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Racial and Ethnic Disparities in the Healing of Pressure Ulcers Present at Nursing Home Admission

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Abstract

Background—Pressure ulcers increase the risk of costly hospitalization and mortality of nursing home residents, so timely healing is important. Disparities in healthcare have been identified in the nursing home population but little is known about disparities in the healing of pressure ulcers.

Purpose—To assess racial and ethnic disparities in the healing of pressure ulcers present at nursing home admission. Multi-levels predictors, at the individual resident, nursing home, and community/Census tract level, were examined in three large data sets.

Methods—Minimum Data Set records of older individuals admitted to one of 439 nursing homes of a national, for-profit chain over three years with a stage 2–4 pressure ulcer (n=10,861) were searched to the 90-day assessment for the first record showing pressure ulcer healing. Predictors of pressure ulcer healing were analyzed for White admissions first using logistic regression. The Peters-Belson method was used to assess racial or ethnic disparities among minority group admissions.

Results—A significantly smaller proportion of Black nursing home admissions had their pressure ulcer heal than expected had they been part of the White group. There were no disparities in pressure ulcer healing disadvantaging other minority groups. Significant predictors of a nonhealing of pressure ulcer were greater deficits in activities of daily living and pressure ulcer severity.

Conclusions—Reducing disparities in pressure ulcer healing is needed for Blacks admitted to nursing homes. Knowledge of disparities in pressure ulcer healing can direct interventions aiming to achieve equity in healthcare for a growing number of minority nursing home admissions.

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Conflict of interest statement

No other authors have a conflict of interest.

Keywords

health disparities; pressure ulcers; decubitus; nursing homes; race

1. Introduction

Timely healing of pressure ulcers is imperative as pressure ulcers are a major health safety hazard. Pressure ulcers increase the risk of expensive hospitalization of NH residents (O'Malley, Caudry, & Grabowski, 2011) and death (Berry, Samelson, Bordes, Broe, & Kiel, 2009; Redelings, Lee, & Sorvillo, 2005). Timely healing is also important for reducing health care costs, which, for pressure ulcer treatment, can be substantial (Gallagher, 2011). Pressure ulcers among older individuals in long-term care facilities are a global problem with prevalence ranging from 10% to 30% (Ahn, Cowan, Garvan, Lyon, & Stechmiller, 2016; Bours, Halfens, Abu-Saad, & Gro, 2002; Capon, Pavoni, Mastromattei, & Di Lallo, 2007; Gunningberg, Hommel, Baath, & Idvall, 2013; Lahmann, Halfens, & Dassen, 2005; Levinson, 2014; Tannen, Bours, Halfens, & Dassen, 2006). The overall prevalence of Stage 2 to 4 pressure ulcers at NH admission in the United States (U.S.) ranges between 5%-20% (Baumgarten et al., 2004; Harms et al., 2014), but among minority NH admissions in the U.S., the prevalence is nearly twice that of Whites (Baumgarten et al., 2004; Harms et al., 2014). Braveman (2006) explains that a worse health or greater risk of worse health in groups systematically disadvantaged or discriminated against due to social factors such as race, ethnicity, poverty, sex, etc. is a health disparity.

There are reports of racial and ethnic disparities in healthcare in the nursing home population, some of which may impact pressure ulcer healing. For example, fewer Black NH residents had a toileting plan for their incontinence, which is a well-known component of a comprehensive treatment plan for pressure ulcers (Frantz, Xakellis, Harvey, & Lewis, 2003), than all other racial groups of residents combined (Jones, Sonnenfeld, & Harris-Kojetin, 2009). The higher percentage of minority NH admissions with a pressure ulcer may increase the risk for a disparity in pressure ulcer treatment and healing. Strategies that reduce or prevent disparities related to pressure ulcers are among current federal funding priorities to improve the safety of NH residents (Department of Health and Human Services, 2015). Eliminating health and healthcare disparities is considered to offer the most feasible opportunity for improving the health of the U.S. population (Centers for Medicare and Medicaid Services, 2013; House, Lantz, & Herd, 2005; U.S. Department of Health and Human Services, 2011) and is a cornerstone of policy of federal agencies involved with healthcare (Centers for Medicare and Medicaid Services, 2013; U.S. Department of Health and Human Services, 2011). Numerous other developing countries have similarly adopted policies for equity in health for their populations (Crombie, Irvine, Elliott, & Wallace, 2005).

The presence and stage of a pressure ulcer is reported as part of the comprehensive admission assessment using the Minimum Data Set (MDS). The MDS is a federally mandated assessment of residents' demographic and clinical characteristics in all Medicare- and Medicaid-certified NHs. Pressure ulcers are staged according to the severity of skin loss. According to the guidance manual for the MDS (Centers for Medicare and Medicaid

Services, 2008), a Stage 2 pressure ulcer is a partial thickness loss of skin layers that can appear as an abrasion, blister, scab, or shallow crater while in a Stage 3 or 4 pressure ulcer, a full thickness of skin is lost. In a Stage 4 pressure ulcer, underlying muscle or bone may be exposed. There are a variety of issues regarding the pressure ulcer staging system used on the MDS 2.0 version as well as the current revised staging system on the MDS 3.0. Among the concerns is the adequacy of the staging system to differentiate all types of pressure ulcers. Another issue relates to reverse staging (i.e., moving from a higher to lower stage of pressure ulcer) to assess healing of pressure ulcers due to differences in these tissues from normal. Whether a system using stages is even appropriate given the lack of full understanding of the course of injury or healing of pressure ulcers has been questioned (Lyder & Ayello, 2012; Sibbald, Krasner, & Woo, 2011).

Despite some of the limitations of the pressure ulcer assessment on the MDS, the data have been useful to report the prevalence and incidence of pressure ulcers among NH residents and can show when pressure ulcers are healed. Yet little is known about disparities in the healing of pressure ulcers in NHs. An increased awareness of health disparities and their impact on the clinical outcomes of vulnerable populations, such as NH residents, is one of the goals of the U.S. National Stakeholder Strategy for Achieving Health Equity (U.S. Department of Health & Human Services, Office of Minority Health, 2011). In addition to the health status of individual residents as reported on the MDS, factors at the NH and community levels have been associated with poorer health outcomes (including pressure ulcers) among NH residents. Some of these factors include the concentration of minority NH residents, extent of care deficiencies, and geographic location of NHs (Gerardo, Teno, & Mor, 2009; Grabowski, 2004; Li, Yin, Cai, Temkin-Greener, & Mukamel, 2011; Mor, Zinn, Angelelli, Teno, & Miller, 2004). Therefore, analyses of health disparities need to consider these multi-level factors. The purpose of this study was to investigate racial and ethnic disparities in the healing of Stage 2 to 4 pressure ulcers that were present at NH admission at the 90-day assessment. Our analysis examined predictors at the individual resident, NH, and community levels.

2. Methods

2.1. Data sources and study design

Three data sets were linked and analyzed: (1) Minimum Dataset (MDS) (version 2.0) records, which contain demographic and health assessment data of individual residents, of a large for-profit chain of NHs; (2) the Online Survey, Certification, and Reporting (OSCAR) which contains measures of NH staffing, quality of care, and the care environment, both from years 2000–2002; and (3) the 2000 U.S. Census which contains socioeconomic and sociodemographic measures of the Census tract of the community in which each NH was located. The XXXXX Population Center at XXXXX in XXXXX had identified the census tracts of the NHs. The study had a cohort design in which MDS records were searched forward after admission until a record showing healing of a pressure ulcer was identified or available records ended. The study was reviewed determined to be exempt by the Institutional Review Board of XXXXX as data were de-identified.

2.2. Cohort selection and definitions of outcome and predictor variables

The criteria for inclusion in the cohort used to analyze disparities in healing of pressure ulcers were age 65 years or greater and having a Stage 2, 3 or 4 pressure ulcer reported as the highest pressure ulcer stage on the full/admission MDS record. The outcome of pressure ulcer healing was defined as the absence of a Stage 2, 3, or 4 pressure ulcer on the first MDS record at the required 90-day assessment (+14 day) after admission. The additional two weeks includes the grace period for completing the MDS and time for making significant changes to the MDS record. Three clinical consultants with expertise in the treatment and healing course of pressure ulcers in NH residents advised that a pressure ulcer of any stage would be expected to heal by the 90-day assessment after admission with proper management, which is supported by reports in the literature (Bergstrom et al., 2008; Brandeis, Morris, Nash, & Lipsitz, 1990; Horn et al., 2002). Time-to-healing for pressure ulcers has been reported as ranging from a mean (sd) of 28 (20) days for Stage 2 pressure ulcers to 42 (Bergstrom et al., 2008) days for Stage 4 pressure ulcers (Horn et al., 2002). Race and ethnicity groups were defined according to MDS classifications: American Indian and Native Alaskan (AIAN), Asian and Pacific Islander (API), Black non-Hispanic (Black), White non-Hispanic (White) and Hispanic.

Relevant potential predictors of pressure ulcer healing were identified using published literature and the expertise of the investigators, the study's advisory board, and the clinical consultants. Predictors at an individual's admission were defined using single items of the data records and established scales with good psychometric properties as multiple items on a record are often related to the same health-related concept. When no scale or a single item was sufficient or available, composite measures were developed following previously established procedures (Savik, Fan, Bliss, & Harms, 2005) and clinical consultation.

Individual level predictors of pressure ulcer healing included variables related to demographics (e.g., age and gender), functional and physical status (e.g., activities of daily living, health comorbidities, incontinence, nutritional status), cognitive and emotional characteristics (e.g., communication difficulties, depressive symptoms), and care (e.g., use of absorbent pads/briefs, number of medications). NH level predictor variables included proportions of residents receiving Medicaid, percentages of admissions with characteristics of interest (e.g., gender and race), staffing, and deficiencies in NH care quality. Total full time equivalents (FTEs) for licensed nurses and certified nursing assistants (including full-time, part-time and contract positions) reported for a two-week period were divided by the total number of residents in a NH to calculate total nurse staffing FTEs per resident. Five composite variables were created for deficiencies in NH care: quality resident behavior-facility, practices-dignity, quality of care, and resident assessment-nursing services, and the total number of these deficiencies by NH. These variables were constructed by summarizing the scope and severity levels of the respective deficiencies for a NH.

At the community level, the sociodemographic and socioeconomic characteristics of the U.S. Census tract of each NH were described using seven Census variables in their original form and 16 variables that were converted into proportions of the Census tract population. Examples of these variables are a community's gender and minority composition and education levels as well as the percentage of the community aged 65 years or living in

urban and rural areas. Socioeconomic variables included poverty level, percentage of working class, and median household income.

Variables were screened for inclusion in the statistical models using bivariate associations with the outcome, and those with associations at $p < .05$ were considered model candidates. Collinearity among predictor variables was also assessed using bivariate correlations. If there was a high association between an individual level and NH/community level variable, the individual level variable was included in the model because it had greater specificity. The following predictors were eligible for inclusion in model for pressure ulcer healing in White admissions, from which disparities for the minority groups were estimated: age, deficits in activities of daily living, (Morris, Fries, & Morris, 1999) poor nutrition, a comorbidity index (Charlson index) (Charlson, Pompei, Ales, & MacKenzie, 1987), a predictive index of mortality (Changes in Health, End-stage disease and Symptoms and Signs (CHESS) score) (Hirdes, Frijters, & Teare, 2003), presence of any fecal incontinence, licensed nurse staffing, and the percentage of NH residents that were on Medicaid.

2.3. Statistical analysis

Data were summarized using descriptive statistics appropriate to their level, but differences were not formally tested for significance and no p-values were generated as the very large sample size renders even the smallest differences as statistically significant. Health disparities were analyzed using the Peters-Belson method (Eberly et al., 2015; Graubard, Sowmya Rao, & Gastwirth, 2005; Rao, Graubard, Breen, & Gastwirth, 2004). The Peters-Belson method tests whether observed outcomes of a disadvantaged group (presumed to be the various groups of non-White minority NH admissions in this study) differ from their expected outcomes. Expected outcomes of disadvantaged groups are predicted using the outcomes of a regression model for an advantaged group (presumed to be White NH admissions in this study). When the characteristics of a minority group are used in the model developed for Whites to predict the healing of pressure ulcers, it is as if we are examining a hypothetical population of Whites with the same clinical and care characteristics as the minority residents. The Peters-Belson method used in this analysis enables a quantification of the percentage of the observed disparity that is explained and unexplained by the available predictors (Eberly et al., 2015; Graubard et al., 2005; Rao et al., 2004). The explained disparity estimates how close the estimated outcomes of those hypothetical Whites would be to the observed White outcomes. The unexplained disparity estimates how close the outcomes of the hypothetical Whites' would be to the observed minority outcomes, with a significant difference showing racial or ethnic disparity.

Because residents are clustered within NHs, unmeasured NH effects were controlled for when modeling disparity. This control was accomplished by insuring that residents of each racial/ethnic minority group were in the same NHs as the Whites whose modeling coefficients were applied to their group. These NHs are referred to as mixed race NHs.

For each model, data of White residents were first analyzed using logistic regression including individual and NH level factors. The estimated regression coefficients (beta weights) from the White model were applied to each minority group separately to predict pressure ulcer healing. A one-sample two-sided z-test compared the difference between

observed and expected pressure ulcer healing of a minority group using individual and NH level predictors; a significant difference indicated a disparity based on race or ethnicity. There is no racial-ethnic disparity detected when the difference between the observed and expected outcome is not significant or when the minority group has a better than expected outcome. Overall disparity is the difference in the observed proportions of minority and White admissions that healed a pressure ulcer. The percent of disparity explained by predictors in the model was calculated as ((expected proportion of minority group minus the observed proportion of Whites) divided by (observed proportion of minority group minus observed proportion of Whites)) multiplied by 100 (Rao et al., 2004). The percent unexplained disparity is 100 minus the percent explained disparity.

Steps of the Peters-Belson analysis were performed using R 2.14. Data management and descriptive statistics of the racial/ethnic groups' characteristics and the NHs and their Census tracts were conducted using SAS 9.2 (SAS Institute Inc., Cary, NC) and SPSS v. 18 (SPSS, Chicago, IL). Final results were considered significant at the $p < .05$ level.

3. Results

3.1. Cohort characteristics

The characteristics of NH admissions in the cohort ($n = 10,862$) are presented by race and ethnicity in Tables 1–2. We have previously reported that the characteristics of older adult admissions in this set of NHs are comparable to those in all Medicare/Medicaid certified NHs in the U. S. in the same time period (Bliss et al., 2015). The average age of admissions was approximately 80 years old with APIs and Whites among the oldest. The percentage of female admissions ranged from 54%-65% and was highest among Blacks. More Whites had a high school or higher education. Cognitive deficits measured by the MDS Cognition Scale (MDS-COGS) (Hartmaier, Sloane, Guess, & Koch, 1994) were at a moderate level in all groups with slightly lower scores in Whites and AIANs. Approximately 30% of all groups had some level of delirium with a higher percentage of APIs having more severe delirium. Communication difficulties were fairly low with APIs having slightly higher scores. The percentage of residents with symptoms of depression ranged from 14% in APIs to 37% in AIANs.

In terms of function, all groups of admission had moderate levels of deficits in ability to perform activities of daily living. The comorbidity risk was fairly low across groups. The CHESS mortality risk was moderate with higher risk seen in APIs. Having any urinary incontinence or fecal incontinence was very common as was the use of pads/briefs. A higher percentage of Blacks had fecal incontinence compared to the other groups. Whites received more medications. Poor nutrition indicators were found in at least 40% of all groups. Fewer Whites were tube-fed compared to the other groups. A Stage 2 pressure ulcer was the most common pressure ulcer among all groups. A higher percentage of AIANs, Blacks, and Hispanics were admitted with a Stage 4 pressure ulcer.

3.2. Characteristics of the NHs and surrounding communities

Residents were located in 439 NHs (representing 98.4% of all available NHs) in 27 states in 9 Census Divisions. Characteristics of the NHs and surrounding Census tract communities are described in Table 3. Staffing of the NHs by licensed nurses was 1.10 (0.52) hours/resident/day (mean (sd)) while CNA staffing was approximately twice that (Table 3). The average number of deficiencies of interest per NH was four. On average, slightly less than three-quarters of residents in the NHs were on Medicaid.

The majority of NHs (87%) was located in a community whose population was more than half White, and 7.5% of the NHs were in a community whose population was 25% to 50% Black (Table 3). Most of the NHs (74.5%) were in communities where 50% to 75% of the population was working class. Half of the NHs were in communities where 75% of the population lived in an urban area.

3.3 Disparities in healing of pressure ulcers

Overall, about 44% of NH admissions healed pressure ulcers present at admission by the 90-day MDS assessment. The percentage of each minority group that was expected and observed to heal pressure ulcers and the proportion of Whites observed to heal pressure ulcers are presented in Table 4. There was a significant disparity in pressure ulcer healing among Blacks. A smaller percentage of Black admissions was observed to heal pressure ulcers by 90-day after admission (37%) compared to what was expected if they had been White (40%).

The odds of healing a pressure ulcer present at NH admission within 90 days are significantly lower if the older individual admitted to a NH has a more severe pressure ulcer such as Stage 3 (0.30 (0.25, 0.36)) (OR (95% CI)) or a Stage 4 (0.23 (0.20, 0.28)) pressure ulcer rather than a Stage 2 pressure ulcer. The likelihood of not healing a pressure ulcer is also significantly lower if the admission has greater deficits in activities of daily living (0.97 (0.96, 0.99)). Predictors in the model explained 54% of the disparity in pressure ulcer cure. There was no significant disparity in healing of pressure ulcers disadvantaging the other minority groups.

4. Discussion

The findings of this study add new information to previous reports of disparities related to pressure ulcers among NH residents. Earlier reports reveal that more Blacks than Whites enter NHs with pressure ulcers and with more severe pressure ulcers (Baumgarten et al., 2004; Harms et al., 2014). A higher prevalence of pressure ulcers among Blacks compared to Whites (from 1% to 4% difference) has been observed in various cross-sections of NH residents (Cai, Mukamel, & Temkin-Greener, 2010; Lapane, Jesdale, & Zierler, 2005; Li, Yin, Cai, Temkin-Greener, & Mukamel, 2011). We are among those who have reported that the incidence of pressure ulcers is also greater among Black NH residents (Baumgarten et al., 2004; Harms et al., 2014; Rosen et al., 2006). The results of this study reveal that Black older adults with a pressure ulcer at NH admission are less likely to heal a pressure ulcer by the 90-day MDS assessment than would be expected had they been part of the White group.

Having worse functional (activities of daily living) status and a more severe stage of a pressure ulcer were significant predictors of delayed pressure ulcer healing. These results are consistent with observations that higher stages of pressure ulcers take longer to heal (Horn et al., 2002). They extend findings focused only on stage 2 pressure ulcers that greater deficits in activities of daily living were among factors delaying healing (Bergstrom et al., 2008).

The results of this study showed a significant unexplained disparity for the Blacks: the observed pressure ulcer healing in the Blacks was significantly worse than what would be expected based on the clinical and care characteristics of the Blacks. For example, the sample of Blacks had more Stage 4 pressure ulcers at admission than the Whites, but even after taking this into account, the Blacks had worse outcomes than expected. In the Peters-Belson method, when the characteristics of the Blacks were used in the model developed in Whites to predict the healing of pressure ulcers, it was as if we were examining a hypothetical population of Whites with the same clinical and care characteristics as the sample of Blacks. The unexplained disparity estimates how close their outcomes would be to the observed outcomes of Blacks. We previously reported that approximately 37,000 Blacks in all U.S. NHs receiving Medicare and Medicaid reimbursement had a pressure ulcer (stage 2 to 4) (i.e., 2.7 million NH residents $\times$ 9% of those with Black race $\times$ 15.4% with a pressure ulcer) (Bliss et al., 2013) at the time of this study. If the 6% disparity in pressure ulcer healing identified in this study were eliminated, such that the pressure ulcer of 6 per 100 Black residents could be healed, approximately 2,200 Black NH residents would have an improvement in their health status and a reduction in health care costs. The percentage of disparity in healing of pressure ulcers explained by the model for Blacks was 54%, which was a moderate amount. The unexplained disparity represents potential discrimination or factors that may be missing from the model (Eberly et al., 2015; Graubard et al., 2005; Rao et al., 2004).

Clinical implications of our findings encourage NHs to include the improvement of a resident's functional abilities as part of the treatment for pressure ulcers. For residents in whom such improvement is not possible or may take extended time, the treatment plan should insure that adequate assistance for alleviating physical pressure is provided. There continues to be regulatory oversight of pressure ulcers and institution of treatment via state surveys of NHs receiving Medicare/Medicaid reimbursement (Levinson, 2014) and financial penalties for deficiencies in care. According to estimates of a U.S. National Healthcare Quality Report, (Agency for Healthcare Research and Quality, 2013) progress in reducing pressure ulcers has been made as the percentage of both short-stay and high-risk long-stay residents with pressure ulcers decreased for all racial/ethnic groups. Among Blacks, however, reaching the benchmark pressure ulcer prevalence, based on the top five states' achievements set in 2012 is expected to take longer (Agency for Healthcare Research and Quality, 2013). Our findings suggest that a purposeful focus on eliminating healthcare disparities as well as effective treatment of more severe pressure ulcers starting from the time of admission may facilitate achieving these objectives for Blacks.

Recommendations for health care organizations to reduce racial-ethnic disparities in care are multi-pronged (Chin et al., 2012; King et al., 2008; Smith, 2002). These recommendations include collecting racial and ethnic information of care recipients so disparities in care can

be monitored (Smith, 2002) and communicating the achievement of benchmarks in more equitable care within the organization as well as externally to the community around the NH (Chin et al., 2012; King et al., 2008; Smith, 2002). Our findings suggest that healing of pressure ulcers and not only their development be monitored by race and ethnicity and included in such communication. Implementing a system-wide disparity reduction process that includes a targeted response to specific disparities, such as in pressure ulcer healing, which has the support from leadership at all levels of the organization is another possible strategy. Other recommended practices include providing incentives and rewards to individuals within the organization for progress in reducing disparities and training staff about culturally competent care (Chin et al., 2012; King et al., 2008; Smith, 2002). For NH care, having a more racially and ethnically diverse nursing workforce that is competent in implementing cross-cultural approaches to care has been proposed to aide in reducing health disparities (Gonzalez, Gooden, & Porter, 2000). The U.S. Affordable Care Act is expected to have a positive impact on the health of minority populations over time by providing greater access to health insurance and reducing financial barriers to care (Errickson et al., 2011). Greater healthcare access designed by laws such as this one (Errickson et al., 2011) could decrease the number of older minority individuals who are admitted with pressure ulcers to NHs or result in less severe pressure ulcers.

There are limitations to our study. Results have limited generalizability to non-profit NHs as data are from for-profit NHs. However, for-profit NHs comprise a majority, 69%, of all U.S. NHs (Centers for Medicare & Medicaid Services, 2015). The models in this study included pressure ulcers in different body locations and of Stages 2 to 4 due to the relatively low rate of higher stages of pressure ulcers and absence of reporting pressure ulcer location on the MDS record; findings might differ by stage and location of pressure ulcer (e.g., sacral vs. heel). Not all relevant predictors that could increase the explained disparity may be known or possible to include in the models. Results could have been affected by limitations of the pressure ulcer staging system on the MDS. The MDS 2.0 does not have separate options for reporting deep tissue injury or necrotic pressure ulcers. Reporting the stage of a pressure ulcer on the MDS 2.0, which was used at the time of our data, required assessing “what is seen (i.e., visible tissue)” (Centers for Medicare and Medicaid Services, 2008) and, therefore, reverse staging could have occurred. For example, if a Stage 3 pressure ulcer was healing and appeared as a Stage 2, it was to be coded as a Stage 2. Scar tissue of a healed pressure ulcer is considered physiologically different than that of non-damaged skin so that pressure ulcer stage descriptions may not adequately characterize the healing process and “what is physiologically occurring in the ulcer,” which is cited as the limitation of reverse coding (The National Pressure Ulcer Advisory Panel, 2000). The appropriateness of the system in which pressure ulcers are staged has been questioned and a paradigm change has been suggested (Sibbald et al., 2011).

The past timing of our data is another limitation. Major reductions in pressure ulcer prevalence among NH residents or reports of significant improvements in treatments or healing could lessen the relevance of these findings. However, as recently as 2014, the occurrence of pressure ulcers among older adults has been called a global “public health problem”, a conclusion based on rates of pressure ulcers among NHs residents as well as hospitalized patients (Jaul & Menzel, 2014). Older hospitalized patients who were nursing

home residents have a two-fold risk of mortality from pressure ulcers compared to those admitted from home (Khor et al., 2014) underscoring the significance of this problem. Since the time of our data, incidence of pressure ulcers among NH residents has been reported to be 14% and 33% in two European countries (Meesterberends et al., 2013) and 39.4% in Brazil (de Souza & de Gouveia Santos, 2010). Prevalence of pressure ulcers in U.S. NHs tends to be lower than in some other parts of the world and varies by state, but there have been small changes in prevalence, from 6.1 to 5.3%, from 2011 to 2014 among for-profit U.S. NHs, the sample in this study (Centers for Medicare & Medicaid Services, 2015). Although studies of pressure ulcer incidence in U.S. hospitals have increased since changes in reimbursement policies, incidence studies in NHs are not common and those of pressure ulcer healing are even more scarce. The focus of a study by Bergtrom et al. (2005) was on changes in size of pressure ulcers and not follow-up through healing. Similarly, there are few studies about race or ethnicity based disparities in pressure ulcers among NH residents. In examining the most frail NH residents, Li et al. (2011) showed an increasing trend in pressure ulcer prevalence for Blacks over five years. Our findings offer new insights into the factors contributing to the increased prevalence in Black residents that may be related to the overall disparity in pressure ulcer occurrence.

Regarding treatments for pressure ulcers, the most recent systematic review sponsored by the U.S. federal agency for healthcare quality concluded that effectiveness of treatment strategies for pressure ulcers remains unclear (Smith et al., 2013). There was low to moderate strength evidence or insufficient evidence about effectiveness of various treatments (from topical dressings to special support surfaces) for pressure ulcers. Their findings were similar to conclusions of two previous systematic reviews (Cullum, Nelson, Flemming, & Sheldon, 2001; McInnes, Jammali-Blasi, Bell-Syer, Dumville, & Cullum, 2011). Hence, the results of our study provide information that has relevance to NHs today.

A strength of our study is that all three levels of data (individual, NH, and community) are from the same point in time and were the most current data available at the start of our analyses. The findings of this study raise awareness of disparities in pressure ulcer healing in NHs and can drive improvements in practice and healthcare policy for NHs.

In conclusion, healing pressure ulcers is a need for which minority individuals seek NH care. The racial and ethnic diversity in NHs is expected to increase due to a variety of factors including greater disability among NH admissions, increased demands on minority family caregivers, and increased use of other models of care such as assisted living by Whites (Angel, Angel, Aranda, & Miles, 2004; Feng, Fennell, Tyler, Clark, & Mor, 2011; Lakdawalla et al., 2003). Given these trends, the goal of national agencies supporting healthcare (Centers for Medicare and Medicaid Services, 2013; U.S. Department of Health and Human Services, 2011) and stakeholders (U.S. Department of Health & Human Services, Office of Minority Health, 2011) to eradicate care disparities becomes all the more important. As the identification of health disparities is the first step in enabling their elimination, our findings advance accomplishing this goal. Our results respond to the current federal priority on developing a better understanding of the epidemiology of disparities in the safety of NH care, which include pressure ulcers (Department of Health and Human Services, 2015). The findings of this study provide evidence to inform and direct future

research examining strategies that are developed and aimed at improving NH safety in an equitable manner. For example, studies might examine the effectiveness of monitoring the healing of pressure ulcers, and not only their development, by race and ethnicity, and offering training for raising awareness of and eliminating disparities to NH organizations and staff using web-based or mobile technologies with a focus on pressure ulcer healing as an exemplar.

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Highlights

- There was a disparity in pressure ulcer healing of Black nursing home admissions.
- Functional limitations and a more severe pressure ulcer predicted delayed healing.
- Blacks' pressure ulcer healing was worse than expected based on clinical status.

Table 1

Demographic, Cognitive, and Emotional Characteristics of Nursing Home Admissions by Race/Ethnicity

Variable Scale	MDS Item Score range	American Indian, Alaskan Native	Asian, Pacific Islander	Black	Hispanic	White
n of Admissions ¹		65	257	1674	228	8637
Demographics						
		(mean (sd))				
Age at Admission	AA3, AB1	79.0 (8.5)	83.5 (7.7)	81.0 (8.3)	80.9 (7.7)	82.1 (7.7)
n (%)						
Female Gender	AA2	41 (63)	141 (55)	1090 (65)	123 (54)	5402 (63)
High School Education	AB7	27 (42)	145 (56)	554 (33)	61 (27)	5275 (61)
Cognitive and Emotional Characteristics						
		(mean (sd))				
Cognition	B2a-b, B3b,	4.0 (3.5)	4.6 (3.0)	5.1 (3.3)	5.2 (3.1)	3.9 (3.2)
<i>MDS-COGS</i>	B3d-e, B4, C4,					
<i>Score</i>	G1gA					
(Hartmaier et al., 1994)	range 0 to 10					
Communication	C1, C5, C6,	1.7 (1.9)	2.5 (1.9)	2.0 (2.1)	2.2 (1.9)	1.6 (1.8)
Difficulty	C3b-f					
score	range 0 to 9					
n (%)						
Delirium	B5a-f, B6, E5					
<i>MDS-CAM*</i>						
Subsyndromal delirium level 1		13 (20)	46 (18)	287 (17)	45 (20)	1477 (17)
Subsyndromal delirium level 2 or Full delirium		9 (14)	50 (20)	153 (10)	23 (10)	1058 (13)
Depression	E1a, E1d, E1f,	24 (37)	35 (14)	343 (21)	49 (22)	2356 (27)
Any indicator	E1h, E1i,					
from <i>MDS</i>	E1l-m					

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Variable Scale	MDS Item Score range	American Indian, Alaskan Native	Asian, Pacific Islander	Black	Hispanic	White
<i>Depression Scale</i>						
(Burrows, Morris, Simon, Hirdes, & Phillips, 2000)						

One individual was missing data for race

Table 2
Functional and Physical Characteristics of Nursing Home Admissions by Race and Ethnicity

Variable Scale/Measure	MDS Item Score Range	American Indian, Alaskan Native	Asian, Pacific Islander	Black	Hispanic	White
n of Admissions ^J		65	257	1674	228	8637
		(mean (sd))				
Activities of Daily Living Scale	G1a-bA, G1eA, G1g-jA	18.5 (6.4)	20.3 (4.8)	19.8 (6.2)	19.5 (6.2)	18.1 (6.1)
Score (Morris et al., 1999)	range 0 to 28					
Body Mass Index	K2a, K2b	25.1 (4.8)	22.5 (3.6)	25.1 (5.2)	25.0 (4.8)	24.9 (4.8)
Comorbidities	I3a-e and/ or II	2.4 (1.7)	2.4 (1.7)	2.4 (1.7)	2.7 (1.8)	2.0 (1.6)
<i>Charlson Index</i> (Charlson et al., 1987)	range 0 to 30					
Number of Medications	O4a-e range 0 to 35	5.3 (5.9)	2.9 (4.3)	5.0 (5.6)	5.5 (6.1)	6.9 (6.2)
Mortality risk	J1c, J1g, J1i, J1o, K3a, K4c, J5c, B6, G9 range 0 to 5	1.4 (1.0)	2.3 (1.0)	1.6 (1.1)	1.5 (1.1)	1.9 (1.1)
<i>CHESS Score</i> (Hirdes et al., 2003)						
Perfusion Problems	J1a, J1c-d, J1g					
<i>Number of Indicators</i>						
1		17 (26.2)	89 (34.6)	515 (30.8)	70 (30.7)	2,887 (33.4)
2		2 (3.1)	15 (5.8)	40 (2.4)	7 (3.1)	351 (4.1)
		n (%)				
Bedfast/Transfer Dependent	G6a, G6d	27 (42)	46 (18)	748 (45)	96 (42)	2416 (28)
Incontinence	H1a	103 (76)	576 (77)	2807 (84)	398 (80)	16247 (69)
Fecal (with or without urinary incontinence)						
Incontinence	H1b	124 (92)	729 (97)	3249 (96)	484 (98)	22696 (97)

Variable Scale/Measure	MDS Item Score Range	American Indian, Alaskan Native	Asian, Pacific Islander	Black	Hispanic	White
Urinary (with or without fecal Incontinence)						
Pads/Briefs	H3g	126 (93)	711 (95)	3,090 (93)	460 (93)	21,132 (90)
Any use						
Poor Nutrition	K3a, K4c					
<i>Number of Indicators</i>						
1		28 (43.1)	120 (46.7)	690 (41.2)	93 (40.8)	4297 (49.8)
2		5 (7.7)	34 (13.2)	113 (6.8)	12 (5.3)	988 (11.4)
Pressure Ulcer	M2a	37 (57)	170 (66)	920 (55)	127 (56)	5788 (67)
Highest Stage = 2						
Pressure Ulcer	M2a	9 (14)	43 (17)	287 (17)	44 (19)	1384 (16)
Highest Stage = 3						
Pressure Ulcer	M2a	19 (29)	44 (17)	467 (28)	57 (25)	1465 (17)
Highest Stage = 4						
Tube Feeding	K5b	13 (20)	55 (21)	433 (26)	58 (25)	960 (11)

/ One individual was missing data for race

Table 3

Characteristics of Nursing Homes and Their Surrounding Community

	Licensed Nurses (FTE)/ resident)	Licensed Nurses (hours/ resident/d)	CNA ² (FTE/ resident)	CNA (hours/ resident /d)	Total number of deficiencies ³	% Residents on Medicaid	% in an Urban Area	% in a Rural Area
Characteristics of Census Tract Community around Nursing Homes								
Levels of Census Tract Community Characteristic	% American Indians, Asians, Pacific Islanders ⁵	% Non-Hispanic Blacks	% Hispanics	% Non-Hispanic Whites	% Below Poverty	% Working class		
n (%) of Nursing Homes								
< 25%	429 (97.5) ⁶	382 (87.0)	401 (91.0)	16 (4.0)	401 (91.0)	2 (0.5)	207 (47.0)	337 (77.0)
25 to < 50%	8 (2.0)	33 (7.0)	27 (6.0)	40 (9.0)	36 (8.5)	45 (10.0)	1 (0.2)	36 (8.0)
50 to < 75%	0 (0.0)	17 (4.0)	8 (2.0)	73 (17.0)	2 (0.5)	326 (74.5)	13 (2.8)	9 (2.0)
75%	2 (0.5)	7 (2.0)	3 (1.0)	310 (70.0)	0 (0.0)	66 (15.0)	218 (50.0)	57 (13.0)

¹ Full-time equivalents/resident;² CNA=Certified Nursing Assistant;³ selected deficiencies relevant to the outcome;⁵ racial and ethnic categories are according to U.S. Census;⁶ as an example, 429 (97.5%) of the 439 NHs in the sample were located in Census tracts that had a community population with < 25% American Indian, Asian, or Pacific Islanders.

Table 4
Percentage of Nursing Home Admissions with Healed Pressure Ulcers at 90-Days Post-Admission

Racial or Ethnic Group	Observed Percentage of Racial/Ethnic Group with Healed Pressure Ulcers	Expected Percentage of Racial/Ethnic Group with Healed Pressure Ulcers	Observed Percentage of Whites with Healed Pressure Ulcers	Percent Overall Disparity	Percentage of Disparity Explained by Predictors ^a
Black	37 (586/1589)	40 (631/1589)	43 (2207/5129)	6	54
Hispanic	42 (94/223)	43 (96/223)	44 (884/2016)		
API	58 (148/254)	45 (114/254)	43 (691/1597)		
AIAN	40 (26/65)	43 (28/65)	45 (289/640)		

^a ((Expected proportion of minority group minus observed proportion of Whites) divided by (observed proportion of minority group minus observed proportion of Whites)) multiplied by 100

API = Asian, Pacific Islander; AIAN = American Indian, Alaskan Native