if patients had a PSC (14.3 days vs 10.5 days for those without evidence of PSCs). The mean number of outpatient visits was generally similar in

TABLE 1.
Demographic and Clinical Characteristics of Study Subjects, by Type of Ostomy^a

Characteristic	Colostomy (N = 51)	Ileostomy (N = 64)	Urinary Diversion (N = 13)	All Subjects (N = 128)
Age at index admission, y				
18-44	4 (7.8)	13 (20.3)	1 (7.7)	18 (14.1)
45-54	13 (25.5)	8 (12.5)	3 (23.1)	24 (18.8)
55-64	13 (25.5)	22 (34.4)	5 (38.5)	40 (31.3)
65-74	8 (15.7)	8 (12.5)	1 (7.7)	17 (13.3)
75-84	9 (17.6)	10 (15.6)	3 (23.1)	22 (17.2)
≥85	4 (7.8)	3 (4.7)	0 (0.0)	7 (5.5)
Mean (SD)	62.2 (14.9)	59.0 (16.8)	61.9 (12.1)	60.6 (15.6)
Gender				
Male	31 (60.8)	32 (50.0)	4 (30.8)	67 (52.3)
Female	20 (39.2)	32 (50.0)	9 (69.2)	61 (47.7)
Race				
African American	15 (29.4)	24 (37.5)	2 (15.4)	41 (32.0)
White	30 (58.8)	33 (51.6)	9 (69.2)	72 (56.3)
Other	6 (11.8)	7 (10.9)	2 (15.4)	15 (11.7)
Year of ostomy surgery				
2008	16 (31.4)	12 (18.8)	1 (7.7)	29 (22.7)
2009	9 (17.6)	12 (18.8)	2 (15.4)	23 (18.0)
2010	11 (21.6)	15 (23.4)	4 (30.8)	30 (23.4)
2011	8 (15.7)	15 (23.4)	4 (30.8)	27 (21.1)
2012	7 (13.7)	10 (15.6)	2 (15.4)	19 (14.8)
Type of ostomy				
Permanent	8 (15.7)	21 (32.8)	6 (46.2)	35 (27.3)
Temporary	20 (39.2)	24 (37.5)	1 (7.7)	45 (35.2)
Unknown	23 (45.1)	19 (29.7)	6 (46.2)	48 (37.5)
Death within 90 d of ostomy surgery	6 (11.8)	4 (6.3)	2 (15.4)	12 (9.4)

^aUnless otherwise indicated, all values are number (%) of subjects.

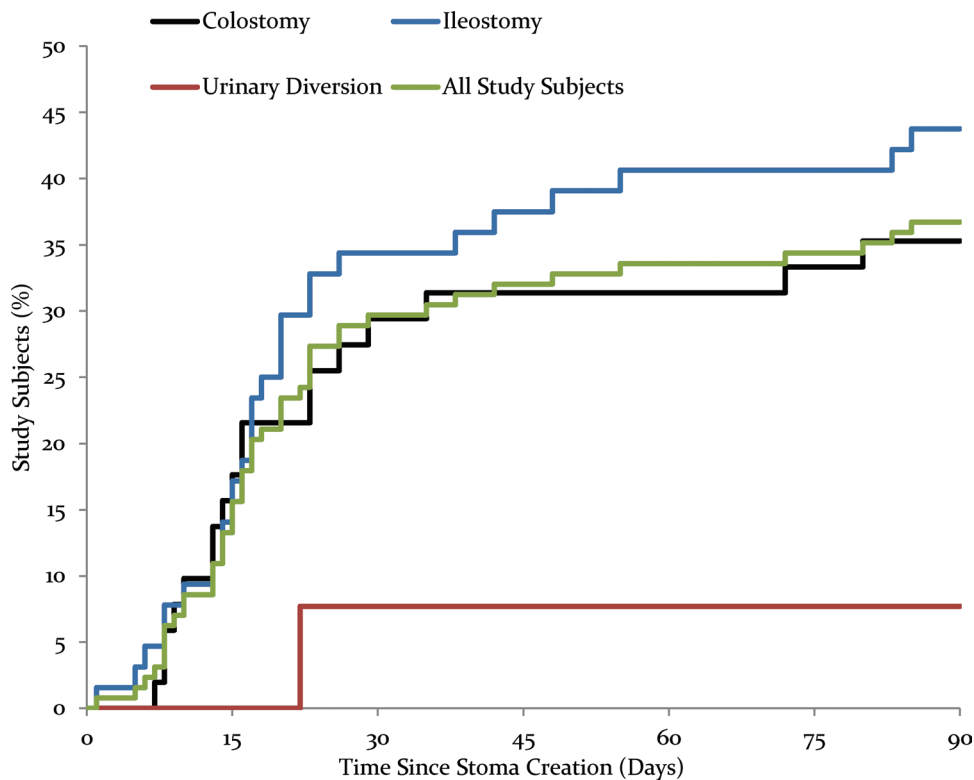


Figure 1. Time to PSC, by type of ostomy surgery.

the 2 groups. Among the 49 patients who were rehospitalized during the 120-day period of follow-up, 15 underwent closure procedures. Mean time to hospital readmission for closure of stoma for these 15 patients was 90.6 days. Five of these 49 patients had evidence of a PSC prior to closure.

Total healthcare costs over 120 days averaged \$204,907 among patients with PSCs and \$126,747 among those without evidence of these complications (difference = \$78,160). Inpatient care accounted for most of the difference (Table 3). Kaplan-Meier estimates of cumulative costs over 120 days by PSC status are presented in Figure 2.

DISCUSSION

We conducted a retrospective study at a large integrated health system in the Midwestern United States to examine the incidence and economic burden of PSCs among a cohort of patients who underwent ostomy surgery during a recent 5-year period. Approximately one-third of study subjects had evidence of PSCs in the 90-day period following surgery. Mean total healthcare charges over 120 days were \$78,160 higher among patients with PSCs compared with those who did not develop these complications.

Although our estimate of the overall incidence of PSCs following ostomy surgery is within the range reported in the literature,⁶ our estimates by type of procedure differ from prior reports. For instance, Herlufsen and colleagues⁸ reported that the incidence of PSCs over 1 year was highest for ileostomy (57%), followed by urostomy (48%) and colostomy (35%). Ratliff and Donovan⁹ reported a similar pattern in their 2001 study. In our study, the incidence was lowest among urostomy patients, but it is important to note that there were relatively few such patients in our sample and our duration of follow-up was shorter.

As noted earlier, information on the economic burden of PSCs in the United States is limited. Wick and colleagues¹¹ investigated the risks and costs of hospital readmission following colorectal surgery. Among 1482 patients with ostomies, 37.2% were readmitted to hospital within 90 days of their index admission; mean length of stay was 8 days. In our study, which focused on a slightly different population, 38.3% of patients were readmitted to hospital within 120 days. In a study based on Medicare claims data, Gore and colleagues¹⁰ reported a 31% rate of readmission over 90 days among urostomy patients. Tyler and colleagues¹² examined the rate of readmission within 30 days of surgery for colostomy and ileostomy, respectively, using data from HCUP. They reported that approximately 27% of colostomy patients and 38.5% of ileostomy patients were readmitted to hospital within 30 days of surgery¹²; corresponding percentages in our study were 11.8% and 20.0%, respectively.

The higher costs that we observed among patients with PSCs versus those without this complication were largely attributable to higher costs of inpatient care. Hospitalization costs were substantially higher for patients with PSCs for 2 reasons. First, 26 of the 47 patients with evidence of PSCs developed these complications during their index admissions, and these patients stayed in hospital almost 1 week longer than patients who did not develop PSCs prior to hospital discharge. Second, patients with evidence of PSCs also were more likely to be readmitted to hospital than patients without these complications. We caution, however, that our findings demonstrate only an association between PSCs and hospital days and not necessarily a causal link between these measures. Patients with PSCs, for example, may differ in other important respects from those who do not develop these complications, and these differences may underlie longer stays in hospital and a higher

TABLE 2. Utilization of Selected Healthcare Services During 120-Day Period Following Ostomy Surgery, by the Absence/Presence of PSC (Analyses Based on Administrative Data)^a

	Colostomy		Ileostomy		Urinary Diversion (Urostomy)		All Subjects	
	No PSC (N = 33)	PSC (N = 18)	No PSC (N = 36)	PSC (N = 28)	No PSC (N = 12)	PSC (N = 1)	No PSC (N = 81)	PSC (N = 47)
<i>Length of stay, index admission, n (% with any)</i>								
<7	7 (21.2)	2 (11.1)	7 (19.4)	1 (3.6)	3 (25.0)	0 (0.0)	17 (21.0)	3 (6.4)
7-13	15 (45.5)	5 (27.8)	15 (41.7)	8 (28.6)	7 (58.3)	0 (0.0)	37 (45.7)	13 (27.7)
≥14	11 (33.3)	11 (61.1)	14 (38.9)	19 (67.9)	2 (16.7)	1 (100.0)	27 (33.3)	31 (66.0)
Mean (SD)	12.2 (6.8)	18.9 (14.4)	17.1 (18.7)	23.1 (16.0)	9.3 (3.9)	22.0 (0.0)	13.9 (13.5)	21.5 (15.2)
Median (IQR)	11.0 (7.0-14.0)	17.5 (10.0-20.0)	10.5 (7.0-16.0)	18.5 (13.0-25.5)	8.5 (6.5-10.0)	22.0 (22.0-22.0)	10.0 (7.0-15.0)	18.0 (11.0-24.0)
<i>Readmissions</i>								
Patients, n (% with any)	6 (18.2)	8 (44.4)	15 (41.7)	14 (50.0)	6 (50.0)	0 (0.0)	27 (33.3)	22 (46.8)
Number of readmissions ^b								
Mean (SD)	1.2 (0.4)	1.3 (0.5)	1.8 (1.1)	1.7 (1.1)	1.3 (0.5)	0.0 (0.0)	1.6 (0.9)	1.5 (0.9)
Median (IQR)	1.0 (1.0-1.0)	1.0 (1.0-1.5)	1.0 (1.0-2.0)	1.5 (1.0-2.0)	1.0 (1.0-2.0)	0.0 (0.0-0.0)	1.0 (1.0-2.0)	1.0 (1.0-2.0)
<i>Days in hospital^b</i>								
Mean (SD)	9.2 (5.7)	7.0 (3.5)	12.1 (11.6)	18.5 (22.0)	8.0 (5.2)	0.0 (0.0)	10.5 (9.4)	14.3 (18.4)
Median (IQR)	8.0 (5.0-12.0)	7.0 (4.0-10.5)	7.0 (3.0-17.0)	9.0 (3.0-21.0)	8.0 (3.0-11.0)	0.0 (0.0-0.0)	7.0 (3.0-15.0)	8.5 (3.0-13.0)
<i>Long-term care</i>								
Patients, n (% with any)	4 (12.1)	5 (27.8)	5 (13.9)	11 (39.3)	2 (16.7)	1 (100.0)	11 (13.6)	17 (36.2)
Number of days ^b								
Mean (SD)	18.0 (17.8)	12.8 (10.0)	11.4 (7.1)	5.8 (4.8)	5.0 (1.4)	2.0 (0.0)	12.6 (11.8)	7.6 (7.2)
Median (IQR)	12.0 (7.5-28.5)	7.0 (6.0-21.0)	10.0 (10.0-17.0)	4.0 (2.0-12.0)	5.0 (4.0-6.0)	2.0 (2.0-2.0)	10.0 (4.0-17.0)	6.0 (2.0-12.0)
<i>Outpatient care</i>								
Physician's office								
Patients, n (% with any)	28 (84.8)	16 (88.9)	34 (94.4)	25 (89.3)	11 (91.7)	1 (100.0)	73 (90.1)	42 (89.4)
Number of visits ^b								
Mean (SD)	9.0 (6.1)	13.4 (6.3)	8.9 (5.2)	10.4 (5.7)	14.8 (8.1)	2.0 (0.0)	9.8 (6.3)	11.4 (6.2)
Median (IQR)	8.0 (4.0-10.5)	15.0 (8.5-18.0)	9.0 (5.0-11.0)	9.0 (6.0-15.0)	13.0 (8.0-21.0)	2.0 (2.0-2.0)	9.0 (5.0-11.0)	10.5 (6.0-16.0)

(continues)

TABLE 2. Utilization of Selected Healthcare Services During 120-Day Period Following Ostomy Surgery, by the Absence/Presence of PSC (Analyses Based on Administrative Data)^a (Continued)

	Colostomy		Ileostomy		Urinary Diversion (Urostomy)		All Subjects	
	No PSC (N = 33)	PSC (N = 18)	No PSC (N = 36)	PSC (N = 28)	No PSC (N = 12)	PSC (N = 1)	No PSC (N = 81)	PSC (N = 47)
Home care								
Patients, n (% with any)	27 (81.8)	13 (72.2)	33 (91.7)	18 (64.3)	10 (83.3)	1 (100.0)	70 (86.4)	32 (68.1)
Number of visits ^b								
Mean (SD)	7.2 (4.2)	9.2 (4.4)	7.2 (3.8)	8.7 (5.0)	8.4 (3.8)	6.0 (0.0)	7.4 (3.9)	8.8 (4.6)
Median (IQR)	6.0 (4.0-10.0)	10.0 (5.0-11.0)	7.0 (4.0-9.0)	7.0 (6.0-11.0)	7.0 (7.0-10.0)	6.0 (6.0-6.0)	7.0 (5.0-10.0)	7.5 (5.5-11.0)
Emergency room								
Patients, n (% with any)	7 (21.2)	5 (27.8)	13 (36.1)	8 (28.6)	6 (50.0)	0 (0.0)	26 (32.1)	13 (27.7)
Number of visits ^b								
Mean (SD)	1.7 (1.0)	1.8 (1.1)	1.9 (1.3)	1.4 (0.7)	1.5 (0.8)	0.0 (0.0)	1.8 (1.1)	1.5 (0.9)
Median (IQR)	1.0 (1.0-3.0)	1.0 (1.0-3.0)	1.0 (1.0-2.0)	1.0 (1.0-1.5)	1.0 (1.0-2.0)	0.0 (0.0-0.0)	1.0 (1.0-2.0)	1.0 (1.0-2.0)
Urgent care								
Patients, n (% with any)	0 (0.0)	1 (5.6)	3 (8.3)	1 (3.6)	0 (0.0)	0 (0.0)	3 (3.7)	2 (4.3)
Number of visits ^b								
Mean (SD)	0.0 (0.0)	1.0 (0.0)	1.7 (0.6)	1.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.7 (0.6)	1.0 (0.0)
Median (IQR)	0.0 (0.0-0.0)	1.0 (1.0-1.0)	2.0 (1.0-2.0)	1.0 (1.0-1.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	2.0 (1.0-2.0)	1.0 (1.0-1.0)
Other outpatient visits								
Patients, n (% with any)	12 (36.4)	8 (44.4)	22 (61.1)	17 (60.7)	5 (41.7)	1 (100.0)	39 (48.1)	26 (55.3)
Number of visits ^b								
Mean (SD)	4.6 (8.2)	2.0 (1.1)	4.1 (4.5)	12.1 (17.6)	4.2 (6.1)	3.0 (0.0)	4.3 (5.9)	8.6 (14.9)
Median (IQR)	2.0 (1.0-3.5)	2.0 (1.0-2.5)	2.0 (1.0-6.0)	4.0 (1.0-13.0)	2.0 (1.0-2.0)	3.0 (3.0-3.0)	2.0 (1.0-5.0)	2.0 (1.0-10.0)

Abbreviations: IQR, interquartile range; PSC, peristomal skin complication.
^aUnless otherwise indicated, all values are number (% of subjects).
^bAmong patients receiving this service.

TABLE 3. Total Healthcare Costs During 120-Day Period Following Ostomy Surgery in Relation to Evidence of PSC (Analyses Based on Administrative Data)

	Colostomy			Ileostomy			Urinary Diversion (Urostomy)			All Subjects		
	No PSC (N = 33)	PSC (N = 18)	No PSC (N = 36)	PSC (N = 28)	No PSC (N = 12)	PSC (N = 1)	No PSC (N = 81)	PSC (N = 47)				
<i>Inpatient care</i>												
Index hospitalization												
Mean (SD)	76,224 (48,519)	145,515 (169,442)	108,120 (115,878)	171,644 (177,917)	126,292 (67,479)	165,500 (0)	97,817 (88,341)	161,507 (171,328)				
Median (IQR)	57,498 (41,071-100,223)	91,245 (55,214-122,004)	63,631 (50,924-126,502)	97,416 (66,293-185,128)	120,163 (83,411-144,248)	165,500 (165,500-165,500)	68,633 (48,331-121,479)	96,927 (62,792-165,500)				
<i>Readmissions</i>												
Mean (SD)	8,467 (25,668)	18,261 (28,396)	17,579 (33,390)	31,170 (63,297)	11,624 (16,916)	0 (0)	12,985 (28,440)	25,563 (51,999)				
Median (IQR)	0 (0-0)	0 (0-37,825)	0 (0-18,511)	1,766 (0-33,123)	3,276 (0-19,504)	0 (0-0)	0 (0-11,889)	0 (0-33,422)				
<i>Long-term care</i>												
Mean (SD)	2,159 (8,507)	3,175 (8,576)	515 (3,090)	311 (1,647)	0 (0)	0 (0)	1,109 (5,825)	1,402 (5,547)				
Median (IQR)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)				
<i>Total</i>												
Mean (SD)	86,850 (61,436)	166,951 (171,715)	126,214 (127,232)	203,126 (200,985)	137,916 (68,824)	165,500 (0)	111,910 (98,468)	188,471 (186,897)				
Median (IQR)	73,029 (41,976-109,959)	113,208 (57,479-142,088)	82,269 (53,940-159,872)	110,118 (80,082-273,160)	120,163 (92,856-167,575)	165,500 (165,500-165,500)	84,535 (53,331-135,069)	114,590 (75,538-253,000)				
<i>Outpatient care</i>												
Physicians' office visits												
Mean (SD)	7,679 (15,718)	17,070 (30,261)	7,970 (13,821)	8,299 (16,267)	13,448 (15,763)	387 (0)	8,663 (14,853)	11,490 (22,689)				
Median (IQR)	1,564 (295-6,117)	3,188 (1,004-16,810)	2,204 (620-8,217)	2,807 (705-5,935)	6,996 (3,155-18,835)	387 (387-387)	3,184 (587-8,468)	2,677 (795-6,252)				
Emergency room visits												
Mean (SD)	993 (2,689)	1,572 (3,761)	990 (2,073)	677 (2,636)	1,106 (1,953)	0 (0)	1,009 (2,302)	1,005 (3,085)				
Median (IQR)	0 (0-0)	0 (0-289)	0 (0-788)	0 (0-0)	372 (0-1,083)	0 (0-0)	0 (0-697)	0 (0-0)				
All other outpatient care												
Mean (SD)	2,110 (8,213)	1,841 (2,434)	2,337 (4,751)	3,098 (5,592)	1,622 (2,522)	1,992 (0)	2,139 (6,148)	2,593 (4,574)				
Median (IQR)	195 (0-1,104)	597 (0-3,731)	25 (0-1,622)	77 (0-4,981)	820 (0-2,240)	1,992 (1,992-1,992)	195 (0-1,123)	343 (0-3,777)				
<i>Total</i>												
Mean (SD)	10,782 (20,773)	20,484 (30,315)	11,297 (15,848)	12,074 (17,334)	16,175 (16,737)	2,379 (0)	11,810 (18,012)	15,088 (23,161)				
Median (IQR)	3,982 (587-9,737)	8,002 (1,578-20,268)	4,239 (1,068-17,220)	5,738 (1,951-16,153)	9,752 (6,483-20,548)	2,379 (2,379-2,379)	5,233 (1,399-11,529)	5,939 (1,828-17,960)				
<i>Outpatient pharmacy</i>												
Mean (SD)												
	4,985 (22,206)	1,501 (2,869)	1,812 (3,115)	1,288 (2,016)	1,284 (2,075)	263 (0)	3,027 (14,310)	1,348 (2,337)				
Median (IQR)												
	205 (30-1,031)	678 (0-1,348)	648 (171-2,153)	273 (0-2,110)	590 (219-1,222)	263 (263-263)	504 (103-1,342)	516 (0-1,434)				
<i>Total</i>												
Mean (SD)	102,618 (73,005)	188,935 (166,034)	139,323 (129,114)	216,488 (197,982)	155,375 (68,144)	168,142 (0)	126,747 (102,459)	204,907 (182,772)				
Median (IQR)	83,753 (46,470-126,418)	140,405 (87,622-226,559)	90,078 (65,377-166,641)	135,627 (96,512-286,047)	146,112 (110,096-179,986)	168,142 (168,142-168,142)	91,906 (63,480-155,233)	142,682 (89,499-260,239)				

Abbreviations: IQR, interquartile range; PSC, peristomal skin complication.

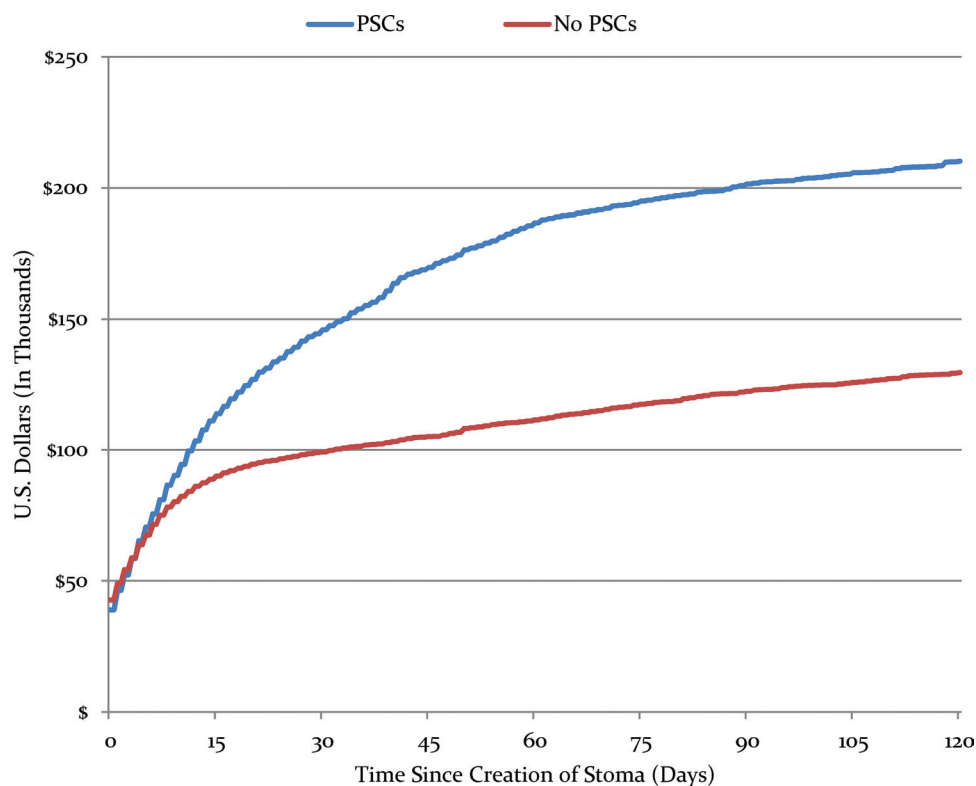


Figure 2. Mean total cumulative cost of healthcare from day of ostomy surgery to day 120, by PSC status.

risk of readmission. The association between PSCs and longer index stays in part also may be artificial, since patients with longer hospital stays, irrespective of the reason, would be at greater risk of developing an in-hospital complication (ie, a patient discharged on day 4, for example, cannot develop an in-hospital complication, on day 5).

Limitations

Limitations of our study should be noted. First, as mentioned earlier, our study sample was small and apparent variability in our results (eg, between procedures) simply may reflect “noise” in the data. Second, patients with PSCs may differ in important respects from those who do not develop these complications; differences in healthcare utilization and costs that we observed accordingly simply may reflect the effects of confounding. Third, data obtained via retrospective chart review are limited to information in patients’ medical records, which may be of variable quality, incomplete and lacking important information, and/or difficult to interpret. Finally, the generalizability of our findings to other institutions and settings is unknown.

CONCLUSIONS

We found that PSCs were a frequent complication following colostomy, ileostomy, or urostomy and that patients with PSCs had substantially higher costs of postsurgical care than those who did not develop these complications. Further study is needed to determine the extent to which higher costs are actually attributable to PSCs and whether our findings are generalizable to other settings and institutions.

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