State Variation in Nursing Home Mortality Outcomes According to Do-Not-R esuscitate Status

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Background. This study compares mortality outcomes of Medicaid-reimbursed nursing home residents with and without do-not-resuscitate (DNR) orders in two diverse states.

Methods. We used 1994 Minimum Data Set Plus (MDS+) information on 3215 nursing home residents from two states. We used Kaplan-Meier analyses to examine unadjusted mortality among those with and without DNR orders across states. We used a proportional hazard regression with main and interaction variables to model the likelihood of survival in the nursing home.

Results. Approximately 27% of nursing home residents with DNR orders in State A die within the year, and approximately 40% of nursing home residents with DNR orders in State B die within the year. Regression results indicate that neither having a DNR order nor state of residence were independently associated with mortality. However, residing in State B and having a DNR order was associated with an increased risk of mortality compared with all others in the sample (risk ratio = 1.73; 95% confidence interval = 1.09, 2.75).

Conclusion. This study demonstrates that DNR orders are associated with varying mortality across states. Future research is needed to identify the reasons why state level differences exist.

DISCUSSIONS about end of life decisions, specifically the decision to implement a do-not-resuscitate (DNR) order, are an important component of nursing home care. DNR orders are intended to eliminate the use of cardiopulmonary resuscitation (CPR) on those who would not benefit from it, and hence do not want it. Decisions to write a DNR order are often made through discussions between residents, residents’ families, and health-care providers; the Patient Self-Determination Act of 1991 requires all federally funded nursing homes to inform residents of advance directive options (1). Although the existence of a DNR order might signify that a nursing home resident has a poor prognosis, many residents with DNR orders live longer than a year (2).

Aside from their explicit interpretation, there is evidence that health-care providers may use DNR orders as indicators that non-CPR treatments should also be limited, leading to the provision of less aggressive care (3–9). Holtzman and Lurie have argued that such use of less aggressive care in those with DNR orders has led to an increase in mortality rates among Medicaid nursing home residents in a Minnesota county (10).

If DNR orders are independently associated with increased mortality outcomes, it is likely that there will be regional differences in the associations. Wennberg has argued that geographic variation in health services utilization is likely to be greater for conditions in which the medical consensus concerning the appropriate treatments for the condition is less clear (11). The use of a DNR order is an example of a medical decision in which physicians differ in their beliefs over its appropriate use (3,6). Any observed differences in mortality rates across states might be indicative of practice pattern variations across states that affect the proportions for which DNR orders are appropriate, or their use as markers to provide less aggressive care.

To investigate the role of DNR orders, this study compares mortality outcomes of Medicaid-reimbursed nursing home residents with and without DNR orders in two states. We suspect that the association of DNR orders with mortality varies across states.

Study Sample. We used Minimum Data Set Plus (MDS+) information collected in 1994 in two states designated State A and State B. The MDS+ is a clinical assessment instrument completed for each nursing home resident upon entry into a long-term care facility and then updated on a quarterly basis. In addition, it is completed following any significant changes in the nursing home resident. The MDS+ is an expanded version of the Minimum Data Set (MDS), created through a Health Care Financing Administration (HCFA) demonstration project in five states. HCFA authorized use of the MDS+ as an improved instrument to identify high-risk nursing home residents. The MDS has been validated for research and contains much unique and clinically important information that deals with function and quality of life (12). Because Medicare- or Medicaid-certified nursing homes are required to complete assessments for every patient under their care, data from the assessments practically represents the universe of nursing home residents in the given states. Nursing homes in some states report mortality and discharge information as part of the MDS+. Because the data used in this study are not public use data, the two states cannot be explicitly identified as a condition of their use.
We chose to examine only those subjects with Medicaid reimbursement both to control for socioeconomic status, and because Medicaid recipients are likely to be affected by state-level regulations that have been shown to impact the use of DNR orders (13). We chose the two states because both have mortality information with the MDS+ data, and both have some diversity in their resident populations. Medicaid per diem reimbursement rates are similar between the two states.

Of those with Medicaid reimbursement, we only included residents who were new admissions to the nursing home in 1994. In this way, we hoped to avoid bias that might result from left truncation of time in the nursing home. We controlled for a previous stay in a nursing home within the past 5 years in our model. Because the reasons for nursing home admission and prognosis at the time of admission are likely to differ substantially between older and younger Medicaid recipients, we excluded from the analysis all of those under 65 years of age. We also excluded all individuals with missing or inconsistent data among the response or predictor variables.

**Data and Statistical Analysis**

We used t tests and chi-square tests to test for significant differences between included and excluded subjects due to missing or inconsistent information, and to test for differences between the two state samples upon admission. Death was the primary outcome of interest in this study. We used Kaplan-Meier analyses to examine unadjusted mortality among those with and without DNR orders across states. We used proportional hazards regressions to model the distribution of survival times in the nursing home. The proportional hazard regression model is an appropriate and useful tool when the data take the form of times to an outcome event and there are much censored data, features of data commonly found in mortality analyses.

**Independent Variables**

The predictor variables in the regression model included a dummy variable for state of residence, and variables intended to control for potential confounding factors. Foremost we included demographic factors generally associated with mortality, including age, sex, and race (black, white). Other ethnic groups, amounting to less than 1% of the sample, were excluded due to insufficient sample size to detect significant differences.

We included dummy variables to control for residents’ previous settings of care, because the likelihood of residents with similar prognoses having a DNR order upon admission may be influenced by previous discussions with health-care providers. We included one variable to indicate whether an individual was admitted from another non–nursing home institution, such as a hospital or other health care facility. We included a variable to indicate if an individual had been admitted from another nursing home, or had resided in a nursing home within the past 5 years. We also included a variable to indicate if a resident had a non-DNR care directive, such as a living will, do-not-hospitalize order, feeding restrictions, medical restrictions, or other treatment restrictions; we combined the restrictions because few residents had them (11% had a living will, each of the other restrictions were found in fewer than 2% of the study sample). We controlled for other advance directives to ensure that any observed effect was associated with DNR status, rather than related treatment restrictions.

We controlled for comorbidity through two ordinal variables entered into the model as continuous variables, one that summed the number of five cardiovascular comorbidities an individual had, including arteriosclerotic heart disease, congestive heart failure, hypertension, stroke, and other cardiac problems; and one that summed the number of noncardiovascular diseases an individual had, including allergies, anemia, arthritis, asthma, depression, diabetes, hypothyroidism, and recent urinary tract infections. We separated cardiovascular diseases from other diseases because of reported state variations in the rates of cardiovascular disease (14–17). Similar comorbidity summary variables have been used in other studies (18, 19). We also included a variable to control for an individual’s body mass index (BMI), because body weight is highly prognostic of an older person’s health status and the likelihood of dying (20–23).

To control for physical function, we developed an ordinal variable entered into the model as a continuous variable summing the number of limitations an individual had in any of seven activities of daily living (ADLs) listed in the MDS: limitations in bed mobility, transfer, locomotion, dressing, toilet use, personal hygiene, and eating ability. We characterized individuals as having a limitation in an ADL if they were not listed as totally independent in that characteristic. To control for cognitive function, we used the MDS Cognitive Performance Scale (MDS CPS) developed and validated by Morris and colleagues (24).

Finally, we included interaction terms of each of the non-DNR predictor variables with the variable noting baseline presence of a DNR order. In this way, we could see if any association of DNR orders with mortality differed across the other predictor variables. As discussed in our hypotheses, we suspected that DNR orders would be differentially associated with mortality across states. Such a differential association can be measured directly from the parameter estimate for the interaction variable.

After conducting our first analysis in which discharge from the nursing home was treated as a censored event, we reanalyzed the data to ensure that our results were not influenced by changes in the location of death across states, rather than actual difference in nursing home mortality rates. First, we suspected that nursing home mortality rates could be influenced by the propensity of nursing home staff to discharge residents to hospitals or hospices in the terminal stages of illness, and as such those with a DNR order and poor prognosis might disproportionately be more likely to die in a non–nursing home setting in one state compared to another state. This could affect the relative mortality outcomes within nursing homes across the states. As such, we reestimated the regression models. Instead of treating discharge as a censoring event, we combined the outcome of death with being discharged to a hospital, nursing home, or other location where death might likely occur, to see if such state level differences might hold in the face of a combined outcome.
Similarly, we hypothesized that short-term mortality rates could be affected if nursing homes were disproportionately favored in one state as a place of death for terminally ill older persons. Hence, to examine if short-term mortality differences across states were causing any state-level mortality differences, we reestimated the regression models with mortality as the outcome, but excluded all of those who died or were discharged within 60 days of their nursing home stays.

Missing Data

We had information on 18,351 newly admitted nursing home residents in both states. Of these, 3215 had known Medicaid reimbursement and complete information upon nursing home admission whereas another 188 had known Medicaid reimbursement but missing information among the model variables and 471 had unknown Medicaid reimbursement information. Of the 188 residents excluded due to missing data in the response or predictor variables, bivariate comparisons of those included and excluded using available data found that those excluded were less likely to be male (18% of those excluded vs 26% of those included, p = .044), were more likely to have DNR orders (29% of those excluded vs 22% of those included, p = .038), and were more likely to be from State A (61% of those excluded vs 37% of those included, p ≤ .001).

Of the 471 excluded due to unknown Medicaid reimbursement status, those excluded were younger (81.56 vs 82.75 years, p = .004), more likely to be male (33% vs 26%, p = .002), less likely to be black (10% vs 26%, p ≤ .001), had fewer comorbidities (1.04 vs 1.21 noncardiovascular comorbidities, p = .002; 0.92 vs 1.18 cardiovascular comorbidities, p < .001), had more non-DNR advance directives (24% vs 13%, p ≤ .001), were less likely to have had a prior nursing home stay (22% vs 30%, p ≤ .001), were more likely to be admitted from a hospital or non–nursing home institution (58% vs 49%, p ≤ .001), and be less cognitively impaired (MDS CPS score 2.03 vs 2.24, p = .030). The differences among those excluded for unknown Medicaid status may reflect state differences in the proportion of residents receiving Medicaid reimbursement because many were more likely to live in State A (85% of those excluded vs 37% of those included, p ≤ .001). It is also possible that many of those excluded for unknown Medicaid status did not have Medicaid-reimbursed stays, and hence would not have been included in the study had their Medicaid status been known.

Results

The data included an average of 2.74 (SD 1.55) assessments per resident. As Table 1 shows, residents in State A were more likely to have DNR orders than residents in State B. Residents in State A were younger, more likely to be white, and more likely to have a prior stay in a nursing home than residents in State B. By most accounts, those in State A had better health status and prognoses than those in State B upon admission; those in State A had higher BMI indexes, fewer comorbidities, and less ADL and cognitive impairment.

Figure 1 depicts unadjusted survival curves stratified by state and presence of DNR order upon admission. Wilcoxon and log-rank tests indicate that the four curves are significantly different (χ² = 55.97, 3 df, for Wilcoxon test, p < .001; χ² = 48.82, 3 df, for log-rank test, p < .001). Overall, it appears that residents in State B have higher unadjusted mortality rates. Approximately 27% of nursing home residents with DNR orders in State A die within the year, and approximately 40% of nursing home residents with DNR orders in State B die within the year.

Table 2 reports the results of the proportional hazard regression modeling mortality. Although we included all variables and their interactions with having a DNR order in the model, we have only reported the statistically significant (p ≤ .05) interaction terms for ease of presentation. Five hundred twenty-eight of the 3215 residents in our study died over the 1-year study period. Findings from the main variables indicate that men and black nursing home residents were more likely to die over the year (risk ratio [RR] = 1.46, 95% confidence interval [95% CI] = 1.17, 1.82 for men; RR = 1.36, 95% CI = 1.08, 1.71 for black residents). Having another care directive at admission showed a borderline association with mortality (RR = 1.41, 95% CI = 1.00, 2.00). Higher baseline body mass index had a protective association with death (RR = 0.96, 95% CI = 0.94, 0.98). Worse physical function at admission was associated with mortality (RR = 1.19, 95% CI = 1.12, 1.27 per ADL limitation). Findings

<table>
<thead>
<tr>
<th>Variable</th>
<th>State A</th>
<th>State B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>1191</td>
<td>2024</td>
</tr>
<tr>
<td>DNR order (%, n)</td>
<td>28 (337)</td>
<td>18 (370)***</td>
</tr>
<tr>
<td>Presence of another care directive (%, n)</td>
<td>27 (316)</td>
<td>5 (103)***</td>
</tr>
<tr>
<td>Age (years; mean, SD)</td>
<td>82.17 (8.54)</td>
<td>83.08 (7.82)***</td>
</tr>
<tr>
<td>Male (%, n)</td>
<td>26 (307)</td>
<td>26 (520)</td>
</tr>
<tr>
<td>Black (%, n)</td>
<td>8 (99)</td>
<td>37 (751)***</td>
</tr>
<tr>
<td>Admitted from hospital or other non–nursing home institution (%, n)</td>
<td>48 (571)</td>
<td>50 (1009)</td>
</tr>
<tr>
<td>Prior stay in nursing home within past five years (%, n)</td>
<td>39 (470)</td>
<td>24 (479)***</td>
</tr>
<tr>
<td>BMI (mean SD)</td>
<td>24.46 (6.68)</td>
<td>23.30 (6.47)***</td>
</tr>
<tr>
<td>Noncardiovascular comorbidities (mean, SD)</td>
<td>1.16 (1.14)</td>
<td>1.24 (1.04)*</td>
</tr>
<tr>
<td>Cardiovascular comorbidities (mean, SD)</td>
<td>1.02 (0.95)</td>
<td>1.27 (1.02)***</td>
</tr>
<tr>
<td>ADL limitations (mean, SD)</td>
<td>4.51 (2.44)</td>
<td>4.86 (2.29)***</td>
</tr>
<tr>
<td>MDS Cognitive Performance Scale score (mean, SD)</td>
<td>2.07 (1.74)</td>
<td>2.34 (1.94)***</td>
</tr>
</tbody>
</table>

*p < .05; **p < .01; ***p < .001.
from the interaction variables suggest that other factors associated with death were: residing in State B with a DNR order (RR = 1.73, 95% CI = 1.09, 2.75), being admitted from a non–nursing home institution with a DNR order (RR = 1.71, 95% CI = 1.13, 2.58), and having a greater number of ADL limitations with a DNR order (RR = 1.16, 95% CI = 1.01, 1.32).

The main association variables for age, admission from another non–nursing home institution, prior nursing home stay, comorbidity, cognitive function, DNR order use, and state of residence were not independently associated with mortality. Neither were the remaining interaction terms.

The state-level and DNR main association variables were not significant in our analyses designed to determine if changes in locations of death across states were driving state-level mortality differences (full results not shown). In the analysis in which the independent variable was death or discharge to a location where death might take place, those with DNR orders in State B were still relatively more likely to have an outcome of death or discharge outcomes compared to those without DNR orders (RR = 1.86, 95% CI = 1.29, 2.70, for the interaction Term of Residing in State B × Having a DNR Order). Similarly, those in State B with DNR orders still had a higher risk of death even if they remained in the nursing home after the first 2 months, although the resulting risk ratio was not statistically significant (RR = 1.81, 95% CI = 0.88, 3.72 for the interaction term).

**Discussion**

Our results in this large census study indicate that DNR orders have different associations with mortality across states. Everything else being equal, those with DNR orders in State B are more likely to die than those without DNR orders in State B. However, there was no difference in mortality among those with and those without DNR orders in State A. Neither the main effects state of residence nor main effects DNR order variables showed a significant relationship with mortality. Because these two variables were not significantly different, it seems that the risk of death in State B among residents with DNR order is 1.73 times greater than the risk of death of any resident in State A or the residents without DNR orders in State B.

DNR orders only seemed to be associated with mortality outcomes in the presence of an admission from a non–nursing home institution, worse levels of ADL function, or residing in State B. It is possible that being admitted from an institution, such as a hospital, with a DNR order suggests a discharge to a nursing home due to impending death. As such, nursing homes may be used as a place of death by other institutions. The interaction of number of ADL limita-

**Table 2. Regression Modeling Time Until Death**

<table>
<thead>
<tr>
<th>Variable†</th>
<th>Risk Ratio</th>
<th>95% Confidence Interval</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.01</td>
<td>1.00, 1.03</td>
<td>.054</td>
</tr>
<tr>
<td>Male</td>
<td>1.46</td>
<td>1.17, 1.82</td>
<td>.001</td>
</tr>
<tr>
<td>Black</td>
<td>1.36</td>
<td>1.08, 1.71</td>
<td>.008</td>
</tr>
<tr>
<td>Noncardiovascular comorbidities</td>
<td>1.07</td>
<td>0.97, 1.18</td>
<td>.179</td>
</tr>
<tr>
<td>Cardiovascular comorbidities</td>
<td>1.09</td>
<td>0.98, 1.20</td>
<td>.120</td>
</tr>
<tr>
<td>Presence of another care directive</td>
<td>1.41</td>
<td>1.00, 2.00</td>
<td>.048</td>
</tr>
<tr>
<td>Body mass index</td>
<td>0.96</td>
<td>0.94, 0.98</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Prior nursing home stay</td>
<td>0.88</td>
<td>0.69, 1.12</td>
<td>.288</td>
</tr>
<tr>
<td>Admitted from non–nursing home institution</td>
<td>1.14</td>
<td>0.92, 1.42</td>
<td>.219</td>
</tr>
<tr>
<td>MDS Cognitive Performance score</td>
<td>1.06</td>
<td>1.00, 1.12</td>
<td>.070</td>
</tr>
<tr>
<td>ADL limitations</td>
<td>1.19</td>
<td>1.12, 1.27</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Resides in State B</td>
<td>1.15</td>
<td>0.88, 1.49</td>
<td>.319</td>
</tr>
<tr>
<td>Baseline DNR order</td>
<td>1.82</td>
<td>0.15, 21.67</td>
<td>.634</td>
</tr>
<tr>
<td>Admitted From Non–Nursing Home Institution × Baseline DNR Order</td>
<td>1.71</td>
<td>1.13, 2.58</td>
<td>.011</td>
</tr>
<tr>
<td>ADL Limitations × Baseline DNR Order</td>
<td>1.16</td>
<td>1.01, 1.32</td>
<td>.036</td>
</tr>
<tr>
<td>Resides in State B × Baseline DNR Order</td>
<td>1.73</td>
<td>1.09, 2.75</td>
<td>.020</td>
</tr>
</tbody>
</table>

Notes: n = 3215; total mortality by 12/31/94 = 528. †Results for main effects and significant interaction variables reported. Full model included all interaction variables between main effects variables and baseline DNR order.
tions and having a DNR order suggests that DNR status may be an indication of worse prognoses as physical function worsens.

The other statistically significant main associations were in expected directions. Men and black nursing home residents were more likely to die than women and white residents, respectively. This is consistent with previous research that men and black persons have worse health outcomes in general (25–28). The differences may also be explained by health status differences across race and sex that were unmeasured in our model. Indeed, past research has found that the amount of social support older persons receive and need varies by race and sex (29,30); differences in social support may allow for racial and sex differences in the demand for nursing home admission for any given health state. Such a hypothesis, for example, could explain a finding that black women have worse ADL function in the nursing home upon admission than white women (31). Having another care directive was predictive of death, consistent with the fact that many of the care directives included in that variable direct providers to withhold potentially life-prolonging treatments such as feeding tubes. Finally, number of ADL limitations and lower body mass index were predictive of death, consistent with previous findings that having ADL limitations and lower weight are associated with worse health status and worse health outcomes (22, 32–37).

The results concerning the association of residing in State B with a DNR order and death do not seem to be due to nursing homes in State A being more likely to discharge residents shortly before death occurs, or to nursing homes in State B being used as a place of death for terminally ill patients.

We can hypothesize as to possible explanations for the increased risk of death associated with having a DNR order in State B. One possibility is that physicians in State B only use DNR orders in patients who are likely to die. Indeed, a study of hospitalized patients found that physicians are more likely to use DNR orders in patients with poor prognoses (38). Because studies have shown that physicians are often able to prognosticate mortality outcomes in patients better than chance would predict (39,40), it is indeed possible that physicians in State B reserve DNR use for patients with the poorest outcomes. As such, our comorbidity variables might have been unable to capture the extent to which prognoses among residents with DNR orders varied. It is also possible that the ability of physicians to prognosticate mortality outcomes within disease groups did not vary across states, but that more diseases occur in State B that allow for better prognostication. It has been found that physicians are more likely to write advance directives for different diseases with similar prognoses, such as writing more DNR orders for patients with AIDS or lung cancer than for patients with cirrhosis or heart failure (41). Although there are many social factors that can possibly explain this finding, it may be that physicians are better able to prognosticate outcomes for some diagnoses than for others. If so, the different distribution of diseases in State B—for example, in our data 23% of residents in State B had a diagnosis of stroke compared with 15% of residents in State A—may be consistent with diagnoses that allow physicians to better prognosticate mortality outcomes. Still, a sensitivity analysis in which we included each of the variables used in the comorbidity index along with its DNR interaction did not reveal substantially different results (results not shown).

This suggests that the differences in mortality associated with DNR status in State B were not caused by a difference in the distribution of disease across the states.

Another possible explanation is that there may be a difference in the aggressiveness of care provided to residents by nursing home professionals in State B. As stated in the introduction, previous studies have found that DNR orders are associated with the provision of less aggressive care and worse than expected health outcomes (3–10). Such an explanation has ethical implications. If DNR orders are used to limit the use of intensive treatment that prolongs suffering at the end of life, then the use of less aggressive care may be favorable as long as a residents’ consent is obtained. However, there are also reasons to suspect that the quality of care given to residents in State B might be less aggressive for reasons other than the residents’ best interests. In 1991, over 50% more nursing home days were funded by Medicaid in State B than in State A (41). In both states, Medicare had higher reimbursement rates than Medicaid, although the difference was greater in State A, and presumably private insurance in both states reimbursed as much or more than Medicaid rates. As such, State A likely had more residents with non-Medicaid reimbursement, resulting in more financial resources for all residents, regardless of reimbursement. Such potential financial constraints in State B might be associated with poorer quality or less aggressive care that negatively affects the most vulnerable residents such as those with DNR orders. However, because we only have aggregate state data rather than nursing home–specific data, we cannot make definitive statements about this relationship.

There are limitations to this study. For one, we did not have enough information to assign causality to the finding that those with DNR orders in State B had higher mortality rates. Still, these findings are among the first to show how DNR orders might affect mortality across regions. At the same time, there was a substantial amount of missing data due to unknown Medicaid reimbursement status. However, it is possible that many of those excluded for unknown Medicaid reimbursement did not have Medicaid reimbursement. At the same time, the lack of substantial significant differences among those excluded for missing information among the model variables, but with known Medicaid reimbursement, suggests that missing data did not substantially bias our results.

Although the nature of our data does not allow us to determine the causal reason why the mortality differences among those with DNR orders in State B exist, the fact that we did find differences raises many questions that future research will hopefully uncover. If the reason for the mortality differences among those with DNR orders in State B are due to better prognostication about mortality outcomes among physicians in State B, then their methods of prognosticating should be emulated elsewhere. However, if the reason for the mortality differences is due to the provision of less aggressive care, efforts should be made to determine if such a provision of less aggressive care is consistent with the desires of nursing home residents. As stated above, many nursing home resi-
dents with DNR orders can expect to live longer than a year (2). As such, the consequences of DNR orders on life expectancy in the nursing home should be known so that physicians, families, and patients can make better informed decisions regarding the initiation of do-not-resuscitate orders.

Acknowledgments

We would like to gratefully acknowledge Susan Miller, PhD, Mark D. Grant, MD, MPH, Gavin W. Hougham, MA, David C. Grabowski, PhD, Kate Cagney, PhD, and Paul Rathouz, PhD, for their comments on this work. This research was supported by Grant NIA AG00488-07 from the National Institute on Aging, a Home Health Care Grant from the University of Chicago, and a grant from the Clinical Nutrition Research Center at the University of Chicago.

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