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Incidence and Predictors of Incontinence Associated Skin Damage in Nursing Home Residents with New Onset Incontinence

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Abstract

Purpose—The purpose of this study was to determine the incidence and predictors of incontinence associated dermatitis (IAD) in nursing home residents.

Methods—Records of a cohort of 10,713 elderly (aged 65+) newly incontinent nursing home residents in 448 nursing homes in 28 states free of IAD were followed for IAD development. Potential multi-level predictors of IAD were identified in four national datasets containing information about the characteristics of individual nursing home residents, nursing home care environment, and communities in which the nursing homes were located. A unique set of health practitioner orders provided information about IAD and the predictors of IAD prevention and pressure injuries in the extended perineal area. Analysis was based on hierarchical logistical regression.

Results—The incidence of IAD was 5.5%. Significant predictors of IAD were not receiving preventive interventions for IAD, presence of a perineal pressure injury, having greater functional limitations in activities of daily living, more perfusion problems, and lesser cognitive deficits.

Conclusion—Findings highlight the importance of prevention of IAD and treatment/prevention of pressure injuries. A Wound Ostomy and Continence (WOC) nurse offers expertise in these interventions and can educate staff about IAD predictors which can improve resident outcomes. Other recommendations include implementing plans of care to improve functional status, treat perfusion problems, and provide assistance with incontinence and skin care to residents with milder as well as greater cognitive deficits.

Keywords

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Introduction

Incontinence can lead to inflammation and damage of the skin resulting in adverse symptoms of discomfort/pain, itching, burning-like sensations, and secondary fungal infection.[1,2] Incontinence associated dermatitis (IAD), has been classified as a type of moisture associated skin damage (MASD) of the superficial skin barrier.[3] It afflicts patients in multiple care settings from critical care to long-term care.[1,4–8] IAD incidence has been reported to be approximately 29% – 36% in critical care patients,[5,6] 7% in long-term acute care residents,[7] and 3% to 4% among nursing homes residents on skin damage prevention programs.[8,9] Numerous characteristics of a patient have been proposed as risk factors for IAD by clinical experts based on practice experience and theoretical knowledge,[2,10–12] but supportive evidence remains sparse. In a cross-sectional study of nursing home residents, Bliss and colleagues[13] reported that skin damage in the perineal area was associated not only with incontinence (mainly fecal and dual incontinence) but with functional, physical, cognitive, and mobility problems of residents. Their multivariate analysis adjusted for effects of other variables in the model. In a cross-sectional study in which data of patients from multiple care settings (hospitals, nursing homes, and home care) were combined, Kottner and associates[14] examined two-way associations between IAD and variables on the Braden Scale and Care Dependency Scale. They observed associations between incontinence associated skin damage and fecal incontinence, skin moisture or friction and shear, higher body mass index, and diabetes mellitus.

In addition to health status factors of individuals, analysis of complex conditions such as IAD in populations, requires consideration of potential predictors at multiple levels. In addition to a nursing home resident's health status, for example, there may be organizational or community resource factors that can influence their healthcare and outcomes.[15,16] Some of these factors might include the proportion of individuals of a racial or ethnic group who reside in a nursing home[17] or require incontinence care, nursing staffing levels,[18,19] knowledge and attitudes of nursing staff,[20,21] deficiencies in the quality of nursing home care, socioeconomic resources of the community in which a nursing home is located,[22] and healthcare access prior to nursing home admission.[23] Limiting analyses to only resident-level characteristics has been referred to by social science researchers as an "individualistic fallacy."[24] The purpose of this study was to determine the incidence and predictors of IAD in nursing home residents. Potential predictors at the individual, nursing home, and community levels were assessed.

Methods

Four large data sets were linked and analyzed. Minimum Dataset (MDS) v.2.0 records provided demographic and comprehensive health assessment data of nursing home residents of a national for-profit chain of nursing homes. Practitioner orders (POs) are legal health records of orders written by physicians or nurse practitioners for residents in the NHs in our data set in electronic form.. Federal regulations require that all prescription and nonprescription drugs and any care interventions (including skin and wound care, mobility and physical therapy, diet, laboratory orders, and procedures administered to a NH resident), and their changes or discontinuations be documented in an order.[25] Practitioner orders in our

data set included a practitioner's reason for a prescriptive order, dose, route, and frequency for medications and other treatments, location for applying topical treatments, and descriptions and locations of some problems. Words and descriptions in POs provided data about interventions and products for care, prevention and treatment as well as the presence of incontinence, and presence/description and location of IAD and/or pressure injury. Data about nursing home staffing and deficiencies in quality of care were in Online Survey, Certification, and Reporting (OSCAR) records. Socioeconomic and sociodemographic characteristics of the Census tract of the community in which the nursing homes were located were obtained from the 2000 U.S. Census. The Minnesota Population Center at the University of Minnesota, Minneapolis, MN provided the Census tracts of the nursing homes. Data from MDS, PO, and OSCAR records were all from the same years, 2000–2002. Data were de-identified and the study was exempt from review according to the University of Minnesota Institutional Review Board.

Design, Cohort, and Outcomes

This study used a cohort design to determine the incidence of IAD in older (aged 65 years) nursing home residents. The cohort comprised nursing home admissions who were continent or usually continent of urine and/or feces on the first full MDS record, were free of IAD per POs at admission, and developed incontinence (urinary, fecal, or dual) during their nursing home stay per MDS or PO records.

Subsequent development of incontinence and IAD was determined by documentation in the POs. Practitioner orders were searched for words or sets of words (including misspellings and different order of words) describing incontinence, IAD, and other outcomes we studied such as pressure injuries and IAD prevention using computerized algorithms developed by a consulting company specializing in this work (Edgeworks Technology, Inc., Chicago, IL). We included ICD9 codes for urinary incontinence (788.30–9, 625.6, 788.91) in the electronic algorithms. Search words were identified from a review of the literature and expertise of the research team and three clinical experts.

For IAD and perineal pressure injury descriptions, both an appropriate description of the skin and body area needed to be present. A list of body areas and skin descriptions for IAD and perineal pressure injuries, which was developed in an earlier study[26] was also reviewed and updated by the clinical experts and investigators. Examples of words describing IAD included redness, erythema, pink areas, skin breakdown, dermatitis, perineal skin damage, and fungal rash. Examples of words searched for IAD locations are perianal, around the anus, perirectal, peri area, perineum, buttock, groin, gluteal, inner thigh. Examples of words describing pressures injuries included decubitus, bedsore, ulcer, report of a pressure injury stage, and wound. Examples of words that were excluded from defining both IAD and perineal pressure injuries included tape tear/burn/blister, burns, cuts/lacerations, and herpes lesions. Within the context of this study, the term "perineal" was used broadly to include pressure injuries in the sacral, ischial, coccygeal, trochanter, hip, buttocks, and lower back areas that would be exposed to leaked urine or feces. Examples of alternate words for incontinence included urine/urinary leakage, dribbling, leaked stool, and bowel leakage. Stress, urge, dual, double, fecal, anal, and bowel incontinence were some other descriptors.

Initial reviews of POs by research assistants which identified other words were added to the algorithms in an iterative manner. Records that contained relevant words were then reviewed and coded for the presence of outcomes of interest by research assistants. In reviewing POs, research assistants consulted with investigators as needed when distinguishing IAD from a pressure injury or determining that IAD and a pressure injury were both present. In the rare instance when IAD could not be discerned from pressure injury based on the description in a PO, the problem was coded as a pressure injury.

Incontinence incidence was also measured using MDS records as described in more detail elsewhere.[27] Briefly, MDS records were searched forward from admission for the first report of urinary or fecal incontinence (indicated by MDS item H1a or H1b >1 meaning incontinent, frequently incontinent, or occasionally incontinent) or until a resident's available data ended. The earliest date reporting occurrence of incontinence was used. Incontinence associated dermatitis needed to occur on or after the onset of incontinence. Because the MDS record of incontinence is based on a resident's status during 14 days before the report, the definition of IAD included data from POs during this 14-day period in residents whose incontinence was documented by the MDS.

Inter-rater reliability of the 10 coders was periodically and randomly assessed. The lowest percent agreement of the coders was 85% for 32,000 POs. Agreement increased to 95% to 100% for 102,119 POs with additional training, use of a written log of coding decisions, and periodic discussions among the coders. All differences in coding among the research assistants were reconciled.

Predictor Variables

Potential predictors of IAD were identified based on literature review and discussion among the investigators and clinical experts. Predictors were operationally defined using individual items available in the data sets or constructing established scales using individual items with good psychometric properties as multiple items on a record may relate to the same concept. At the individual resident level, potential predictors included residents' admission demographic characteristics, functional deficits, physical health, and cognitive and emotional status. The characteristics of the cohort were also described with these variables (Tables 1 and 2). Examples of scales used for individual level predictors were those for deficits in activities of daily living (ADLs) which include assessments of bed mobility, transferring, locomotion, dressing, eating, toilet use, and personal hygiene; cognitive deficits (MDS-COGS)[28] which include assessments of short and long-term memory, memory and recall ability, cognitive skills for daily decision making, making oneself understood, and dressing ability.[29] In addition, the Charlson Index[30] was used to identify the number of comorbid conditions such as diabetes mellitus or atherosclerotic heart disease. Where no scale existed but was needed, composite variables of multiple items were developed. Items from the MDS used in defining the variables or composite scales are listed in Tables 1 and 2. Creation of composite measures of individual resident level predictors used procedures we previously established and published.[26] Scales at all levels (individual, nursing home, and community) used in this analysis were coded so that a higher score indicated a worse condition.

The predictor, receipt of IAD prevention, was defined using POs as described above with the addition of searching for words found in skin care product catalogs. Descriptions of IAD prevention in the POs may have included use of specific products (e.g., apply petrolatum after every incontinence episode to prevent skin breakdown) or a general protocol (e.g., start protocol to prevent skin breakdown) and needed to occur before IAD.

Predictors at the nursing home level included the percentage of residents receiving Medicaid and composite variables developed for deficiencies in quality of care, types of nursing home staff, and percentages of admissions by gender, race, and ethnicity. Procedures are described in more detail elsewhere.[31] The sociodemographic and socioeconomic characteristics of the communities in the US Census tracts of the nursing homes included the proportions or percentages of the community that was female or male under < 65 years or 65 years old, part of a racial or ethnic minority group, completed 1–8 years or 9–16 years of education, and resided in an urban or rural area. Others community level variables included the proportion of the tract that was working class or below poverty level, as well as the median home value in the tract.

Data Analysis

Data were summarized and examined using descriptive statistics (e.g., frequencies and percentages and means and standard deviations) as appropriate. Relevant predictors were screened for inclusion in the statistical model using bivariate associations with the outcome of IAD; those associated at $p < .05$ were considered candidates for inclusion. Collinearity between predictor variables was also examined. If a resident level and nursing home or community level variable were highly correlated, the resident level variable was included as it was more specific.

The incidence of IAD was modeled using hierarchical logistic regression with nursing home-specific random effects that accounted for clustering of residents within nursing homes. The potential predictors included in the IAD incidence model were limitations in activities of daily living (ADLs),[29] race and ethnicity, cognitive deficits per the MDS Cognition scale (MDS-COGS),[28] oxygenation and perfusion problems, presence of a perineal pressure injury at admission, prevention of IAD program, and the percentage of nursing home residents receiving Medicaid. Data management and statistical analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC, USA) and SPSS v. 22 (SPSS, Chicago, IL) or R software. Significance level was set at $p < .05$.

Results

The cohort comprised 10,713 residents in 448 nursing homes located in 28 states and all 9 United States Census divisions. Their mean age was 82 years, most were female, and approximately half had a high school education or greater (Table 1). All race and ethnic groups were represented with the largest group being Whites followed by Blacks. The level of ADL deficits and the mortality (CHESS[32]) index of the residents were moderate while their comorbidity (Charlson Index[30]) score was relatively low. Approximately one-third of residents had perfusion or vision problems, and about a quarter of them had an acute

condition. Oxygenation and bowel problems were present in about 20% of residents. Nearly half of the cohort (47%) had poor nutrition, assessed by weight loss 5% or more in the last 30 d or 10% or more in the last 180 days and leaves 25% or more of food uneaten at most meals (per MDS items noted in Table 1). Use of tube feeding and restraints was low (approximately 1%).

Regarding the residents' cognitive function, the average level of cognitive deficits was moderate, and delirium affected nearly a quarter of the residents (Table 2). The levels of communication difficulties and discomfort behaviors were fairly low. Depressive symptoms were present in approximately one-third of residents.

Characteristics of the nursing homes and community

Staffing by licensed nurses was 1.1 ± 0.5 hours/resident/day (mean ± SD) while staffing by CNAs was approximately twice that at 2.2 ± 2.1 CNA hours/resident/day. The average number of deficiencies of interest for which a nursing home was cited was 3.8 ± 2.4. Nearly three quarters $73.8\% \pm 15.9\%$ of the residents received Medicaid. The nursing homes were located in communities with diverse racial and ethnic populations, although the percentage of minorities in some communities was small (Table 3). A majority of nursing homes tended to be in working class communities. Approximately half (49.3%) of the nursing homes were in tracts that were largely (75%) urban.

Incidence and Predictors of IAD

The incidence of IAD among nursing home residents with new incontinence after nursing home admission was 5.5%. Of the residents who developed IAD, 89% did so within 14 days of the occurrence of incontinence. Significant predictors of developing IAD were having greater limitations in ADLs, more perfusion problems, a perineal pressure injury at admission, fewer cognitive deficits and not receiving preventive interventions for IAD (Table 4). Receiving preventive interventions for IAD was the strongest protective factor against its occurrences. The odds of developing IAD among residents receiving IAD prevention were about half (46%) the odds among those not receiving prevention (OR = 0.46; 95% CI: 0.33–0.65). Residents who had a perineal pressure injury present upon nursing home admission were much more likely to develop IAD than those without a pressure injury (OR=2.04; 95% CI: 1.32–3.15).

Discussion

This study is among the few[5–9] to examine the incidence of IAD in a national nursing home population and the first to our knowledge to report predictors of new onset IAD in those residents. Incontinence associated dermatitis occurred in nearly 6% of nursing home residents who developed incontinence after NH admission. This rate is similar to that reported in long-term acute care[7] and greater than that in nursing homes with a skin damage prevention program in place for all residents.[8,9]

Gray and colleagues[33] underscored the need for and importance of prevention of IAD, and our results provide evidence supporting its value. Preventive measures for IAD was a strong protective factor against its development. Others have reported a strong association of

incontinence with inflammatory type damage of the skin barrier as well as pressure related injury in the perineal area in cross-sectional studies of NH residents[34] and hospitalized patients.[35] Since IAD occurred within two weeks of new incontinence in the vast majority of residents (89%), instituting prevention of skin damage at the start of incontinence seems critical.

These findings are also among the first to show that pre-existing skin damage from a perineal pressure injury is a risk factor for IAD suggesting that damaged skin is more vulnerable to subsequent IAD. Other predictors for IAD suggest that functional/ADL deficits of nursing home residents may interfere with their ability to properly cleanse soiled skin. Activity of daily living deficits in residents' mobility or toileting abilities may result in more frequent incontinence and exposure of skin to local inflammatory irritants. Perfusion problems in this study include dehydration and edema; perfusion/hydration problems are components of conceptual models of factors associated with IAD.[2,36] Epidermal cells are 70% water and dehydration impairs their normal life cycle and function.[37] Edema increases interstitial fluid disrupting the normal matrix of epidermal cells resulting in increased permeability of the skin barrier and inflammation.[38,39] Residents with lesser cognitive deficits may be more likely to develop IAD because they may need more assistance than assumed in managing perineal cleansing after incontinence. Further studies explaining the mechanisms underlying IAD predictors are needed. The results of this study can be used to guide the focus of such investigations. Our results support and extend associations of similar variables with IAD observed in previous cross-sectional studies,[13,14] and proposed in a conceptual model.[2]

Preventing and managing IAD is an integral part of WOC nursing practice and findings of this study affirm the value of the WOC nurse in the nursing home setting. The predictors of IAD identified in this study assist WOC nurses in developing the focus of education for nursing home staff and in planning their consultation services. For example, WOC nurses can use the research-based evidence of this study to assist nursing homes in identifying residents at risk for IAD to reduce their morbidity and improve their health outcomes. Findings also support WOC nurse efforts advocating for IAD prevention. They emphasize the need for timely healing of perineal pressure injuries which is facilitated by the expertise of the WOC nurse.

Strengths and Limitations

Our procedures for identifying IAD in the POs may have underreport IAD as not all cases may have been identified. The time frame of our data is a limitation as newer skin care products may have increased effectiveness of IAD prevention if used by nursing homes. All relevant predictors of incontinence prevention may not be known, available in our datasets, or perhaps possible to include in our models. For example, data about the knowledge and attitudes of nursing staff were not available in our datasets, and we were unable to differentiate the type of incontinence in our model because some residents did not have these data specified in their POs. Logistic regression analysis does not account for time to development of IAD and admissions in our study had differing times to the first occurrence of IAD. However, we observed that IAD occurred within 14 days of the onset of

incontinence in 89% of the residents who developed incontinence associated skin damage. The generalizability of results is limited to residents in for-profit nursing homes. We note that 69% of all US nursing homes are for-profit; furthermore, our admission cohort has similar characteristics as residents in all US nursing homes.[40]

There are also strengths of this study. As IAD is not a standardized resident assessment item on the MDS, the POs provided a unique resource for investigating this understudied problem. Incontinence associated dermatitis has been shown to recur after healing in individuals whose incontinence persists.[1] We analyzed data of residents who newly developed incontinence after nursing home admission to reduce variability. Similarly, we studied only nursing home residents because risk factors for IAD in community-living individuals and critically-ill patients may be different than those in nursing home residents.[41] Another strength is that the four datasets used are from the same time period, using the most recent Census data available at the beginning of our study. We considered/ screened potential predictors variables at multiple levels, and our model adjusted for the percentage of residents on Medicaid, a nursing home level factor indicating a financial resource of nursing homes. Use of multi-item scales and composite predictors, as done in this study, has been shown to improve predictive ability, including that of MDS data.[42]

Conclusions

This is the first study to report incidence of IAD and predictors in NH residents who developed incontinence during their stay. Residents with functional, physical, and cognitive deficits are at risk for developing IAD. Lack of prevention of IAD and presence of pressure injury in the perineal area were among the strongest predictors of IAD. These findings guide WOC nurses in educating nursing home staff about the risk factors for IAD and in reducing its incidence, which will improve NH resident outcomes.

Acknowledgments

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Table 1

Demographic, Functional, and Physical Characteristics of Older, Incontinent Nursing Home Admissions Followed for Developing Incontinent Associated Dermatitis

Variable/*Scale*	MDS Item	Admissions n = 10,713
Demographic Characteristics		mean (SD)
Age	AA3, AB1	82.47 (7.57)
		n (%)
Female Gender	AA2	7,551 (70.5)
Race[1] and Ethnicity	American Indian or Alaskan Native	51 (0.5)
	Asian or Pacific Islander	125 (1.2)
	Black Not Hispanic	837 (3.7)
	White Not Hispanic	9,556 (89.2)
	Hispanic	143 (1.3)
High School Education or Greater	AB7	5,989 (55.9)
Functional Deficits and Physical Health		mean (sd)
Activities of Daily Living Deficit Score[29]	G1aA, G1bA, G1eA, G1gA, G1hA, G1iA, G1jA, Range 0–28	11.03 (6.46)
Body Mass Index	K2a-b	25.20 (5.08)
Comorbidity Index Charlson Index[30]	I3a-e, and/or I1, Range 0–30	1.83 (1.53)
Medications Number per week	O4a-e, Range 0–35	6.89 (6.19)
Mortality risk *CHESS* Score[32]	J1c, J1g, J1l, J1o, K3a,K4c, J5c, B6, G9, Range 0–5	1.63 (1.08)
		n (%)
Acute Condition – Any	J5b	2,631 (24.6)
Bowel Problems - Any	I2b, H2b-d	1,943 (18.1)
Fever in Last 7 Days	J1h	280 (2.6)
Oxygenation Problems Number of Indicators	J1b, J1k-l, P1ag, P1ai-j, P1al, P1bdA	
1		1,126 (10.5)
2		723 (6.7)
3		586 (5.5)
Perfusion Problems Number of Indicators	J1a, J1c-d, J1g	
1		2,906 (27.1)
2		244 (2.3)
Plegia or Pareses - Any	I1v, I1x, I1z	444 (4.1)
Poor Nutrition Number of Indicators	K3a, K4c	
1		4,369 (40.8)

Variable/*Scale*	MDS Item	Admissions n = 10,713
2		730 (6.8)
Presence of a Perineal Pressure Injury	By practitioner orders	862 (8.0)
Restraint Use - Any	P4c-e	167 (1.6)
Tube Feeding	K5b	148 (1.4)
Vision Impairment Number of Indicators	D1, D2a, D2b	
1		2,569 (24.0)
2		778 (7.3)

[1]Race/ethnicity is missing for one resident.

Table 2

Cognitive and Emotional Characteristics of Older Incontinent Nursing Home Residents

Variable/*Scale*	MDS Item	Admissions n = 10,713
Cognitive and Emotional Status		mean (SD)
Cognitive deficits *MDS-COGS* Score[28]	B2a, B2b, B3b, B3d, B3e, B4, C4, G1gA, Range 0–10	2.59 (2.45)
Communication Difficulties Score	C1, C5, C6, C3b-f, Range 0–9	0.98 (1.23)
Discomfort Behavior Scale score[43] (mean (sd))	E1c, E1k, E1l-p, E4a-eA, E4a-eB, Range 0–102	4.46 (8.76)
		n (%)
Delirium *MDS-CAM* score[44]	B5a-f, B6, E5	
Subsyndromal Delirium Level 1		1,462 (13.6)
Subsyndromal Delirium Level 2 or Full Delirium		1,051 (9.8)
Depression[45] – Any	E1a, E1d, E1f, E1h, E1i, E1l, E1m	3,351 (31.3)

Table 3

Characteristics of Nursing Homes and Their Surroundings

Level of Census Tract Characteristic	Characteristics of Census Tract of Community around Nursing Homes							
	% American Indians/ Asians/ Pacific Islanders[1] in Census Tract	% Non-Hispanic Blacks in Census Tract	% Hispanics in Census Tract	% Non-Hispanic Whites in Census Tract	% Census Tract below Poverty	% Working Class in Census Tract	Proportion of Census Tract in an Urban Area	Proportion of Census Tract in a Rural Area
	n (%) of Nursing Homes							
< 25%	434 (97.5)[2]	387 (87.1)	406 (91.2)	16 (3.6)	406 (91.2)	2 (0.4)	210 (47.2)	341 (76.6)
25 to < 75%	9 (2.0)	51 (11.4)	36 (8.1)	115 (25.8)	39 (8.7)	377 (84.7)	14 (3.1)	45 (10.1)
75%	2 (0.4)	7 (1.6)	3 (0.7)	314 (70.6)	0 (0.0)	66 (14.8)	221 (49.7)	59 (13.3)

[1] Racial/ethnic categories are according to US Census;

[2] For example, 97.5% of nursing homes were located in Census tracts that had < 25% American Indian/Asian/Pacific Islander population.

Table 4

Predictors of Incontinence Associated Dermatitis in Older Nursing Home Residents

Predictors	Odds Ratio	95% Confidence Interval	p-value
Individual Level			
Activities of Daily Living Deficit Score[29]	1.02	1.01–1.04	.001
Oxygenation Problems	1.08	0.98–1.18	.11
Perfusion Problems	1.25	1.06–1.47	.01
Presence of a Perineal Pressure injury	2.04	1.32–3.15	.002
Race			.09
Cognitive Deficits Score[28]	0.87	0.83–0.90	<.001
Prevention of IAD	0.46	0.33–0.65	<.001
Nursing Home Level			
Percentage of Residents on Medicaid	1.00	1.00–1.01	.39