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Prevention of Incontinence Associated Skin Damage in Nursing Homes: Disparities and Predictors

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Abstract

Racial/ethnic disparities in preventing health problems have been reported in nursing homes. Incontinence is common among nursing home residents and can result in inflammatory-type skin damage, referred to as incontinence associated skin damage (IASD). Little is known about the prevention of IASD and whether there are racial/ethnic disparities in its prevention. This study assessed the proportion of older nursing home residents receiving IASD prevention after developing incontinence after admission (n=10,713) and whether there were racial/ethnic disparities in IASD prevention. Predictors of preventing IASD were also examined. Four national datasets provided potential predictors at multiple levels. Disparities were analyzed using the Peters-Belson method; predictors of preventing IASD were assessed using hierarchical logistic regression. Prevention of IASD was received by 0.12 of residents and no racial/ethnic disparities were found. Predictors of preventing IASD were primarily resident level factors including limitations in activities of daily living, poor nutrition, and more oxygenation problems.

Keywords

dermatitis; incontinence; disparities; nursing homes

Inflammatory damage of the skin barrier is a common physical consequence of incontinence. Incontinence associated skin damage (IASD), as we refer to this problem, results in symptoms of discomfort/ pain, itching, and burning sensations and comorbidity

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Conflict of Interests

The authors declare that there is no conflict of interest.

Disclosures

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such as fungal infection (Arnold-Long, Reed, Dunning, & Ying, 2012; Bliss, Funk, Jacobson, & Savik, 2015; Gray et al., 2007). Considering that there are more than a million individuals residing in nursing homes in the United States (US) (Harris-Kojetin, Sengupta, Park-Lee, & Valverde, 2013), and as many as one-half are incontinent (Bliss et al., 2013; Gorina, Schappert, Bercovitz, Elgaddal, & Kramarow, 2014; Milson et al., 2013), the potential morbidity, negative effect on well-being, and treatment expense of IASD are large. Primary prevention of IASD can promote the health and comfort of incontinent nursing home residents and avoid costs of treating incontinence complications. Interventions to prevent IASD and the importance of its prevention have been recommended by clinical experts (Beeckman, Woodward, Rajpaul, & Vanderwee, 2011; Gray, McNichol, & Nix, 2016). However, little is known about the initiation of IASD prevention interventions in nursing homes or for that matter in any other clinical setting. Racial and ethnic disparities in prevention of health problems have been reported in nursing homes. As the percentage of minority older adults admitted to nursing homes increases (Feng, Fennell, Tyler, Clark, & Mor, 2011; Lakdawalla et al., 2003), examining nursing home care practices for racial and ethnic disparities is an important first step for insuring equity of nursing home care.

Potential Racial and Ethnic Disparity in Preventing Incontinence Associated Skin Damage in Nursing Homes

Elimination of racial and ethnic disparities in health and healthcare is a priority of healthcare policy in the United States (US) (Centers for Medicare and Medicaid Services, 2013a; US Department of Health and Human Services, 2011). Using Braveman's (2006) framework, healthcare disparities are differences in the health or healthcare of racial and ethnic minorities who have systematically experienced disadvantage or discrimination which can be changed by healthcare policies and actions of healthcare clinicians. There are reports of racial and ethnic disparities in nursing home prevention interventions that could increase the risk of IASD and led us to question whether there may be disparities in IASD prevention. For example, we have recently reported that there were disparities in prevention of incontinence among Black nursing home residents (Bliss, Gurvich, Savik, Eberly, Wyman, et al., 2015; Bliss, Gurvich, Savik, Eberly, Wyman, et al., 2016). Others have shown that compared to non-Hispanic white residents, all minority groups of nursing home residents studied were less likely to receive medications to prevent stroke, which is associated with incontinence (Christian, Lapane, & Toppa, 2003) and hence IASD.

Various factors may influence resident outcomes and care in nursing homes including the health status of residents, organizational features such as nursing staffing and the quality of care delivered, and resources of the community around the nursing home. Regarding non-resident level factors, for example, several investigators have shown that the quality of nursing home care is lower in economically-disadvantaged areas with larger minority populations and nursing home admissions are often from the local community (Gerardo, Teno, & Mor, 2009; Mor, Zinn, Angelelli, Teno, & Miller, 2004; Smith & Mor, 2006). Therefore, social epidemiologists recommend that factors at multiple levels be considered when assessing complex problems such as healthcare disparities (Diez-Roux, 1998).

Purpose

The purpose of this study was to assess whether there were racial or ethnic disparities in the prevention of IASD in nursing home residents. If no disparity was found, an analysis examining predictors of receiving IASD prevention was planned a priori to increase understanding about IASD prevention in nursing homes.

Methods

Data Sources

Data from four sources were linked and analyzed. Minimum Data Set (v. 2.0) records contained demographic and health assessment data of nursing home residents. A second source contained practitioner orders of physicians and nurse practitioners which were required for all interventions and care of nursing home residents including prevention and treatments. Online Survey, Certification, and Reporting records contained information about nursing home staffing and quality of care. The US Census contained sociodemographic and socioeconomic measures of the Census tract of the community surrounding the nursing homes. The Minnesota Population Center at the University of Minnesota, Minneapolis, MN, identified the Census tracts of the nursing homes. Data were from a national for-profit chain of nursing homes during the years 2000–2002. The University of Minnesota Institutional Review Board reviewed the study and determined it was exempt as data were de-identified.

Design, Cohort, and Outcome

The study had a cohort design. The cohort consisted of older (65+ years) nursing home residents who developed incontinence after nursing home admission. Racial and ethnic groups were defined according to the Minimum Data Set: American Indian or Alaskan Native (AIAN), Asian or Pacific Islander (API), Black not Hispanic (Black), White not Hispanic (White) and Hispanic. The first occurrence of incontinence after nursing home admission was determined by Minimum Data Set records or practitioner orders, whichever was earlier. Methods for defining the incidence of incontinence using Minimum Data Set records (Bliss, Gurvich, Savik, Eberly, Harms, et al., 2015) and for defining incontinence and IASD using practitioner orders have been previously described (Bliss, Gurvich, Savik, Eberly, Fisher, et al., 2016). Practitioner orders of were also searched for IASD prevention on or after the date of incontinence until evidence of the presence of IASD was found or a resident's practitioner orders ended.

Terms describing IASD prevention were identified by the investigators, three clinical experts, and a pharmacist using their expertise, a literature review, and catalogues of commercially-available skincare products. Examples of types of practitioner orders that indicated IASD prevention included the following: to assess skin for damage (e.g., after an incontinence episode or at regular time intervals), to use skin care products, such as cleansers, wipes, barriers/protectants, lotions/ moisturizes (generic or brand name) to protect the skin or prevent damage, to start a skin damage prevention protocol, or to use practices such as timely or gentle cleansing of incontinence to prevent damage to skin. All practitioner orders of a resident were reviewed at the same time to improve accuracy of coding.

Practitioner orders were searched using computerized algorithms to search the practitioner orders for terms or combinations of terms, including common misspellings and various orderings of terms by consulting company that developed specializing in this type of analysis (Edgeworks Technology, Inc. Chicago, IL). Research assistants reviewed and confirmed the electronic classification of random sets of practitioner orders with and without words of interest and added new descriptive words refining the algorithms and manual reviews in an iterative manner. Approximately 2.3 million practitioner orders were then reviewed and coded for the presence of outcomes of interest of which more than 850,000 related to the IASD prevention study by the research assistant. Agreement among the coders on 102,119 random practitioner orders rose from 85% to 97% and 100% after additional training and improved communication procedures.

Predictors

Potential predictors of IASD prevention were identified using a literature review, consultation of the clinical experts, and expertise of the research team. Predictors were defined using variables available in the datasets. Individual variables or composite scores of established multi-variable scales with good psychometric properties were used as several items on a record may refer to the same concept. When no scale existed and single items were considered insufficient, composite scales/measures were developed. Scales were coded so that a higher score of a variable indicated a worse status.

In constructing composite measures of individual level predictors, previously established procedures were followed (Savik, Fan, Bliss, & Harms, 2005). Predictors at the individual level included residents' demographic characteristics, measures of residents' physical health, functional abilities, cognitive status, and emotional state. (Tables 1–2 of the Results describing the cohort also show key individual level predictors). Predictors at the nursing home level included variables for deficiencies in the quality of care of the nursing home facility, and for percentages of nursing home admissions by gender, race, and ethnicity, and of residents receiving Medicaid. Predictor variables were also created for the different types of nursing home staff. Licensed nurse staff included registered nurses and licensed practical nurses. For nursing staff (licensed nurses and certified nursing assistant/medication aide (CNA), total full time equivalents per resident were calculated by dividing the total of each type of nursing staff (including full-time, part-time and contract positions) reported for a two-week period by the total number of residents in a nursing home.

At the community level, potential predictors measured the sociodemographic and socioeconomic characteristics of the Census tracts in which the nursing homes were located. For example, these included the proportion (or percentage) of the tract that was female or male aged < 65 years and 65 years old, in a racial or ethnic minority group, had a high school education, or was working class, below poverty level, or residing in an urban or rural area. Other potential predictors were the median home value and the Census division of the tract of the nursing home.

Statistical Analysis

Data were summarized using descriptive statistics appropriate to their level and type. Differences among groups were not formally tested as the large sample size renders small differences as statistically significant. Potential predictors were screened for inclusion in the statistical models using bivariate associations with the outcome of IASD prevention (significance level was set at $p < .05$), and possible collinearity among variables was also assessed. If an individual level variable was highly correlated with a nursing home or community level variable, the individual level variable was included in the model as it was more specific. The following predictors were included in the analysis of disparities in IASD prevention: deficits in activities of daily living (Morris, Fries, & Morris, 1999), poor nutrition, deficiencies in a nursing home's quality of care, and the percentage of residents receiving Medicaid.

Disparities in the prevention of IASD due to race and ethnicity were assessed using the Peters-Belson method. The Peters-Belson method uses a two-step procedure and estimates the proportion of a presumed disadvantaged group (in this study, each racial or ethnic minority resident group) expected to receive IASD prevention as if its members were part of a presumed advantaged group (the White residents) (Graubard, Sowmya Rao, & Gastwirth, 2005). First a logistic regression model of predictors associated with IASD prevention was fit for White residents. The regression coefficients from the model for Whites were then applied to each racial or ethnic minority resident group separately in other logistic regression models. The expected and observed proportions of residents receiving IASD prevention for each minority group were then compared using a one-sample two-sided log-rank test (Eberly et al., 2015). A significant difference represented the disparity in IASD prevention unexplained by predictors in the model suggesting disparity due to race or ethnicity (Eberly et al., 2015; Graubard et al., 2005). As residents were clustered within nursing homes, the nursing homes of Whites being modeled included the minority group of interest to control for unmeasured nursing home confounders and heterogeneity in variability. We refer to these nursing homes as mixed race nursing homes, which may have also included other minority groups.

If no racial or ethnic disparity was found, a hierarchical logistic regression analysis was planned *a priori* to be performed to examine predictors of IASD prevention among all residents. The model incorporated nursing home specific random effects to adjust for clustering of residents within the nursing homes. Predictors were screened for inclusion in this model following the same procedures as described for the analysis of disparities. The model for predicting IASD prevention among all residents included the following: deficits in activities of daily living, oxygenation problems, poor nutrition, deficiencies in nursing home quality of care, and the percentage of residents receiving Medicaid. For data management and descriptive statistics, SPSS v. 22 (Chicago, IL) or SAS v. 9.4 (SAS Institute, Inc., Cary, NC) were used. The Peters-Belson analysis was performed using R software. Hierarchical logistic regression was conducted using SAS version 9.4. Results were considered statistically significant if $p < .05$.

Results

Characteristics of the Cohort

The cohort was comprised of 10,713 older adults admitted to 448 nursing homes located in 28 states and all 9 Census divisions. The characteristics of the residents in the cohort by racial and ethnic group are presented in Tables 1 and 2. The residents across groups were nearly 80 years old on average (Table 1). More than half of each group was female (Table 2). A greater percentage of Whites, APIs, and AIANs had at least a high school education (Table 2).

Regarding functional and physical status, all of the groups had a moderate level of limitation in activities of daily living (Morris et al., 1999) with APIs having the greatest limitation (Table 1). APIs had the lowest BMI and Hispanics the highest. The number of comorbidities measured by the Charlson Index (Charlson, Pompei, Ales, & MacKenzie, 1987) was low among all groups with AIANs and Whites having slightly lower scores. The mortality index of the groups, measured by the Changes in Health, End-Stage. Disease, Signs, and Symptoms (CHESS) scale (Hirdes, Frijters, & Teare, 2003) was moderate, and Blacks had more comorbidities than the other groups. Whites received the most medications per week. Bowel problems were most common in APIs. Oxygenation problems occurred in 15% to 20% of all groups with the higher percentages in Whites and Hispanics (Table 2). Perfusion problems were more common in Whites and APIs. At least one-third of all groups on average had poor nutrition. The use of tube feeding and restraints was low in all groups (Table 2).

The level of cognitive deficits (Hartmaier, Sloane, Guess, & Koch, 1994) was moderate among all groups (Table 1). Delirium (Dosa, Intrator, McNicoll, Cang, & Teno, 2007) was slightly more common among AIANs and Whites (Table 2). APIs and Hispanics had the most communication difficulties (Table 1). Compared to other groups, more AIANs had signs of depression (Burrows, Morris, Simon, Hirdes, & Phillips, 2000) (Table 2).

Characteristics of the Nursing Homes and Surrounding Communities

Nursing staffing was 0.22 (0.10) licensed nurse full time equivalents which was 1.1 (0.5) licensed nurse hours/resident day (mean (sd)). The full time equivalents of CNAs were 0.44 (0.43) which was 2.2 (2.1) CNA hours/resident day. On average, the total number of deficiencies of interest for which a nursing home was cited was 3.9 (2.4), and the composite scope and severity score was 7.6 (6.3). The percentage of nursing home residents receiving Medicaid was 73.8 (15.9) (mean (sd)). The characteristics of the nursing homes and their surrounding communities have been described in detail elsewhere (Bliss, Gurvich, Savik, Eberly, Fisher, et al., 2016). Briefly, the nursing homes were located in communities with diverse racial and ethnic populations, although the percentages of some minorities were small. Approximately 8% of nursing homes were in a community in which 25% to 50% of their population was Black whereas 2% of nursing homes were in communities where this percentage of the community was AIAN. Approximately 70% of nursing homes were located in Census tracts whose community was 75% White. Half of the nursing homes

were in areas that were largely (>75%) urban. Nearly three-quarters (74%) of the nursing homes were in communities in which 50% to 75% of their population was working class.

Prevention of Incontinence Associated Skin Damage

The overall proportion of older nursing home residents with new incontinence who received IASD prevention was 0.12. There were no racial or ethnic disparities in IASD prevention for any minority group. The observed proportion of a minority group who received IASD prevention did not differ significantly from the proportion expected to receive prevention had they been part of the White group: observed for AIANs = 0.06 vs. expected = 0.10 ($p = .37$); for APIs observed = 0.10 vs. expected = 0.16 ($p = .053$); for Blacks observed = 0.12 vs. expected = 0.13 ($p = .11$); and for Hispanics observed = 0.14 vs. expected = 0.15 ($p = .86$).

Significant predictors of receiving IASD prevention were having poorer nutrition, more oxygenation problems and greater deficits in activities of daily living (Table 3). For example, for a one-point increase on the poor nutrition scale, there is about a 20% increase in the odds of receiving IASD prevention, and for every point higher in the score of deficits in activities in daily living (possible score range = 0–28), the odds of receiving IASD prevention increased by 2%.

Discussion

This is the first study to our knowledge to report the prevention of IASD in nursing home residents or in patients in any clinical setting. Furthermore, this is the first study to investigate whether there are any racial or ethnic disparities in IASD prevention in nursing homes. The lack of disparity is a positive finding suggesting that IASD prevention is ordered equitably across racial/ethnic groups. The low incidence of preventing IASD in residents with new incontinence found in this study can serve to encourage increased prevention efforts and documentation/ordering of those efforts. Primary prevention interventions aim to reduce the occurrence of a health problem, such as IASD, and may decrease a resident's susceptibility to other comorbidities associated with skin damage such as a pressure ulcer (Beeckman, Van Lancker, Van Hecke, & Verhaeghe, 2014). Results show that a resident's health status (i.e., more indicators of poor nutrition status, oxygenation problems, and functional deficits) predicted receipt of IASD prevention. These factors, in addition to incontinence, have been reported among those associated with perineal skin damage in cross-sectional studies of nursing home residents (Bliss, Savik, Harms, Fan, & Wyman, 2006; Brown, 1995). Studies examining strategies to guide nursing home nursing in providing prevention for IASD are needed. Our models adjusted for nursing home level factors of quality of care and percentage of residents receiving Medicaid.

Preventing skin damage is an integral component of incontinence management and nursing care of residents in nursing homes. Study findings support recent calls to increase awareness about the need for increasing efforts to prevent IASD in incontinent nursing home residents (Gray et al., 2016). Additionally, avoidance of preventable problems, such as IASD, is a priority of consumer advocates and cost-effective healthcare delivery (Gallagher, 2011). Interventions and types of products to prevent IASD have been described by clinical experts (Beeckman, Woodward, & Gray, 2011; Nix & Haugen, 2010) Various cost-effective

strategies have been used in developing skin care products for treating IASD that are also used for its prevention (Bliss, Zehrer, Savik, Smith, & Hedblom, 2007; Gray et al., 2012; Zehrer, Lutz, Hedblom, & Ding, 2004). To our knowledge, there are no studies comparing the cost of prevention versus treatment of IASD. However, others have shown that prevention of several clinical conditions, including other types of skin damage such as pressure ulcers, results in cost savings in a variety of ways (Gallagher, 2011).

There are limitations of our study. Although practitioner orders were required for prevention interventions for IASD, our procedures may have missed some orders. We assumed orders for IASD prevention were implemented but there is no guarantee that this was done. There is limited generalizability of the results to non-profit nursing homes; however, nearly 70% of all US nursing homes are for-profit (Centers for Medicare & Medicaid Services, 2013b). We have shown that characteristics of our admission cohort are comparable to those of admission in all US nursing homes (Bliss et al., 2013). Not all relevant predictors of incontinence prevention may be known, available in our datasets, or perhaps possible to include in our models. For example, we were unable to assess the contributions of factors such as the culture in a nursing home, which has been associated with other better outcomes of residents (Miller, Lepore, Lima, Shield, & Tyler, 2014) and might foster prevention because they were not in our datasets. The time frame of our data is a limitation as publications since 2002 about IASD and its adverse effects may have increased the administration of IASD prevention in nursing homes. We used the US Census records and Minimum Data Set that were available at the time of funding of our grant and start of our analyses and for which scales of Minimum Data Set composite variables were tested.

There are several strengths of our study. Use of composite variables comprised of multiple items as predictors that were incorporated in our analyses has been shown to promote accuracy of statistical models (Teigland, Gardiner, Li, & Byrne, 2005). Our analyses considered and screened for predictors of IASD prevention at the individual, nursing home, and community levels in our data sets. The data at all levels of measurement were from the same period of time which reduced variability and strengthened inferences. The practitioner orders provide a unique resource enabling investigation of the understudied issues of disparities and predictors of preventing IASD in nursing homes. The Peters-Belson approach is an innovative method for analyzing racial-ethnic disparities, and its advantages have been reviewed elsewhere (Eberly et al., 2015).

This study addresses goals of quality nursing home care as well as priorities of federal agencies supporting health care. Preventing illness and additional morbidity is a key theme of the strategic plan of the National Institute of Nursing Research, NIH (National Institute of Nursing Research, n.d.). Equity in health and healthcare are goals of the US Department of Health and Human Services (US Department of Health and Human Services, 2011). The study found no racial or ethnic disparities in IASD prevention among nursing home residents. However, the percentage of residents receiving primary prevention of IASD was low and increased efforts are recommended.

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Variable/Scale	Minimum Data Set Item	American Indian/Alaskan Native	Asian/ Pacific Islander	Black	Hispanic	White
# of Admissions ¹		n = 51	n = 125	n = 837	n = 143	n = 9,556
Demographic, Physical and Functional						
(mean(sd))						
Age	AA3, AB1	78.99 (9.02)	83.18 (7.33)	80.90 (8.48)	80.93 (7.80)	82.63 (7.46)
Activities of Daily Living Deficit Score (Morris et al., 1999)	GIaA, GIbA, GIeA, GIgA, GIhA, GIiA, GIjA, Range 0–28	10.59 (6.52)	13.17 (5.36)	10.93 (6.63)	11.01(7.1)	11.01 (6.44)
Body Mass Index	K2a–b	25.74 (5.72)	22.73 (3.81)	25.43 (5.21)	26.15 (4.99)	25.19 (5.07)
Comorbidity Index <i>Charlson Index</i> (Charlson et al., 1987)	I3a–e, and/or I1, Range 0–30	2.18 (1.56)	2.10 (1.71)	2.23 (1.62)	2.16 (1.55)	1.79 (1.51)
Mortality risk <i>CHESS Score</i> (Hirdes et al., 2003)	J1c, J1g, J1l, J1o, K3a, K4c, J5c, B6, G9, Range 0–5	1.22 (1.17)	2.02 (0.92)	1.30 (1.03)	1.27 (1.13)	1.66 (1.08)
Cognitive and Emotional						
(mean(sd))						
Cognitive Deficits <i>MDS-COGS</i> Score (Hartmaier et al., 1994)	B2a, B2b, B3b, B3d, B3c, B4, C4, GIgA, Range 0–10	2.49 (2.44)	2.41 (1.95)	2.96 (2.47)	2.64 (2.65)	2.55 (2.45)
Communication Difficulties	C1, C5, C6, C3b–f, Range 0–9	1.06 (1.41)	1.22 (1.27)	0.86 (1.10)	1.19 (1.43)	0.98 (1.23)

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Table 2

Additional Characteristics of Nursing Home Residents

Variable/Scale	Minimum Data Set Item	American Indian/Alaskan Native n = 51	Asian/ Pacific Islander n = 125	Black n = 837	Hispanic n = 143	White n = 9,556
# of Admissions						
n (%)		Demographic, Physical, and Functional				
Female Gender	AA2	27 (52.9)	83 (66.4)	545 (65.1)	83 (58.0)	6,812 (71.3)
High School Education or Greater	AB7	22 (43.1)	50 (40.0)	256 (30.6)	45 (31.5)	5,593 (58.5)
Bowel Problems	I2b, H2b-d	6 (11.8)	30 (24.0)	82 (9.8)	22 (15.4)	1,802 (18.9)
Oxygenation Problems	J1b, J1k-l, P1ag, P1ai-j, P1ai, P1bdA					
1		7 (13.7)	13 (10.4)	64 (7.6)	16 (11.2)	1,026 (10.7)
2		4 (7.8)	7 (5.6)	60 (7.2)	13 (9.1)	1,225 (12.8)
Perfusion Problems	J1a, J1c-d, J1g					
1		6 (11.8)	36 (28.8)	209 (25.0)	23 (16.1)	2,632 (27.5)
2		1 (2.0)	3 (2.4)	7 (0.8)	4 (2.8)	229 (2.4)
Poor Nutrition	K3a, K4c					
1		20 (39.2)	50 (40.0)	291 (34.8)	44 (30.8)	3,964 (41.5)
2		9 (17.7)	20 (16)	71 (8.5)	20 (14.0)	1,130 (11.8)
Tube Feeding	K5b	0 (0)	5 (4.0)	12 (1.4)	5 (3.5)	126 (1.3)
Restraint use - Any	P4c-e	1 (2.0)	2 (1.6)	20 (2.4)	1 (0.7)	143 (1.5)
n (%)		Cognitive and Emotional				
Delirium	MDS-CAM (Dosa et al., 2007)					
Subsyndromal Delirium Level 1	B5a-f, B6, E5	10 (19.6)	20 (16.0)	95 (11.4)	20 (14.0)	1,317 (13.8)
Subsyndromal Delirium Level 2 and Full Delirium		4 (7.8)	11 (8.8)	62 (7.4)	10 (7.0)	964 (10.1)
Depression – Any (Burrows et al., 2000)	E1a, E1d, E1f, E1h, E1i, E1l, E1m	23 (45.1)	19 (15.2)	171 (20.4)	36 (25.2)	3,102 (32.5)

¹ Race/ethnicity is missing for one subject.

Table 3

Predictors of Prevention of Incontinence Associated Skin Damage in Incontinent Nursing Home Residents

Predictor	Odds Ratio	95% CI
Individual Level		
Activities of Daily Living Deficit Score (Morris et al., 1999)	1.02	1.01–1.03
Oxygenation Problems	1.12	1.05–1.20
Poor Nutrition	1.20	1.07–1.33
Nursing Home Level		
Deficiencies in Quality of Nursing Home Care	1.00	0.98–1.01
Percentage of Residents on Medicaid	1.01	1.00–1.02