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ORIGINAL ARTICLE

Physical Restraint Usage in Hospitals Across the United States: 2011-2019

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Abstract

Objective: To determine the change in rates of physical restraint (PR) use and associated outcomes among hospitalized adults.

Patients and Methods: Using national inpatient sample databases, we analyzed years 2011-2014 and 2016-2019 to determine trends of PR usage. We also compared the years 2011-2012 and 2018-2019 to investigate rates of PR use, in-hospital mortality, length of stay, and total hospital charges.

Results: There were 242,994,110 hospitalizations during the study period. 1,538,791 (0.63%) had coding to signify PRs, compared with 241,455,319 (99.3%), which did not. From 2011 to 2014, there was a significant increase in PR use (p-trend<.01) and a nonsignificant increase in PR rates from 2016-2019 (p-trend=.07). Over time, PR use increased (2011-2012: 0.52% vs 2018-2019: 0.73%; p<.01). Patients with PRs reported a higher adjusted odds for in-hospital mortality in 2011-2012 (adjusted odds ratio [aOR], 3.9; 95% CI, 3.7-4.2; p<.01) and 2018-2019 (aOR, 3.5; 95% CI, 3.4-3.7; p<.01). Length of stay was prolonged for patients with PRs in 2011-2012 (adjusted mean difference [aMD], 4.3 days; 95% CI, 4.1-4.5; p<.01) and even longer in 2018-2019 (aMD, 5.8 days; 95% CI, 5.6-6.0; p<.01). Total hospital charges were higher for patients with PRs in 2011-2012 (aMD, +$55,003; 95% CI, $49,309-$60,679; p<.01). Following adjustment for inflation, total charges remained higher for patients with PRs compared with those without PRs in 2018-2019 (aMD, +$70,018; 95% CI, $65,355-$74,680; p<.01).

Conclusion: Overall, PR rates did not decrease across the study period, suggesting that messaging and promulgating best practice guidelines have yet to translate into a substantive change in practice patterns.

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The Centers for Medicare and Medicaid Services define physical restraints (PRs) as "any manual method, device, material, or equipment that immobilizes or reduces the ability of a patient to move their arms, legs, or head freely."[1] This can include belts, mittens, vests, bed rails, or geriatric chairs that restrict patient movement. PRs are designed to protect patients at risk of self-harm (ie, falling, dislodging intravenous lines, or removing endotracheal tubes).[2,3] Furthermore, PRs are used preemptively to protect staff and visitors when patients are physically aggressive.[3]

Research shows the risks of poor outcomes associated with PRs and a lack of evidence supporting their use in promoting patient safety.[4] Physical restraints are associated with an increased incidence of delirium, pressure ulcers, deep vein thromboses, prolonged ventilator use, and death.[5-7] Patients subjected to PRs later reported feelings of loss of dignity, post-traumatic stress, and disruption of the therapeutic relationship with health care providers.[8]

In recent years, multiple professional societies and governmental organizations have recommended reducing PR use among hospitalized patients.[9-11] Theoretically, advances in the delivery of hospital care, such as video-sitters, behavioral response teams, sedation for patients on ventilators, and enhanced management of withdrawal symptoms should have reduced the need for PRs.[12,13] Thus, we conducted this study to examine trends in PR use and outcomes among hospitalized adults in the United States between 2011 and 2019. Our team hypothesized that given the national attention on reducing the use of PRs, we would see a drop in their usage over the study period.

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PATIENTS AND METHODS

Setting or Database

The National Inpatient Sample (NIS) database years 2011-2019 was used to study PR use during hospitalizations in the United States. The NIS is available through the Agency for Healthcare Research and Quality by the Healthcare Cost and Utilization Project (HCUP)-(https://www.hcup-us.ahrq.gov/nisoverview.jsp). The NIS is a large, publicly available all-payer inpatient health care database for US hospitals. The databases approximate a 20% stratified sample of hospital discharges from 46 participating states and the District of Columbia and include more than 7 million annual unweighted hospital stays. When weighted to reflect all annual admissions, it estimates more than 35 million hospitalizations, or 95% of US hospitalizations. Strata include hospital size or volume, academic teaching status, geographic region, and hospital ownership. Our study years use the International Classification of Diseases, 9th Revision, and 10th Revision, Clinical Modification (ICD-9 CM and ICD-10 CM) coding system for all discharge diagnoses.

Study Population, Patient and Hospital Characteristics, and Outcomes

Patients 18 years and older were included in the study, and those <18 years old were excluded. The exposure variable was PR status (ICD-9 CM code V49.87; ICD-10 CM code Z78.). The ICD-9 CM code for PRs was first implemented in October 2010 and transitioned in October 2015 to the ICD-10-CM code. We compared patients with and without secondary codes for PRs and used block years 2011-2012 and 2018-2019 to assess the clinical and resource outcomes. The primary outcome was the rate of PR use over time. Secondary outcomes included in-hospital mortality, length of stay (LOS), total hospital charges, and disposition post-discharge (home versus another acute or subacute facility). We also investigated age, racial, and economic differences, and their relation to PRs. The following categories were studied: age, race (Black vs White), income (median yearly income: ≤$38,999 vs ≥$63,000), and insurance type differences (Medicare vs private insurance).

Given the significant incongruency of coding for PRs for the 2015 transition year (between ICD-9 CM and ICD-10 CM codes), we followed HCUP recommendations to separately examine trends based on ICD-9 CM and ICD-10 CM codes for PR status.[14] Because of this issue and that the year 2010 only captured PR data from October to December, we separately trended rates of PR use for years 2011-2014 and 2016-2019 to better assess trends or PR use by age category and all combined age groups for adults over time. We trended PR rates by the following age categories: (1) young adults (18-44 years old); (2) middle-aged adults (45-64 years old); (3) early older adults (65-84 years old); (4) late older adults (85 years and older); and (5) all combined age groups. Yearly PR rates for each group were adjusted using predictive margins for multiple confounders listed below.[15] We used 2011 dollars to adjust for inflation over time.

As reported in similarly conducted NIS studies, we controlled for the following a priori hospital and patient confounders in our multivariable regression models) (i) hospital geographic region (Northeast, Midwest, South, and West); (ii) hospital teaching status; (iii) hospital volume capacity; (iv) age; (v) gender (male and female only); (vi) race (White, Black, Hispanic, Asian, or Pacific Islander); (vii) insurance (Medicare, Medicaid, private insurance, and uninsured); (viii) median household income (from <$38,999 to >$63,000 based on home zip code); and (ix) comorbidity burden assessed using the Charlson comorbidity index (CCI).[16-18] Before each phase of the analysis, we considered the applicability of discrete variables to the particular study outcome measure. We only included those covariates that had a theoretical or practical connection. For instance, studies have identified race as a risk factor for patients being physically restrained,[19] and older hospitalized patients who required PRs have been found to have longer hospital stays.[20] Some studies also suggest males, perhaps because of greater overall strength, are more frequently physically restrained.[21] Finally, hospital characteristics that may influence staffing ratios—including teaching status, volumes, region, and more—may affect the decision to use PRs.[22]

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TABLE 1. Patient Demographic and Hospital Characteristics for Hospitalized Patients (N=242,994,110) Comparing Those With and Without Physical Restraints: National Inpatient Sample January 2011-December 2019[a,b]

Characteristic	Patients Without Physical Restraints	Patients With Physical Restraints	*P*[c]
Total, n (%)	241,455,319 (99.3)	1,538,791 (0.63)	
Age (y), mean ± SE	57.6±0.04	61±0.1	<.01
Age groups, n (%)			<.01
18-44 y	69,192,223 (28.6)	328,119 (21.3)	
45-64 y	69,801,791 (28.9)	485,570 (31.5)	
65-84 y	79,329,441 (32.8)	526,853 (34.2)	
≥85 y	23,131,864 (9.5)	198,249 (12.8)	
Male, n (%)	100,180,584 (41.4)	900,341 (58.5)	<.01
Race, n (%)			<.01
White	164,044,743 (67.9)	1,014,37 (65.9)	
Black	36,170,006 (14.9)	265,287 (17.2)	
Hispanic	26,222,047 (10.8)	155,264 (10.0)	
Asian or Pacific Islander	6,205,401 (2.5)	46,163 (3.0)	
Native American	1,521,168 (0.63)	11,694 (0.76)	
Charlson comorbidity score, n (%)			<.01
0	102,884,111 (42.6)	462,099 (30.0)	
1	47,518,406 (19.6)	330,224 (21.4)	
2	31,727,229 (13.1)	239,589 (15.5)	
3 or more	59,325,571 (24.5)	506,877 (32.9)	
Insurance, n (%)			<.01
Medicare	117,709,468 (48.7)	861,415 (55.9)	
Medicaid	43,075,629 (17.8)	313,605 (20.3)	
Private	69,201,094 (28.6)	267,903 (17.4)	
Uninsured	11,469,127 (4.7)	95,866 (6.2)	
Median income (USD), n (%)			<.01
$1-$38,999	72,605,614 (30.0)	489,797 (31.8)	
$39,000-$47,999	62,947,401 (26.0)	374,695 (24.3)	
$48,000-$62,999	57,707,821 (23.9)	363,924 (23.6)	
$63,000 or more	48,170,336 (19.9)	310,528 (20.1)	
Hospital bed size, n (%)			<.01
Small	42,737,591 (17.7)	218,046 (14.1)	
Medium	67,486,761 (27.9)	407,471 (26.4)	
Large	131,230,965 (54.3)	913,118 (59.3)	
Hospital region, n (%)			<.01
Northeast	45,079,708 (18.6)	240,667 (15.6)	
Midwest	54,110,137 (22.4)	314,836 (20.4)	
South	94,384,884 (39.0)	524,112 (34.0)	
West	47,880,589 (19.8)	459,175 (29.8)	
Hospital location, n (%)			<.01
Urban	216,891,900 (89.8)	1,455,541 (94.5)	
Rural	24,563,418 (10.1)	83,249 (5.4)	
Academic status, n(%)			0.21
Teaching	142,190,333 (58.8)	929,669 (60.4)	
Non-teaching	99,264,986 (41.1)	609,121 (39.5)	

Continued on next page

TABLE 1. Continued

Characteristic	Patients Without Physical Restraints	Patients With Physical Restraints	P[c]
Day of week, n(%)			<.01
Weekday	192,467,222 (79.7)	1,151,488 (74.8)	
Weekend	48,988,097 (20.2)	387,302 (25.1)	

[a]Abbreviation: USD, United States Dollars
[b]Data for the year 2015 was not included in the Table.
[c]Analyses used adjusted Wald tests for categorical and continuous variables.

In the trend analyses, we also included the years as a covariate for the adjustment of proportions of PR use. Finally, we conducted a sub-analysis and collected data on the top admitting diagnoses for patients requiring PRs during hospitalization from October 2010 to December 2019. Our institutional review board designated the project exempt from requiring detailed review.

Statistical Analyses

Adjusted Wald tests were used for categorical and continuous variables. Adjusted odds ratios (aORs) for PR use were obtained for separate block years 2011-2012 and 2018-2019 (young adults as a reference compared to all other age groups) by multiple logistic regression. In addition, for our trend analysis, yearly rates of PR use were adjusted for the multiple confounders using predictive margins.[15]

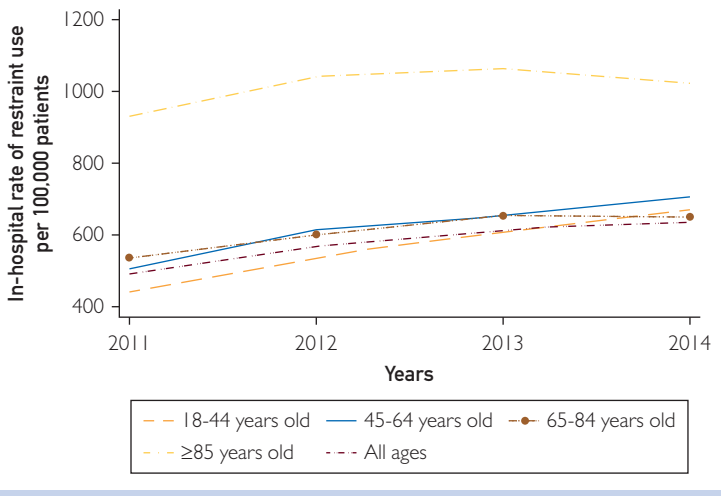

FIGURE 1. In-hospital physical restraint use (trend analysis January 2011 to December 2014 ICD-9 coding).

We also used multiple logistic regression to obtain aORs for in-hospital mortality and discharge disposition. Adjusted mean differences (aMD) from multivariable linear regression analyses helped compare LOS and total hospital charges. Using univariable analysis, we tested the strength of predictors for PR use and subsequently carried out multiple variable regression on variables that had relevant associations. The *P*-values were 2-sided, and the significance level of type I errors was .05. Stata 15.0 statistical software (Stata Corp) allowed us to account for design complexity (stratification, weighting, and clustering) and incorporated strata and primary and sampling weights.[23]

RESULTS

There were 242,994,110 hospitalizations from 2011 to 2014 and 2016 to 2019. Among these, 1,538,791 (0.63%) had coding that signified PR usage, compared with 241,455,319 (99.3%) that did not (Table 1).

Rates and Trends of Physical Restraint Use

I. 2011 to 2014 (Figure 1)

Rates of PR use significantly increased overall for adults from 2011-2014 (*p*-trend <.01). There was a significant increase in PR use among young adults, middle-aged adults, and early older adults (all *p*-trend ≤.01). Late older adults had higher restraint rates compared with all groups from 2011-2014 and these rates remained stable (*p-trend*=.29).

II. 2016 to 2019 (Figure 2)

Overall, rates of PR use remained stable from 2016-2019 (*p*-trend=.07). Similar to 2011 to 2014, young adults had a significant increase in rates of PR use (*p*-trend<.01).

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TABLE 2. Adjusted Odds Ratios for Being Physically Restrained With Age, Race, Insurance, and Median Income Comparisons for Years 2011-2012 to 2018-2019

	2011-2012		
	Physically restrained patients, N (%)	Multivariable adjusted odds ratios (95% CI)	*P*
Age (y)[a]	Total N=320,755		
18-44 [ref]	57,736 (18.1)	1	
45-64	97,509 (30.4)	1.38 (1.31-1.44)	<.01
65-84	114,188 (35.6)	1.34 (1.25-1.32)	<.01
≥85	50,679 (15.8)	2.12 (1.95-2.3)	<.01
Race[b]	Total N=253,169		
White [ref]	211,776 (83.6)	1	
Black	41,393 (16.3)	1.02 (0.92-1.12)	0.66
Insurance[b]	Total N=98,909		
Private [ref]	55,122 (55.7)	1	
Medicaid	43,786 (44.2)	1.75 (1.59-1.93)	<.01
Median Income[b]	Total N=165,451		
≥$63,000 [ref]	74,348 (44.9)	1	
$1-$38,999	91,102 (55.0)	0.87 (0.76-1.00)	0.05
	2018-2019		
	Physically Restrained Patients, N (%)	Multivariable Adjusted Odds Ratios (95% CI)	*P*
Age (y)[a]	Total N=439,845		
18-44 [ref]	103,803 (23.6)	1	
45-64	136,791 (31.1)	0.95 (0.92-0.98)	<.01
65-84	149,107 (33.9)	0.74 (0.70-0.78)	<.01
≥85	49,262 (11.2)	0.98 (0.93-1.0)	.67
Race[b]	Total N=356,130		
White [ref]	273,410 (76.7)	1	
Black	82,720 (23.2)	1.38 (1.31-1.46)	<.01
Insurance[b]	Total N=172,545		
Private [ref]	71,904 (41.6)	1	
Medicaid	100,640 (58.3)	2.08 (1.99-2.19)	<.01
Median Income[b]	Total N=219,255		
≥$63,000 [ref]	79,795 (36.9)	1	
$1-$38,999	139,460 (63.6)	1.14 (1.06-1.22)	<.01

[a]Age was adjusted for hospital geographic region, hospital teaching status, hospital volume capacity, gender, race, insurance, median household income, and Charlson comorbidity index.
[b]Race, insurance, and income were adjusted for age and gender.

However, rates of PRs remained stable for other groups: middle age (*p*-trend=.29), early older adults (*p*-trend=.20), and late older adults (*p*-trend=.18).

III. 2011-2012 versus 2018-2019

In 2011-2012, younger adults (18-44 years) had lower adjusted odds for being physically restrained compared with all other age groups ($p<.01$) (Table 2). In 2018-2019, younger adults had significantly higher adjusted odds of being physically restrained than middle age (45-64 years) and early older adults (65-84 years); both $p<.01$. Younger adults also had similar adjusted odds of being physically restrained compared with later older adults (aOR, 0.98; 95% CI, 0.93-1.0; $p=.67$) in 2018-2019. Adjusted proportions

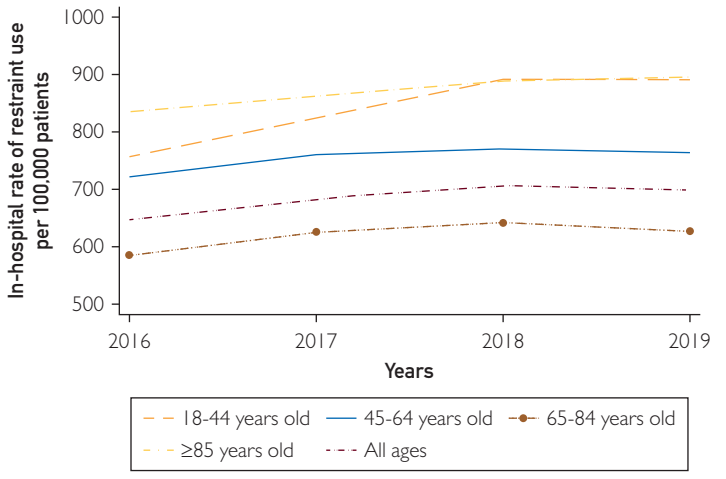

FIGURE 2. In-hospital physical restraint use (trend analysis January 2016 to December 2019 ICD-10 coding).

identified an increase in PR use over the time period for all ages combined (2011-2012: 0.52% vs 2018-2019: 0.73%; $p<.01$).

Racial, income, and insurance comparisons for the years 2011-2012 and 2018-2019 are also displayed in Table 2. Patients on Medicare had higher adjusted odds of being restrained for both block years (2011-2012 and 2018-2019; $p<.01$ for both time frames). No significant differences were observed in the odds of PR use between Black and White patients in 2011-2012. In addition, we saw no significant differences in adjusted odds of PR use in 2011-2012 between patients with low and high incomes. However, in later years, 2018-2019, Black patients had higher adjusted odds of being physically restrained compared with White patients. Furthermore, lower-income patients reported higher adjusted odds of being restrained than those with higher incomes in the years 2018-2019.

Physical Restraint and Mortality Outcomes

Compared with patients without PRs, those with PRs had higher adjusted odds for in-hospital mortality in 2011-2012 (aOR, 3.9; 95% CI, 3.7-4.2; $p<.01$). The odds for death remained higher for those with PRs in the years 2018-2019 (aOR, 3.5; 95% CI, 3.4-3.7; $p<.01$). Top admitting diagnoses for patients requiring PRs are displayed in the Supplemental Table, available online at http://www.mcpiqojournal.org.

Resource Utilization Outcomes

Length of stay was longer for patients with PRs than those without in 2011-2012 (aMD, +4.3 days; 95% CI, 4.1-4.5; $p<.01$). The LOS was even longer for patients with PRs for years 2018-2019 (aMD, +5.8 days; 95% CI, 5.6-6.0; $p<.01$). Total hospital charges were higher for patients with PRs in 2011-2012 (aMD, +$55,003; (95% CI, $49,309-$60,679; $p<.01$). Following adjustment for inflation, total charges remained higher for patients with PRs versus those without PRs in 2018-2019 (aMD, +$70,018; 95% CI, $65,355-$74,680; $p<.01$). The adjusted odds of patients being discharged to home after hospitalization was lower for patients who required PRs during hospitalization in 2011-2012 (aOR, 0.22; 95% CI, 0.21-0.23; $p<.01$). This was sustained in 2018-2019 with an adjusted odds of 0.24 (95% CI, 0.23-0.25); $p<.01$.

DISCUSSION

This study describes the trends in the use of PRs across a sample of adult patients admitted to US hospitals between 2011 and 2019. Despite advances in care and national efforts to discourage PR use whenever possible, our study shows that overall rates have remained high and even increased in some groups.

In a multicenter study across 40 acute care hospitals in the United States between 2003 and 2005, Minnick et al[2] found that PRs were used at a rate of about 50 per 1000 patient days. A study of administrative data from 2007 to 2013 from adult psychiatric units at 317 US hospitals studied PR frequency and duration.[24] The study found a reduction in the duration of restraint use but not a decrease in frequency. By contrast, a 10-year study across a health system in Pennsylvania found a decrease in the frequency and duration of PR use from 2013 to 2020.[25] However, this study was conducted at relatively few hospitals (n=8) that had a homogenous PR policy and low baseline rate of restraint use (262 of the 100,000 patient days), which may explain the positive findings. Of importance, the declining rate of PR use may have been driven by local interventions within specific homogenous patient populations.

Our data highlights significantly higher use of PRs among vulnerable patient

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groups—particularly minorities (Black patients), those without private insurance, and those with lower incomes. Even after adjustment for comorbidity, the increased use of restraints among these groups suggests that structural biases and discrimination may explain, at least in part, these inequities. Further studies with databases that collect more granular data are needed to understand what factors drive the difference in PR use among marginalized patient populations. The root cause of the inequity may stem in part from healthcare needs that are unmet before hospitalization, including the availability of outpatient behavioral health and psychiatric treatment.

Explaining the geographical variation in PR use, which is higher in hospitals in the West, is challenging. Still, this finding has been noted in previous studies at regional inter-hospital, or intra-hospital levels.[25,26] The regional variation may be because of more closely connected hospital organizational cultures, similar staffing patterns, regional laws, and inconsistent adoption of evidence-based practices at large health systems in the western United States.[27,28] Future studies should investigate how regional characteristics, such as access to mental health services and local practices, impact the use of restraints.

Other studies also corroborate our secondary outcomes. Okumura et al[29] examined PR use for patients with dementia and pneumonia in Japan, relating it to several outcomes. They found higher hospitalization costs, longer LOS, and higher rates of institutionalization for those who had restraints for some days during their hospitalization compared with those who never had restraints. A study by Singh et al[30] found that patients with PR use had longer lengths of stays, higher total hospital charges, and lower likelihood of discharge home compared with those without PRs. We posit that these results could be multifactorial and would benefit from further investigation. The restrained population may be sicker in ways not captured by the Charlson Comorbidity Index. For example, in our study, acute respiratory failure is among the top 3 diagnoses in restrained patients. Previous studies have noted that restraint use is highest among hospitalized patients in intensive care units.[2] A post-hoc analysis of the multicenter study of ICUs noted a higher LOS and mortality in restrained patients.[5] It is possible that the use of restraints could suggest more severe behavioral disturbances, delirium, and decompensated psychiatric symptoms requiring higher resource utilization in the hospital and supervision after discharge.

Several limitations of this study should be considered. First, NIS is an administrative database dependent on accurate coding imputations. Second, the database does not contain vital signs, laboratory findings, specific medications, or imaging results. The lack of granular data limits our ability to draw more specific associations between individual patient characteristics and the appropriate use of PRs. Third, in trend analyses, it is only possible to account for some, rather than all, external factors that may have changed over the study period. For instance, changes to hospitals' budgets or staffing ratios might have influenced the PR use but were not analyzed in our study. Finally, in observational studies, unmeasured and unknown confounders may influence outcomes.

CONCLUSION

Our study highlights that the rate of restraint utilization in US hospitals has remained high between 2011 and 2019 despite efforts and guidance to curtail its use. The trend data also shows that the rates of PR increased from 2011-2014. However, a nonsignificant increase followed by flattening in PR rates was observed from 2016-2019. These data suggest that hospitals have failed to reduce PR use over the last decade and highlight the association of PR use with worse outcomes in several domains. There is a need to find safer alternatives to PRs and more effective evidence-based strategies to reduce PR use across our nation's hospitals.

POTENTIAL COMPETING INTERESTS

Dr Wright is the Anne Gaines and G. Thomas Miller Professor of Medicine supported through the Johns Hopkins Center for Innovative Medicine, and he is the Mary & David Gallo Scholar for Hopkins' Initiative to Humanize Medicine. All other authors report no conflict of interest.

SUPPLEMENTAL ONLINE MATERIAL

Supplemental material can be found online at http://www.mcpiqojournal.org. Supplemental material attached to journal articles has not been edited, and the authors take responsibility for the accuracy of all data.

Abbreviations and Acronyms: **aMD,** adjusted mean difference; **aOR,** adjusted odds ratio; **CCI,** Charlson comorbidity index; **HCUP,** Healthcare Cost and Utilization Project; **ICD-9 CM,** International Classification of Diseases, 9th Revision; **ICD-10 CM,** International Classification of Diseases, 10th Revision; **LOS,** length of stay; **NIS,** national inpatient sample; **PR,** physical restraint; **TX,** Texas; **US,** United States

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REFERENCES

1. United States Department of Health and Human Services. Health Care Financing Administration. Medicare and Medicaid programs: Hospital Conditions of Participation: Patients' Rights CFR 482. Fed Regist. 42. Interim Final Rule; 1999:36069—36089. https://www.federalregister.gov/documents/1999/07/02/99-16543/medicare-and-medicaid-programs-hospital-conditions-of-participation-patients-rights. Accessed December 27, 2022.
2. Minnick AF, Mion LC, Johnson ME, Catrambone C, Leipzig R. Prevalence and variation of physical restraint use in acute care settings in the US. *J Nurs Scholarsh*. 2007;39(1):30-37.
3. Thomann S, Zwakhalen S, Richter D, Bauer S, Hahn S. Restraint use in the acute-care hospital setting: a cross-sectional multicentre study. *Int J Nurs Stud*. 2021;114:103807.
4. Gunawardena R, Smithard DG. The attitudes towards the use of restraint and restrictive intervention amongst healthcare staff on acute medical and frailty wards-a brief literature review. *Geriatrics (Basel)*. 2019;4(3):50.
5. Rose L, Burry L, Mallick R, et al. Prevalence, risk factors, and outcomes associated with physical restraint use in mechanically ventilated adults. *J Crit Care*. 2016;31(1):31-35.
6. Healey F, Oliver D, Milne A, Connelly JB. The effect of bedrails on falls and injury: a systematic review of clinical studies. *Age Ageing*. 2008;37(4):368-378.
7. Evans D, Wood J, Lambert L. Patient injury and physical restraint devices: a systematic review. *J Adv Nurs*. 2003;41(3):274-282.
8. Franks ZM, Alcock JA, Lam T, Haines KJ, Arora N, Ramanan M. Physical restraints and post-traumatic stress disorder in survivors of critical illness. a systematic review and meta-analysis. *Ann Am Thorac Soc*. 2021;18(4):689-697.
9. Position statement on seclusion and restraint. National Association of State Mental Health Program. https://www.nasmhpd.org/content/position-statement-seclusion-and-restraint. Accessed December 19, 2022.
10. *Comprehensive Accreditation Manual for Hospitals: the Official Handbook*. Joint Commission Resources; 2000.
11. *Promoting Alternatives to the Use of Seclusion and Restraint—Issue Brief # 1: A National Strategy to Prevent Seclusion and Restraint in Behavioral Health Services*. Substance Abuse and Mental Health Services Administration; 2010.
12. Abraham J, Hirt J, Richter C, Köpke S, Meyer G, Möhler R. Interventions for preventing and reducing the use of physical restraints of older people in general hospital settings. *Cochrane Database Syst Rev*. 2022;8(8):CD012476.
13. Hall DK, Zimbro KS, Maduro RS, Petrovitch D, Ver Schneider P, Morgan M. Impact of a restraint management bundle on restraint use in an intensive care unit. *J Nurs Care Qual*. 2018;33(2):143-148.
14. Elixhauser A, Heslin KC, Owens PL. Healthcare Cost and Utilization Project (HCUP) recommendations for reporting trends using ICD-9-CM and ICD-10-CM/PCS data ONLINE. Revised July 5, 2017. U.S. Agency for Healthcare Research and Quality. https://hcup-us.ahrq.gov/datainnovations/HCUP_RecomForReportingTrends_070517.pdf. Accessed December 27, 2023.
15. Graubard BI, Korn EL. Predictive margins with survey data. *Biometrics*. 1999;55(2):652-659.
16. Peluso H, Cull JD, Abougergi MS. Race impacts outcomes of patients with firearm injuries. *Am Surg*. 2020;86(9):1113-1118.
17. Elbadawi A, Albaeni A, Elgendy IY, et al. Transcatheter versus surgical aortic valve replacement in patients with prior mediastinal radiation. *JACC Cardiovasc Interv*. 2020;13(22):2658-2666.
18. Shahreyar M, Fahhoum R, Akinseye O, Bhandari S, Dang G, Khouzam RN. Severe sepsis and cardiac arrhythmias. *Ann Transl Med*. 2018;6(1):6-6.
19. Eswaran V, Molina MF, Hwong AR, et al. Racial disparities in emergency department physical restraint use: a systematic review and meta-analysis. *JAMA Intern Med*. 2023;183(11):1229-1237.
20. Chou MY, Hsu YH, Wang YC, et al. The adverse effects of physical restraint use among older adult patients admitted to the internal medicine wards: a hospital-based retrospective cohort study. *J Nutr Health Aging*. 2020;24(2):160-165.
21. Harris CM, Gupta I, Beydoun H, Wright SM. Outcomes for hospitalized aggressive and violent patients when physical restraints are introduced. *J Patient Saf*. 2023;19(3):216-219.
22. Walker RJ, Segon A, Good J, et al. Differences in length of stay by teaching team status in an academic medical center in the Midwestern United States. *Hosp Pract (1995)*. 2021;49(2):119-126.
23. Houchens R, Ross D, Elixhauser A. Final Report on Calculating National Inpatient Sample (NIS) Variances for Data Years 2012 and Later. https://www.hcup-us.ahrq.gov/reports/methods/2015_09.jsp. vol 2015; 2015. HCUP methods series Report No. 2015-09 online.
24. Staggs VS. Trends in use of seclusion and restraint in response to injurious assault in psychiatric units in U.S. hospitals. 2007 to 2013. *Psychiatr Serv*. 2015;66(12):1369-1372.
25. Smith GM, Altenor A, Altenor RJ, et al. Effects of ending the use of seclusion and mechanical restraint in the Pennsylvania state hospital system, 2011-2020. *Psychiatr Serv*. 2023;74(2):173-181.
26. Luccarelli J, Sacks CA, Snydeman C, et al. Coding for physical restraint status among hospitalized patients: a 2019 National Inpatient Sample Analysis. *J Gen Intern Med*. 2023;38(11):2461-2469.
27. Anderson E, Mohr DC, Regenbogen I, et al. Influence of organizational climate and clinician morale on seclusion and physical restraint use in inpatient psychiatric units. *J Patient Saf*. 2021;17(4):316-322.
28. Krüger C, Mayer H, Haastert B, Meyer G. Use of physical restraints in acute hospitals in Germany: A multi-centre cross-sectional study. *Int J Nurs Stud*. 2013;50(12):1599-1606.
29. Okumura Y, Sakata N, Ogawa A. Association of physical restraint duration and undesirable outcomes amongst inpatients comorbid with dementia and pneumonia in acute care settings. *J Clin Nurs*. 2023;32(17-18):6394-6402.
30. Singh A, Gupta I, Wright SM, Harris CM. Outcomes among hospitalized patients with dementia and behavioral disturbances when physical restraints are introduced. *J Am Geriatr Soc*. 2023;71(9):2886-2892.