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# Physical Restraint Initiation in Nursing Homes and Subsequent Resident Health

John Engberg, PhD,[1] Nicholas G. Castle, PhD,[2] and Daniel McCaffrey, PhD[1]

***Purpose:*** It is widely believed that physical restraint use causes mental and physical health decline in nursing home residents. Yet few studies exist showing an association between restraint initiation and health decline. In this research, we examined whether physical restraint initiation is associated with subsequent lower physical or mental health. ***Design and Methods:*** We used all nursing homes ($N = 740$) in Pennsylvania in 2001, with 12,820 residents. We used the Minimum Data Set data; Online Survey, Certification and Reporting data; and the Area Resource File as data sources. We restricted our sample to newly admitted nursing home residents who were not restrained in the first two quarters of their residency. We examined which facility and individual characteristics during those first two quarters were associated with restraint initiation during the third quarter. We then examined the association of third-quarter restraint initiation with fourth-quarter health outcomes, using regressions that controlled for first- and second-quarter health status as well as other resident, facility, and market characteristics. The physical health outcomes examined consisted of falls, walking dependence, activities of daily living (ADLs), pressure ulcers, and contractures. Mental health outcomes examined consisted of cognitive performance, depression, and behavior problems. ***Results:*** The initiation of restraint use was associated with a previous fall ($p < .01$), psychoactive medication use ($p < .05$), low cognition ($p < .01$), ADL scores ($p < .01$), and the absence of pressure ulcers ($p < .10$), as well as a variety of facility characteristics. Subsequent to restraint initiation, we found an association with lower cognitive performance ($p < .01$), lower ADL performance ($p < .01$), and higher walking dependence ($p < .01$). ***Implications:*** We found that an association between restraint initiation and subsequent adverse health consequences exists and is substantial. Moreover, these results would appear to have practical as well as statistical significance.

*Key Words: Physical restraint, Outcomes, Health, Nursing homes*

A physical restraint is "a device that is attached . . . and cannot be easily removed by the resident which restricts freedom of movement and/or normal access to his/her body" (State Operations Manual, 2002, p. 23). Some believe that these restraints cause negative health outcomes for nursing home residents. But in actuality, many of the pernicious effects of physical restraint use are not well investigated, and questions exist as to whether adverse effects of restraint use exist. Thus, in this study we investigated the nexus between the use of physical restraints and the subsequent lower health status of residents.

Understanding whether physical restraints contribute to health problems is important. As others have pointed out, it is not good clinical practice, or even ethical, to physically restrain nursing home residents (Evans & Strumpf, 1989). Consumer groups such as the National Citizens Coalition for Nursing Home Reform have been particularly successful in sensitizing policy makers, the public, and practitioners about the indiscriminate use of physical restraints in nursing homes. However, if restraints are shown to cause physical or mental health decline, a more powerful rationale for limiting their use may develop, helping further reduce restraint use and improving the health and satisfaction of residents. With a concomitant reduction in residents with health problems, nursing homes may then better provide services to other impaired residents.

Prior studies have shown that restraint use may be associated with mental health problems, including

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Address correspondence to Nicholas G. Castle, PhD, A610 Crabtree Hall, 130 DeSoto Street, School of Public Health, University of Pittsburgh, Pittsburgh, PA 15261. E-mail: CASTLEN@Pitt.edu
[1]RAND Corporation, Pittsburgh, PA.
[2]School of Public Health, University of Pittsburgh, PA.

increased social isolation and decreased cognitive function. Restraint use can create social isolation, as both other residents and staff avoid restrained residents (Lofgren, MacPherson, Granieri, Myllenbeck, & Sprafka, 1989). Social isolation negatively impacts the health of elders (Mor et al., 1995). Folmar and Wilson (1989) suggested that the least socially active residents are most likely to be restrained, which further attenuates their social performance. In addition, combative residents often become more combative when restrained (Marks, 1992). Burton, German, Rovner, and Brant (1992) suggested that restraints may contribute to cognitive decline. Moseley (1997) determined that physical restraint use was associated with increased resident disorientation and walking dependence.

Residents are frequently restrained to prevent them from falling (Capezuti, Evans, Strumpf, & Maislin, 1996). However, restrained residents still experience falls. For example, Werner, Cohen-Mansfield, Braun, and Marx (1989) cited a resident who fell four times, even though he was restrained during three of these falls. In an empirical analysis, Mion, Frengley, Jakoveic, and Marino (1989) identified more frequent falls ($p = .001$) in restrained patients. Tinetti, Wen-Liang, Marottoli, and Ginter (1991) found serious fall-related injuries in 17% of restrained residents as compared to 5% of those who remained unrestrained (significant at $p < .001$). In contrast, Ejaz, Folmar, Kaufmann, Rose, and Goldman (1994) identified a significant increase in falls after the implementation of a restraint reduction program. However, a more recent study by Capezuti and associates (1996) found restraint use to neither increase nor decrease falls among nursing home residents. Levine, Marchello, and Totolos (1995) did not observe any increase in the number of falls (or injuries) over a 3-year period, even though they reduced restraint use from 39% to 4%. It is interesting to note that falls are probably the most researched health consequence associated with physical restraint use, yet the findings of these studies are equivocal.

It is also worth noting that federal regulations mandate that to prevent the damaging side effects of immobility due to restraint, restrained residents should be released, exercised, and repositioned every 2 hours (Schnelle, Simmons, & Ory, 1992). However, Schnelle and colleagues (1992) determined that facilities often do not follow this mandate. Rather, they found that facilities with restrained residents also have poor restraint management practices. Two other well-known consequences of immobility are pressure ulcers and contractures. Pressure ulcers affect both the comfort and the medical outcomes of nursing home residents with impaired mobility. Contractures are an abnormal shortening and stiffening of muscle tissue that can decrease the range of motion at a joint. This can produce a change in gait and a decrease in walking velocity—both of which are major risk factors for falls—and may also limit mobility in daily life.

Based on these prior studies, we hypothesized that the initiation of physical restraints would be associated with lower subsequent mental and physical health outcomes. Following these prior studies, we examined the following mental health outcomes: cognitive performance, depression, and behavior issues. Also following these prior studies, we examined the following physical health outcomes: falls, activities of daily living (ADLs), pressure ulcers, contractures, and walking dependence.

These previous studies were mostly observational and used small sample sizes. The most comprehensive empirical examination in this area comes from Castle (2006), who, using 2,000 nursing home residents, found that restraint use was associated with lower cognitive performance, depression, and social engagement. However, this study only examined mental health outcomes (Castle, 2006). In addition, this study, and all others in this area, used limited statistical tests that could not account for potential biases such as the fact that residents who have already become impaired may be most likely to be restrained. Some of these studies were done at the facility level and aggregated nonrepresentative samples of residents. Other studies did not account for different sources of resident and facility variation. Thus, in this analysis we used a large sample size and took into consideration statistical variation at the market, facility, and individual level in a regression model of outcomes. Most important, we used the longitudinal information on a sample of unrestrained new residents and investigated the factors that are associated with restraint initiation and the subsequent health outcomes of individuals who are and are not restrained.

## Methods

### *Data*

Three sources of information constituted the primary project database: Minimum Data Set (MDS) data; Online Survey, Certification and Reporting (OSCAR) system data; and the Area Resource File.

The MDS is a summary assessment of nursing home residents. It was created to measure residents' functional status, health conditions, services received, demographics, and payer source and has nearly 400 data elements, including cognitive function, communication/hearing problems, physical functioning, continence, psychosocial well-being, mood state, activity and recreation, disease diagnoses, health conditions, skin conditions, special treatments, and medication use. All Medicare- and Medicaid-certified nursing facilities are required to use the MDS on at least three occasions: (a) on admission, (b) at least annually, and (c) if the resident shows "significant change." In addition, all

residents are assessed quarterly on a subset of the MDS. In this analysis, we used both the full MDS and subsequent quarterly MDS assessments of residents. The MDS data are carefully constructed and reliable (Hawes et al., 1995).

The OSCAR contains facility and aggregated resident data routinely collected through the nursing home certification process conducted by state licensure and certification agencies (Harrington, Zimmerman, Karon, Robinson, & Beutel, 2000). Approximately 17,000 facilities are included in the OSCAR. OSCAR files include data for general facility characteristics, including facility ownership, number of beds, and the average census. The validity and reliability of many OSCAR data elements is debatable (Straker, 1999); nevertheless, the facility characteristics used in this analysis generally are considered accurate and reliable (Harrington et al., 2000).

The Area Resource File is a publicly available data set summarizing a large array of census, health, and social resource information. It is not a primary data collection effort but a compilation of data taken from sources such as the American Hospital Association annual hospital survey, the U.S. Census of Population and Housing, and the National Center for Health Statistics. Extensive details regarding this data can be found on the World Wide Web (http://wonder.cdc.gov/wonder/sci_data/census/arf).

### Sample Selection

In this analysis we used residents and facilities from Pennsylvania. We used this state because of data availability and because it represents a sample of convenience. We excluded short-stay residents, hospice residents, and those in a coma. Although restraint use on all residents is important, coma and hospice residents have special issues that are distinct from those of the general population and are beyond the scope of our study. The outcomes we used cannot be utilized for coma residents and for short-stay residents (less than 3-month length of stay); and for hospice residents (less than 6-month length of stay), multiple data points for the outcomes of interest are unlikely and resident health status is likely to be more transitional.

A further analytic consideration was the need to specify an index point in time for the initial assessment of mental/physical health status and use of restraints. One conservative way of doing so, which we used, was to examine ''new'' nursing home residents. We could identify residents new to the nursing home from the MDS. We restricted our sample to residents for whom the MDS contained at least four records approximately 3 months apart, the first of which had to be an admission assessment. We used only one admission per individual to avoid unmeasured correlation among repeat stays by the same individual.

The requirement that we observe the admission record plus at least three subsequent records spaced approximately 3 months apart eliminated all individuals who were admitted before 2001, who were admitted later than March 2001, or who stayed less than 9 months. We also eliminated nonelderly and comatose patients. This left almost 14,000 residents in Pennsylvania. We eliminated approximately 8% who were restrained during the first two quarterly records. This left us with an analytic sample of 12,820 residents. This number represented approximately 20% of the Pennsylvania resident census for 2001. Of these residents, 2.3% were restrained in the third quarter of their stay. This rate is lower than the prevalence rates cited elsewhere in our study because it reflects the incidence of restraint initiation rather than the overall prevalence. Table 1 gives these and other descriptive statistics.

### Dependent and Independent Variables

We examined the restraint process in two steps. In the first step, we modeled who got restrained. In the second step, we modeled the association of restraint initiation with subsequent changes in health outcomes.

In the first step, the dependent variable was physical restraint initiation. Restraint type and use are given in Section P of the MDS, and five categories (types) of restraint use can be recorded: (a) full bed rails on all open sides of bed, (b) other types of side rails used (e.g., half rail, one side), (c) trunk restraint, (d) limb restraint, and (e) chairs prevent rising. No further detail, other than these five categories of restraints, is available from the MDS. However, a national advisory committee created these five categories to be both comprehensive and distinct from one another (Hawes, Vladeck, Morris, Phillips, & Fredeking, 2003). Thus, it is likely that these categories are sufficient to capture restraint use. Furthermore, the inclusion of few ''clarifications'' in the *MDS 2.0 Training Manual* indicates that the industry is able to use these categories with few problems.

We created a single dichotomous measure of restraint use that indicated whether trunk, limb, or chair restraints were used. We excluded information on bed rail restraints. We used the values of this restraint use variable in the first and second quarter to define our analytic sample, which consisted of individuals who were not restrained in either of these quarters. The third-quarter value of this variable was the dependent variable in the first step of the analysis, as described more fully in ''Statistical Analysis.''

The physical health outcomes examined consisted of falls, walking dependence, ADLs, pressure ulcers, and contractures. Mental health outcomes examined consisted of cognitive status, alterations in mood, and behavior problems. These are shown in Table 1

**Table 1. Dependent and Independent Variables**

| *M* (*SD*) | Variable | Operational Definition |
|---|---|---|
| Dependent variables[a] | | |
| 2.662 (1.653) | CPS | Measure of cognitive performance using five MDS items (comatose status, short-term memory, ability to make decisions, ability to make self understood, and self-performance in eating); higher values indicate lower cognitive functioning. |
| 2.791 (1.502) | ADL scale | Five items from the MDS (transfer, locomotion, dressing, eating, and toilet use); higher values indicate lower functioning. |
| 0.872 (1.587) | Depression | Measure of depression (MDS-DRS) using seven MDS items (resident made negative statements; persistent anger and irritability with self and others; expressions of what appear to be unrealistic fears; repetitive health complaints; repetitive anxious complaints/concerns [non-health-related]; sad, pained, worried facial expressions; and crying, tearfulness); higher values indicate greater depression. |
| 0.411 (0.855) | Behavior issues | Measure of resident behavior problems using four MDS items (verbally abusive, physically abusive, socially inappropriate/disruptive behavior, and resisted assistance in ADLs); higher values indicate greater behavior problems. |
| 0.160 (0.366) | Falls | Dichotomous variable indicating having fallen in the past 30 days. |
| 0.078 (0.267) | Pressure ulcers | Dichotomous variable indicating presence of any pressure ulcer. |
| 0.019 (0.135) | Contractures | Dichotomous variable indicating presence of any contracture. MDS records contractures as: 1 = none, 2 = face/neck, 3 = shoulder/elbow, 4 = hand/wrist, 5 = hip/knee, and 6 = foot/ankle. |
| 0.745 (0.436) | Walking dependence | Dichotomous variable indicating assistance needed when walking in room. |
| Independent variables | | |
| 0.023 (0.150) | Restraint use[b] | Dichotomous variable indicating use of trunk, limb, or chair restraints. |
| 0.093 (0.291) | Psychoactive meds[c] | Whether psychoactive medications are given or not, including four categories of drugs (antianxiety, sedative/hypnotic, antipsychotic, or antidepressant). |
| 83.590 (7.415) | Age[d] | Standardized age (in years). |
| 0.236 (0.425) | Male[d] | Male = 1, female = 0. |
| 0.080 (0.271) | Black[d] | Racial/ethnic background = 3 (racial/ethnic background as recorded on the MDS: 1 = American Indian/Alaska native; 2 = Asian/Pacific Islander; 3 = Black, not of Hispanic origin; 4 = Hispanic; 5 = White, not of Hispanic origin). |
| 0.010 (0.098) | Other minority[d] | Racial/ethnic background = 1, 2, or 4 (racial/ethnic background as recorded on the MDS: 1 = American Indian/Alaska native; 2 = Asian/Pacific Islander; 3 = Black, not of Hispanic origin; 4 = Hispanic; 5 = White, not of Hispanic origin). |
| 0.411 (0.492) | Ownership[d] | For profit or not for profit (for profit = 1, other = 0). |
| 0.514 (0.500) | Chain[d] | Whether facility is a member of a nursing home chain. |
| 0.623 (0.214) | Medicaid occupancy[d] | Average daily Medicaid occupancy rate (fraction of total occupancy). |
| 193.202 (154.092) | Bed size[d] | Number of beds. |
| 0.899 (0.087) | Occupancy rate[d] | Average daily overall occupancy rate. |
| 0.051 (0.029) | RNs per bed[d] | FTEs of RNs aides per bed. |
| 0.095 (0.046) | LPNs per bed[d] | FTEs of LPNs per bed. |
| 0.297 (0.096) | NAs per bed[d] | FTEs of NAs per bed. |
| 2.255 (1.063) | NA per nurse[d] | FTEs of NAs divided by number of LPNs and RNs. |
| 1.166 1.248) | Competition[d] | Market competition measured with the Herfindahl index: each facility's percentage share of beds in the county divided by the sum of the squared market shares of all facilities in the county (0–1) calculated for nursing facilities. |
| 0.878 (0.047) | County occupancy rate[d] | Average occupancy rate for nursing facilities in the market. |
| 0.571 (0.160) | Nonprofit market share[d] | Proportion of nonprofit facilities in county. |
| 0.330 (0.153) | Managed care[d] | Managed care penetration in the county. |

*Notes*: $N$ = 12,820. The dependent variables come from the MDS, measured in the fourth quarter post admission. The independent variables restraint use, psychoactive meds, age, male, Black, and other minority come from the MDS; the nonprofit market share and managed care come from the Area Resource File; and all remaining independent variables come from the Online Survey, Certification and Reporting system. CPS = Cognitive Performance Scale; MDS = Minimum Data Set; ADL = activity of daily living; MDS-DRS = MDS–Depression Rating Scale; RN = registered nurse; FTE = full-time equivalent; LPN = licensed practical nurse; NA = nurse aide.

[a]Also used as lagged variables to control for prior health status measured in the first and second quarters.
[b]Measured in the third quarter post admission.
[c]Measured in the first and second quarters post admission.
[d]Measured at admission.

and described in more detail below. As described in "Statistical Analysis," we used the values of these outcome measures in the first two quarters to risk adjust, and the values in the fourth quarter were the dependent variable in the second step of the analysis.

The MDS records two measures of falls: (a) fell in past 30 days, and (b) fell in past 31 to 180 days. Given that restraint use is likely to cause muscle deconditioning and problems with balance, we believe a fall could occur as a result of restraint initiation. We based our measure on falls within 30 days because the longer time frame would overlap with the third-quarter measurement. It was important that we measure falls subsequent to restraint initiation.

The MDS records whether a resident can walk independently in his or her room. We created a dichotomous variable that indicated walking dependence; we coded the variable as 0 if the resident could walk independently and 1 if the resident needed supervision or assistance or could not perform this task.

We used a score measuring ADL status. We created this from five MDS items: transfers, locomotion, dressing, eating, and toilet use. We gave residents dependent in a category a score of 1, and those independent a score of 0. Thus, we used a 6-point scale from 0 to 5, with higher values indicating greater ADL impairment.

The MDS records pressure ulcers as follows: 1 = Stage 1, a persistent area of skin redness (without a break in the skin) that does not disappear when pressure is relieved; 2 = Stage 2, a partial-thickness loss of skin layers that presents clinically as an abrasion, blister, or shallow crater; 3 = Stage 3, a full thickness of skin is lost, exposing the subcutaneous tissue—presents as a deep crater with or without undermining; and 4 = Stage 4, a full thickness of skin and subcutaneous tissue is lost, exposing muscle and/or bone. We created a dichotomous variable that indicated the presence of one or more pressure ulcers at any stage.

The MDS records contractures as follows: (1) none, (2) face/neck, (3) shoulder/elbow, (4) hand/wrist, (5) hip/knee, and,(6) foot/ankle. We set our dichotomous measure of contractures equal to 1 if any of these contractures was present.

Depression was measured using the MDS–Depression Rating Scale (Burrows, Morris, Simon, Hirdes, & Phillips, 2000). This scale is based on seven MDS items and achieved a correlation of .69 with the Cornell scale and .70 with the Hamilton Depression Rating Scale. This has a range of scores from 0 to 6.

The MDS also includes a behavior problems index that has been used successfully by several researchers. Snowden and associates (1999) determined that the MDS index of behavior problems had a .50 correlation with physician-observed behavior problems. This has a range of scores from 0 to 3.

For a quantitative assessment of the mental health status of residents we used the Cognitive Performance Scale. Gruber-Baldini, Zimmerman, Mortimore, and Magaziner (2000) determined that the MDS Cognitive Performance Scale had a .68 correlation with the Mini-Mental State Examination. This has a range of scores from 0 to 6.

### *Control Variables*

Outcomes can rarely be fully attributable to antecedent care and are therefore often "adjusted" for differences in risk for adverse outcome among patients (and/or facilities). Clearly, in an investigation of health outcomes as a consequence of physical restraint initiation, resident risk factors for physical restraint initiation and physical/mental health need to be carefully controlled. This is because some resident factors may be associated with both physical restraint initiation and physical/mental health outcomes. Several studies have characterized characteristics of nursing home residents that predict physical restraint initiation, and several resident (i.e., demographic and clinical) characteristics are consistent in their association with restraint initiation. These include age, gender, race/ethnicity, cognition, ADL status, history of falls, psychotropic medication use, mental health, and ambulatory status (Capezuti et al., 1996; Castle & Mor, 1998).

Given prior findings showing a relationship between the structural characteristics facility size, staffing, staff-to-patient ratios, occupancy rate, ownership, chain membership, and Medicaid census in the use of physical restraints, we included these factors in this analysis as facility-level control variables (Davis, 1991).

We also included several market and policy factors. These variables were significant in studies that examined the utilization of other nursing home services. They include competition (measured using the Herfindahl index) and managed care penetration (Banaszak-Holl & Hines, 1996).

### *Statistical Analysis*

We first analyzed factors that were associated with the initiation of physical restraints. We examined the association of resident, facility, market, and policy factors with restraint initiation for a sample of new residents who were unrestrained for the first two quarters of residency. By conditioning on these health status variables measured at admission and in the second quarter, we accounted for the residents' health status and health trend in a very comprehensive way. Next we analyzed the association of restraint initiation with subsequent physical and mental health, controlling for prior physical and mental health, facility, and market characteristics. We motivated these analyses with

simple empirical models of the decision by a facility to restrain a resident and of the subsequent change in health status.

In a simple model of the decision by a facility to restrain a resident, this is the result of the facility's orientation (this may be an explicit policy, or culture, or normal operating procedure) to the particular situation of the resident. From the perspective of the facility, residents can be characterized by the degree to which their care would be made easier if they were restrained. We call this characteristic $R^*_i$, where the subscript $i$ represents an individual resident. Residents will have a higher value of $R^*_i$ if they are more likely to disrupt the facility and harm themselves or others if left untended and unrestrained. In the empirical work, we represent $R^*_i$ for each resident as a linear combination of health status measures, demographic measures, and an unobserved residual.

Each facility has an orientation that it applies to its residents to determine whether a resident should be restrained. The orientation for facility $j$ is represented by a cutoff value $P^*_j$. A facility will have a higher value of $P^*_j$ if it has a more aggressive restraint orientation. Facility $j$ will restrain all of its residents for whom the advantage to the facility of restraints exceeds this cutoff: $R^*_i > P^*_j$. Facilities will differ in the value they place on restraint use and therefore have different values of $P^*_j$. Formally, the model can be written as follows:

$$R_i = 1 \quad \text{if} \quad R_i{*} > P_j{*} = 0, \tag{1}$$

otherwise

$$R_i{*} = \mathbf{X}_i\beta + \varepsilon_i, \tag{2}$$

$$P_j{*} = \mathbf{Z}_j\gamma + \upsilon_j, \tag{3}$$

where $\mathbf{X}_i$ is a vector of measured resident characteristics, $\mathbf{Z}_j$ is a vector of measured facility characteristics, $\varepsilon_i$ and $\upsilon_j$ represent unmeasured resident and facility characteristics, and $\beta$ and $\gamma$ are coefficient vectors to be estimated. Equation 1 represents the application of facility $j$'s restraint orientation to resident $i$, resulting in the resident being restrained ($R_i = 1$) or not ($R_i = 0$).

The appropriate method for estimating the coefficients associated with the restraint initiation decision depends on the assumptions that are made regarding the distributions of the unmeasured resident and facility characteristics $\varepsilon_i$ and $\upsilon_j$. The unmeasured resident characteristic $\varepsilon_i$ is modeled with a logistic distribution that is independent of $\mathbf{X}_i$ and $\mathbf{Z}_j$. We model the distribution of $\upsilon_j$ with a normal distribution that is independent of the other characteristics ($\mathbf{X}_i$, $\mathbf{Z}_j$, and $\varepsilon_i$). This model is referred to as a random effects logit (Robins, 2003). This model accounts for the nesting of residents within facilities and provides estimates of the impact of resident and facility characteristics on the probability of a resident being restrained.

For the second analysis, we modeled the impact of restraints on resident health status with the following equation:

$$H_i = R_i\alpha_1 + \mathbf{X}_i\alpha_2 + \mathbf{Z}_j\alpha_3 + \omega_j + \eta_i. \tag{4}$$

Here, $H_i$ is any one of various measures of health status measured at a time following the decision of whether to restrain resident $i$. Parameter $\alpha_1$ captures the impact of the restraint decision. Equation 4 indicates that $H_i$ depends on the same measured resident and facility characteristics that affect the restraint decision. In particular, the collection of resident characteristics contained in $\mathbf{X}_i$ includes the same information on health status measured by $H_i$ although measured prior to the decision of whether to restrain the resident.

The measures of health status that we used as the dependent variables in Equation 4 were from the fourth quarterly record. Again, we let a quarter pass, rather than use health status from the third quarter, because we wanted to be certain that we took our measures of health status following the imposition of restraints for those residents who were restrained.

## Results

Table 2 contains the estimates of the logit specification for physical restraint initiation using the Pennsylvania sample. We found that a personal history of falls in the first two quarters was associated with restraint initiation in the third quarter and that an increase in falls from the admission quarter to the second quarter was further associated with restraint initiation. Likewise, low ADL performance in the first two quarters was associated with restraint initiation, and the worsening of ADL performance between the admission quarter and the second quarter was further associated with restraint initiation. Low cognitive performance and the absence of pressure ulcers during the first two quarters were associated with restraint initiation, but changes in these measures between the admission quarter and the second quarter did not have a significant association with restraint initiation. The average use of psychoactive medications in the first two quarters of residency was associated with restraint initiation in the third quarter. Demographics (age, race, gender) were all insignificant. For-profit facilities, facilities with a low ratio of nurse aides to nurses, and facilities in counties with high managed care penetration were more likely to use physical restraints.

Table 3 shows the eight outcomes examined subsequent to physical restraint initiation. We found that lower cognitive performance ($p < .001$), lower ADL performance ($p < .001$), and more walking dependence ($p < .001$) were associated with prior restraint use. We did not find a significant relationship between physical restraint initiation and

**Table 2. Factors That Affect Initiation of Physical Restraint Use**

| Variable | Physical Restraint Use in Third Quarter of Stay | |
|---|---|---|
| | Coefficient | *SE* |
| Health status variables | | |
| CPS (average of first two quarters) | 0.269*** | 0.050 |
| CPS (change) | 0.048 | 0.065 |
| ADL scale (average of first two quarters) | 0.402*** | 0.091 |
| ADL scale (change) | 0.290*** | 0.081 |
| Depression (average of first two quarters) | 0.009 | 0.053 |
| Depression (change) | −0.017 | 0.042 |
| Behavior issues (average of first two quarters) | 0.107 | 0.080 |
| Behavior issues (change) | −0.005 | 0.061 |
| Falls (average of first two quarters) | 1.197*** | 0.177 |
| Falls (change) | 0.202** | 0.099 |
| Pressure ulcers (average of first two quarters) | −0.139 | 0.231 |
| Pressure ulcers (change) | −0.308** | 0.151 |
| Contractures (average of first two quarters) | −0.021 | 0.565 |
| Contractures (change) | 0.579 | 0.540 |
| Walking dependence (average of first two quarters) | −0.302 | 0.310 |
| Walking dependence (change) | 0.046 | 0.234 |
| Resident control variables | | |
| Age | 0.170 | 0.163 |
| Age squared | −0.001 | 0.001 |
| Male | 0.097 | 0.147 |
| Black | 0.022 | 0.260 |
| Minority (other than Black) | −0.337 | 0.748 |
| Psychoactive meds (average of first two quarters) | 0.691*** | 0.197 |
| Psychoactive meds (change) | 0.112 | 0.178 |
| Facility control variables | | |
| For-profit ownership | 0.426** | 0.196 |
| RNs per bed | −4.854 | 3.675 |
| LPNs per bed | −2.269 | 2.846 |
| NAs per bed | 1.077 | 1.457 |
| Bed size | 0.001 | 0.001 |
| Chain | −0.001 | 0.183 |
| Medicaid occupancy | 0.206 | 0.455 |
| Occupancy rate | −0.295 | 1.024 |
| NAs per nurse | −0.278* | 0.167 |
| Market control variables | | |
| Competition | 0.025 | 0.071 |
| County occupancy rate | 2.228 | 1.996 |
| Nonprofit market share | −0.398 | 0.522 |
| Managed care | 1.844*** | 0.591 |
| Constant | −15.400** | 6.934 |
| Observations | 12,686 | |
| Number of facilities | 637 | |
| Model degrees of freedom | 36.000 | |
| Log likelihood | −1,232.975 | |

*Notes*: CPS = Cognitive Performance Scale; ADL = activity of daily living; RN = registered nurse; LPN = licensed practical nurse; NA = nurse aide.
*$p < .10$; **$p < .05$; ***$p < .01$.

subsequent levels of depression, behavior issues, falls, pressure ulcers, or contractures. Each of the regressions controlled for the level and change in health status during the first two quarters of residency as well as other resident, facility, and market characteristics that potentially had an impact on fourth-quarter health outcomes.

## Discussion

In 1989, 44% of nursing home residents were physically restrained (Rader, 1991). More recent research suggests that 11% of nursing home residents are physically restrained (Sullivan-Marx, Strumpf, Evans, Baumgarten, & Maislin, 1999), and the 2006 Nursing Home Compare Web site shows that,

**Table 3. Regressions of Fourth-Quarter Health Outcomes on Third-Quarter Restraint Use and Resident, Facility, and Market Factors**

| Variable | CPS | ADL Scale | Depression | Behavior Issues | Falls | Pressure Ulcers | Contractures | Walking Dependence |
|---|---|---|---|---|---|---|---|---|
| Restrained (third quarter of stay) | 0.381*** (0.054) | 0.447*** (0.054) | −0.102 (0.080) | 0.024 (0.043) | 0.028 (0.021) | 0.006 (0.015) | 0.004 (0.006) | 0.102*** (0.019) |
| CPS (prior average) | 0.835*** (0.006) | 0.071*** (0.006) | 0.006 (0.009) | 0.044*** (0.005) | 0.016*** (0.002) | −0.004*** (0.002) | 0.001 (0.001) | −0.003 (0.002) |
| CPS (change) | 0.237*** (0.009) | 0.031*** (0.009) | −0.010 (0.013) | −0.003 (0.007) | 0.003 (0.003) | 0.002 (0.002) | −0.000 (0.001) | 0.000 (0.003) |
| ADL scale (prior average) | 0.093*** (0.011) | 0.824*** (0.011) | −0.049*** (0.016) | −0.012 (0.009) | −0.040*** (0.004) | 0.021*** (0.003) | 0.000 (0.001) | 0.094*** (0.004) |
| ADL scale (change) | 0.073*** (0.010) | 0.312*** (0.010) | 0.015 (0.015) | 0.013 (0.008) | −0.003 (0.004) | 0.009*** (0.003) | 0.001 (0.001) | 0.042*** (0.004) |
| Depression (prior average) | −0.010 (0.007) | 0.016** (0.007) | 0.577*** (0.010) | 0.039*** (0.005) | 0.006** (0.003) | −0.000 (0.002) | 0.001 (0.001) | 0.008*** (0.002) |
| Depression (change) | 0.005 (0.005) | 0.006 (0.005) | 0.132*** (0.008) | 0.019*** (0.004) | 0.003 (0.002) | 0.002 (0.002) | −0.000 (0.001) | −0.001 (0.002) |
| Behavior issues (prior average) | 0.084*** (0.012) | 0.063*** (0.012) | 0.072*** (0.018) | 0.494*** (0.010) | 0.018*** (0.005) | −0.000 (0.003) | 0.003** (0.001) | −0.001 (0.004) |
| Behavior issues (change) | 0.019** (0.009) | 0.025*** (0.009) | 0.025* (0.014) | 0.104*** (0.007) | 0.007** (0.004) | 0.004 (0.003) | 0.003** (0.001) | 0.005* (0.003) |
| Falls (prior average) | 0.043* (0.025) | 0.028 (0.025) | 0.035 (0.037) | 0.027 (0.020) | 0.186*** (0.010) | −0.010 (0.007) | 0.000 (0.003) | 0.035*** (0.009) |
| Falls (change) | 0.065*** (0.014) | 0.078*** (0.014) | 0.033 (0.021) | 0.008 (0.011) | 0.048*** (0.006) | 0.002 (0.004) | 0.002 (0.002) | 0.015*** (0.005) |
| Psychoactive meds (prior average) | 0.136*** (0.031) | 0.058* (0.031) | −0.013 (0.047) | 0.075*** (0.025) | 0.021* (0.012) | 0.004 (0.009) | −0.002 (0.004) | 0.003 (0.011) |
| Psychoactive meds (change) | 0.023 (0.029) | 0.034 (0.029) | 0.009 (0.043) | −0.062*** (0.023) | −0.015 (0.012) | 0.016* (0.008) | −0.001 (0.003) | 0.006 (0.010) |
| Pressure ulcers (prior average) | −0.097*** (0.031) | −0.008 (0.031) | 0.050 (0.046) | −0.041 (0.025) | −0.037*** (0.012) | 0.268*** (0.009) | −0.001 (0.004) | −0.007 (0.011) |
| Pressure ulcers (change) | 0.014 (0.021) | 0.028 (0.021) | −0.017 (0.031) | −0.009 (0.017) | 0.007 (0.008) | 0.082*** (0.006) | −0.002 (0.002) | 0.005 (0.007) |
| Contractures (prior average) | 0.025 (0.073) | 0.042 (0.073) | −0.069 (0.109) | −0.018 (0.059) | 0.002 (0.029) | −0.016 (0.021) | 0.708*** (0.009) | −0.041 (0.026) |
| Contractures (change) | −0.006 (0.076) | −0.040 (0.076) | 0.124 (0.114) | 0.136** (0.062) | −0.006 (0.030) | 0.060*** (0.021) | 0.168*** (0.009) | −0.017 (0.027) |
| Walking dependence (prior average) | −0.196*** (0.035) | 0.011 (0.035) | 0.108** (0.052) | −0.016 (0.028) | 0.064*** (0.014) | −0.016* (0.010) | −0.002 (0.004) | 0.472*** (0.012) |
| Walking dependence (change) | −0.040 (0.026) | −0.041 (0.026) | −0.069* (0.039) | 0.034 (0.021) | −0.001 (0.010) | 0.006 (0.007) | −0.003 (0.003) | 0.124*** (0.009) |
| Age | 0.047** (0.019) | 0.009 (0.019) | 0.022 (0.028) | −0.001 (0.015) | 0.005 (0.008) | 0.007 (0.005) | −0.001 (0.002) | 0.005 (0.007) |
| Age squared | −0.000** (0.000) | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) | 0.000 (0.000) | −0.000 (0.000) |
| Male | 0.018 (0.019) | 0.013 (0.019) | −0.042 (0.029) | 0.083*** (0.016) | 0.031*** (0.008) | 0.017*** (0.005) | 0.003 (0.002) | −0.003 (0.007) |
| Black | 0.009 (0.032) | −0.010 (0.032) | −0.110** (0.048) | −0.061** (0.026) | −0.012 (0.013) | 0.004 (0.009) | −0.008** (0.004) | 0.004 (0.011) |
| Minority (other than Black) | −0.065 (0.082) | −0.075 (0.082) | −0.027 (0.122) | −0.053 (0.066) | 0.033 (0.032) | −0.009 (0.023) | −0.006 (0.010) | −0.027 (0.029) |
| For-profit ownership | 0.027 (0.020) | −0.010 (0.020) | −0.041 (0.030) | −0.018 (0.016) | 0.001 (0.008) | −0.005 (0.006) | 0.000 (0.002) | 0.004 (0.007) |
| RNs per bed | 0.228 (0.342) | −0.291 (0.342) | 0.691 (0.510) | 0.046 (0.276) | −0.428*** (0.136) | 0.030 (0.096) | −0.030 (0.040) | −0.099 (0.120) |
| LPNs per bed | 0.048 (0.240) | −0.177 (0.241) | 1.436*** (0.359) | 0.100 (0.194) | −0.115 (0.096) | 0.042 (0.068) | −0.022 (0.028) | −0.107 (0.084) |
| NAs per bed | −0.128 (0.121) | 0.038 (0.122) | −0.180 (0.181) | −0.147 (0.098) | 0.087* (0.048) | −0.053 (0.034) | 0.001 (0.014) | 0.011 (0.043) |
| Bed size | 0.000*** (0.000) | −0.000 (0.000) | 0.000*** (0.000) | 0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) |
| Chain | 0.027 (0.018) | −0.008 (0.018) | −0.035 (0.027) | −0.033** (0.015) | 0.001 (0.007) | 0.001 (0.005) | 0.001 (0.002) | −0.006 (0.006) |
| Medicaid occupancy | −0.128*** (0.047) | −0.029 (0.047) | 0.100 (0.070) | 0.084** (0.038) | −0.067*** (0.019) | −0.004 (0.013) | 0.006 (0.006) | −0.016 (0.016) |
| Occupancy rate | −0.118 (0.108) | −0.015 (0.108) | 0.305* (0.161) | 0.103 (0.087) | −0.007 (0.043) | −0.025 (0.030) | 0.017 (0.013) | 0.056 (0.038) |
| NAs per nurse | 0.015 (0.013) | −0.003 (0.013) | 0.061*** (0.019) | 0.004 (0.010) | −0.010** (0.005) | 0.001 (0.004) | 0.002 (0.001) | −0.008* (0.004) |
| Competition | −0.003 (0.007) | 0.005 (0.007) | −0.002 (0.011) | −0.004 (0.006) | −0.004 (0.003) | 0.000 (0.002) | −0.001 (0.001) | 0.002 (0.003) |
| County occupancy rate | −0.095 (0.193) | −0.211 (0.194) | −1.021*** (0.289) | 0.017 (0.156) | −0.024 (0.077) | 0.093* (0.055) | −0.096*** (0.023) | 0.007 (0.068) |
| Nonprofit market share | 0.033 (0.054) | −0.064 (0.054) | −0.094 (0.080) | 0.005 (0.043) | 0.012 (0.021) | 0.012 (0.015) | 0.000 (0.006) | −0.004 (0.019) |
| Managed care | −0.027 (0.060) | −0.064 (0.060) | −0.115 (0.089) | −0.061 (0.048) | −0.044* (0.024) | −0.004 (0.017) | 0.015** (0.007) | −0.021 (0.021) |
| Constant | −1.642** (0.801) | 0.225 (0.802) | 0.002 (1.195) | 0.087 (0.648) | −0.021 (0.318) | −0.307 (0.226) | 0.124 (0.094) | −0.152 (0.280) |
| Observations | 12,686 | 12,686 | 12,685 | 12,685 | 12,685 | 12,686 | 12,647 | 12,686 |
| $R^2$ | 0.71 | 0.64 | 0.29 | 0.28 | 0.06 | 0.10 | 0.38 | 0.49 |

*Notes*: Standard errors in parentheses. CPS = Cognitive Performance Scale; ADL = activity of daily living; RN = registered nurse; LPN = licensed practical nurse; NA = nurse aide.

*$p < .10$; **$p < .05$; ***$p < .01$.

nationally, approximately 9% of residents are restrained. However, these figures may underestimate true restraint initiation, as counts are often made during the day. Restraint initiation may be much higher at night, when staffing levels are lower. Even at 9% to 11%, the potential adverse consequences of restraint use create concern that physical restraints are still overused. Physical restraint use is lower among nursing homes in many other developed countries, ranging from 2% to 9% of facility residents (Ljunggren, Phillips, & Sgadari, 1997). This, and the fact that restraint use rates in U.S. nursing homes vary widely, suggests that many facilities here in the United States could function with lower rates of restraint use than are currently employed.

Most significantly, cited potential adverse consequences include falls, agitation of residents, and cognitive decline. However, the many pernicious effects of restraint use are not well investigated. To date, the health consequences of restraining residents are unclear. Thus, the results of this study are important. We show that adverse consequences of restraint initiation exist and are substantial. We show that lower cognitive performance, lower ADL performance, and more walking dependence result within 3 months of restraint initiation. Moreover, these results would appear to have practical as well as statistical significance. For example, when a resident is restrained, one can expect 5% lower ADL performance, 10% more walking dependence, and 4% lower cognitive performance compared to no restraint use.

We must clearly interpret the practical significance of our findings based on the residents we examined. That is, these results apply to newly admitted residents who are not restrained for 6 months. Also, we do not expect the same level of ADL, walking, and cognitive performance decline for each restraint episode (i.e., a uniform dose–response). We also note that we only found significant findings for three of the eight outcome measures examined. Nonetheless, the higher expected resident health outcomes associated with simply not using physical restraints are large.

These findings have practice and policy implications. For nursing homes, decline in resident health status could necessitate the dedication of additional resources to prevent further decline. Thus, we speculate that restraint initiation may also necessitate subsequent use of additional staff (as a result of resident decline). From a cost–benefit standpoint, it may then be more expensive to restrain a resident compared with not restraining the resident in the first place. For policy makers, our findings provide further justification for implementing restraint reduction policies and for providing resources to promote restraint reduction. These kinds of activities would include additional training, practice guides, and emphasis by state surveyors.

### *Limitations and Suggestions for Further Research*

Our study combined trunk, limb, and chair restraint use into a single measure of restraint use. Further research may find that different categories of restraints are associated with different resident outcomes. The possibility that such relationships exist necessitates that researchers examine each type of restraint separately. Even with all MDS data from 1 year from Pennsylvania, our sample size lacked the power for us to perform this analysis.

Our measure of restraint ''use'' may also have been limited. The MDS records use of the five categories of restraints as 0 = not used, 1 = used less than daily, and 2 = used daily. We combined ''used less than daily'' and ''used daily'' for analysis. This was not a fine-grained measure of intensity of use, but again we were limited by the available data.

Recently, Schnelle and associates (2004) questioned the accuracy of the restraint use MDS items. These authors' research is based on a very short period of observation, a small sample of residents, and an even smaller sample of facilities, and it certainly needs further verification. Nevertheless, this issue needs careful consideration for an analysis such as ours. Schnelle and associates (2004) surfaced the issue that restraints may be undercounted—but not that they are either overcounted or miscounted. Thus, for this research we can be fairly certain that if the MDS recorded a resident as restrained, then that resident was in fact highly likely to have been restrained. Thus, no confound based on misclassification is likely with any associations with health outcomes for these restrained residents. In addition, any residents who were restrained, but who were not recorded as such in the MDS, would have been included in our pool of comparison residents. So any bias that exists would likely have served to make our results more conservative.

Some authors have also noted that ascertainment bias may exist with the MDS (Mor, 2004). Simply put, better facilities may be better at completing the MDS. This bias is likely minimal for restraint use but more likely for the outcomes we examined. Again, this would likely have served to make our results more conservative.

We were careful throughout our study not to claim a causal interpretation for our findings. However, in some branches of applied science, the use of temporal ordering, after matching on prior characteristics, is sufficient to make claims of causality (Granger, 1969). In the present study, we implicitly compared two sets of individuals with similar existing health conditions, one of whom was then placed in restraints and one of whom was not. A causal interpretation would hold that if the restrained group experienced a subsequent decline in health status, then the initiation of restraints caused this decline.

Such a causal interpretation would not be valid if restrained residents were atypical in the progression of their health conditions. Although we controlled for two quarters of health outcomes, the possibility remains that changes in health status during the third quarter brought about restraint initiation rather than arose from them. It is also possible that facilities that were more aggressive in their restraint initiation also differed in other dimensions of care that affected health outcomes. If either of these factors are correlated with a decline in health outcomes, then restraint initiation is said to be *endogenous* and the estimated effect of restraint initiation on health outcomes will not be valid, unless methods are used that allow for these correlations.

The most common method for addressing this problem in a nonexperimental setting is to use one or more instrumental variables to identify the impact of an endogenous treatment. Instrumental variables are measured characteristics that have a direct effect on the treatment (i.e., restraint initiation) but only affect the outcome through the treatment. Such variables would induce a variation in restraint initiation that is ''random,'' that is, uncorrelated with the unobserved components in the health outcome equation, and that can be used to estimate the impact of restraint initiation on health after controlling for the measured variables that are included in the health outcome equation. We propose that this approach be used in future research by using policy differences among states as instrumental variables for restraint use. Some states, for example, provide training for restraint reduction, and others report restraint levels on long-term care facility report cards. This advanced nonexperimental statistical method would allow for causal inferences in a setting such as this in which a randomized controlled clinical trial is not feasible.

Another extension of the current work would be to develop a full dynamic model of health status and restraint use. Such a model could use all available information from the MDS on changes over time in health status for each resident as well as information about the initiation and cessation of restraint use. Researchers could use event history methods, especially methods for analyzing repeat events, or other panel data methods to study the dynamics of restraint use and discrete changes in health status. However, such methods require careful consideration of all events that are determined simultaneously and the careful modeling of asymmetries between the associations with event initiation and with event cessation. For example, standard methods for the analysis of time-series cross-section data on restraint use and health status would imply that the association of restraint initiation with health status is equal in magnitude but opposite in sign to the association of restraint cessation with health status. We find this implication implausible, and we leave this complex analysis to future work.

## Conclusion

We examined eight mental and physical outcomes 3 months post physical restraint initiation. Even after controlling for prior health status and resident, facility, and market factors, we found that restrained residents are significantly more likely to exhibit low cognitive performance, low ADL performance, and more walking dependence than similar residents who are not restrained. The magnitude of the findings would suggest that the benefits to residents of not using restraints are substantial.

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