# Colorado
# Nursing Home Disparities
# Quarterly Report

## January 31, 2010

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**Colorado Nursing Home Disparity Report**
**State: Colorado**
**Deliverable Due Date: January 31, 2010**

## INTRODUCTION

Pressure Ulcers (PrUs) represent serious medical conditions and are an important measure of the quality of clinical care in nursing homes[1,2]. The incidence (estimate of the number of residents with new PrU over a specified time period) and prevalence (number of residents who currently have PrUs) of PrUs vary greatly in long-term care settings. Estimates of prevalence range from 2.3% to 28%, and incidence rates range from 2.2% to 24%[3]. Although the implementation of the Omnibus Budget Reconciliation Act (OBRA), mandating changes designed to improve the quality of care in nursing homes, was passed by the United State Congress two decades ago, a minimal change in PrU prevalence has been seen since that time. Therefore, PrUs continue to be a major, intransigent problem in acute and long-term care facilities.

The use of physical restraints (PRs) in nursing homes has been challenged in the past and is considered poor clinical practice that is unethical. The use of PRs has many negative side effects and risks, including leading to death, that far outweigh any possible benefit that can be derived from their use. The prevalence of PR use in nursing homes has declined dramatically in the last two decades from 21% in 1991 to 5% in 2007 according to CMS[4]. The ideal goal is to attain zero PR use across all nursing homes, thus necessitating continued efforts and interventions.

Early recognition of PrUs in people with dark skin is more challenging for clinical staff in most of nursing home. As the current nursing home population in Colorado is overwhelmingly white (86%)[5], health care providers can be unfamiliar with the scientific evidence, classification, and treatment of chronic wounds for people with dark skin. A previous study has suggested that people of color may have an increasing risk for PrU development [6]. In order to improve the quality of care and reduce the prevalence of PrUs in nursing homes, health care providers will need to be skilled at the detection of PrUs in residents of all skin color.

Early in the 9th scope of work, the Colorado Foundation for Medical Care (CFMC) sponsored a presentation by Dr. Heather Hettrick that addressed PrU issues on residents with dark skin. This presentation was well received by the nursing homes and hospitals in attendance, leading to further discussion of this issue. The Colorado Department of Public Health and Environment (CDPHE), Colorado's State Survey Agency (SSA), joined the discussion and felt this to be an opportunity for improved assessments. CFMC joined in this investigation.

Anecdotal information from Colorado nursing homes, state surveyors, and federal surveyors at the Centers for Medicare & Medicaid Services (CMS) Region VIII office indicated that staff is interested in learning about the different presentation of PrUs in residents with dark skin. As part of the Colorado project to prevent and reduce PrUs, we presented clinical information on issues related to PrU identification on non-Caucasian skin. This information was very well received by

providers including representatives from Colorado nursing homes. Additionally, we conferred with key informants in the nursing home community on the issue of PrU care for people with dark skin. They were supportive of our efforts to investigate the issue and provide clinical information to the community on how PrUs present differently on those with dark skin.

Colorado has a noticeable proportion of Hispanic residents (20%) and a small percentage of African American (4%) in general population[7]. Given the demographics of the younger population in Colorado as well as immigration patterns, we can expect to see the number of non-Caucasian residents in nursing homes increasing. The State Health Department agrees that this investigation is a worthy effort.

The Colorado state report of Measures Disparities Analysis from the Health Disparities (HD) Quality Improvement Organization Support Contractor (QIOSC) indicated a disparity in race/ethnicity for both PrUs and PRs, but no disparity between rural and urban for either PrUs or PRs[8].The purpose of this report is to provide updated information regarding disparities in PrU prevalence and PR use in Colorado nursing homes, based on race/ethnicity as well as gender. Our focus was primarily on Black and Hispanic groups, as these are the predominantly underserved groups in the state of Colorado, although statistics are reported for Native American and Asian groups as well.

## METHODS

### Data Sources

Data for this study were from Minimum Data Set (MDS) assessments data from Quarter 4-2008 through Quarter 2-2009 for all Colorado Medicare and Medicaid nursing home residents. These data assessments were provided to CFMC by our state MDS Automation Coordinator with, the CDPHE, to assist in the investigation of potential disparities in nursing home residents.

The MDS is a core set of screening, clinical and functional status elements, including common definitions and coding categories, which forms the foundation of the comprehensive assessment for all residents of long-term care facilities certified to participate in Medicare or Medicaid. The items in the MDS standardize communication about resident problems and conditions within facilities, between facilities, and between facilities and outside agencies. This includes records of PrUs and the use of PRs [9] .

All Medicare and Medicaid certified nursing homes are required to use the MDS for all residents. The OBRA regulations have defined a schedule of assessments that will be performed for a nursing facility resident at admission, quarterly, and annually, whenever the resident experiences a significant change in status, and whenever the facility identifies a significant error in a prior assessment. These are known as “OBRA assessments.” MDS assessments are also required for Medicare payment purposes. The MDS is a nationally representative continuous, multipurpose survey of nursing home residents. It collects detailed information for Medicare and Medicaid beneficiaries who stay in the nursing homes including demographics (age, gender, and race/ethnicity) and clinical characteristics such as physical functioning, continence,

psychosocial well-being, mood state, disease diagnoses, health conditions, skin conditions, special treatments and medication use. This includes records of PrUs and the use of PRs [9] .

All Medicare and Medicaid certified nursing homes are required to use the MDS for all residents. The MDS is required to be completed on at least 3 occasions: (1) on admission, (2) annually, and (3) with any significant clinical change in a resident. In addition, all residents are assessed quarterly on a subset of the MDS items.

**Study Population**

Instead of limiting our analyses to residents at high risk of developing a PrU or to long-term care residents, our study population (denominator) included all residents in the nursing home during the study period. For PrU incidence analysis, we combined three quarters of MDS information to create a comprehensive longitudinal data file which included cumulative information on PrUs. For PrU prevalence analyses, we used all MDS assessments or all but the admission assessment, independently for each quarter; PR prevalence rates were calculated from all MDS assessment for each quarter.

Nursing home residents may have PrUs prior to entering the facility or may develop them at any time during their nursing home stay. Thus, for estimating PrU incidence rate (new cases during a nursing home stay over the entire three quarters), we included only residents who had at least two MDS records within the nine month study period, the first of which had to be an admission assessment. Only one admission per resident was used to avoid duplicate records for the same individual. No PR incidence rates were calculated since this is not a clinical condition found prior to admission to the nursing home.

**Subgroup Study Populations**

Two subgroup study populations were created from the total study population to study specific groups of interest. First, a subgroup of only Black and White residents was used to explore differences in PrU prevalence between these two racial/ethnic groups. In addition, each of the four PrU stages was assessed independently in an attempt to better understand differences in racial/ethnic groups at each level of PrU severity. These analyses were completed only on residents identified with the specific PrU stage of interest.

**Study Variables**

***Outcome Variables***

All outcome variables were constructed using guidance provided in the Nursing Home Quality Initiative (NHQI) Quality Measures Resource Manual[10].

**Pressure Ulcers:** Nursing home providers record the number of pressure ulcers at each ulcer stage during the last 7 days on MDS assessments, Section M. Skin Condition 1. Ulcers (a, b, c, and d). Our PrU outcome was defined as “Yes” if a resident had one or more stage 1 to stage 4 PrUs. Note that this is different from the CMS Quality Measures (QMs) for high risk and low risk PrU QMs, which stratifies residents by various risk factors.

**Physical Restraint Use:** This outcome was calculated using three MDS items from Section P Special Treatments & Procedures; 4. Devices and Restraints: trunk restraint, limb restraint, and chair prevents rising (c, d, and e). If a resident had any one of these devices used daily for the last 7 days ("2" used daily on the MDS), it was defined as "Yes" for our PR use outcome. This mimics the CMS PR QM, although we included all residents, and CMS only considers long-stay residents. This coding is also different from our last (July 2009) disparities report in that PR use was calculated as 'Yes' if a resident had any one of three types of restraint for any length of time ("1" used less than daily or "2" used daily" on the MDS).

**Stage of Pressure Ulcer:** Sub-analyses were performed on four additional outcomes, one for each of the four PrU stages. For each stage, the outcome was defined as "Yes" if the relevant MDS assessment noted the respective stage for that resident's PrU.

***Primary Independent Variables***

Our key independent variables were demographic in nature and included age (classified as <65 years old, 65-74 years, 75-84 years, and 85 years or older), gender (Male or Female), and race/ethnicity (White, Black, Hispanic, Asian, and Native American; or nonwhite vs. White).

## STATISTICAL ANALYSIS

We describe the demographic characteristics of the study population at both the resident level and facility level and estimate the prevalence of PrUs and PR use among all nursing home residents. For PrUs, two prevalence rates were calculated from MDS assessment data: (1) including ***all*** MDS assessments, and (2) all MDS assessment ***excluding*** admission assessments. The latter rate more closely reflects residents with PrUs that were developed during the nursing home stay, as opposed to those residents admitted with a PrU.

In addition, the PrU incidence rate was calculated. Because of the necessity to limit the denominator to residents with an MDS admission assessment and at least one subsequent assessment, not all residents were included in the PrU incidence calculation. To construct Colorado state estimates appropriately, a facility-level weighting scheme was developed based on the total number of residents in a facility and the number of residents meeting the requirement of at least two MDS assessments.

Univariate logistic regression analysis was performed for each outcome measurement to examine the independent and significant effect of age, gender and race/ethnicity on the respective outcome. Subsequent multivariate logistic regression was performed for each outcome, primarily to determine the affect of race/ethnicity on the outcome, while controlling for other independent variables that were found to be significant in the univariate analysis. Statistical significance was defined at the 5% level ($p<0.05$) for all analyses. Data analyses were performed using the statistical packages SAS version 9.1 (SAS Institute, Gary, N.C.).

## RESULTS

It is noteworthy that statistics calculated for this report will not match PrU and PR rates in the HD QIOSC report for a couple of reasons. First, their rates are calculated over a one year

period, and ours are primarily from one quarter in time. Additionally, as noted previously, our rates do not align with CMS specifications for PrU and PR, due to the availability of specific MDS elements.

**Characteristic of the Study Population**

***Residents***

We reviewed three quarters of MDS assessment data, which included 20,292 unique residents from 199 Colorado nursing homes in Quarter 4-2008; 20,443 residents from 202 nursing homes in Quarter 1-2009; and 20,613 residents from 201 nursing homes in Quarter 2-2009. **Table 1** provides descriptive information on demographic characteristics of nursing home residents in each one of the three quarters. As noted in Table 1, the distribution of age group, gender and race/ethnicity demographic of residents across the three quarters were very similar. The average age of residents was 80 years old. White residents (87%) and female residents (66%) are predominant in the study population.

Table 1 also provides the prevalence of PrUs and PR use across all three quarters of time. Both estimates of PrU prevalence (including and excluding admission MDS assessments) remain consistent across quarters (~11% prevalence for all MDS assessments and ~8% prevalence for MDS excluding admission assessments). The prevalence of PR use shows a declining trend over time with 3.0% in Quarter 4-2008, 2.9% in Quarter 1-2009, and 2.7% in Quarter 2-2009. However, there are no statistically significant differences across quarters.

In addition, the incidence of PrUs over the nine month period of Quarter 4-2008 through Quarter 2-2009 was estimated to be 8.3% (standard deviation=0.19). Our estimates of PrU prevalence (excluding admission assessments) in each of the three quarters were similar to the PrU incidence rate over the entire three quarter period. Because of this similarity, and the ease of using only one quarter of resident MDS data, PrU prevalence for the most recent quarter was used in all subsequent analyses.

***Table 1: Resident Demographics Across All Colorado Nursing Homes by Quarter (Quarter 4-2008 through Quarter 2-2009)***

| Resident Characteristics | Number of Residents (Percent) | | |
|---|---|---|---|
| | **Q4-2008 N=20,292** | **Q1-2009 N=20,443** | **Q2-2009 N=20,613** |
| Age | | | |
| Mean/Median Age (years) | 80/83 | 80/82 | 80/83 |
| <65 years old | 2,685 (13.2%) | 2,684 (13.1%) | 2,781 (13.5%) |
| 65-74 years old | 2,848 (14.0%) | 2,968 (14.5%) | 3,054 (14.8%) |
| 75-84 years old | 6,246 (30.8%) | 6,304 (30.8%) | 6,276 (30.4%) |
| 85+ years old | 8,513 (42.0%) | 8,487 (41.5%) | 8,502 (41.2%) |
| Race/Ethnicity | | | |
| Native American | 82 (0.4%) | 85 (0.4%) | 79 (0.4%) |
| Asian | 218 (1.1%) | 211 (1.0%) | 209 (1.0%) |
| Black | 763 (3.8%) | 759 (3.7%) | 759 (3.7%) |
| Hispanic | 1,602 (8.0%) | 1,619 (8.0%) | 1,644 (8.0%) |
| White | 17,481 (86.8%) | 17,643 (86.8%) | 17,769 (86.8%) |
| Gender | | | |
| Male | 6,798 (33.5%) | 6,822 (33.4%) | 6,920 (33.6%) |
| Female | 13,493 (66.5%) | 13,620 (66.6%) | 13,691 (66.4%) |
| Pressure Ulcer on Any MDS Assessment | | | |
| No | 18,045 (88.9%) | 18,124 (88.7%) | 18,370 (89.1%) |
| Yes | 2,246 (11.1%) | 2,318 (11.3%) | 2,243 (10.9%) |
| Pressure Ulcer on MDS Excluding Admission Assessment | | | |
| No | 18,635 (91.8%) | 18,716 (91.6%) | 18,974 (92.0%) |
| Yes | 1,656 (8.2%) | 1,726 (8.4%) | 1,639 (8.0%) |
| Physical Restraint Use on Any MDS Assessment | | | |
| No | 19,674 (97.0%) | 19,845 (97.1%) | 20,057 (97.3%) |
| Yes | 618 (3.0%) | 596 (2.9%) | 553 (2.7%) |

MDS = Minimum Data Set

**Table 2** summarizes the number and proportion of all PrUs (not residents) identified by MDS assessments at a specific stage (stage 1 through 4), across all Colorado nursing homes by quarter. In this subgroup analysis of PrU stage, the denominator is the total number of any PrU rather than total number of resident with any PrU. Each resident may have more than one PrU of differing stages. As table 2 shows, stage 2 was the most commonly (~50% for each quarter for both prevalence estimates) reported stage. Because there are no observed significant distribution differences in PrUs across the three quarters, subsequent data analyses were performed only on the most recent quarter of data (Quarter 2-2009).

***Table 2: Resident Pressure Ulcer Staging Across All Colorado Nursing Homes by Quarter Quarter 4-2008 through Quarter 2-2009***

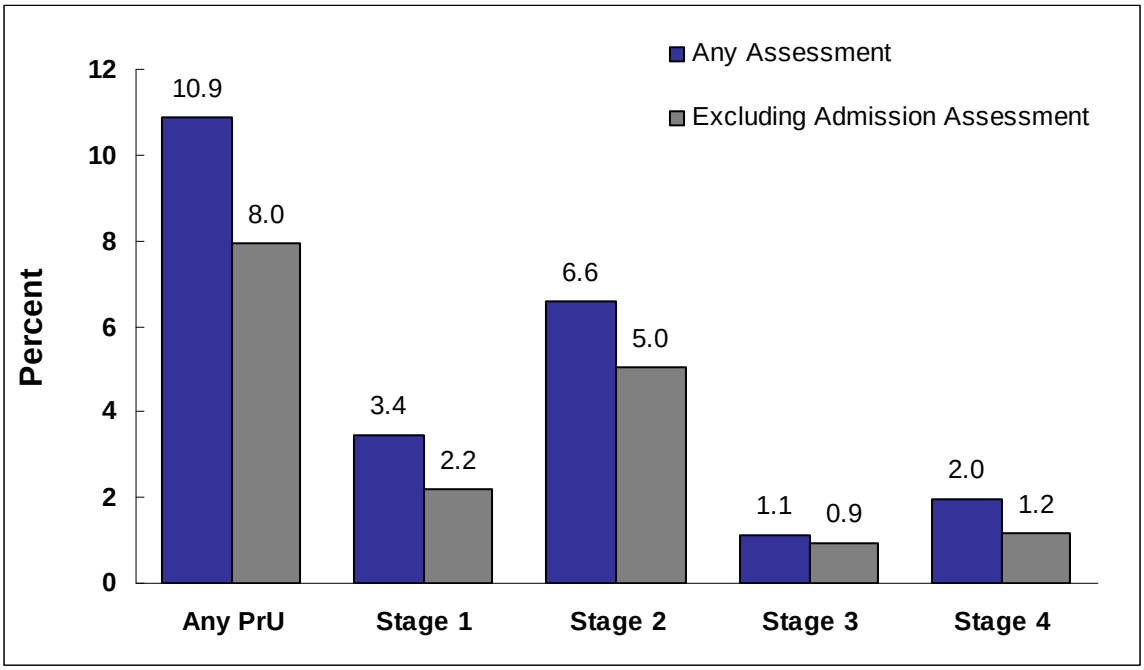
| Stage of Pressure Ulcer | Number of Pressure Ulcers (Percent) | | |
|---|---|---|---|
| | **Q4-2008** | **Q1-2009** | **Q2-2009** |
| Any MDS Assessment | N=2,704 (2,246 residents) | N=2,791 (2,318 residents) | N=2,704 (2,243 residents) |
| Stage1 | 656 (24.3%) | 678 (24.4%) | 710 (26.3%) |
| Stage2 | 1,421 (52.6%) | 1,441 (51.6%) | 1,358 (50.2%) |
| Stage3 | 251 (9.2%) | 247 (8.8%) | 227 (8.4%) |
| Stage4 | 376 (13.9%) | 425 (15.2%) | 409 (15.1%) |
| Excluding MDS Admission Assessment* | N=2,030 (1,565 residents) | N=2,106 (1,726 residents) | N=2,012 (1,639 residents) |
| Stage1 | 430 (21.2%) | 471 (22.4%) | 455 (22.6%) |
| Stage2 | 1,077 (53.1%) | 1,079 (51.2%) | 1,034 (51.4%) |
| Stage3 | 206 (10.1%) | 208 (9.9%) | 191 (9.5%) |
| Stage4 | 317 (15.6%) | 348 (16.5%) | 332 (16.5%) |

MDS is Minimum Data Set

*Approximates # / % of pressure ulcers developed in the nursing homes

**Figure 1** illustrates the summary of prevalence of all PrUs and stage 1-4 of PrUs in Quarter 2-2009. It should be noted that the percentage of any stage of PrUs presented in Figure 2 was calculated using total number of residents with any PrU as the denominator. Of the 20,613 nursing home residents in Quarter 2-2009, 2,243 (10.9%) had PrUs of any stage when including all MDS assessments; 1,639 (8.0%) had PrUs of any stage when including all MDS assessments except admission assessments; Stage 2 was the most common (6.6 % and 5.0% respectively), accounting for approximately 50% (for both prevalence types) of all PrUs.

***Figure 1: Prevalence of Pressure Ulcers Across All Colorado Nursing Home Residents Quarter 2-2009***




***Facilities***

To assess possible race/ethnicity disparities in PrU rates and the use of PRs, we needed to first understand the distribution of residents within each nursing home by race/ethnicity. **Tables 3a** and **3b** present the distribution of resident race/ethnicity demographics by facility size in Quarter 2-2009.

Table 3a presents the number and percentage of nursing homes within the specified facility size that had at least one resident of identified race/ethnicity group. For example, 23 of the 24 (95.8%) small nursing homes have at least one White resident; 58.3% (14/24) of small facilities have at least one Hispanic resident. Comparing across facility size, only 58.3% of small facilities have at least one Hispanic resident, but 91.9% of medium facilities and 97.8% of large facilities have at least one Hispanic resident. Only 12.5% of small, 43% of medium and 68.1% of large nursing homes have at least one Black resident.

Table 3b shows the median and range proportion of race/ethnicity group by facility size. For example, the median proportion of Hispanic residents across small facilities is 5%, and ranges between zero and 100% of residents in the nursing home. Nursing homes with 50-99 beds (medium facilities) have the highest proportion (top of the range values) of each of the four minority groups. As expected, White residents represent the majority group regardless of the size of facility.

***Table 3a: Distribution of Race/Ethnicity Demographics by Facility Size***
***201 Colorado Nursing Homes, Quarter 2-2009***

| Race/Ethnicity | Number (%) of NHs with at least One Resident of Identified Race/Ethnicity Group | | |
|---|---|---|---|
| | Small (<50 beds) N=24 NHs | Medium (50-99 beds) N=86 NHs | Large (>=100 beds) N=91 NHs |
| Native American | 3 (12.5%) | 16 (18.6%) | 18 (19.8%) |
| Asian | 1 (4.2%) | 36 (41.9%) | 57 (62.6%) |
| Black | 3 (12.5%) | 37 (43.0%) | 62 (68.1%) |
| Hispanic | 14 (58.3%) | 79 (91.9%) | 89 (97.8%) |
| White | 23 (95.8%) | 86 (100.0%) | 91 (100.0%) |

***Table 3b: Distribution of Race/Ethnicity by Facility Size***
***201 Colorado Nursing Homes, Quarter 2-2009***

| Race/Ethnicity | Median (Range) Proportion of Race/Ethnicity across Facility Size Group | | |
|---|---|---|---|
| | Small (<50 beds) N=24 NHs | Medium (50-99 beds) N=86 NHs | Large (>=100 beds) N=91 NHs |
| Native American | 0.0 ( 0.0 - 3.0) | 0.0 ( 0.0 - 9.1) | 0.0 ( 0.0 - 8.9) |
| Asian | 0.0 ( 0.0 - 3.8) | 0.0 ( 0.0 - 21.1) | 0.8 ( 0.0 - 5.8) |
| Black | 0.0 ( 0.0 - 14.8) | 0.0 ( 0.0 - 80.4) | 0.9 ( 0.0 - 29.9) |
| Hispanic | 5.0 ( 0.0 - 100.0) | 6.1 ( 0.0 - 53.2) | 5.2 ( 0.0 - 32.0) |
| White | 95.0 ( 0.0 - 100.0) | 88.1 ( 13.7 - 100.0) | 90.2 ( 60.4 - 100.0) |

**Figure 2** illustrates the distribution of facility-level PrU prevalence across Colorado nursing homes. Both prevalence numbers (with and without MDS admission assessments) are included in the graph. Both measures of facility-level PrU prevalence appear to be normally distributed across Colorado nursing homes.

For the PrU prevalence including all assessments, there are 3 nursing homes with zero prevalence, representing 1.5% of all nursing homes, and 15 nursing home with >20% prevalence, representing 7.5% of Colorado nursing homes. For the prevalence of PrU excluding admission assessment, 7 nursing homes have zero prevalence, representing 3.5% of nursing homes, and 6 nursing homes have >20% prevalence, representing 3% of facilities. Although the data are not presented in this report, facility-level PrU prevalence was not found to be associated with facility size or race/ethnicity distribution.

***Figure 2: Distribution of Facility-Level Pressure Ulcer Prevalence***
***All Colorado Nursing Homes, Quarter 2-2009***

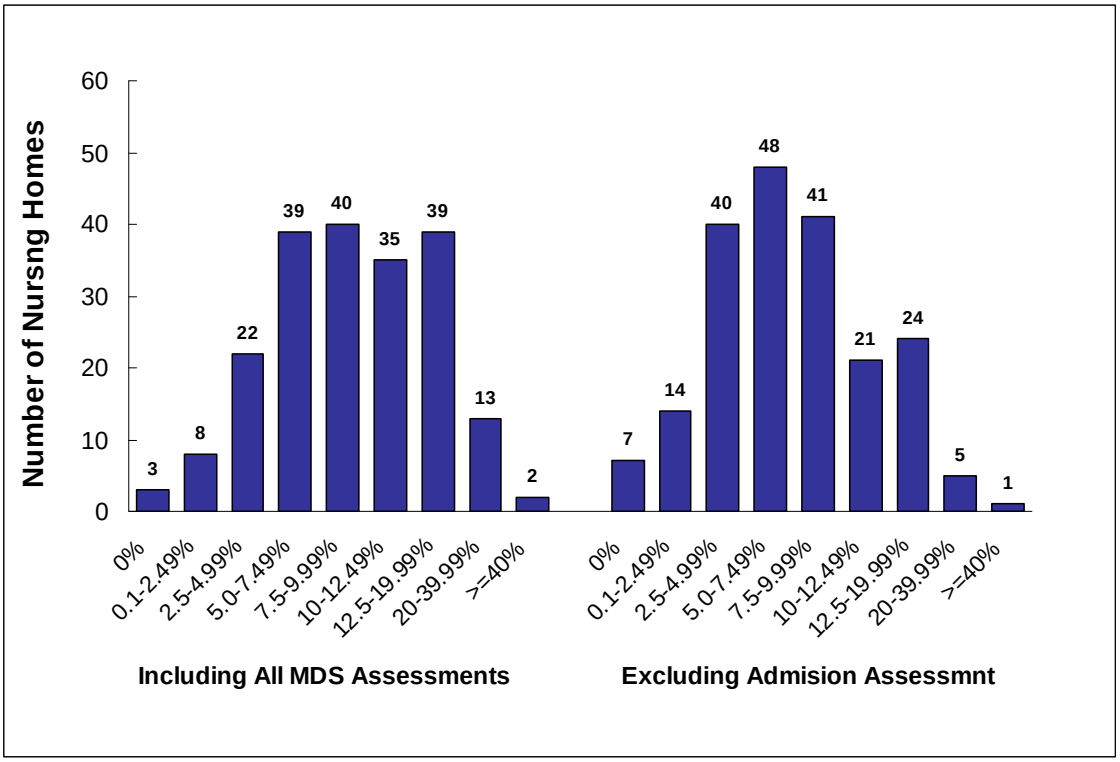
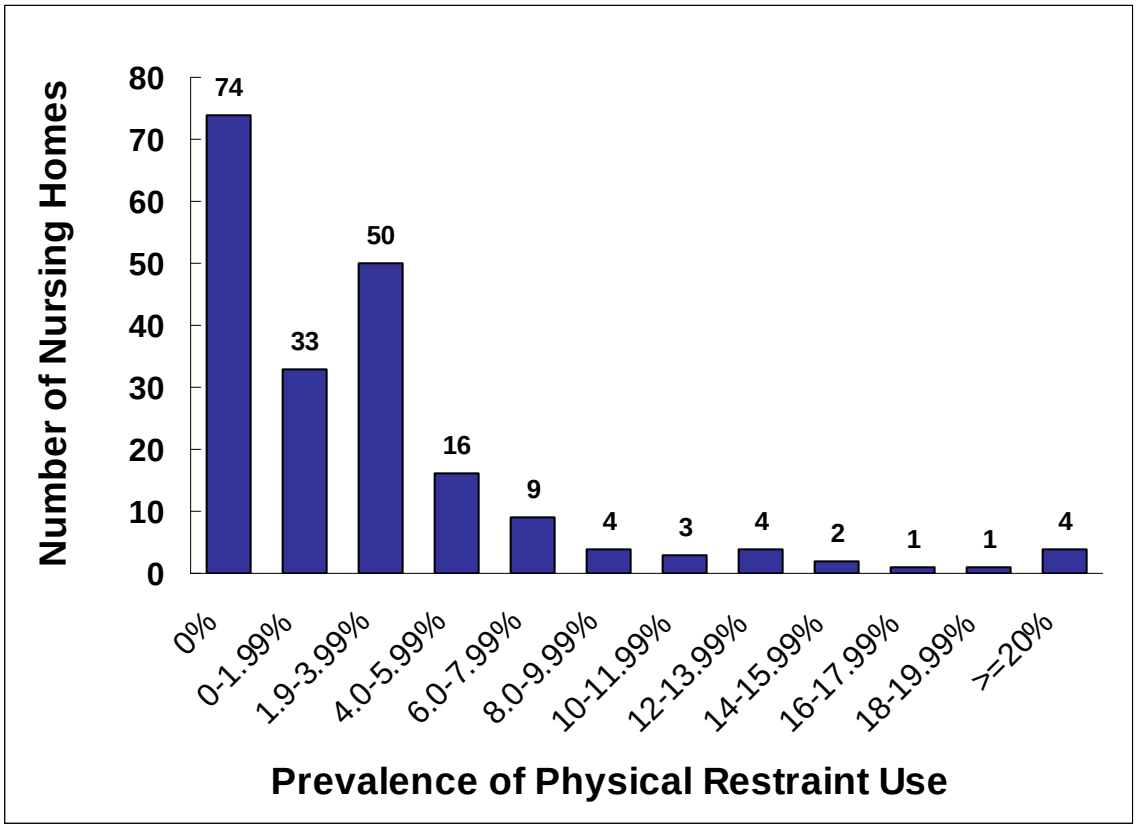



**Figure 3** illustrates the distribution of facility-level PR prevalence across Colorado nursing homes, which is positively skewed. There are 74 nursing homes with zero PR prevalence, representing 37% of all nursing homes; 33 (16%) nursing homes have less than 2% PR prevalence; 50 (25%) nursing homes have a 2-4% PR prevalence (overall mean PR prevalence is 2.7% for all facilities); and 44 (22%) nursing homes have a PR prevalence greater than 4%. Facility-level PR prevalence was not found to be associated with size of facility or race/ethnicity (data not shown).

***Figure 3: Distribution of Facility-Level Physical Restraint Prevalence***
***201 Colorado Nursing Homes, Quarter 2-2009***




**Univariate and Multivariate Statistical Analysis**
Univariate analyses were conducted to determine the independent association of age, gender, and race/ethnicity with PrU and PR prevalence. Results for PrU analyses are presented first in this section, followed by results for PR.

**Table 4 and Figure 4** summarize the results of the univariate analyses for each of the two PrU prevalence estimates. Table 4 provides numeric statistics for the univariate analysis, including the number of residents in each level of facility characteristics as well as the number and proportion of those residents who had at least one PrU on the respective MDS assessment. The p-value in the table indicates statistical significance between the characteristic and the outcome if its value is <0.05 (5% level of significance, indicated with " * " symbol). The first p-value in each characteristic group represents the overall statistical test for that group. The subsequent p-values represent the statistical test for that specific level of the respective characteristic group, as compared to the reference level (indicated in the table with " + " symbol) of the group. Since the reference level is what all other levels are compared to, "reference" is found in the p-value cell, since no p-value is calculated for this level. The odds ratio provides an estimate of the likelihood of a resident with the respective characteristic having a PrU, as compared to the reference characteristic level. For example, the reference group for age is those residents who are at least 85 years old. Each of the other age categories are compared to this reference

group. Residents who are younger than 65 have an odds ratio of 1.25, indicating that those residents <65 years old are 1.25 times more likely to have a PrU than residents who are 85 and older. The 95% confidence interval (CI) provides additional information as to how certain you are of the accuracy of the odds ratio. If the 95% CI contains 1.0, which would indicate 'even odds' (chances are '50-50' of the group having a PrU, as compared to the reference group), it indicates that the chance of a resident in the respective age group of having a PrU is not significantly different than those residents in the reference group. This is true for residents who are 75-84 years old. Their odds ratio is 1.01, but the 95% CI (0.90-1.12) includes 1.0, indicating they are approximately just as likely to have a PrU as residents who are at least 85 years of age.

Figure 4 provides a graphical representation of the "Number (%) of PrU" columns found in Table 4. It simply displays the distribution of PrU prevalence for age, gender, and race/ethnicity groupings. As can be seen in Figure 4, results from two estimations were very similar. For PrU prevalence including all MDS assessments (Figure 4A), residents who were under 65 years old (12%, p=0.001) and between 65 and 74 years old (13%, p<0.001) were more likely than residents who were over 85 years old (10%) to have a PrU. Pressure ulcers were more common in male residents (13%, p<0.001) than in female residents (10%). There were no significant differences among race/ethnicity whether categorized as 5 groups (White, Black, Hispanic, Asian, and Native American) or 2 groups (White and nonwhite) with respect to the prevalence of PrU, although Black residents had the highest prevalence. However, when conducting subgroup analysis in which only White and Black residents were included in the study population, a significant (p=0.044) difference in estimated PrU prevalence without the MDS admission assessment was observed between White (8.0%) and Black (10%) residents.

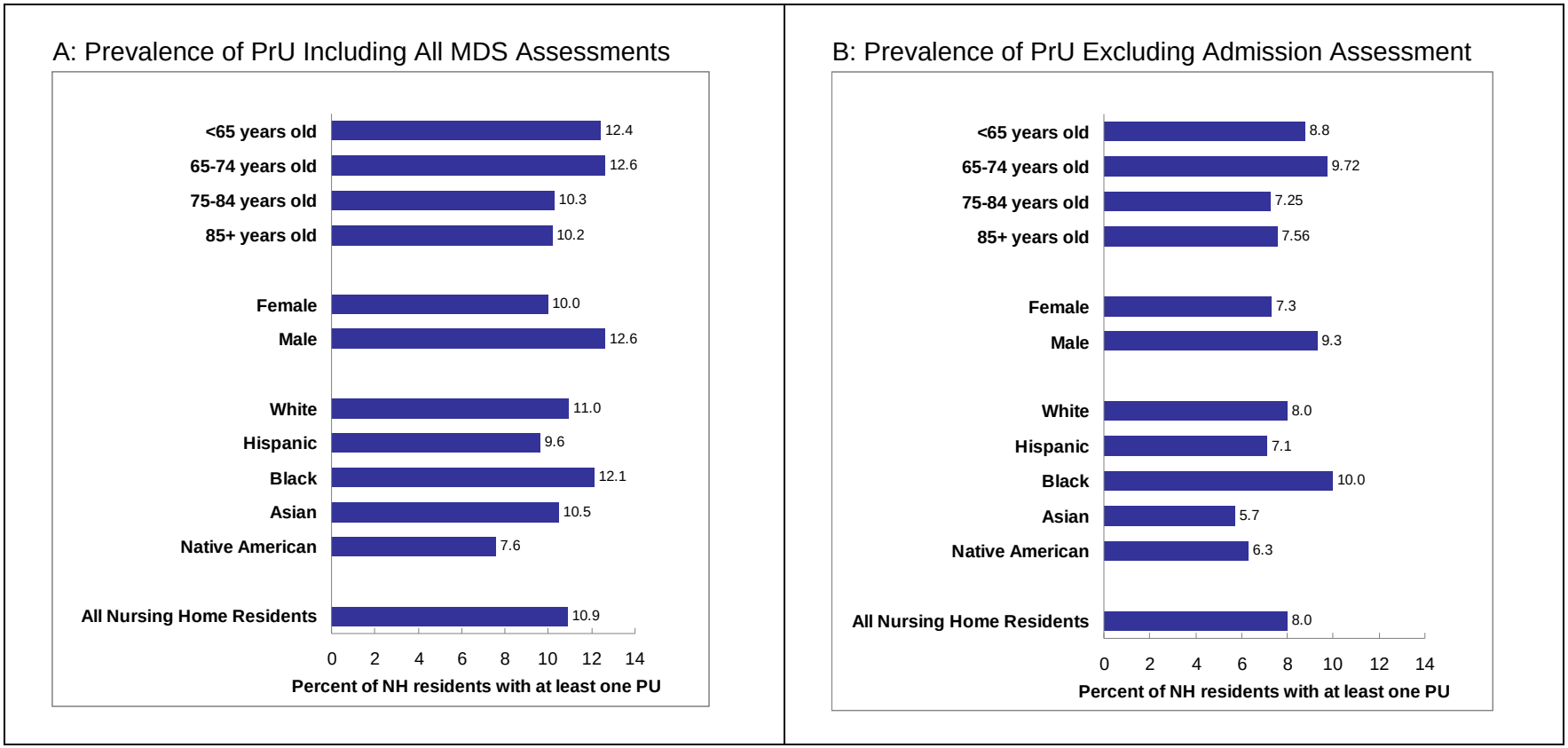
The only statistically significant differences found for the outcome that includes PrU for all MDS assessment was in age and gender. For the outcome excluding admission MDS assessments (Figure 4B), age, gender, and Black vs. White sub-grouping were independently statistically significant.

***Table 4: Univariate Logistic Regression for Presence of Pressure Ulcers with Age, Race/Ethnicity, Gender***
***Total of 20,613 Residents in 201 Nursing Homes, Quarter 2-2009***

| Characteristics | Number of Residents | Outcome is PrU at *Any* MDS Assessments (Yes/No) | | | Outcome is PrU *excluding* Admission Assessment (Yes/No) | | |
|---|---|---|---|---|---|---|---|
| | | Number (%) of PrU | Odds Ratio (95% CI) | p-value | Number (%) of PrU | Odds Ratio (95% CI) | p-value |
| Age | 20,613 | 2,243 | | <0.001* | 1,639 | | <0.001* |
| <65 years old | 2,781 | 345 (12.4) | 1.25 (1.09-1.42) | 0.001* | 244 (8.8) | 1.18 (1.01-1.37) | 0.039* |
| 65-74 years old | 3,054 | 385 (12.6) | 1.27 (1.12-1.44) | <0.001* | 297 (9.7) | 1.32 (1.14-1.52) | <0.001* |
| 75-84 years old | 6,276 | 645 (10.3) | 1.01 (0.90-1.12) | 0.893 | 455 (7.2) | 0.96 (0.84-1.08) | 0.473 |
| 85+ years old[+] | 8,502 | 868 (10.2) | 1.0 | reference | 643 (7.6) | 1.0 | reference |
| Race/Ethnicity | | | | 0.290 | | | 0.106 |
| Native American | 79 | 6 (7.6) | 0.67 (0.29-1.54) | 0.342 | 5 (6.3) | 0.78 (0.31-1.93) | 0.590 |
| Asian | 209 | 22 (10.5) | 0.95 (0.61-1.49) | 0.837 | 12 (5.7) | 0.70 (0.39-1.26) | 0.238 |
| Black | 759 | 92 (12.1) | 1.12 (0.90-1.40) | 0.323 | 76 (10.0) | 1.28 (1.01-1.64) | 0.044* |
| Hispanic | 1,644 | 158 (9.6) | 0.86 (0.73-1.02) | 0.089 | 117 (7.1) | 0.88 (0.73-1.07) | 0.215 |
| White[+] | 17,769 | 1,950 (11.0) | 1.0 | reference | 1,418 (8.0) | 1.0 | reference |
| Race/Ethnicity Combination | | | | 0.318 | | | 0.755 |
| Nonwhite | 2,691 | 278 (10.3) | 0.93 (0.82-1.07) | 0.318 | 210 (7.8) | 0.98 (0.84-1.14) | 0.755 |
| White[+] | 17,769 | 1,950 (11.0) | 1.0 | reference | 1,418 (8.0) | 1.0 | reference |
| Gender | | | | <0.001* | | | <0.001* |
| Male | 6,920 | 873 (12.6) | 1.30 (1.19-1.42) | <0.001* | 646 (9.3) | 1.32 (1.19-1.46) | <0.001* |
| Female[+] | 13,691 | 1,370 (10.0) | 1.0 | reference | 993 (7.3) | 1.0 | reference |
| Race/Ethnicity Sub-group | | | | 0.323 | | | 0.044* |
| Black | 759 | 92 (12.1) | 1.12 (0.90-1.40) | 0.323 | 76 (10.0) | 1.28 (1.01-1.64) | 0.044* |
| White[+] | 17,769 | 1,950 (11.0) | 1.0 | reference | 1,418 (8.0) | 1.0 | reference |

[+] Indicates reference group
* Indicates statistically significant at 0.05 (5%) level

***Figure 4: Pressure Ulcer Prevalence Across All Colorado Nursing Homes by Age, Gender, and Race/Ethnicity Prevalence for All MDS Assessments and Assessments Excluding Admissions, Quarter 2-2009***



Based on characteristics found to be statistically significant in the univariate analysis, multivariate modeling was subsequently performed to determine the combined association of age, gender, and race/ethnicity with PrU and PR prevalence. One model was developed for PrU prevalence using all MDS assessments, and a second model was developed for MDS assessments excluding admissions. Additionally, two separate models were developed under each of these prevalence outcomes: (1) using all residents and the 5-level race/ethnicity variable, and (2) using the subgroup of residents that are included in the 2-level race/ethnicity breakdown of Black and White residents.

Results for the two prevalence models using the 5-level race/ethnicity variable with all residents are presented in **Table 5a**. The parameter estimate represents the additive contribution of the variable, in the final model. Gender, Hispanic residents (vs. White), and the two youngest age groups (vs. residents at least 85 years of age) were each statistically significant for the model predicting PrU prevalence on any MDS assessment. However, when admission assessments were excluded, only gender and one age group (65-74 years of age) were significant.

**Table 5b** present results for the two prevalence models using the 2-level race/ethnicity variable with only Black and White residents being included. Only gender and 65-74 year old residents (vs. residents at least 85 years of age) were statistically significant for both the model predicting PrU prevalence on any MDS assessment, and the model excluding admission assessments. Race/ethnicity was not significant in either model.

***Table 5a: Multivariate Logistic Regression for Presence of Pressure Ulcers with 5-Level Race/Ethnicity Total of 20,613 Residents in 201 Nursing Homes, Quarter 2-2009***

| Characteristic | Outcome is PrU at Any MDS Assessments (Yes/No) | | | Outcome is PrU excluding Admission Assessment (Yes/No) | | |
|---|---|---|---|---|---|---|
| | Parameter Estimate | Odds Ratio (95% CI) | p-value | Parameter Estimate | Odds Ratio (95% CI) | p-value |
| Age Group (85+ years [+]) | | | | | | |
| < 65 years old | 0.160 | 1.17 (1.02-1.35) | 0.022* | 0.081 | 1.08 (0.93-1.27) | 0.318 |
| 65-74 years old | 0.195 | 1.22 (1.07-1.38) | 0.003* | 0.218 | 1.24 (1.07-1.44) | 0.004* |
| 75-84 years old | -0.020 | 0.98 (0.88-1.09) | 0.724 | -0.076 | 0.93 (0.82-1.05) | 0.238 |
| Race/Ethnicity (White[+]) | | | | | | |
| Native American | -0.494 | 0.61 (0.26-1.41) | 0.246 | -0.332 | 0.72 (0.29-1.78) | 0.474 |
| Asian | -0.063 | 0.94 (0.60-1.46) | 0.780 | -0.373 | 0.69 (0.38-1.24) | 0.213 |
| Black | 0.046 | 1.05 (0.84-1.31) | 0.690 | 0.189 | 1.21 (0.95-1.54) | 0.131 |
| Hispanic | -0.194 | 0.82 (0.69-0.98) | 0.027* | -0.166 | 0.85 (0.70-1.03) | 0.098 |
| Gender (Female[+]) | | | | | | |
| Male | 0.234 | 1.26 (1.15-1.39) | <0.001* | 0.259 | 1.29 (1.16-1.44) | <0.001* |

[+] indicates reference group

* Indicates significant at 0.05 level

***Table 5b: Multivariate Logistic Regression for Presence of Pressure Ulcers for Black and White Resident Subgroups Total of 18,528 Residents in 201 Nursing Homes, Quarter 2-2009***

| Characteristic | Outcome is PrU at Any MDS Assessments (Yes/No) | | | Outcome is PrU excluding Admission Assessment (Yes/No) | | |
|---|---|---|---|---|---|---|
| | Parameter Estimate | Odds Ratio (95% CI) | p-value | Parameter Estimate | Odds Ratio (95% CI) | p-value |
| Age Group (85+ years [+]) | | | | | | |
| < 65 years old | 0.095 | 1.10 (0.95-1.27) | 0.204 | 0.013 | 1.01 (0.85-1.20) | 0.885 |
| 65-74 years old | 0.179 | 1.20 (1.04-1.37) | 0.010* | 0.206 | 1.23 (1.05-1.43) | 0.008* |
| 75-84 years old | -0.029 | 0.97 (0.87-1.09) | 0.613 | -0.087 | 0.92 (0.80-1.04) | 0.191 |
| Race/Ethnicity (White[+]) | | | | | | |
| Black | 0.055 | 1.06 (0.84-1.32) | 0.634 | 0.197 | 1.22 (0.95-1.56) | 0.116 |
| Gender (Female[+]) | | | | | | |
| Male | 0.261 | 1.30 (1.18-1.43) | <0.001* | 0.294 | 1.34 (1.20-1.50) | <0.001* |

[+] indicates reference group

* Indicates significant at 0.05 level

Similar univariate and multivariate analyses of age, race/ethnicity, and gender disparity on each of the four stages of PrUs were performed in the subgroup population, which included only the residents with one or more PrUs. No statistical significances were found for stages 2 or 3, therefore only results for stage 1 and stage 4 PrUs are presented in this report.

**Table 6a** presents results for the univariate analysis of differences of stage 1 PrU rates among age, race/ethnicity, and gender groups in two estimates of PrU prevalence (all MDS assessments and excluding admissions). For all MDS assessment PrU prevalence, residents less than 65 years old (26%) had a lower rate of stage 1 PrUs than residents who were 85+ years old (26% and 32% respectively, p=0.028). Black (20%) and Hispanic residents (21%) had lower rates of stage 1 PrUs than white residents (33%, p=0.008 for Black residents; p=0.002 for Hispanic residents). When comparing White with nonwhite residents, the latter had a lower rate (21%) of stage 1 PrUs than White residents (33%, p<0.001). Male residents (29%) had lower rates of stage 1 PrUs than female residents (33%, p=0.047).

When comparing White with Black residents in the subgroup analysis, Black residents (20%) had lower rates of stage 1 PrUs than White residents (33%, p=0.008). Similar results were also seen in the analyses for the second estimate of the prevalence of PrUs, which excluded admission assessment, but subgroup analysis between White and Black was barely non-significant (p=0.051).

**Table 6b** shows the results for the univariate analysis of differences of stage 4 PrU rates among age, race/ethnicity, and gender in the two estimates of prevalence of PrU respectively (with and without admission MDS assessments). For PrU prevalence including all MDS assessments, residents less than 65 years of age (26%) and residents 65-74 years old (19%) had significantly higher rates of stage 4 PrUs than residents who were 85+ years old (15%, p<0.001 and p=0.048 respectively). Male residents (21%) had a higher rates of stage 4 PrUs than female residents (16%, p=0.004). When comparing White with Black residents in the subgroup analysis, Black residents (27%) had a higher rates of stage 4 PrUs than White residents (18%, p=0.021). However, since the overall test of association between rates of stage 4 and race/ethnicity group (5 categorical groups) was not significant (p=0.192), we may not consider the individual level result to be valid. Similar results were also seen in the analyses for the second estimate of prevalence PrU, which excluded admission MDS assessments.

***Table 6a: Univariate Logistic Regression for Presence of Stage 1 Pressure Ulcers with Age, Race/Ethnicity, Gender Quarter 2-2009***

| Characteristic | Outcome is Stage 1 PrU at Any MDS Assessments (Yes/No) | | | | Outcome is Stage 1 PrU excluding Admission Assessment (Yes/No) | | | |
|---|---|---|---|---|---|---|---|---|
| | Number of PrU | Number of Stage 1 PrU (%) | Odds Ratio (95% CI) | p-value | Number of PrU | Number of Stage 1 PrU (%) | Odds Ratio (95% CI) | p-value |
| Age | | | | 0.005* | | | | 0.009* |
| <65 years old | 345 | 89 (25.8) | 0.73 (0.55-0.97) | 0.028* | 244 | 53 (21.7) | 0.69 (0.49-0.98) | 0.039* |
| 65-74 years old | 385 | 109 (28.3) | 0.83 (0.64-1.08) | 0.164 | 297 | 71 (23.9) | 0.78 (0.57-1.08) | 0.132 |
| 75-84 years old | 645 | 232 (36.0) | 1.18 (0.95-1.46) | 0.132 | 455 | 147 (32.3) | 1.19 (0.92-1.54) | 0.189 |
| 85+ years old[+] | 868 | 280 (32.3) | 1.0 | reference | 643 | 184 (28.6) | 1.0 | reference |
| Race/Ethnicity | | | | 0.002* | | | | 0.017* |
| Native American | 6 | 3 (50.0) | 2.02 (0.41-10.05) | 0.389 | 5 | 3 (60.0) | 3.69 (0.61-22.15) | 0.154 |
| Asian | 22 | 7 (31.8) | 0.94 (0.38-2.33) | 0.901 | 12 | 4 (33.3) | 1.23 (0.37-4.10) | 0.737 |
| Black | 92 | 18 (19.6) | 0.49 (0.29-0.83) | 0.008* | 76 | 14 (18.4) | 0.56 (0.31-1.00) | 0.051* |
| Hispanic | 158 | 33 (20.9) | 0.53 (0.36-0.79) | 0.002* | 117 | 21 (17.9) | 0.54 (0.33-0.87) | 0.012* |
| White[+] | 1,950 | 645 (33.1) | 1.0 | reference | 1,418 | 410 (28.9) | 1.0 | reference |
| Race/Ethnicity | | | | <0.001* | | | | 0.008* |
| Nonwhite | 278 | 61 (21.9) | 0.57 (0.42-0.77) | <0.001* | 210 | 42 (20.0) | 0.61 (0.43-0.88) | 0.008* |
| White[+] | 1,950 | 645 (33.1) | 1.0 | reference | 1,418 | 410 (28.9) | 1.0 | reference |
| Gender | | | | 0.047* | | | | 0.012* |
| Male | 873 | 255 (29.2) | 0.83 (0.69-1.00) | 0.047* | 646 | 157 (24.3) | 0.75 (0.60-0.94) | 0.012* |
| Female[+] | 1,370 | 455 (33.2) | 1.0 | reference | 993 | 298 (30.0) | 1.0 | reference |
| Race/Ethnicity Subgroup | | | | 0.008* | | | | 0.051 |
| Black | 92 | 18 (19.6) | 0.49 (0.29-0.83) | 0.008* | 76 | 14 (18.4) | 0.56 (0.31-1.00) | 0.051 |
| White[+] | 1,950 | 645 (33.1) | 1.0 | reference | 1,418 | 410 (28.9) | 1.0 | reference |

[+]Indicates reference group

*Indicates significant at 0.05 level

***Table 6b: Univariate Logistic Regression for Presence of Stage 4 Pressure Ulcers with Age, Race/Ethnicity, Gender Quarter 2-2009***

| Characteristic | Outcome is Stage 4 PrU at Any MDS Assessments (Yes/No) | | | | Outcome is Stage 4 PrU excluding Admission Assessment (Yes/No) | | | |
|---|---|---|---|---|---|---|---|---|
| | Number of PrU | Number of Stage 4 PrU (%) | Odds Ratio (95% CI) | p-value | Number of PrU | Number of Stage 4 PrU (%) | Odds Ratio (95% CI) | p-value |
| Age Group | | | | <0.001* | | | | <0.001* |
| <65 years old | 345 | 91 (26.4) | 2.07 (1.53-2.81) | <0.001* | 244 | 70 (28.7) | 2.08 (1.47-2.95) | 0.001* |
| 65-74 years old | 385 | 74 (19.2) | 1.38 (1.00-1.89) | 0.048* | 297 | 65 (21.9) | 1.45 (1.03-2.05) | 0.035* |
| 75-84 years old | 645 | 116 (18.0) | 1.27 (0.96-1.67) | 0.091 | 455 | 93 (20.4) | 1.33 (0.98-1.82) | 0.070 |
| 85+ years old[+] | 868 | 128 (14.7) | 1.0 | reference | 643 | 104 (16.2) | 1.0 | reference |
| Race/Ethnicity | | | | 0.192 | | | | 0.286 |
| Native American | 6 | 1 (16.7) | 0.94 (0.11-8.05) | 0.953 | 5 | 1 (20.0) | 1.02 (0.11-9.13) | 0.989 |
| Asian | 22 | 5 (22.7) | 1.38 (0.50-3.76) | 0.531 | 12 | 3 (25.0) | 1.35 (0.36-5.04) | 0.650 |
| Black | 92 | 25 (27.2) | 1.75 (1.09-2.81) | 0.021* | 76 | 23 (30.3) | 1.76 (1.06-2.93) | 0.028* |
| Hispanic | 158 | 32 (20.3) | 1.19 (0.79-1.78) | 0.400 | 117 | 23 (19.7) | 0.99 (0.62-1.60) | 0.982 |
| White[+] | 1,950 | 343 (17.6) | 1.0 | reference | 1,418 | 280 (19.7) | 1.0 | reference |
| Race/Ethnicity | | | | 0.041* | | | | 0.172 |
| Nonwhite | 278 | 63 (22.7) | 1.37 (1.01-1.86) | 0.041* | 210 | 50 (23.8) | 1.27 (0.90-1.79) | 0.172 |
| White[+] | 1,950 | 343 (17.6) | 1.0 | reference | 1,418 | 280 (19.7) | 1.0 | reference |
| Gender | | | | 0.004* | | | | 0.016* |
| Male | 873 | 185 (21.2) | 1.38 (1.11-1.71) | 0.004* | 646 | 150 (23.2) | 1.35 (1.06-1.72) | 0.016* |
| Female[+] | 1,370 | 224 (16.4) | 1.0 | reference | 993 | 182 (18.3) | 1.0 | reference |
| Race/Ethnicity Subgroup | | | | 0.021* | | | | 0.028* |
| Black | 92 | 25 (27.2) | 1.75 (1.09-2.81) | 0.021* | 76 | 23 (30.3) | 1.76 (1.06-2.93) | 0.028* |
| White[+] | 1,950 | 343 (17.6) | 1.0 | reference | 1,418 | 280 (19.7) | 1.0 | reference |

[+]Indicates reference group

* Indicates significant at 0.05 level

Note: the p-value for Black residents in the 5-level race/ethnicity group for the prevalence of PrU at any MDS assessment (p=0.021) and the prevalence of PrU excluding admission assessment (p=0.028) may not be considered significant because the overall tests are not significant (p=0.192 or p=0.286 respectively)

Multivariate analyses were subsequently performed to further determine whether significant disparities observed in the univariate analyses would remain when controlled by other demographic characteristic variables. All characteristics found to be statistically significant in the univariate analysis were included as candidate variables in the multivariate modeling.

**Tables 7a** through **Table 7c** represent the results of multivariate analyses for stage 1 PrUs, with each one including a different category for race/ethnicity. Table 7a contains the 5-level race/ethnicity variable; Table 7b aggregates race/ethnicity to White and nonwhite; Table 7c used the subgroup population of only Black and White residents. The only age category remaining significant in all three of the multivariate models was the 75-84 year range, and only in the prevalence models that included all MDS assessments. Gender remained significant when combined with any of the three race/ethnicity groupings, but only in the prevalence models that excluded admissions. All race/ethnicity groupings were significant in both prevalence models except for the subgroup analysis with only Black and White residents for the model excluding admissions.

**Tables 7d** through **Table 7e** are similar to Tables 7a through 7e, but they provide results for stage 4 PrUs. For age group, when controlled by race/ethnicity and gender, only differences between residents less than 65 years of age and those 85+ years old remain significant in both estimates of the PrU prevalence. For race/ethnicity, no significant disparities were seen in any combination of multivariate analyses after controlled by age and gender.

***Table 7a: Multivariate Logistic Regression for Presence of Stage 1 Pressure Ulcers with 5-Level Race/Ethnicity Quarter 2-2009***

| Characteristic | Outcome is Stage 1 PrU at Any MDS Assessments (Yes/No) | | | Outcome is Stage 1 PrU excluding Admission Assessment (Yes/No) | | |
|---|---|---|---|---|---|---|
| | Parameter Estimate | Odds Ratio (95% CI) | p-value | Parameter Estimate | Odds Ratio (95% CI) | p-value |
| Age Group (85+ years [+]) | | | | | | |
| < 65 years old | -0.193 | 0.82 (0.62-1.10) | 0.190 | -0.236 | 0.79 (0.55-1.13) | 0.199 |
| 65-74 year old | -0.129 | 0.88 (0.67-1.15) | 0.343 | -0.181 | 0.83 (0.60-1.15) | 0.271 |
| 75-84 years old | 0.224 | 1.25 (1.01-1.56) | 0.043* | 0.242 | 1.27 (0.98-1.66) | 0.073 |
| Race/Ethnicity (White[+]) | | | | | | |
| Indian | 0.864 | 2.37 (0.47-11.86) | 0.293 | 1.457 | 4.29 (0.71-26.03) | 0.113 |
| Asian | 0.014 | 1.01 (0.41-2.51) | 0.976 | 0.352 | 1.42 (0.42-4.81) | 0.571 |
| Black | -0.645 | 0.52 (0.31-0.89) | 0.017* | -0.504 | 0.60 (0.33-1.10) | 0.099 |
| Hispanic | -0.595 | 0.55 (0.37-0.82) | 0.003* | -0.589 | 0.55 (0.34-0.91) | 0.019* |
| Gender (Female[+]) | | | | | | |
| Male | -0.156 | 0.86 (0.71-1.03) | 0.105 | -0.259 | 0.77 (0.61-0.97) | 0.028* |

[+] indicates reference group

* Indicates significant at 0.05 level

***Table 7b: Multivariate Logistic Regression for Presence of Stage 1 Pressure Ulcers with White/Nonwhite Race/Ethnicity***

***Quarter 2-2009***

| Characteristic | Outcome is Stage 1 PrU at Any MDS Assessments (Yes/No) | | | Outcome is Stage 1 PrU excluding Admission Assessment (Yes/No) | | |
|---|---|---|---|---|---|---|
| | **Parameter Estimate** | **Odds Ratio (95% CI)** | **p-value** | **Parameter Estimate** | **Odds Ratio (95% CI)** | **p-value** |
| Age Group (85+ years [+]) | | | | | | |
| < 65 years old | -0.190 | 0.83 (0.62-1.10) | 0.195 | -0.227 | 0.80 (0.56-1.14) | 0.215 |
| 65-74 year old | -0.132 | 0.88 (0.67-1.15) | 0.333 | -0.184 | 0.83 (0.60-1.15) | 0.263 |
| 75-84 years old | 0.217 | 1.24 (1.00-1.54) | 0.051 | 0.230 | 1.26 (0.97-1.64) | 0.089 |
| Race/Ethnicity (White[+]) | | | | | | |
| Nonwhite | -0.517 | 0.60 (0.44-0.81) | 0.001* | -0.429 | 0.65 (0.45-0.94) | 0.021* |
| Gender (Female[+]) | | | | | | |
| Male | -0.154 | 0.86 (0.71-1.03) | 0.109 | -0.255 | 0.77 (0.62-0.98) | 0.030* |

[+] indicates reference group

* Indicates significant at 0.05 level

***Table 7c: Multivariate Logistic Regression for Presence of Stage 1 Pressure Ulcers for Black and White Resident Subgroup Quarter 2-2009***

| Characteristic | Outcome is Stage 1 PrU at Any MDS Assessments (Yes/No) | | | Outcome is Stage 1 PrU excluding Admission Assessment (Yes/No) | | |
|---|---|---|---|---|---|---|
| | Parameter Estimate | Odds Ratio (95% CI) | p-value | Parameter Estimate | Odds Ratio (95% CI) | p-value |
| Age Group (85+ years [+]) | | | | | | |
| < 65 years old | -0.162 | 0.85 (0.63-1.15) | 0.292 | -0.255 | 0.78 (0.53-1.13) | 0.189 |
| 65-74 year old | -0.211 | 0.81 (0.61-1.07) | 0.141 | -0.285 | 0.75 (0.54-1.05) | 0.098 |
| 75-84 years old | 0.227 | 1.25 (1.00-1.57) | 0.047* | 0.237 | 1.27 (0.97-1.66) | 0.086 |
| Race/Ethnicity (White[+]) | | | | | | |
| Black | -0.652 | 0.52 (0.31-0.88) | 0.016* | -0.502 | 0.61 (0.33-1.10) | 0.100 |
| Gender (Female[+]) | | | | | | |
| Male | -0.184 | 0.83 (0.68-1.01) | 0.066 | -0.256 | 0.77 (0.61-0.98) | 0.037* |

[+] indicates reference group

* Indicates significant at 0.05 level

***Table 7d: Multivariate Logistic Regression for Presence of Stage 4 Pressure Ulcers with 5-Level Race/Ethnicity Quarter 2-2009***

| Characteristic | Outcome is Stage 4 PrU at Any MDS Assessments (Yes/No) | | | Outcome is Stage 4 PrU excluding Admission Assessment (Yes/No) | | |
|---|---|---|---|---|---|---|
| | Parameter Estimate | Odds Ratio (95% CI) | p-value | Parameter Estimate | Odds Ratio (95% CI) | p-value |
| Age Group (85+ years [+]) | | | | | | |
| < 65 years old | 0.624 | 1.87 (1.36-2.56) | <0.001* | 0.641 | 1.90 (1.32-2.73) | <0.001* |
| 65-74 year old | 0.258 | 1.29 (0.94-1.78) | 0.115 | 0.325 | 1.38 (0.97-1.97) | 0.070 |
| 75-84 years old | 0.201 | 1.22 (0.93-1.61) | 0.156 | 0.267 | 1.31 (0.95-1.79) | 0.095 |
| Race/Ethnicity (White[+]) | | | | | | |
| Indian | -0.279 | 0.76 (0.09-6.62) | 0.801 | -0.103 | 0.90 (0.10-8.26) | 0.927 |
| Asian | 0.197 | 1.22 (0.44-3.36) | 0.704 | 0.109 | 1.12 (0.30-4.21) | 0.872 |
| Black | 0.405 | 1.50 (0.92-2.43) | 0.100 | 0.427 | 1.53 (0.91-2.57) | 0.105 |
| Hispanic | 0.060 | 1.06 (0.70-1.60) | 0.775 | -0.115 | 0.89 (0.55-1.44) | 0.638 |
| Gender (Female[+]) | | | | | | |
| Male | 0.230 | 1.26 (1.01-1.57) | 0.042* | 0.187 | 1.21 (0.94-1.55) | 0.143 |

[+] indicates reference group

* Indicates significant at 0.05 level

***Table 7e: Multivariate Logistic Regression for Presence of Stage 4 Pressure Ulcers with White/Nonwhite Race/Ethnicity Quarter 2-2009***

| Characteristic | Outcome is Stage 4 PrU at Any MDS Assessments (Yes/No) | | | Outcome is Stage 4 PrU excluding Admission Assessment (Yes/No) | | |
|---|---|---|---|---|---|---|
| | Parameter Estimate | Odds Ratio (95% CI) | p-value | Parameter Estimate | Odds Ratio (95% CI) | p-value |
| Age Group (85+ years [+]) | | | | | | |
| < 65 years old | 0.627 | 1.88 (1.37-2.57) | <0.001* | 0.647 | 1.91 (1.33-2.74) | <0.001* |
| 65-74 year old | 0.256 | 1.29 (0.94-1.78) | 0.117 | 0.320 | 1.38 (0.97-1.96) | 0.074 |
| 75-84 years old | 0.200 | 1.22 (0.92-1.61) | 0.159 | 0.260 | 1.30 (0.95-1.77) | 0.103 |
| Race/Ethnicity (White[+]) | | | | | | |
| Nonwhite | 0.186 | 1.20 (0.88-1.64) | 0.243 | 0.111 | 1.12 (0.79-1.59) | 0.536 |
| Gender (Female[+]) | | | | | | |
| Male | 0.229 | 1.26 (1.01-1.57) | 0.043* | 0.191 | 1.21 (0.94-1.55) | 0.134 |

[+] indicates reference group

* Indicates significant at 0.05 level

***Table 7c: Multivariate Logistic Regression for Presence of Stage 1 Pressure Ulcers for Black and White Resident Subgroup Quarter 2-2009***

| Characteristic | Outcome is Stage 4 PrU at Any MDS Assessments (Yes/No) | | | Outcome is Stage 4 PrU excluding Admission Assessment (Yes/No) | | |
|---|---|---|---|---|---|---|
| | Parameter Estimate | Odds Ratio (95% CI) | p-value | Parameter Estimate | Odds Ratio (95% CI) | p-value |
| Age Group (85+ years [+]) | | | | | | |
| < 65 years old | 0.632 | 1.88 (1.35-2.62) | <0.001* | 0.642 | 1.90 (1.30-2.79) | 0.001* |
| 65-74 year old | 0.269 | 1.31 (0.94-1.83) | 0.114 | 0.358 | 1.43 (0.99-2.06) | 0.054 |
| 75-84 years old | 0.206 | 1.23 (0.92-1.64) | 0.161 | 0.319 | 1.38 (1.00-1.90) | 0.052 |
| Race/Ethnicity (White[+]) | | | | | | |
| Black | 0.405 | 1.50 (0.92-2.43) | 0.101 | 0.436 | 1.55 (0.92-2.59) | 0.098 |
| Gender (Female[+]) | | | | | | |
| Male | 0.202 | 1.22 (0.97-1.54) | 0.089 | 0.134 | 1.14 (0.88-1.49) | 0.314 |

[+] indicates reference group

* Indicates significant at 0.05 level

**Table 8** provides prevalence of PR use by age, race/ethnicity and gender, respectively, across all Colorado nursing homes. There were significant overall age, race/ethnicity (nonwhite vs. white) and gender disparities on the PR use in Colorado the nursing homes. Residents who were in age of 65-74 years old group (2.0%) had less chance having PR than residents who were over 85 years old (2.6%, p=0.029). Nonwhite residents (3.3%) had higher rate of PR use than white residents (2.6%, p=0.026). Male residents (3.0%) had higher rate of PR use than female residents (2.5%). Significant disparities seen in the univariate analyses was confirmed in the multivariate analyses for age and race/ethnicity (nonwhite vs. White), but not for gender (**Table 9**).

***Table 8: Univariate Logistic Regression for Physical Restraint Use with Age, Race/Ethnicity, Gender Total of 20,613 Residents in 201 Nursing Homes, Quarter 2-2009***

| Characteristics | Number of Residents | Outcome is Physical Restraint Use at Any MDS Assessments (Yes/No) | | |
|---|---|---|---|---|
| | | Number (%) with PR Use | Odds Ratio (95% CI) | p-value |
| Age | | | | 0.011* |
| <65 years old | 2,781 | 95 (3.4) | 1.24 (0.98-1.59) | 0.077 |
| 65-74 years old | 3,054 | 62 (2.0) | 0.73 (0.55-0.97) | 0.029* |
| 75-84 years old | 6,276 | 161 (2.6) | 0.93 (0.76-1.13) | 0.459 |
| 85+ years old(+) | 8,502 | 235 (2.8) | 1.0 | reference |
| Race/Ethnicity | | | | 0.070 |
| Native American | 79 | 4 (5.1) | 2.00 (0.73-5.49) | 0.179 |
| Asian | 209 | 9 (4.3) | 1.69 (0.86-3.31) | 0.129 |
| Black | 759 | 19 (2.5) | 0.96 (0.60-1.53) | 0.869 |
| Hispanic | 1,644 | 58 (3.5) | 1.37 (1.04-1.81) | 0.026* |
| White(+) | 17,769 | 462 (2.6) | 1.0 | reference |
| Race/Ethnicity | | | | 0.026* |
| Nonwhite | 2,691 | 90 (3.3) | 1.30 (1.03-1.63) | 0.026* |
| White(+) | 17,769 | 462 (2.6) | 1.0 | reference |
| Gender | | | | 0.042* |
| Male | 6,920 | 208 (3.0) | 1.20 (1.01-1.43) | 0.042* |
| Female(+) | 13,691 | 345 (2.5) | 1.0 | reference |

+ Indicates reference group

* Indicates significant at 0.05 level

Note: the p-value for Hispanic residents in the 5-level race/ethnicity group (p=0.026) may not be considered significant because the overall test is not significant (p=0.070)

***Table 9: Multivariate Logistic Regression for Physical Restraint Use with Age, Race/Ethnicity, Gender 18,528 Residents in 201 Nursing Homes, Quarter 2-2009***

| Characteristics | Outcome is Physical Restraint Use at Any MDS Assessments (Yes/No) | | |
|---|---|---|---|
| | Parameter Estimate | Odds Ratio (95% CI) | p-value |
| Age Group (>85 years+) | | | |
| < 65 years old | 0.130 | 1.14 (0.89-1.46) | 0.308 |
| 65-74 years old | -0.371 | 0.69 (0.52-0.92) | 0.011* |
| 75-84 years old | -0.113 | 0.89 (0.73-1.10) | 0.282 |
| Race/Ethnicity (White+) | | | |
| Nonwhite | 0.243 | 1.28 (1.01-1.61) | 0.040* |
| Gender (Female+) | | | |
| Male | 0.169 | 1.18 (0.99-1.42) | 0.065 |

+ indicates reference group

* Indicates significant at 0.05 level

## DISCUSSION AND CONCLUSIONS

This study estimated prevalence and incidence of PrUs and prevalence of PRs use across all Colorado nursing homes. We found that the prevalence of PrUs including all MDS assessments remained at approximately 10% across each quarter and the prevalence of PrUs excluding admission assessment was approximately 8% for each quarter between Quarter 4-2008 and Quarter 2-2009. The incidence of PrUs was approximately 8% over the cumulative 9 month study period. The prevalence of PRs showed a pattern of declining from 3% in Quarter 4-2008 to 2.9% in Quarter 1-2009 and 2.7% in Quarter 2-2009. However, the declining margin of 0.1-0.3% was not statistically significant. Subgroup estimation for residents with any PrU also found that stage 2 PrUs are the most common among the 4 PrU stages. Both univariate and multivariate analyses found significant age and gender disparities in PrU prevalence. Residents who were 65-74 years old had a higher rate of any PrU and were more likely to have a PrU during their nursing home stay than residents who were over 85 years of age. Similarly, male residents had a higher rate of any PrU and were more likely to have a PrU during a nursing home stay. Surprisingly, race/ethnicity showed no significant disparities on the prevalence of PrUs despite the fact that Black residents had higher PrU prevalence than White residents. Interestingly, residents who are Black, Hispanic or nonwhite show substantially lower rates of stage 1 PrUs than White residents, but had higher rates of stage 4 PrUs than did White residents, regardless of inclusion of admission MDS assessments. Both univariate and multivariate analyses also found that there are significant age and race/ethnicity disparities on the prevalence of PRs use. Residents who are 65-74 years old or nonwhite had higher rates of PR than residents who are over 85 years old or White.

Estimations of the prevalence of PrUs and PRs at the facility level also found that although PrU prevalence across all Colorado nursing homes are normally distributed, 15 out of 201 (3.5%) nursing homes had a PrU prevalence greater than 20% (exceeding the average of 11%), when including all MDS assessments. Additionally, 30 out of 201 nursing homes (15%) had a prevalence of PrUs greater than 12.5% (exceeding the average of 8%) when estimates excluded admission assessments. Furthermore, the prevalence of PRs across all Colorado nursing homes is positively skewed. Seventy-four of 201 (37%) nursing homes had zero PR use; however, 44 of 210 (22%) nursing homes exceeded the average of 2.7% prevalence of PRs.

Estimations from this study of PrU prevalence and the findings of PrU disparities among age and gender, but not race/ethnicity, are consistent with the findings of a national report from CDC [11] and with our last July 2009 quarterly report [5]. The estimate from CDC using 2004 National Nursing Home Survey (NNHS) data shows that 11% of U.S. nursing home residents had a PrU of any stage. Our last quarterly report reveals similar prevalence of PrUs (10%) in Colorado nursing home residents. This evidence suggests that the prevalence of PrUs in Colorado nursing home has not changed, and is relatively consistent with the national average.

Racial disparities in incidence and prevalence of PrUs have been reported in nursing homes in previous studies[12],[13] . Residents with dark skin tones have an increased risk for more severe PrUs. Our findings of lower rates of stage 1 and higher rates of stage 4 PrUs in Black and Hispanic residents indicate that early stage PrUs and PrUs having subsequently progressed to a more severe stage in dark skin residents may be under diagnosed. This information is consistent with findings from previous studies [12],[13]. It has long been noted that detection of early stage PrUs due to its definition (persistent nonblanchable erythema) could cause under diagnosis of these lesions on dark skin. Because detection of early stage PrUs is an important first step in preventing their progression to severe stages, under diagnosis likely contributes to the higher rate of later stages of PrUs found in Black and Hispanic residents.

The results from this analysis also reveal a substantially lower rate of PR use (2.7%) when compared to national estimates. The national prevalence of PR use in nursing home residents from 2007 to 2009 were 5.5%, 4.3% and 3.8% respectively [4, 7], It is likely that continuing efforts for staff training and/or education, and effective interventions to reduce unnecessary PRs in Colorado nursing homes contribute to this lower rate.

**Study Limitations**

This study had several limitations. First, PrU and PR measures are based on MDS assessments, which could result in an underestimate of PrU and PR frequency. Second, the factors associated with PrUs, such as residents' health conditions, and medical reasons for restraining residents were not available in the MDS data received from our SSA state MDS Automation Coordinator, and are therefore not represented in our analysis. Facility level information, such as staff and resident ratio, type of nursing home, and staff's educational background, is also not included in our analysis. This information could be important to further understand why residents developed a PrU, and why PRs are used at what appears to be high

levels in some nursing homes. The c-index, a model fit statistic used to assess discrimination of statistical models[14], was low (<0.6) for all multivariate models developed in this analysis. Although the purpose of this study was not to comprehensively determine factors that significantly predict PrUs or PRs, the low c-indices confirm that racial/ethnic disparities do not readily or significantly influence PrUs or PRs in nursing homes in Colorado. In the future, we may assess interventions used in nursing homes, tracking changes in prevalence of PrUs and PRs to better understand how each may effectively be reduced.

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