J Wound Ostomy Continence Nurs. 2021;48(6):545-552.
Published by Lippincott Williams & Wilkins

OPEN

Incontinence and Incontinence-Associated Dermatitis in Acute Care

A Retrospective Analysis of Total Cost of Care and Patient Outcomes From the Premier Healthcare Database

Susan A. Kayser ◆ Kimberly Koloms ◆ Angela Murray ◆ Waqaar Khawar ◆ Mikel Gray

ABSTRACT

PURPOSE: To evaluate the prevalence of incontinence and treatment of incontinence-associated dermatitis (IAD) and associations with outcomes including total cost of care, length of stay (LOS), 30-day readmission, sacral area pressure injuries present on admission and hospital acquired pressure injuries, and progression of all sacral area pressure injuries to a higher stage.

DESIGN: Retrospective analysis.

SUBJECTS AND SETTINGS: Data were retrieved from the Premier Healthcare Database and comprised more than 15 million unique adult patient admissions from 937 hospitals. Patients were 18 years or older and admitted to a participating hospital between January 1, 2016, and December 31, 2019.

METHODS: Given the absence of an IAD *International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM)* code, we categorized patients treated for IAD by selecting patients with a documented incontinence *ICD-10-CM* code and a documented charge for dermatology products used to treat IAD. The *t* test and χ^2 tests determined whether incontinence and treatment for IAD were associated with outcomes.

RESULTS: Incontinence prevalence was 1.5% for the entire sample; prevalence rate for IAD among incontinent patients was 0.7%. As compared to continent patients, incontinent patients had longer LOS (6.4 days versus 4.4 days), were 1.4 times more likely to be readmitted, 4.7 times more likely to have a sacral pressure injury upon admission pressure injury, 5.1 times more likely to have a sacral hospital-acquired pressure injury, and 5.8 times more likely to have a sacral pressure injury progress to a severe stage. As compared to incontinent patients without IAD treatment, those with IAD treatment had longer LOS (9.7 days versus 6.4 days), were 1.3 times more likely to be readmitted, and were 2.0 times more likely to have a sacral hospital-acquired pressure injury. Total index hospital costs were 1.2 times higher for incontinent patients and 1.3 times higher for patients with IAD treatment.

CONCLUSIONS: Incontinence and IAD prevalence are substantially lower than past research due to underreporting of incontinence. The lack of an *ICD-10-CM* code for IAD further exacerbates the underreporting of IAD. Despite low prevalence numbers, our results show higher health care costs and worse outcomes for incontinent patients and patients with IAD treatment.

KEY WORDS: Acute care, Cost of care, Health economics, Incontinence, Incontinence-associated dermatitis, Length of stay, Pressure injury, Prevalence, Readmission rates.

INTRODUCTION

Urinary and fecal incontinence are common and associated with adverse outcomes in hospitalized patients.[1] Incontinence damages the tissue integrity of the skin, which leaves patients susceptible to skin breakdown such as pressure injuries and incontinence-associated dermatitis (IAD).[2,3] Incontinence-associated dermatitis is characterized by inflammation and/or erosion of the skin from prolonged exposure to urine, stool, or both.[4] Studies have found incontinence prevalence ranges from 18% to 46.6%, and among incontinent patients, prevalence of IAD ranges from 18% to 45.7%.[5,6] Despite high prevalence rates, incontinence and IAD are believed to be underreported due in part to lack of screening,[7] and for IAD, because it lacks an optimal *International Classification of Diseases, Tenth Revision, Clinical Modification* (*ICD-10-CM*) code.[8,9]

Incontinence and IAD are both independent risk factors for higher stage pressure injuries.[9-11] In addition to skin breakdown, recent evidence has shown urinary incontinence is associated with serious comorbid conditions such as frailty, increased risk of falls, depression, and infections, which contributes to an associated increased risk of mortality.[10,11] Yet, incontinence continues to be treated as a hygienic challenge rather than a serious comorbid condition.[7] The critical nature of incontinence in hospitalized patients underscores the importance of understanding the economic

Susan A. Kayser, PhD, *Hillrom Holdings, Inc, Batesville, Indiana.*

Kimberly Koloms, MS, *Hillrom Holdings, Inc, Chicago, Illinois.*

Angela Murray, MN, RN, *Hillrom Holdings, Inc, Chicago, Illinois.*

Waqaar Khawar, MD, *Hillrom Holdings, Inc, Chicago, Illinois.*

Mikel Gray, PhD, *Department of Urology, University of Virginia Charlottesville.*

Dr Kayser, Kimberly Koloms, Angela Murray, and Dr Khawar are employees of Hillrom.

This research did not receive funding from any outside entities.

Correspondence: *Susan A. Kayser, PhD, Hillrom Holdings, Inc, 1069 State Rd 46, Batesville, IN 47006 (Susan.Kayser@Hillrom.com).*

DOI: 10.1097/WON.0000000000000818

costs and healthcare resources necessary to treat incontinent patients and patients with IAD.[12]

Given the absence of an optimal IAD *ICD-10-CM* code, we employed a novel approach to identify incontinent patients treated for IAD. Using a highly generalizable and large database of US hospitals, we categorized patients treated for IAD by selecting those patients with a documented urinary and/or fecal incontinence *ICD-10-CM* code, as well as a documented charge for one or more dermatology products used to treat IAD. The aim of this study was to determine 5 main outcomes including the prevalence of incontinence and treatment of IAD on total cost of care, length of stay (LOS), 30-day readmissions, sacral area pressure injury occurrences for both present on admission (POA) and hospital acquired, and progression of sacral area pressure injuries to a higher stage.

TABLE 1.
***ICD-10-CM* Codes Used to Define a Patient as Incontinent**

ICD-10-CM	Description
R32	Unspecified urinary incontinence
R15.9	Full incontinence of feces
N39.41	Urge incontinence
N39.46	Mixed (urge and stress) incontinence
N39.490	Overflow incontinence
R39.81	Functional urinary incontinence
N39.44	Nocturnal enuresis
N39.42	Incontinence without sensory awareness
N39.45	Continuous leakage of urine

Abbreviation: *ICD-10-CM, International Classification of Diseases, Tenth Revision, Clinical Modification.*

METHODS

This was a retrospective analysis of inpatient data from the Premier Healthcare Database (PHD).[13] The PHD is a hospital administration database that at the time of the analysis contained more than 231 million unique patients for approximately 25% of hospital admissions in the United States.[13] The database included data from over 1000 hospitals, across all regions of the United States, rural and urban locations and both teaching and nonteaching hospitals, from 2000 through the end of 2019. Information was collected on hospital characteristics, patient demographics, disease state, and all billed services including medications, diagnostic, and therapeutic services. Billed services were captured using the *ICD-10-CM* codes currently used in the United States for admissions after October 2015. Detailed pharmacy data, including brand and generic drug names, were available. Costs to the hospital for a patient's care were validated against the hospital's own financial reports. If charge data were not within 2% of the financial report, it was returned to the hospital for correction. In other studies the PHD has been used to determine healthcare costs associated with diagnoses such as sepsis, *Staphylococcus aureus* infections, and acute kidney injury.[14-16]

Study Population

Inclusion criteria were data from patients 18 years or older and admitted to a participating hospital between January 1, 2016, and December 31, 2019. Patient admissions were excluded from the study if it was not the patient's first admission during the data collection period, the patient was admitted to a labor and delivery unit owing to the low risk of skin breakdown due to incontinence, or the patient had a fistula or ostomy causing continuous leakage of effluent from the gastrointestinal or urinary tract typically managed by a pouching system. A 180-day lookback period and a 30-day follow-up period were used to assess comorbid conditions of participants. Prevalence and costs of incontinence and ongoing IAD treatment were also studied for 2 subpopulations of patients: those receiving care for more than 24 hours in an intensive care unit (ICU) and 75 years and older. This research was exempt from Institutional Review Board oversight per Title 45 Code of Federal Regulations, Part 46 of the United States, specifically 45 CFR 46.101(b)(4).[13]

Outcomes

Patients were classified as being continent or incontinent based on *ICD-10-CM* codes. Only *ICD-10-CM* codes related to urinary, fecal, and dual incontinence were included because these conditions put patients at risk of skin breakdown (Table 1). Patients with an incontinence code were further segmented by whether they were likely receiving IAD treatment. IAD treatment was operationally defined as the use of prescribed products and medications identified in the PHD chargemaster during the patient's admission. The PHD chargemaster consists of items billable to the patient or their health insurance provider and includes hospital services, medical procedures, equipment fees, supplies, drugs, and diagnostic evaluations such as imaging and laboratory tests.[13] Categories of prescribed products included skin protectants, moisture barriers, incontinence wipes, and/or perineal skin cleansers. Table 2 lists each category and the inclusion criteria.

Total cost of care (in 2019 US dollars) was calculated as the sum of all costs incurred during the index hospital visit and/or subsequent readmissions during a 30-day follow-up period. The total LOS was defined as the sum of days during the patient's index hospitalization, including ICU days, and any hospitalization days that occurred during the 30-day follow-up period. Thirty-day all-cause readmission was operationally defined as having a readmission to the same hospital for any cause within 30 days of the discharge. To better examine the link between incontinence and IAD with pressure injuries, we limited the analysis to those in sacral locations that could be impacted by incontinence similar to the analysis reported by Lachenbruch and colleagues.[17] Pressure injury POA status was determined by the Centers for Medicare & Medicaid Services POA indicator to determine whether the pressure injury was POA or hospital acquired. To determine whether a sacral pressure injury progressed, those documented in the same site were compared from admission and discharge. If the pressure injury was minor (stages 1 or 2) on admission and progressed to major (stages 3, 4, or deep tissue injury), the pressure injury was deemed as having progressed.

Instruments

Patient characteristics examined by incontinence status were age, gender, and race. The Charlson Comorbidity Index (CCI) was developed as a method of categorizing comorbidities of patients to predict the likelihood of mortality or greater resource utilization.[18] The severity of comorbidity may be categorized into 3 grades (a score of 0 indicates no comorbidities were found): mild, with CCI scores of 1 to 2; moderate,

TABLE 2.
Categories of Products Used to Identify Patients Receiving Treatment for IAD

Category	Inclusion Criteria
Perineal or incontinence skin cleanser	Liquid or foam formulation that includes one or more cleansers, foaming agents usually combined with a moisturizing agent, and possibly a skin protectant. Perineal or incontinence skin cleaners are usually described as "pH balanced" indicating the pH of the foam or liquid is neutral or close to that of health human skin. These products are also described as "no rinse"; they are applied to the skin as a "leave on" product that is not rinsed off as are traditional cake soaps.
Skin protectant	Skin protectants are products that are applied to the skin in order to protect damaged skin or protect healthy skin from damage due to potentially irritating or harmful substances such as urine or fecal matter; these products are also applied to provide relief to irritated or damaged skin. Skin protectants used for patients with urinary, fecal, or dual fecal incontinence are formulated as creams, ointments, or pastes. Many contain petrolatum, dimethicone, or zinc oxide. In addition, liquid polymer or cyanoacrylate topical products are also used as skin protectants. These topical products are described as "no sting" (free from alcohol) and come in multiple delivery vehicles such as wipes, films, nonaerosol sprays, wands, or an all-in-one paint.
Premoistened cloth for prevention or treatment of IAD	Premoistened cloths typically containing cleanser, one or more moisturizing products, and a dimethicone-based skin protectant. Products included in this study were limited to those that included a skin protectant designed for prevention or management of IAD.

Abbreviation: IAD, incontinence associated dermatitis.

scores of 3 to 4; and severe, scores of 5 or more. In a study of 1313 acutely ill adults 65 years and older, a logistic regression adjusting for age and sex showed a CCI of 5 or more had higher 3-month (odds ratio [OR] = 3.6, $P < .05$) and 1-year (OR = 7.1, $P < .05$) likelihood of mortality.[19] Furthermore, Vitzthum and colleagues[20] found the CCI to have an intraclass correlation of 0.74 (95% confidence interval, 0.58-0.87). We also included the risk of mortality and severity of illness using the patient-refined diagnosis-related group (APR-DRG), which is a computerized scoring system used in US hospitals to adjust patient data for severity of illness and risk of mortality.[21] The APR-DRG scale consists of 5 categories: undefined, minor, moderate, major, or extreme. This scale was validated in a group of 1213 hospitalized patients, and a logistic regression, adjusting for age and disease group, found a 1-unit increase in the severity (eg, minor to moderate) was associated with a 3-fold increase in mortality (OR = 3.0, $P < .05$) with an area under the curve of 0.78.[22] Characteristics of the patient's stay included whether the patient stayed 24 plus hours in an ICU and their discharge status (expired, home, hospice, skilled nursing facility, rehab, long-term care, transferred, or other). The study included whether the patient had mobility difficulties, defined as having an *ICD-10-CM* code associated with abnormal gait or difficulty walking. Finally, we included whether the patient was cognitively impaired defined as having an *ICD-10-CM* code associated with dementia, cognitive decline, or altered mental status.

Data Analysis

Descriptive summary statistics were provided for patient, hospital and visit/encounter characteristics, payer type, main outcomes variables, and comorbid conditions. Descriptive data were summarized as mean and standard deviation or as median and interquartile range for continuous and ordinal outcomes. Categorical data such as readmission and sacral pressure status were summarized as counts and percentages of patients in the categories. For purposes of the cost analysis, we categorized patients as continent versus incontinent; incontinent patients (at risk for IAD by definition) were then divided into those receiving or not receiving ongoing treatment for IAD. χ^2 tests were used to test for statistical differences between groups for categorical variables; 2 sample comparisons were evaluated using a *t* test for other continuous variables such as LOS and total cost of care. Statistical significance level was set to .05. Length of stay and total cost of care were censored at the 2nd percentile and the 99th percentile to avoid undue influence of outliers. A box and whiskers plot visualized total cost of care. The plot included the sample minimum, 25th percentile, 50th percentile (median), 75th percentile, maximum, and mean of total cost of care by incontinence status for the entire sample, the ICU population, and the 75 and older population. The box plot was created in R (v4.1.0) and all analyses were performed using SAS software version v9.4 (SAS, Cary, North Carolina).

RESULTS

The sample comprised 15,793,765 patients captured from 937 hospitals that met inclusion criteria. Among this larger group, 235,141 had an *ICD-10-CM* code for incontinence, yielding a prevalence of 1.5% (Table 3). The prevalence of incontinence was higher for patients 75 years and older (4.1%) and lower for patients cared for in an ICU (1.0%). The proportion of patients receiving IAD treatment was 0.7% (1602 patients). The proportion of patients receiving treatment for IAD was 0.7% among patients 75 years and older and 1.1% among ICU patients. Of the 937 hospitals, 933 (99.6%) had incontinent patients and 124 (13%) had patients receiving IAD treatment.

Most incontinent patients (86%) were incontinent of urine only; 7.3% were fecally incontinent only and the remaining 6.7% were dually incontinent (Table 4). Those ratios were similar for those 75 years and older and the ICU subpopulations. Patients with IAD treatment were more likely to be fecally incontinent (10.1% vs 7.3%) and dually incontinent (12% vs 6.6%) compared to incontinent patients without IAD treatment ($P = .000$).

Demographics

Compared to the group without incontinence, those with incontinence were statistically significantly ($P = .000$) older (mean age 71 years vs 61 years), more likely to have an APR-DRG classified as a major illness (31% vs 21%), and had a significantly higher CCI (2.4 vs 1.8) (Table 5). Incontinent patients were statistically significantly (all *P*s = .000) more likely to be immobile (5.5% vs 2.4%), cognitively impaired (21% vs 6.8%), and were less likely to be discharged home (37% vs 64%). Similarly, incontinent patients treated for IAD had statistically significantly (all *P*s = .000) higher CCI (3.0 vs 2.4), were more likely to be immobile (6.5% vs 5.5%) and

TABLE 3.
Prevalence of Incontinence and IAD

	Incontinence Status				
Population	Overall	Incontinent	Incontinent Prevalence	Incontinent and IAD	IAD Prevalence
Entire sample	15,793,765	235,141	1.5%	1,602	0.70%
Age ≥75 y	2,785,357	113,113	4.1%	824	0.70%
ICU	4,161,652	40,858	1.0%	430	1.1%
Hospitals	937	933	99.6%	124	13.3%

Abbreviations: IAD, incontinence-associated dermatitis; ICU, intensive care unit.

cognitively impaired (27% vs 21%) than those with incontinence only, and received no IAD treatment. Black patients were statistically significantly (all *P*s = .000) less likely to be incontinent (12% versus 13%), but were more likely to have IAD treatment (17% vs 12%).

Length of Stay, Readmission Rates, and Cost of Care

Statistically significant differences (all *P*s = .000) were noted for average LOS for incontinent patients and those who were older and in the ICU. Compared to continent patients, incontinent patients stayed 2 days longer (4.4 vs 6.4) while LOS was 1.2 days longer for the population older than 75 years (6.3 vs 4.8) and 3.0 days longer for the ICU population (10 vs 7) (Table 6). There were statistically significant differences (*P* = .000) noted for incontinent patients treated for IAD who had 3.3 longer LOS days than incontinent patients without IAD treatment (9.7 days vs 6.4 days). The average LOS was 2.4 days longer in patients 75 years and older who received IAD treatment (8.4 days vs 6.0 days) and 2.9 days longer for the ICU population (12.8 vs 9.9) compared to patients who received no treatment.

The readmission rate was 1.4 times higher for incontinent patients compared to continent patients (12% vs 8.8%), the 30-day readmission rate was 1.1 times higher in the older population 75 years and older (12% vs 11%), and 1.4 times higher in the ICU population (15% vs 10.9%) (Table 7). The readmission rate was 1.3 times higher for incontinent patients with IAD treatment compared to incontinent patients without IAD treatment (16% vs 12%), 1.4 times higher in the older population 75 years and older (17% vs 12%), and 1.3 times higher for the ICU population (20% vs 15%). All were statistically significant (*P* = .000).

The average total index hospital costs were 1.2 times higher for incontinent patients compared to continent patients ($17,020 vs $13,713), 1.3 times higher for incontinent patients with IAD treatment compared to those incontinent patients without IAD treatment ($22,832 vs $16,981) (Table 8). A box and whisker plot (Figure) visualizes the minimum total cost of care, at the 25th, 50th, and 75th percentiles, the censored maximum, and the mean (marked by an x) for the entire sample, the older age group, and the ICU population. Compared to continent patients, costs were higher for incontinent patients for all populations, and higher still for incontinent patients with IAD treatment. All were statistically significant (*P* = .000).

TABLE 4.
Proportion of Incontinent Patients With Each Type of Incontinence

	Incontinence Status		
Population	Incontinent n (%)	Incontinent, No IAD n (%)	Incontinent and IAD n (%)
Entire sample			
Urine	202,282 (86)	201,035 (86)	1,247 (78)
Fecal	17,184 (7.3)	17,022 (7.3)	162 (10.1)
Dual	15,675 (6.7)	15,482 (6.6)	193 (12)
Age ≥ 75 y			
Urine	99,567 (88)	98,890 (88)	677 (82)
Fecal	6,600 (5.8)	6,536 (5.8)	64 (7.8)
Dual	6,946 (6.1)	6,863 (6.1)	83 (10.1)
ICU			
Urine	34,380 (84)	34,047 (84)	333 (77)
Fecal	3,531 (8.6)	3,482 (8.6)	49 (11)
Dual	2,947 (7.2)	2,899 (7.2)	48 (11)

Abbreviations: IAD, incontinence-associated dermatitis; ICU, intensive care unit.

Pressure Injuries

Incontinent patients were more likely than continent patients to have sacral pressure injuries (Table 9). Incontinent patients were 4.7 times more likely to have a sacral pressure injury upon admission than continent patients (4.7% vs 1.0%) and 5.1 times more likely to have a sacral hospital-acquired pressure injury (0.59% vs 0.12%). Incontinent patients were 5.8 times more likely to have a sacral pressure injury progress from a stage 1 or 2 to a severe state 3 or 4 pressure injury during their stay (0.002% vs 0.01%). Results were similar among the older age and ICU subpopulations for POA and hospital-acquired pressure injury. All were statistically significant (*P* = .000). There were no data on progression of pressure injuries for the subpopulations. Similarly, incontinent patients with IAD treatment were more likely than incontinent patients without IAD treatment to have sacral pressure injuries. Those with IAD treatment were 2.4 times more likely to have a sacral pressure injury upon admission than continent patients (10.9% vs 4.6%) and 2 times more likely to have a hospital-acquired sacral pressure injury (1.2% vs 0.59%). Results were similar among the ICU and older adult subpopulations for POA and hospital-acquired pressure injuries. All were statistically significant (*P* = .000). There were no data on progression of pressure injuries for the IAD treatment comparisons.

DISCUSSION

In this retrospective analysis of a large database, we evaluated the prevalence of incontinence and treatment of IAD

TABLE 5.
Demographic and Clinical Characteristics of Patients by Incontinence and IAD Treatment Status

		Incontinence Status			
	Overall	**Continent**	**Incontinent**	**Incontinent, No IAD**	**Incontinent and IAD**
Patient admissions, n	15,793,765	15,558,624	235,141	233,539	1,602
Age, mean (SD)	61 (18)	61 (18)	71 (16)	71 (73)	73 (14)
Gender					
Male	48%	49%	36%	36%	39%
Female	52%	51%	64%	64%	61%
Race					
White	75%	74%	78%	78%	78%
Black	13%	13%	12%	12%	17%
Other	12%	12%	10%	10%	5.0%
CCI, mean (SD)	1.8 (2.1)	1.8 (2.1)	2.4 (2.3)	2.4 (3)	3.0 (2.4)
APR-DRG severity of illness					
Undefined	26%	26%	25%	26%	24%
Minor	16%	16%	7.4%	7.5%	2.7%
Moderate	30%	30%	25%	26%	16%
Major	21%	21%	31%	31%	34%
Extreme	6.8%	6.8%	11%	11%	22%
Discharge status					
Expired	2.1%	2.1%	2.5%	2.5%	3.4%
Home	63%	64%	37%	37%	20%
Hospice	1.6%	1.6%	3.6%	3.6%	5.1%
SNF, rehab, ICF, or LTC	14%	14%	36%	36%	49%
Transferred	17%	17%	20%	20%	22%
Other	1.8%	1.8%	1.0%	1.0%	0.4%
ICU/CCU admission	18%	18%	17%	17%	27%
Immobile	2.5%	2.4%	5.5%	5.5%	6.5%
Cognitive impairment	7.1%	6.8%	21%	21%	27%

Abbreviations: APR-DRG, patient-refined diagnosis-related group; CCI, Charlson Comorbidity Index; IAD, incontinence-associated dermatitis; ICF, intermediate care facility; ICU/CCU, intensive care unit/critical care unit; LTC, long-term care; SD, standard deviation; SNF, skilled nursing facility.

and examined associations with outcomes including total cost of care, LOS, 30-day readmission rate, sacral area POA and hospital-acquired pressure injuries, and progression of all sacral area pressure injuries to a higher stage. We found incontinent patients had higher costs of care, longer LOS, were more likely to be readmitted, have a POA or hospital-acquired sacral pressure injury, and experience progression of sacral pressure injury to a higher stage than patients without an incontinence diagnosis. Similarly, patients undergoing treatment for IAD had higher costs of care and risk for the negative outcomes including longer LOS and an increased likelihood of hospital readmission as compared to patients with an incontinence diagnosis but without IAD treatment.

The prevalence of urinary, fecal, and dual incontinence, based on *ICD-10-CM* codes, was 1.5%. Among all patients with *ICD-10-CM* incontinence coding, only 0.7% had charges for products associated with IAD treatment. Both rates were substantially lower than previous studies. Incontinence rates

TABLE 6.
Mean and Standard Deviation Length of Stay by Incontinence and IAD Treatment Status

		Incontinence Status			
Population	**Overall**	**Continent**	**Incontinent**	**Incontinent, No IAD**	**Incontinent and IAD**
Entire sample	4.5 (4.4)	4.4 (4.3)	6.4 (5.9)	6.4 (5.9)	9.7 (7.4)
Age ≥75 y	4.8 (4.2)	4.8 (4.2)	6.3 (8.6)	6.0 (5.1)	8.4 (6.4)
ICU	7.5 (8.8)	7.0 (6.1)	10.0 (7.3)	9.9 (7.3)	12.8 (7.9)

Abbreviations: IAD, incontinence-associated dermatitis; ICU, intensive care unit.

TABLE 7.
30-Day All-Cause Readmission Rates by Incontinence and IAD Treatment Status

		Incontinence Status			
Population	**Overall**	**Continent**	**Incontinent**	**Incontinent, No IAD**	**Incontinent and IAD**
Entire sample	8.9%	8.8%	12%	12%	16%
Age ≥75 y	11%	11%	12%	12%	17%
ICU	11%	10.9%	15%	15%	20%

Abbreviations: IAD, incontinence-associated dermatitis; ICU, intensive care unit.

in the United States have ranged from 18% to 46.6%, and among incontinent patients, prevalence of IAD ranges from 18% to 45.7%.[5,6,24,25] Our low IAD prevalence rate was more consistent with findings from a meta-analysis of IAD rates in Chinese patients (1.44%).[23] The reason for these disparities is not entirely certain, though we hypothesized information on claims forms are primarily related to reimbursement and some data may be excluded due to information restrictions, insufficient information in chart, and/or coder error/misunderstanding or typographical.[26] Additionally, several studies suggest formal documentation of incontinence is low[1,7] and the lack of any *ICD* code for IAD may influence our IAD prevalence rate.

We found incontinence and IAD treatment were associated with multiple negative outcomes including longer LOS and an increased likelihood of hospital readmission. Evidence concerning the influence of urinary and fecal incontinence upon LOS is particularly sparse; however, John and colleagues[27] found urinary incontinence was associated with longer stays in nursing homes. We found no previous studies examining the effects of urinary, fecal, or dual incontinence on hospital LOS or readmission rates. The paucity of such studies may be attributed to the well-documented lack of consistent incontinence assessments upon hospital admission.[7,28] Past research has found ICU patients with IAD have longer ICU LOS (for an additional 12.8 days), which is similar to our findings that incontinent patients with IAD treatment have an average LOS 3.3 days longer than incontinent patients without IAD treatment (9.7 days vs 6.4 days) and 5.3 days longer than continent patients (9.7 versus 4.4).[29]

Similar to prior studies, we found incontinent patients with IAD interventions were associated with an increased likelihood of both POA and hospital-acquired sacral pressure injuries and at greater risk for progression of a sacral pressure injury to a higher stage.[2,5,17,24] Multivariate analyses from past studies indicated all forms of incontinence (urinary, fecal, and dual urinary and fecal) act as an independent risk factor for sacral pressure injury; though, research suggests fecal or dual incontinence is most likely to result in a pressure injury.[30,31] Moreover, multivariate analysis has indicated IAD is an independent risk factor for pressure injury and this link persists even when controlling for immobility, a common comorbid condition in both groups.[5] Research further indicates incontinence is associated with higher grade (stages 3 and 4) rather than lower stage 1 and 2 pressure injuries, reducing the likelihood of misdiagnosis of IAD versus stage 2 pressure injury as an explanation for this link.[5,17] These outcomes are consistent with data from our study, showing incontinence and IAD interventions are associated with an increased likelihood of progression of sacral pressure injury to a higher stage.

We found patients with incontinence cost the health care system, on average $3307 (24%) more than continent patients ($17,020 vs $13,713) and patients with IAD treatment cost $5851 (34%) more than incontinent patients without IAD treatment ($22,832 vs $16,981). Strategies to manage incontinence and IAD involve a variety of products[12] and require substantial nursing time.[32] Results of previous IAD studies of IAD and healthcare costs, mostly conducted in nursing homes, show direct costs of products related to prevention of IAD ranged from $0.23 to $20.17 per patient day.[12] In addition, these studies did not consistently include labor costs or secondary conditions such as IAD-associated fungal infection and pressure injuries resulting from IAD, nor did they include costs associated with longer LOS or readmissions. At the time of publication, we were not aware of any studies examining the effect of incontinence and/or IAD on the total cost of care in acute care.

Limitations and Considerations

This study has several limitations. First, due to the analysis of data from the retrospective database, we were unable to assess whether incontinence or IAD caused additional healthcare costs. Thus, this study is limited to correlation analyses. Second, the use of *ICD-10-CM* codes to identify incontinent patients

TABLE 8.
Total Index Cost by Incontinence and IAD Treatment Status

		Incontinence Status			
Population	**Overall**	**Continent**	**Incontinent**	**Incontinent, No IAD**	**Incontinent and IAD**
Entire sample, n	15,763,098	15,528,364	234,734	233,147	1,587
Cost, mean (SD)	$13,762 (14,658)	$13,713 (14,607)	$17,020 (17,401)	$16,981 (17,358)	$22,832 (22,121)
Age ≥75 y, n	4,152,939	4,040,057	112,882	112,065	817
Cost, mean (SD)	$13,781 (13,868)	$13,747 (13,844)	$14,989 (14,646)	$14,963 (14,611)	$18,645 (18,479)
ICU, n	2,780,891	2,740,074	40,817	40,390	427
Cost, mean (SD)	$26,402 (22,762)	$26,308 (22,705)	$32,758 (25,509)	$32,717 (25,499)	$36,657 (26,180)

Abbreviations: IAD, incontinence-associated dermatitis; ICU, intensive care unit; SD, standard deviation.

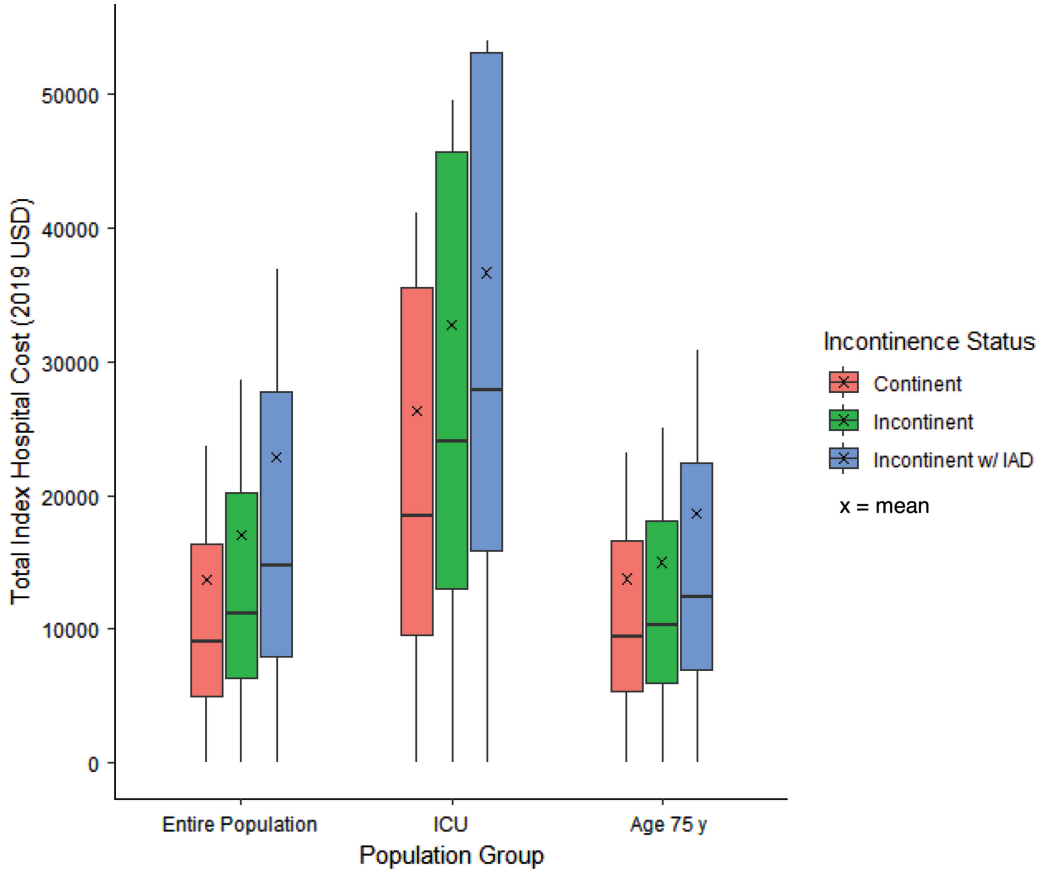

Figure. Box and whisker plot of the total index hospital cost by incontinence and IAD treatment status.

led to the underestimation of incontinence prevalence and the underidentification of patients receiving IAD treatment because that population was limited to those with incontinence. Third, our method of using chargemaster data to identify patients receiving treatment for IAD was a result of the lack of an IAD relevant *ICD-10-CM* code. Meaning we may have inadvertently excluded patients with IAD receiving or not receiving treatments that did not appear in the chargemaster such as cleansing with soap and water. Fourth, the PHD only captures visits to the same hospital for each patient; thus, risk of readmission and associated costs might have been underestimated. Finally, while the PHD covers approximately 20% of US hospitals, the hospitals submitting data to Premier do so to drive quality efforts by benchmarking their facility's patient outcomes and

TABLE 9.
PI Prevalence of Incontinence and IAD Treatment Status

	Incontinence Status					
Population	**Continent**	**Incontinent**	***P***	**Incontinent, No IAD**	**Incontinent and IAD**	***P***
Entire sample, n	15,558,624	235,141		233,539	1,602	
Present on admission	158,433 (1.0%)	11,007 (4.7%)	.000	10,832 (4.6%)	175 (10.9%)	.000
Hospital acquired	18,040 (0.12%)	1,398 (0.59%)	.000	1,379 (0.59%)	19 (1.2%)	.002
Progression	365 (0.00%)	32 (0.01%)	.000	32 (0.01%)	0 (0.00%)	NA
Age ≥75 y, n	4,048,539	113,113		112,289	824	
Present on admission	82,422 (2.0%)	5,885 (5.2%)	.000	5,792 (5.2%)	93 (11.3%)	.000
Hospital acquired	6,631 (0.16%)	578 (0.51%)	.000	571 (0.51%)	7 (0.85%)	.170
Progression	NA	NA	NA	NA	NA	NA
ICU, n	2,785,357	40,858		40,428	430	
Present on admission	45,956 (1.7%)	2,440 (6.0%)	.000	2,400 (5.9%)	40 (9.3%)	.003
Hospital acquired	9,178 (0.33%)	528 (1.3%)	.000	517 (1.3%)	11 (2.6%)	.020
Progression	NA	NA	NA	NA	NA	NA

Abbreviations: IAD, incontinence-associated dermatitis; ICU, intensive care unit; NA, not assessed; PI, pressure injury.

financial performance against other peer hospitals to improve quality, resource utilization, and efficiency.[13,16] This may impact the generalizability of the study findings, as these facilities may be more likely to identify and manage incontinence and IAD.

CONCLUSIONS

In contrast to previous studies with higher prevalence of incontinence ranging from 18% to 46.6%,[5,6] findings from this retrospective analysis of data collected from a large multisite study show incontinence prevalence of 1.5% when using *ICD-10-CM* diagnosis codes to determine incontinence status. We hypothesize the low prevalence rate was due to underreporting of incontinence.[1,7] Similarly, we found a lower than previously reported rate of IAD, which we hypothesized was due to its lack of *ICD-10-CM* code. Despite low prevalence numbers, our results found incontinent patients and patients with IAD treatment had longer LOS, higher readmission rates, were more likely to have a POA sacral pressure injury, develop a hospital-acquired sacral pressure injury, to have a sacral pressure injury progress to a higher stage, and have an overall higher total cost of care. These results present a call to action among caregivers and hospital administrators to regard incontinence and IAD as serious comorbid conditions, requiring consistent assessment, prevention, treatment, and management practices, including documentation in the patients' medical records.

REFERENCES

1. Condon M, Mannion E, Molloy D, O'Caoimh R. Urinary and faecal incontinence: point prevalence and predictors in a university hospital. *Int J Environ Res Public Health*. 2019;16(2):194. doi:10.3390/ijerph16020194.
2. Beeckman D, Van Lancker A, Van Hecke A, Verhaeghe S. A systematic review and meta-analysis of incontinence-associated dermatitis, incontinence, and moisture as risk factors for pressure ulcer development. *Res Nurs Health*. 2014;37(3):204-218. doi:10.1002/nur.21593.
3. Shaked E, Gefen A. Modeling the effects of moisture-related skin-support friction on the risk for superficial pressure ulcers during patient repositioning in bed. *Front Bioeng Biotechnol*. 2013;1:9. doi:10.3389/fbioe.2013.00009.
4. Gray M, Bliss DZ, Doughty DB, Ermer-Seltun J, Kennedy-Evans KL, Palmer MH. Incontinence-associated dermatitis: a consensus. *J Wound Ostomy Continence Nurs*. 2007;34(1):45-54; quiz 55-56.
5. Gray M, Giuliano KK. Incontinence-associated dermatitis, characteristics and relationship to pressure injury: a multisite epidemiologic analysis. *J Wound Ostomy Continence Nurs*. 2018;45(1):63-67. doi:10.1097/WON.0000000000000390.
6. Kayser SA, Phipps L, VanGilder CA, Lachenbruch C. Examining prevalence and risk factors of incontinence-associated dermatitis using the international pressure ulcer prevalence survey. *J Wound Ostomy Continence Nurs*. 2019;46(4):285-290. doi:10.1097/WON.0000000000000548.
7. Zurcher S, Saxer S, Schwendimann R. Urinary incontinence in hospitalised elderly patients: do nurses recognise and manage the problem? *Nurs Res Pract*. 2011;2011:671302. doi:10.1155/2011/671302.
8. Beeckman D. A decade of research on Incontinence-associated dermatitis (IAD): evidence, knowledge gaps and next steps. *J Tissue Viability*. 2017;26(1):47-56. doi:10.1016/j.jtv.2016.02.004.
9. McNichol LL, Ayello EA, Phearman LA, Pezzella PA, Culver EA. Incontinence-associated dermatitis: state of the science and knowledge translation. *Adv Skin Wound Care*. 2018;31(11):502-513. doi:10.1097/01.ASW.0000546234.12260.61.
10. John G, Bardini C, Combescure C, Dällenbach P. Urinary incontinence as a predictor of death: a systematic review and meta-analysis. *PLoS One*. 2016;11(7):e0158992. doi:10.1371/journal.pone.0158992.
11. Matta R, Hird AE, Saskin R, et al. Is there an association between urinary incontinence and mortality? A retrospective cohort study. *J Urol*. 2020;203(3):591-597. doi:10.1097/ju.0000000000000574.
12. Raepsaet C, Fourie A, Van Hecke A, Verhaeghe S, Beeckman D. Management of incontinence-associated dermatitis: a systematic review of monetary data. *Int Wound J*. 2021;18(1):79-94. doi:10.1111/iwj.13496.
13. Premier Applied Sciences. *Premier Healthcare Database White Paper: Data that informs and performs*. https://products.premierinc.com/downloads/PremierHealthcareDatabaseWhitepaper.pdf. Published 2020.
14. Prasad A, Rosenthal NA, Kartashov A, Knish K, Dreyfus J. Contemporary trend of acute kidney injury incidence and incremental costs among US patients undergoing percutaneous coronary procedures. *Catheter Cardiovasc Interv*. 2020;96(6):1184-1197. doi:10.1002/ccd.28824.
15. Rosenthal NA, Heinrich KH, Chung J, Yu H. Cost and hospital resource utilization of *Staphylococcus aureus* infection post elective posterior instrumented spinal fusion surgeries in U.S. hospitals: a retrospective cohort study. *Spine (Phila Pa 1976)*. 2019;44(9):637-646. doi:10.1097/BRS.0000000000002898.
16. Paoli CJ, Reynolds MA, Sinha M, Gitlin M, Crouser E. Epidemiology and costs of sepsis in the United States—an analysis based on timing of diagnosis and severity level. *Crit Care Med.* 2018;46(12):1889-1897. doi:10.1097/CCM.0000000000003342.
17. Lachenbruch C, Ribble D, Emmons K, VanGilder C. Pressure ulcer risk in the incontinent patient: analysis of incontinence and hospital-acquired pressure ulcers from the international pressure ulcer prevalence survey. *J Wound Ostomy Continence Nurs*. 2016;43(3):235-241. doi:10.1097/WON.0000000000000225.
18. Charlson M, Szatrowski TP, Peterson J, Gold J. Validation of a combined comorbidity index. *J Clin Epidemiol*. 1994;47(11):1245-1251. doi:10.1016/0895-4356(94)90129-5.
19. Frenkel WJ, Jongerius EJ, Mandjes-van Uitert MJ, van Munster BC, de Rooij SE. Validation of the Charlson Comorbidity Index in Acutely hospitalized elderly adults: a prospective cohort study. *J Am Geriatr Soc*. 2014;62(2):342-346. doi:10.1111/jgs.12635.
20. Vitzthum LK, Feng CH, Noticewala S, et al. Comparison of comorbidity and frailty indices in patients with head and neck cancer using an online tool. *JCO Clin Cancer Inform*. 2018;2:1-9. doi:10.1200/cci.18.00082.
21. Averill R, Goldfield N, Hughes J, et al. *All Patient Refined Diagnosis Related Groups (APR-DRGs), Version 20.0: Methodology Overview*. Wallingford, CT: 3M Health Information Systems; 2003:2015.
22. Baram D, Daroowalla F, Garcia R, et al. Use of the all patient refined-diagnosis related group (APR-DRG) risk of mortality score as a severity adjustor in the medical ICU. *Clin Med Circ Respirat Pulm Med*. 2008;2:19-25. doi:10.4137/ccrpm.s544.
23. Wei M, Yang D, Wu L, Chen W, Chen Y, Fu Q. The Prevalence of Incontinence-Associated Dermatitis in Hospitalized Patients in China. *Advances in Skin & Wound Care*. 2020;33(10):1-7. doi:10.1097/01.ASW.0000695764.47424.aa
24. Barakat-Johnson M, Barnett C, Lai M, Wand T, White K. Incontinence, incontinence-associated dermatitis, and pressure injuries in a health district in Australia: a mixed-methods study. *J Wound Ostomy Continence Nurs*. 2018;45(4):349-355. doi:10.1097/WON.0000000000000446.
25. Campbell JL, Coyer FM, Osborne SR. Incontinence-associated dermatitis: a cross-sectional prevalence study in the Australian acute care hospital setting. *Int Wound J*. 2016;13(3):403-411. doi:10.1111/iwj.12322.
26. Ferver K, Burton B, Jesilow P. The use of claims data in healthcare research. *Open Public Health J*. 2009;2(1):11-24. doi:10.2174/1874944500902010011.
27. John G, Gerstel E, Jung M, et al. Urinary incontinence as a marker of higher mortality in patients receiving home care services. *BJU Int*. 2014;113(1):113-119. doi:10.1111/bju.12359.
28. Ostaszkiewicz J, O'Connell B, Millar L. Incontinence: managed or mismanaged in hospital settings? *Int J Nurs Pract*. 2008;14(6):495-502. doi:10.1111/j.1440-172X.2008.00725.x.
29. Campbell J, Cook JL, Doubrovsky A, Vann A, McNamara G, Coyer F. Exploring incontinence-associated dermatitis in a single center intensive care unit: a longitudinal point prevalence survey. *J Wound Ostomy Continence Nurs*. 2019;46(5):401-407. doi:10.1097/WON.0000000000000571.
30. Hodl M, Blanar V, Amir Y, Lohrmann C. Association between incontinence, incontinence-associated dermatitis and pressure injuries: a multisite study among hospitalised patients 65 years or older. *Australas J Dermatol*. 2020;61(1):e144-e146. doi:10.1111/ajd.13163.
31. Kayser SA, VanGilder CA, Lachenbruch C. Predictors of superficial and severe hospital-acquired pressure injuries: a cross-sectional study using the international pressure ulcer prevalence survey. *Int J Nurs Stud*. 2018;89:46-52. doi:10.1016/j.ijnurstu.2018.09.003.
32. Avsar P, Karadag A. Efficacy and cost-effectiveness analysis of evidence-based nursing interventions to maintain tissue integrity to prevent pressure ulcers and incontinence-associated dermatitis. *Worldviews Evid Based Nurs*. 2018;15(1):54-61. doi:10.1111/wvn.12264.