Racial and Ethnic Disparities in the Time to Dual Incontinence and its Treatment in Older Adults after Nursing Home Admission

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Abstract

Introduction: Older adults admitted to nursing homes (NHs) are at risk for dual incontinence (urinary and fecal incontinence; DI). Minority residents may be disadvantaged for DI and its treatment because of their racial or ethnic group identity.

Materials and Methods: This study assessed if there were racial/ethnic disparities in time to DI and in its treatment in a cohort of NH residents age ≥ 65 years (N = 39,181) who were free of DI at the time of NH admission. Individual, NH, and community level predictors of time to DI and its treatment (any and behavioral treatment) from three national surveys were modeled. Disparities were analyzed in four racial/ethnic groups using the Peters-Belson method.

Results and discussion: A significant disparity in time to DI and in receiving its treatment was found for Black residents. Significant predictors associated with disparity in time to DI were older age, male sex, greater functional and cognitive deficits, higher comorbidity, fecal incontinence at admission, and Census division. Significant predictors associated with disparity in receiving any treatment for DI were greater functional deficits, fewer cognitive deficits, and living in a NH with fewer care deficiencies. Significant predictors associated with disparity in receiving behavioral treatment for DI were fewer functional deficits, greater cognitive deficits, living in a NH with fewer qualities of care deficiencies, and a lower percentage of residents receiving Medicaid.

Conclusions: Efforts to eliminate disparities in the development and treatment of DI for Black NH residents are recommended.

ABBREVIATIONS

DI: Dual Incontinence; NH: Nursing Home; MDS: Minimum Data Set; U.S.: United States; OSCAR: Online Survey Certification and Reporting; CNA: Certified Nursing Assistants/Medication Aides; FTE: Full Time Equivalents; ADLs: Activities of Daily Living; SD: Standard Deviation; MDS-COGS: MDS Cognition Scale; MDS-CAM: Nursing Home Confusion Assessment Method; CHESS: Changes in Health, End-Stage Disease, Signs, and Symptoms Scale; HR: Hazard Ratio; CI: Confidence Interval; M: Mean

INTRODUCTION

An increasing number of minority older adults are being admitted to NHs [1], with differences reported in their health care needs and how they are met [2,3]. One area where there may be racial and ethnic disparities is dual incontinence (DI) or the co-occurrence of urinary and fecal incontinence. DI is highly prevalent in NHs residents with estimates ranging from 14.9% to 55.4%, with this condition associated with higher resource use [4,5].

Because there tends to be racial segregation and disparities in NH quality across United States (U.S.) NHs [18,19], minority residents may be at increased risk for developing DI as well as receiving inferior treatment after it develops. Reports from national cross-sectional surveys indicate that a higher percentage of older Black residents had DI compared to other races or other races combined [15,16]. Furthermore, Black residents were less likely to have scheduled toileting programs for their incontinence than all other races combined [5]. Little is known about BI in racial/ethnic disparities in development of DI and/or its treatment, and whether factors can be identified that might predict the disparities that are found.

Eliminating racial/ethnic disparities is an important national health policy goal [20,21]. The crucial first step in improving equity in health care quality is to gain awareness of the sources and predictors of disparities. Braveman’s [22] description of health disparity guided our study which defined it as worse health or greater risk of worse health in groups systematically disadvantaged or discriminated against as a result of factors such as race, ethnicity, poverty, and sex. Potential predictors of disparities include characteristics of individual residents (e.g., functional and cognitive status, and multiple chronic conditions).
Residents who developed DI were classified as receiving “Any Treatment” if one or more of the following items was reported on the same MDS record as the incident DI: toileting, bladder retraining; catheter—external or intermittent; pads/briefs; and enemas/irrigations. Residents who received Any Treatment for DI were further categorized as receiving “Non-behavioral Treatment” versus “Behavioral Treatment.” Non-behavioral treatment involved catheters, enemas/irrigations, and pads/briefs, whereas Behavioral treatment included toileting and bladder retraining.

Predictor variables

Individual level predictors (e.g., demographic, clinical, and functional characteristics) from the MDS were identified by investigators and three clinical consultants using published research and their expertise (Table 1). Where no scale existed or multiple MDS items could define a predictor, established scales of composite measures were used [23-30] or scales were developed following previously reported methods [23]. All scales and composite variables were coded so that a higher score indicated a worse status.

Potential NH and community level predictors were developed and assessed for inclusion in the statistical models. NH predictors included the proportion of NH admissions by gender and race, percentage of residents receiving Medicaid, and variables related to resident conditions as described elsewhere [31]. Composite variables were created for NH quality deficiencies in four areas (resident behavior/facility practices, dignity/quality of care, resident assessment, and nursing services) by summarizing the scope and severity levels of respective deficiencies in a NH. In addition, the total number of deficiencies in each NH was calculated. Composite variables constructed for NH staffing included activity staff, certified nursing assistants/medication aides (CNA), licensed nurses, dieticians, nursing administrators, physicians and other advanced practice providers, and therapists. Total licensed nursing and CNA staffing full time equivalents (FTEs) per resident were calculated by dividing the total FTEs of the type of staff reported for a two-week period by the number of residents.

For community level predictors, socioeconomic and sociodemographic data from the Census tract surrounding each NH (e.g., percentage of working class, percentage of poverty level, percentage in urban and in rural areas) were obtained. Other community level variables were proportions of the Census tract population by sex, age (age < 65 years and ≥ 65 years), high school education, median home values, and Census tract.

Statistical analysis

Descriptive statistics summarized the characteristics of the racial/ethnic groups, NHs, and surrounding communities. Differences among the racial and ethnic groups were formally tested for significance because the large sample size renders even the smallest differences as statistically significant. Variables were screened for inclusion in statistical models using bivariate associations with each outcome (time to DI and DI treatment), and those with association of p < .05 considered as candidates for model inclusion. Potential collinearity between variables was assessed using bivariate associations. If individual resident, NH, or community level variables were highly correlated, the individual level variable was included in the model because it was more specific. Variables used in the final model included: age at admission, gender; activities of daily living deficit scale (ADLs), comorbidities (Charlson Index), cognitive deficits, baseline fecal incontinence only, and Census division.

The Peters-Belson method was used to assess racial/ethnic disparity in time to DI [32-35]. This method involved a two-staged approach in which a Cox proportional hazards regression was used to analyze predictors for White residents. Then,
estimates of coefficients from the Cox model were applied to the same predictors for each minority group (Blacks, Asian/Pacific Islanders, Hispanics, and American Indian/Alaska Natives) separately. This resulted in an estimate of the expected time to DI for the minority groups as if they were part of the White group. The expected and observed times to DI of the minority group were used to calculate Kaplan-Meier estimates that were then plotted on the same graph and compared using a one-sample two-sided log-rank test [32]. A log-rank statistic with p < .05 indicated a significant race/ethnic disparity.

The Peters-Belson method was also used to assess racial/ethnic disparities in DI treatment. Models for assessing disparities in the outcomes of receiving “Any Treatment” versus “No Treatment” for DI and for receiving “Behavioral Treatment” versus “Non-behavioral Treatment” utilized logistic regression [33], and the analysis followed the same procedures for assessing disparities as that for the time to DI outcome. The variables used in the final model included: activities of daily living, cognitive deficits, and quality of care deficiencies.

Models controlled for clustering of individuals in NHs by analyzing Whites who were in NHs with the respective minority group for whom disparities were being investigated; these NHs were termed “mixed race.” The Peters-Belson analyses were performed with R software version 3.1 (The R Foundation for Statistical Computing) and other analyses used SAS version 9.2 and 9.3 (SAS Institute, Inc., Cary, North Carolina) and IBM SPSS Statistics for Windows, version 21.0 (IBM Corporation, Armonk, New York).

RESULTS AND DISCUSSION

Cohort characteristics

The cohort consisted of 39,181 older adults admitted to 445 NHs in 27 states and all nine Census divisions. The cohort was predominantly female (69.2%), with a mean age of 81.3 years (standard deviation [SD] 7.6). Of these, 77.3% were continent, 20.5% had urinary incontinence only, and 2.2% had fecal incontinence only. Cohort characteristics by racial/ethnic group are shown in Table (1) also see (Supplemental Table). Higher percentages of Whites and Asians/Pacific Islander residents were older, female, and had a high school or greater education compared to the other groups. American Indian/Alaska Native and Black residents had fewer ADL deficits [24], and Asians/Pacific Islanders residents had the highest. Black residents had greater impaired cognitive function as measured by the MDS.

<table>
<thead>
<tr>
<th>Variable/Scale</th>
<th>MDS Item</th>
<th>American Indian/Alaska Native</th>
<th>Asian/Pacific Islander</th>
<th>Black Non-Hispanic</th>
<th>Hispanic</th>
<th>White Non-Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at Admission, M±SD</td>
<td>AA3, AB1</td>
<td>77.9±8.3</td>
<td>82.4±7.2</td>
<td>79.6±8.1</td>
<td>79.8±8.2</td>
<td>82.1±7.5</td>
</tr>
<tr>
<td>Female Gender, n (%)</td>
<td>AA2</td>
<td>120 (56.9)</td>
<td>395 (66.2)</td>
<td>1731 (62.8)</td>
<td>299 (58.1)</td>
<td>24,584 (70.0)</td>
</tr>
<tr>
<td>≥ High School Education, n (%)</td>
<td>AB7</td>
<td>80 (37.9)</td>
<td>317 (53.1)</td>
<td>948 (34.4)</td>
<td>143 (27.8)</td>
<td>21,222 (60.5)</td>
</tr>
<tr>
<td>Activities of Daily Living Deficit Score, “M±SD</td>
<td>G1aA, G1bA, G1eA, G1gA, G1hA, G1IA</td>
<td>9.8±7.1</td>
<td>14.5±5.3</td>
<td>10.9±6.7</td>
<td>11.3±6.9</td>
<td>11.3±6.5</td>
</tr>
<tr>
<td>Restraint Use – any, n (%)</td>
<td>P4c-e</td>
<td>4 (1.9)</td>
<td>20 (3.4)</td>
<td>41 (1.5)</td>
<td>5 (1)</td>
<td>476 (1.4)</td>
</tr>
<tr>
<td>Body Mass Index, M±SD</td>
<td>K2a-b</td>
<td>25.7±5.1</td>
<td>22.9±3.9</td>
<td>25.8±5.4</td>
<td>26.1±5.1</td>
<td>25.5±5.2</td>
</tr>
<tr>
<td>Cognitive Deficits MDS-COG M±SD</td>
<td>B2a, B2b, B3b, B3d, B3e, B4, C4, G1gA</td>
<td>2.2±2.3</td>
<td>2.3±2.1</td>
<td>2.5±2.4</td>
<td>2.3±2.5</td>
<td>2.2±2.4</td>
</tr>
<tr>
<td>Communication Difficulties, M±SD</td>
<td>C1, C5, C6, C3b-f</td>
<td>1.1±1.5</td>
<td>1.39±1.5</td>
<td>0.8±1.1</td>
<td>1.1±1.3</td>
<td>0.9±1.2</td>
</tr>
<tr>
<td>Delirium, MDS-CAM “n (%)</td>
<td>B5a-f, B6, E5</td>
<td>44 (20.9)</td>
<td>137 (22.9)</td>
<td>761 (27.6)</td>
<td>114 (22.1)</td>
<td>7,642 (21.8)</td>
</tr>
<tr>
<td>Subsyndromal Delirium Level 1</td>
<td>49 (23.2)</td>
<td>94 (15.7)</td>
<td>285 (10.3)</td>
<td>64 (12.4)</td>
<td>4,622 (13.2)</td>
<td></td>
</tr>
<tr>
<td>Subsyndromal Delirium Level 2 or Full Delirium</td>
<td>14 (6.6)</td>
<td>59 (9.8)</td>
<td>164 (6.0)</td>
<td>26 (5.1)</td>
<td>3,065 (8.7)</td>
<td></td>
</tr>
<tr>
<td>Depression–Any, n (%)</td>
<td>E1a, E1d, E1f, E1h, E1l, E1l, E1m</td>
<td>83 (39.3)</td>
<td>79 (13.2)</td>
<td>554 (20.1)</td>
<td>114 (22.1)</td>
<td>10,254 (29.2)</td>
</tr>
<tr>
<td>Discomfort Behavior Scale, n (%)</td>
<td>E1c, E1k, E1l-p, E4a-eA, E4a-eB</td>
<td>5.4 (8.9)</td>
<td>2.6 (6.3)</td>
<td>3.2 (7.7)</td>
<td>3.5 (7.1)</td>
<td>3.7 (7.9)</td>
</tr>
<tr>
<td>Vision Impairment Number of Indicators, n (%)</td>
<td>1</td>
<td>44 (20.9)</td>
<td>137 (22.9)</td>
<td>761 (27.6)</td>
<td>114 (22.1)</td>
<td>7,642 (21.8)</td>
</tr>
<tr>
<td>2</td>
<td>20 (9.5)</td>
<td>37 (6.2)</td>
<td>221 (8.0)</td>
<td>39 (7.6)</td>
<td>2,410 (6.9)</td>
<td></td>
</tr>
<tr>
<td>≥3</td>
<td>17 (8.1)</td>
<td>7 (1.2)</td>
<td>141 (5.1)</td>
<td>32 (6.2)</td>
<td>1,480 (4.2)</td>
<td></td>
</tr>
<tr>
<td>Bowel Problems, n (%)</td>
<td>I2b, H2b-d</td>
<td>30 (14.2)</td>
<td>198 (33.2)</td>
<td>310 (11.2)</td>
<td>86 (16.7)</td>
<td>6,850 (19.5)</td>
</tr>
<tr>
<td>Incontinence – Only Fecal, n (%)</td>
<td>H1a-b</td>
<td>11 (5.2)</td>
<td>19 (3.2)</td>
<td>86 (3.1)</td>
<td>11 (2.1)</td>
<td>718 (2.0)</td>
</tr>
<tr>
<td>Incontinence – Only Urinary, n (%)</td>
<td>H1a-b</td>
<td>32 (15.2)</td>
<td>171 (28.6)</td>
<td>533 (19.3)</td>
<td>99 (19.2)</td>
<td>7,210 (20.5)</td>
</tr>
<tr>
<td>Poor Nutrition, n (%)</td>
<td>K3a, K4c</td>
<td>59 (28)</td>
<td>274 (45.9)</td>
<td>905 (32.8)</td>
<td>173 (33.6)</td>
<td>13,870 (39.5)</td>
</tr>
<tr>
<td>Number of Indicators</td>
<td>1</td>
<td>13 (6.2)</td>
<td>70 (11.7)</td>
<td>98 (3.6)</td>
<td>26 (5)</td>
<td>2,290 (6.5)</td>
</tr>
</tbody>
</table>
Racial and ethnic disparities in time to dual incontinence

Findings related to disparities in time to DI by specific minority group are illustrated in Figure (1). A significant disparity in time to DI was observed for Black residents, that is, more Blacks were observed to develop DI and sooner than expected than if they had been part of the White group. No significant disparities disadvantaging other minority groups were found.

Table 3 provides the percentages of Blacks who were expected and observed to develop DI at various time points of follow-up and the percentages of White residents observed to develop DI. For example, at 12 months after admission, 48% of Blacks were observed to develop DI, while 41.8% were expected to do so if they had been in the White group. This led to a total observed disparity of 5.2% in time to DI for Black residents at 12 months, of which 80.9% was unexplained by the modeled predictors.

Significant predictors for time to DI in Whites in mixed race NHs and used in modeling disparity for Blacks were older age (hazard ratio [HR] 1.02 per year, 95% confidence interval [CI] 1.01, 1.02), being male (HR = 0.81, 95% CI: 0.76, 0.86), greater ADL and cognitive deficits (HR = 1.06, 95% CI: 1.06, 1.07; HR = 1.20, 95% CI: 1.18, 1.22, respectively), having fecal incontinence (FI) at admission (HR = 1.52, 95% CI: 1.31, 1.76), and higher comorbidity (HR = 1.06, 95% CI: 1.04,1.08). Compared to residents living in the New England Census division (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; reference division), those who lived in the West North Central division (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota) were less likely to develop DI (HR = 0.80, 95% CI: 0.70, 0.92).

Racial and ethnic disparities in treatment of dual incontinence

DI treatment status was known for 92% (n = 8,832 out of 9,645) of residents who developed DI. Of those with known DI treatment status, 84.5% (n = 7,461 out of 8,832) received some

<table>
<thead>
<tr>
<th>Levels of Community Characteristic</th>
<th>American Indians/Asians</th>
<th>Non-Hispanic Blacks</th>
<th>Hispanics</th>
<th>Non-Hispanic Whites</th>
<th>Below Poverty</th>
<th>Working Class</th>
<th>Urban Area</th>
<th>Rural Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25%</td>
<td>432 (97.5)</td>
<td>387 (87.0)</td>
<td>406 (91.2)</td>
<td>16 (3.6)</td>
<td>406 (91.2)</td>
<td>2 (0.5)</td>
<td>210 (47.2)</td>
<td>341 (76.6)</td>
</tr>
<tr>
<td>25 to &lt; 50%</td>
<td>9 (2.0)</td>
<td>34 (7.6)</td>
<td>28 (6.3)</td>
<td>41 (9.2)</td>
<td>37 (8.3)</td>
<td>46 (10.3)</td>
<td>1 (0.2)</td>
<td>36 (8.1)</td>
</tr>
<tr>
<td>50 to &lt; 75%</td>
<td>0 (0.0)</td>
<td>17 (3.8)</td>
<td>8 (1.8)</td>
<td>74 (16.6)</td>
<td>2 (0.5)</td>
<td>331 (74.4)</td>
<td>13 (2.9)</td>
<td>9 (2.0)</td>
</tr>
<tr>
<td>≥ 75%</td>
<td>2 (0.5)</td>
<td>7 (1.6)</td>
<td>3 (0.7)</td>
<td>314 (70.6)</td>
<td>0 (0.0)</td>
<td>66 (14.8)</td>
<td>221 (49.7)</td>
<td>58 (13.3)</td>
</tr>
</tbody>
</table>

*Racial and ethnic categories are according to US Census; as an example, 97.5% of NHs (n = 432) in our sample were located in Census tract communities with <25% American Indian/Asian/Pacific Islander population.
Figure 1 Time to Development of Dual Incontinence Controlling for Individual, Nursing Home, and Community Level Characteristics. Compared to what is expected if the minority residents had been part of the White group, Blacks (p < 0.001) develop DI sooner, and Hispanics (p = 0.14), Asians/Pacific Islanders (p = 0.84), and American Indians/Alaskan Natives (p = 0.95) did not significantly differ in time to DI.

Note to Figure 1: The solid line represents the proportion of each minority group observed to develop DI, with the dotted line representing the proportion expected to develop DI as if they had been part of the White group over time. The dash-dotted line represents the observed proportion of Whites who developed DI. The total disparity between these two proportions is the gap between the solid and dash-dotted lines.

Table 3: Percentage of Black Nursing Home Residents Observed and Expected to Develop Dual Incontinence (DI) at a Selected Time Point after Nursing Home Admission.

<table>
<thead>
<tr>
<th>Time after Admission</th>
<th>% Blacks Observed with DI (%)</th>
<th>% Blacks Expected to Develop DI</th>
<th>% Whites in Mixed Race Nursing Homes Observed with DI</th>
<th>Total Disparity (%)</th>
<th>Unexplained Disparity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 months</td>
<td>35.6</td>
<td>28.7</td>
<td>28.8</td>
<td>6.8</td>
<td>98.5</td>
</tr>
<tr>
<td>12 months</td>
<td>48</td>
<td>41.8</td>
<td>42.8</td>
<td>5.2</td>
<td>80.8</td>
</tr>
<tr>
<td>18 months</td>
<td>57.4</td>
<td>52</td>
<td>53.7</td>
<td>3.7</td>
<td>54.1</td>
</tr>
<tr>
<td>24 months</td>
<td>67.4</td>
<td>60.5</td>
<td>62.9</td>
<td>4.5</td>
<td>46.7</td>
</tr>
</tbody>
</table>

* Observed proportion of Blacks – observed proportion of White Non-Hispanics x 100;

[1-(Observed proportion of White Non-Hispanics - Expected proportion of Blacks)/(Observed proportion of Blacks - Observed proportion of White Non-Hispanics)] × 100

type of treatment; on average, they were 83.1 (7.7) years old and predominantly female (68.6%). Of those receiving any treatment, 42.4% (n = 3,164 out of 7,461) received behavioral treatment, with similar age and gender characteristics.

The percentage of Black residents who were observed to receive any treatment for DI was lower than expected had they been part of the White group (77.0% versus 83.2%, respectively). Fewer Black residents who received any treatment were observed to receive behavioral treatments than expected (27.4% versus 31.9%, respectively). The unexplained disparity for any treatment was 98.4% and for behavioral treatment, it was 90.6%. There were no disparities disadvantaging the other three minority groups in receiving any treatment or in receiving behavioral treatment for DI. Significant predictors of receiving any treatment were greater ADL deficits (HR = 1.02, 95% CI: 1.02-1.03), fewer cognitive deficits (HR = 0.88, 95% CI: 0.82-0.94), and residing in NHs with fewer deficiencies in quality of care (HR = 0.98, 95% CI: 0.96-0.99). Significant predictors of
receiving behavioral treatment were having fewer ADL deficits (HR = 0.98, 95% CI: 0.96, 0.99), greater cognitive deficits (HR = 1.15, 95% CI: 1.09, 1.22), living in NHs with fewer deficiencies in quality of care (HR = 0.96, 95% CI: 0.95, 0.98), and with a lower percentage of residents receiving Medicaid (HR = 0.996, 95% CI: 0.991, 0.999).

**DISCUSSION**

This study extends knowledge regarding DI in NH residents by contributing new information on racial/ethnic disparities in the time to DI and in its treatment in four minority groups. The hypothesis that there would be racial/ethnic disparities in the time to DI was supported for Black residents. Disparity based on Black race is suggested by the high percentage of disparity unexplained by factors in the model for Black residents. For example, more Black residents developed DI sooner even after adjusting for factors such as their higher rates of fecal incontinence. This finding is similar to large prevalence studies [15,16] that observed Black residents have higher rates of DI when compared to all other races combined. An early longitudinal study conducted within one U.S. state found that non-White residents (all races and ethnicities combined) were twice as likely to have DI as White residents [14].

Our study is the first to consider predictors of disparities in the time to DI at multiple levels ranging from individual through community level data. Results suggest that interventions to reduce disparities for Black residents and improve their health outcomes should include a focus on maintaining or improving ADL function, reducing fecal incontinence, and assisting residents with lesser levels of cognitive impairment.

In general, NHs in the West North Central Census Division perform better on quality indicators than the rest of the nation [34] Consistent with this observation, we found Black residents who were admitted to NHs in the West North Central Census division were at lower risk for the development of DI compared to those in the New England Census division. Further studies are needed to investigate reasons underlying these geographic differences.

Our finding that fewer Black residents received DI treatment than would be expected if they had been part of the White group is consistent with a recent national survey that found Black residents having fewer toileting programs in place than all other races combined [10]. Our results suggest that disparities in DI treatment may be reduced by intervening for Black residents with moderate to lower deficits in ADLs and greater cognitive deficits.

In providing behavioral treatment for DI, NH staff appeared to focus on residents with fewer ADL impairments and greater cognitive deficits. The findings suggest that disparities for Black residents might be reduced by providing behavioral therapies to those with a greater range of ADL and cognitive functions.

NHs could follow a comprehensive approach [36] such as the six-step model described by Chinn et al. [37], which emphasizes the importance of creating an organizational culture and infrastructure to reduce racial/ethnic disparities. This approach uses interventions based upon the specific causes of the disparities, the unique institutional environment, and resident needs.

Our results support recent federal policies that make equity an important component in care delivery [20,21]. Given the challenges that are involved in caring for residents with DI and NH payment models, one strategy that might achieve the goal of reducing health disparities might be to provide incentives to improve health care quality for minority populations [38], although this represents a major policy change. In one study, even a modest increase ($10/day) in Medicaid payment was associated with a significant reduction in ADL decline rates [39]. Given the relationship between functional status and incontinence, it seems likely that care quality could be improved if Medicaid payments were increased.

Among the strengths of our methods was the use of composite scales serving as potential predictors rather than individual items which helped take advantage of the comprehensive data available while reducing the number of potential predictors and collinearity. All of our datasets are from the same period using Census data that were available at the start of our analyses. Other unique features were the analyses of potential NH and community level characteristics. The innovation and advantages of use of the Peters-Belson method for estimating racial/ethnic disparities in health conditions have been described elsewhere [32,34].

There are several limitations to this study. First, we used a convenience sample from a single for-profit NH chain that may not be generalizable to residents in all U.S. NHs. However, the majority (72.2%) of all current U.S. NH residents reside in for-profit facilities [35]. Our admission cohort was similar in clinical and functional characteristics when compared to the population of NH admissions aged 65 years and older in all Medicare/Medicaid certified NHs in the U.S. during the years 2000-2002, increasing its generalizability [31]. Second, even though we used a comprehensive set of possible predictors identified from the literature and by an expert panel, our models may not include all possible predictors (known or unknown) of the outcomes. For example, medications and pelvic floor muscle exercises are not included under treatments for incontinence on the MDS. Predictors missing from the model may also contribute to the percentage of unexplained disparity [32,33]. In addition, regulatory changes [40] may have influenced incontinence treatment since the data was collected. However, there have been no regulatory changes since the F-Tag 315 revision related to the prevention of incontinence in NHs, and DI remains a significant problem in NH residents.

In conclusion, this study identified that there were disparities in the time to DI in NHs and found that there are disparities in treatment that disadvantage older Black residents. The results support developing interventions to prevent and treat DI in Blacks with a range of physical and cognitive function.

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