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Impact of Medication Aide Use on Skilled Nursing Facility Quality

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Abstract:

Purpose of the Study: A number of states have begun to allow skilled nursing facilities to employ medication aides, who have less formal education than registered nurses (RNs) or licensed practical nurses (LPNs), to administer medications. If this results in fewer RNs or LPNs, quality degradation may occur. We evaluated the effect of regulations allowing for medication aides on subsequent medication aide use and the effect of changes in medication aide use on other nurse staffing, deficiencies, and Nursing Home Quality Initiative (NHQI) health outcome measures. **Design and Methods:** Staffing levels and inspection deficiencies from the Online Survey and Certification and Reporting System and NHQI data from 2004 to 2010 for facilities from eight southeastern U.S. states are used in instrumental variables models with facility fixed effects. **Results:** Facilities in states allowing for medication aide use increased medication aide use with no statistically significant reduction in RN or LPN use. Medication aide use decreased the probability that a facility received a deficiency citation for unnecessary drug use or having a medication error rate greater than or equal to 5% and had no effect on deficiencies for significant or harmful medication errors. Increased medication aide use was associated with fewer pharmacy and total deficiency citations and decreased use of physical restraints; in contrast, more use of medication aides was associated with an increase in the percentage of residents needing help with activities of daily living and losing continence. **Implications:** This study provides support for state policies that allow skilled nursing facilities to use medication aides.

Key words:

Deficiency; Nursing assistant; Skilled nursing facility; Staffing; Medication

Skilled nursing facilities in the United States have often been criticized for providing inadequate nurse staffing levels leading to lower quality of care. The registered nurses' (RNs) role in the nursing home often encompasses care of complex residents, implementation of resident care plans, and teaching and directing of licensed practical or vocational nurses (LPNs) and certified nurse aides (CNAs). In contrast, CNAs provide a majority of the day-to-day direct resident care. The use of specially trained CNAs in nursing facilities to administer resident medications could afford licensed nursing professionals (RNs and LPNs) more time to provide critical resident care, while also heightening job satisfaction levels for nurses and offering a potential career path for CNAs. A more efficient use of licensed nursing professionals could lead to improved quality of care as measured by reductions in the number of reported inspection deficiencies and in improved resident health outcomes. However, if nursing facilities choose to trim their costs by decreasing RN and LPN staffing levels, this may in turn reduce skilled nursing facility quality. Finally, use of CNAs to administer resident medications could result in more medication errors and further jeopardize resident health. In this paper, we consider the relationship between medication aide use in skilled nursing facilities and both other staffing levels and facility-level quality measures.

Medication administration is one phase of the complex medication use process that also includes prescribing, dispensing, documenting, and monitoring. Although the entire process requires a multidisciplinary approach to medication management in nursing facilities, medication administration is typically the responsibility of an RN or LPN (Long Term Care Leadership Council, 2008). Administering medications involves a series of tasks, including reviewing the order; confirming the transcription of the medication order; reviewing all warnings, interactions, and allergies; evaluating the patient; and, finally, administering the medication (Long Term Care Leadership Council, 2008). Of those on this list, the only task considered technical is the last one—actual administering of the medication to the resident. Recently, two states in Center for Medicare and Medicaid Services (CMS) Region 4 passed legislation allowing nursing facilities to employ medication aides, who are CNAs with additional formal training, to “perform technical aspects of medication administration” (General Assembly of North Carolina. SL 2005–276. G.S. 131E-114.2. Use of Medication Aides to Perform Technical Aspects of Medication Administration in Skilled Nursing Facilities). North Carolina in 2006 and Tennessee in 2009 joined Kentucky as the only three states in the eight-state southeast U.S. region (which also includes Alabama, Florida, Georgia, Mississippi, and South Carolina) to allow for medication aide use in skilled nursing facilities (see Table 1). The laws and subsequent regulations specify the training required, competency examination, and registry listing requirements impacting the use of medication aides in skilled nursing facilities.

Table 1.

Medication Aide Use Among Skilled Nursing Facilities Within CMS Region 4

State	Date medication aide use first allowed
Alabama	Medication aide use <i>not</i> allowed in skilled nursing facilities
Florida	Medication aide use <i>not</i> allowed in skilled nursing facilities
Georgia	Medication aide use <i>not</i> allowed in skilled nursing facilities
Kentucky	1991
Mississippi	Medication aide use <i>not</i> allowed in skilled nursing facilities
North Carolina	July 1, 2006
South Carolina	Medication aide use <i>not</i> allowed in skilled nursing facilities
Tennessee	July 1, 2009

Prior Literature

Many studies have explored the relationship between nurse staffing levels and quality-of-care outcomes in nursing homes, including a systematic review of studies (Bostick, Rantz, Flesner, & Riggs, 2006) and a literature review (Castle, 2008). Bostick and colleagues (2006) concluded that many studies found higher staffing levels to be associated with improved quality. Likewise, Castle's (2008) review found that 40% of the quality indicators examined revealed an association with staffing levels. In addition, studies have assessed the association between levels of various types of staff (RNs, LPNs, and CNAs) or combinations of the types of staff (staff mix) and quality (Castle & Engberg, 2008; Toles et al., 2009). Several studies have evaluated the association between RN staffing levels and resident quality measures and reported that higher RN staffing levels are associated with better resident outcomes (Castle & Anderson, 2011; Harrington, Zimmerman, Karon, Robinson, & Beutel, 2000; Kim, Harrington, & Greene, 2009; Kim, Kovner, Harrington, Greene, & Mezey, 2009; Konetzka, Stearns, & Park, 2008). Recently, Hyer, Thomas, Branch, Harman, Johnson, and Weech-Maldonado (2011), in examining a combination of RNs and LPNs, reported that increased staffing levels are associated with better quality.

Two recent studies indicate that staffing levels alone are inadequate when studying the staffing–quality relationship. When considering staffing characteristics and quality of care, Castle and Anderson (2011) reported that the composition of care staff might be just as important as staff levels. Similarly, Arling, Kane, Mueller, Bershadsky, and Degenholtz (2007) found that “how staff members are used may be as important as how many are employed” (p. 680). To date, few studies have shown an association between increases in CNA staffing and other staffing or quality outcomes (Castle & Anderson, 2011; Hyer et al., 2011).

The quality indicators used in many studies of the staffing–quality relationship include nursing facility inspection deficiency citations and resident-level health. State survey agencies determine adherence to regulations governing resident care during their approximately annual onsite state inspection. A deficiency issued to a nursing facility during the survey process is “a finding that a facility failed to meet one or more federal or state requirement” (Department of Health and Human Services, 2004, p. 34),

where examples of the broad deficiency categories include deficiency citations for mistreatment, violations of residents' rights, and quality-of-care problems. Nursing facility health-related outcomes are constructed from resident assessments conducted by facility staff and submitted quarterly through the minimum data set (MDS). Resident data are then used to construct facility-level health measures, such as incidence of pressure ulcers, urinary tract infections (UTIs), and physical restraint use.

Castle and Engberg (2007) examined pharmacy deficiency citations for medication use from 1997 to 2003. They found that one quarter of nursing facilities received medication error or medication administration deficiency citations. They also found higher RN staffing levels to be associated with fewer medication error and medication administration deficiencies, whereas LPN and nursing assistant staffing were not significantly associated with either deficiency citation category.

One possible cause for medication errors in nursing facilities is the complexity of the RNs' role as both a supervisor and caregiver, where nursing tasks often compete for a nurse's time and attention (Siegel, Young, Mitchell, & Shannon, 2008). If administering medications requires focus and an intimate knowledge of specific residents, medication administration by CNAs, who are often responsible for a much smaller number of residents and are able to focus more on individualized attention, may reduce medication errors.

Conceptual Model and Hypotheses

We used Donabedian's framework to consider the impact of various skilled nursing facility structure measures (such as size, ownership, chain membership, and Medicare and Medicaid occupancy rates), in addition to being located in a state allowing for medication aide use, on the process of nurse staffing and the impact of increased medication aide use on the changes in other staff, numbers of cited deficiencies, and long-term-stay resident health outcomes ([Donabedian, 1966](#)).

Specifically, our first hypothesis (H1) considers the impact of state policies on medication aide use in skilled nursing facilities on the adoption of medication aides as part of the staffing mix. Our second (H2) and third (H3) hypotheses consider the impact of medication aide use on other staffing levels, deficiencies, and health outcomes. Although the effect of the medication aides on skilled nursing facility quality is uncertain, H2 and H3 propose a negative effect of medication aides on quality measures.

H1: Nursing facilities in states that allow for medication aide use will take advantage of the policy and use medication aides.

H2: Increased medication aide use will decrease the use of RNs and LPNs.

H3: Increased medication aide use will lead to an increase in reported deficiencies and in poorer resident health outcomes.

Data and Methods

Data

To consider the above hypotheses, skilled nursing facility data from 2004 to 2010 were used. We limited our analysis to freestanding facilities that were certified by the CMS, eliminating hospital-based skilled nursing facilities and skilled nursing facilities that did not accept Medicare or Medicaid. We limited our analysis to the eight states in CMS Region 4: southeast U.S. states that would have some cultural characteristics in common. Of these states, only three (Kentucky, North Carolina, and Tennessee) had

programs allowing for medication aide use in skilled nursing facilities during the period under consideration.

Our key outcome variables were staffing measures, deficiencies, and NHQI facility-level health outcome measures. All key outcomes and explanatory variables considered come from two sources: Online Survey and Certification and Reporting System (OSCAR) and Nursing Home Compare (www.medicare.gov/nhcompare). The OSCAR database includes data on staffing, facility characteristics, and facility-level measures of resident characteristics. Data on inspection deficiencies and NHQI quarterly facility-level health outcome measures derived from the MDS come from Nursing Home Compare.

Staffing data were taken from the approximately annual inspection, where construction of the staffing variables was based on facility-reported full-time equivalency (FTE) data for a 14-day period. Included among our staffing measures are measures of medication aides, administrative RNs, non-administrative RNs, LPNs, and other (excludes medication aides) certified nurse aides and nurse aides in training (CNAs). Following Harrington, Carrillo, and Mercado-Scott (2005), we converted staffing data to staffing hours per resident-day (HPRD) by taking the total nursing staff FTEs reported for a 2-week period, multiplying by 70 work hours for the period, and dividing by the total number of residents and then by 14 days in the reporting period. We also followed their approach for the removal of outliers in the staffing data. Specifically, first, observations with average nursing HPRD that was greater than 24 hours of nursing per resident were considered erroneous and eliminated from the analysis. Distributions of the nursing HPRD were then examined, where facilities reporting staffing HPRD in the upper 2% or lower 1% for any of the key staffing types (RN, LPN, and CNA) were eliminated from the analyses (Harrington, Carrillo, & Mercado-Scott, 2005). We did not attempt to eliminate observations with likely errors in the medication aide measure. We found that prior to the regulatory change allowing for medication aides in Tennessee and North Carolina, approximately 4% of all Tennessee and North Carolina facilities reported medication aide use; in states never allowing for medication aide use in the period examined, a little over 1% of all facilities reported medication aide use. In contrast, in states allowing for medication aide use, in the periods where medication aides were allowed, the proportion of facilities reporting medication aides was nearly 46%. Although we could have eliminated North Carolina and Tennessee observations with medication aide use prior to the law change and observations with any medication aide use in states that did not allow medication aides, we did not have a good mechanism for identifying misreporting in the time period during which medication aides were allowed by Kentucky, North Carolina, and Tennessee facilities. Therefore, we chose not to eliminate any facilities based on medication aide use reporting. As such, we recognize that measurement error in this key variable is likely to bias the coefficients on medication aide use toward zero in our analyses.

Counts of deficiencies were taken from each inspection, where nine categories of deficiencies used for publicly reporting quality indicators for nursing facilities on the Nursing Home Compare website were used: mistreatment, quality, nutrition, residents' rights, environment, administrative, pharmacy, total, and total G-level or higher deficiencies (i.e., deficiencies that caused actual harm to one or more residents). Specific F-tags for deficiencies contained in each category are found in the State Operations Manual: Appendix PP (CMS, 2007). In addition to total pharmacy deficiencies at inspection, we also considered the following sub-categories of pharmacy deficiencies: total G-level or higher pharmacy deficiencies, F329 (resident free from unnecessary drug use) citation, F332 (facility free from medication error rate $\geq 5\%$) citation, and F333 (resident free from significant medication error) citation. An F329

deficiency indicates that one or more residents were not free from unnecessary drug use and evaluates medication prescribing and monitoring processes. An F329 deficiency citation indicates that the surveyor identified one or more of the following as missing: appropriate diagnosis and/or indication for the use of a medication, appropriate dose and duration of use, and/or monitoring of medication (i.e., resident assessment, vital signs, lab results, and no adverse drug reaction). Compliance with these aspects of the medication use process typically falls to RNs or LPNs, physicians, and pharmacists. Medication error citations (F332 and F333) address the administration of medications. Nursing facilities are assessed for compliance with regulation F332 (medication error rate <5%) by the surveyor observing medications being administered compared to medications ordered. In most instances, medication administration is completed by RNs or LPNs, but in states allowing for the use of medication aides, medication aides could also administer medications. Citation for a significant medication error (F333) is for an error that causes a resident discomfort or jeopardizes his/her health and safety.

The last set of outcomes considered were quarterly NHQI measures of health outcomes for a facility's residents. In this study, only measures related to long-stay residents are used, including the following eleven measures: percent whose need for help with daily activities has increased; percent who have moderate to severe pain; percent of high-risk residents who have pressure sores; percent of low-risk residents who have pressure sores; percent of residents who were physically restrained; percent of residents who are more depressed or anxious; percent of low-risk residents who lose control of their bowels or bladder; percent of residents who have/had a catheter inserted and left in their bladder; percent of residents who spend most of their time in bed or in a chair; percent of residents whose ability to move about in and around their room decreased; and percent of residents with a urinary tract infection. For each measure, data for some facilities in some quarters are missing due to an insufficient number of residents available for calculating a specific measure.

Our control variables, taken from the OSCAR database, include the following facility characteristics: number of beds; whether the facility is for-profit, not-for-profit, or government-owned; whether the facility is part of a chain; and the proportion of Medicaid- and Medicare-funded residents.

Organizational characteristics have long been used as explanatory variables in the literature studying nursing home quality (Grabowski, 2001; Spector & Takada, 1991). As Castle and Engberg (2007, 2008) point out, variables such as size and ownership may have a strong impact, both indirectly (through staffing) and directly, on nursing facility quality. There have been a number of studies that indicate that Medicaid's lower reimbursement rates may account for poorer quality in some facilities with high Medicaid occupancy (Hughes, Lapane, & Mor, 2000; O'Neill, Harrington, Kitchener, & Saliba, 2003). Facility-level case-mix controls for the proportion of residents with activities of daily living (ADL) limitations in three areas (toileting, transferring, and eating) were included because facilities with more severe case-mix may have more experience in serving residents with higher needs that could affect quality (Konetzka, Stearns, & Park, 2008). Harrington, O'Meara, Kitchener, Simon, and Schnelle (2003) have found these organizational characteristics are reliable as taken from OSCAR.

Two versions of the merged data sets were used. First, where staffing and deficiency measures were the key outcome of interest, we used a data set where a facility at a specific inspection was the unit of observation. Second, for models in which the quarterly NHQI health outcomes were considered, we created a data set with one observation per facility per quarter, where explanatory variables from the inspection data were from the inspection occurring in the current quarter or the most recent past inspection.

Methods

We considered (1) the effect of being in a state during a time that allowed for medication aide use by skilled nursing facilities and (2) the effect of the change in medication aide use on other staffing, deficiencies, and NHQI health outcome measures. To consider these effects jointly, we modeled facility-level measures of staffing, deficiencies, and NHQI health outcomes using an instrumental variables approach with facility fixed effects to correct for the endogeneity of medication aide use. Staffing decisions regarding the level of medication aide use are likely to be endogenous in any model of deficiencies or health outcomes, given that managers generally make decisions about staffing and quality of care simultaneously. The endogeneity of medication aide use in the outcome models would cause OLS estimates of the effect of medication aide use on an outcome to be incorrectly, that is inconsistently, estimated.

To correct for the endogeneity of medication aide use in our models, we estimated our models of continuous outcome measures using two-stage least squares with facility fixed effects. The main outcome equation is as follows:

$$Y_{it} = \alpha_i + \beta_1 \text{MedAideUse}_{it} + \beta_2 \text{Facility}_{it} + \beta_3 \text{Resident}_{it} + \beta_4 \text{Year}_t + u_{it}$$

where Y_{it} is different for each model and is the measure of non-medication aide staffing, deficiencies, or NHQI health outcomes. MedAideUse_{it} , the key explanatory variable, is the number of medication aide HPRD. Facility_{it} and Resident_{it} are vectors of time-varying, facility- and resident-level control variables, as discussed previously. Year_t is a vector that includes a series of six indicator variables for years 2005–2010 that account for any underlying time trend. Finally, u_{it} is the disturbance term, and α_i indicates the facility-level fixed effects. As noted previously, the key concern is that MedAideUse_{it} is endogenous. Therefore, using an instrumental variables approach, we estimate MedAideUse_{it} in the first stage and replace MedAideUse_{it} in Equation (1) with a predicted value of MedAideUse_{it} obtained from the estimation of the following first-stage model with facility fixed effects:

$$\text{MedAideUse}_{it} = \gamma_i + \delta_1 \text{Treatment}_{it} + \delta_2 \text{Facility}_{it} + \delta_3 \text{Resident}_{it} + \delta_4 \text{Year}_t + v_{it}$$

where Treatment_{it} is a binary indicator for being located in a state and in a time period in which medication aide use is allowed, that is, the policy treatment group. Using the treatment indicator as our instrument, we were able to isolate the variation in medication aide use that is not endogenous for use in the second stage of the model.

The facility fixed effects specification allows us to control for unmeasured characteristics that are constant at the facility level over the 7 years considered, including factors such as urban/rural location and per capita income in the area near the nursing facility. Although some of the characteristics (chain affiliation, ownership type) are constant for some facilities over time, we do have some variation in these measures for some nursing facilities; thus, we include them as control variables. Reported results

include standard errors adjusted for facility-level clustering. Given potential concerns about mismeasurement of the medication aide use variable (which would tend to bias the coefficient estimate toward zero, indicating no significant effect), we report statistical significance at the .1%, 1%, and 5% levels and will point out variables significant to 10%.

Although most of the staffing, deficiency, and facility-level health outcome measures are continuous in nature, three of the pharmacy deficiency measures are binary indicators of the presence of a specific deficiency citation at inspection: F329 (resident free from unnecessary drug use) citation, F332 (facility free from medication error rate $\geq 5\%$) citation, and F333 (resident free from significant medication error) citation. For these variables, we estimated the models using a two-stage residual inclusion approach (Terza, Basu, & Rathouz, 2008), which is more appropriate for non-linear models where there is an endogenous explanatory variable.

In our results that follow, first, we present summary statistics for all of the outcome variables and explanatory variables stratified by whether or not the facility-level observations were from a time period and state that allowed for medication aides. Second, we present the first-stage results indicating the effect of being in a state in a period with a policy allowing for the use of medication aides using both data sets described previously. Third, we report the coefficient on medication aide HPRD from all of the models of other staffing, deficiencies, and NHQI health outcomes, which allows us to determine the effect of medication aide use on these key facility-level quality-oriented outcomes.

Results

In [Table 2](#), we present descriptive statistics for all variables used in the analysis. This table distinguishes the means or proportions of staffing, deficiency, and health outcome measures of nursing facilities in states when they allow for medication aide use in skilled nursing facilities (Kentucky, North Carolina on or after July 1, 2006, and Tennessee on or after July 1, 2009) from those of nursing facilities in states when they do not (Alabama, Florida, Georgia, Mississippi, South Carolina, and North Carolina before July 1, 2006 and Tennessee before July 1, 2009). Staffing measures are represented in terms of HPRD. On average, nursing facilities in states and during periods that allowed for medication aide use tended to utilize more RNs (0.343 vs. 0.279 HPRD), fewer LPNs (0.892 vs. 0.963 HPRD), and more nurse administrators (0.243 vs. 0.196) than facilities in states that did not allow for the use of medication aides. Total average CNA use was similar across the two groups, where CNA HPRD in states not allowing for medication aides was 2.581 and in states and periods allowing for medication aides was 2.567 (0.137 medication aide + 2.43 non-medication CNAs).

Table 2.

Summary Statistics for Skilled Nursing Facilities (SNFs)

Variables	Mean or proportion ^a	
	States and time periods allowing for medication aide use in SNFs ^b	States and time periods not allowing for medication aide use in SNFs ^b
Outcome variables		
Medication aides hours per resident-day	0.137	0.002

Variables	Mean or proportion ^a	
	States and time periods allowing for medication aide use in SNFs ^b	States and time periods not allowing for medication aide use in SNFs ^b
Other staffing measures		
RN hours per resident-day	0.343	0.279
LPN hours per resident-day	0.892	0.963
Nurse administrator hours per resident-day	0.243	0.196
Non-medication nursing aides hours per resident-day	2.430	2.581
Pharmacy deficiencies		
F329—Resident free from unnecessary drug use	0.051	0.094
F332—Facility free from medication error rate $\geq 5\%$	0.085	0.116
F333—Resident free from significant medication error	0.034	0.041
Total pharmacy	0.384	0.579
Total G-level or higher pharmacy deficiencies	0.006	0.006
Other deficiencies		
Total mistreatment	0.212	0.213
Total quality	0.935	1.639
Total assessment	0.368	0.658
Total nutrition	0.387	0.622
Total residents' rights	0.394	0.838
Total environment	0.638	1.084
Total administrative	0.192	0.477
Total deficiencies (All)	4.620	6.747
Total G-level or higher deficiency	0.174	0.248
NHQI health outcomes		
Long-term-stay residents (%)		
Needing help with ADLs	20.261	14.561
Moderate to severe pain	4.126	4.723
Pressure sores (high risk)	11.964	12.715
Pressure sores (low risk)	2.259	2.202
Physically restrained	5.552	6.954

Variables	Mean or proportion ^a	
	States and time periods allowing for medication aide use in SNFs ^b	States and time periods not allowing for medication aide use in SNFs ^b
Depressed or anxious	16.677	12.176
Lose bowel or bladder control	52.572	50.059
Catheter inserted	5.593	4.911
Spend time in bed or chair	8.429	6.461
Ability to move about	12.865	11.154
Urinary tract infection	11.211	9.935
Explanatory variables		
Facility characteristics		
Total beds	99.268	111.871
For-profit facility (%)	72.926	70.972
Not-for-profit facility (%)	23.750	22.206
Government facility (%)	2.740	6.034
Chain operated (%)	66.278	60.533
Non-chain operated (%)	33.722	39.467
Resident characteristics		
Medicare residents (%)	18.478	17.887
Medicaid residents (%)	62.911	63.571
Resident needs assistance with eating (%)	19.181	19.409
Resident needs assistance with transfer (%)	28.276	29.332
Resident needs assistance with toilet (%)	34.189	36.559
Number of facility inspections	3,941	13,325
Total number of facilities—inspections <i>N</i> = 2,853		
Number of quarters of NHQI health outcome measures ^c	12,988	48,815
Total number of facilities—NHQI measures <i>N</i> = 2,814 ^c		

^aThe facility and resident means/proportions characteristics are taken from the inspection-level data set.

bStates allowing for medication aide use include Kentucky (throughout), North Carolina (on or after January 7, 2006), and Tennessee (on or after January 7, 2009). States not allowing for medication aide use in skilled nursing facilities include North Carolina (prior to July 1, 2006), Tennessee (prior to July 1, 2009), Alabama, Florida, Georgia, Mississippi, and South Carolina.

cThe number of quarters and facilities for the NHQI measures vary somewhat across outcome measures, as facilities with few instances of a health outcome are given missing values for that health outcome. The reported number of quarters and facilities is for the sub-sample with non-missing data for urinary tract infection.

In states allowing for medication aide use, the rate of overall pharmacy deficiencies was considerably lower when compared to other states studied, as was the prevalence of deficiencies in nearly all other categories (excepting mistreatment deficiencies). However, on average, nursing facilities in these states reported higher incidence of many of the NHQI health outcome measures for long-stay residents, including a higher percentage of residents needing help with ADLs, feeling more depressed or anxious, spending more time in bed, and experiencing loss of bowel and bladder control and UTIs.

The first-stage results as reported in Table 3 indicate the effect on medication aide use of operating within a state after use has been allowed. In both Model 1, which uses the facility inspection as the unit of analysis ($p < .001$), and Model 2 using the quarterly facility assessments as the unit of observation ($p < .01$), we find, in accordance with our first hypothesis, that nursing facilities were significantly more likely to employ more medication aides when located in states allowing for their use. Second-stage results are shown in Table 4, where each coefficient estimate on the medication aide use variable is reported for each model with a different staffing, deficiency, or NHQI health outcome measure. In terms of staffing, an increase in medication aide use resulted in a decrease in the use of non-medication nursing aides, but this result is only significant at a 10% (not 5%) significance level. Contrary to our second hypothesis, medication aide use was not statistically significant in any of the other staffing models (RNs, LPNs, or nurse administrators). Turning to deficiencies, with an increase in medication aide use, we found a decrease in total pharmacy deficiencies ($p < .001$). Individual pharmacy deficiency categories showed similar results, where increased use of medication aides was associated with a decrease in the probability of an F329 (residents are free from unnecessary drug use) deficiency citation ($p < .001$) and a decrease in the probability of an F332 (facility is free from medication error rate $\geq 5\%$) citation ($p < .001$). Other statistically significant effects related to increased medication aide utilization include a decrease in total deficiencies ($p < .01$) and most individual deficiencies categories, such as quality, assessment, residents' rights, and environment deficiencies ($p < .001$), nutrition ($p < .01$) deficiencies, and decreased administrative deficiencies ($p < .05$).

Table 3.

First-Stage Results from IV Models: Effect of State Policy Allowing for Medication Aide Use on Medication Aide Hours per Resident Day

Explanatory variables	Model 1 using facility inspection as the unit of observation		Model 2 using quarterly facility assessments as the unit of observation	
	Coefficient estimate	Standard error ^a	Coefficient estimate	Standard error ^a
Facility characteristics				
Total beds	0.000	0.000	0.000	0.000
For-profit facility (%)	−0.001	0.003	0.002	0.003
Not-for-profit facility (%)	0.001	0.005	−0.004	0.004
Chain operated (%)	−0.003	0.002	−0.002	0.003
Resident characteristics				
Medicare residents (%)	0.059	0.039	0.002	0.015
Medicaid residents (%)	0.032	0.018	0.021	0.016
Resident needs assistance with eating (%)	0.011	0.016	0.016	0.011
Resident needs assistance with transfer (%)	−0.007	0.018	0.002	0.009
Resident needs assistance with toilet (%)	0.012	0.011	−0.002	0.007
Year				
2005	0.001	0.002	0.001	0.001
2006	0.000	0.003	0.002	0.002
2007	−0.003	0.002	−0.001	0.002
2008	0.000	0.003	0.000	0.002
2009	−0.004	0.002	−0.001	0.002
2010	−0.008	0.004	−0.002	0.002
Treatment group (SNF in state allowing for medication aide use)	0.033***	0.007	0.021**	0.008
Number of observations ^b	17,195		61,789	

^aCluster-robust standard errors. Significance levels are as follows: **for 1%, and ***for .1%.

^bThe number of observations for the quarterly NHQI measures varies somewhat across outcome measures, as facilities with few instances of a health outcome are given missing values for that health outcome. The reported number of observations and results is for the sub-sample with non-missing data for urinary tract infection.

Table 4.

Second-Stage Results from IV Models: Effect of Medication Aide Hours per Resident-Day on Staffing, Deficiencies, and NHQI Health Outcome Measures

Outcome variables	Medication aide hours per resident-day	
	Coefficient estimate a	Standard error b
Other staffing measures		
RN hours per resident-day	−0.304	0.277
LPN hours per resident-day	0.103	0.323
Nurse administrator hours per resident-day	0.130	0.234
Non-medication nursing aides hours per resident-day	−1.835	0.994
Pharmacy deficiencies		
F329—Resident free from unnecessary drug use	−31.268***	4.634
F332—Facility free from medication error rate $\geq 5\%$	−16.917***	4.505
F333—Resident free from significant medication error	4.132	6.727
Total pharmacy	−5.990***	1.476
Total G-level or higher pharmacy deficiency	−0.096	0.105
Other deficiencies		
Mistreatment	0.019	0.495
Quality	−10.954***	2.795
Assessment	−4.545***	1.277
Nutrition	−2.428**	0.899
Residents' rights	−7.213***	1.875
Environment	−6.460***	1.744
Administrative	−1.673*	0.798
Total deficiencies (All)	−14.416**	5.423
Any G-level or higher deficiency	−5.181***	1.421
NHQI health outcomes		
Long-term-stay residents (%)		
Needing help with ADLs	43.286***	12.704
Moderate to severe pain	−4.389	8.351
Pressure sores (high risk)	−13.718	11.658
Pressure sores (low risk)	−5.483	5.780

Outcome variables	Medication aide hours per resident-day	
	Coefficient estimate ^a	Standard error ^b
Physically restrained	−64.709*	26.066
Depressed or anxious	−13.332	13.517
Lose bowel or bladder control	47.311*	18.677
Catheter inserted	−0.648	4.767
Spend time in bed or chair	0.480	10.580
Ability to move about	1.569	9.137
Urinary tract infection	−3.975	8.628
Number of facility inspections	17,195	
Number of quarters of NHQI health outcome measures ^c	61,789	

aEach coefficient estimate is from a model of a particular quality measure, where the key explanatory variable is medication aide use. Other explanatory variables include total beds, indicators for for-profit and not-for-profit (government-owned is reference), binary indicator for chain operated (non-chain is reference), Medicare residents (%), Medicaid residents (%), resident needs assistance with eating (%), resident needs assistance with transfer (%), resident needs assistance with toilet (%), and a binary indicator for being in a state that allows for medication aide use.

bCluster-robust standard errors. Significance levels are as follows: *for 5%, **for 1%, and ***for .1%.

cThe number of observations for the quarterly NHQI measures varies somewhat across outcome measures, as facilities with few instances of a health outcome are given missing values for that health outcome. The reported number of observations and results is for the sub-sample with non-missing data for urinary tract infection.

Finally, examining NHQI health outcomes impacted by an increase in medication aide use, we noted a significant increase in the percentage of residents reported to need help with ADLs ($p < .001$). In addition, we found an increase in the percentage of residents with lost bowel or bladder control ($p < .05$) and found that higher medication aide use significantly decreased use of physical restraints ($p < .05$). In general, these results do not support the second and third hypotheses, which posited a negative effect of medication aide use on skilled nursing facility quality.

Discussion

As proposed in hypothesis 1, we found a significant increase in the use of medication aides in states allowing for the administration of medications by trained CNAs. Yet, the increased use of medication aides did not lead to the use of fewer licensed nurses and provides little support for hypothesis 2. Staffing levels of non-medication aides were lower, but when combined with the medication aide staff

numbers, total facility CNA levels in facilities that were in states and time periods that allowed for medication aide use were similar to CNA staffing levels in facilities in states and time periods not allowing for medication aide use.

Hypothesis 3 posited a negative effect of medication aide use on quality as measured by inspection deficiency citations and long-stay-resident health outcomes. This hypothesis was not supported, as medication aide use did not lead to an increase in reported deficiencies and in poorer resident health outcomes. In fact, the results are consistent with a significant and positive effect of medication aide use on reducing citations for pharmacy deficiencies. In the states studied, decreases in total pharmacy deficiencies resulting from higher levels of medication aide use are the net result of both a decrease in the probability that a facility was cited for not keeping residents free from unnecessary drugs and a decrease in the probability of being cited for a medication error rate of 5% or more. Keeping residents free from unnecessary drugs requires communication between the RN or LPN, physician, psychiatrist, pharmacist, and the medication aide administering the medication as well as the availability and attention of RNs or LPNs for supervision of CNAs and coordination of resident care. Studies have reported the challenges RNs and LPNs face balancing the duties of caring for residents while overseeing the work of the CNAs (Eriksson & Fagerberg, 2008; Hall, 2005; Siegel et al., 2008). Allowing for medication aides may free up RN and LPN time for higher-level tasks. When medication aide use was increased, the results also indicate a decrease in the probability of having a high medication error rate. This positive effect could be a result of the medication aide's ability to focus on the process of administering medications without being distracted or called away from the medication cart to complete other duties. Studies indicate that an estimated 350,000 adverse drug events occur in skilled nursing facilities in the United States each year (Gurwitz et al., 2005), indicating an important quality problem that exists within the industry that might be mitigated by increased medication aide use.

Decreases in the number of quality, assessment, nutrition, resident's rights, environment, administrative, and G-level or higher deficiencies (causing harm or jeopardy) might be related to a decrease in the medication administration duties of the licensed nurse (RN or LPN). Although the medication aide is administering medications, the licensed nurse is able to supervise CNAs and observe other aspects of resident care. Additionally, the decreased number of administrative deficiencies resulting from higher levels of medication aide use may be attributable to a required focus on various aspects of medication aide use necessitated by state law. For a facility to allow medication aides to pass medication, considerable administrative focus around nursing training, competency, and licensure is required. Attention to these details may have spillover effects on other nursing and resident care tasks that result in fewer deficiency citations.

When examining the impact of medication aide use on facility-level NHQI health outcomes, we noted a significant decrease in the incidence of physical restraint use in facilities locating in states allowing for medication aide use. Realizing that nursing assistants in skilled nursing facilities provide most of the direct resident care (including assisting with ADLs, and proper positioning, hydration, and hygiene care for bed-bound residents), it is possible that the medication aide is feeling empowered by the additional training and status. These feelings, thus, direct the aide to attend to non-medication resident needs that are noted during the resident contact related to medication administration. Studies of individual empowerment have shown that if the employee perceives his work to be important and meaningful, he/she will feel highly competent (Bandura, 1997; Ford & Fottler, 1995; Spreitzer, Kizilos, & Nason, 1997). Yeatts and Cready (2007) reported that empowered CNA work teams had better performance,

improved resident care, and improved procedures, coordination, and cooperation between CNAs and RNs and LPNs. The medication aide is likely to feel empowered as he/she administers medications on 'her hall.' If he/she notices that a resident is physically restrained, he/she will be likely to verify its appropriateness and communicate this to a nurse. In contrast, an RN or LPN who is already feeling pressed for time may continue with the medication pass without directly and immediately verifying the appropriate use of a restraint. However, it is important to note that restraint use in skilled nursing facilities throughout the United States was trending downward during this same time period (AHRQ, 2009). Facilities in those states that adopted use of medication aides may have also focused on reducing restraint use over the period examined.

Increases in the percent of residents needing help with ADLs or with lost bowel or bladder control could be a result of differences between the interaction of the MDS coordinator with medication aides versus with RNs/LPNs. MDS coordinator interactions with staff are critical for information flow and resident assessment and care planning (Piven et al., 2006). Often the MDS coordinator will communicate with the resident's caregivers when completing the quarterly or annual assessments. If he/she asks the RN/LPN questions related to the ambulation or continence of residents, he/she may get a different response than he/she would if asking a medication aide, as these typically are functions of CNAs. The medication aide, for example, may report more residents needing help with ADLs as she has provided ADL assistance during the last quarter, whereas the RN or LPN has not provided the care nor observed the CNA assisting the resident. In addition, the increases could be related to licensed nurse observation of resident care activities while the medication aide completes the 60–90-minute medication administration three times a day, resulting in a more realistic report of residents needing assistance with ADLs and loss of bowel or bladder control. However, it is also possible that the relationship between medication aide use and ADLs is due to the inadequate risk adjustment in our models; our data do not allow us to disentangle these competing explanations.

Finally, the use of medication aides by nursing facilities coincides with recent literature promoting the use of consistent assignment (Castle, 2011) and job enrichment programs for CNAs (Barry, Brannon, & Mor, 2005). Similar to the staffing pattern used for other nurses, we would expect medication aides to be assigned to the same hall and same residents each shift to pass medications. This consistency of assignment and advanced CNA position could contribute to the decreases in deficiency citations and the physical restraint of residents.

To our knowledge, this is the first study of state policies allowing for the use of medication aides in skilled nursing facilities. The use of longitudinal data, a mix of facilities subject to and not subject to the policy allowing medication aide use over time, and an instrumental variables approach to account for the endogeneity of medication aide use allow us to confirm a causal relationship between medication aide use resulting from state policies allowing for their use and various staffing, deficiency, and health outcome variables.

Our study is not without limitations. We selected the eight southeastern states within CMS Region 4 believing that both the facilities and regulatory teams maintain some degree of geographic and cultural homogeneity. This may limit the generalizability of our findings due to the known variation in OSCAR outcomes across CMS regions. We recognize that the findings may change in future research that uses more states or time periods. Although every effort was made in the study to eliminate outliers, reporting errors, and extreme staffing levels, the data sets have potential intrinsic limitations, including

the known self-reporting bias and validity concerns with OSCAR staffing data (Castle, 2008; Kash, Hawes, & Phillips, 2007). Although OSCAR staffing data is not perfect, it is the only uniform national data source for nurse staffing data and is widely used for studies of nursing facility staffing–quality relationships. Bostick and colleagues (2006) noted in their systematic review that there appears to be agreement that the measure of HPRD is the most accurate measure currently available to capture staffing for national comparisons. Studies differ, however, on whether facility reporting of staffing during the 2 weeks prior to state survey is underreported (Feng, Katz, Intrator, Karuza, & Mor, 2005) or overreported (Harrington, Kovner, et al., 2000; Harrington, Zimmerman, et al., 2000; Zhang & Grabowski, 2004). Any errors in the reported use of medication aides are likely to bias the coefficients on medication aides toward zero in our analyses, potentially indicating no effect of medication use when the true effect is statistically significant. In addition, future researchers may consider a larger set of control variables, including occupancy rates, and more detailed case-mix adjustment measures.

Implications

The safety and health of nursing facility residents should be the number one concern of legislators, administrators, medical practitioners, and family members. In states allowing for medication aide use, we find that, on average, nursing facilities increased their use of medication aides and improved quality of care, without significant decreases in RN or LPN staffing levels. This analysis highlights some apparent benefits of using medication aides to administer medications in the nursing facility, such as reductions in the proportion of facilities cited for pharmacy, quality, assessment, nutrition, residents' rights, environment, and G-level (causing harm or jeopardy) deficiencies, and with fewer residents being physically restrained. Many recent studies have shown that the staffing composition is a key to skilled nursing facility quality (Arling et al., 2007; Castle & Anderson, 2011). Our results suggest that using medication aides, focused on administering medications, allows licensed nurses more freedom to engage in more critical nursing care and supervision of CNAs; however, future researchers may wish to focus on qualitative studies around the changing nature of the RN or LPN job in the face of increased medication aide use. Because our study is confined to the southeastern United States, our results may not be generalizable to other regions of the United States. However, our findings would support expansion of medication aide use in skilled nursing facilities in two states in the region, Georgia and South Carolina, that already have training programs and certification requirements in place authorizing medication technicians' use in community residential care facilities. More research into the costs and benefits of medication aide use could further encourage Boards of Nursing in other states to consider promoting such an arrangement in skilled nursing facilities.

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